ANDALEX
RESOURCES, INC.

P.O. Box 910, East Carbon, Utah 84520
Telephone (435) 888-4000 Fax (435) 888-4002

February 24, 2016

Utah Division of Oil, Gas & Mining
Utah Coal Program
1594 West North Temple, Suite 1210
P.O. Box 145801
Salt Lake City, UT 84114-5801

Attn: Daron Haddock
Permit Supervisor

Re: Andalex Resources, Inc. C/007/019
T16-001 Kenilworth Lease Addition, Task ID# 4763

Dear Mr. Haddock,

Attached within this digital submittal you will find the complete application addressing all deficiencies for the Kenilworth Lease Addition, Task ID #4763. The majority of the corrections were due to formatting issues, therefore all chapter text of the permit have been corrected and updated. There are also digital PDF files of each map for the property attached. These maps are not PE stamped. After approval, we will submit stamped, hard, clean copies of these maps.

If you have any questions, or need any additional information regarding this submittal, please contact me directly at 435-888-4000.

Sincerely,

Karin Madsen
Engineering Tech
UtahAmerican Energy, Inc.

APPLICATION FOR PERMIT PROCESSING

Permit Change X	New Permit ☐	Renewal ☐	Transfer ☐	Exploration ☐	Bond Release ☐	Permit Number: ACT/007/019
Title of Proposal: T16-001 Kenilworth Lease Addition Deficiencies Task ID #4763						Mine: Tower Mine
						Permittee: Andalex Resources, Inc

Description, include reason for application and timing required to implement:

Instructions: *If you answer yes to any of the first 8 questions (gray), submit the application to the Salt Lake Office. Otherwise, you may submit it to your reclamation*

☐ Yes	☐ No	1. Change in the size of the Permit Area? _____ acres Disturbed Area? _____ acres ☐ increase ☐ decrease.
☐ Yes	☐ No	2. Is the application submitted as a result of a Division Order? DO #
☐ Yes	☐ No	3. Does application include operations outside a previously identified Cumulative Hydrologic Impact Area?
☐ Yes	☐ No	4. Does application include operations in hydrologic basins other than as currently approved?
☐ Yes	☐ No	5. Does application result from cancellation, reduction or increase of insurance or reclamation bond?
☒ Yes	☐ No	6. Does the application require or include public notice/publication?
☐ Yes	☐ No	7. Does the application require or include ownership, control, right-of-entry, or compliance information?
☐ Yes	☐ No	8. Is proposed activity within 100 feet of a public road or cemetery or 300 feet of an occupied dwelling?
☐ Yes	☐ No	9. Is the application submitted as a result of a Violation? NOV #
☐ Yes	☐ No	10. Is the application submitted as a result of other laws or regulations or policies? Explain:
☐ Yes	☐ No	11. Does the application affect the surface landowner or change the post mining land use?
☐ Yes	☐ No	12. Does the application require or include underground design or mine sequence and timing? (Modification of R2P2?)
☐ Yes	☐ No	13. Does the application require or include collection and reporting of any baseline information?
☐ Yes	☐ No	14. Could the application have any effect on wildlife or vegetation outside the current disturbed area?
☐ Yes	☐ No	15. Does application require or include soil removal, storage or placement?
☐ Yes	☐ No	16. Does the application require or include vegetation monitoring, removal or revegetation activities?
☐ Yes	☐ No	17. Does the application require or include construction, modification, or removal of surface facilities?
☐ Yes	☐ No	18. Does the application require or include water monitoring, sediment or drainage control measures?
☐ Yes	☐ No	19. Does the application require or include certified designs, maps, or calculations?
☐ Yes	☐ No	20. Does the application require or include subsidence control or monitoring?
☐ Yes	☐ No	21. Have reclamation costs for bonding been provided for?
☐ Yes	☐ No	22. Does application involve a perennial stream, a stream buffer zone or discharges to a stream?
☐ Yes	☐ No	23. Does the application affect permits issued by other agencies or permits issued to other entities?

X Attach 1 complete digital copy of the application.

I hereby certify that I am a responsible official of the applicant and that the information contained in this application is true and correct to the best of my information and belief in all respects with the laws of Utah in reference to commitments, undertakings, and obligations, herein.

Karin Madsen / Eng. Tech / 2-24-16
Signed - Name - Position - Date

Subscribed and sworn to before me this 24th day of February 2016

Linda Kerns
Notary Public

My Commission Expires: 3/27/17
Attest: STATE OF Utah
COUNTY OF Carbon

LINDA KERNS
NOTARY PUBLIC • STATE of UTAH
COMMISSION # 663815
COMM. EXP. 03/27/2017

Received by Oil, Gas & Mining

ASSIGNED TRACKING NUMBER

Application for Permit Processing
Detailed Schedule of Changes to the MRP

Title of Proposal: T16-001 Kenilworth Lease Addition Deficiencies Task ID # 4763	Permit Number: ACT/007/019
	Mine: Tower
	Permittee: Andalex Resources, Inc.

Provide a detailed listing of all changes to the mining and reclamation plan which will be required as a result of this proposed permit application. Individually list all maps and drawings which are to be added, replaced, or removed from the plan. Include changes of the table of contents, section of the plan, pages, or other information as needed to specifically locate, identify and revise the existing mining and reclamation plan. **Include page, section and drawing numbers as part of the description.**

			DESCRIPTION OF MAP, TEXT, OR MATERIALS TO BE CHANGED
☐ ADD	☐ REPLACE	☐ REMOVE	Replace Chapter 1 Text
☐ ADD	☐ REPLACE	☐ REMOVE	Replace Chapter 2 Text
☐ ADD	☐ REPLACE	☐ REMOVE	Replace Chapter 3 Text
☐ ADD	☐ REPLACE	☐ REMOVE	Replace Chapter 4 Text
☐ ADD	☐ REPLACE	☐ REMOVE	Replace Chapter 5 Text
☐ ADD	☐ REPLACE	☐ REMOVE	Replace Chapter 6 Text
☐ ADD	☐ REPLACE	☐ REMOVE	Replace Chapter 7 Text
☐ ADD	☐ REPLACE	☐ REMOVE	Renamed all maps to follow a continuous flow per chapter. Fixed all plate references in chapters
☐ ADD	☐ REPLACE	☐ REMOVE	T&E information to Appendix A
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Any other specific or special instructions required for insertion of this proposal into the Mining and Reclamation Plan?

ANDALEX RESOURCES, INC.
CENTENNIAL PROJECT

CHAPTER 1

Legal, Financial, Compliance And Related Information

C/007/019

~~(Revised)~~
~~July, 2014~~

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CHAPTER 1, LEGAL

R645-301-100. General

The Kenilworth Lease (UTU-81893),Boundary Change is simply an extension of our underground mine workings and will in no way involve any new surface facilities or otherwise have any ~~affect~~effect on the surface. It does not involve any new hydrologic basins. It should be noted that UTU-81893 was previous included in the Willow Creek Mine Permit No. ACT/007/038 which was approved by DOGM. After the Willow Creek Mine was closed the Kenilworth lease was terminated. The area was subsequently re-leased by BLM in 1986 through the normal LBA process after an application by Andalex Resources. Refer to R645-301-200 through R645-301-800 for additional information.

R645-301-110. LEGAL, FINANCIAL, AND COMPLIANCE INFORMATION

Legal, Financial, Compliance and Information

The objective of this chapter is to set forth all relevant information concerning ownership and control of Andalex Resources, Inc., the ownership and control of the property to be affected by mining activities and all other information and documentation required.

Please note that right-of-entry information for all new Leases is included in Appendix J, "Other Approvals". This includes the short form of the Mathis lease recorded at Carbon County.

Compliance Information

a) Suspension and Revocation

Andalex Resources, Inc., affiliates or persons controlled by or under common control with Andalex haven't had a mining permit suspended or revoked within the last five years.

b) Forfeiture of Bond

Andalex Resources, Inc., affiliates or persons controlled by or under common control with Andalex have not forfeited a mining bond or similar security in lieu of bond.

c) History of Violations

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Appendix 1, Part 3 contains a listing of all violations received within the last three years prior to the date of this application by Andalex and affiliated companies.

R645-301-111. INTRODUCTION

Overview and Summary of Project

Mining operations at the Pinnacle Mine began in the Gilson Seam on October 3, 1980, according to the Mining and Reclamation Plan approved by the State of Utah, Department of Natural Resources, Division of Oil, Gas, and Mining. The mining began on the Zion's fee lease and extended onto Andalex's federal leases according to federal approval granted in 1982. Andalex also opened the Apex Mine in the Lower Sunnyside Seam late in 1982. Mining commenced in the Aberdeen Mine in the Aberdeen Seam in mid 1988. The Pinnacle Mine, Apex Mine, and most recently the Aberdeen Mine are now essentially worked out. With the addition of the Kenilworth lease the Aberdeen could possibly reopen depending upon market conditions. The restart date of the Aberdeen mine has yet to be determined. The coal is classified as High Volatile B bituminous in the Lower Sunnyside and Gilson Seams and as High-volatile A bituminous in the Aberdeen Seam. The mine plan area is located approximately 10 miles north-northeast of Price, Utah in Carbon County in T12 and 13S and R10 and 11E (See Plate 1-1).

The Operator relinquished portions of the mined out Federal coal leases in two separate lease relinquishments. The first lease relinquishment approved 3/12/2012 reduced the Federal coal leased acreage from 5,436.24 down to 2,813.48. The second coal relinquishment reduced the Federal coal lease even further down to 894.55 acres. UEI retained all areas of surface disturbance conducted in association with the underground mining and surface access to the gob-vent holes was retained through surface use agreements.

With the relinquishments the permit acreage dropped from 6,516.91 down to 2,274.77 acres. When Kenilworth lease is added the permit acreage goes back up to 4,035.90 which is the new permit acreage. The disturbed area has not changed and remains at 47.19 acres. Since the disturbed area has not changed and the disturbed legal description stays the same the bond does not change with the addition of the Kenilworth lease. The breakdown of Federal, and Fee for both coal leases and surface leases are shown on Tables 1-1 for Coal leases and 1-2 for Surface leases.

The existing ~~permit's~~permit's property is located in the Book Cliffs coal field and includes Alrad Canyon, Deadman Canyon, Starpoint Canyon, Straight Canyon, and Hoffman Creek Canyon areas. The Kenilworth Tract occupies the area of Summit Creek, Deep Canyon and Mathis Canyon. The Coal outcrops along the

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cliffs between 7,000 feet and 7,700 feet elevations. The topography is very rugged, the Book Cliffs being dissected by box canyons created by ephemeral streams. Large sandstone boulders eroded from the cliffs are scattered along the sides of the canyons. The land is undeveloped, used primarily for grazing, and there are no areas of national importance in the region. Mountain-Brush vegetative type covers most of the area.

There are no perennial streams or bodies of water on the property. Ground water recharge is from precipitation in the vicinity. Water supply for mine development is from water encountered in the existing underground mine workings. Culinary usage is supplied by an independent contractor who hauls Price City culinary water to the mine on an as-needed basis. Historically, coal mining has been the only industry in the permit area and there are several abandoned mines located on the property. Other than the GVH holes, no oil or gas wells exist in the area.

Access to the existing mine surface facilities area is by way of the Airport Road, an existing paved county road which has been upgraded and is maintained by Carbon County. It is used as an access road as well as a haul road. All surface and support facilities necessary for present operations have been completed and are located on the Zion's fee or on rights-of-way granted by the Bureau of Land Management. This is also a small private easement granted to Andalex from David Cave for a small portion of pond E. Andalex has acquired all applicable state and federal licenses, permits, and rights-of-way necessary to conduct mining activities on all private (fee) and federal leases.

As of 7-6/2007 the Apex Mine and the Pinnacle Mine have been worked out. Also, The BLM has recently determined that the Aberdeen mine is mined out. The Apex Mine has been sealed at the portals. The Pinnacle mine is still being ventilated because the power to the Aberdeen mine runs into the Pinnacle mine from the substation and then drops down to the Aberdeen Mine through a borehole connecting the two mines. However, there are no plans to produce any more coal from the Pinnacle Mine. Therefore, all future mine production on the Centennial Project will be solely from the Kenilworth Lease in the Aberdeen Mine.

The mining method being employed in the Aberdeen Mine is gateroad development utilizing continuous miners with final extraction by longwall. Certain fringe area reserves, if any, inadequate for longwall panels, will be evaluated for possible room-and-pillar mining.

This operation does not face any of the mining complications caused by faults or other intrusive geologic features. The mine plan area is located in a region where mining has been the major industry; therefore, the nearby communities

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are geared for coal operations. The labor supply is excellent and well trained. With these considerations, and Andalex's prudent management, the Centennial Project will continue to be a model mining operation in the Carbon County area with very minimal environmental and socioeconomic impact.

Upon cessation of final mining activities, reclamation activities will commence as soon as is practicable, according to the plans outlined in this application. The land will be restored according to available technology to as nearly its original condition as is possible.

Organization of Application

This underground mining permit application has been organized in accordance with the general requirements for format and contents as outlined in the R645-Coal Mining Rules.

R645-301-111.100. OBJECTIVES

Objectives

The objective of this chapter is to set forth all relevant information concerning ownership and control of Andalex Resources, Inc., the ownership and control of the property to be affected by mining activities and all other information and documentation required.

Please note that right-of-entry information for all new Leases is included in Appendix J, "Other Approvals".

R645-301-111.200. RESPONSIBILITY

Andalex Resources, Inc., is responsible for submission of information and will pay abandoned mine reclamation fees.

R645-301-111.300. APPLICABILITY

The requirements of R645-301-100 apply to Andalex Resources, Inc.

R645-301-112. IDENTIFICATION OF INTERESTS

a) Permit Applicant

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Andalex Resources, Inc.
Tower Division
P.O. Box 910
East Carbon, Utah 84520-0910
(801) 888-4000

b) Legal and Equitable Owners of Record

Earth work for the Aberdeen Mine was completed in 1989. Surface facilities for the Aberdeen Mine were completed early in 1990. All existing facilities are located either on land owned by Zions Securities Corporation or on federal land. The addresses of these owners of record are as follow:

Bureau of Land Management (801) 524-3004
Utah State Office
324 South State Street
Salt Lake City, Utah 84111

Zion Securities Corporation (801) 363-3841
10 East South Temple
Salt Lake City, Utah 84111

All coal to be mined on the permit area is owned by the federal government, Zion Securities Corporation, Sunedco Coal Company or AMCA Coal Leasing, Inc. The addresses of these owners of record are as follow:

Bureau of Land Management
Utah State Office
440 West 200 South, Suite 500
Salt Lake City, Utah 84101-1345

AMCA Coal Leasing, Inc.
PO Box 910
East Carbon, Utah 84520-0910

Zion Securities Corporation
10 East South Temple
Salt Lake City, Utah 84111
Sunedco Coal Company
7401 West Mansfield Avenue
Suite 418
P.O. Box 35-B
Lakewood, Colorado 80235

R645-301-112.100. TYPE OF BUSINESS

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Andalex Resources is a corporation organized and existing under the laws of Delaware and qualified to do business in Utah. Andalex Resources, Inc, is a wholly owned subsidiary of UtahAmerican Energy Inc., which in turn is a wholly owned subsidiary of Murray Energy Corporation. Andalex began mining operations in the Pinnacle Mine October, 1980, and in the Apex Mine in late 1982. Mining commenced in the Aberdeen Mine in mid-1988. These mines are located on fee and federal lands in Carbon County, Utah. Andalex, the designated operator, along with AMCA Coal Leasing, Inc., its land acquisition and development branch, controls all federal and fee mining leases within the mine plan area. This underground mining permit application has been prepared by Andalex Resources and is being submitted for review and approval by the appropriate regulatory authorities.

R645-301-112.200. NAMES, LOCATIONS, RESIDENT AGENT

Resident Agent who will accept service of process for Andalex Resources, Inc., Tower Division, Centennial Mines, ACT/007/019:

~~Jay Marshall~~

Karin Madsen
Andalex Resources, Inc.
Tower Division
P.O. Box 910
East Carbon, Utah 84520-0910

Also, see Chapter 8, Page 24 for notarized statement pertaining to completeness and accuracy.

R645-301-112.300. OTHER THAN SINGLE PROPRIETORSHIPS

Andalex Resources, Inc., Tower Division, holds the exclusive coal operating interests in the permit area.

R645-301-112.310. OFFICERS AND SHAREHOLDERS

See Appendix 1, Part 1 for ownership and control information.

R645-301-112.320. OWNERSHIP AND CONTROL RELATIONSHIP TO APPLICANT

See Appendix 1, Part 1 for ownership and control information.

R645-301-112.400. PENDING, CURRENT AND PREVIOUS COAL PERMITS

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See Appendix 1, Part 2 for current and previous coal mining permits

R645-301-112.500. SURFACE AND MINERAL OWNERSHIP

Owners of Record of Surface and Subsurface Contiguous Areas

Names and addresses of all owners of record for all surface and subsurface areas contiguous to and within the permit area are listed below and indicated on Plates ~~2~~5-1 and ~~3~~5-2.

Subsurface Owners (See Plate ~~3~~5-2 for Mineral Ownership)

Franklin Real Estate Company (contiguous)
(American Electric Power)
#2 Broadway
New York, New York

Bureau of Land Management (contiguous & within)
Utah State Office
440 West 200 South, Suite 500
Salt Lake City, Utah 84101-1345

Andalex Resources, Inc. (within)
PO Box 910
East Carbon, Utah 84502-0910

Zion Security Corp. (within)
10 East South Temple
Salt Lake City, Utah 84111

Mathis Land Co. (contiguous & within)
Sunnyside Star Route
Price, Utah 84501

Surface Owners (See Plate ~~2~~5-1 Surface Ownership)

Deseret Title Holding Corp (within)
50 E North Temple
Tax Div.-22nd Floor
Salt Lake City, Utah 84150

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Bureau of Land Management (contiguous & within)
Utah State Office
440 West 200 South, Suite 500
Salt Lake City, Utah 84101-1345

Dave Cave et al (contiguous & within)
1220 South 530 West
Price, Utah 84501

Shimmin Investments Ltd (contiguous)
P.O. Box 785
Price, Utah 84501

Mathis Land Co. (contiguous & within)
2699 E Hwy 6
Price, Utah 84501

State of Utah (contiguous & within)
School Trust Lands Administration
355 West North Temple
3 Triad Center, Suite 400
Salt Lake City, Utah 84180

Scott W. Mathis, et al (contiguous and within)
1322 S Fairgrounds Rd
Price, Utah 84501

Scott W. And Donna Mathis,(contiguous and within)
1322 S Fairgrounds Rd
Price, Utah 84501

Mathis Canyon Inc (contiguous)
c/o Arnold Mathis
1366 South Fairgrounds
Price, Utah 84501

Blackhawk Coal Company (contiguous)
700 Morrison Road
Gahanna, Ohio 43232

Mary Frandsen Trust (contiguous)
506 S 100 W
American Fork, Utah 84003

R645-301-112.600. ADJACENT SURFACE AND MINERAL OWNERSHIP

Interests in Contiguous Lands

The Uintah-Southwest Utah Federal Coal Leasing Program has been dropped by the U.S. Department of Interior; therefore, previous expressions of interests by this company are no longer valid. However, existing unleased federally owned coal resources remain of interest to Andalex at such time as currently controlled reserves have been exhausted.

R645-301-112.700. MSHA NUMBERS FOR ALL MINE-ASSOCIATED STRUCTURES

The Centennial Project includes the development of three separate mines. All are currently in operation. The names and M.S.H.A. I.D. numbers for existing mines and all sections are as follow:

Pinnacle Mine - M.S.H.A. I.D. #42-01474
Apex Mine - M.S.H.A. I.D. #42-01750 -Inactive
Aberdeen Mine - M.S.H.A. I.D. #42-02028

R645-301-112.800. STATEMENT OF ALL LANDS AND INTERESTS IN LANDS

The Uintah-Southwest Utah Federal Coal Leasing Program has been dropped by the U.S. Department of Interior; therefore, previous expressions of interests by this company are no longer valid. However, existing unleased federally owned coal resources remain of interest to Andalex at such time as currently controlled reserves have been exhausted.

R645-301-113. VIOLATION INFORMATION

History of Violations

Appendix 1, Part 3 contains a listing of all violations received within the last three years prior to the date of this application by Andalex and affiliated companies.

R645-301-113.100. COMPLIANCE INFORMATION

Andalex Resources, Inc., affiliates or persons controlled by or under common control with Andalex haven't had a mining permit suspended or revoked within the last five years.

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Andalex Resources, Inc., affiliates or persons controlled by or under common control with Andalex have not forfeited a mining bond or similar security in lieu of bond.

Appendix 1, Part 3 contains a listing of all violations received within the last three years prior to the date of this application by Andalex and affiliated companies.

R645-301-113.110. SUSPENDED OR REVOKED PERMITS

Andalex Resources, Inc., affiliates or persons controlled by or under common control with Andalex haven't had a mining permit suspended or revoked within the last five years.

R645-301-113.120. FORFEITED BONDS

Andalex Resources, Inc., affiliates or persons controlled by or under common control with Andalex have not forfeited a mining bond or similar security in lieu of bond.

R645-301-113.200. EXPLANATION OF PERMIT OF BOND FORFEITURE

N/A

R645-301-113.210 PERMIT AND BOND IDENTIFICATION

The following is a list of all other licenses and permits under applicable state and federal land-use, air and water quality, water rights and health and safety laws and regulations held by Andalex in order to conduct underground coal mining activities.
All permits listed are up to date and current. The NPDES Permit for the Centennial Project has been replaced by an individual UPDES permit, UT0025674.

1) State of Utah
Department of Natural Resources
Division of Oil, Gas and Mining
1594 West North Temple, Suite 1210
Salt Lake City, Utah 84114-5801

- Mining and Reclamation Plan for Andalex Resources' Centennial Project
Permit I.D. Number C/007/019
Approved January 4, 1982

2) State of Utah

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Department of Environmental Quality
Division of Air Quality
150 North 1950 West
P.O. Box 144820
Salt Lake City, Utah 84114-4820

- Air Quality Approval Order, Permit No DAGE-977-96
Approved June 13, 1980

3) State of Utah
Department of Environmental Quality
Division of Water Quality
150 North 1950 West
P.O. Box 144820
Salt Lake City, Utah 84114-4820

- UPDES permit UT0025674
(Replaced previous EPA NPDES permit)

- Water Quality - Sediment and Drainage
Approved May 14, 1980

- Septic and Culinary Plan (2)
Approved September 17, 1980 (Office Site)
Approved May 8, 1980 (Bathhouse Facility)

4) Bureau of Land Management
Utah State Office
440 West 200 South, Suite 500
Salt Lake City, Utah 84101-1345
- Access Road Right-of-Way
Permit Number U-45966
Granted September 1, 1980

- Buried Telephone Cable Right-of-Way
Permit Number U-36739
Granted November 20, 1978

- Power Transmission Line Right-of-Way
Permit Number U-36741
Granted November 20, 1978, assigned to UP&L

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- Material Storage Site Right-of-Way
Permit Number U-45965
Granted September 11, 1980

- Aberdeen Mine Right-of-Way
Permit Number UTU-62045
Granted June 6, 1988

5) Mine Safety and Health Administration (M.S.H.A.)
P.O. Box 25367
Denver, Colorado 80225
(District 9)

Pinnacle Mine I.D. 42-01474
Apex Mine I.D. 42-01750 (inactive)
Aberdeen Mine I.D. 42-02028

- Roof Control Plan
Reviewed and approved every six months

- Ventilation System and Methane and Dust Control Plan
Reviewed and approved every six months

- Smoking Prohibition Plan
Approved August 4,1992

- Training Plan
Approved November 27, 1990

- Instruction Program: Firefighting and Evacuation Plan
Approved August 4, 1992

- SCSR Storage Plan
Approved May 18, 1992

- Chest X-Ray Plan
Approved March 15, 1990

R645-301-113.220. REGULATORY AUTHORITIES INVOLVED

See above

R645-301-113.230. CURRENT STATUS OF PERMIT AND BOND

See above

R645-301-113.240. ADMINISTRATIVE OR JUDICIAL PROCEDURES

Appendix 1, Part 3

R645-301-113.250. CURRENT STATUS OF PROCEEDINGS

Appendix 1, Part 3

R645-301-113.300. LIST OF ALL VIOLATIONS NOTICES

Appendix 1, Part 3

R645-301-113.310. IDENTIFICATION OF VIOLATIONS

Appendix 1, Part 3

R645-301-113.320. DESCRIPTION OF VIOLATIONS

Appendix 1, Part 3

R645-301-113.330. LOCATION OF VIOLATIONS PROCEEDINGS

Appendix 1, Part 3

R645-301-113.340. STATUS OF VIOLATIONS PROCEEDINGS

Appendix 1, Part 3

R645-301-113.350. ACTIONS TAKEN TO ABATE VIOLATIONS

Appendix 1, Part 3

R645-301-114. RIGHT-OF-ENTRY INFORMATION

Andalex Resources, Inc., in sublease agreement with AMCA Coal Leasing, Inc., currently holds approximately 4,035.90 acres of private and federal coal leases and rights-of-way listed below, all of which are included in their entirety within the permit area. Andalex basis its legal right to enter and conduct mining activities in the permit area pursuant to the language contained in the Federal Coal Leases, Section 2, Rights of Lessee as follows:

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"The lessor, in consideration of any bonus paid (or to be paid if deferred), rents and royalties and other conditions hereinafter set forth, hereby grants and leases to the lessee the exclusive right and privilege to mine and dispose of all coal ... subject to the conditions, limitations and prohibitions provided in this lease and in applicable acts and regulations, the right to construct all works, buildings, structures, equipment, and appliances which may be necessary and convenient for the mining and preparation of the coal for market, and subject to the conditions herein provided, to use so much of the surface as may reasonably be required in the exercise of the rights and privileges herein granted..."

A similar right to enter and conduct underground mining activities is contained in the private lease agreement with the Zion Securities Corporation as follows:

"During the life of the lease, so long as lessee is not in default hereunder, it may freely prospect, mine and develop the lease premises, extract and sell such coal therefrom as it may elect, and use the surface and underground thereof for all lawful purposes including the exploration and mining to be conducted therein and thereon. It may also use the leased lands in connection with the mining and development of other lands which it may own, lease, or acquire as a part of its general mining operations in the area."

Legal right-of-entry information for all federal and fee leases and rights-of-way are found in Appendix J, "Other Approvals". None of the leases' rights-of-entry is a subject of pending litigation.

The Federal and Fee Coal Leases: Federal and Fee Coal as well as ~~ROW's~~ ROW's and Easements are described in Table 1-1 Below: Plate ~~3~~ 5-2 depicts on a map the Coal Leases:

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TABLE 1-1
Andalex Resources, Inc.
Tower Division
Centennial Project Permit Coal Lease Areas

FEDERAL COAL LEASES

Federal Lease UTU-66060

T. 13 S., R. 10 E., SLM, Utah

Section 1

Lot 3	40.59	Acres
Lot 4	40.82	Acres
S1/2 ~~NE~~SW1/4	80.00	Acres
Total	**161.41**	**Acres**

Federal Lease UTU-69600

T. 13 S., R.10 E., SLM, Utah

Section 1

SW1/4	160.00	Acres

Section 12

Lot 3	36.71	Acres
Lot 4	37.16	Acres
Lot 5	44.08	Acres
Lot 6	45.01	Acres
Lot 7	47.17	Acres
Lot 11	47.05	Acres
W1/2 NW	80.00	Acres
Total	**497.18**	**Acres**

Federal Lease UTU-010581

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T. 13 S., R. 11 E., SLM, Utah
Section 7
NW SE 40.00 Acres

Total **40.00 Acres**

Federal Lease UTSL--27304

T. 13 S., R. 11 E., SLM, Utah
Section 7
Lot 4 42.98 Acres

Section 18
Lot 1 42.98 Acres
NW NE 40.00 Acres
N1/2 NE NW 20.00 Acres
SW NE NW 10.00 Acres

Total **155.96 Acres**

Federal Lease SL--63058

T. 13 S., R. 11 E., SLM, Utah
Section 18
SW NE 40.00 Acres

Total **40.00 Acres**

Federal Lease UTU--81893 (Kenilworth Lease)
T. 12 S., R. 10 E., SLM, Utah
Section 26
N1/2 SW1/4 80.00 Acres

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SE SW	40.00	Acres
SE	160.00	Acres
Section 27		
S1/2	320.00	Acres
Section 34		
S1/2 NE	80.00	Acres
NW NE	40.00	Acres
NW	160.00	Acres
S1/2	320.00	Acres
Section 35		
NE	160.00	Acres
S1/2 NW	80.00	Acres
S1/2	320.00	Acres
Total	**1,760.00**	**Acres**

Total of Federal Leases **2,654.55 Acres**

FEE COAL LEASES

Mathis Fee Lease

T. 12 S., R. 10 E., SLM, Utah

Section 36

All	640.00	Acres
Total	**640.00**	**Acres**

Zion Fee Lease

T. 13 S., R. 11 E., SLM, Utah

Section 7

Lot 2	42.99	Acres
Lot 3	42.99	Acres
SE NW	40.00	Acres
E1/2 SW	80.00	Acres

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Total **205.98** **Acres**

Total of Fee Leases **845.98** **Acres**

~~**ROW'S**~~

ROW'S

Bureau of Land Management ROW U-62045

T. 13 S., R. 11 E., SLM, Utah
Section 18
~~SE NE NW~~Portion of NESENW 10.00 Acres

Total **10.00 Acres**

Bureau of Land Management ROW UTU-64158
(Left fork fan and access road)

Located within:
T. 13 S., R. 10 E., SLM, Utah
Section 13
Lot 1

T. 13 S., R. 11 E., SLM, Utah
Section 18
Lot 2
NE SW

Total **1.45 Acres**

Total of BLM R.O.W.~~'S~~.'S **11.45 Acres**

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Private Easements

Cave Private Easement
Located within:
T. 13 S., R. 11 E., SLM, Utah
Section 18
SE NW 1.50 Acres

Total Cave 1.50 Acres

Total Private Easements 1.50 Acres

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TABLE 1-2

Andalex Resources, Inc.

~~Tower Division~~

Centennial Project Surface Only Leases Within Permit Area

Federal Lease UTU-66060

T. 13 S., R. 10 E., SLM, Utah
Section 1

Lot 1	40.12	Acres
Lot 2	40.35	Acres

T. 12 S., R. 11 E., SLM, Utah
Section 31

Lot 3	7.58	Acres
Lot 4	7.60	Acres
Lot 5	7.17	Acres
Lot 12	40.00	Acres
Lot 13	1.13	Acres
Lot 14	40.00	Acres
Lot 15	40.00	Acres
Lot 16	40.00	Acres
Lot 21	22.86	Acres
Total	**286.81**	**Acres**

Federal Lease UTU-79975

T. 12 S., R. 11 E., SLM, Utah
Section 31

Lot 2	7.53	Acres
Lot 7	40.00	Acres
Lot 8	40.00	Acres
Lot 10	40.00	Acres
Lot 11	40.00	Acres
Total	**167.53**	**Acres**

Federal Lease UTU-010581

T. 13 S., R. 11 E., SLM, Utah
Section 7

SW NE	40.00	Acres

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Total **40.00 Acres**

Federal Lease UTSL-27304

T. 13 S., R. 11 E., SLM, Utah
Section 7
SW SE 40.00 Acres

Total **40.00 Acres**

Surface Only Permit Area **534.34 Acres**

PERMIT AREA TABULATION

Federal Coal Leases:	2,654.55	Acres (Including Kenilworth)
Fee Coal Leases:	845.98	Acres
BLM Surface R.O.W.	11.45	Acres
Private Easements:	1.50	Acres
Surface Only Federal Leases:	534.34	Acres
Permit Area Subtotal	4,047.82	Acres
Less OSO Gaswell Area	-11.92	Acres
Total Permit Area:	**4,035.90**	**Acres**

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R645-301-114.100. DOCUMENTATION

Appendix J

R645-301-114.200. SEVERED SURFACE AND MINERAL ESTATES

Appendix J

R645-301-114.210. WRITTEN SURFACE OWNER CONSENT FOR COAL EXTRACTION

Appendix R

R645-301-114.220. CONVEYANCE EXPRESSLY GRANTING RIGHT TO MINE COAL

Appendix J

R645-301-114.230. DOCUMENTATION OF LEGAL AUTHORITY TO MINE COAL

Appendix J

R645-301-114.300. ADJUDICATION OF PROPERTY RIGHTS DISPUTES

R645-301-114.300. ADJUDICATION OF PROPERTY RIGHTS DISPUTES

The Division does not have the authority to adjudicate property rights disputes.

R645-301-115. STATUS OF UNSUITABILITY CLAIMS

Carbon County has authorized mining and reclamation activities within 100 feet of County Road 299. (See Appendix B)

R645-301-115.100. IDENTIFICATION OF LANDS UNSUITABLE

The permit area is not within an area designated unsuitable for the surface effects of underground coal mining activities or under study for designation in an administrative proceeding initiated under those pasts. Further, there are no occupied dwellings within 300 feet of the permit area including the Hoffman Creek area.

R645-301-115.200. CLAIMS OF EXEMPTION BY COMMITMENT PRIOR TO JANUARY 4, 1977

None.

R645-301-115.300. MINING AND RECLAMATION OPERATIONS WITHIN 300 FEET OF AN OCCUPIED DWELLING OR WITHIN 100 FEET OF A PUBLIC ROAD

None.

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R645-301-116. PERMIT TERM

The starting and termination dates as well as the horizontal and vertical extent of the proposed underground mining activities over the total life of the permit are indicated on the ~~revised Pinnacle~~ underground layout map ~~included as Plate 30. Also refer to the underground layout maps~~ for the ~~Apex and~~ Aberdeen ~~Mines~~ Mine (see Plates ~~29 and 31). Refer to plate 41.~~ 5-6).

R645-301-116.100. SCHEDULE OF PHASED MINING AND RECLAMATION ACTIVITIES

All surface facilities have been constructed for the Pinnacle, Apex and Aberdeen Mines. Earthwork for the Aberdeen Mine was completed in 1989. The surface facilities for the Aberdeen Mine were completed in early 1990. No additional surface facilities are required for any new leases.

Andalex has added a fan installation in the left-hand fork of Deadman Canyon. This installation was conducted according to measures outlined by the Bureau of Land Management as part of Right-of-Way U-64158. (Copy of Right-of-Way is included in Appendix B.) The location of this breakout is shown on Plate ~~29~~ 5-6.

Andalex will fill, regrade and stabilize rills and gullies over 9 inches in depth. Further, Andalex has agreed to interim stabilization of all slopes and embankments within the disturbed area and has done so. One slope located at the bottom of the office driveway, has been attempted through hydroseeding, fertilizing and mulching techniques on three separate occasions. No significant erosion problems have occurred, Andalex will notify the Division in the event of any slides or other damage.

Andalex will cover acid or toxic forming materials if any are encountered. Andalex will advise the Division in the event of a temporary shutdown, such as a letter sent to the Division when Andalex's Apex Mine was temporarily closed.

R645-301-116.200. PERMIT TERM IN EXCESS OF FIVE YEARS

The requested term of this permit is five years. Andalex will then apply for five year extensions over the life of the mine.

R645-301-116.210. COMPLETENESS AND ACCURACY FOR LONGER TERM

N/A

R645-301-116.220. DEMONSTRATION OF NEED FOR LONGER TERM

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N/A

R645-301-117. INSURANCE, PROOF OF PUBLICATION AND FACILITIES OR STRUCTURES USED IN COMMON

~~Appendix B contains certificates~~Certificate of liability insurance covering personal injury and property damage resulting from this operation can be found onsite in the inspection binder. Andalex commits to mitigate all subsidence related damage to renewable resources, including, but not limited to water, grazing, and wildlife habitat including raptor nests.

R645-301-117.~~100. LIABILITY INSURANCE~~

~~Appendix B~~

~~R645-301-117.~~**200. NEWSPAPER PUBLICATION**

A copy of the newspaper advertisement of this Mining and Reclamation Plan and proof of publication of the advertisement is filed with the Division and made part of the complete application.

R645-301-117.300. FACILITIES USED IN COMMON

The Centennial Project includes the development of three separate mines. All are currently in operation. The names and M.S.H.A. I.D. numbers for existing mines and all sections are as follow:

Pinnacle Mine - M.S.H.A. I.D. #42-01474
Apex Mine - M.S.H.A. I.D. #42-01750 (inactive)
Aberdeen Mine - M.S.H.A. I.D. #42-02028

All coal from the newly acquired AEP Lease will be mined simply as an underground extension of the existing Pinnacle and Aberdeen Mines.

R645-301-118. FILING FEE

N/A Page 1-27 of document

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R645-301-120. PERMIT APPLICATION FORMAT AND CONTENTS

Summary of Table of Contents

R645-301-100. General

R645-301-200. Soils

R645-301-300. Biology

R645-301-400. Land Use and Air Quality

R645-301-500. Engineering

R645-301-600. Geology

R645-301-700. Hydrology

R645-301-800. Bonding and Insurance

R645-301-121. REQUIREMENTS

R645-301-121.100. CURRENT INFORMATION

Information is current.

R645-301-121.200. CLEAR AND CONCISE

Information is clear and concise.

R645-301-121.300. FORMAT REQUIREMENTS

To facilitate review of the application, each chapter listed above has been further divided into specific parts and sections. These can be found listed in the detailed table of contents appearing at the beginning of this text along with the page numbers on which they appear. This table of contents also contains lists of figures, tables, plates, exhibits, and appendices to facilitate cross referencing between chapters.

Exhibits include appropriate supporting documents, reports and publications and are included as appendices.

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Maps which were not reduced to fit into the text are included in a separate volume as plates. All maps and plans are submitted in accordance with the requirements.

R645-301-123. APPLICATION FOR PERMITS, CHANGES, RENEWALS, OR TRANSFERS

Text deleted as instructed by Technical analysis.

R645-301-130. REPORTING AND TECHNICAL DATA

Persons and Consultants Involved

The following persons and/or organizations were involved in collection and analysis of the technical data set forth in this application.

1. In-House Consulting Services

a) Andalex Resources, Inc. - AMCA Coal Leasing, Inc.
Samuel C. Quigley - Western Project Manager (Former)
Michael W. Glasson - Senior Geologist (Former)
Allen D. Emmel - Environmental Planning Coordinator (Former)

2. Outside Consulting Services

a) Dan W. Guy - Registered Professional Engineer (State of Utah No. 4548)
Price, Utah
-Sedimentation and Drainage Control Plan (April, 1980)

- Wastewater Disposal System; Pinnacle Mine (April, 1980)
Office Building (September, 1980)

b) Bruce T.S. Ware - Registered Land Surveyor
Price, Utah

c) A and W Surveying
Price, Utah

d) Commercial Testing & Engineering Co.
Denver, Colorado

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e) Standard Laboratories
Huntington, Utah

f) Western Testing and Engineering
Helper, Utah

g) VanCott, Bagely, Cornwall and McCarthy
Attorneys at Law
Salt Lake City, Utah

h) Rollins, Brown, and Gunnel
Provo, Utah

i) Brigham Young University
Provo, Utah
Department of Zoology
Clayton M. White
(Raptor Study)
Department of Anthropology/Archaeology
Dr. Ray T. Matheny
(Archaeological Survey)

j) Earth Environmental Consultants
Albuquerque, New Mexico

k) Vaughn Hansen Associates
Salt Lake City, Utah
(Hydrology Study)

l) Horrocks Engineers
American Fork, Utah

Coordination and Consultation with Governmental Agencies

The following governmental agencies were consulted in the preparation of information set forth in this application.

U.S. Department of Agriculture
Soil Conservation Service
Price, Utah
(Soil and Vegetation Survey)

U.S. Department of the Interior

Bureau of Land Management
Price, Utah
Salt Lake City, Utah

Office of Surface Mining, Reclamation and Enforcement
Denver, Colorado

U.S. Geological Survey
Salt Lake City, Utah

State of Utah:
Department of Natural Resources
Division of Oil, Gas, and Mining
Salt Lake City, Utah

Antiquities Section (Consulting Services Branch)
Salt Lake City, Utah
(Archaeological Survey)

Department of Natural Resources
Division of Wildlife Resources
Salt Lake City, Utah

References:

AMCA Coal Leasing, Inc., 1978. Mining and Reclamation Plan, Zion's Fee. Submitted to the State of Utah, Department of Natural Resources, D.O.G.M.

Centennial Coal Associates, 1976. Mining Application. Submitted to the U.S. Geological Survey.

Doelling, H.H., 1972. Central Utah Coal Fields. U.G.M.S. Monograph Series No. 3.

U.S.D.A., 1978. Soil Survey and Interpretations of the Coal Creek Emery Portion of the Price River and Emery County Areas, Carbon and Emery Counties, Utah. S.C.S.

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U.S.D.I., 1979. Final Environmental Statement, Development of Coal Resources in Central Utah, Parts 1 and 2.

U.G.M.S., 1966. Central Utah Coals. U.G.M.S. Bulletin No. 80.

R645-301-131. TECHNICAL DATA REQUIREMENTS

Where applicable, technical data submitted has been identified as to who prepared the information and is stamped by that registered professional engineer (P.E.).

R645-301-132. TECHNICAL ANALYSES REQUIREMENTS

Analyses are prepared by a qualified professional engineer.

R645-301-140. MAPS AND PLANS

R645-301-141. MAP FORMATS

R645-301-142. PHASES OF OPERATIONS AND MINING ACTIVITY

Mining operations at the Pinnacle Mine began in the Gilson Seam on October 3, 1980, according to the Mining and Reclamation Plan approved by the State of Utah, Department of Natural Resources, Division of Oil, Gas, and Mining. The mining began on the Zion's fee lease and extended onto Andalex's federal leases according to federal approval granted in 1982. Andalex also opened the Apex Mine in the Lower Sunnyside Seam late in 1982. Mining commenced in the Aberdeen Mine in the Aberdeen Seam in mid 1988. The Pinnacle Mine, Apex Mine, and most recently the Aberdeen Mine are now essentially worked out. With the addition of the Kenilworth lease the Aberdeen could possibly reopen depending upon market conditions. The restart date of the Aberdeen mine has yet to be determined. The coal is classified as High Volatile B bituminous in the Lower Sunnyside and Gilson Seams and as High-volatile A bituminous in the Aberdeen Seam.

The mine plan area is located approximately 10 miles north-northeast of Price, Utah in Carbon County in T12 and 13S and R10 and 11E (See Figure 1-2. The existing permit property is located in the Book Cliffs coal field and includes Alrad Canyon, Deadman Canyon, Starpoint Canyon, Straight Canyon, and Hoffman Creek Canyon areas. The Kenilworth Tract occupies the area of Summit Creek, Deep Canyon and Mathis Canyon. The Coal outcrops along the cliffs between 7,000 feet and 7,700 feet elevations. The topography is very rugged, the Book Cliffs being dissected by box canyons created by ephemeral streams. Large sandstone

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boulders eroded from the cliffs are scattered along the sides of the canyons. The land is undeveloped, used primarily for grazing, and there are no areas of national importance in the region. Mountain-Brush vegetative type covers most of the area.

There are no perennial streams or bodies of water on the property. Ground water recharge is from precipitation in the vicinity. Water supply for mine development and culinary usage is supplied by wells that have been drilled.

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Historically, coal mining has been the only industry in the permit area and there are several abandoned mines located on the property. No oil or gas wells exist in the area.

Access to the mine plan area is by an existing paved county road which has been upgraded and is maintained by Carbon County. Maintenance consists of paving, chipping, patching, culvert work, ditch work, signs, snow removal, painting, patrolling (county sheriff), etc., as needed. Andalex assumes no responsibility for road maintenance or repair. The road is used as an access road as well as a haul road. It should be noted that in the event of a catastrophic event which damaged the road, Andalex would pursue all avenues to assist Carbon County in reparation of the road. All surface and support facilities necessary for present operations have been completed and are located on the Zion's fee or on rights-of-way granted by the Bureau of Land Management. This is also a small private easement granted to Andalex from Gladys M. Artman for a small portion of pond E. All proposed facilities are indicated in this application. Andalex has acquired all applicable state and federal licenses, permits, and rights-of-way necessary to conduct mining activities on the Zion's fee property and contiguous federal leases.

As of 7-6/2007 the Apex Mine and the Pinnacle Mine have been worked out. The Apex Mine has been sealed at the portals. The Pinnacle mine is still being ventilated because the power to the Aberdeen mine runs into the Pinnacle mine from the substation and then drops down to the Aberdeen Mine through a borehole connecting the two mines. However, there are no plans to produce any more coal from the Pinnacle Mine. Therefore, all existing and future mine production from the Centennial Project will be solely from the Aberdeen Mine

Upon cessation of mining activities, reclamation activities will commence as soon as is practicable, according to the approved Mining and Reclamation Plan. The land will be restored according to available technology to as nearly its original condition as is possible.

This operation does not face any of the mining complications caused by faults or intrusives. The mine plan area is located in a region where mining has been the major industry; therefore, the nearby communities are geared for coal operations. The labor supply is excellent and well trained. With these considerations, and Andalex's prudent management, the Centennial Project has become a model mining operation in the Carbon County area with very minimal environmental and socioeconomic impact.

R645-301-142.100. PRIOR TO AUGUST 3, 1977

None by Andalex Resources. Several mines were operated by other independent companies or individuals in areas presently consumed by Andalex's surface facilities. Andalex's encroachment onto these previously disturbed areas

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transferred the responsibility for reclamation to Andalex. The specific locations of disturbed areas prior to Andalex's mining activities is irrelevant.

R645-301-142.200. AFTER AUGUST 3, 1977

All of Andalex's surface facilities and mining operations began after August 3, 1977.

R645-301-142.210. PRIOR TO MAY 3, 1978

See R645-301-142.100.

R645-301-142.220. SMALL OPERATOR'S EXEMPTION PRIOR TO JANUARY 1, 1979

N/A

R645-301-142.300. AFTER MAY 3, 1978 (OR JANUARY 1, 1979 FOR SMALL OPERATOR'S EXEMPTION) AND PRIOR TO APPROVAL OF STATE PROGRAM

N/A

R645-301-142.400. AFTER ISSUANCE OF PERMIT BY THE DIVISION

The following is a list of all other licenses and permits under applicable state and federal land-use, air and water quality, water rights and health and safety laws and regulations held by Andalex in order to conduct underground coal mining activities.

All permits listed are up to date and current. The NPDES Permit for the Centennial Project has been replaced by an individual UPDES permit, UT0025674.

1) State of Utah
Department of Natural Resources
Division of Oil, Gas and Mining
1594 West North Temple, Suite 1210
Salt Lake City, Utah 84114-5801

- Mining and Reclamation Plan for Andalex Resources' Centennial Project Permit I.D. Number C/007/019
Approved January 4, 1982

2) State of Utah
Department of Environmental Quality
Division of Air Quality
150 North 1950 West

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P.O. Box 144820
Salt Lake City, Utah 84114-4820

- Air Quality Approval Order, Permit No DAGE-977-96
Approved June 13, 1980

3) State of Utah
Department of Environmental Quality
Division of Water Quality
150 North 1950 West
P.O. Box 144820
Salt Lake City, Utah 84114-4820

- UPDES permit UT0025674
(Replaced previous EPA NPDES permit)

- Water Quality - Sediment and Drainage
Approved May 14, 1980

- Septic and Culinary Plan (2)
Approved September 17, 1980 (Office Site)
Approved May 8, 1980 (Bathhouse Facility)

4) Bureau of Land Management
Utah State Office
440 West 200 South, Suite 500
Salt Lake City, Utah 84101-1345

- Access Road Right-of-Way
Permit Number U-45966
Granted September 1, 1980

- Buried Telephone Cable Right-of-Way
Permit Number U-36739
Granted November 20, 1978

- Power Transmission Line Right-of-Way
Permit Number U-36741
Granted November 20, 1978, assigned to UP&L

- Material Storage Site Right-of-Way
Permit Number U-45965
Granted September 11, 1980

- Aberdeen Mine Right-of-Way

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5) Mine Safety and Health Administration (M.S.H.A.)
P.O. Box 25367
Denver, Colorado 80225
(District 9)

Pinnacle Mine I.D. 42-01474
Apex Mine I.D. 42-01750 (inactive)
Aberdeen Mine I.D. 42-02028

- Roof Control Plan
Reviewed and approved every six months

- Ventilation System and Methane and Dust Control Plan
Reviewed and approved every six months

- Smoking Prohibition Plan
Approved August 4,1992

- Training Plan
Approved November 27, 1990

- Instruction Program: Firefighting and Evacuation Plan
Approved August 4, 1992

- SCSR Storage Plan
Approved May 18, 1992

- Chest X-Ray Plan
Approved March 15, 1990

R645-301-150. COMPLETENESS

Per Division.

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ANDALEX RESOURCES, INC.
CENTENNIAL PROJECT

CHAPTER 2

Soils

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R645-301-200. SOILS

List of Plates

Plate 2-1 Regional Soils Map
Plate 2-2 Soil Survey Map - Deadman Canyon
Plate 2-3 Topsoil Storage Piles - Deadman Canyon

R645-301-210. INTRODUCTION

The Kenilworth Lease (UTU-81893) Boundary Change is simply an extension to the Aberdeen Mine workings and will in no way involve any new surface facilities or otherwise have any ~~affect~~effect on the surface. It does not involve any new hydrologic basins. It should be noted that UTU-81893 was previous included in the Willow Creek Mine Permit No. ACT/007/038, which was approved by DOGM. After the Willow Creek Mine was closed the Kenilworth lease was terminated. The area was subsequently re-leased by BLM in 1986 through the normal LBA process after an application by Andalex Resources. Refer to R645-301-200 through R645-301-800 for additional information.

Mining operations at the Pinnacle Mine began in the Gilson Seam on October 3, 1980, according to the Mining and Reclamation Plan approved by the State of Utah, Department of Natural Resources, Division of Oil, Gas, and Mining. The mining began on the Zion's fee lease and extended onto Andalex's federal leases according to federal approval granted in 1982. Andalex also opened the Apex Mine in the Lower Sunnyside Seam late in 1982. Mining commenced in the Aberdeen Mine in the Aberdeen Seam in mid 1988. The Pinnacle Mine, Apex Mine, and most recently the Aberdeen Mine are essentially worked out. With the addition of the Kenilworth lease the Aberdeen could possibly reopen depending upon market conditions. The restart date of the Aberdeen

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mine has yet to be determined. The coal is classified as High Volatile B bituminous in the Lower Sunnyside and Gilson Seams and as High-volatile A bituminous in the Aberdeen Seam. The mine plan area is located approximately 10 miles north-northeast of Price, Utah in Carbon County. (See Plate 1-1).

The Operator relinquished portions of the mined out Federal coal leases in two separate lease relinquishments. The first lease relinquishment approved 3/12/2012 reduced the Federal coal leased acreage from 5,436.24 down to 2,813.48. The second coal relinquishment reduced the Federal coal lease even further down to 894.55 acres. UEI retained all areas of surface disturbance conducted in association with the underground mining and surface access to the gob-vent holes was retained through surface use agreements.

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With the relinquishments the permit acreage dropped from 6,516.91 down to 2,274.77 acres. When Kenilworth lease is added the permit acreage goes back up to 4,035.90 which is the new permit acreage. The disturbed area has not changed and remains at 47.19 acres. Since the disturbed area has not changed and the disturbed legal description stays the same the bond does not change with the addition of the Kenilworth lease.

As the Kenilworth Tract is simply an extension of underground mine workings under roughly 2,000 to 3,000 feet of cover there will be absolutely no effect on soils.

R645-301-211. PREMINING SOIL RESOURCES

The Regional Soils Map, shown as Plate ~~10~~2-1 in Volume II. EEC performed the work on the north and south one-thirds of the disturbed area and the SCS performed the work on the one-third in the middle. This was for the original Pinnacle Mine approval on the Zion's Fee area (please see second half of Appendix M.

The acreages given by EEC in their soils report does not include the entire disturbed area since we know that the SCS surveyed roughly one-third of the disturbed or "to be" disturbed area. The correct acreages as planimetered by Andalex staff is 47.19 acres including the GVH holes. This of course includes the area where the Aberdeen Mine has been developed. The area of disturbed Brycan is approximately 8 acres and the Datino is 4 acres within the SCS survey. EarthFax Engineering has performed the Order 1 soil survey for the left fork fan installation. (See Appendix M.)

R645-301-212. STOCKPILING AND REDISTRIBUTION

Topsoil Handling During Operations

Removal

The area from which topsoil was projected to be removed is 47.19 acres and includes poorly developed soils. Using dozers and front end loaders, the soil was scraped from the surface and dumped at a site near the facility location. The topsoil was removed as a separate operation from areas to be disturbed by surface installations such as roads and areas upon which support facilities are sited. The left fork topsoil will be salvaged according to EarthFax.

Storage

The topsoil storage areas are shown on Plate ~~6~~5-7. The topsoil has been segregated, stockpiled, and protected from wind and water erosion and contaminants through revegetation and the use of berms.

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Surveys conducted on the topsoil piles which were drawn into plans and profiles are now included in the plan in Volume II, Plates ~~37 and 36~~2-3. This shows volumes stored currently.

The completed disturbance which reports to sedimentation Pond E is 9.96 acres. Please review the top soil summaries which show totals.

The new substitute topsoil pile plan and profile is included.

The new substitute topsoil will be protected by the use of vegetation.

Disturbed areas no longer required for the conduct of mining operations have been revegetated. Upon completion of mining activities, topsoil will be distributed and reclamation will commence as outlined. Andalex will adhere to all UDOGM guidelines.

R645-301-220. ENVIRONMENTAL DESCRIPTION

Regional soils information for the Kenilworth Tract is taken from the approved Willow Creek permit 007/0038, and is presented herein verbatim:

3.1.1.3 Regional Soils Information

The USDA-SCS General Soils Map - Carbon County Area, Utah, shows the following three general soils types as
occurring within the boundaries of the permit area:

* Type 7 - Strych-Gerst-Travessilla: Shallow to very deep, well drained, nearly level to moderately
steep soils, on outwash plains, benches and mesas

* Type 10 - Travessilla-Rock Outcrop-Midfork Family: Shallow to very deep, well drained, steep and
very steep, soils; and rock outcrop, on mountain slopes and canyonsides

* Type 14 - Beje-Trag-Senchert: Shallow to very deep, well drained, gently sloping to moderately steep
soils, on plateaus and mountain valley floors

Type 10 is found over approximately 85 percent of the permit area and is found in nearly all areas except a portion of
the extreme northeast comer of the permit area and a narrow tier along the southern edge of the permit area.
Descriptions of each of these primary soil types as contained in the USDA-SCS Soils Survey are as follows:

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Additional information can be found in Appendix M.

R645-301-221. PRIME FARMLAND INVESTIGATION

The land within the Kenilworth lease area has not been historically used as cropland, contains steep slopes, and the area is not conducive to intensive agricultural uses and no surface disturbance. The Permittee does not believe that any Prime Farmland exists with the permit revision area, Kenilworth lease, being added to the Mine and Reclamation Plan. The Kenilworth lease has been previously permitted under the Willow Creek Mine Permit ACT/007/0038. Since Kenilworth lease is found in T12S R10E Section 26, the Willow Creek Permit information found below is pertinent. Prime farmland information for the Kenilworth Tract is taken from the Willow Creek permit presented herein verbatim:

3.1.1.6 Prime Farm Land

Several previous investigations have been conducted for the permit area to determine whether any prime farmlands exist in the area. Each of these investigations involved formal consultation with the USDA-SCS. The initial determination, included in PRCCs Mining and Reclamation Permit application, was provided by Mr. George D. McMillan, USDA-SCS State Conservationist in a letter dated July 16, 1979. This letter concluded that, based upon the absence of any irrigation, and excessive slopes, no prime farmlands existed in the area corresponding to Townships 12 & 13 South, Ranges 8, 9 and 10 East. A second negative determination for prime farmlands in the permit area was issued in connection with the permitting efforts for the CGCC Permit submitted to UDOGM in February 1991. The CGCC permit application contains a letter dated May 21, 1991 from Mr. Ferris P. Allgood, USDA-SCS State Soil Scientist, stating that due to the excessive amount of rock fragments, high erodibility and lack of a reliable source of irrigation waters for lands within the CGCC Mine Permit area, the soils within this area are excluded from consideration as important farmlands. Confirmation of these negative determinations was included in the findings documents issued by UDOGM for both permit applications and documentation is provided in Exhibit 5, Soils Information. Since the limitations which exclude these soils for consideration as prime farmlands still exist, and all surface disturbance associated with the mining and reclamation activities will occur on either previously disturbed areas or on slopes greater than ten percent, UDOGM is requested to reaffirm the negative determination regarding the presence of prime farmland soils in the permit area.

Additional information can be found in Appendix M.

R645-301-222. SOIL SURVEY

Appendix M

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R645-301-222.100. SOIL MAP

Plate ~~18~~2-1

R645-301-222.200. SOIL IDENTIFICATION

Appendix M

R645-301-222.300. SOIL DESCRIPTION

Appendix M

R645-301-222.400. SOIL PRODUCTIVITY

Appendix M

R645-301-223. SOIL CHARACTERIZATION

Appendix M

R645-301.224. SUBSTITUTE TOPSOIL

Two test plot locations were decided upon based on certain known parameters. The 5,240 yard substitute material area chosen was once designated as substitute topsoil. Now that the shop building is in place, this should not have any impact on the suitability of the material. The second location depicted on Plate ~~6~~5-7 near the Apex Truck Loadout is very similar, if not identical material, to the shop pad material (the revegetation test will ultimately prove this). To prove the materials suitability, Andalex has proposed to test the material using the approved seed mixture on the locations shown on Plate ~~6~~5-7. The area of the test plots are both currently heavily vegetated indicating good potential. These test plots will be monitored for two years and evaluated for growth and species success. It is anticipated that these areas will succeed and solve the deficit problem.

These pads were constructed in 1982 during the construction of the Apex Mine. The Shop pad and the Apex truck loadout pad both have out-slopes which we currently feel contain suitable topsoil substitute material. In 1982 these slopes were groomed with heavy equipment and graded prior to being hydroseeded with the interim seed mixture and then hydromulched. Mulch in the amount of one ton per acre was used at the time. In 1990 the approved seed mixture was hand broadcasted onto these same slopes which were already fairly heavily vegetated. The seed was raked in to the extent possible and no additional mulch was used because of the vegetative cover in place. Also, samples have been taken of this substitute material (three separate locations at each site) and have been sent in to a qualified soil testing laboratory. These samples will be tested for parameters outlined in Table 6 "Guidelines for Overburden and Topsoil Management", 1988. Results of these tests will be included in the permit as soon as they are available.

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Topsoil Pile Summary, Existing
(See Plates 5-7 and 2-3)

Topsoil Pile A	35,731 cubic feet
Topsoil Pile C	6,829 cubic feet
Topsoil Pile F	60,290 cubic feet
Topsoil Pile G	167,980 cubic feet
Topsoil Pile J	94,500 cubic feet

Topsoil Pile Summary, Proposed
(See Plates 5-7 and 2-3)

Topsoil Piles J contains 94,500 cubic feet which includes the original Topsoil Pile B which was moved during the construction of the Aberdeen Mine.

Based on the size of the disturbed area and the amount of topsoil required (6"), we have calculated that there is a 8,000 yd.^{3} topsoil deficit. The topsoil substitutes will make up this deficit.

The test plots previously discussed regarding the topsoil deficit is further discussed here.

Two test plot locations were decided upon based on certain known parameters. The first location is south of the shop building and contains 5,240 cubic yards. The second location is southwest of the Apex Mine truck loadout and contains 1,700 cubic yards (see Plate 5-7). The 5,240 yard substitute material area chosen was once designated as substitute topsoil. Now that the shop building is in place, this should not have any impact on the suitability of the material. The second location depicted on Plate 5-7 near the Apex Truck Loadout is very similar, if not identical material, to the shop pad material (the revegetation test will ultimately prove this). To prove the materials suitability, Andalex has proposed to test the material using the approved seed mixture on the locations shown on Plate 5-7. The area of the test plots are both currently heavily vegetated indicating good potential. These test plots will be monitored for two years and evaluated for growth and species success. It is anticipated that these areas will succeed and solve the deficit problem. The first quantitative monitoring study will take place in the summer of 1992.

Topsoil substitute storage area signs have been placed strategically at the two substitute storage areas at the minesite. They will clearly mark the location of these storage area.

R645-301-230. OPERATION PLAN

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Topsoil Handling During Operations

Removal

The area from which topsoil has been removed is 47.19 acres and includes poorly developed soils. Using dozers and front end loaders, the soil was scraped from the surface and dumped at a site near the facility location. The topsoil was removed as a separate operation from areas to be disturbed by surface installations such as roads and areas upon which support facilities are sited. Approximately 750 cubic yards of topsoil will be stored in the left hand fork of Deadman Canyon for use during reclamation of the left fork fan installation. (See Plate LF-1.)

Storage

The topsoil storage areas are shown on Plate ~~6~~5-7. The topsoil has been segregated, stockpiled, and protected from wind and water erosion and contaminants through revegetation and the use of berms.

Surveys conducted on the topsoil piles which were drawn into plans and profiles are now included in the plan in Volume II, ~~Plates 37 and 36.~~Plate 2-3. This shows volumes stored currently.

The completed disturbance which reports to sedimentation Pond E is 9.96 acres. Please review the top soil summaries which show totals and deficiencies in R645-301-224.

The new substitute topsoil pile plan and profile is included.

The new substitute topsoil will be protected by the use of vegetation.

R645-301-231. GENERAL REQUIREMENTS

R645-301-231.100 REMOVAL AND STORAGE

See R645-301-212.

R645-301-231.200. SUITABILITY OF TOPSOIL SUBSTITUTES

See R645-301-224.

R645-301-231.300. TESTING PLAN

See R645-301-224.

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R645-301-231.400. TOPSOIL HANDLING AND STORAGE AREAS

See R645-301-212.

R645-301-232. TOPSOIL AND SUBSOIL REMOVAL

See R645-301-212.

R645-301-232.100. TOPSOIL SEGREGATION

See R645-301-212.

R645-301-232.200. INSUFFICIENT QUANTITY OR POOR QUALITY

See R645-301-224.

R645-301-232.300. TOPSOIL LESS THAN SIX INCHES THICK

N/A

R645-301-232.400. TOPSOIL REMOVAL FOR MINOR DISTURBANCES

N/A

R645-301-232.410. SMALL STRUCTURES

N/A

R645-301-232.420. PROTECTION OF EXISTING VEGETATION AND EROSION PROTECTION

Disturbed areas no longer required for the conduct of mining operations have been revegetated. Upon completion of mining activities, topsoil will be distributed and reclamation will commence as outlined in re Reclamation. Andalex will adhere to all UDOGM guidelines.

R645-301-232.500. SUBSOIL SEGREGATION

N/A

R645-301-232.600. TIMING

All soils have been removed.

R645-301-232.700. TOPSOIL AND SUBSOIL REMOVAL UNDER ADVERSE CONDITIONS

N/A

R645-301-232.710. IMPRACTICABILITY

N/A

R645-301-232.720. IMPORTING TOPSOIL MATERIAL

N/A

R645-301-233. TOPSOIL SUBSTITUTES AND SUPPLEMENTS

See R645-301-224.

R645-301-233.100. SELECTED OVERBURDEN MATERIALS

See R645-301-224.

R645-301-233.200. SUITABILITY OF TOPSOIL SUBSTITUTES AND SUPPLEMENTS

See R645-301-224.

R645-301-233.300. PHYSICAL AND CHEMICAL ANALYSES

Appendix M

R645-301-233.310. SCS PUBLISHED DATA

Appendix M

R645-301-233.320. SCS TECHNICAL GUIDES

Appendix M

R645-301-233.330. OTHER PUBLISHED DATA

Appendix M

R645-301-233.340. RESULTS OF FIELD-SITE TRAILS OR GREENHOUSE TESTS

Appendix M

R645-301-233.400. DEMONSTRATION OF INSUFFICIENT TOPSOIL AND SUITABILITY OF SUBSTITUTE MATERIALS

See R645-301-224.

R645-301-234. TOPSOIL STORAGE

See R645-301-212,224.

R645-301-234.100. STOCKPILING AND REDISTRIBUTION

See R645-301-212.

R645-301-234.200. STOCKPILING REQUIREMENTS

See R645-301-212.

R645-301-234.210. PLACEMENT

See R645-301-212.

R645-301-234.220. PROTECTION

See R645-301-212.

R645-301-234.230. VEGETATIVE COVER

Appendix M

R645-301-234.240. REHANDLING

N/A

R645-301-234.300. LONG-TERM STORAGE AND DISTRIBUTION

See R645-301-212.

R645-301-234.310. CAPABILITY OF HOST SITE

R645-301-234.320. SUITABILITY FOR REDISTRIBUTION

See R645-301-212.

R645-301-240. RECLAMATION PLAN

Timetable of Major Reclamation Steps

Introduction

As this is an underground mine, there will be a limited amount of surface disturbance, consequently, reclamation will be uncomplicated.

All disturbed areas no longer required for the conduct of mining operations were immediately revegetated. In the future, any areas no longer required for operations will also be immediately reclaimed and revegetated. The only new surface disturbance required at this time will be for a mine-fan break-out in the left fork of Deadman Canyon.

When buildings and final site preparation had been completed, the soil was revegetated to prevent erosion.

When the project is expired, all buildings and extraneous material will be removed, all mine openings will be covered and sealed, roads will be regraded and using the most advanced technology at the time, Andalex will re-establish the terrain to as nearly the original as practical. The area will be reseeded and vegetation re-established in accordance with recommendations from the regulatory authorities.

Reclamation Timetable

This timetable represents the general sequence which will be used for final reclamation. The bond estimate has the costs broken down on a site by site basis; however, actual work will be performed simultaneously at all the sites. For example, all structures and buildings will be removed prior to any recontouring. This will allow us to have certain equipment for certain jobs the shortest time possible. Detail of work involved in various jobs (portal seals, revegetation, etc.) can be found in Appendix C. The addition of the Kenilworth Lease will have no impact on the reclamation schedule or cost.

Phase I

Job 1. Portal Seals (include fan removal)

a. 4 Apex
b. 7 Pinnacle
c. 7 Aberdeen (includes left fork)
d. 5 Wells

Job 2. Building Removal

a. 1 Shop
b. 1 Main Office
c. 3 Trailers (2 warehouse, 1 lab)
d. 3 Lamphouses
e. 3 Bathhouses

Job 3. Structure Removal

a. 3 Mine Conveyor Structures
b. 3 Truck Loadouts

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c. 1 Substation
d. Power distribution lines
e. 4 Water Tanks
f. 5 Fuel Tanks
g. Main and Side Culverts *

Job 4. Recontouring & Regrading*
a. 105,500 yds.^{3} fill material
b. Enlarge Pond E, Remove B and C

Job 5. Compaction, Scarification
a. 33.5 acres (not including Pond E)
b. Additional sediment measures, i.e., check dams

Job 6. Topsoil Redistribution
a. 47.19 acres (additional approved substitute hauled in if necessary)

* Culverts will be removed starting at the north end so that natural drainage may be re-established as the culvert is removed.

Job 7. REVEGATATION
a. 2.15 acres shrubs
b. 14.32 acres drainage (except Pond E)
c. 17.03 acres slopes

Job 8. Commence Monitoring
a. REVEGATATION
1. Woody plants will be quantitatively monitored in years 4 and 8
2. Success for woody plants will be based on a minimum 2,000 plants-per-acre in stream bottoms and on east-facing slopes; 1,500 plants-per-acre on west-facing slopes.
b. Slope Stability
c. Water Monitoring including inlet and discharge at Pond E**

** Sampling of this water will consist of grab samples taken quarterly if any runoff occurs. Andalex's experience with this drainage is that runoff may occur every several years so that monitoring of this runoff will take place infrequently. Quarterly reports will indicate whether or not any runoff has occurred. The

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samples will be tested to assure that state and federal water quality requirements are being met.

Phase II

Starts When Phase I Monitoring Allows. Sedimentation Pond E will not be removed until the revegetation requirements of 817.111-.117 are met. This includes the revegetation of the entire disturbed area with the exception of Pond E. Also, Pond E will not be removed until the drainage entering the ponds meets applicable state and federal limitations. When Pond E is removed and revegetated, additional sediment control measures will be placed downstream from the revegetated area such as straw dikes until revegetation has been deemed complete by Phase II Monitoring.

Job 1. Done Simultaneously

a. Remove (recontour) Pond E

b. Remove remaining culvert

Job 2. Compact & Scarify Location

Job 3. Distribute Remaining Topsoil

Job 4. Revegetate

Job 5. Continue Monitoring until Bond is released

Please note that the earthwork involved will be done during the dry season to avoid unnecessary erosion of regraded areas. Water will be implemented if dust becomes a problem.

Reclamation Cost and Bonding

Introduction

An estimate for the reclamation costs is provided in appendix B. Andalex has provided, as Plate ~~15~~5-9, accurate as built versus reclaimed cross sections which show the mass balance for earthwork. The approximate original contours will be achieved using the material cut out to create the fill areas. No material will be hauled in. Maps depicting accurately the surface facilities including topsoil areas, structures and facilities are included in Volume II and also specific topsoil maps and cross sections are included. Andalex expects to return topsoil to a depth of up to 6" around the surface area of 47.19 acres.

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Phase I of the reclamation will include, chronologically, structure removal including culverts, portal sealing, well sealing, regrading, recontouring, distribution of topsoil and revegetation. Additional sediment control during Phase I such as straw dikes and rock check dams will be implemented as shown on Plate ~~16~~7-12. Once Phase I is adequately achieved, Phase II will commence which includes the removal of sediment structure E and revegetation of this area. This is followed by monitoring, noting that monitoring had begun during Phase I. See 5.8 re Monitoring. This section discusses the extended period of liability as being ten years if necessary. The entire permit area receives less than 26 inches of annual precipitation; therefore, it is generally accepted that Andalex is subject to an extended period of liability. Obviously if revegetation is deemed successful prior to this ten year period, Andalex will request bond release. Andalex has not proposed any selective husbandry practices.

Cost of Reclamation

Detailed Estimate

A detailed cost projection is included in Appendices B and C.

Calculations

Calculations of the estimate reclamation costs are included in Appendices A and B. Calculations for cuts and fills were made and are included. This summary shows the mass balance for the entire disturbed area, as taken from Plates ~~14~~5-9 and ~~15~~ 5-9. Station numbers are referenced on Plate ~~14~~5-8 and cross sections are shown on ~~Plates 15-~~ sheets 1, 2, and 3 of Plate 5-9. Similarly, topsoil piles have been surveyed for the existing minesite and are summarized following the cut and fill summary. Because of deficits Andalex has committed to testing topsoil substitute areas.

Bond or Surety Arrangement

Andalex currently holds a bond, approved by UDOGM in the amount shown in Appendix B.

Regarding the left hand fork fan installation, the specific time table for this project will coincide with the reclamation of the right hand fork minesite. The specific schedule for reclamation of the fan will begin with the cut slope backfill, followed by removal of the culvert from the left fork drainage and, finally, by streambed reclamation the same as will be performed in the right hand fork. According to comments received by the majority of the surface lands managers, the access road to the left hand fork fan installation will be reclaimed by recontouring to the extent possible (this road has been in existence for over 50 years) and revegetated. One of the surface owners (Gladys Artman) has specifically indicated her desire to leave the road in place, therefore, her permission will be required to reclaim the road. Topsoil redistribution and revegetation will follow the culvert removal. During both construction and reclamation phases, Andalex will provide

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adequate supplementary sediment control in the form of silt fences and/or straw berms to prevent additional sediment loads to the drainage.

Andalex has supplied the Division with a Drawing entitled "Left Hand Fork Cut/Fill". This drawing has a notation which indicates that the existing contours will reflect the reclamation contours (post-mining).

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MASS BALANCE SUMMARY

Station	CUT		FILL	
	ft^2	yds^3	ft^2	yds^3
-1 + 00	520	963	160	2148
0 + 00	0	815	1000	1889
1 + 00	440	1000	20	407
2 + 00	100	1074	200	1259
3 + 00	480	3333	480	1519
4 + 00	1320	2593	340	2259
5 + 00	80	2889	880	1852
6 + 00	1480	6778	120	2704
7 + 00	2180	9037	1340	4074
8 + 00	2700	8259	860	2556
9 + 00	1760	6000	520	4297
10 + 00	1480	6444	1800	6519
11 + 00	2000	6259	1720	5593
12 + 00	1380	9222	1300	5074
13 + 00	3600	7037	1440	6148
14 + 00	200	370	1880	8852
15 + 00	0	370	2900	5815
16 + 00	200	407	240	2111
17 + 00	20	1889	900	5593
18 + 00	1000	2889	2120	8185
19 + 00	560	2000	2300	5319
20 + 00	520	4444	572	3059
21 + 00	1880	8704	1080	3185
22 + 00	2820	8556	640	3037
23 + 00	1800	3741	1000	3370
24 + 00	220	1148	820	2963
25 + 00	400	926	780	4519
26 + 00	100	2630	1660	10222
27 + 00	1320	4444	3860	7407
28 + 00	1080	3111	140	1741
29 + 00	600	2222	800	2815
30 + 00	600	2074	720	2222
31 + 00	520	1889	480	1741
32 + 00	500	1482	460	2185
33 + 00	300	2037	720	1815
34 + 00	800	3111	260	852
35 + 00	880	3185	200	1630
36 + 00	840	1963	680	3482
37 + 00	220	1741	1200	5407
38 + 00	720	2741	1720	4037
39 + 00	760	3000	460	6111
40 + 00	860	2704	2840	5593

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41 + 00	600	1444	180	1148
42 + 00	180	482	440	963
43 + 00	80	148	80	148

* Total Cut = 147,555 yds^3; * Total Fill = 163,825 yds^3

* Ratio of fill to cut = 1.11:1.00. This allows for an expansion factor of 1.11 or 11% on the cut material.

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As Constructed Earthwork Volume (Aberdeen Mine)

Cut 63,506 yds.^{3}
Fill 66,625 yds.^{3}
Topsoil 3,500 yds.^{3} (Piles H & J)

As Constructed Earthwork Volumes
(including Aberdeen Site)

Cut 117,273 yds.^{3}
Fill 112,969 yds.^{3}
Topsoil 8,500 yds.^{3}

For purposes of reclamation costs for earthwork, the following estimates can be used. Please keep in mind that as built cross sections for the Aberdeen Mine will aid in the final earthwork estimates.

There is a 8,000 yd.^{3} topsoil deficit. The topsoil substitutes will make up this deficit.

The test plots previously discussed regarding the topsoil deficit is further discussed here.

Two test plot locations were decided upon based on certain known parameters. The 5,240 yard substitute material area chosen was once designated as substitute topsoil. Now that the shop building is in place, this should not have any impact on the suitability of the material. The second location depicted on Plate ~~6~~5-7 near the Apex Truck Loadout is very similar, if not identical material, to the shop pad material (the revegetation test will ultimately prove this). To prove the materials suitability, Andalex has proposed to test the material using the approved seed mixture on the locations shown on Plate ~~6~~5-7. The area of the test plots are both currently heavily vegetated indicating good potential. These test plots will be monitored for two years and evaluated for growth and species success. It is anticipated that these areas will succeed and solve the deficit problem.

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R645-301-241. GENERAL REQUIREMENTS

R645-301-242. SOIL REDISTRIBUTION

Soil is to be redistributed to a depth of 6-inches across the entire 47.19 acre disturbed area.

R645-301-242.100. CRITERIA FOR REDISTRIBUTION

The only criteria is that it will be redistributed to a depth of 6 inches.

R645-301-242.110. UNIFORMITY AND CONSISTENCY

The soil will be redistributed uniformly and consistent with the regraded contours.

R645-301-242.120. PREVENTION OF COMPACTION

Once redistributed, unnecessary compaction from equipment will be avoided.

R645-301-242.130. PROTECTION FROM WIND AND WATER EROSION

The topsoil will be protected from wind and water erosion through mulching.

R645-301-242.200. REGRADING AND TREATMENT

Not applicable, unless unacceptable rills and gullies are observed.

R645-301-242.300. EMBANKMENTS OF PERMANENT IMPOUNDMENTS OR ROADS

N/A

R645-301-242.310. PREVENTION OF SEDIMENTATION

Pond E will be in place until the release of Phase I reclamation.

R645-301-242.320. OTHER METHODS OF STABILIZATION

Other methods may include excelsior matting on steep slopes and rip-rap.

R645-301-243. SOIL NUTRIENTS AND AMENDMENTS

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As needed to be determined through Phase I monitoring.

R645-301-244. SOIL STABILIZATION

See R645-301-242.

R645-301-244.100. EROSION CONTROL AND AIR POLLUTION

See R645-301-242.

R645-301-244.200. SOIL STABILIZING PRACTICES

See R645-301-242.

R645-301-244.300. RILLS AND GULLIES

See R645-301-242.

R645-301-244.310. DISRUPTION OF POSTMINING LAND USE OR ESTABLISHMENT OF VEGETATIVE COVER

Vegetative cover will be in accordance with revegetation practices found in R645-301-331.

R645-301-244.320. CAUSE OR CONTRIBUTE TO A VIOLATION OF WATER QUALITY STANDARDS

Andalex will not violate water quality standards. This will be demonstrated through monitoring practices.

R645-301-250. PERFORMANCE STANDARDS

All performance standards will be adhered to.

R645-301-251. SOIL REMOVAL

See R645-301-212.

R645-301-252. SOIL STORAGE AND REDISTRIBUTION

See R645-301-212.

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ANDALEX RESOURCES, INC.
CENTENNIAL PROJECT

CHAPTER 3

Biology

C/007/019

~~(Revised)~~
~~July, 2014~~

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R645-301-310. INTRODUCTION

310. Introduction

At present the Mining and Reclamation Plan for the Centennial Project includes 2,274.77 acres under permit (see Plate ~~3~~5-2). This permit is now being amended to include the Kenilworth Federal Lease UTU-81893 (1760.0 acres), bringing the total permit area to 4,034.77 acres (see Plate ~~3~~5-2). Lease UTU-81893 was acquired in 2006. Mining activity within the Kenilworth lease area will be an extension of the

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underground workings of the existing Aberdeen Mine. Therefore there will be no new surface facilities associated with mining in the new lease areas (other than additional Gob Gas Vent holes, if needed, which will be permitted on a site-specific basis in the future). It should be noted that UTU-81893 was previous included in the Willow Creek Mine Permit No. ACT/007/038 which has been previously approved by DOGM. After the Willow Creek Mine was closed the Kenilworth lease was terminated. The area was subsequently re-leased by BLM in 2006 through the normal LBA process after an application by Andalex Resources.

Since the Kenilworth Lease is simply an extension of underground mine workings under roughly 2,000 to 3,000 feet of cover, it is unlikely there will be ~~absolutely no~~any effect on vegetation, fish or wildlife. Raptor surveys will be conducted while active mining takes place. Because there will be no additional surface disturbance on the lease area, a First Order Survey is not deemed necessary.

311. Vegetative, fish, and wildlife resources of the permit area and adjacent areas are described in section 320.

312. Potential impacts to vegetative, fish and wildlife resources and methods proposed to minimize these impacts during coal mining and reclamation operations are described in sections 330 and 340.

313. Proposed reclamation designed to restore or enhance vegetative, fish and wildlife resources to a condition suitable for the designated post-mining land use are described under section 340.

320. Environmental Description

321. Vegetation Information

Vegetative Types: Please see Soil Survey & Vegetation Inventory in Appendix M.

The vegetative types include Mountain Brush, Pinion-Juniper Woodland, Sagebrush-Grass, and Conifer-Aspen. The Sunedco Lease as well as the Graves Lease are located primarily in the Mountain Brush and Conifer-Aspen communities.

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Reference Areas

The reference areas to be used by Andalex Resources in Revegetation are shown on Plate 7-1, which is a Watershed and Revegetation Reference Areas Map. These reference areas have been described by the Soil Conservation Service with

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regard to condition and production. This description can be found in Appendix M following EEC's soils and vegetation survey.

There are three reference areas, each one acre in size, two of which are located on slopes and one in a drainage area. Reference area R-1 will be used in conjunction with the seed mixture for drainage areas. Areas R-3 and R-4 will be used in conjunction with the seed mixture for slopes and will also be used in conjunction with drainage areas to establish the success of Gamble's Oak. See plate 9. Additionally, a "**Reference Area**" for the GVH's with the same plant community was sampled. The Reference Area was used for comparisons of the proposed disturbed site at that time and will also be used at the time of final reclamation of the GVH's for standards of final revegetation success.

Each reference area established will be re-evaluated every five years prior to permitting.

Mountain-Brush, Desert Shrub, Pinion-Juniper Woodland, Sagebrush-Grass, Conifer-Aspen, and minor stream-side vegetative types cover the total mine plan area. Most of the area is covered by the Mountain-Brush type while the Pinion-Juniper Woodland type is predominant in the mine mouth area as well as the access routes and utility corridors; this area has been reseeded with a mixture as recommended by the U.S.D.A. S.C.S. (please see Soil Survey and Vegetation Inventory in Appendix M).

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Andalex has selected and marked three reference areas in the field for vegetation. The Division has reviewed and approved these reference areas. (plate 7-1). Areas chosen include all types of vegetation conditions such as drainage areas, shallow slopes and steep slopes. Andalex contacted the SCS to help evaluate the condition of these sites. Please see SCS letter in Appendix M. It should be noted that Andalex does have the benefit of a revegetation test plot located on one of the topsoil piles. The drainage area reference area is the most adaptable to the left fork fan installation.

~~The revegetation map now shows the original permit acreages for the three range types. Shrub clumps make up 2.15 acres, drainage areas make up 15.02 acres and steep slopes make up 17.03 acres. Total disturbed area, including the Aberdeen Mine left fork fan and road is 47.19 acres.~~

~~New vegetation mapping has been created for the entire permit area of the Centennial Mine. The mapping was done by Mt.~~ ~~Nebo Scientific, Inc. Springville, Utah. EarthFax Engineering did the Vegetation mapping for the Kenilworth Lease.~~ ~~See Plate 19 for vegetation mapping for the permit area.~~

~~The vegetation map was created by using new and/or current available aerial photography with field work accomplished as a means for ground truthing. Field verification work was conducted during the growing season of 2002. Vegetation maps were consolidated and expanded and a new total permit vegetation map was created in 2014 as Plate 19.~~

~~It should be noted that no wetland or riparian areas are known to exist on the current permit or on the Kenilworth Lease Area, based on vegetation mapping and site visits by company and Division personnel.~~

Source of Data

Department of the Interior, 1979. Final Environmental Statement, Development of Coal Resources in Central Utah; Part 1 Regional Analysis; Part 2 Site Specific Analysis.

United States Department of Agriculture, Soil Conservation Service, May, 1980. Soil Survey and Interpretations, Vegetation Survey.

Centennial Coal Associates, May, 1976 Mining Application. Submitted to the United States Geologic Survey, Conservation Branch.

A.M.C.A. Coal Leasing, June, 1978 Mining and Reclamation Plan (Zion's fee). Submitted to the State of Utah, Department of Natural Resources, Division of Oil, Gas, and Mining.
Revised 8/8/95

Earth Environmental Consultants

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September, 1981
Soil Survey and Vegetation Inventory
(Appendix M)

Plateau Mining Corporation
Willow Creek Permit #007/0038
Map #5

~~Description~~

~~Vegetative Types: Please see Soil Survey and Vegetation Inventory in Appendix M.~~

~~The vegetative types include Mountain Brush, Pinion-Juniper Woodland, Sagebrush-Grass, and Conifer-Aspen. The Sunedco Lease as well as the Graves Lease are located primarily in the Mountain Brush and Conifer-Aspen communities.~~

~~Threatened or Endangered Species~~

~~A listing of threatened or endangered plant species known to occur in Carbon County is included in Appendix M.~~

~~There have been no known threatened or endangered species observed in the lease area (Welsh 1977).~~ ~~A study was conducted in the Left Hand Fork for both the access road and the fan installation site to determine the presence of Canyon Sweetvetch.~~ ~~None was found. Additionally, the surveyor does not believe the habitat exists for this plant.~~

Plant Communities: Please see Soil Survey and Vegetation Inventory in Appendix M.

The Mountain Brush type is the largest in the area. It is found predominately at elevations of about 7,500 feet. This community consists of sage, mountain mahogany, serviceberry, snowberry, squaw apple, gambels oak, and maple. Minor amounts of rabbitbrush, cliffrose, and bitterbrush can be found. Associated grass species are wildrye, Indian ricegrass, wheat grass, bull grass, and blue grass.

The Sagebrush-Grass group is present from 7,200 to 9,000 feet on and in the low benches below the cliffs. Sage and rabbit brush appear associated with the common grasses occurring in other communities such as curly grass, indian rice grass, and bull grass. Fourwing and saltbrush is found on better drained soils. Shad scale and curly grass associations are found on the heavier clay soils.

The Pinion-Juniper Woodland community occurs in the area from an elevation of 5,600 to 8,000 feet and dominates the area below the escarpment of the Book Cliffs. Pinion pine and Utah juniper are the dominant species with bull grass, indian rice grass, and birch leaf mahogany as associated species.

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The Conifer-Aspen becomes fairly extensive in the more moist sites and at higher elevations. Elevations range from about 7,000 to 9,000 feet. Aspen predominates at the lower elevations with associated species being serviceberry, snowberry, Oregon grape, mountain brome, and peavine. Douglas fir is scattered throughout the area above 7,500 feet elevation. A few big red pine, white pine, and fir are found in the upper canyon bottoms. Understory grasses present include curly grass, indian rice grass, shadscale, black sage, and crested wheatgrass.

Identified species of noxious or poisonous weeds in the area are halogeton, cockleburr, loco, and copperweed. There are no concentrated areas or serious problems from these poisonous plants.

Some of the most important vegetation species are listed in Table III-10 following this page.

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TABLE III-10

Vegetation Possibly Occurring in Area

Common Name	Scientific Name
Grasses:	
~~curly grass~~ Curly Grass	Hilaria ~~jamesii~~Jamesii
~~indian rice grass~~ Indian Rice Grass	Oryzopsis ~~hymenoides~~Hymenoides
~~squirreltail~~ Squirreltail	Sitanian ~~hystix~~Hystix
~~needle~~ Needle and ~~thread grass~~ Thread Grass	Stipa ~~commata~~Commata
~~no eatum grass~~ No Eatum Grass	Aristida ~~fendleriana~~Fendleriana
~~western wheat grass~~ Western Wheat Grass	Agropyron ~~smithii~~Smithii
~~bull grass~~ Bull Grass	Elymus ~~salinus~~Salinus
Shrubs:	
~~nuttal saltbush~~ Nuttal Saltbush	Atriplex ~~nuttallii~~Nuttallii
~~mat saltbush~~ Mat Saltbush	Atriplex ~~corrugata~~Corrugata
~~shadscale~~ Shadscale	Atriplex ~~confertifoldia~~Confertifoldia
~~fourwing saltbush~~ Fourwing Saltbush	Atriplex ~~canecens~~Canecens
~~big sagebrush~~ Big Sagebrush	Artemisia ~~tridentate~~Tridentate
~~black sagebrush~~ Black Sagebrush	Artemisia ~~arbuscula nova~~Arbuscula Nova
~~greasewood~~ Greasewood	Sarobatus ~~vermiculatus~~Vermiculatus
~~small rabbitbrush~~ Small Rabbitbrush	Chrysothamnus ~~viscidiflorus~~Viscidiflorus
~~big rabbitbrush~~ Big Rabbitbrush	Chrysothamnus ~~nauseosus~~Nauseosus
~~mountain-mahogany~~ Mountain-Mahogany	Cercocarpus ~~montanus~~Montanus
~~serviceberry~~ Serviceberry	Amelanchief ~~alnifolia~~Alnifolia
~~curlleaf mahogany~~ Curlleaf Mahogany	Cercocarpus ledifolius
~~squaw apple~~ Squaw Apple	Peraphyllum ~~ramosissimum~~Ramosissimum
~~snowberry~~ Snowberry	Symphoricarpos ~~oreophilus~~Oreophilus

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Trees:

~~juniper~~ Juniper	Juniperus ~~osteosperma~~Osteosperma	
~~pinion~~ ~~Pinus edulis~~		
~~ponderosa pine~~ Pinion	Pinus Edulis	
Ponderosa Pine	Pinus ~~ponderosa~~Ponderosa	
~~aspen~~ Aspen	Populus ~~temuloides~~Temuloides	
~~limber pine~~ ~~Pinus flexilis~~		
~~douglas fir~~ Limber Pine	Pinus Flexilis	
Douglas Fir	Pseudotsuga ~~menziesii~~Menziesii	
~~gambel oak~~Gambel Oak	Quercus ~~gambelii~~Gambelii	

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Extent of Cover

Since the elevations and terrain varies drastically from steep walled canyons to high ridges, vegetation density also varies. Percent cover is greater at the higher elevations and on the gentler topography. The Bureau of Land Management estimates cover of 25 to 30 percent at the higher elevations and 10 to 12 percent on the lower canyon sides and bottoms.

Shrub Height

Shrub height varies over the lease area. Topography, aspect, elevation, and soil cause these modifications.

322. Fish and Wildlife Information

Introduction

The mine plan area is located in the West Tavaputs Plateau, a region which supports about 360 vertebrate wildlife species. The abundance and distribution of wildlife in the lease area is directly related to present land use activities and capabilities. Use of this area by certain species is limited to lack of perennial water. Mammal and bird species possibly occurring in the lease area are listed in Table III-11. Please refer to Plates 3-3A, 3-3B, 3-3C, and 3-3D, which have been revised to include the Kenilworth Lease. A "Species List of Vertebrate Wildlife that Inhabit Southeastern Utah", compiled by the Utah State Division of Wildlife Resources, can now be found in Appendix A.

Source of Data

Department of the Interior, 1979. Final Environmental Statement - Development of Coal Resources in Central Utah, Parts 1 and 2.

Utah Department of Natural Resources, Division of Wildlife Resources.

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Habitats

Previously described vegetation provides fair to excellent habitat for a variety of wildlife species.

Animal Species (See Table III-11)

Mammals

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Mammals occurring in the area can be divided into two groups, game species and non-game species.

The main game species include mule deer, mountain lion, black bear, elk, and cottontail rabbits. Mule deer, however, are the most important wildlife resources in the area. Mountain lion are present but little information is available due to their ranging habits. Generally, their movement coincides with the migration of deer. Black bear may occasionally be found in the vegetated canyons, usually along the cliff face. They normally inhabit the Book Cliffs to the north but little data is available on their populations. The permit area is within the lower limits of the elk range, however, elk are generally found north of the mine plan area at higher elevations. Cottontail rabbits are distributed throughout the area.

Non-game mammals include several species of small animals inhabiting the area. Predator species such as coyote and bobcat occasionally are found in the area and depend on small rodents and rabbits for their source of food. Information on non-game species is generally unavailable.

Additional information on species, habitat, and status, can be found in Appendix A. New habitat maps have been completed and can be found as Plates 3-3A, 3-3B, 3-3C, and 3-3D.

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TABLE III-11

List of Animals Possibly Occurring in Lease Area

Common Name	Scientific Name
Mammals:	
Badger	Taxidea Taxus
Black Bear	Ursus Americanus
Bobcat	Lynx Rufus
Coyote	Canis Latrans
Deer mouse	Peromyscus Maniculatus
Desert Cottontail	Sylvilagus Audubonni
Elk	Cervus Elaphus
Ground Squirrel	Spermophillus Tridecelineatus
Least Chipmunk	Eutomias Minimus
Mountain Lion	Felis Concolor
Mule Deer	Odocoileus Hemionus
Porcupine	Evethizon Dorsatum
Striped Skunk	Mephitus Mephitus
White-tailed Jackrabbit	Lepus Townsendii
Birds:	
Brewers Sparrow	Spizella Breweri
Blue Grouse	Dendragapus Obscurus
Common Nighhawk	Chordeiles Minor
House Sparrow	Passer Domesticus
Lark Sparrow	Chondestes Grammacus
Magpie	Pica Pica
Mourning Dove	Zenaidura Macroura
Pinion Jay	Gymnorhinus Cyanocephala
Red-tailed Hawk	Buteo Jamaicenis
Robin	Turdus Migratorius
Ruffed Grouse	Bonasa Umbellus
Sage Grouse	Centrocercus Urophasianus
Sparrow Hawk	Falco Sparverius
Turkey Vulture	Cathartes Aura
Vesper Sparrow	Pooecetes Gromineus

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Birds

Raptors

The turkey vulture and red-tailed hawk frequent the area. A variety of other raptors breed in the Price area; however there is a poor density of raptors throughout the mine plan area. A raptor survey performed for Andalex Resources of the proposed permit area by Clayton M. White of Brigham Young University is attached as Appendix D. Please see Plate 3-3A in the confidential binder for the raptor survey done in 2007 on the Kenilworth Lease. These Plates now include information from the raptor survey performed in May, 1994, by the Utah DWR and the Utah DOGM. Also refer to letter from USFWS found in Appendix J indicating clearance for our powerline distribution regarding raptors.

Other

Sage grouse inhabit the sagebrush flats at the foot of the cliffs (Plate 3-3D). Blue and ruffed grouse may occasionally be found in the vegetated canyons of the area. Chukkars can be found around the cliffs. Mourning doves are generally distributed throughout the area, however, the lack of perennial water limits dove nesting habitat in the area. Other representative birds include the magpie, bluebird, robin, and several species of sparrow.

Reptiles and Amphibians

The most prominent species of reptiles include the rattlesnake and sagebrush lizard. No aquatic fauna are present in the area.

Snake dens will be reported to the DWR.

Fish

There are no active fisheries as there are no permanent bodies of water or perennial streams in the area. No aquatic fauna are found.

322.210

Threatened or Endangered Species

There are 6 threatened or endangered species on or near the lease area according to a survey conducted by the Utah Division of Wildlife Resources.

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A listing of threatened or endangered plant species known to occur in Carbon County is included in Appendix M.

There have 6 threatened or endangered species observed in the lease area. Additionally, Representative from Fish and Wildlife Services does not believe the habitat exists for these species within the permit area.

322.220

It should be noted that no wetland or riparian areas are on the current permit or on the Kenilworth Lease Area, will be affected due to no additional surface disturbance being needed.

330. OPERATION PLAN

Maps and Plans

Most of the maps and plans previously submitted as part of the approved Mining and Reclamation Plan, are applicable. Where necessary, the original maps have been revised to indicate the addition of new leases and rights-of-ways and the revisions are indicated in this submittal.

1) All necessary maps and plans to complete this section are found in Volume II of the submittal and also in the appendices, specifically.

   a) Underground coal mining activities to be conducted and lands to be affected by surface facilities are shown on Plates 5-7, and 5-6.

   b-1) Buildings, utilities, and facilities are depicted on Plates 5-7.

2) The area to be affected is shown on several plates, including 7-11, 7-3, 7-9. These last four plates show the sequence of mining in the four seams over the five year term of the permit. Plate 5-6 has been revised to show immediate development in the Gilson Seam as soon as approval is achieved. Reclamation will not take place until after all four seams are mined out. This activity is depicted on Plates 5-9, 7-12, 7-13, 3-2.

3) Plate 5-7 depicts the entire disturbed area for which a performance bond is posted. The acreage is shown on Plate 1-5.

4) Coal storage and loading areas are shown on Plate 5-7. No cleaning takes place.

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5) Plate 5-7 shows a non-coal waste storage area as well as topsoil storage areas. Plate 2-3 show the topsoil piles in detail.

6) All water diversions and other water facilities are shown on Plates 5-7, 7-2, 7-1, 7-4, 7-5, and 7-7. Also, typical diversions for disturbed area and undisturbed areas are shown in the Sedimentation and Drainage Control.

Diversion ditches as they exist are shown on Revised Plate 5-7. Topographic detail has been added to Plate 7-2 to allow determination of watershed slopes within the disturbed area.

Topographic detail has been added to Plate 7-2 to allow determination of watershed slopes within the disturbed area. Plate 7-12 has been revised to show drainage during the reclamation period before and after removal of sediment ponds (Phase I).

Plate 7-13 shows final drainage details.

Plate 7-1 shows delineations of watershed areas.

The main culvert will be removed entirely during the reclamation/earthwork phase except under Pond E. Pond "E" will be enlarged, and the entire drainage area above will flow into the restored channel RC-1 and through Pond "E-PM". Once Revegetation and water quality standards have been met, Pond "E-PM" will be removed and reclaimed.

7) There is no coal processing waste at the Centennial facility. There are no pollution control facilities other than sedimentation ponds on the permit area. Waste rock from the Centennial Mine rock tunnels has been disposed of underground in the Pinnacle Mine.

8) Specific facilities are not used to protect or enhance wildlife with the exception of the powerline which was built according to strict guidelines issued by the Division of Wildlife Resources and the U.S. Fish and Wildlife Service regarding raptor protection. The powerline design is included in Volume I as Appendix I (powerline design). Also, speed limits are posted within the permit area.

9) The two powder magazines are shown on Plate 5-7.

10) Plates 6, 7, 8, and 9 show these facilities associated with protection of the hydrologic balance including sedimentation ponds and storage of non-coal waste. There are no permanent impoundments, coal processing wastes or underground development wastes. Any underground development waste or excess spoil which was generated while putting in the Aberdeen portals, has been used as stock pile pad material at the Aberdeen Minesite. The volume of this material is minimal.

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11) Plates 16 and 17 show the final reclamation contours and configuration of the surface for Phases I and II respectively.

12) Subsidence monitoring points are shown on Plate 25. Water monitoring locations are shown on Figure IV-11 and on Plates found in Chapter 7.

13) There will be no facilities left on the permit area permanently with the exception of the roads through the right fork of Deadman Canyon. The left hand fork road will be reclaimed. After the completion of underground mining, all facilities will be removed with the exception of one downstream sedimentation pond. This pond will be removed upon final reclamation.

c) Maps, plans, and cross sections required under

b) (5),(6),(10), and (11) have been prepared under the direction of, and certified by a registered professional engineer. Assistance has come from a registered land surveyor.

1) Detailed maps, plans, and cross sections for our sediment ponds, Plates 11, 12, and 13 have been certified by a registered professional engineer.

2) Andalex has not used any excess spoil or underground development waste maps or cross sections. A map depicting the location of non-coal waste storage is included as Plate 6.

Andalex will endeavor to use the best technology current available to enhance wildlife habitat during the reclamation phase of its operation. This will include, but not be limited to water sources (if available), thermal cover, escapeways, hiding and loafing places, and travelways. ANDALEX will consult with the Division of Wildlife Resources, at the time of final reclamation, to determine exactly what reclamation designs, planting arrangements, and artificial structures would best enhance a wildlife habitat.

330.331 MINIMIZING IMPACT AND SURFACE EROSION

REVEGATATION and Interim Revegetation

Revegetation will be accomplished by Andalex or under Andalex's direct supervision and under the recommendations of the regulatory authority (see Plates 3-1 and 3-2).

Interim Revegetation for stabilization of disturbed areas will take place on all disturbed slopes within the disturbed area. These slopes will be hydroseeded using the approved final reclamation seed mixture and rate of application along with hydromulch

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at the rate of one-and-one-half tons per acre. The vegetation cover will be maintained as necessary and slope stability will be measured by visual inspection.

Schedule of Revegetation

The seeding of native flora (consisting where possible of deer browse species), will commence as soon as is practical following shutdown and abandonment to stabilize erosion. Agencies such as the B.L.M., O.S.M., and Utah Department of Natural Resources will be consulted at the time for recommendations on recontouring, soil reconditioning, and Revegetation. Revegetation will be accomplished by Andalex or under Andalex's direct supervision and under the recommendations of the regulatory authorities.

The first normal planting season will be used for Revegetation following the removal of all structures and regrading. The season for normal planting of seed mixtures is the fall, prior to snowfall and after October 1st. The normal season for shrub plantings is the spring after thawing while moisture is available.

The new Left Hand Fork fan installation will have its own separate topsoil storage area. Andalex will utilize this topsoil storage area to test shrub species in the coming years beginning in the fall of 1995.

Standards for success for woody species is 2000 woody plants-per-acre for stream bottom areas and east-facing slopes; 1500 woody plants-per-acre for west-facing slopes.

Sediment Pond E - PM will be maintained until removal is authorized by the Division and the disturbed area has been stabilized and revegetated. In no case will the structure be removed sooner than two years after the last augmented seeding

Soil Testing Plan and Soil Preparation

Where possible the soil will be distributed along the contour. The thickness of the re-established soil will be sufficient to support vegetation equal to or superior to pre-mining history (6"). Soils will be tested according to the most advanced technology. Samples will be taken to determine any deficiencies which would affect the growth of newly revegetated areas. Any deficiencies will be corrected by adding to the soil chemical fertilizers, organic mulch, or any other substances recommended by the regulatory authority. Preparation techniques such as disking will be incorporated.

Species and Amounts of Seeds and Seedlings

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The seed mixtures outlined for steep slopes and drainage areas developed by UDOGM (12-10-86) will be used. Shrub clumps will be planted as shown on Plate 20. This constitutes an area of 2.15 acres (Drainage areas are 15.02 and Slopes are 17.03). Species shall include serviceberry, mountain big sagebrush, squawbush, blue elderberry, mountain snowberry, and mountain mahogany. They will be planted at a rate of 1,000 containerized plants per acre using fertilizer and crimped straw for stabilization. Drainage area seed mix will be used around and among the shrub clumps beneath the straw stabilization. Re Reference Areas. Plate 20 in Volume II shows that Andalex will plant the drainage mixture around and beneath the shrub clumps (transplants). These transplants listed above will be used in the drainage areas as depicted on Plate 20.

Planting and Seeding Methods

Where possible the areas will be disked using conventional farm equipment. Andalex will make every effort to leave surfaces to be reseeded as rough as possible (one method could be gouging by a trackhoe). The seed will be spread using a rangeland drill where possible. Areas which cannot be seeded mechanically will be hand seeded or hydroseeded. Steeper slopes will be raked to provide a slight soil cover for the seed. Steep slopes may also be hydroseeded and hydromulched.

Mulching Techniques

Vegetative cover will be promptly re-established following cessation of mining activities to stabilize erosion. Mulch will be used and re-seeding will occur during the first normal period for favorable growth following regrading. Mulch will be applied to all reseeded areas. Where hydromulching cannot be used, straw mulch (at the rate of 1-1/2 to 2 tons/acre) will be crimped either mechanically or by hand. Hydromulch will be used on steep slopes and straw will be used wherever possible.

Andalex would plan on using organic mulch (wood fiber). It will be used wherever seeds are planted. These areas are shown on Plate 20 and constitute 47.19 acres. The rate of application will be one ton per acre. The remaining acres are shrub plantings which will be stabilized with the drainage area seed mix and crimped straw.

Management Practices, e.g., Irrigation, Pest, and Disease Control

Andalex does not anticipate irrigation will be used because of the lack of water in the area. Vegetative growth will be subject to normal rainfall and winter snowfall. As a contingency irrigation by mechanical methods could be used if Revegetation of the transplants is unsuccessful. Vegetation will be protected from both wildlife and livestock by drift-fences until the reclaimed areas have been adequately re-established. Upon approval, the fences will be removed. Pesticides and herbicides will be used as

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necessary. Should any persistent pesticides be needed, the Division's approval will be obtained prior to their use.

Measures to Determine Success

Revegetation will be closely monitored. Areas which fail to support sufficient growth to stabilize conditions will be tested and reseeded until a proper cover is established. Vegetation reference areas will be consulted to determine success. Physical examinations will be conducted to note any species which are not thriving or regenerating. If this occurs, species will be substituted at the recommendation of the regulatory authority. Any other species will be added at the time of reclamation upon recommendation of the regulatory authority. The company will maintain close contact with the Bureau of Land Management in all of its Revegetation efforts, and incorporate their suggestions into its over all plan. All reclaimed areas will be monitored and maintained by the constant observation of Andalex until the surety release is granted.

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Revegetation monitoring parameters to be measured are growth rate, plant density and percent cover. We would expect to monitor or supervise monitoring at least monthly during the first two growing seasons. From experience with interim Revegetation at the minesite, we have learned that two growing seasons are needed to establish any success. After this we would know whether reclamation was progressing successfully.

Monitoring will take place during years 1, 2, 5, 9, and 10. Years 9 and 10 will include estimates of cover, wood density, productivity, and composition, both on reclaimed areas and on reference areas. Parameters sampled on reclaimed areas will meet or exceed 90% of the reference area standard with a 90% confidence level. Andalex will use approved sampling methods and will use the same method for both reclaimed and reference areas.
In 1983, Andalex planted several shrub species which are part of our approved transplant mixture on topsoil pile F. These plantings were not performed under the direction of the Division and were merely for Andalex's reference. Andalex will attempt a new test plot with our approved transplant mixture in 1992 in the same area.
Monitoring, both qualitative and quantitative, will be performed in years 1, 2, 5, 9, and 10. Data will be submitted to the Division as part of the annual report starting in 1993.

Area to be Disturbed

The surface area disturbed is very minimal, 47.19 acres as shown on Plate 7. It should be again stressed that there will be no additional surface disturbances and no additional surface facility construction on the new Kenilworth Lease area. Mining on the Kenilworth Lease will simply be an extension of existing underground workings. Site of the present surface facilities is located in an area that has been previously impacted by mining activities. Actual plant communities which have been disturbed are the Pinion-Juniper and associated species and similar impact is foreseen on vegetation overlying the remainder of the lease area at the proposed surface facilities' sites. Extreme care will be taken however, to disturb as little vegetation as possible and revegetation has been immediately carried out on all disturbed areas no longer needed for the mining operation.

Andalex has maintained small islands of natural vegetation within the site, but upon final reclamation, we do not intend to remove natural vegetation from other sites and transplant it. Andalex does not intend to encapsulate seed and fertilizer for release over several years. All disturbed slopes have been revegetated.

Berry producing shrubs have naturally re-occurred within the disturbed area for avifauna species. No avifauna will be disturbed within Andalex's minesite and in particular, raptors and their nests. Andalex's powerline was constructed under the guidance of the Utah DWR.

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330.332 IMPACTS OF SUBSIDENCE ON RENEWABLE RESOURCE LANDS

Subsidence

Survey of Structures and Renewable Resource Lands

There are no structures present other than those constructed for mining operations, on the permit area. The land is presently used for grazing and wildlife habitat which constitutes a renewable resource area. It should be noted that geographic areas above Andalex's 5 year mine plan do not include any area suitable for grazing, nor do they contribute significantly to the long-range productivity of water, food or fiber products. Andalex commits to mitigate all subsidence related damage to renewable resources including, but not limited to water, grazing, and wildlife habitat including raptor nests.

Andalex, through raptor surveys conducted, has identified Golden Eagle nests which could be impacted by subsidence. Andalex is committed to acquiring necessary take permits prior to longwall mining under these sites. Andalex is also committed to additional mitigation which might include measures to prevent nesting on those nests which could be affected by subsidence or removal of nests for scientific study. Please refer to Plate 3-3A for the most current raptor nesting information including the raptor survey conducted in May, 1994, and Plate 3-3A in the Confidential Binder for the Kenilworth lease. Three nests have been identified as being located within potential subsidence impact zones. They are identified on Plate 3-3 and a take permit application for these nests is on file with the U.S. Fish and Wildlife Service. The longwall panel affecting these nests will not be removed prior to the acquisition of this permit. There are no known raptor nests located on the Kenilworth Lease Area. (See Plate 3-3A in the Confidential File)

Andalex has committed to compensation for livestock lost as a result of subsidence which in turn is a direct result of underground mining activities. Also, major cracks caused by subsidence which are demonstrated to be a direct result of underground mining will be repaired.

330.333 USING THE BEST TECHNOLOGY CURRENTLY AVAILABLE TO MINIMIZE DISTURBANCE AND IMPACT

As the Kenilworth Lease is simply an extension of our underground mine workings under roughly 2,600 to 3,000 of cover, there will be likely be no effect to the surface biology of the area.

Preventive Measures

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Subsidence due to mining on the Andalex property will not occur outside of the approved permit area. Stations have been set up as required for constant monitoring of subsidence movements. (See 6., Monitoring.) The only absolute preventive measure possible is to leave coal in place. This is in direct contrast to maximum economic coal recovery.

Resources on the lands above Andalex's mining plan consist only of wildlife habitat with very limited grazing access.

Subsidence monitoring stations will be established as necessary along the first proposed longwall mining. (See 6., Monitoring and Plate 25.) The results of this monitoring program will define monitoring and permitting needs in the future.

~~Fish and Wildlife Resources and Plan~~

~~Introduction~~

~~The mine plan area is located in the West Tavaputs Plateau, a region which supports about 360 vertebrate wildlife species. The abundance and distribution of wildlife in the lease area is directly related to present land use activities and capabilities. Use of this area by certain species is limited to lack of perennial water. Mammal and bird species possibly occurring in the lease area are listed in Table III-11. Please refer to Plates 34, 34A, 34B, 34C, and 34D, which have been revised to include the Kenilworth Lease. A "Species List of Vertebrate Wildlife that Inhabit Southeastern Utah", compiled by the Utah State Division of Wildlife Resources, can now be found in Appendix A.~~

~~**Source of Data**~~

~~Department of the Interior, 1979. Final Environmental Statement - Development of Coal Resources in Central Utah, Parts 1 and 2.~~

~~Utah Department of Natural Resources, Division of Wildlife Resources.~~

~~Habitats~~

~~Previously described vegetation provides fair to excellent habitat for a variety of wildlife species.~~

~~**Animal Species (See Table III-11)**~~

~~**Mammals**~~

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Mammals occurring in the area can be divided into two groups, game species and non-game species.

The main game species include mule deer, mountain lion, black bear, elk, and cottontail rabbits. Mule deer, however, are the most important wildlife resources in the area. Mountain lion are present but little information is available due to their ranging habits. Generally, their movement coincides with the migration of deer. Black bear may occasionally be found in the vegetated canyons, usually along the cliff face. They normally inhabit the Book Cliffs to the north but little data is available on their populations. The permit area is within the lower limits of the elk range, however, elk are generally found north of the mine plan area at higher elevations. Cottontail rabbits are distributed throughout the area.

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Non-game mammals include several species of small animals inhabiting the area. Predator species such as coyote and bobcat occasionally are found in the area and depend on small rodents and rabbits for their source of food. Information on non-game species is generally unavailable.

Additional information on species, habitat, and status, can be found in Appendix A. New habitat maps have been completed and can be found as Plates 34A, 34B, 34C and 34D.

~~TABLE III-11~~

~~List of Animals Possibly Occurring in Lease Area~~

~~Common Name~~	~~Scientific Name~~
~~Mammals:~~	
~~Badger~~	~~Taxidea taxus~~
~~Black Bear~~	~~Ursus americanus~~
~~Bobcat~~	~~Lynx rufus~~
~~Coyote~~	~~Canis latrans~~
~~Deer mouse~~	~~Peromyscus maniculatus~~
~~Desert Cottontail~~	~~Sylvilagus audubonni~~
~~Elk~~	~~Cervus elaphus~~
~~Ground Squirrel~~	~~Spermophillus tridecelineatus~~
~~Least Chipmunk~~	~~Eutomias minimus~~
~~Mountain Lion~~	~~Felis concolor~~
~~Mule Deer~~	~~Odocoileus hemionus~~
~~Porcupine~~	~~Evethizon dorsatum~~
~~Striped Skunk~~	~~Mephitus mephitus~~
~~White-tailed Jackrabbit~~	~~Lepus townsendii~~
~~Birds:~~	
~~Brewers Sparrow~~	~~Spizella breweri~~
~~Blue Grouse~~	~~Dendragapus obscurus~~
~~Common Nighthawk~~	~~Chordeiles minor~~
~~House Sparrow~~	~~Passer Domesticus~~
~~Lark Sparrow~~	~~Chondestes grammacus~~
~~Magpie~~	~~Pica pica~~
~~Mourning Dove~~	~~Zenaidura macroura~~
~~Pinion Jay~~	~~Gymnorhinus cyanocephala~~
~~Red-tailed Hawk~~	~~Buteo jamaicenis~~
~~Robin~~	~~Turdus migratorius~~
~~Ruffed Grouse~~	~~Bonasa umbellus~~
~~Sage Grouse~~	~~Centrocercus urophasianus~~
~~Sparrow Hawk~~	~~Falco sparverius~~
~~Turkey Vulture~~	~~Cathartes aura~~
~~Vesper Sparrow~~	~~Poocectes gromineus~~

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Birds

Raptors

The turkey vulture and red tailed hawk frequent the area. A variety of other raptors breed in the Price area; however there is a poor density of raptors throughout the mine plan area. A raptor survey performed for Andalex Resources of the proposed permit area by Clayton M. White of Brigham Young University is attached as Appendix D. Please see Plate 34A in the confidential binder for the raptor survey done in 2007 on the Konilworth Lease. These Plates now include information from the raptor survey performed in May, 1994, by the Utah DWR and the Utah DOGM. Also refer to letter from USFWS found in Appendix J indicating clearance for our powerline distribution regarding raptors.

Other

Sage grouse inhabit the sagebrush flats at the foot of the cliffs (Plate 34D). Blue and ruffed grouse may occasionally be found in the vegetated canyons of the area. Chukkers can be found around the cliffs. Mourning doves are generally distributed throughout the area, however, the lack of perennial water limits dove nesting habitat in the area. Other representative birds include the magpie, bluebird, robin, and several species of sparrow.

Reptiles and Amphibians

The most prominent species of reptiles include the rattlesnake and sagebrush lizard. No aquatic fauna are present in the area.

Fish

There are no active fisheries as there are no permanent bodies of water or perennial streams in the area. No aquatic fauna are found.

Threatened or Endangered Species

In the event problems should occur, which are verified by the company and the Division to be the result of mining, the company will develop a mitigation plan with the Division of Wildlife Resources.

There have been no known threatened or endangered species on or near the lease area according to a survey conducted by the Utah Division of Wildlife Resources (Boner 1977).

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Impacts of Operation

Construction of all roads, powerlines, and surface facilities has been completed. The earthwork and surface facilities for the Aberdeen Mine are complete. The fish and wildlife information contained in this MRP pertains to the entire permit area including the Kenilworth Lease. The only potential impact to wildlife as a result of construction (golden eagle nests) has been addressed thoroughly and a negative impact determination was made. (Plate 3-3A). Regarding temporary interruption of wildlife habitat, this has also been addressed in the Fish and Wildlife Plan and the Reclamation Plan. Therefore, no additional impact of operations on wildlife is anticipated. Wildlife education has been implemented through the training department. All new employees will receive wildlife education training.

Fish & Wildlife Plan (please see Appendix A).

There will be no additional surface disturbance required on the new Kenilworth coal lease. Consequently, there will be no additional disturbance or adverse impacts on fish and wildlife or related environmental values. New habitat maps have been completed and can be found as Plates ~~34A~~3-3A (Confidential binder) 34B, 34C and 34D.

Andalex will make every possible effort to minimize disturbances to wildlife habitat in the area and where possible enhance that habitat during reclamation. It should be noted that there is no aquatic life in the permit area as these canyons are dry except as a result of direct precipitation (ephemeral streams). Straight, Mathis and Alrad Canyons are ephemeral drainages. Andalex has performed numerous mitigative measures including extensive revegetation. Andalex has performed all mitigative measures outlined in the Fish and Wildlife Plan (Appendix A) with the exception of the use of swareflex reflectors.

Andalex has advised and encouraged employees to avoid unnecessary disturbances to all wildlife regardless of the season, but especially the depleted winter season or the breeding season. Hunting and all wildlife regulations are adhered to.

The largest part of Andalex's road is screened from view by vegetative cover. During Revegetation, Andalex will use seed mixtures which are favorable for wildlife enhancement.

To date, Andalex has had no use for poisons for rodent control or any other use.

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~~Andalex has maintained small islands of natural vegetation within the site, but upon final reclamation, we do not intend to remove natural vegetation from other sites and transplant it. Andalex does not intend to encapsulate seed and fertilizer for release over several years. All disturbed slopes have been revegetated.~~

~~Snake dens will be reported to the DWR.~~

~~Berry producing shrubs have naturally re-occurred within the disturbed area for avifauna species. No avifauna will be disturbed within Andalex's minesite and in particular, raptors and their nests. Andalex's powerline was constructed under the guidance of the Utah DWR.~~

Lodges, nests, and dens for all mammals will be protected from disturbance. Andalex has reduced speed limits posted within the minesite and the entire length of the haulroad year-round (20 mph and 40 mph). Swareflex reflectors will not be implemented.

There are no unpaved sections of the haul road and swareflex reflectors are not being used. Andalex has demonstrated mitigation of impacted habitat through revegetation efforts on areas in and outside the permit area. We have had employee wildlife education sessions in the past and may perhaps in the future. A description of the values of wildlife as well as methods for avoiding impacts to wildlife could be written into a form which could be passed out during annual employee training. The Division of Wildlife Resources may be able to assist Andalex with this idea. The powerline was constructed under strict guidelines and has been thoroughly checked by both the Utah DWR and the U.S. Fish and Wildlife Service. Both agencies are pleased with the design and the as-built facilities. Andalex is willing to adhere to reasonable and practical recommendations given by any agency and has for the most part taken the advice of the DWR on most all occasions as outlined in the Wildlife Resources, Appendix A. Special condition #7 was answered by posting 40 mph speed limits, year round.

To the extent possible, Andalex will commit to prevent, control, and suppress range, forest, and coal fires within the permit area. The control of range and forest fires may very well be out of Andalex's hands and it may only be possible for Andalex to report these incidences to organizations such as the BLM who are equipped to handle these situations.

Andalex has committed to continuing wildlife education as part of its employee training. This will be coordinated with the local office of UDWR through the use of videos and possibly guest speakers.

~~Andalex has committed to continuing wildlife education as part of its employee training. This will be coordinated with the local office of UDWR through the use of videos and possibly guest speakers.~~

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Andalex, through raptor surveys conducted, has identified Golden Eagle nests which could be impacted by subsidence. Andalex is committed to acquiring necessary take permits prior to longwall mining under these sites. Andalex is also committed to additional mitigation which might include measures to prevent nesting on these nests which could be affected by subsidence or removal of nests for scientific study. Please refer to Plate 34 for the most current raptor nesting information including the raptor survey conducted in May, 1994, and Plate 34A in the Confidential Binder for the Kenilworth lease. Three nests have been identified as being located within potential subsidence impact zones. They are identified on Plate 34 and a take permit application for these nests is on file with the U.S. Fish and Wildlife Service. The longwall panel affecting these nests will not be removed prior to the acquisition of this permit. There are no known raptor nests located on the Kenilworth Lease Area. (See Plate 34A in the Confidential File)

Andalex has committed to compensation for livestock lost as a result of subsidence which in turn is a direct result of underground mining activities. Also, major cracks caused by subsidence which are demonstrated to be a direct result of underground mining will be repaired.

R645-301-311. VEGETATIVE, FISH AND WILDLIFE RESOURCES

See R645-301-310.

R645-301-312. POTENTIAL IMPACTS

See R645-301-310 "Area to be Disturbed".

R645-301-313. RESTORATION OR ENHANCEMENT

See R645-301-240.

R645-301-320. ENVIRONMENTAL **DESCRIPTION**

See R645-301-310, Appendices A, D and M.

R645-301-321. VEGETATION INFORMATION

See R645-301-310, Appendix M.

R645-301-321.100. POTENTIAL FOR REESTABLISHING VEGETATION

Appendix M

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R645-301-321.200. PREMINING PRODUCTIVITY

Appendix M

R645-301-322. FISH AND WILDLIFE INFORMATION

See R645-301-310,and Appendices A, D, and M.

R645-301-322.100. PROTECTION AND ENHANCEMENT PLAN

Appendix A

R645-301-322.200. SITE-SPECIFIC RESOURCE INFORMATION

Appendix A

R645-301-322.210. THREATENED OR ENDANGERED SPECIES

See R645-301-310.

R645-301-322.220. HABITATS OF UNUSUALLY HIGH VALUE FOR FISH AND WILDLIFE

See R645-301-310.

R645-301-322.230. OTHER SPECIES OR HABITATS REQUIRING SPECIAL PROTECTION

N/A

R645-301-322.300. FISH AND WILDLIFE SERVICE REVIEW

Appendix A

R645-301-323. MAPS AND AERIAL PHOTOGRAPHS

Appendix A

R645-301-323.100. REFERENCE AREAS

See R645-301-331 "Reference Areas".

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R645-301-323.200. MONITORING STATIONS

N/A

R645-301-323.300. ENHANCEMENT FACILITIES

N/A

R645-301-323.400. PLANT COMMUNITIES

See R645-301-310.

R645-301-330. OPERATION PLAN

Maps and Plans

Most of the maps and plans previously submitted as part of the approved Mining and Reclamation Plan, are applicable. Where necessary, the original maps have been revised to indicate the addition of new leases and rights-of-ways and the revisions are indicated in this submittal.

1) All necessary maps and plans to complete this section are found in Volume II of the submittal and also in the appendices, specifically,

a) Underground coal mining activities to be conducted and lands to be affected by surface facilities are shown on Plates 6, 29, 30, 31 and 41;

b 1) Buildings, utilities, and facilities are depicted on Plates 6 and 7.

2) The area to be affected is shown on several plates, including 4, 5, 6, and 41. These last four plates show the sequence of mining in the four seams over the five-year term of the permit. Plate 29, 30, 31, 41 has been revised to show immediate development in the Gilson Seam as soon as approval is achieved. Reclamation will not take place until after all four seams are mined out. This activity is depicted on Plates 15, 16, 17, and 20.

3) Plate 6 depicts the entire disturbed area for which a performance bond is posted. The acreage is shown on Plate 5.

4) Coal storage and loading areas are shown on Plate 6. No cleaning takes place.

5) Plate 6 shows a non-coal waste storage area as well as topsoil storage areas. Plates 36 and 37 show the topsoil piles in detail.

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6) All water diversions and other water facilities are shown on Plates 6, 8, 9, 11, 12, and 13. Also, typical diversions for disturbed area and undisturbed areas are shown in the Sedimentation and Drainage Control.

Diversion ditches as they exist are shown on Revised Plate 6. Topographic detail has been added to Plate 8 to allow determination of watershed slopes within the disturbed area.

Topographic detail has been added to Plate 8 to allow determination of watershed slopes within the disturbed area. Plate 16 has been revised to show drainage during the reclamation period before and after removal of sediment ponds (Phase I).

Plate 17 shows final drainage details.

Plate 9 shows delineations of watershed areas.

The main culvert will be removed entirely during the reclamation/earthwork phase except under Pond E. Pond "E" will be enlarged, and the entire drainage area above will flow into the restored channel RC-1 and through Pond "E-PM". Once Revegetation and water quality standards have been met, Pond "E-PM" will be removed and reclaimed.

7) There is no coal processing waste at the Centennial facility. There are no pollution control facilities other than sedimentation ponds on the permit area. Waste rock from the Centennial Mine rock tunnels has been disposed of underground in the Pinnacle Mine.

8) Specific facilities are not used to protect or enhance wildlife with the exception of the powerline which was built according to strict guidelines issued by the Division of Wildlife Resources and the U.S. Fish and Wildlife Service regarding raptor protection. The powerline design is included in Volume I as Appendix I (powerline design). Also, speed limits are posted within the permit area.

9) The two powder magazines are shown on Plates 6 and 7.

10) Plates 6, 7, 8, and 9 show those facilities associated with protection of the hydrologic balance including sedimentation ponds and storage of non-coal waste. There are no permanent impoundments, coal processing wastes or underground development wastes. Any underground development waste or excess spoil which was generated while putting in the Aberdeen portals, has been used as stock pile pad material at the Aberdeen Minesite. The volume of this material is minimal.

11) Plates 16 and 17 show the final reclamation contours and configuration of the surface for Phases I and II respectively.

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12) Subsidence monitoring points are shown on Plate 25. Water monitoring locations are shown on Figure IV-11 and on Plates found in Chapter 7.

13) There will be no facilities left on the permit area permanently with the exception of the roads through the right fork of Deadman Canyon. The left hand fork road will be reclaimed. After the completion of underground mining, all facilities will be removed with the exception of one downstream sedimentation pond. This pond will be removed upon final reclamation.

c) Maps, plans, and cross sections required under

b) (5),(6),(10), and (11) have been prepared under the direction of, and certified by a registered professional engineer. Assistance has come from a registered land surveyor.

1) Detailed maps, plans, and cross sections for our sediment ponds, Plates 11, 12, and 13 have been certified by a registered professional engineer.

2) Andalex has not used any excess spoil or underground development waste maps or cross sections. A map depicting the location of non-coal waste storage is included as Plate 6.

R645-301-331. MINIMIZING IMPACT AND SURFACE EROSION

REVEGATATION Plan

REVEGATATION and Interim Revegetation

Revegetation will be accomplished by Andalex or under Andalex's direct supervision and under the recommendations of the regulatory authority (see Plates 19 and 20).

Interim Revegetation for stabilization of disturbed areas will take place on all disturbed slopes within the disturbed area. These slopes will be hydroseeded using the approved final reclamation seed mixture and rate of application along with hydromulch at the rate of one and one half tons per acre. The vegetation cover will be maintained as necessary and slope stability will be measured by visual inspection.

Schedule of Revegetation

The seeding of native flora (consisting where possible of deer browse species), will commence as soon as is practical following shutdown and abandonment to stabilize erosion. Agencies such as the B.L.M., O.S.M., and Utah Department of Natural

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Resources will be consulted at the time for recommendations on recontouring, soil reconditioning, and Revegetation. Revegetation will be accomplished by Andalex or under Andalex's direct supervision and under the recommendations of the regulatory authorities.

The first normal planting season will be used for Revegetation following the removal of all structures and regrading. The season for normal planting of seed mixtures is the fall, prior to snowfall and after October 1st. The normal season for shrub plantings is the spring after thawing while moisture is available.

Soil Testing Plan and Soil Preparation

Where possible the soil will be distributed along the contour. The thickness of the re-established soil will be sufficient to support vegetation equal to or superior to pre-mining history (6"). Soils will be tested according to the most advanced technology. Samples will be taken to determine any deficiencies which would affect the growth of newly revegetated areas. Any deficiencies will be corrected by adding to the soil chemical fertilizers, organic mulch, or any other substances recommended by the regulatory authority. Preparation techniques such as disking will be incorporated.

Species and Amounts of Seeds and Seedlings

The seed mixtures outlined for steep slopes and drainage areas developed by UDOGM (12-10-86) will be used. Shrub clumps will be planted as shown on Plate 20. This constitutes an area of 2.15 acres (Drainage areas are 15.02 and Slopes are 17.03). Species shall include serviceberry, mountain big sagebrush, squawbush, blue elderberry, mountain snowberry, and mountain mahogany. They will be planted at a rate of 1,000 containerized plants per acre using fertilizer and crimped straw for stabilization. Drainage area seed mix will be used around and among the shrub clumps beneath the straw stabilization. Re Reference Areas. Plate 20 in Volume II shows that Andalex will plant the drainage mixture around and beneath the shrub clumps (transplants). These transplants listed above will be used in the drainage areas as depicted on Plate 20.

Planting and Seeding Methods

Where possible the areas will be disked using conventional farm equipment. Andalex will make every effort to leave surfaces to be reseeded as rough as possible (one method could be gouging by a trackhoe). The seed will be spread using a rangeland drill where possible. Areas which cannot be seeded mechanically will be hand seeded or hydroseeded. Steeper slopes will be raked to provide a slight soil cover for the seed. Steep slopes may also be hydroseeded and hydromulched.

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Mulching Techniques

Vegetative cover will be promptly re-established following cessation of mining activities to stabilize erosion. Mulch will be used and re-seeding will occur during the first normal period for favorable growth following regrading. Mulch will be applied to all reseeded areas. Where hydromulching cannot be used, straw mulch (at the rate of 1-1/2 to 2 tons/acre) will be crimped either mechanically or by hand. Hydromulch will be used on steep slopes and straw will be used wherever possible.

Andalex would plan on using organic mulch (wood fiber). It will be used wherever seeds are planted. These areas are shown on Plate 20 and constitute 47.19 acres. The rate of application will be one ton per acre. The remaining acres are shrub plantings which will be stabilized with the drainage area seed mix and crimped straw.

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Management Practices, e.g., Irrigation, Pest, and Disease Control

Andalex does not anticipate irrigation will be used because of the lack of water in the area. Vegetative growth will be subject to normal rainfall and winter snowfall. As a contingency irrigation by mechanical methods could be used if Revegetation of the transplants is unsuccessful. Vegetation will be protected from both wildlife and livestock by drift fences until the reclaimed areas have been adequately re-established. Upon approval, the fences will be removed. Pesticides and herbicides will be used as necessary. Should any persistent pesticides be needed, the Division's approval will be obtained prior to their use.

Measures to Determine Success

Revegetation will be closely monitored. Areas which fail to support sufficient growth to stabilize conditions will be tested and reseeded until a proper cover is established. Vegetation reference areas will be consulted to determine success. Physical examinations will be conducted to note any species which are not thriving or regenerating. If this occurs, species will be substituted at the recommendation of the regulatory authority. Any other species will be added at the time of reclamation upon recommendation of the regulatory authority. The company will maintain close contact with the Bureau of Land Management in all of its Revegetation efforts, and incorporate their suggestions into its over all plan. All reclaimed areas will be monitored and maintained by the constant observation of Andalex until the surety release is granted.

Revegetation monitoring parameters to be measured are growth rate, plant density and percent cover. We would expect to monitor or supervise monitoring at least monthly during the first two growing seasons. From experience with interim Revegetation at the minesite, we have learned that two growing seasons are needed to establish any success. After this we would know whether reclamation was progressing successfully.

Monitoring will take place during years 1, 2, 5, 9, and 10. Years 9 and 10 will include estimates of cover, wood density, productivity, and composition, both on reclaimed areas and on reference areas. Parameters sampled on reclaimed areas will meet or exceed 90% of the reference area standard with a 90% confidence level. Andalex will use approved sampling methods and will use the same method for both reclaimed and reference areas.

In 1993, Andalex planted several shrub species which are part of our approved transplant mixture on topsoil pile F. These plantings were not performed under the direction of the Division and were merely for Andalex's reference. Andalex will attempt a new test plot with our approved transplant mixture in 1992 in the same area.

Monitoring, both qualitative and quantitative, will be performed in years 1, 2, 5, 9, and 10. Data will be submitted to the Division as part of the annual report starting in 1993.

Reference Areas

The reference areas to be used by Andalex Resources in Revegetation are shown on Plate 9 which is a Watershed and Revegetation Reference Areas Map.

These reference areas have been described by the Soil Conservation Service with regard to condition and production. This description can be found in Appendix M following EEC's soils and vegetation survey.

There are three reference areas, each one acre in size, two of which are located on slopes and one in a drainage area. Reference area R-1 will be used in conjunction with the seed mixture for drainage areas. Areas R-3 and R-4 will be used in conjunction with the seed mixture for slopes and will also be used in conjunction with drainage areas to establish the success of Gamble's Oak. See plate 9. Additionally, a "**Reference Area**" for the GVH's with the same plant community was sampled. The Reference Area was used for comparisons of the proposed disturbed site at that time and will also be used at the time of final reclamation of the GVH's for standards of final revegetation success.

Each reference area established will be re-evaluated every five years prior to permitting.

The new Left Hand Fork fan installation will have its own separate topsoil storage area. Andalex will utilize this topsoil storage area to test shrub species in the coming years beginning in the fall of 1995.

Standards for success for woody species is 2000 woody plants per acre for stream bottom areas and east facing slopes; 1500 woody plants per acre for west facing slopes.

Sediment Pond E - PM will be maintained until removal is authorized by the Division and the disturbed area has been stabilized and revegetated. In no case will the structure be removed sooner than two years after the last augmented seeding.

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~~R645-301-332. IMPACTS OF SUBSIDENCE ON RENEWABLE RESOURCE LANDS~~

~~Subsidence~~

~~Survey of Structures and Renewable Resource Lands~~

~~There are no structures present other than those constructed for mining operations, on the permit area. The land is presently used for grazing and wildlife habitat which constitutes a renewable resource area. It should be noted that geographic areas above Andalex's 5 year mine plan do not include any area suitable for grazing, nor do they contribute significantly to the long range productivity of water, food or fiber products. Andalex commits to mitigate all subsidence related damage to renewable resources including, but not limited to water, grazing, and wildlife habitat including raptor nests.~~

~~R645-301-333. USING THE BEST TECHNOLOGY CURRENTLY AVAILABLE TO MINIMIZE DISTURBANCE AND IMPACT~~

~~As the Konilworth Lease is simply an extension of our underground mine workings under roughly 2,600 to 3,000 of cover, there will be likely be no effect to the surface biology of the area.~~

~~Preventive Measures~~

~~Subsidence due to mining on the Andalex property will not occur outside of the approved permit area. Stations have been set up as required for constant monitoring of subsidence movements. (See 6., Monitoring.) The only absolute preventive measure possible is to leave coal in place. This is in direct contrast to maximum economic coal recovery.~~

~~Resources on the lands above Andalex's mining plan consist only of wildlife habitat with very limited grazing access.~~

~~Subsidence monitoring stations will be established as necessary along the first proposed longwall mining. (See 6., Monitoring and Plate 25.) The results of this monitoring program will define monitoring and permitting needs in the future.~~

333.200

There have been ~~In the event problems should occur, which are verified by the company and the Division to be the result of mining, the company will develop a mitigation plan with the Division of Wildlife Resources.~~

~~R645-301-333.100. PROTECTION OF THREATENED AND ENDANGERED SPECIES~~

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~~There have been~~ ~~no known~~ threatened or endangered species on or near the lease area according to a survey conducted by the Utah Division of Wildlife Resources ~~(Boner 1977)~~.

333.300

Calculations have been performed to evaluate the potential water depletion to the Colorado River system as a result of the mining at this site. The calculations are shown on Table III-12, and indicate a net increase of approximately 47.61 acre-feet of water per year to the Colorado River.

Table III-12
Potential Water Depletion
To
Colorado River Drainage

The following calculations are intended to define the potential depletion or addition of water to the Colorado River Drainage System, as a result of mining at this operation. It should be noted that the criteria is based on the U.S. Fish and Wildlife Service Windy Gap Process, and only those parameters that apply to this operation have been calculated.

Projected Water Depletion

1- Bathhouse/Office

~~Calculations have been performed to evaluate the potential water depletion to the Colorado River system as a result of the mining at this site. The calculations are shown on Table III-12, and indicate a net increase of approximately 47.61 acre-feet of water per year to the Colorado River.~~

~~R645-301-333.200.~~ ~~SITE-SPECIFIC PROTECTION OF THREATENED AND ENDANGERED SPECIES~~

~~See R645-301-310.~~

~~R645-301-333.300. PROTECTIVE MEASURES DURING ACTIVE PHASES OF MINING OPERATIONS~~

~~Appendix A~~

~~R645-301-340.~~ ~~RECLAMATION PLAN~~

~~See R645-301-240.~~

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~~R645-301-341.~~ ~~REVEGATATION~~

~~See R645-301-240.~~

~~R645-301-341.100 SCHEDULE AND TIMETABLE~~

~~See R645-301-240.~~

~~R645-301-341.200. DESCRIPTION~~

~~See R645-301-240.~~

~~Table III-12~~
~~Potential Water Depletion~~
~~to~~
~~Colorado River Drainage~~

~~The following calculations are intended to define the potential depletion or addition of water to the Colorado River Drainage System, as a result of mining at this operation. It should be noted that the criteria is based on the U.S. Fish and Wildlife Service Windy Gap Process, and only those parameters that apply to this operation have been calculated.~~

~~Projected Water Depletion~~

~~1- Bathhouse/Office~~
a. 140 people @ 35 ngpd/ea x 240 days/yr = 1,176,000,gal/yr

2- Ventilation

~~2- Ventilation~~
a. Evaporation
1) 450,000 cfm = 236,520 M cf/yr
2) 2.5 gallon/M cf = 591,300 gal/yr

Total Loss = 1,767,300 gal/yr
5.424 ac ft/yr

Projected Water Addition

1- Mine Discharge

~~Projected Water Addition~~

~~1- Mine Discharge~~
a. 100gpm x 120 days/yr = 17,280,000 gal/yr

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Total Gain = 17,280,000 gal/yr
53.034 ac ft/yr

Summary

Projected Depletion = -5.424 ac ft/yr

~~Summary~~

~~Projected Depletion = 5.424 ac ft/yr~~
Projected Addition = +53.034 ac ft/yr

Total Addition = + 47.61 ac ft/yr

Note: Moisture loss from mined coal and use of sprays have not been included, since the spray water is derived from perched aquifers and is recycled within the mine. Any excess water from the perched aquifers is eventually discharged, resulting in the addition to stream flow.

~~Note: Moisture loss from mined coal and use of sprays have not been included, since the spray water is derived from perched aquifers and is recycled within the mine. Any excess water from the perched aquifers is eventually discharged, resulting in the addition to stream flow.~~

340. Reclamation Plan

340.341. Revegetation

The revegetation map now shows the original permit acreages for the three range types. Shrub clumps make up 2.15 acres, drainage areas make up 15.02 acres and steep slopes make up 17.03 acres. Total disturbed area, including the Aberdeen Mine left fork fan and road is 47.19 acres.

Vegetation mapping has been created for the entire permit area of the Centennial Mine by Mt. Nebo Scientific, Inc. Springville, Utah. EarthFax Engineering did the Vegetation mapping for the Kenilworth Lease. See Plate 3-1 for vegetation mapping for the disturbed area.

The vegetation map was created by using new and/or current available aerial photography with field work accomplished as a means for ground-truthing. Field verification work was conducted during the growing season of 2002. Vegetation maps were consolidated and expanded and a new total permit vegetation map was created in 2014 as Plate 3-1.

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The life of the mine is estimated to be at least 5 years after the continuation of mining, therefore, a detailed schedule and timetable for the completion of each major step in the revegetation plan will be completed at a time nearer to the end of the mine's life. Reclamation Phase 1 and Phase 2 can be found on plate 3-2.

340.341.210

Table III-13
Recommended Seed Mix for Steep Slope Areas
~~Andalex Resources, Inc.~~

SPECIES	# PLS/Acre
Grasses :	
Agropyron ~~smithii~~Smithii	
Western Wheatgrass	3.0
Agropyron ~~spicatum~~Spicatum	
Bluebunch Wheatgrass	2.0
Agropyron ~~trachycaulum~~Trachycaulum	
Slender Wheatgrass	2.0
Bromus ~~marginatus~~Marginatus	
Mountain Brome	3.0
Oryzopsis ~~hymenoides~~Hymenoides	
Indian ~~ricegrass~~ Ricegrass	2.0
Poa sandbergii (~~secunda~~Secunda)	
Sandberg ~~bluegrass~~ Bluegrass	0.25
Forbs:	
Artemisia ludoviciana	
Louisiana ~~sagebrush~~ Sagebrush	0.1
Hedysarum ~~boreale~~Borealis	
Northern ~~sweetvetch~~ Sweetvetch	1.0
Linum ~~lewisii~~Lewisii	
Lewis ~~flax~~ Flax	1.0
Melilotus ~~officinalis~~Officinalis	
Yellow ~~sweetclover~~ Sweetclover	0.5
Penstemon ~~strictus~~Strictus	
~~'Bandera'~~ 'Bandera' Rocky Mtn. ~~penstemon~~Penstemon	0.25
Shrubs:	
Amelanchier ~~alnifolia~~Alnifolia	
Serviceberry	1.0
Artemisia ~~tridentara vaseyana~~Tridentara Vaseyana	

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Mountain ~~big sagebrush~~ Big Sagebrush		0.2
Cercocarpus ~~ledifolius~~Ledifolius		
Curlleaf ~~mountain mahogany~~Mountain Mahogany		1.0
Cercopcarpus ~~montanus~~Montanus		
True ~~mountain mahogany~~ Mountain Mahogany		1.0
Chrysothamnus ~~nauseosus albicaulis~~Nauseosus Albicaulis		
Whitestem ~~rubber rabbitbrush~~ Rubber Rabbitbrush		1.0
Purshia ~~tridentata~~Tridentata		
Bitterbrush	3.0	

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Symphoricarpos ~~oreophilus~~Oreophilus		
Mountain ~~snowberry~~ Snowberry		1.0
Total		**23.3**

Rate is pounds Pure Live Seed/Acre for drill seeding. Broadcast seeding is double the drill rate.
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Table III-14
Recommended Seed Mix for Drainage Areas
Andalex Resources, Inc.

SPECIES (DRAINAGE AREAS)	# PLS/acre
Grasses:	
Agropyron ~~riparium~~ Riparium	2.0
Western ~~wheatgrass~~ Wheatgrass	
Agropyron ~~trachycaulum~~ Trachycaulum	2.0
Slender ~~wheatgrass~~ Wheatgrass	
Bromus marginatus	3.0
Mountain ~~brome~~ Brome	
Elymus cinereus	2.0
Great Basin ~~wildrye~~ Wildrye	
Phalaris ~~arundinacea~~ Arundinacea	0.5
Reed ~~canarygrass~~ Canarygrass	
~~Poa pratensis~~ ~~0.1~~	
Poa Pratensis	0.1
Sandberg ~~bluegrass~~ Bluegrass**	
Forbs:	
Achillea ~~millifolum~~ Millifolum	0.1
Yarrow	
Artemisia ~~ludoviciana~~ Ludoviciana	0.1
Louisiana ~~sagebrush~~ Sagebrush**	
Hedysarum ~~borealis~~ Borealis	1.0
Northern ~~sweetvetch~~ Sweetvetch	
Melilotus ~~officinalis~~ Officinalis	0.5
Yellow ~~sweetclover~~ Sweetclover	
Osmorhiza ~~occidentalis~~ Occidentalis	2.0
Sweet ~~anise~~ Anise	
Shrubs:	
Amelanchier ~~alnifolia~~ Alnifolia	1.0
Serviceberry	
Artemisia ~~tridentata vaseyana~~ Tridentata Vaseyana	0.1
Mountain ~~big sagebrush~~ Big Sagebrush**	
Rhus ~~trilobata~~ Trilobata	1.0
Squawbush	
Sambucus ~~cerulea~~ Cerulea	1.0
Blue ~~elderberry~~ Elderberry	
Symphoricarpos ~~oreophilus~~ Oreophilus	1.0
Mountain ~~snowberry~~ Snowberry	
Total	**17.4**

Trees (transplants):	**#/Acre**
Populus ~~angustifolia~~ Angustifolia (Narrowleaf ~~cottonwood~~) Cottonwood)	250
Acer ~~negundo~~ Negundo (Box Elder)	250
Prunus ~~virginiana~~ Virginiana (Chokecherry)	250

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Quercus ~~gambelii~~Gambelii (Gambel ~~oak)~~	Oak)	250
Total		**1000**

Rate is pounds Pure Live Seed/Acre for drill seeding. Broadcast seeding is double the drill rate.
*This seed mixture and shrub list will be used for interim reclamation in the left hand fork fan installation and on the new topsoil pile. This seed mixture and shrub list will also be used for final reclamation. Also, this shrub list will be attempted on the new topsoil pile in the left hand fork.
**Big sage, Louisiana sage, rabbit brush and bluegrass will be broadcast behind the drill where possible.

300.350. Performance Standards

353.120.

An evaluation of species composition will be made, including species present, form and diversity.

353.210

For a postmining land use of grazing and wildlife habitat, the ground cover and production will be equal to or greater that a reference area. The Division's "Vegetation Information Guidelines", Appendix A will be utilized for the evaluation of the success of Revegetation. Appendix B will be references for calculating diversity.

~~R645-301-341.220. METHODS USED IN PLANTING AND SEEDING~~

~~See R645-301-240.~~

~~R645-301-341.230. MULCHING TECHNIQUES~~

~~See R645-301-240.~~

~~R645-301-341.240. IRRIGATION AND PEST CONTROL MEASURES~~

~~See R645-301-240.~~

~~R645-301-341.250. METHODS USED TO DETERMINE REVEGATATION SUCCESS~~

~~See R645-301-240.~~

~~R645-301-341.300. STUDIES AND TESTING TO DEMONSTRATE FEASIBILITY OF REVEGATATION PLAN~~

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See R645-301-240.

R645-301-342. FISH AND WILDLIFE

See R645-301-310, Appendices A and D.

R645-301-342.100. ENHANCEMENT MEASURES

Appendix A. Andalex will endeavor to use the best technology current available to enhance wildlife habitat during the reclamation phase of its operation. This will include, but not be limited to water sources (if available), thermal cover, escapeways, hiding and loafing places, and travelways. ANDALEX will consult with the Division of Wildlife Resources, at the time of final reclamation, to determine exactly what reclamation designs, planting arrangements, and artificial structures would best enhance a wildlife habitat.

R645-301-342.200. PLANT SPECIES SELECTION

See R645-301-341.210.

R645-301-342.210. NUTRITIONAL VALUE

Appendix A

R645-301-342.220. COVER AND PROTECTION

Appendix A

R645-301-342.230. ABILITY TO SUPPORT AND ENHANCE HABITAT

Appendix A

R645-301-342.300. CROPLAND

N/A

R645-301-350 PERFORMANCE STANDARDS

R645-301-351 General

R645-301-352 Contemporaneous Reclamation

See R645-301-331 356.110.

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Ground

~~R645-301-353.~~ ~~REVEGATATION: GENERAL REQUIREMENTS~~

~~R645-301-353.100.~~ ~~VEGETATIVE COVER~~

~~The vegetative~~ cover will be ~~as stated~~estimated by using one of the methods listed in ~~the following categories:~~"Vegetation Information Guidelines" Appendix A.

Andalex does not propose to stock shrubs or trees during interim or final Revegetation.

Production measurements will be made in accordance with DOGM's "Vegetation Information Guidelines" Appendix A. Estimates may be made by the methodology which the vegetation consultant feels is the most suitable method to used for the work being performed.

Sampling Techniques - Andalex Resources, Inc. will comply with the standards for success, statistically valid sampling techniques for measuring success, and the approved methods outline in the Division's "Vegetation Information Guidelines, Appendix A" for sampling.

The sampling methods to be used during reclamation will be specific to the requirements at the time of reclamation. Nonetheless, according to the currently approved UDOGM guidelines, these sampling methods would be used: sample adequacy, cover (line interception), density (belt transects or plots) and productivity (clipping).

~~R645-301-353.110.~~ ~~DIVERSITY, EFFECTIVENESS AND PERMANENCE~~

The Jaccard's Community Coefficient will be used to calculate acceptable plant similarity and diversity.

356.120.

The vegetative cover will be diverse, effective and permanent. Standards for reclamation success will be evaluated accordance with DOGM's "Vegetation Information and Monitoring Guidelines", Appendix A. The success of final reclamation will be judged on the effectiveness of the vegetation for the postmining land use and the extent of cover compared to the extent of cover for the reference area. Ground cover, production or stocking will be considered equal to the approved success standard when it reaches 90% of the success standard. Statistical adequacy of all statistical sampling will be determined using the following formula:

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$$N_{min} = \frac{t^2 S^2}{(dx)^2}$$

~~where~~Where: t = the value from appropriate t-table*, (2-tail test for pre-mine studies, 1-tail test for success studies)
s = the sample standard deviation,
d = the desired change in the mean,
x = the sample mean of the parameter in question
* = All parameters are to be tested at the 90% confidence level with a 10% change in the mean (d = .1).

~~Ground cover will be estimated by using one of the methods listed in "Vegetation Information Guidelines" Appendix A.~~

~~Andalex does not propose to stock shrubs or trees during interim or final Revegetation.~~

356.210

Grazing Land and Pasture Land - The ground cover and production of living plants on the revegetated area will be at least equal to the reference area.

356.220

Andalex Resources, Inc. will be responsible for the success of revegetation for a period of 10 years following seeding of the reclaimed area or upon Diviison bond release.

356.230

Fish and Wildlife Habitat - The postmining land use for the degas well sites will be wildlife habitat on pre-existing roads. Pre-existing roads will be returned to their approximate original contour and compacted.

356.240

Industrial, Commercial or Residential - The postmining land use for the permit area is not designated for industrial, commercial, or residential use.

356.250

Previously Disturbed Areas - N/A

356.300

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~~Production measurements will be made in accordance with DOGM's "Vegetation Information Guidelines" Appendix A. Estimates may be made by the methodology which the vegetation consultant feels is the most suitable method to used for the work being performed.~~

~~An evaluation of species composition will be made, including species present, form and diversity.~~

~~For a postmining land use of grazing and wildlife habitat, the ground cover and production will be equal to or greater that a reference area. The Division's "Vegetation Information Guidelines", Appendix A will be utilized for the evaluation of the success of Revegetation. Appendix B will be references for calculating diversity.~~

Siltation structures will be maintained until the disturbed area is revegetated and stabilized. They will remain in place at least two years after the last augmented seeding. Siltation structures may include straw bales, silt fences or filter baskets. Removal will be contingent upon Revegetation and stabilization of the area as well as DOGM concurrence. Following removal, the area will be revegetated in accordance with the reclamation plan.

358.100

There have been 6 threatened or endangered species observed in the lease area. A study was conducted in the Left Hand Fork for both the access road and the fan installation site to determine the presence of Canyon Sweetvetch.

358.510.

State or federally listed endangered or threatened species will be reported to the Division upon its discovery. It is listed in Appendix M.

358.520.

Electric Power Lines - No utilities will exist at the well sites.

Potential Barriers - No potential barriers will exist in the permit area.

R645-301-320. ENVIRONMENTAL DESCRIPTION

Appendices A, D and M.

R645-301-321. VEGETATION INFORMATION

Appendix M.

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R645-301-321.100. POTENTIAL FOR RE-ESTABLISHING VEGETATION

Appendix M

R645-301-321.200. PRE-MINING PRODUCTIVITY

Appendix M

R645-301-322. FISH AND WILDLIFE INFORMATION

Appendices A, D, and M.

R645-301-322.100. PROTECTION AND ENHANCEMENT PLAN

Appendix A

R645-301-322.200. SITE-SPECIFIC RESOURCE INFORMATION

Appendix A

R645-301-322.210. THREATENED OR ENDANGERED SPECIES

R645-301-322.220. HABITATS OF UNUSUALLY HIGH VALUE FOR FISH AND WILDLIFE

R645-301-322.230. OTHER SPECIES OR HABITATS REQUIRING SPECIAL PROTECTION

N/A

R645-301-322.300. FISH AND WILDLIFE SERVICE REVIEW

Appendix A

R645-301-323. MAPS AND AERIAL PHOTOGRAPHS

Appendix A

R645-301-323.100. REFERENCE AREAS

See R645-301-331 "Reference Areas".

R645-301-323.200. MONITORING STATIONS

N/A

R645-301-323.300. ENHANCEMENT FACILITIES

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R645-301-323.400. PLANT COMMUNITIES

R645-301-333.200. SITE-SPECIFIC PROTECTION OF THREATENED AND ENDANGERED SPECIES

R645-301-333.300. PROTECTIVE MEASURES DURING ACTIVE PHASES OF MINING OPERATIONS

Appendix A

R645-301-340. RECLAMATION PLAN

See R645-301-240.

R645-301-341. REVEGATATION

See R645-301-240.

R645-301-341.100 SCHEDULE AND TIMETABLE

See R645-301-240.

R645-301-341.200. DESCRIPTION

See R645-301-240.

R645-301-341.220. METHODS USED IN PLANTING AND SEEDING

See R645-301-240.

R645-301-341.230. MULCHING TECHNIQUES

See R645-301-240.

R645-301-341.240. IRRIGATION AND PEST CONTROL MEASURES

See R645-301-240.

R645-301-341.250. METHODS USED TO DETERMINE REVEGATATION SUCCESS

See R645-301-240.

R645-301-341.300. STUDIES AND TESTING TO DEMONSTRATE FEASIBILITY OF REVEGATATION PLAN

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See R645-301-240.

R645-301-342. FISH AND WILDLIFE

Appendices A and D.

R645-301-342.100. ENHANCEMENT MEASURES

R645-301-342.200. PLANT SPECIES SELECTION

See R645-301-341.210.

R645-301-342.210. NUTRITIONAL VALUE

Appendix A

R645-301-342.220. COVER AND PROTECTION

Appendix A

R645-301-342.230. ABILITY TO SUPPORT AND ENHANCE HABITAT

Appendix A

R645-301-342.300. CROPLAND

N/A

R645-301-350 PERFORMANCE STANDARDS

R645-301-351 General

R645-301-352 Contemporaneous Reclamation

See R645-301-331

R645-301-353. REVEGATATION: GENERAL REQUIREMENTS

R645-301-353.100. VEGETATIVE COVER

The vegetative cover will be as stated in the following categories.

R645-301-353.

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110. DIVERSITY, EFFECTIVENESS AND PERMANENCE

The vegetative cover will be diverse, effective and permanent.

R645-301-353.120. NATIVE OR DESIRABLE INTRODUCED SPECIES

The vegetative cover will be comprised of species native to the area, or of introduced species where desirable and necessary to achieve the approved postmining land use and approved by the Division.

R645-301-353.130. EXTENT OF COVER

The vegetative cover will be at least equal in extent of cover to the natural vegetation of the area.

R645-301-353.140. STABILIZING SOIL FROM SURFACE EROSION

The vegetative cover will be capable of stabilizing the soil surface from erosion.

R645-301-353.200. REESTABLISHED PLANT SPECIES

The reestablished plant species will:

R645-301-353.210. COMPATIBILITY WITH APPROVED POST-MINING LAND USE

The reestablished plant species will be compatible with the approved postmining land use.

R645-301-353.220. SEASONAL CHARACTERISTICS OF GROWTH

The reestablished plant species will have the same seasonal characteristics of growth as the original vegetation.

R645-301-353.230. SELF-REGENERATION AND PLANT SUCCESSION

The reestablished plant species will be capable of self-regeneration and plant succession.

R645-301-353.240. COMPATIBILITY WITH AREA PLANT AND ANIMAL SPECIES

The reestablished plant species will be compatible with the plant and animal species of the area.

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R645-301-353.250. COMPLIANCE WITH OTHER APPLICABLE LAWS OR REGULATIONS

The reestablished plant species will meet the requirements of applicable Utah and federal seed, poisonous and noxious plant; and introduced species laws or regulations.

R645-301-353.250 Vegetative Exception

Andalex Resources, Inc. does not require vegetative exception at this time.

R645-301-353.400 Cropland

The permit area contains no land designated as cropland.

R645-301-354 Revegetation: Timing

Andalex Resources, Inc. will follow the recommended guidelines for revegetation and planting during the first normal period for favorable planting conditions after replacement of the topsoil. In Utah the planting period is usually Fall due to the precipitation events.

R645-301-355 Revegetation: Mulching and Other Soil Stabilizing Practices

Mulch and/or other soil stabilizing practices (roughing, etc.) Will be used on all areas that have been regraded and covered by topsoil (Section 341.200). Andalex, Resources, Inc. will exercise care to guard against erosion during and after application of topsoil.

R645-301-356 Revegetation: Standards for Success

R645-301-356.100 Success of Revegetation

The success of revegetation will be judged on the effectiveness of the vegetation for ~~postmining~~post-mining land use, the extent of cover on each degassification well site compared to their respective reference areas as described in Section 321~~ and in Attachment 3-1~~.

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Sampling Techniques - Andalex Resources, Inc. will comply with the standards for success, statistically valid sampling techniques for measuring success, and the approved methods outline in the Division's "Vegetation Information Guidelines, Appendix A" for sampling.

The sampling methods to be used during reclamation will be specific to the requirements at the time of reclamation. Nonetheless, according to the currently approved UDOGM guidelines, these sampling methods would be used: sample adequacy, cover (line interception), density (belt transects or plots) and productivity (clipping). The Jaccard's Community Coefficient will be used to calculate acceptable plant similarity and diversity.

R645-356.200 Standards for Success

Standards of success will be applied in accordance with the approved postmining land use as described in this section.

Grazing Land and Pasture Land - The ground cover and production of living plants on the revegetated area will be at least equal to the reference area.

Fish and Wildlife Habitat - The postmining land use for the dogas well sites will be wildlife habitat on pre-existing roads. Pre-existing roads will be returned to their approximate original contour and compacted.

Industrial, Commercial or Residential - The postmining land use for the permit area is not designated for industrial, commercial, or residential use.

Previously Disturbed Areas - N/A

R645-356.300 Siltation Structures

Siltation structures will be maintained until the disturbed areas have been stabilized and revegetated. For additional details on siltation structures, see Sections 542 and 763.

R645-356.400 Removal of Siltation Structures

The land on which siltation structures are located will be revegetated in accordance with the reclamation plan discussed in Section 353 and 357. Refer to Section 763 for additional information pertaining to the removal of siltation structures.

R645-357 Revegetation: Extended Responsibility Period

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~~Andalex Resources, Inc. will be responsible for the success of revegetation for a period of 10 years following seeding of the reclaimed area or upon Diviison bond release.~~

R645-357.100 Extended Period Begins

The period of extended responsibility will begin after disturbed areas have been reseeded.

R645-357.200 Vegetation Parameters

Vegetation parameters will equal or exceed the approved success standard during the last 2 years of the responsibility period. The success standards are outlined in Section 356 of this application.

R645-357.300 Husbandry Practices

The use of husbandry practices are not being requested.

R645-358 Protection of Fish, Wildlife, and Related Environmental Values

Andalex Resources, Inc. will minimize disturbances and adverse impacts on wildlife and their related environments as outlined in Section 333 of the approved M&RP and Section 342 of this submittal. See Chapter 7, Section 731.100 of the approved M&RP for methods to protect water sources in the area.

R645-358.100 Existence of Endangered or Threatened Species

A listing of threatened or endangered plant species known to occur in Carbon County is included in Appendix M.

~~There have been no known threatened or endangered species observed in the lease area (Welsh 1977). A study was conducted in the Left Hand Fork for both the access road and the fan installation site to determine the presence of Canyon Sweetvetch. None was found. Additionally, the surveyor does not believe the habitat exists for this plant~~

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~~State or federally listed endangered or threatened species will be reported to the Division upon its discovery.~~

R645-358.200 Bald and Golden Eagles

Andalex Resources, Inc. understands that there is no permission implied by these regulations for taking of bald or golden eagles, their nest, or eggs. If found, nests will be reported to the Division.

R645-358.300 Taking of Endangered or Threatened Species

Andalex Resources, Inc. understands that there is no permission implied by these regulations for taking of endangered or threatened species, their ~~nest, or eggs.~~nests, or eggs. Annual Raptor surveys will be conducted to monitor any nest activity to prevent any takings.

R645-358.400 Replacement of Wetland or Riparian Vegetation

~~The sites contain no~~ No wetland or riparian vegetation will be disturbed during mining.

R645-358.500 Manmade Wildlife Protection Measure

~~**Electric Power Lines** - No utilities will exist at the well sites.~~

~~**Potential Barriers** - No potential barriers will exist in the permit area.~~

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ANDALEX RESOURCES, INC.
CENTENNIAL PROJECT

CHAPTER 4

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Land Use and Air Quality

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~~(Revised)~~

~~July, 2014~~

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R645-301-400. LAND USE AND AIR QUALITY

R645-301-410. LAND USE

At present the Mining and Reclamation Plan for the Centennial Project includes 2,274.77 acres under permit (see Plate ~~3~~5-2). This permit is now being amended to include the Kenilworth Federal Lease UTU-81893 (1760.0 acres), bringing the total permit area to 4,034.77 acres (see Plate ~~3~~5-2). Lease UTU-81893 was acquired in 2006. Mining activity within the Kenilworth lease area will be an extension of the underground workings of the existing Aberdeen Mine. Therefore there will be no new surface facilities associated with mining in the new lease areas (other than additional Gob Gas Vent holes, if needed, which will be permitted on a site-specific basis in the future). It should be noted that UTU-81893 was previous included in the Willow Creek Mine Permit No. ACT/007/038 which has been previously approved by DOGM. After the Willow Creek Mine was closed the Kenilworth lease was terminated. The area was subsequently re-leased by BLM in 2006 through the normal LBA process after an application by Andalex Resources.

Since the Kenilworth Lease is simply an extension of underground mine workings under roughly 2,000 to 3,000 feet of cover there will be absolutely no effect on Land use or air quality. Because there will be no additional surface disturbance on the lease area, a First Order Survey is not deemed necessary.

R645-301-411. ENVIRONMENTAL DESCRIPTION

Due to the rugged topography and sparse rainfall, the land area is presently used only for grazing, wildlife habitat, and outdoor recreation. Historically, the land has also been used for coal mining.

R645-301-411.100. PREMINING LAND USE INFORMATION

The initial development of the Book Cliffs Coal Field was started in the early 1890's. By the early 1900's practically the entire field had been prospected. Mines in the lease area were not active until the 1920's because the cliffs were less accessible and the coal beds were thinner.

The Knight-Ideal mines, relinquished by Andalex Resources are located adjacent to the Hoffman Creek lease area. Initial prospecting took place at this location in 1906 and extensive
mining began in 1948 and ceased in 1958. During this period, 1,680,000 tons of coal were produced from the Gilson seam. The Knight-Ideal Mine is contiguous to our relinquished Sunedco leases (U-05067) in Hoffman Creek. By mining this lease, Andalex recovered all minable coal between Centennial and Knight-Ideal.

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Three mines on or adjacent to the lease area in Deadman Canyon were the Zion, Olsen, and Sutton (Blue Flame) mines. The Zion was located on the Zion's fee lease and the Olsen and Sutton were on SL-027304. The first two produced from the Gilson seam and the last produced from the Aberdeen or Castlegate "A" seam. Production figures are not reliable but it is estimated that between 216,000 tons and 720,000 tons may have been produced from the Sutton mines. The Olsen mines produced about 18,000 tons and the Zion mine around 240,000 tons, between 1924 and 1944.

There was also a prospect entry driven in the Lower Sunnyside Seam (the Hileman) on lease U-010581 from which production was insignificant, approximately 1,400 tons. Mining ceased in the area in 1964.

R645-301-411.110. USES OF THE LAND AT THE TIME OF FILING APPLICATION

The Deadman Canyon area as well as the Straight and Hoffman Canyons would fall into two land use categories: 1) Fish and Wildlife habitat and recreation lands, and 2) Range Lands. County zoning regulations (1974) indicate all lands involved in the lease application area are within zone M and G1 which is for mining and grazing. Current land use consists of grazing and deer hunting. For recreational purposes the land is suitable for deer hunting. Other recreational uses for the permit area could include hiking, cross-country skiing, four wheeling, camping, and snowmobiling in winters with adequate snow cover. The lack of water prevents the establishment of a chukker/partridge population. Usually there are no elk in the area although an animal or two may occasionally wander onto the area.

There are no oil and gas wells or water wells other than those water wells drilled by Andalex for use in mining activities, on the lease area. Also, there are no oil and gas wells or water wells in adjacent areas.

The area is eight air miles from Price, but the unavailability of water precludes any development for residential or summer homes.

See Figure 4-1 for a Regional Land Use Map.

R645-301-411.120. LAND USE DESCRIPTION IN CONJUNCTION WITH OTHER ENVIRONMENTAL RESOURCES INFORMATION

Livestock grazing has been the most intense use of the lease area. However, due to the expansive cliff formations and the roughness of the canyon walls, grazing has been principally limited to the canyon bottoms and extreme tops to the north of the lease boundary.

Mule deer are found within the lease area as well as the usual small mammals, predators, and passerine and raptorial birds.

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Outdoor recreation in the lease area is limited and usually related to enjoyment of the open space and associated scenic facilities and hunting for wild animals. The number of people using the area is small due to the rough terrain, poor roads, and lack of water.

The AEP Lease Area has the same land-use as that of the original permit area.

R645-301-411.130. EXISTING LAND USES AND LAND USE CLASSIFICATION

No existing land use under local law.

R645-301-411.140. CULTURAL AND HISTORIC RESOURCES INFORMATION

Most of the maps previously submitted as part of the Mining and Reclamation Plan are applicable. Where necessary, original maps have been revised to indicate the newly acquired lease areas and these revisions are included with this submittal as figures or as plates in Volume II. An archaeological clearance for the Left Hand Fork fan installation can be found in Appendix C along with all other previously conducted archaeological surveys. An archaeological survey, prepared by professional Archaeologist J Terry Walker of the Department of Anthropology at Brigham Young University, for the Kenilworth Lease can be found in the confidential binder, Appendix C.

R645-301-411.141. CULTURAL AND HISTORIC RESOURCES MAPS

~~See Appendix C.~~

All maps included in Appendix C were prepared by J Terry Walker, a professional Archaeologist of the Department of Anthropology and Archaeology at Brigham Young University in 1976, and deemed accurate.

R645-301-411.141.1 PUBLIC PARKS AND LOCATIONS OF ANY CULTURAL OR HISTORICAL RESOURCES

N/A

R645-301-411.141.2 CEMETERIES

There are no cemeteries or burial grounds in or within 100 feet of the permit area.

R645-301-411.141.3 NATIONAL SYSTEM OF TRAILS OR THE WILD AND SCENIC RIVERS SYSTEM

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N/A

R645-301-411.142. COORDINATION WITH THE STATE HISTORIC PRESERVATION OFFICER (SHPO~~)~~)

Appendix C.

R645-301-411.142.1 PREVENTION OF ADVERSE IMPACTS

Appendix C.

R645-301-411.142.2 VALID EXISTING RIGHTS OR JOINTS AGENCY APPROVAL

Appendix C.

R645-301-411.143. IMPORTANT HISTORIC AND ARCHAEOLOGICAL RESOURCES THAT MAY BE ELIGIBLE FOR LISTING ON THE NATIONAL REGISTER OF HISTORIC PLACES

Appendix C.

R645-301-411.143.1 COLLECTION OF ADDITIONAL INFORMATION

Appendix C.

R645-301-411.143.2 CONDUCTING FIELD INVESTIGATIONS

Appendix C.

R645-301-411.143.3 OTHER APPROPRIATE ANALYSES

Appendix C.

R645-301-411.144. APPROPRIATE MITIGATION AND TREATMENT MEASURES

Appendix C. Annual Subsidence Surveys will include Kenilworth area.

R645-301-411.145. EXCEPTIONS

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Appendix C.

R645-301-411.200. PREVIOUS MINING ACTIVITY

Previous activity consisted of small "dog hole" punch mines used for domestic coal in the 1930's, 1940's and 1950's.

R645-301-411.210. TYPE OF MINING METHOD USED

Previous mining was using conventional sections.

R645-301-411.220. COAL SEAMS OR OTHER MINERAL STRATA MINED

The coal seams previously mined were Lower Sunnyside, Gilson and Aberdeen.

R645-301-411.230. EXTENT OF COAL OR OTHER MINERALS REMOVED

The extent of removed coal was not significant, roughly 2,000,000 tons over 30 years.

R645-301-411.240. APPROXIMATE DATES OF PAST MINING

Approximately 1930-1960.

R645-301-411.250. USES OF LAND PRECEDING MINING

See R645-301-411.140.

R645-301-412. RECLAMATION PLAN

See R645-301-240.

R645-301-412.100. POSTMINING LAND USE PLAN

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The post-mining land use will consist of livestock grazing with wildlife habitat and some recreation.

R645-301-412.110. ACHIEVEMENT OF PROPOSED POSTMINING LAND USE

See R645-301-412.100.

R645-301-412.120. RANGE OR GRAZING LAND USE

See R645-301-412.100.

R645-301-412.130. ALTERNATE POSTMINING LAND USE

N/A

R645-301-412.140. CONSISTENCY WITH SURFACE OWNER PLANS AND APPLICABLE UTAH AND LOCAL LAND USE PLANS

Socioeconomic Impacts

The proposed project is located in an area where coal mining is the major industry, therefore, the community is geared for coal operations. The labor supply is excellent, well-trained, and available. Most people in this area have a very favorable attitude towards the increased coal activity. They look forward to growth in the area which will increase population, home construction, and provide other facilities for community use.

The need for development of additional housing, school space, and changes in present community services would be among the greatest impacts, due to the increase in population. Positive effects of the project will be to increase the number of jobs, payroll, and taxes thus helping to build the community.

Land Use Changes

The nature of an underground mine of this type and size requires minimal surface disturbance. There will be no additional surface disturbance whatsoever with the addition of any new leases, except for possible GVH holes if required. There will be no change in land-use status from pre-mining to post-mining use. The limited resources both physical and scenic will dictate no future change in land status. Considering the extent and nature of similar lands in the Book Cliffs, no uses other than those previously discussed can be forecast.

Deadman Canyon has been unsightly since the earliest mining began in the 1920's, the new mine surface facility and portal site will be in the same area as the old

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mine tipples and waste dumps. These waste dumps are numerous and located throughout the canyon bottom and consist of coal fines which were unmarketable during the earlier mining history. This coal waste has been recovered, reprocessed, and cleaned up during the new operation. This new operation will actually be a significant reclamation phase to the canyon area.

During and after completion of mining operations, the land will continue to be used for grazing and hunting. No future change is dictated in the land status. Please refer to Appendix R for surface owner comments. Existing surface owners did not feel any change in postmining land use was dictated. Surface disturbances will be very minimal and all disturbed land will be restored in a timely manner, according to the Reclamation Plan to conditions that are capable of supporting the uses they were capable of supporting before mining.

No grazing land has been impacted by Andalex's minesite or permit area as none exists within the disturbed area. As far as wildlife habitat is concerned, two things should be pointed out. First, Andalex has successfully provided new vegetation and food sources through revegetation within the deer winter range in acreages greatly exceeding the disturbed or "impacted" area. These areas include large acreages along the haul road and powerline corridor. Second, and perhaps more importantly, on Andalex's minesite, wildlife abounds. There are large numbers of small mammals of many varieties including, but not limited to, squirrels, chipmunks, mice and rabbits. There are large numbers of all types of birds, including large and small raptors hunting in the area. The DWR has indicated that our powerline has provided important hunting opportunities for large raptors. Deer are commonly observed within our disturbed area feeding on revegetated slopes. Revegetation within our disturbed area is mitigation in itself to the impacted area.

R645-301-412.200. LAND OWNER OR SURFACE MANAGER COMMENTS

Appendix R.

R645-301-413.300. SUITABILITY AND COMPATIBILITY

Appendix R.

R645-301-413. PERFORMANCE STANDARDS

R645-301-413.100. POSTMINING LAND USE

See R645-301-412.100.

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R645-301-413.110. CAPABILITY OF SUPPORTING POSTMINING LAND USE

See R645-301-412.100.

R645-301-413.120. HIGHER OR BETTER USES

See R645-301-412.100.

R645-301-413.200. DETERMINING PREMINING USES OF LAND

See R645-301-412.100.

R645-301-413.210. PREMINING USES OF LAND NOT PREVIOUSLY MINED

See R645-301-412.100.

R645-301-413.220. POSTMINING LAND USE FOR LAND THAT HAS BEEN PREVIOUSLY MINED AND NOT RECLAIMED

See R645-301-412.100.

R645-301-413.300. CRITERIA FOR ALTERNATIVE POSTMINING LAND USES

N/A

R645-301-413.310. LIKELIHOOD FOR ACHIEVEMENT LAND USE

Post-mining land use as proposed shall be achieved.

R645-301-413.320. HAZARDS TO PUBLIC HEALTH OR SAFETY, OR THREAT OF WATER DIMINUTION OR POLLUTION

This section deleted as instructed in the Technical Analysis.

R645-301-413.330. PROHIBITED LAND USES

N/A

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R645-301-413.331. IMPRACTICAL OR UNREASONABLE

N/A

R645-301-413.332. INCONSISTENT WITH APPLICABLE LAND USE POLICIES

N/A

R645-301-413.333. UNREASONABLE DELAY IN IMPLEMENTATION

N/A

R645-301-413.334. VIOLATION OF FEDERAL, UTAH OR LOCAL LAW

N/A

R645-301-414. PERMIT REVISIONS REQUESTING APPROVAL OF ALTERNATE POSTMINING LAND USE

N/A

R645-301-414.100. FILING DEADLINES

N/A

R645-301-414.200. SIGNIFICANT ALTERATION FROM MINING OPERATIONS IN THE ORIGINAL PERMIT

N/A

R645-301-414.300. OTHER REQUIREMENTS

N/A

R645-301-420. AIR QUALITY

As the Kenilworth Lease is simply an extension of underground mine workings under roughly 2,600 to 3,000 feet of cover there will be absolutely no effect on air quality.

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Air Pollution Control Plan and Compliance with Air Quality Laws

Existing Environment

The permit area is located in a Class II air quality area.

Air Quality Impact Analysis

Please see the following section, section 3 re Emission Estimates.

Emission Estimates

Emission estimates are included as Appendix F in the form of an emission inventory. This inventory has been reviewed and approved by the Utah Bureau of Air Quality and the E.P.A. It has been re-approved to increase our production restriction on the basis the haul road has been paved by Carbon County. Air quality permit in appendix F.

Proposed Controls

Since this is an underground operation, no air quality problems are anticipated. The only changes in air quality will be attributable to minor road dust and exhaust mine dust. Methods of control are spray systems, chemical treatment, enclosures, pavement, and other fugitive dust control practices outlined in 30 CFR 817.95.

There will be no additional fugitive emissions or air pollution associated with the newly acquired Kenilworth Lease.

PSD Permit and Compliance with Air Quality Laws

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The Environmental Protection Agency has determined that this project does not need a PSD air quality permit. This is based on our fugitive and non fugitive dust emissions inventory which assumes facilities necessary for 1.5 mm tons per year production. Further, the mine is not subject to the PSD regulations because of the new definition of a major source. (Refer to letter dated March 21, 1980 in Appendix J). All applicable air quality laws will be complied with and fugitive dust control practices, as required under 30 CFR 817.95, will be followed.

Andalex has been issued a new approval order for the mines and the Wildcat Loadout for 1.5 million tons per year. These were inspected and met compliance during the summers of 1989-1992.

R645-301-421. CLEAN AIR ACT AND OTHER APPLICABLE LAWS

See R645-301-420.

R645-301-422. UTAH BUREAU OF AIR QUALITY

See R645-301-420.

R645-301-423. SURFACE COAL MINING AND RECLAMATION ACTIVITIES EXCEEDING 1,000,000 TONS PER YEAR

See R645-301-420.

R645-301-423.100. COMPLIANCE WITH FEDERAL AND UTAH AIR QUALITY STANDARDS

See R645-301-420.

R645-301-424 FUGITIVE DUST CONTROL PLAN

See also Appendix J

R645-301-425 ADDITIONAL DIVISION REQUIREMENTS

NA

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ANDALEX RESOURCES, INC.
CENTENNIAL PROJECT

CHAPTER 5

Engineering

C/007/019

~~(Revised)~~
~~July, 2014~~

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~~MAPS~~

~~Found In VOLUME II~~

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Plate #5-9 (Sheet 10 of 19) Deadman Canyon Profiles

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Plate #5-9 (Sheet 11 of 19) Deadman Canyon Profiles

Plate #5-9 (Sheet 12 of 19) Deadman Canyon Profiles

Plate #5-9 (Sheet 13 ~~Sediment Pond E - Proposed Aberdeen Surface~~ of 19) Deadman Canyon Profiles

Plate #5-9 (Sheet 14 ~~Cut & Fill Cross Section Reference -~~ of 19) Deadman Canyon Profiles

Plate #5-9 (Sheet 15 ~~Cut & Fill Cross Sections, Original Surface, As Constructed, As Reclaimed -~~ of 19) Deadman Canyon ~~(18 Sheets)~~ Profiles

Plate #5-9 (Sheet 16 ~~Post Mining Hydrology - Final Reclamation Plan -~~ of 19) Deadman Canyon ~~- Phase I~~ Profiles

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~~Plate 26~~ ~~Lower Sunnyside Seam Isopach~~

~~Plate 27~~ ~~Gilson Seam Isopach~~

~~Plate 28~~ ~~Aberdeen Seam Isopach~~

~~Plate 29~~ ~~Proposed Mine Plan Lower Sunnyside Seam~~

~~Plate 30~~ ~~Proposed Mine Plan Gilson Seam~~

~~Plate 31~~ ~~Proposed Mine Plan A Seam~~

~~Plate 32~~ ~~Pinnacle Mine Current Mine Plan~~

~~Plate 33~~ ~~Apex Mine Current Mine Plan~~

~~Plate 34A~~ ~~Centennial Project - Wildlife Distribution Map~~

~~Plate 34B~~ ~~Centennial Project - Wildlife Distribution Map~~

~~Plate 34C~~ ~~Centennial Project - Wildlife Distribution Map~~

~~Plate 34D~~ ~~Centennial Project - Wildlife Distribution Map~~

~~Plate 35~~ ~~Typical Road Cross Section~~

~~Plate 36~~ ~~Top Soil Storage Pile "G"~~

~~Plate 37~~ ~~Topsoil Piles - Deadman Canyon~~

~~Plate 38~~ ~~Previously Omitted~~

~~Plate 39~~ ~~Previously Omitted~~

~~Plate 40~~ ~~Centennial Seam Isopach (Mine is closed and sealed)~~

~~Plate 41~~ ~~Proposed Mine Plan Centennial Seam (Mine is closed and sealed)~~

~~Figure 4~~ ~~Water Quality Data~~

~~Figure 5~~ ~~Surface and Ground Water Rights~~

~~Figure 6~~ ~~Ground and Surface Water Monitoring~~

~~Figure 4-1~~ ~~Regional Land Use Map~~

~~Figure 1-2~~ ~~Centennial Leases / Permit Area~~

~~Figure 1-2A~~ ~~Centennial Disturbed Area~~

~~Figure 7-1~~ ~~Water Monitoring Locations~~

~~Figure 1-1~~ ~~GVH Locations Map~~

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R645-301-500. ENGINEERING

The Kenilworth Tract will not require any changes to engineering practices currently employed at the Aberdeen Mine. The change simply involves an extension of underground mine workings and does not involve the surface in any way. See 522-301-~~522~~ and 525-301-~~525~~ for additional comments on subsidence.

~~R645-301-~~510. INTRODUCTION

At present the Mining and Reclamation Plan for the Centennial Project includes 2,274.77 acres under permit (see Plate ~~3~~5-2). This permit is now being amended to include the Kenilworth Federal Lease UTU-81893 (1760.0 acres), bringing the total permit area to 4,034.77 acres (see Plate ~~3~~5-2). Lease UTU-81893 was acquired in 2006. Mining activity within the Kenilworth lease area will be an extension of the underground workings of the existing Aberdeen Mine. Therefore there will be no new surface facilities associated with mining in the new lease areas (other than additional Gob Gas Vent holes, if needed, which will be permitted on a site-specific basis in the future). It should be noted that UTU-81893 was previous included in the Willow Creek Mine Permit No. ACT/007/038 which has been previously approved by DOGM. After the Willow Creek Mine was closed the Kenilworth lease was terminated. The area was subsequently re-leased by BLM in 2006 through the normal LBA process after an application by Andalex Resources.

Since the Kenilworth Lease is simply an extension of underground mine workings under roughly 2,000 to 3,000 feet of cover there will be absolutely no effect on Engineering except for additional subsidence points. (Plate ~~25~~5-11)

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Most of the maps previously submitted as part of the Mining and Reclamation Plan are applicable. Where necessary, original maps have been revised to indicate the newly acquired lease area and these revisions are included with this submittal ~~as figures or as plates in Volume II. Plates which have been changed to show the location of the incidental boundary change are included~~.

It should be noted that no man made surface features are located in or around the Kenilworth Lease UTU 81893 shown on Plate ~~25~~5-11 and others.

All categories within this section have been addressed ~~, primarily~~ in ~~Volume II of~~ the MRP ~~which contains most of the~~ and plates.

a) Surface and subsurface ownership of lands contiguous to the permit area are shown on Plates ~~2~~5-1 and ~~3~~5-2.

b) The leases for which we have the legal right of entry are shown on Plate ~~4~~5-2.

c) Andalex has submitted a permit modification to include the new Kenilworth Lease recently acquired. ~~Also, a permit was sought in 1993 for a fan installation immediately adjacent to Andalex's leases in the left hand fork in Deadman Canyon.~~

d) There are no buildings within 1,000 feet of the permit area except those used as part of the existing mining operation. They are shown on ~~Plates 6 and~~ Plate 5-7.

e) There are no surface or subsurface man-made features within, passing through or passing over the permit area except the powerline, telephone cables, culverts, and etc., installed for the operation of this mine. See Plate ~~6~~5-7 for their locations.

f) Reference areas are shown on Plate ~~9~~7-1 as R-1, R-3 and R-4. They are each 200 feet square approximately.

g) Surface water users within this immediate hydrologic area are shown on Plate 7-3 (Refer to ~~Figure 5,~~ Appendix L, which shows additional water use on Emma Park in the form of stock watering). Water rights for this area are found in Appendix L ~~Tables 1~~ and ~~5 and Figure 5.~~ on Plate 7-3. The intake location for this water into the mine is located on Plate ~~6~~5-7. Disturbed area runoff is collected in a culvert and taken directly into the mine. Andalex controls this water right. If a discharge were to occur from any sediment pond (this has yet to occur), it would discharge into the Deadman Canyon drainage (Plate ~~21~~7-2) which is ephemeral.

h) County Road 299 starts at highway 6 in Price and terminates at Andalex Resources' mine site (Plate 1-1).

i) There are no public parks nor any cultural or historical sites eligible for listing in the National Register in or adjacent to the mine plan area.

j) There are no cemeteries or burial grounds in or within 100 feet of the permit area.

k) There is no land which is within the boundaries of any units of the National System of Trails or the Wild and Scenic Rivers System including study rivers.

Cross Sections, Maps, and Plans

Most of the cross sections, maps, and plans of the approved plan remain applicable. Where necessary, original maps have been revised to indicate the addition of the newly acquired lease area and are included in this submittal~~, primarily in Volume II~~.

All categories within this section have been addressed. Specifically,

a) Plates ~~26, 27~~5-3, 5-4, and ~~28~~5-5 show all the test borings locations and elevations. Specific information relating to these drill holes and the strata encountered can be found in Appendix E (coal quality, description of other strata). Into regarding roof & floor analyses is in Appendix E.

b) Monitoring stations for water quality are shown on Figure 7-~~1~~8. Fish and wildlife monitoring stations were not set up for this application. However, refer to Plates ~~34A, 34B, 34C~~3-4A, 3-4B, 3-4C, and ~~34D~~3-4D, which depicts wildlife distribution. Air quality monitoring was not required for this application. ~~Figure 6 in Appendix L~~Plate 7-8 shows proposed monitoring stations. Andalex has adhered to the locations shown on ~~Figure IV-11~~Plate 7-8 which is included in Andalex's operating plan.

c) Refer to Appendix E for specific drill hole lithologies as well as data on quality and chemical characteristics.

d) Crop lines and strikes and dips can be found on the coal thickness isopachs in Volume II, Plates ~~26, 27, 28,~~5-3, 5-4 and ~~40~~5-5 and 5-6.

e) All old workings in the three coal seams to be mined are shown on ~~Plates 29, 30, and 31.~~Plate 5-6. There are no old workings in the Centennial Seam.~~(plate 41)~~

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f) All subsurface water on the permit area exists in perched aquifers. The Aberdeen sandstone is the lowest water bearing unit within the permit area and is discussed in this chapter, Geology. The only water well drilled on the property which has been used with any frequency (well #1) has not depicted any seasonal variation. It is always a low producer.

g) There are no surface waters within the permit area. All drainages (natural) are shown on the topography on Plate ~~21~~5-11. All constructed drainages are shown on ~~Plates 6 and~~ Plate 5-7. There are no irrigation ditches. Appendix L, which is the Hydrologic Inventory, contains Figure 4 , and Plate 7-7 which clearly depicts the location of springs in the permit area and adjacent areas. ~~This figure, along with Figures 5 and 6,~~ Plate 7-7 depict the areal extent of the inventory. ~~See Plate 1 for other spring locations in the adjacent area and 1A for Kenilworth Lease Area.~~

h) N/A

i) Plate ~~6~~5-7 shows the location of temporary storage for underground development waste and excess spoil which can be stored in an area which was previously used as a sediment pond. Plate ~~6~~5-7 now also shows the location of a new area above the Apex Mine which can be used for temporary and permanent storage of coal mine development waste such as sediment pond material. All dams and impoundments are shown on Plates ~~6~~5-7 and 7-2, and detailed on Plates ~~11, 12~~7-4, 7-5, and ~~13~~7-6. There are no other water treatment or air pollution control facilities on the permit area.

j) There are no oil or gas wells within the permit area. Three water wells are shown on Plate ~~6~~5-7. Well number 1 is 220 feet deep; number 2 is 100 feet deep, and number 3 is 120 feet deep. Also, there are no oil or gas wells located in the adjacent areas.

k) Plates ~~14~~5-7 and ~~15~~7-10, and 7-11 accurately depict the area currently affected by mining as well as the area to be affected. They show the slopes as they exist as well as ~~after construction and~~ upon final reclamation.

~~R645-301-~~

511. GENERAL REQUIREMENTS

See R645-301-510.

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R645-301-511.100. **PROPOSED COAL MINING AND RECLAMATION ~~OPERATIONS~~PERATIONS**

~~See R645-301-510.~~

The permit application includes a description of the proposed coal mining and reclamation operations with appropriate maps, plans, and cross sections.

R645-301-511.200. **POTENTIAL IMPACTS TO THE ENVIRONMENT**

See R645-301-510.

R645-301-511.300. **RECLAMATION**

See R645-301-240.

R645-301-512. **CERTIFICATION**

See Volume II and R645-301-510.

R645-301-512.100. **CROSS SECTIONS AND MAPS**

See R645-301-510.

R645-301-512.110. **MINE WORKINGS TO THE EXTENT KNOWN**

Introduction

Mine Property

The coal leases owned by Andalex Resources are located in the Deadman Canyon area of the Book Cliffs coal field. The property is located about 10 miles north-northeast of Price, Utah in Carbon County. Mining has progressed onto all of Andalex's federal leases except the Kenilworth Lease. As is shown on the enclosed Plate ~~6~~5-7, development into all seams involves separate surface facilities which are located adjacent to each other in Deadman Canyon. The Centennial coal seam which is an isolated pocket of recoverable coal was accessed from the Pinnacle Mine via rock slopes~~.~~, which is now closed and sealed. The three rock slopes constructed each of which was be approximately 500' in length. The three tunnels are for intake air, return air, and belt line. No waste rock was removed from the Pinnacle Mine either during or after construction. All waste rock will be disposed of underground.

Economic Geology

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This project is located in a region where coal mining has historically been the only industry. The main coal-bearing rocks occur in the Blackhawk Formation of the Upper Cretaceous Mesa Verde Group. Several small operations have mined coal in the Deadman Canyon area over the past 70 years. These mines, however, merely scratched the surface of the estimated reserve. There are no other economically recoverable, replenishible or non-replenishible resources within this property.

Exploration

All exploration and drilling programs have been completed. The drilling and exploration activities were supplemented by mine samples and outcrop information, and the results used to estimate the coal reserves of the lease area. Numerous samples were taken from the outcrops of the Lower Sunnyside, Gilson, and Aberdeen seams, as well as from mine faces in the Hileman, Zion's, Star Point, and Blue Flame No. 1 mines. Samples have been taken from the Centennial Seam at 89-1-CP and underground. See appendix E.

A five hole drilling program was conducted by Centennial Coal Associates in 1971. A seven hole drilling program was conducted by Andalex in 1977. These programs were supplemented by two holes drilled west of the property by North American Coal Company in 1948 and one drilled by Pacific, Gas and Electric in 1980. All drill sites are shown on Plates 26, 27, and 28. Refer to Appendix E.

Reserves

By U.S. Geological Survey definition, approximately 30% of the entire reserve is classified as "measured". The remainder is classified as indicated, based on all available measurements.

Total coal reserves in the four seams have been estimated at 50.8 million tons. Recoverable coal has been estimated at 30.5 million tons. Andalex expects an initial recovery rate of about 35 percent and upon final pillar extraction, total recovery is expected to be more than 65 percent. Cover ranges from 0 feet to more than 3,000 feet on the northern end of the property.

Underground Operation and Facilities

Mine Layout(Refer to Plates ~~26, 27, 28~~5-3, 5-4, 5-5, and ~~29~~5-6).
Multiple Seam Considerations

There were four economic seams present on the property. The uppermost seam is the Lower Sunnyside which varies from four to six feet thick. The second highest seam is the Centennial Seam which varies from four to eight feet thick. The third seam is the Gilson Seam which also varies from 4' to 8' thick. The lowermost seam is the Aberdeen which varies from four to thirteen feet in thickness. The bottom two seams

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are separated by a 200 foot interval which includes a massive sandstone. The Gilson and the Centennial Seams are separated by approximately 130' and the Centennial and Lower Sunnyside Seams are separated by 80' including a massive sandstone. It should be noted that the area in which the Centennial Seam is to mined does not contain any reserves in either the Lower Sunnyside nor the Gilson Seams. Only the Aberdeen Seam is present where the Centennial Seam is to be mined. The mine plans for each seam are shown on Plates ~~26, 27, 28~~5-3, 5-4, 5-5, and ~~29~~5-6.

Portals

Portals for the present mining operations in the Aberdeen, Gilson and Lower Sunnyside seams are located in Deadman Canyon as shown on Plate ~~6~~5-7. The portal areas consist of a conveyor portal, two air intake portals, and an 88" fan portal.

Portals have been enlarged above the coal seam to facilitate men and equipment at the mine opening. Steel sets have been used to support mine roof in the portal areas. The Aberdeen portals have been constructed in a similar fashion, facilitating air intake, conveyor, and an exhaust fan.

The portals are generally 6' high and 20' wide in the Pinnacle and Aberdeen Mines and 4.5' high in the Apex Mine. The portal mine pads consist of approximately one acre. Located on these pads are the fans, conveyor portals, air intake portals, and mine water storage tanks. It should be noted that the mining of the Centennial Seam did not require new portals on the surface. The Centennial Seam is accessed via rock tunnels from the existing Pinnacle Mine.

The Apex, and Pinnacle mines are now closed and sealed.

Mains, Submains, and Slopes

A five entry system is being used (two intake portals) and using a continuous miner, the entries are being driven to the property line. Generally, entries on 80 foot centers with crosscuts every 80 feet are being driven on the strike and dip of the coal seam. Development mining for the longwall panels are on 5th entry and 3rd entry systems. Refer to ~~Plates 26 through 29~~Plate 5-6. There exists only one return air portal on the surface, however, two exist underground making the five entry system.

Shafts and Interconnecting of Slopes

Mining plans called for rock tunnels to be constructed from the existing Pinnacle Mine up to the Centennial Seam mining area. These rock slopes are each approximately 500' in length. The three tunnels consist of an intake air tunnel, a return

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air tunnel, and a belt tunnel. Coal is transported via the belt tunnel and transferred on to the existing Pinnacle Mine conveyor belts. These tunnels were constructed in the Spring of 1990 and mining has commenced.

Longwall Panels

The mining sequence calls for the development of panels longwall using 2, 3 and 5 entry systems. These panels will be generally 650 to 800 feet in width and up to 800 feet in length.

Barrier Pillars

A barrier pillar will be left between the bleeders and the longwall panels. A barrier will also be left wherever old mine workings are skirted such as the Olsen Mine on the east side of Deadman Canyon in the Gilson Seam. Due to resent MSHA requirements a barrier pillar will be left between longwall panels at depths deeper than 1,500 feet.

Bleeder System

A bleeder system will be maintained and pillars left to provide for ventilation, eventually extending around all mined out areas.

Ventilation

The ventilation plan calls for a fan of sufficient capacity to provide air to each working section to control methane and dust; there has been small amounts only found to date in any of the old works or new faces. The longwall faces will be ventilated with a live brattice system consisting of a line curtains. The conveyor systems will be isolated from intake and return except in 2 entry gate systems when the belt will double as the intake. All ventilation requirements of the Coal Mine Health and Safety Act will be met. This ventilation plan will be strictly adhered to, in order to insure safety of all personnel. Please note that the Centennial Seam mining area is ventilated by the existing Pinnacle Mine fan system. The new left fork fan installation will provide additional required ventilation for the Aberdeen Mine longwall faces.

Roof Control

All Andalex Mines operate under an approved M.S.H.A. roof support plan which calls for bolting on five foot centers with a minimum 42" bolt length in our development entries. Roof control in the longwall faces will be accomplished using hydraulic shields. The roof in all four seams is a massive sandstone (60'+) and offers excellent support in itself. The old mine workings which were rehabilitated for the Pinnacle Mine main entries had stood unsupported for 40 years. This roof control plan will be strictly adhered to, in order to insure the safety of all personnel.

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Explosives and Blasting

All blasting performed underground will conform to both state and federal regulations governing explosives and blasting in underground coal mines. The rock tunnels to the Centennial Seam were constructed by professional hard rock mining company.

All surface blasting activities necessary for present operations have been completed in compliance with sections 817.61 through 817.68 of Chapter VIII of Title 30 of the Code of Federal Regulations.

Blasting consisted of portal highwall construction for purposes of stability. A powder magazine has been set up on one of the surface pads, located in a remote area. It is built to conform to all regulations, such as segregation, regarding such a structure (see ~~plate 6~~Plate 5-7). All blasting operations shall be conducted by experienced, trained, and competent persons who understand the hazards involved and who possess a valid certificate as required by Title 30 of the Code of Federal Regulations.

General Safety Measures

A great emphasis is put on assuring a safe mine operation and the mine and surface facilities will be operated within prudent standards to insure the health and safety of all employees. The facilities will be carefully inspected by company-trained safety engineers and state and federal mine inspectors.

The operation will abide by Utah State Coal Mine Regulations and the 1969 Federal Coal Mine Health and Safety Act. In addition, these regulations will be supplemented by a company safety policy. Various training programs will be utilized such as the following:

- Methane Measurements
- Roof and Rib Control
- Oxygen Deficiency Testing
- Ventilation
- First Aid
- Mine Rescue
- Mine Electrical Certification
- Self Rescue Training
- Use of Personal Protective Equipment
- Recognition of Electrical Hazards
- General Accident Prevention
- Mine Communications
- Job Safety Training

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Many of the training programs will run continuously, such as those involving roof control and ventilation. Other programs are held annually with many oriented toward new employees.

Mine Development (Refer to Plates ~~26, 27, 28~~5-3, 5-4, 5-5, and ~~29~~5-6).

Room and Pillar

Room and pillar design will be employed in fringe areas surrounding the longwall panels as conditions allow.

Pillar Extraction

Once development in fringe areas is completed, pillar extraction will commence as conditions permit. Final pillar extraction will result in a total recovery rate of approximately 65 percent.

Cycle and Sequence of Mining

As mining progresses, the following equipment was added to start up additional mining areas and increase production (currently four units have been employed):

4th Mining Unit - January, 1990
Longwall - August, 1994

As there was four coal seams of minable thickness on the leases, a systematic plan of mining will be followed to assure maximum recovery of the coal reserves. When mining is progressing concurrently in two seams, the room and pillar design and layout will be columnized to assure maximum roof support.

Underground Equipment

Production Units

In each mine, the longwall development entry systems, will be mined with a drum-type continuous miner similar to the Joy 12 CM. Presently, Joy 12 CM-11's and 14 CM's are being used in the operation. Coal is transported by shuttle car (Joy) to a loading point consisting of a Long Airdox Feeder Breaker or similar machine, which will discharge onto a 42" panel conveyor or a 42" main conveyor. Roofbolting is and will be accomplished by a Lee Norse Roof Bolter or a similar type machine. The longwall panels will employ a Joy, 4-LS or similar shearer. Coal will be discharged into a pan face conveyor which will carry the coal to a crusher 1 stage loader for transportation by belt conveyor to the surface. Roof support will be by hydraulic shields. Additional production units will be added as previously outlined.

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Belt Conveyors

The feeder breaker or ~~state~~stage loader will discharge the coal onto either a 48" panel conveyor or a 42" main conveyor. The conveyor will transport the coal to the outside, where it will be discharged to a live stockpile, (see Plate ~~6~~5-7). Currently, Long Airdox conveyor belt drives are being used. For the longwall installations, the same, or similar drives will be employed.

Water System

Water for mining use, such as for providing face fire protection and dust suppression, will be obtained from Water Well No. 1, shown on Plate ~~6~~5-7. Water is also collected from the disturbed area via a system of culverts to underground workings connected to the Pinnacle Mine. This water will be pumped to the Mine Water Storage Tank and from there into the mine using a high pressure pump. Several sumps have been cut in the mine for the purpose of reclaiming water as most available water will be needed. Enough water is currently generated from the formation and coal seam that Andalex currently discharges approximately 50% of the time through approved UPDES point 002.

Power System and Communication Facilities

A 7200 volt, 3 phase, 60 hertz power distribution system has been taken underground from a 2500 KW substation located on the surface plant area. The primary feed into the substation is 46,000 volts from the Utah Power and Light Company transmission system located approximately 6 miles south, adjacent to the airport. This 46 KV line taps Utah Power and Light's Helper - Columbia 46 KV line, at structure #89. The powerline was designed according to Utah Power and Light's specifications. After approval by Utah Power and Light, it was installed by a private local contractor at the expense of Andalex Resources. Within the minesite area, the power is reduced to 7200 volts for the primary underground usage. This is fracture reduced up to 2300 to 6000, 480 and 240 volts for equipment operation. Surface power is on a 480 volt system. Electrical Specifications for the Deadman Canyon Mine Substation are included as Appendix I.

A 25-pair telephone communications cable is buried along the existing Deadman Canyon road, with its origin at Carbon County Airport approximately 7.5 miles from the minesite. Currently, 13 pairs are in use with additional capacity to add as the mine facilities expand. This cable was designed, supplied and installed by Mountain Bell Telephone at the expense of Andalex Resources. Mountain Bell is responsible for maintenance

The mine permit area has no utilities or services through it other than those which are accurately depicted on Plate ~~6~~5-7. All utilities have been constructed under the close scrutiny of the Utah DWR and the U.S. Fish and Wildlife Service.

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Other Equipment

Other equipment being utilized includes mantrips, rock dusters, tractors, rubber tired scoops, power cables, communication equipment, and miscellaneous section tools. The mine is also equipped with emergency tools and necessary supplies in the unlikely event that a fire or explosion should occur, in accordance with M.S.H.A. regulations.

Surface Equipment

Surface equipment includes a Cat 980-B front-end loader. Also, there is a grader for road maintenance. Other equipment such as diesel scoops and tractors will be utilized on the surface from time to time for material haulage. There are two bulk rock dust silos on the surface.

Employment

Andalex Resources is an Equal Employment Opportunity Employer. The type of hourly employees to be hired are highly skilled personnel, including miner operators, shuttle car operators, roof bolters, mechanics, and electricians. All hourly employees will be properly trained and certified where necessary in accordance with M.S.H.A. regulations. Currently, Andalex Resources' employs 75 hourly wage earners. Employment at the mine will not change significantly with the installation of the longwall. The Pinnacle Andalex's Mines, are located in Carbon County near the town of Price. Since this area is supported to a large degree by coal mining and other related industries, it is anticipated that a labor force will always be readily available.

Management and other salaried employees will consist of the Manager of Mines, the General Superintendent, the Mine Superintendents, the Mine Foremen, Safety Personnel, Secretarial and Clerical, Geologists, and Engineers (see Table IV-1).

Schedule of Development and Mining

There are four economic seams present on the property; mining plans are based on simultaneously developing longwall panels in 3 of the 4 seams. The incremental increases listed below represent the first eight years of production (from 1982):

Year	Production Rate Tons/Year
1st year (1982)	700,000
2nd year (1983)	350,000
3rd year (1984)	300,000
4th year (1985)	650,000
5th year (1986)	700,000
6th year (1987)	400,000

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7th year (1988)	700,000	
8th year (1989)	1,100,000	

Mining progression for the life of the mine is shown on Plates 26, 27, 28, and 29, and will increase from 1,100,000 tpy current to 1.5 mm tpy by 1995 and will stay at this rate until mining is completed making a mine life of approximately 15-20 years.

Year	Estimated Production	Recoverable Tons Remaining
1993	1,200,000	21.2 million
1994	1,200,000	20.0
1995	1,500,000	18.5
1996	1,500,000	17.0
1997	2,000,000	15.5
Duration	2,000,000	10 years

To date, Andalex has mined approximately 20% of its Lower Sunnyside Reserve, 80% of its Gilson Reserve, 5% of its Aberdeen Reserve and 20% of its Centennial Reserve (The Centennial Reserve consisted originally of approximately 2.5 million recoverable tons). All seams within the current leases have been mined out. The addition of the Kenilworth lease will provide some coal for future recovery.

Support Structures and Buildings

Support structures and buildings are shown on ~~Plates 6 and~~ Plate 5-7.

Parking Areas

Parking areas have been covered with gravel and magnesium chloride and will be maintained. These are shown on Plate ~~6~~5-7. The main office parking area is paved.

Storage Areas

There are several storage areas at the site. These include the Material Storage Area No. 1, Raw Coal Pile Area, Material Storage Area No. 2, and the Topsoil Storage Area. All areas are shown on Plate 5-7.

~~There are several storage areas at the site. These include the Material Storage Area No. 1, Raw Coal Pile Area, Material Storage Area No. 2, and the Topsoil Storage Area. All areas are shown on Plate 6.~~

Water Supply

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Water for use in the mine is described. Water for culinary use is hauled in approved water haulers from Price City. There is a sump cut in the mine from which water can be reclaimed as all available water will be needed. Since all mining is down dip from the portals, little water will exit from the mine. Information concerning the wells and water analysis is presented as Appendix L.

Landscaping

All disturbed areas have been graded to the most moderate slope possible to assure stability. Vegetative cover has been promptly re-established to stabilize erosion. Revegetation was accomplished by Andalex under the recommendations of the U.S. Department of Agriculture, Soil Conservation Service and the Division of Oil, Gas, and Mining.

Signs, Markers, Fences, and Gates

Signs of a uniform design, showing the company name, business address, and telephone number as well as the identification number of the current regulatory program permit authorizing the underground mining activities, have been placed at all access points to the permit area. These signs have been placed to be easily seen, are made of a durable material, and conform to local laws and regulations. The topsoil storage area is clearly marked.

As this is an underground mine, there will be no blasting conducted on the surface with the exception of highwall construction. When blasting for highwall construction does occur, conspicuous signs and flagging will be posted as required by 30 CFR Parts 817.11 (f) and 817.65 (e).

As the Left Hand Fork is classified as a intermittent drainage, stream buffer zone markers will be placed within 100 feet of the drainage disallowing access except for the disturbed site.

As there are no perennial streams or a stream with a biological community on the permit area, buffer zone markers will not be necessary. The perimeters of all areas affected by surface operations and facilities are clearly marked. These signs and markers shall be maintained during all activities and retained and maintained until after the release of all bonds for the permit area.

R645-301-512.120. SURFACE FACILITIES AND OPERATIONS

See Volume II.

Support structures and buildings are shown on ~~Plates 6 and~~ Plate 5-7, and LF-1.

Parking Areas

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Parking areas have been covered with gravel and magnesium chloride and will be maintained. These are shown on Plate ~~6~~5-7. The main office parking area is paved.

Storage Areas

There are several storage areas at the site. These include the Material Storage Area No. 1, Raw Coal Pile Area, Material Storage Area No. 2, and the Topsoil Storage Area. All areas are shown on Plate ~~There are several storage areas at the site. These include the Material Storage Area No. 1, Raw Coal Pile Area, Material Storage Area No. 2, and the Topsoil Storage Area. All areas are shown on Plate ~~6~~~~5-7.

R645-301-512.130. SURFACE CONFIGURATIONS

See Volume II, Plates ~~6 and~~ 5-7.

R645-301-512.140 HYDROLOGY

See Sections R645-301-711, R645-301-722, R645-301-700 through R645-301-731.740

Drainage Control - Diversions, etc.

The drainage control plan is presented in this Chapter.

Sediment Control

The sedimentation plan is presented in this Chapter.

R645-301-512.150. GEOLOGIC CROSS SECTIONS AND MAPS

See R645-301-622

R645-301-512.200 PLANS AND ENGINEERING DESIGNS

R645-301-512.210. EXCESS SPOIL

N/A

R645-301-512.220. DURABLE ROCK FILLS

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R645-301-512.230. COAL MINE WASTE

There has been no development waste or excess spoil to date excepting sedimentation pond material. In the event sediment ~~pond~~pond material were to catch fire, it would be compacted. MSHA and the Division have approved the disposal of sediment pond material (coal mine wash) underground. Therefore, inspections are not required.

Coal Processing Waste

N/A - Text removed as directed in Technical Analysis Requirements.

Coal Refuse

Please refer to Plate ~~6~~5-7 for location of disposal areas.

R645-301-512.240. IMPOUNDMENTS

See R645-301-733.

R645-301-512.250. PRIMARY ROADS

All Primary Road Design and construction has been certified by a Professional Engineer.

R645-301-512.260. VARIANCE FROM APPROXIMATE ORIGINAL CONTOUR

~~Only cut slopes at Apex, Pinnacle and Aberdeen will vary from the AOC. Slopes will be backfilled to the extent possible.~~

No variance has been granted at this time.

R645-301-513. COMPLIANCE WITH MSHA REGULATIONS AND MSHA APPROVALS

Ventilation

The ventilation plan calls for a fan of sufficient capacity to provide air to each working section to control methane and dust; there has been small amounts only found to date in any of the old works or new faces. The longwall faces will be ventilated with a live brattice system consisting of a line curtains. The conveyor systems will be isolated from intake and return except in 2-entrygate systems when the belt will double as the intake. All ventilation requirements of the Coal Mine Health and Safety Act will be met. This ventilation plan will be strictly adhered to, in order to insure safety of all personnel.

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Please note that the Centennial Seam mining area is ventilated by the existing Pinnacle Mine fan system.

General Safety Measures

A great emphasis is put on assuring a safe mine operation and the mine and surface facilities will be operated within prudent standards to insure the health and safety of all employees. The facilities will be carefully inspected by company-trained safety engineers and state and federal mine inspectors.

The operation will abide by Utah State Coal Mine Regulations and the 1969 Federal Coal Mine Health and Safety Act. In addition, these regulations will be supplemented by a company safety policy. Various training programs will be utilized such as the following:

Methane Measurements
Roof and Rib Control
Oxygen Deficiency Testing
Ventilation
First Aid
Mine Rescue
Mine Electrical Certification
Self Rescue Training
Use of Personal Protective Equipment
Recognition of Electrical Hazards
General Accident Prevention
Mine Communications
Job Safety Training

Many of the training programs will run continuously, such as those involving roof control and ventilation. Other programs are held annually with many oriented toward new employees.

All Andalex Mines operate under an approved M.S.H.A. roof support plan which calls for bolting on five foot centers with a minimum 42" bolt length in our development entries. Roof control in the longwall faces will be accomplished using hydraulic shields. The roof in all four seams is a massive sandstone (60'+) and offers excellent support in itself. The old mine workings which were rehabilitated for the Pinnacle Mine main entries had stood unsupported for 40 years. This roof control plan will be strictly adhered to, in order to insure the safety of all personnel.

R645-301-513.100. **COAL PROCESSING WASTE DAMS AND EMBANKMENTS**

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R645-301-513.200. **IMPOUNDMENTS AND SEDIMENTATION PONDS MEETING MSHA CRITERIA**

N/A

R645-301-513.300. **WASTE DISPOSED IN UNDERGROUND MINE WORKINGS**

Return of Coal Processing Waste to Abandoned Underground Workings

As raw coal is hauled from the permit area, there will be no processing waste and no return of processing waste to underground workings. If in the future it is decided that a processing facility is to be incorporated, waste or reject material would be taken to an approved refuse disposal site. Please note that underground development waste rock generated by the Centennial Seam rock tunnels was disposed of underground in the existing Pinnacle Mine workings.

R645-301-513.400. **REFUSE PILES**

There has been no development waste or excess spoil to date excepting sedimentation pond material.

Coal Processing Waste

The only coal processing waste to date is rock material manually separated from Andalex Resources' lump coal product at Wildcat. This is currently placed in an approved area at Wildcat Loadout. This MRP contains an Appendix Q. Appendix Q references the plan for reclamation of the waste rock pile at the Wildcat Loadout and should not be confused with the Centennial Reclamation Plan. Disposal of sediment pond material (temporary and permanent) is shown on Plate ~~6~~5-7. Sediment pond waste has already been tested in one case to be ~~non toxic~~nontoxic and non-acid forming and is being used currently in the Aberdeen Mine fill areas. Other material which is generated will be placed in temporary storage above the Apex Mine as shown on Plate ~~6~~5-7 and will be disposed of permanently as back fill in high walls upon final reclamation. This material will be tested prior to final reclamation if used for final reclamation purposes. Based on previous experience, Andalex estimates that up to 3,000 yards of material at most will be generated. This material is included in the earthwork estimates. Please note that the rock tunnels constructed to the Centennial coal seam generated significant amounts of waste rock. One hundred percent of this waste rock was disposed of underground in the existing Pinnacle Mine. None of the waste rock appeared at the surface.

Coal Refuse

Please refer to Plate ~~6~~5-7 for location of disposal areas.

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R645-301-513.500. MINE OPENINGS

Portals

Portals for the present mining operations in the Aberdeen, Gilson and Lower Sunnyside seams are located in Deadman Canyon as shown on Plate ~~6~~5-7. The portal areas consist of a conveyor portal, two air intake portals, and an 88" fan portal.

Portals have been enlarged above the coal seam to facilitate men and equipment at the mine opening. Steel sets have been used to support mine roof in the portal areas. The Aberdeen portals have been constructed in a similar fashion, facilitating air intake, conveyor, and an exhaust fan.

The portals are generally 6' high and 20' wide in the Pinnacle and Aberdeen Mines and 4.5' high in the Apex Mine.

~~The portal mine pads consist of approximately~~ The portal mine pads consist of approximately one acre. Located on these pads are the fans, conveyor portals, air intake portals, and mine water storage tanks. It should be noted that the mining of the Centennial Seam did not require new portals on the surface. The Centennial Seam is accessed via rock tunnels from the existing Pinnacle Mine.

R645-301-513.600. DISCHARGES INTO AN UNDERGROUND MINE

Andalex has approved water rights for collection of disturbed area drainage for collection in the underground workings. This is used as needed.

R645-301-513.700. SURFACE COAL MINING CLOSER THAN 500 FEET TO AN ACTIVE UNDERGROUND MINE

N/A

R645-301-513.800. COAL MINE WASTE FIRES

N/A

R645-301-514. INSPECTIONS

N/A

R645-301-514.100. EXCESS SPOIL

N/A

R645-301-514.110. QUARTERLY INSPECTIONS AND CRITICAL CONSTRUCTION PERIODS

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R645-301-514.111. **FOUNDATION PREPARATION, TOPSOIL REMOVAL**

N/A

R645-301-514.112. **UNDERDRAINS AND PROTECTIVE FILTER SYSTEMS**

N/A

R645-301-514.113. **FINAL SURFACE DRAINAGE SYSTEMS**

N/A

R645-301-514.114. **FINAL GRADED AND REVEGETATED FILL**

N/A

R645-301-514.120. **CERTIFIED REPORTS**

N/A

R645-301-514.130. **CERTIFIED REPORTS ON DRAINAGE SYSTEM AND PROTECTIVE FILTERS**

N/A

R645-301-514.131. **PHASES OF CERTIFICATION**

N/A

R645-301-514.132. **UNDERDRAINS**

N/A

R645-301-514.133. **PHOTOGRAPHS**

N/A

R645-301-514.140. **INSPECTION REPORTS**

N/A

R645-301-514.200. **REFUSE PILES**

N/A

R645-301-514.210. **REGULAR INSPECTIONS**

N/A

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R645-301-514.220. CRITICAL CONSTRUCTION PERIODS

Construction of the left fork break-out and fan will occur during the Golden Eagle off-nesting period (January 15 through July 15).

R645-301-514.221. FOUNDATION PREPARATION AND TOPSOIL REMOVAL

N/A

R645-301-514.222. UNDERDRAINS

N/A

R645-301-514.223. FINAL SURFACE DRAINAGE ~~SYSTEMS~~SYSTEMS

N/A

R645-301-514.224. FINAL GRADING AND Revegetation

N/A

R645-301-514.230. CERTIFIED REPORT

N/A

R645-301-514.240. SEPARATE CERTIFICATION FOR EACH PHASE OF CONSTRUCTION

N/A

R645-301-514.250. ON-SITE COPY OF CERTIFICATION REPORTS

N/A

R645-301-514.300. IMPOUNDMENTS

See R645-301-733..

R645-301-514.310. CERTIFIED INSPECTION

This is performed annually by a registered P.E.

R645-301-514.311. COMPLETION OF CONSTRUCTION AND YEARLY INSPECTIONS

See R645-301-514.310.

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R645-301-514.312. CERTIFIED REPORTS

Certified reports are kept on-site.

R645-301-514.313. ON-SITE COPY OF CERTIFICATION REPORTS

See R645-301-514.312.

R645-301-514.320. WEEKLY INSPECTIONS

N/A

R645-301-514.330. QUARTERLY INSPECTIONS

These are conducted quarterly by on-site personnel to evaluate erosion, stability, and other items.

R645-301-515. REPORTING AND EMERGENCY PROCEDURES

R645-301-515.100. SLIDES AND OTHER DAMAGE

Schedule of Construction, Mine Development, Mining and Reclamation

All surface facilities have been constructed for the Pinnacle, Apex and Aberdeen Mines. Earthwork for the Aberdeen Mine was completed in 1989. The surface facilities for the Aberdeen Mine were completed in early 1990. No additional surface facilities are required for any new leases. There will be no additional construction activities or surface disturbance whatsoever in Hoffman Creek or Alrad Canyon.

However, Andalex does intend to add a fan installation in the left-hand fork of Deadman Canyon at some point in time. This installation will be according to measures outlined by the Bureau of Land Management as part of Right-of-Way U-64158. (Copy of Right-of-Way is included in Appendix B.) Andalex will submit detailed plans for this installation at the appropriate time. The location of this breakout is shown on Plate ~~29~~5-19 (R.O.W.).

Mining in the Gilson seam began in October, 1980 with a single unit's production. As mining progresses, additional units will be added with three production units and the longwall scheduled to be operating by mid-1994. A systematic mining plan will be followed to assure maximum recovery. All planning and scheduled production, however, will be contingent upon the coal market. Upon the conclusion of mining activities in the area, the scheduled reclamation phase will begin immediately.

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Andalex will fill, regrade and stabilize rills and gullies over 9 inches in depth. Further, Andalex has agreed to interim stabilization of all slopes and embankments within the disturbed area and has done so. One slope located at the bottom of the office driveway, has been attempted through hydroseeding, fertilizing and mulching techniques on three separate occasions. Although no significant erosion problems have occurred, Andalex will notify the Division by the fastest available means of any slides or other damage and comply with any remedial measures required by the Division (generally, reporting will be accomplished by telephone).

Andalex will cover acid or toxic forming materials if any are encountered.

Andalex will advise the Division in the event of a temporary shutdown, such as a letter sent to the Division when Andalex's Apex Mine was temporarily closed.

R645-301-515.200. IMPOUNDMENT HAZARDS

Safety Precautions

The ponds were built as per specifications and under supervision of a qualified, registered professional engineer. The ponds are inspected quarterly for safety and compliance. Inspection reports are maintained on-site, and submitted to the Division on an annual basis. Ponds will be cleaned at minimum when sediment reaches 60% of designed sediment volume. Measuring devices will be installed in the ponds to show when the ponds have filled with sediment to the clean-out level (please see plates 11, 12, and 13). Drainage directly into the Pinnacle and Apex Portals is not part of the calculation for sediment pond sizing (Pond C).

R645-301-515.300. TEMPORARY CESSATION OF OPERATIONS

Whenever it is known that operations are to be temporarily ceased for more than 30 days, Andalex Resources will submit to the Division a notice of intention to cease or abandon the operations, in accordance with R645-301-515.320 and to MSHA standards.

This notice will describe mitigation measures to be employed in accordance with the terms and conditions of the permit approval, such as a statement of the number of surface areas involved in the cessation, extent of sub-surface strata, prior reclamation efforts accomplished on the property, and identification of all backfilling, regrading, revegetation, environmental monitoring, underground opening closures and water treatment activities that will continue during the temporary cessation.

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Temporary closing of underground workings will be accomplished with chain link fence material as recommended by MSHA. This prevents access by unauthorized individuals during idol periods. It is not anticipated that once Andalex reaches its peak production that this will occur.

If underground openings are to remain inactive for a period greater than 90 days, such openings will be temporarily closed off from access. Such closures will consist of a chain link or other substantial wire mesh fabric fence placed over the portals to prevent public access while allowing for air flow. Locked gates may be installed in the portal to allow for mine inspection.

HISTORICAL NOTE: On June 11, 2008 the company requested permission from the BLM to modify the R2P2 to allow the mine to be temporarily idled due to economic factors. The BLM approved the modification on June 20, 2008. The portals were then sealed to prevent public access. The idle status has continued for more than 30 days. The surface facilities are secured by a security guard at all times. At the time of the temporary idling, the permit area included 6516.91 acres, and the total disturbed area included 47.19 acres (minesite = 34.2 acres, Left Fork fan and access road = 1.45 acres, and GVH sites = 11.54 acres). The subsurface strata extends from zero at the outcrop to more than 3000' under the northernmost longwall panels, and the horizontal extent of the subsurface strata over the permit area is about 21,432' measured north-south and about 21,768' measured east-west. There has been no reclamation done at the site as a result of the temporary closure, although two GVH sites were reclaimed in the meantime. There are no water treatment ~~activity~~activities going on at the mine.

The normal required environmental monitoring has continued since the mine has been idled, including hydrologic monitoring of springs, seeps and wells, UPDES monitoring, subsidence monitoring, and raptor surveys. The UPDES outfall points continue to be monitored but there has been no reported flow since the mine was shut down and the pumps were shut off. Nearly all water in the mine was created from the floor strata as mining occurred, and would normally dry up after the mine advanced several hundred feet. None of the flow was attributed to geological structures such as faults or dikes. Since all mining was advancing down-dip the water had to be continually pumped out to the surface since there were no sumps constructed below the workings to collect and store the water. Now that mining has stopped there is no reason to believe that the floor strata will continue to make water, especially at the liberation rate of 800 gpm typical of the operational period. Also, since all the water was being made in the extreme down-dip section of the mine, the water that does continue out of the floor will fill up the bottom of the mine until it reaches a level of potentiometric equilibrium. The portals are at the highest end of the mine, and are 1,640' vertically above the impounding area, and more than 14,000' vertically separated. This situation is very different than, for example the Crandall Mine where water is presently discharging from the portals. There, the mine is essentially flat and the source of the water is likely the ~~Joe's~~Joe's Valley Fault which probably serves as a direct conduit for surface water draining through ~~Joe's~~Joe's Valley above down to the mine workings. At the Tower Mine there is no primary recharge mechanism, and the vertical dip should

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serve to allow the water level to stabilize within the mine without discharging from the portals.

R645-301-515.310. TEMPORARY ABANDONMENT

See R645-301-515.300.

R645-301-515.311. SUPPORT AND MAINTENANCE

See R645-301-515.300.

R645-301-515.312. SECURING SURFACE FACILITIES

See R645-301-515.300.

R645-301-515.320. NOTICE OF INTENT TO CEASE OR ABANDON OPERATIONS

See R645-301-515.300.

R645-301-515.321. STATEMENT OF CONDITIONS PRIOR TO CESSATION OR ABANDONMENT, UNDERGROUND

See R645-301-515.300.

R645-301-515.322. STATEMENT OF CONDITIONS PRIOR TO CESSATION OR ABANDONMENT, SURFACE

See R645-301-515.300.

R645-301-516. PREVENTION OF SLIDES

Andalex has agreed to interim stabilization of all slopes and embankments within the disturbed area and has done so. One slope located at the bottom of the office driveway, has been attempted through hydroseeding, fertilizing and mulching techniques on three separate occasions. No significant erosion problems have occurred, Andalex will notify the Division in the event of any slides or other damage.

R645-301-520. OPERATION PLAN

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R645-301-521. GENERAL

Requirements for Reclamation and Operation Plan

Operation Plan: General Requirements

Andalex Resources, Inc. has added 802 acres in the AEP lease #UTU 69600 to its currently approved Centennial Project. The lease contains 3.0 million tons of recoverable coal in the Centennial and Aberdeen Seams. All reserves will be mined simply as an underground extension of the existing, approved, and currently operating Pinnacle and Aberdeen Mines. As such, no additional surface facilities are required. Access to and handling and extraction of all coal will be through the existing Pinnacle and Aberdeen Mines.

All necessary surface and support facilities have been constructed, approved, and are currently in operation for the Pinnacle, Apex and Aberdeen Mines. There will be no change in the currently approved Environmental Protection Plan.

Overview of Project

Type of Mine

The initial underground mining operation known as the Pinnacle Mine, located on the Zion's fee property, began production on October 3, 1980. It consisted of a single unit's production with an output projected to be approximately 200,000 tons per year and with 20 employees. The mine moved onto the federal leases and with the addition of the Apex Mine in 1982, the Centennial Project now has a production capacity of 1,200,000 tons per year. As there are four minable seams present, the Aberdeen, Gilson, Centennial, and Lower Sunnyside, in ascending order, mining plans call for simultaneous operation of a mine in each seam. The existing operations are in all four seams. The Centennial Seam has been accessed via rock tunnels from the existing Pinnacle Mines (Gilson Seam).

Mining will consist of the underground method of coal extraction using continuous miners and longwall. Room and pillar longwall panel development will be employed with final overall extraction estimated to be about 80 percent of the reserve.

Coal is presently being loaded into 40-ton coal trucks and hauled to Wildcat Jct. near Helper. All seams will be mined using continuous miners and longwall extraction. Because there is deep cover over the reserves on portions of the Graves Lease, it is likely that first mining only will be possible. Please refer to Plate ~~26~~5-16, 27, 28, & 29 which show depth of cover over the seams.

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Area of Operations

Mine Plan Area

The mine plan area is limited to and contained within the proposed permit area. Mine plans for each of the minable seams are included as Plates 29, 30, 31 and 41.

Permit Area

The permit area consists of seven federal leases and two fee leases, all controlled by Andalex Resources. The Hoffman Creek federal coal Lease (U-52341) has been relinquished although the acreage still remains in the permit area. Presently, mining operations are taking place on five federal coal leases. Federal leases are U-010581, SL-027304, SL-063058, #U-05067 and UTU-66060. These leases are shown on Plate 4. Mining commenced on #U-05067 in July of 1989. Mining commenced on #UTU-66060 in late 1990. Mining will commence on UTU-69600 in June of 1993.

Disturbed Surface Area

Surface disturbances are minimal due to the nature of the mining activities. The permit area has been previously impacted by mining. Surface disturbances will be limited to the existing facilities which have been constructed. The total existing surface area disturbed is 34.2 acres. Existing facilities are indicated on Plate ~~6~~5-7 and 7.

The land affected by mining operations which shall be reclaimed, in compliance with the Mining and Reclamation Plan and all requirements of the Mined Land Reclamation Act and Rules and Regulations adopted in accordance therewith, can be described as follows:

47.19 acres located in T13S, R11E, S.L.B.&M., Carbon County, Utah and contained within,
SE 1/4 SW 1/4 Section 7
NE 1/4 SW 1/4 Section 7
SW 1/4 SE 1/4 Section 7
NW 1/4 SE 1/4 Section 7
SW 1/4 NE 1/4 Section 7
NE 1/4 NW 1/4 Section 18
NW 1/4 NE 1/4 Section 18

Reserves, Production, and Life of Mine

Andalex's most recent reserve estimates, using the longwall mining method, are calculated at 23 million recoverable tons. This includes all seams on all leases.

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If the extraction rate of 1.5 million tons is accomplished according to schedule, the project life will be about 15 years. The theoretical life could be closer to 25 years however due to the existence of unleased federal coal logically accessible through only the existing and future Andalex mine workings.

R645-301-521.100. CROSS SECTIONS AND MAPS

See R645-301-510, Volume II

R645-301-532.110. PREVIOUSLY MINED AREAS

See R645-301-510, Volume II

R645-301-521.111. LOCATION AND EXTENT OF KNOWN WORKINGS

See R645-301-510, Volume II

R645-301-521.112. EXISTING OR PREVIOUSLY SURFACE MINED AREAS

N/A

R645-301-521.120. EXISTING SURFACE AND SUBSURFACE FACILITIES AND FEATURES

See R645-301-510.

R645-301-521.121. BUILDINGS IN AND WITHIN 1000 FEET OF THE PERMIT AREA

There are no buildings within 1,000 feet of the permit area except those used as part of the mining operation. They are shown on ~~Plates 6 and~~ Plate 5-7.

R645-301-521.122. SURFACE AND SUBSURFACE MAN-MADE FEATURES WITHIN THE PERMIT AREA

There are no surface or subsurface man-made features within, passing through or passing over the permit area except the powerline, telephone cables, culverts, and etc., installed for the operation of this mine. See Plate 5-7 for their locations.

R645-301-521.123. PUBLIC ROADS IN OR WITHIN 100 FEET OF THE PERMIT AREA

County Road 299 starts at highway 6 in Price and terminates at Andalex Resources' minesite (Plate 1).

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R645-301-521.124. EXISTING FACILITIES WITHIN THE PERMIT AREAS

There are no surface or subsurface man-made features within, passing through or passing over the permit area except the powerline, telephone cables, culverts, and etc., installed for the operation of this mine. See ~~Plates 6 and~~ Plate 5-7 for their locations.

~~**R645-301-521.123. PUBLIC ROADS IN OR WITHIN 100 FEET OF THE PERMIT AREA**~~

~~County Road 299 starts at highway 6 in Price and terminates at Andalex Resources' minesite (Plate 1).~~

~~**R645-301-521.124. EXISTING FACILITIES WITHIN THE PERMIT AREAS**~~

~~There are no surface or subsurface man-made features within, passing through or passing over the permit area except the powerline, telephone cables, culverts, and etc., installed for the operation of this mine. See Plates 6 and 7 for their locations.~~

R645-301-521.125. SEDIMENTATION PONDS AND IMPOUNDMENTS

See R645-301-733..

R645-301-521.130. LANDOWNERS AND RIGHT OF ENTRY AND PUBLIC INTEREST MAPS

The leases for which we have the legal right of entry are shown on Plate 4. See Appendix R.

R645-301-521.131. SURFACE AND SUBSURFACE OWNERS

Owners of Record of Surface and Subsurface Contiguous Areas

See R645-301-112.500

R645-301-521.132. RIGHT TO ENTER AND CONDUCT MINING ACTIVITIES

See R645-301-114.230.

R645-301-521.133.1 OPERATIONS WITHIN 100 FEET OF ROAD RIGHT-OF-WAY

County Road 299 starts at highway 6 in Price and terminates at Andalex Resources' minesite (Plate 1).

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R645-301-521.133.2 RELOCATING A PUBLIC ROAD

N/A

R645-301-521.140. MINE AND PERMIT AREA MAPS

Cross Sections, Maps, and Plans

Most of the cross sections, maps, and plans previously submitted as part of the approved Mining and Reclamation Plan, are applicable. Where necessary, the original maps have been revised to indicate the lease in Hoffman Creek and the revisions are included in this submittal in Volume II.

All categories within this section have been addressed. Specifically,

a) Plates 26, 27, and 28 and 40 show all the test borings locations and elevations. Specific information relating to these drill holes and the strata encountered can be found in Appendix E (coal quality, description of other strata).

b) Monitoring stations for water quality are shown on Figure IV-11. Including the new 12-11 in Alrad Canyon. Fish and wildlife monitoring stations were not set up for this application. However, refer to Plate ~~34~~5-24 which depicts wildlife distribution. Air quality monitoring was not required for this application. Figure 6 in Appendix L shows proposed monitoring stations. Andalex has adhered to the locations shown on Figure IV-11 which is included in Andalex's operating plan.

c) Refer to Appendix E for specific drill hole lithologies as well as data on quality and chemical characteristics.

d) Crop lines and strikes and dips can be found on the coal thickness isopachs in Volume II, Plates 26, 27, and 28.

e) All old workings in the three coal seams to be mined are shown on Plates 29, 30, and 31. There are no old workings in the Centennial Seam.

f) All subsurface water on the permit area exists in perched aquifers. The Aberdeen sandstone is the lowest water bearing unit within the permit area and is discussed in Geology. The only water well drilled on the property which has been used with any frequency (well #1) has not depicted any seasonal variation. It is always a low producer.

g) There are no surface waters within the permit area. All drainages (natural) are shown on the topography on Plate ~~21~~5-11. All constructed drainages are shown on ~~Plates 6 and~~ Plate 5-7. There are no irrigation ditches. Appendix L, which is the Hydrologic Inventory, contains Figure 4 which clearly depicts the location of springs in the permit area and adjacent areas. This figure, along with Figures 5 and 6, depict the areal extent of the inventory.

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h) N/A

i) Plate ~~6~~5-7 shows the location of development waste stored in an area which was previously used as a sediment pond. Plate ~~6~~5-7 now also shows the location of a new area above the Apex Mine which can be used for temporary and permanent storage of development waste such as sediment pond material. All dams and impoundments are shown on ~~Plates 6 and~~ Plate 5-7, and detailed on Plates 11, 12, and 13. There are no other water treatment or air pollution control facilities on the permit area.

j) There are no oil or gas wells within the permit area. Three water wells are shown on Plate ~~6~~5-7. Well number 1 is 220 feet deep; number 2 is 100 feet deep, and number 3 is 120 feet deep.

k) Plates 14 and 15 accurately depict the area currently affected by mining as well as the area to be affected. They show the slopes as they exist as well as after construction and upon final reclamation.

Operation Plan: Maps and Plans

1) Most of the maps and plans previously submitted as part of the approved Mining and Reclamation Plan, are applicable. Where necessary, the original maps have been revised to indicate the lease in Hoffman Creek and the revisions are included in this submittal in Volume II.

All necessary maps and plans to complete this section are found in Volume II of the submittal and also in the appendices of Volume I specifically,

a) Underground coal mining activities to be conducted and lands to be affected by surface facilities are shown on Plates 6, 29, 30, 31 and 41.

b-1) Buildings, utilities, and facilities are depicted on Plates 6 and Plate LF-1.

2) The area to be affected is shown on several plates, including 4, 5, 6, 29, 30, 31 and 41. These last four plates show the sequence of mining in the four seams over the five year term of the permit. Plate ~~30~~5-20 has been revised to show immediate development in the Gilson Seam as soon as approval is achieved. Reclamation will not take place until after all four seams are mined out. This activity is depicted on Plates 15, 16, 17, and 20.

3) Plates 5 depict the entire disturbed area for which a performance bond is posted. The acreage is shown on Plate 5.

4) Coal storage and loading areas are shown on Plates 6. No cleaning takes place.

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5) Plates 6 show a non-coal waste storage area as well as topsoil storage areas. Plates 36 and 37 show the topsoil piles in detail.

6) All water diversions and other water facilities are shown on Plates 6, 8, 9, 11, 12, and 13. Also, typical diversions for disturbed area and undisturbed areas are shown in the Sedimentation and Drainage Control Plan.

Diversion ditches as they exist are shown on Revised Plate ~~6~~5-7. Topographic detail has been added to Plate 8 to allow determination of watershed slopes within the disturbed area.

Diversions and other hydrologic controls are shown on Plates 6, 7, 8, 11, 12 and 13, for the Aberdeen Mine. Topographic detail has been added to Plate 8 to allow determination of watershed slopes within the disturbed area.

Plate 16 has been revised to show drainage during the reclamation period before and after removal of sediment ponds (Phase I).

Plate 17 shows final drainage details.

Plate 9 shows delineations of watershed areas.

The main culvert will be removed entirely during the reclamation-earthwork phase except under Pond "E". Pond "E" will be enlarged, and the entire drainage area above will flow into the restored channel RC-1 and through Pond "E-PM". Once revegetation and water quality standards have been met, Pond "E-PM" and the culvert will be removed and reclaimed.

7) There is no coal processing waste at the Centennial facility There are no pollution control facilities other than sedimentation ponds on the permit area. Please note that waste rock generated by the Centennial Seam rock tunnels was disposed of underground in the existing Pinnacle Mine workings.

8) Specific facilities are not used to protect or enhance wildlife with the exception of the powerline which was built according to strict guidelines issued by the Division of Wildlife Resources and the U.S. Fish and Wildlife Service regarding raptor protection. The powerline design is included in Volume I as Appendix I (powerline design). Also, speed limits are posted within the permit area.

9) The two powder magazines are shown on Plates 6.

10) Plates 6, 8, and 9 show these facilities associated with protection of the hydrologic balance including sedimentation ponds and storage of non-coal waste. There are no permanent impoundments, or coal processing wastes. Underground development waste has been generated while putting in the Aberdeen portals, and has been used as stock pile pad material at the Aberdeen Minesite. The volume of this material is minimal.

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11) Plates 16 and 17 show the final reclamation contours and configuration of the surface for Phases I and II respectively.

12) Subsidence monitoring points are shown on Plate ~~25~~5-15. Additional stations have been added to Plate ~~25~~5-15 to cover long wall mining on the new Kenilworth Lease. Water monitoring locations are shown on Plate 7-1.

13) There will be no facilities left on the permit area permanently excepting possibly the road through the site. After the completion of underground mining, all facilities will be removed with the exception of one downstream sedimentation pond. This pond will be removed upon final reclamation.

c) Maps, plans, and cross sections required under b)(5),(6),(10), and (11) have been prepared under the direction of, and certified by a registered professional engineer. Assistance has come from a registered land surveyor.

1) Detailed maps, plans, and cross sections for our sediment ponds, Plates 11, 12, and 13 have been certified by a registered professional engineer.

2) Andalex has not used any excess spoil or underground development waste maps or cross sections. A map (uncertified) depicting the location of non-coal waste storage is included as Plate ~~6~~5-7.

R645-301-521.141. AFFECTED AREA

R645-301-521.142. UNDERGROUND WORKINGS AND SUBSIDENCE AREAS

See R645-301-510, Volume II.

R645-301-521.143. WASTE DISPOSAL SITES

See R645-301-510, Volume II.

R645-301-521.150. LAND SURFACE CONFIGURATION MAPS

See R645-301-510, Volume II.

R645-301-521.151. REQUIREMENTS

See R645-301-510, Volume II.

R645-301-521.152. PREVIOUSLY MINED AREAS

See R645-301-510, Volume II.

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R645-301-521.160. MAPS OR CROSS SECTIONS OR PROPOSED FEATURES

See R645-301-510, Volume II.

R645-301-521.161. BUILDINGS, UTILITY CORRIDORS AND FACILITIES

See R645-301-510, Volume II.

R645-301-521.162. AREA AFFECTED ACCORDING TO SEQUENCE AND TIMING OF OPERATIONS

See R645-301-510, Volume II.

R645-301-521.163. BONDED AREA

See R645-301-510, Volume II.

R645-301-521.164. COAL HANDLING FACILITIES

See R645-301-510, Volume II.

R645-301-521.165. TOPSOIL AND WASTE STORAGE AREAS

See R645-301-510, Volume II.

R645-301-521.166. WASTE SOURCES AND DISPOSAL FACILITIES

See R645-301-510, Volume II.

R645-301-521.167. EXPLOSIVES STORAGE AND HANDLING FACILITIES

See R645-301-510, Volume II.

R645-301-521.168. AIR POLLUTION CONTROL FACILITIES

N/A

R645-301-521.169. COAL PROCESSING WASTE FACILITIES

N/A

R645-301-521.170. TRANSPORTATION FACILITIES MAPS

See R645-301-510, Volume II.

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R645-301-521.180. OTHER INFORMATION

See R645-301-510, Volume II.

R645-301-521.200. SIGNS AND MARKERS SPECIFICATIONS

Signs of a uniform design, showing the company name, business address, and telephone number as well as the identification number of the current regulatory program permit authorizing the underground mining activities, have been placed at all access points to the permit area. These signs have been placed to be easily seen, are made of a durable material, and conform to local laws and regulations. The topsoil storage area is clearly marked.

As this is an underground mine, there will be no blasting conducted on the surface with the exception of highwall construction. When blasting for highwall construction does occur, conspicuous signs and flagging will be posted as required by 30 CFR Parts 817.11 (f) and 817.65 (e).

As there are no perennial streams or a stream with a biological community on the permit area, buffer zone markers will not be necessary. The perimeters of all areas affected by surface operations and facilities are clearly marked. These signs and markers shall be maintained during all activities and retained and maintained until after the release of all bonds for the permit area.

R645-301-521.210. PLACEMENT AND REMOVAL

See R645-301-521.200.

R645-301-521.220. DESIGN

See R645-301-521.200.

R645-301-521.230. MAINTENANCE

See R645-301-521.200.

R645-301-521.240. MINE AND PERMIT IDENTIFICATION SIGNS

See R645-301-521.200.

R645-301-521.241. LOCATION, UNDERGROUND MINING

See R645-301-521.200.

R645-301-521.242. LOCATION, SURFACE MINING

N/A

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R645-301-521.243. INFORMATION

See R645-301-521.200.

R645-301-521.244. REQUIREMENTS

See R645-301-521.200.

R645-301-521.250. PERIMETER MARKERS

See R645-301-521.200.

R645-301-521.251. SURFACE AFFECTED AREAS FOR UNDERGROUND MINING OPERATIONS

See R645-301-521.200.

R645-301-521.252. PERMIT AREA PERIMETER FOR SURFACE MINING OPERATIONS

N/A

R645-301-521.260. BUFFER ZONE MARKERS

N/A

R645-301-521.261. BOUNDARY MARKERS FOR SURFACE ACTIVITIES OF UNDERGROUND OPERATIONS

They consist of orange "Tee" posts which are clearly visible from one marker to the next.

R645-301-521.262. BOUNDARY MARKERS FOR SURFACE MINING OPERATIONS

N/A

R645-301-521.270. TOPSOIL MARKERS

See R645-301-521.200.

R645-301-522. COAL RECOVERY

Cycle and Sequence of Mining

The panel-barrier-panel mine design is the only feasible and approvable mine plan. The BLM and MSHA have agreed and the R2P2 reflects this design The R2P2 Plan contains specific timing, sequence and method details for recovery of this resource. The panel-barrier design will minimize probability of subsidence.

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R645-301-523. MINING METHOD

The initial underground mining operation known as the Pinnacle Mine, located on the Zion's fee property, began production on October 3, 1980. It consisted of a single unit's production with an output projected to be approximately 200,000 tons per year and with 20 employees. The mine moved onto the federal leases and with the addition of the Apex Mine in 1982, the Centennial Project now has a production capacity of 1,800,000 tons per year. As there are four minable seams present, the Aberdeen, Gilson, Centennial, and Lower Sunnyside, in ascending order, mining plans call for simultaneous operation of a mine in each seam. The existing operations are in all four seams. The Centennial Seam has been accessed via rock tunnels from the existing Pinnacle Mines.

Mining will consist of the underground method of coal extraction using continuous miners, shuttle cars, roof bolters and feeders and longwall equipment consisting of a shearer, armored face conveyor and shield type roof supports. Room and pillar longwall panel development will be employed with final overall extraction estimated to be about 60 percent of the reserve. See ~~plate 29~~Plate 5-19 for cover isopachs.

Coal will be loaded into 40-ton coal trucks and hauled to a unit train loadout in the near vicinity.

R645-301-523.100. SURFACE MINING OPERATIONS WITHIN 500 FEET OF AN UNDERGROUND MINE

N/A

R645-301-523.200. EXCEPTIONS TO SURFACE MINING OPERATIONS WITHIN 500 FEET OF UNDERGROUND WORKINGS

N/A

R645-301-523.210. RESOURCE RECOVERY OF ELIMINATION OF HAZARDS

N/A

R645-301-523.220. APPROVAL BY DIVISION AND MSHA

Appendix B; Appendix J

R645-301-524. BLASTING AND EXPLOSIVES

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All blasting performed underground will conform to both state and federal regulations governing explosives and blasting in underground coal mines.

A powder magazine has been set up on one of the surface pads, located in a remote area. It is built to conform to all regulations, such as segregation, regarding such a structure (see ~~plate 6~~Plate 5-7). All blasting operations shall be conducted by experienced, trained, and competent persons who understand the hazards involved and who possess a valid certificate as required by Title 30 of the Code of Federal Regulations. If any additional surface blasting is required, powder magazines at that location will be in a remote site and will comply with all federal and state regulations.

If required, MSHA will be notified if surface blasting will be performed within 500 feet of an active coal mine. If necessary, joint approval will be obtained from the Division and MSHA.
Revised 9/12/95

R645-301-524.100. BLASTER CERTIFICATION

All blasting conducted on the surface will be performed by a DOGM- certified blaster.

R645-301-524.110. CERTIFIED BLASTER

See 301-524.100.

R645-301-524.120. BLASTING CERTIFICATES

Blasting certificates will be kept on site during blasting operations.

R645-301-524.130. FIRING OF A BLAST

A blaster and at least one other person will be present at the firing of the blast.

R645-301-524.140. RESPONSIBILITY

The certified blaster will be familiar with the blasting plan and performance standards, and will give on-the-job training to uncertified persons.

R645-301-524.200. BLAST DESIGN

A blast design will be submitted prior to blasting.

R645-301-524.210. ALL BLASTING OPERATIONS

See 301-524.200.

R645-301-524.211. BUILDINGS WITHIN 1000 FEET OUTSIDE THE PERMIT AREA

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See 301-524.200.

R645-301-524.212. WITHIN 500 FEET OF UNDERGROUND MINE

See 301-524.200.

R645-301-524.220. BLAST DESIGN APPROVAL PRIOR TO BLAST

See 301-524.200.

R645-301-524.230. BLAST DESIGN CRITERIA

See 301-524.200. All blasts will meet the requirements of 301-524.600.

R645-301-524.240. CERTIFICATION

The blast design will be prepared and signed by a certified blaster.

R645-301-524.250. CHANGES TO BLAST DESIGN

All blasts will comply with requirements of the Division.

R645-301-524.300. PRE-BLASTING SURVEY

See 301-524.200

R645-301-524.310. NOTIFICATION OF RESIDENTS

See 301-524.200

R645-301-524.320. REQUESTS FOR PRE-BLASTING SURVEY

See 301-524.200

R645-301-524.330. ASSESSMENT OF FACILITIES

See 301-524.200

R645-301-524.340. REPORT OF SURVEY

See 301-524.200

R645-301-524.350. COMPLETION OF SURVEY PRIOR TO BLAST

See 301-524.200

R645-301-524.400. BLAST SCHEDULE

A schedule will be contained in the permit if required.

R645-301-524.410. UNSCHEDULED BLASTS

There will be no unscheduled blasts.

R645-301-524.420. TIME PERIODS FOR BLASTING

All blasting will be conducted between sunrise and sunset hours.

R645-301-524.430. BLASTING NOTICES FOR UNDERGROUND MINING OPERATIONS

See 301-524.200. Local governments will be notified that blasting may be conducted in the Left Hand Fork.

R645-301-524.450. BLASTING SCHEDULE PUBLICATION AND DISTRIBUTION

There will be one blast conducted in the Left Hand Fork between sunrise and sunset September 13, 1995.

R645-301-524.451. NEWSPAPER PUBLICATION

Appropriate publications will be made regarding surface blasting.

R645-301-524.452. DISTRIBUTION OF NOTICES

There are no requirements for distribution due the remote location (greater than ~~½~~½ mile) of the blast. Local government will be notified.

R645-301-524.453. REPUBLISHING AND REDISTRIBUTION

Not applicable. This is a one-time blast and there will be no new requirements for distribution of notices.

R645-301-524.460. BLASTING SCHEDULE CONTENTS

See 301-524.200

R645-301-524.461. OPERATOR IDENTIFICATION

See 301-524.200

R645-301-524.462. BLASTING LOCATION

See 301-524.200

R645-301-524.463. DATES AND TIME PERIODS OF DETONATIONS

See 301-524.200

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R645-301-524.464. ACCESS CONTROL METHODS

See 301-524.200

R645-301-524.465. WARNING SIGNALS

See 301-524.200

R645-301-524.500. DESCRIPTION OF BLASTING SAFEGUARDS

See 301-524.200

R645-301-524.510. BLASTING SIGNS

See 301-524.200

R645-301-524.511. CONSPICUOUSLY PLACED SIGNS

See 301-524.200

R645-301-524.512. ENTRANCES FROM PUBLIC ROADS OR HIGHWAYS

See 301-524.200

R645-301-524.520. WARNINGS

See 301-524.200

R645-301-524.530. ACCESS CONTROL

See 301-524.200

R645-301-524.531. UNUSUAL HAZARDS

No unusual hazards exist.

R645-301-524.532. ACCESS WITHIN THE BLASTING AREA

See 301-524.200

R645-301-524.600. CONTROL OF ADVERSE BLASTING EFFECTS

The blast planned in the Left Hand Fork is a one-time blast consisting of a pre-split shot and will be totally contained. The nature of this type of blast will contain both noise and particles. It will have no affect on underground mining, channels, surface or ground water outside the permit area. The location of this blast is a minimum of 7 miles from any public building, church or occupied dwelling.

R645-301-524.610. GENERAL REQUIREMENTS.

See 301-524.600.

R645-301-524.620. AIR BLAST LIMITS.

See 301-524.600.

R645-301-524.621. MAXIMUM AIR BLAST LIMITS.

See 301-524.600. Air blasts will not exceed the maximum limits at the location of any dwelling, public building, school, church, or community or institutional building outside the permit area. The blast will be located in a remote steep-sided canyon and will not allow air blasts to affect any of the above items.

R645-301-524.622. PREVENTION OF DAMAGE.

See 301-524.600. and 621.

R645-301-524.630. MONITORING.

See 301-524.600. Monitoring will be conducted if required by the Division.

R645-301-524.631. MEASUREMENTS AND LOCATIONS.

See 301-524.630.

R645-301-524.632 MEASURING SYSTEMS.

See 301-524.630.

R645-301-524.633. FLY ROCK.

The blast is designed to contain all fly rock and cannot travel beyond the permit boundary.

R645-301-524.640. GROUND VIBRATION.

Due to the location of the blast there is no potential for damage to any structure as the result of ground vibration.

R645-301-524.641. GENERAL.

See 301-524.633.

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R645-301-524.642. **MAXIMUM PEAK-PARTICLE VELOCITY.**

See 301-524.633.

R645-301-524.643. **SEISMOGRAPHIC RECORD.**

A seismographic record will be kept if required by the Division.

R645-301-524.650. **ALLOWABLE CHARGE WEIGHT.**

See 301-524.643.

R645-301-524.652. **MODIFIED SCALED-DISTANCE FACTOR.**

See 301-524.643.

R645-301-524.660. **BLASTING-LEVEL CHART.**

See 301-524.643.

R645-301-524.661. **GROUND VIBRATION LIMITS.**

See 301-524.643.

R645-301-524.662. **PARTICLE VELOCITY AND VIBRATION FREQUENCY LEVELS.**

See 301-524.643.

R645-301-524.670. **DAMAGE PROTECTION.**

See 301-524.643.

R645-301-524.680. **SEISMIC MONITORING.**

See 301-524.643.

R645-301-524.690. **STRUCTURES NOT SUBJECT TO AIR BLAST AND GROUND VIBRATION LIMITS.**

See 301-524.643.

R645-301-524.700. **RECORDS OF BLASTING OPERATIONS.**

Records will be kept of all blasting operations as required by the regulations.

R645-301-524.710. **RECORDS.**

See R645-301-524.700

R645-301-524.711. OPERATOR IDENTIFICATION

See R645-301-524.700

R645-301-524.712. BLAST LOCATION AND SCHEDULE

See R645-301-524.700

R645-301-524.713. BLASTER CERTIFICATION

See R645-301-524.700

R645-301-524.720. NEAREST DWELLING OR FACILITY OUTSIDE THE PERMIT AREA

See R645-301-524.700

R645-301-524.730. WEATHER CONDITIONS

See R645-301-524.700

R645-301-524.740. BLASTING RECORD

See R645-301-524.700

R645-301-524.741. TYPE OF MATERIAL BLASTED

See R645-301-524.700

R645-301-524.742. BLASTING PATTERN

See R645-301-524.700

R645-301-524.743. DIAMETER AND DEPTH OF HOLES

See R645-301-524.700

R645-301-524.744. TYPES OF EXPLOSIVES USED

See R645-301-524.700

R645-301-524.745. TOTAL WEIGHT OF EXPLOSIVES USED PER HOLE

See R645-301-524.700

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R645-301-524.746. **MAXIMUM WEIGHT OF EXPLOSIVES DETONATED IN AN EIGHT-MILLISECOND PERIOD**

See R645-301-524.700

R645-301-524.747. **INITIATION SYSTEM**

See R645-301-524.700

R645-301-524.748. **STEMMING**

See R645-301-524.700

R645-301-524.749. **MATS OR OTHER PROTECTIONS USED**

See R645-301-524.700

R645-301-524.750. **SEISMOGRAPHIC AND AIR BLAST INFORMATION**

See R645-301-524.700

R645-301-524.751. **INSTRUMENTATION**

See R645-301-524.700

R645-301-524.752. **LOCATION OF INSTRUMENTATION**

See R645-301-524.700

R645-301-524.753. **PERSONS COLLECTING DATA**

See R645-301-524.700

R645-301-524.754. **PERSONS ANALYZING DATA**

See R645-301-524.700

R645-301-524.755. **VIBRATION AND/OR AIR BLAST LEVEL RECORDED**

See R645-301-524.700

R645-301-524.760. **UNSCHEDULED BLASTS**

See R645-301-524.700

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R645-301-524.800. COMPLIANCE WITH OTHER APPROPRIATE REGULATIONS

Andalex Resources will comply with appropriate Utah and federal regulations in the use of explosives.

R645-301-525. SUBSIDENCE

Survey of Structures and Renewable Resource Lands

There are no structures present other than those constructed for mining operations, on the permit area. The land is presently used for grazing and wildlife habitat which constitutes a renewable resource area. It should be noted that geographic areas above Andalex's 5 year mine plan do not include any area suitable for grazing, nor do they contribute significantly to the long-range productivity of water, food or fiber products. Andalex commits to mitigate all subsidence related damage to renewable resources including, but not limited to water, grazing, and wildlife habitat including raptor nests.

Mining Method

Mining will consist of the underground method of coal extraction using the longwall method, continuous miners on fringe areas, and conveyor haulage. Continuous miners will be employed for longwall development with longwall extraction completing the operation.

Geologic Factors

The Pinnacle Mine is located within the Blackhawk formation of the upper Cretaceous Mesa Verde Group. As is the case with all the active mines in the Book Cliffs coal field, the Pinnacle Mine drifts in from the outcrop and immediately the cover drastically increases as there are very steep sided canyons. Naturally, the same factors are present in the Lower Sunnyside, Aberdeen and the Centennial Seams. There are small areas of multiple seam extraction where a total thickness of up to 16 feet of coal could be removed. From a geologic standpoint, the following conclusion can be drawn: as mining progresses and the longwall panels are pulled the roof will cave in behind the shields as they advance. This is the normal scheme in this type of mining. In our longwall mining sequence, average cover over the coal seams is 2,700 feet or more. Use of longwall mining on the Andalex property will minimize the surface disturbance while enhancing safety underground.

Subsidence has not been detected at any monitoring location currently in place at Andalex, including two pillar extraction sections in close proximity to our initial longwall panel in the Gilson Seam. These pillar sections extracted 90% of the coal which is similar to longwall (See IBC PHC for additional comments on subsidence. The panel-barrier design will minimize the probability of subsidence. This fact, in combination with research performed by the Bureau of Mines will justify Andalex using a

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maximum angle of draw on this property of ~~20°~~ .20°. The Bureau of Mines performed extensive research at Price River Coal Co. (AEP) in the early 1980's at the #5 and #3 Mines where longwall mining was taking place.

That mining property is in the Book Cliffs Coal field as is Andalex's and is within seven miles. The Bureau's data showed a maximum draw angle over longwall extraction of (+) 15.~~2°~~2° and a minimum of (-) 7.~~4°~~.4°. (See App. T.) The massive sandstones and geologic conditions above the Price River Coal mine are the same as those found above the Andalex permit area. Therefore, similar subsidence results will occur.

Preventive Measures

Subsidence due to mining on the Andalex property will not occur outside of the approved permit area. Stations have been set up as required for constant monitoring of subsidence movements. (See 6., Monitoring.) The only absolute preventive measure possible is to leave coal in place. This is in direct contrast to maximum economic coal recovery.

Resources on the lands above Andalex's mining plan consist only of wildlife habitat with very limited grazing access.

Subsidence monitoring stations will be established were established along the first proposed longwall mining (Plate ~~25~~5-15). The results of this monitoring program define monitoring and permitting needs in the future.

Mitigative Measures

If minor subsidence would occur, there would be no material damage or diminution of valuable or foreseeable use of lands including wildlife habitat. It should be noted that subsidence has been occurring in the Book Cliffs coal field for decades with no diminution of resources. The Bureau of Mines Subsidence Study over the #3 Mine longwall panels has substantiated this. (See App. T.) There are no man-made structures or hydrologic concerns located within the affected area of Andalex's mining plan. It has been demonstrated that broad areas of subsidence over longwall panels do not represent adverse impact, if they are even noticeable. Smaller cracks, should they occur, heal themselves quickly and thoroughly.

The one spring located in Hoffman Creek was located stratigraphically well below the lowest coal to be mined. Springs above the seams outside the permit area will not be affected due to their distance from mining activity. Andalex has committed to replacing water should it be proven that mining has disrupted water flow at any location.

In the event mining related subsidence should cause material damage to the land, Andalex Resources, Inc. Will take appropriate steps to mitigate or repair such damage. Such repairs or mitigation may consist of one or more of the following steps:

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(1) Filling of hazardous subsidence cracks;
(2) Leveling or regrading of subsidence damaged areas;
(3) Reseeding of repaired areas;
(4) Purchase of damaged site

In the event mining related activities should be shown to adversely affect State-appropriated water supplies, Andalex Resources, Inc. will attempt to repair and restore the affected supply; however, in the event, the supply cannot be restored, the loss may be mitigated by replacement of equivalent water rights from the 19 shares of primary water owned by Andalex Resources, Inc.

Methods to be used to repair damaged supplies may include installation of pipes and/or spring boxes, concreting or filling of cracks with impervious material, reconstructing ponds or damaged channels, or other methods of repair found to be acceptable and based on consultation with the Division and water right owner. It should be noted that any work performed on such hydrologic structures will be first permitted as necessary (i.e. Stream Alteration Permits, etc.).

Monitoring

There are no structures or surface features which could be affected adversely by subsidence. Monitoring stations, however, have been set up at the locations shown on Plate 7-1. Locations over the first longwall mining are also shown on Plate ~~28~~5-18.

The purpose of the detailed monitoring program over the initial longwall mining is to establish baseline information which is useful in the long-term operation of the Andalex mines. This program will consist of surveyable monuments (nail, rebar, etc.) established on 100-foot centers (where possible) over the lines designated on Plate ~~28~~5-18. Where 100-foot spacing is not possible due to topographic or other obstacles, spacing will be as near 100-foot as possible, particularly along potential tension areas above the panel. Distances between points within the compression area of the longwall panel may be increased up to 500-feet depending on accessibility. Also, Andalex will conduct visual inspections over the first panel prior to and subsequent to mining the panel.

In addition, Andalex is committed to establishing subsidence monitoring programs over successive longwall panels which will consist of up to two monuments per panel and will also include visual inspections annually on active panels.

R645-301-525.100.

SUBSIDENCE CONTROL PLAN

See R645-301-525.

R645-301-525.110. MINING METHODS

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See R645-301-525.

R645-301-525.120. LIKELIHOOD OF SUBSIDENCE

See R645-301-525.

R645-301-525.130. SUBSIDENCE CONTROL MEASURES

See R645-301-525.

R645-301-525.131. BACKSTOWING OR BACKFILLING OF VOIDS

N/A

R645-301-525.132. LEAVING SUPPORT PILLARS OF COAL

See R645-301-525.

R645-301-525.133. BARRIER PILLARS

See R645-301-525.

R645-301-525.134. MEASURES TO PREVENT DAMAGE

See R645-301-525.

R645-301-525.140. MONITORING

See R645-301-525.

R645-301-525.150. ANTICIPATED EFFECTS OF PLANNED SUBSIDENCE

See R645-301-525.

R645-301-525.160. MITIGATION OR REMEDY OF SUBSIDENCE-RELATED DAMAGE

See R645-301-525.

R645-301-525.170. OTHER INFORMATION

Upon completion of mining and following all required subsidence monitoring, subsidence monitoring stations (which consist of cemented rebar) will be removed.

R645-301-525.200. SUBSIDENCE CONTROL

See R645-301-525.

R645-301-525.210. SUBSIDENCE DESIGN

N/A

R645-301-525.220. **COMPLIANCE WITH SUBSIDENCE CONTROL PLAN**

See R645-301-525.

R645-301-525.230. **OPERATOR REQUIREMENTS**

See R645-301-525.

R645-301-525.231. **SUBSIDENCE MITIGATION**

See R645-301-525.

R645-301-525.232. **COMPENSATION**

N/A

R645-301-525.240. **RESTRICTED FACILITIES**

N/A

R645-301-525.241. ~~**PUBLIC BUILDINGS AND FACILITIES**~~

~~N/A~~

~~**R645-301-525.242.** **CHURCHES, SCHOOLS AND HOSPITALS**~~

~~N/A~~

~~**R645-301-525.243.** **IMPOUNDMENTS WITH A VOLUME OF 20 ACRE-FEET OR MORE**~~

~~N/A~~

~~**R645-301-525.244.** **SIGNIFICANT WATER SOURCE FOR ANY PUBLIC WATER SUPPLY SYSTEM**~~

~~N/A~~

~~**R645-301-525.250.** **SUSPENSION OF MINING TO MODIFY SUBSIDENCE CONTROL PLAN**~~

~~N/A~~

~~**R645-301-525.260.** **SUSPENSION OF MINING DUE TO IMMINENT DANGER**~~

~~N/A~~

~~**R645-301-525.270.**~~ **DETAILED UNDERGROUND MINE PLANS**

Underground Operation and Facilities

Mine Layout (Refer to Plate ~~29~~5-19).

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Multiple Seam Considerations

There was four economic seams present on the property. The uppermost seam is the Lower Sunnyside which varies from four to six feet thick. The second highest seam is the Centennial Seam which varies from four to eight feet thick. The third seam is the Gilson Seam which also varies from 4' to 8' thick. The lowermost seam is the Aberdeen, the only seam with coal remaining, which varies from four to thirteen feet in thickness. The bottom two seams are separated by a 200 foot interval which includes a massive sandstone. The Gilson and the Centennial Seams are separated by approximately 130' and the Centennial and Lower Sunnyside Seams are separated by 80' including a massive sandstone. It should be noted that the area in which the Centennial Seam is to mined does not contain any reserves in either the Lower Sunnyside nor the Gilson Seams. Only the Aberdeen Seam is present where the Centennial Seam is to be mined. The mine plan for the aberdeen seam is shown on Plate ~~29~~5-19.

Portals

Portals for the present mining operations in the Aberdeen, Gilson and Lower Sunnyside seams are located in Deadman Canyon as shown on Plate ~~6~~5-7. The portal areas consist of a conveyor portal, two air intake portals, and an 88" fan portal.

Portals have been enlarged above the coal seam to facilitate men and equipment at the mine opening. Steel sets have been used to support mine roof in the portal areas. The Aberdeen portals have been constructed in a similar fashion, facilitating air intake, conveyor, and an exhaust fan.

The portals are generally 6' high and 20' wide in the Pinnacle and Aberdeen Mines and 4.5' high in the Apex Mine.

The portal mine pads consist of approximately The portal mine pads consist of approximately one acre. Located on these pads are the fans, conveyor portals, air intake portals, and mine water storage tanks. It should be noted that the mining of the Centennial Seam did not require new portals on the surface. The Centennial Seam is accessed via rock tunnels from the existing Pinnacle Mine.

Mains, Submains, and Slopes

A five to seven entry system is being used (two intake portals) and using a continuous miner, the entries are being driven to the property line. Generally, entries on 80 foot centers with crosscuts every 80 feet are being driven on the strike and dip of the coal seam. Development mining for the longwall panels are on 5th entry and 3rd entry systems. Refer to Plates 26 through 29. There exists only one return air portal on the surface, however, two exist underground making the five entry system. A seven entry system is used under shallow cover.

Shafts and Interconnecting of Slopes

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Mining plans called for rock tunnels to be constructed from the existing Pinnacle Mine up to the Centennial Seam mining area. These rock slopes are each approximately 500' in length. The three tunnels consist of an intake air tunnel, a return air tunnel, and a belt tunnel. Coal is transported via the belt tunnel and transferred on to the existing Pinnacle Mine conveyor belts. These tunnels were constructed in the Spring of 1990 and mining has commenced.

Longwall Panels

The mining sequence calls for the development of panels longwall using 2, 3 and 5 entry systems. These panels will be generally 650 to 800 feet in width and up to 8,000 feet in length.

Barrier Pillars

A barrier pillar will be left between the bleeders and the longwall panels. A barrier will also be left wherever old mine workings are skirted such as the Olsen Mine on the east side of Deadman Canyon in the Gilson Seam. The approved R2P2 also places barrier pillars between longwall panels to maintain safe working conditions. This was the only mine design approvable by ANDALEX and the BLM.

Bleeder System

A bleeder system will be maintained and pillars left to provide for ventilation, eventually extending around all mined out areas.

R645-301-525.300. PUBLIC NOTICE OF PROPOSED MINING

A copy of the newspaper advertisement of this Mining and Reclamation Plan and proof of publication of the advertisement is filed with the Division and made part of the complete application.

525.400. DETAILS OF THE SUBSIDENCE CONTROL PLAN

Since state-appropriated water supplies exist on the surface, 525.400 has been addressed.

525.410 Coal will be removed using a combination of continuous miner and long wall methods as described in sections 522 and 523. Sequence and timing for the development of underground workings are also discussed in sections 522 and 523.

525.420 Plate 5-6 shows the underground workings and depicts areas where first mining or partial mining will be utilized to protect the escarpment and raptor nests that may exist on the escarpment, and to insure that subsidence remains within the permit area. State-appropriated water rights are shown on Plates 7-3.

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525.430 No major impacts of subsidence to the surface caused by the underground mining methods proposed during the permit term are anticipated.

The coal seam is approximately 10 to 13 feet thick with only about 10.5 feet being extracted, and the depth of cover ranges from 1,500' to approximately 3,000. The rocks overlaying the coal seam are sandstones and mudstones with some thin bands of coal. Due to the strength of the overburden and depth of workings, even with full seam extraction, only minimal subsidence if any is anticipated.

525.440 Aerial subsidence monitoring will be done annually while the significant subsidence is taking place. The subsidence monitoring will be initiated in an area prior to any 2nd mining being done within that area. Initially a 200 foot grid along with baseline photograph will be established prior to any 2nd mining. Approximately 12-16 control points will be needed to cover the total mining area. Six of these points will be located outside of the subsidence zone. The accuracy of this survey will be plus or minus 6" horizontally and vertically. From this data a map will be created that will show subsided areas. Once per year a follow up aerial will be performed to determine the extent and degree of active subsidence. Subsidence monitoring will continue for a minimum of 5 years after the mining ceases. If at the end of the 5 year period the annual subsidence in any of the 3 prior years measures more than 10 percent of the highest annual subsidence amount, subsidence monitoring will continue until there are 3 consecutive years where the annual subsidence amount is less than 10 percent of the highest annual subsidence amount. If for three years in a row the subsidence is measured to be less than 10% of the highest subsidence year, subsidence will be determined to be complete, and no additional monitoring for that area will be required.

"A ground survey of the mine permit area 'where secondary extraction has occurred over the last year' will be conducted in conjunction with the quarterly water monitoring program." Identified features will be monitored until they are repaired or self-healed. The survey will be conducted on roads, adjacent to stock watering ponds, and in drainage channels where they cross tension areas relative to the underground extraction areas."

"The results of this survey will be documented quarterly in a written report which provides global positioning co-ordinates as well as the following information;

A) a description of the identified subsidence related feature,
B) length, and width measurements, and compass bearing,
C) dated photographic documentation,
D) located on a topographic overlay map of the underground disturbed area.
E) if the feature is determined as significant, the Division will be notified within a 48 hour period.
F) A written report, compiling the four quarterly reports for the monitoring year, will be submitted as part of the Annual Report required by the Division.

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G) The commitment "to restore the land where subsidence damage has affected the use of the surface" must be revised to read "to restore the land where subsidence damage has been determined as significant enough to require repair, as determined by the Division".

The ground survey will consist of walking and photographing the various areas of the surface over the mine where subsidence might occur. If evidence of subsidence is identified, the area of subsidence will be surveyed and the extent of the disruption identified. Depending on the extent and location of the damage, mitigation measures will be reviewed and implemented. Due to the fact that mitigation options change with time as new technology and measures are developed, better options may be implemented in the future. However, UEI provides a commitment that where subsidence damage affects uses of the surface, the land will be restored to a condition capable of maintaining the value and reasonable foreseeable uses which it was capable of supporting before the subsidence. The surface effects will be repairs as described in Section 525.500.

525.450 Subsidence control measures.

525.451. No backstowing or backfilling of voids used as a subsidence control measure is planned at this time. Therefore, this section is not applicable.

525.452. Support pillars as a subsidence control measure is not anticipated at this time. However, an area of partial mining where an unmined coal block will be left for subsidence control is shown on Plate 5-6. Both first mining and partial mining will leave support that can be used to control subsidence.

525.453. Mining in the Kenilworth Lease is not near the outcrop of the area.

525.454 No surface disturbance is planned. No measures will be taken on the surface to prevent material damage or lessening of the value or reasonable foreseeable use of the surface.

525.460. Anticipated effects of planned subsidence may include tension cracks, fissures, or sink holes. Areas of minimal ground lowering may be anticipated. The chances of subsidence-related damage to any perceived renewable resource is minimal.

525.470. Since no urbanized areas, cities, towns, public buildings, facilities, churches, schools, or hospitals exist within the permit area this section does not apply.

525.480. There are no plans to change or modify the mining plan to protect any springs or seeps. Springs with water rights will be monitored for flow and quality as described in Chapter 7 Section 731.211. UEI has committed to provide for mitigation of any lost water rights as per Chapter 7 Section 727.

525.490. Other information specified by the Division as necessary to demonstrate that the operation will be conducted in accordance with R645-301-525.300 will be provided.

525.500. Repair of damage.

525.510. If effects of subsidence are confirmed, any material damage to the surface lands will be restored to the extent technologically and economically feasible. The land will be restored to a condition capable of maintaining the value and reasonable foreseeable uses which it was capable of supporting before the subsidence.

525.520. Since no structures exist within or adjacent to the permit area which could be damaged by subsidence, should it occur, this section does not apply.

525.530. No structures, facilities, or county roads exist on the Kenilworth Lease area and no subsidence damage is expected.

525.600 Compliance

UEI agrees to comply with all provisions of the approved subsidence control plan.

525.700. Public Notice.

At least six months prior to mining, or within that period if approved by the Division, the underground mine operator will mail a notification to all owners and occupants of surface property and structures above the underground workings. The notification oil include, at a minimum, identification of specific areas in which mining will take placce, dates that specific areas will be undermined, and the location or locations where the operator's subsidence control plan may be examined.

R645-301-526. MINE FACILITIES

Support Structures and Buildings

Support structures and buildings are shown on ~~Plates 6 and~~ Plate 5-7.

Parking Areas

Parking areas have been covered with gravel and magnesium chloride and will be maintained. These are shown on Plate ~~6~~5-7. The main office parking area is paved.

Storage Areas

There are several storage areas at the site. These include the Material Storage Area No. 1, Raw Coal Pile Area, Material Storage Area No. 2, and the Topsoil Storage Area. All areas are shown on Plate 5-7.

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~~There are several storage areas at the site. These include the Material Storage Area No. 1, Raw Coal Pile Area, Material Storage Area No. 2, and the Topsoil Storage Area. All areas are shown on Plate 6.~~

R645-301-526.100. MINE STRUCTURES AND FACILITIES

See Volume II.

R645-301-526.110. EXISTING STRUCTURES

Operation Plan: Existing Structures

Construction and Design of Surface Facilities

Existing Structures

It should be noted that there are no existing structures located in the Mathis Tract I.B.C. area or on adjacent proposed Federal Lease Applications shown on Plate I-A.

All existing structures are situated on the Zion's fee land, on federal lease SL-027304, or on right-of-way UTU-62045 and are shown on Plate ~~6~~5-7. There are no structures existing as part as Andalex's facility which were constructed prior to 1980. Originally it was anticipated that all buildings and structures were to be completed during the first five year permit term. Obviously this is not the case since the Aberdeen Mine has only recently been completely finished to this date. Plate ~~6~~5-7 depicts the Aberdeen Mine with the surface facilities completed in early 1990. No new structures on the surface will be required to mine the Kenilworth Lease.

Underground rock tunnels access the Centennial Seam. See 1.1, 2.1-1, 2.1-4. Existing structures include the following:

Bathhouse (5)	14' x 60'
Mine Water Storage Tanks (3)	12' x 16'
Warehouse (1)	14' x 60'
Lamphouse (2)	40' x 40'
Substations (2)	60' x 100'
Office Building	28' x 60'
Mine Fans (4)	88"
Portals (15)	6' x 20'
Culinary Water Tanks (3)	12' x 10'
Shop	80' x 120'
Guard Shack	8' x 8'

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The Aberdeen Mine surface facilities will include one additional bathhouse, and one lamphouse.

Upon completion of mining activities, the portals will be sealed according to existing state and federal regulations and all buildings and structures not being utilized as part of the reclamation sequence, will be removed.

R645-301-526.111. LOCATION

See R645-301-110.

R645-301-526.112. PLANS OR PHOTOGRAPHS

See R645-301-110.

R645-301-526.113. DATES OF CONSTRUCTION OF EXISTING STRUCTURES

See R645-301-110.

R645-301-526.114. MONITORING DATA

N/A

R645-301-526.115. COMPLIANCE PLAN

N/A

R645-301-526.115.1 DESIGN SPECIFICATION

See R645-301-525.110.

R645-301-526.115.2 CONSTRUCTION SCHEDULE

Construction Schedule

All of the above structures have been completed. The earthwork for the Aberdeen Mine was completed in 1989. The surface facilities were in early 1990. Construction has been located and carried out so as to prevent and control erosion, siltation, water pollution, and damage to property. All facilities have been designed and constructed and will be maintained and used in a manner which prevents damage to wildlife and related environmental values. Any future construction will be conducted in a similar manner according to regulations regarding protection of the hydrologic system, etc. The rock tunnels for the Centennial Seam development were constructed in the spring of 1990 and completed late in 1990. As previously discussed this mining will require no new surface facilities.

R645-301-526.115.3 MONITORING SCHEDULES

General Requirements

Most of the maps and plans previously submitted as part of the approved Mining and Reclamation Plan, are applicable. Where necessary, the original maps have been revised to indicate the lease in Hoffman Creek and the revisions are included in this submittal as figures or as plates in Volume II.

All categories within this section have been addressed, primarily in Volume II of the MRP which contains most of the plates.

a) Surface and subsurface ownership of lands contiguous to the permit area are shown on Plates 2 and 3.

b) The leases for which we have the legal right of entry are shown on Plate 4.

c) At this time all plates and maps have been revised to include all new leases and beyond these leases Andalex does not anticipate making application for additional permits in this five year permit term with the possible exception of a breakout and fan installation on a newly acquired right-of-way in the left fork of Deadman Canyon. The sequence of mining for the next five year permit term as it relates to the entire permit area is shown on revised Plates 29, 30, 31, 41 to include the Hoffman lease, the Graves Lease and the AEP Lease.

d) There are no buildings within 1,000 feet of the permit area except those used as part of the mining operation. They are shown on ~~Plates 6 and~~ Plate 5-7.

e) There are no surface or subsurface man-made features within, passing through or passing over the permit area except the powerline, telephone cables, culverts, and etc., installed for the operation of this mine. See ~~Plates 6 and~~ Plate 5-7 for their locations.

f) These reference areas are shown on Plate 9 as R-1, R-3 and R-4. They are each 200 feet square approximately.

g) The only user of surface water within this hydrologic area is Andalex. The intake location for this water into the mine is located on Plate ~~6~~5-7. Disturbed area runoff is collected in a culvert and taken directly into the mine. Andalex controls this water right. If a discharge were to occur from any sediment pond (this has yet to occur), it would discharge into the Deadman Canyon drainage (Plate ~~21~~5-11) which is ephemeral.

h) County Road 299 starts at highway 6 in Price and terminates at Andalex Resources' minesite (Plate 1).

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i) There are no public parks nor any cultural or historical sites eligible for listing in the National Register in or adjacent to the mine plan area.

j) There are no cemeteries or burial grounds in or within 100 feet of the permit area.

k) There is no land which is within the boundaries of any units of the National System of Trails or the Wild and Scenic Rivers System including study rivers.

R645-301-526.115.4 MINIMIZING RISK OR HARM TO ENVIRONMENT, HEALTH OR PUBLIC SAFETY

R645-301-526.116. PROTECTION OF PUBLIC AND LANDOWNERS

See R645-301-525 and R645-301-510.

R645-301-526.116.1 MINING OPERATIONS WITHIN 100 FEET OF THE RIGHT-OF-WAY OF A PUBLIC ROAD

County Road 299 begins at Highway 6 in Price and terminates at the minesite.

R645-301-526.116.2 RELOCATING A PUBLIC ROAD

N/A

R645-301-526.200. UTILITY INSTALLATION AND SUPPORT FACILITIES

Appendices G & I

R645-301-526.210. DESCRIPTION

Appendices G & I

R645-301-526.220. COMPLIANCE REQUIREMENTS

Appendices G & I

R645-301-526.221. PROTECTION

Appendices G & I

R645-301-526.222. MINIMIZATION OF ENVIRONMENTAL IMPACT AND COMPLIANCE WITH EFFLUENT LIMITATIONS

Appendices G & I

R645-301-526.300. WATER POLLUTION CONTROL FACILITIES

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See R645-301-733..

R645-301-526.400. AIR POLLUTION CONTROL FACILITIES

Air Pollution Control Plan and Compliance with Air Quality Laws

Existing Environment

The permit area is located in a Class II air quality area.

Air Quality Impact Analysis

Please see the following section on Emission Estimates.

Emission Estimates

Emission estimates are included as Appendix F in the form of an emission inventory. This inventory has been reviewed and approved by the Utah Bureau of Air Quality and the E.P.A. It has been reapproved to increase our production restriction on the basis the haul road has been paved by Carbon County. Air quality permit in appendix F.

Proposed Controls

Since this is an underground operation, no air quality problems are anticipated. The only changes in air quality will be attributable to minor road dust and exhaust mine dust. Methods of control are spray systems, chemical treatment, enclosures, pavement, and other fugitive dust control practices outlined in 30 CFR 817.95.

~~Since this is an underground operation, no air quality problems are anticipated. The only changes in air quality will be attributable to minor road dust and exhaust mine dust. Methods of control are spray systems, chemical treatment, enclosures, pavement, and other fugitive dust control practices outlined in 30 CFR 817.95.~~

There will be no additional fugitive emissions or air pollution associated with the newly acquired AEP Lease.

PSD Permit and Compliance with Air Quality

Laws

The Environmental Protection Agency has determined that this project does not need a PSD air quality permit. This is based on our fugitive and non fugitive dust emissions inventory which assumes facilities necessary for 1.5 mm tons per year production. Further, the mine is not subject to the PSD regulations because of the new definition of a major source. (Refer to letter dated March 21, 1980 in Appendix J). All applicable air

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quality laws will be complied with and fugitive dust control practices, as required under 30 CFR 817.95, will be followed.

Andalex has been issued a new approval order for the mines and the Wildcat Loadout for 1.5 million tons per year. These were inspected and met compliance during the summers of 1989-1992.

Since this is an underground operation, no air quality problems are anticipated. The only changes in air quality will be attributable to minor road dust and exhaust mine dust. Methods of control are spray systems, chemical treatment, enclosures, pavement, and other fugitive dust control practices outlined in 30 CFR 817.95.

~~Since this is an underground operation, no air quality problems are anticipated. The only changes in air quality will be attributable to minor road dust and exhaust mine dust. Methods of control are spray systems, chemical treatment, enclosures, pavement, and other fugitive dust control practices outlined in 30 CFR 817.95.~~

There will be no additional fugitive emissions or air pollution associated with the newly acquired AEP Lease.

R645-301-527. TRANSPORTATION FACILITIES

R645-301-527.100. ROAD CLASSIFICATION

All roads within the permit area are classified as "Primary Roads" in accordance with R614-301-527.100 or "Ancillary Roads" in accordance with R645-301-527.130. Roads on the site are of 2 typical designs:

1. Single-lane, gravel or asphalt surfaced roads approximately 12 - 15' wide; and

2. Double-lane, either gravel or asphalt surfaced roads, approximately 26' wide.

Although all roads on site are not used for coal hauling, each primary road is constructed to the respective typical design and dimensions shown on Plate ~~35~~5-25.

All roads are shown on Plate ~~6~~5-7 and Plate 8. Specifics about the road are described individually and include road widths, gradients and surfaces. Drainage ditches and drainage structures for each road (disturbed area ditches or culverts) can be found in Tables IV-2 through IV-8.

Because of the variance in road types, widths and lengths, the roads have been designated on Plate ~~6~~5-7 with numbers (i.e. PR-1= Primary Road 1, Ar-1= Ancillary Road 1) to facilitate the description of each:

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Primary Road 1 (PR-1) - This road connects Carbon County Road 199 to the two lane paved road which travels past the Aberdeen Mine facilities, past the office driveway and bath house drive ways and past the Pinnacle truck loadout. This is an asphalt surfaced road approximately 26 feet wide and 2700 feet long. The grade on PR-1 ranges from 4% to 8%. It is used for hauling coal and for men and material access to the mines.

Primary Road 2 (PR-2) - This road begins at the end of PR-1 and continues north past the shop/warehouse and ends at the eastern side of the Apex Mine stockpile. This is a two lane gravel surfaced road which is approximately 26 feet wide and 1400 feet long. It is treated annually with Magnesium Chloride. The grade on this stretch of road ranges from 5% to 9%. It is used for hauling coal and equipment as well as providing men and materials access to the mines.

Primary Road 3 (PR-3) - This road provides access to the Aberdeen Mine truck loadout. It is a single lane gravel surface road approximately 15 feet wide and 590 feet long. It is treated with Magnesium Chloride annually. The grade on this road ranges from 0% to 4%.

Primary Road 4 (PR-4) - This road provides access for the coal haul trucks to the Pinnacle Mine truck loadout. It is also crossed to access the bath house parking area. This is a single lane, paved surface road which is approximately 15 feet wide and 500 feet long. The grade on this loop ranges from 0% to 9%.

Primary Road 5 (PR-5) - This road provides access for the coal haul trucks coming off of PR-2 to the Apex Mine truck loadout. It is a single lane gravel surfaced road approximately 15 feet wide and 425 feet in length. The grade on this road ranges from 0% to 7%. It is treated annually with Magnesium Chloride. The three truck loadout roads are also accessed by front-end loaders for the purpose of cleaning up occasional coal spills.

Primary Road 6 (PR-6) - This is an access road which leads to the main office parking area. It is a single lane, paved surface road which is approximately 15 feet wide and 600 feet long. The average grade of this road is 5% to 7%.

Primary Road 7 (PR-7) - This is an access road for mining equipment. It provides heavy equipment access to and from the Aberdeen Mine. It begins at the south inlet to pond C and it ends at the bath house parking area. It is a gravel surfaced road and is approximately 12 feet wide and 450 feet long. It has grades which range from 4% to 14%. Magnesium Chloride is applied annually.

Primary Road 8 (PR-8) - This road leads from the fuel storage area at the Pinnacle Mine facility to the oil storage area near the upper Pinnacle portals. This is a single lane, gravel surface road approximately 15 feet wide and 325 feet long. The grade on this road has a range of 9% to 11%. It is treated with Magnesium Chloride annually.

Primary Road 9 (PR-9) - This road leads from PR-2 and turns west over the top of the Apex Mine conveyor belt. The road leads to the Apex Mine material storage

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area, adjacent to the mine fan. This is a single lane gravel surfaced road which is approximately 15 feet wide and 200 feet long and includes a steel deck bridge over the mine conveyor. The grade on this road ranges between 0% and 8%, and the gravel is treated with Magnesium Chloride.

Primary Road 10 (PR-10) - This is an access road which leads from the upper Aberdeen Mine material storage area down to the Aberdeen Mine stockpile pad. This is a short stretch of road which is approximately 12 feet wide and 150 feet long. It is a single lane road with an average grade of 12% to 15%.

Primary Road 11 (PR-11) - This is a very short access road which accesses the bath house pad from two directions; both from PR-1 and from PR-4. This road is approximately 12 feet wide and 150 feet long. It is a single lane road with a grade of 0% to 6%. This road is treated with magnesium chloride annually.

Ancillary Road 1 (AR-1) - This is an access road which leads from the south Aberdeen intake portal to the Aberdeen mine fan. It is a single lane road which has a surface of sandstone. The road is used primarily for access to the fan, water system and conveyor. This road is approximately 20 feet wide and 400 feet long. There is a steel deck bridge over the Aberdeen mine conveyor. The grade on this road ranges from 8% to 10%.

Ancillary Road 2 (AR-2) - This road leads from the upper Pinnacle Mine intake portals to the Pinnacle Mine fan. It is a single lane gravel surfaced road which has a steel deck bridge where the road crosses the Pinnacle Mine conveyor. Its primary use is to access the Pinnacle Mine fan. It is approximately 12 feet wide and 250 feet long. The grade on this road ranges from 0% to 12%.

Ancillary Road 3 (AR-3) - This road leads from PR-2 up to the Apex material storage area (Gun range). This is a single lane gravel surface road which is approximately 12 feet wide and 175 feet long. The grade on this road is on an average of 9%. It is treated with Magnesium Chloride annually. It is used primarily for access.

Ancillary Road 4 (AR-4) - This road is access from the upper Apex material storage area to the Powder Magazines. This road continues beyond the north end of our permit area but it becomes a private road beyond the permit area. This is a single lane dirt road which is approximately 12 feet wide and 150 feet long. The grade on this short stretch of road is 5% to 8%.

Ancillary Road 5 (AR-5) - This road is access from Carbon County Road 299 to the left hand fork installation. This existing road will be upgraded adequately for maintenance and emergency access only. It will be equipped with a locked gate. This is a single lane dirt road which is approximately 15 feet wide and 4000 feet long. There will be 3 or 4 locations specifically widened so that two vehicles may

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pass. The grade on this stretch of road ranges from 0% to 15%. This road will be reclaimed upon cessation of mining pending the approval of Mrs. Gladys Artman.

Andalex commits to repair roads damaged by a catastrophic event as soon as practical according to R645-301-527.240. According to R645-301-534.100 Andalex has located, designed, constructed, used and maintained Primary Roads so as to prevent or control damage to private and public property. Andalex has used non-acid or non-toxic forming materials in road surfacing. Roads have, at a minimum a static safety factor of 1.3 on embankments. Andalex has a schedule and plan to remove roads that will not be retained as part of the approved post mining land use. Ancillary roads will be traveled only by light vehicles for routine access. Occasionally, they will be traveled by larger equipment but probably only in emergency or repair situations, as 2 of 534.100, R645-301-534.200, R645-301-542.600 and R645-301-762. Primary Roads will be located in so far as practical on the most stable available surfaces. The roads are surfaced with rock, gravel or asphalt according to R645-301-534.320. They will be routinely maintained, and have culverts which are designed and installed as necessary according to the requirements of R645-301-534.340.

Railroad

There are no existing or proposed railroad spurs on the property.

Other Transportation Facilities

The conveyor structures at the minesite are very standard cross member, bent designs. The Pinnacle conveyor is 180 feet in length and uses a 42" conveyor belt. It is covered with galvanized corrugated sheeting. The Pinnacle Truck Loadout is an under pile gravity feed reclaim system in 8 foot diameter sectioned steel tunnel for 90 feet and surfaces on the typical bent, steel structure for an additional 110 feet. The Apex truck loadout is identical to Pinnacle. The mine conveyor is also the same bent/cross member design with a 42" conveyor; however, it is 250 feet in length. The Aberdeen facility is equipped with conveyor facilities similar to that of Pinnacle with only slight variations in exact length anticipated or possible. These facilities will be completed in early 1990.

Revised 8/8/95

Transportation facilities such as roads have been addressed. The roads, Class II and I are to be removed upon cessation of mining by simple regrading and re-establishment of contours, unless surface owners request access through the mine area might remain.

Protection of the environment through the use of these facilities is achieved by speed controls (20 mph minesite). The conveyor structures as such do not impose environmental problems. Public safety obviously is a requirement of law including MSHA but also public safety is a requirement of Andalex Resources. Also the minesite is not frequented by any public outside of normal, weekly business hours.

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R645-301-527.110. DESIGNATION OF ALL ROADS

See R645-301-527.

R645-301-527.120. PRIMARY ROADS

See R645-301-527.

R645-301-527.122. FREQUENT USE OR FOR PERIODS IN EXCESS OF 6 MONTHS

See R645-301-527.

R645-301-527.123. RETAINED FOR POSTMINING LAND USE

See R645-301-527.

~~**R645-301-527.122. FREQUENT USE OR FOR PERIODS IN EXCESS OF 6 MONTHS**~~

~~See R645-301-527.~~

~~**R645-301-527.123. RETAINED FOR POSTMINING LAND USE**~~

~~See R645-301-527.~~

R645-301-527.130. ANCILLARY ROADS

See R645-301-527.

R645-301-527.200. TRANSPORTATION FACILITIES
Revised 8/8/95

R645-301-527.210. DESIGNS AND SPECIFICATIONS

See R645-301-527.

R645-301-527.220. RELOCATION OF A NATURAL DRAINAGEWAY
N/A

R645-301-527.230. MAINTENANCE AND REPAIRS

N/A

R645-301-527.240. GEOTECHNICAL ANALYSIS

Roads and road cuts in this permit area are typical of others within the county and other mine access roads. No alternative specifications have been requested, therefore the geotechnical analysis is not required.

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R645-301-528. HANDLING AND DISPOSAL OF COAL, OVERBURDEN, EXCESS SPOIL, AND COAL MINE WASTE

As raw coal is hauled from the permit area, there will be no processing waste and no return of processing waste to underground workings. If in the future it is decided that a processing facility is to be incorporated, waste or reject would taken to an approved refuse disposal site. Please note that underground development waste rock generated by the Centennial Seam rock tunnels was disposed of underground in the existing Pinnacle Mine workings.
See R645-301-528.300.

R645-301-528.100. COAL REMOVAL, HANDLING, STORAGE, CLEANING, AND TRANSPORTATION AREAS AND STRUCTURES

Coal Handling Facilities

Stockpiles

Coal is discharged from the conveyor onto a coal stockpile in the Raw Coal Stockpile Area indicated as on Plate ~~6~~5-7. This is a live stockpile as opposed to a storage pile. It should be noted that when the Centennial Seam is mined it is transferred underground to existing Pinnacle Mine conveyors and therefore, ends up in the Pinnacle Mine stockpile.

Loadout

Coal is loaded from the stockpile by an electronic automatic loadout into 40 ton coal trucks and hauled to Wildcat Jct. which is on the Utah Railroad.

Preparation Plant

A coal cleaning facility will not be used. However, by the new definition of a preparation plant, the Wildcat Loadout now comes under the SMCRA and a plan has been approved under ACT 007/033.

Removal of Surface Structures

Upon completion of mining activities, all surface facilities will be removed. The coal pile area will be filled, the slope contoured, compacted, topsoil replaced, regraded, and revegetated. In the materials storage and building areas, all structures and foundations including the shop, office building, bathhouse, substation, and water storage tanks, will be removed, re-contoured, compacted, topsoil replaced and graded, and revegetated according to revegetation procedures described in this chapter.

R645-301-528.200. OVERBURDEN

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R645-301-528.300. SPOIL, COAL PROCESSING WASTE, MINE DEVELOPMENT WASTE, AND NON-COAL WASTE REMOVAL

Underground Development Waste

There has been no development waste or excess spoil to date excepting sedimentation pond material.

Coal Waste

Coal Processing Waste

The only coal processing waste to date is rock material manually separated from Andalex Resources' lump coal product at Wildcat. This is currently placed in an approved area at Wildcat Loadout. This MRP contains an Appendix Q. Appendix Q references the plan for reclamation of the waste rock pile at the Wildcat Loadout and should not be confused with the Centennial Reclamation Plan. Disposal of sediment pond material (temporary and permanent) is shown on Plate 5-7. Sediment pond waste has already been tested in one case to be non toxic and non acid forming and is being used currently in the Aberdeen Mine fill areas. Other material which is generated will be placed in temporary storage above the Apex Mine as shown on Plate 5-7 and will be disposed of permanently as back fill in high walls upon final reclamation. ~~The only coal processing waste to date is rock material manually separated from Andalex Resources' lump coal product at Wildcat. This is currently placed in an approved area at Wildcat Loadout. This MRP contains an Appendix Q. Appendix Q references the plan for reclamation of the waste rock pile at the Wildcat Loadout and should not be confused with the Centennial Reclamation Plan. Disposal of sediment pond material (temporary and permanent) is shown on Plate 6. Sediment pond waste has already been tested in one case to be non toxic and non acid forming and is being used currently in the Aberdeen Mine fill areas. Other material which is generated will be placed in temporary storage above the Apex Mine as shown on Plate 6 and will be disposed of permanently as back fill in high walls upon final reclamation.~~ This material will be tested prior to final reclamation if used for final reclamation purposes. Based on previous experience, Andalex estimates that up to 3,000 yards of material at most will be generated. This material is included in the earthwork estimates. Please note that the rock tunnels constructed to the Centennial coal seam generated significant amounts of waste rock. One hundred percent of this waste rock was disposed of underground in the existing Pinnacle Mine. None of the waste rock appeared at the surface.

Coal Refuse

Please refer to Plate ~~6~~5-7 for location of disposal areas.

Acid and Toxic-Forming Materials

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The only spoil material which has been developed from the minesite is sediment pond waste. It has been determined that this material is non-toxic or acid-forming and that it may be used in a fill situation (see Appendix H). Samples are currently being further analyzed to determine whether they are toxic or acid forming. These materials include mid seam, roof, and floor material. Appendices E and H currently contain the majority of the information necessary to determine whether roof, floor, or mid seam material is acid or toxic forming. If any roof rock from the Aberdeen Mine is developed, it will be disposed of underground or in one of the underground development waste storage areas depicted on Plate ~~6~~5-7. Some coal development waste has been used as a stock pile pad for the Aberdeen Mine. This material will be treated as coal mine development waste upon reclamation and back filled into our high wall areas.

Future pond accumulations for the entire mine site will be stored at least temporarily on the material storage site located above the Apex Mine or in the now defunct Pond A. depicted as "temporary excess spoil and mine development waste" and shown on ~~plate 6~~Plate 5-7. Please see Plate ~~6~~5-7.
Andalex will analyze the mid-seam of all four coal seams in addition to the roof and floor material on an annual basis or more frequently if mining operations change which could result in a modification to the roof floor or the mid-seam. Andalex will use this monitoring program in conjunction with the new AEP Lease. Andalex will make an effort to sample the material in the vicinity of section corners which occur within our leases. Andalex agrees to monitor for acid or toxic forming materials according to Table 6, "Guidelines for Management of Topsoil and Overburden for Underground and Surface Coal Mining". These parameters will prove pH, Electrical Conductivity, Saturation Percentage, Particle Size Analysis, Soluble Ca, Mg and Na, Sodium Adsorption Ratio, Selenium, Total N, Nitrate-N, Boron, Maximum Acid Potential, Neutralization Potential, Organic Carbon, Exchangeable Sodium, Available Water Capacity, and Rock Fragments. These parameters will be measured by acceptable methods at a qualified commercial testing laboratory.
There is no equipment located within our permit area which contain any of the substances listed by the Toxic Substances and Control Act, particularly PCB's. All transformers and OCB's are relatively new and are PCB free.
The storage of petroleum products on site is done in such a manner that hazards from spillage are minimal. Andalex operates with an SPCC Plan approved by a registered professional engineer (Appendix S). It is inevitable that during the course of operations, small amounts of oil and fuel will be accidently spilled and soaked up by soils and gravels. Andalex proposes to designate a specific area within our disturbed area at which contaminated soils or gravels will be brought, spread out, and aerated using only solar heat. We propose this area to be south of the Aberdeen truck loadout. The area will be small, however, it will be bermed to avoid runoff while the aeration process is ongoing. Once the aeration process is complete and the material is satisfactorily decontaminated, it will be used again as fill or hauled to our waste disposal area. Another possibility is the use of bioremediation. As this process is still being tested, Andalex does not propose to use this method at this time. However, should the method prove successful and acceptable, Andalex will consider using the process.

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At the time of final reclamation, Andalex will need to treat or dispose of small quantities of soils and gravels which have been contaminated with oil and/or fuel. At final reclamation, Andalex will utilize the best available technology (BAT) to treat this quantity of soil and gravel in order that it is suitable for fill material. This would include methods for removing volatile matter and other contaminants. Should it prove at that time that best available technology is inadequate for decontamination, Andalex will dispose of this material at an approved disposal site (not within the permit area). This site would be approved by State Health and EPA for the disposal of this type of material.

Non-Coal Waste

Non-coal waste consists of lubricants, paints garbage, timber, and other waste generated during mining. Please refer to Plate ~~6~~5-7 for the location of non-coal waste disposal (dumpsters).

Combustible Materials

No special measures are required. All combustibles (paper, etc.), are collected in trash containers and hauled to local city and land fill areas. Andalex currently operates under an SPCC Plan approved by a registered professional engineer. All materials such as oil and grease will be disposed of according to specific local requirements. All used motor oil is collected in 55 gallon drums and is recycled by local oil distributors. All used oils are recycled.

Contingency Plans to Prevent Sustained Combustion

All which could burn would be small in quantity and consist of mine trash. The trash facility is segregated and if ignited accidentally, could be extinguished using either water or fire extinguishers.

R645-301-528.310. EXCESS SPOIL

See R645-301-528.300.

R645-301-528.320. COAL MINE WASTE

See R645-301-528.300.

R645-301-528.321. RETURN OF COAL PROCESSING WASTE TO ABANDONED UNDERGROUND WORKINGS

See R645-301-528.300.

R645-301-528.322. REFUSE PILES

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N/A

R645-301-528.323. BURNING AND BURNED WASTE UTILIZATION

N/A

R645-301-528.323.1 COAL MINE WASTE FIRES

In the unlikely event that any coal mine waste, including boney material or fine coal waste, were to ignite the fire would be extinguished in the same way that coal stockpile fires are extinguished. That is, the material will be dug out with front-end loaders, spread out on the ground inside the permit area, and be compacted. The material would then be returned to the waste storage area.

R645-301-528.323.2 BURNING OR BURNED COAL MINE WASTE REMOVAL PLAN

N/A

R645-301-528.330. NON-COAL MINE WASTE

See R645-301-528.300.

R645-301-528.331. DESIGNATION OF NON-COAL MINE WASTE MATERIALS

See R645-301-528.300.

R645-301-528.332. FINAL DISPOSAL OF NON-COAL MINE WASTES

See R645-301-528.300.

R645-301-528.333. RESTRICTIONS ON DISPOSAL ON NON-COAL MINE WASTE MATERIAL

See R645-301-528.300.

R645-301-528.334. HAZARDOUS WASTE MATERIALS

See R645-301-528.300.

R645-301-528.340. UNDERGROUND DEVELOPMENT WASTE

See R645-301-528.300.

R645-301-528.350. DISPOSAL REQUIREMENTS

See R645-301-528.300.

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R645-301-528.400. DAMS, EMBANKMENTS AND OTHER IMPOUNDMENTS

See R645-301-528.300.

R645-301-529. MANAGEMENT OF MINE OPENINGS

See R645-301-528.300.

R645-301-529.100. CLOSURE OF MINE OPENINGS

Abandonment of Portals and Underground Workings

Introduction

Upon completion of mining activities, the portals will be sealed according to existing state and federal regulations. Conveyors will be removed and pads filled. The slope will be contoured, compacted, and topsoil replaced and graded.

The final sealing of mine openings will be accomplished by placing a recessed concrete block seal 25 to 50 feet from the mouth of the portal. Since a portion of the mine slopes towards the portals, and mine water is present, seals will be constructed with at least one drainage pipe in the lowest portal. This pipe shall be a schedule 80 - 4" PVC, with a U-tube water trap and a valve or cap on the end. The pipe will be extended beyond the portal backfill. The area from the seals to the mouth of the portals will be backfilled. The portal structures will be removed and the exposed coal seam, including portal area, will be covered during reclamation. Please note that the Centennial Seam Mine will not require any new portals on the surface.

If a discharge is found to occur after sealing, the water will be sampled quarterly for compliance with effluent standards of 817.42 and treated (if necessary) during the liability period. See Figures IV-1 and IV-2 for portal sealing details.

It is very unlikely that a mine discharge will occur from any of the permanently sealed mine portals, although each seal will be equipped with a drainage pipe described above. To date, Andalex has encountered dry mining conditions and all portals in all three mines drift into the mountain in a down dip direction. If a discharge were to occur, it would only be after the entire pillared out workings had filled first. Then only would the static head against the seal allow any discharge. There is no way of knowing or estimating the mine discharge rate.

As maintained above, Andalex will monitor any discharge. Andalex's existing NPDES allows for a certain volume of mine discharge. This permit will be maintained after cessation of mining for the liability period until the bond is released.

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The blowing fan ventilation shaft will be sealed by completely backfilling it from bottom to top. This shaft is 370' deep by 16' diameter, and will require approximately 2,755 cubic yards of backfill material. This backfill material will be hauled in from an offsite commercial gravel pit. See Appendix Y for reclamation information regarding the Ventilation Shaft/Blowing Fan Installation.

Temporary Cessation

Whenever it is known that operations are to be temporarily ceased for more than 30 days, Andalex Resources will submit to the Division a notice of intention to cease or abandon the operations, in accordance with MSHA standards.

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Figure IV-1
Typical Portal Sealing

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Typical Portal Seal
Figure IV-2

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This notice will describe mitigation measures to be employed in accordance with the terms and conditions of the permit approval, such as a statement of the number of surface areas involved in the cessation, extent of sub-surface strata, prior reclamation efforts accomplished on the property, and identification of all backfilling, regrading, revegetation, environmental monitoring, underground opening closures and water treatment activities that will continue during the temporary cessation.

Temporary closing of underground workings will be accomplished with chain link fence material as recommended by MSHA. This prevents access by unauthorized individuals during idol periods. It is not anticipated that once Andalex reaches its peak production that this will occur.

If underground openings are to remain inactive for a period greater than 90 days, such openings will be temporarily closed off from access. Such closures will consist of a chain link or other substantial wire mesh fabric fence placed over the portals to prevent public access while allowing for air flow. Locked gates may be installed in the portal to allow for mine inspection.

Casing and Sealing of Drill Holes

All exploratory drill holes have been sealed with cement and all water wells have been cased with steel casing and will be maintained. After mining is completed, the water wells and monitoring wells will be sealed except in the event the state engineer allows them to remain opened for other purposes.

R645-301-529.200. UNDERGROUND MINING OPERATIONS

R645-301-529.210. TEMPORARILY INACTIVE OPERATIONS

See R645-301-515.300.

R645-301-529.220. RETURN UNDERGROUND DEVELOPMENT WASTE, COAL PROCESSING WASTE OR WATER TO UNDERGROUND WORKINGS

See R645-301-515.300.

R645-301-529.300. HOLES USED FOR BLASTING

N/A

R645-301-529.400. SURFACE MINING OPERATIONS

N/A

R645-301-530. OPERATIONAL DESIGN CRITERIA AND PLANS

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R645-301-531. GENERAL

Schedule of Construction, Mine Development, Mining and Reclamation

All surface facilities have been constructed for the Pinnacle, Apex and Aberdeen Mines. Earthwork for the Aberdeen Mine was completed in 1989. The surface facilities for the Aberdeen Mine were completed in early 1990. No additional surface facilities are required for any new leases. There will be no additional construction activities or surface disturbance whatsoever in Hoffman Creek or Alrad Canyon.

However, Andalex does intend to add a fan installation in the left-hand fork of Deadman Canyon at some point in time. This installation will be according to measures outlined by the Bureau of Land Management as part of Right-of-Way U-64158. (Copy of Right-of-Way is included in Appendix B.) Andalex will submit detailed plans for this installation at the appropriate time. The location of this breakout is shown on Plate ~~29~~5-19 (R.O.W.).

Mining in the Gilson seam began in October, 1980 with a single unit's production. As mining progresses, additional units will be added with three production units and the longwall scheduled to be operating by mid-1994. A systematic mining plan will be followed to assure maximum recovery. All planning and scheduled production, however, will be contingent upon the coal market. Upon the conclusion of mining activities in the area, the scheduled reclamation phase will begin immediately.

Andalex will fill, regrade and stabilize rills and gullies over 9 inches in depth. Further, Andalex has agreed to interim stabilization of all slopes and embankments within the disturbed area and has done so. One slope located at the bottom of the office driveway, has been attempted through hydroseeding, fertilizing and mulching techniques on three separate occasions. No significant erosion problems have occurred, Andalex will notify the Division in the event of any slides or other damage immediately by telephone and in writing.

Andalex will cover acid or toxic forming materials if any are encountered.

Andalex will advise the Division in the event of a temporary shutdown, such as a letter sent to the Division when Andalex's Apex Mine was temporarily closed.

R645-301-532. SEDIMENT CONTROL

See R645-301-733.

R645-301-532.100. MINIMIZING DISTURBANCES

Surface disturbances are minimal due to the nature of the mining activities. The permit area has been previously impacted by mining. Surface disturbances will be limited to the existing facilities which have been constructed. The total existing surface area disturbed is 47.19

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Existing facilities are indicated on Plate ~~6~~5-7 and 7.

The land affected by mining operations which shall be reclaimed, in compliance with the Mining and Reclamation Plan and all requirements of the Mined Land Reclamation Act and Rules and Regulations adopted in accordance therewith, can be described as follows:

47.19 acres located in T13S, R11E, S.L.B.&M., Carbon County, Utah and contained within,
SE 1/4 SW 1/4 Section 7
NE 1/4 SW 1/4 Section 7
SW 1/4 SE 1/4 Section 7
NW 1/4 SE 1/4 Section 7
SW 1/4 NE 1/4 Section 7
NE 1/4 NW 1/4 Section 18
NW 1/4 NE 1/4 Section 18

R645-301-532.200. STABILIZING BACKFILLED MATERIAL

Backfilling, Grading, and Soil Replacement and Stabilization

All disturbed areas will be backfilled and graded to as near as possible the approximate original contour, and to the most moderate slope possible. Slopes shall not exceed the angle of repose or such lessor slopes as required by the regulatory authority to maintain stability. Fill material will be compacted to assure stability.

~~All disturbed areas will be backfilled and graded to as near as possible the approximate original contour, and to the most moderate slope possible. Slopes shall not exceed the angle of repose or such lessor slopes as required by the regulatory authority to maintain stability. Fill material will be compacted to assure stability.~~

Andalex has had a slope stability study performed on a fill pad with a slope greater than 2h:1v and it was determined, even prior to compaction, that the fill had an adequate safety factor. Refer to Appendix K for this study done at the Pinnacle Mine. Andalex has committed to five years of monitoring of this site or whatever amount of time is necessary to assure stability of slopes has been achieved. It should be noted that all highwalls on Andalex's minesite are in or will be in bedrock. This is a steep sided, narrow canyon and Andalex will not be relieved of liability until reasonable stability has been achieved through compaction and revegetation. Steep slopes will be reclaimed according to the approved plan shown on Plates 14 and 15.

Areas to be regraded include the portal site, surface facility siteand roads. Because of the diversity of these areas, all regrading will conform to the specific site. Specific to high wall areas, some of the back filling will include excess spoil and underground development waste. We estimate this may be as much as 3000 yards of material. Please refer to Plate ~~15~~5-9 addendum for a detailed drawing on the high wall

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Andalex will rip the subsurface material to 6" using most likely a toothed motor grader or a disc, prior to soil redistribution.

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Andalex will distribute topsoil to a minimum depth of 6" as previously stated.

Andalex has already committed to testing of redistributed soil and fill material and has committed to use proper additives if it is discovered necessary. Specifically, Andalex will test for organic matter, phosphorous, potassium, pH, conductivity, and texture. The samples will be taken at 0-6 inches, 6-12 inches, and 12-24 inches at least 90 days prior to final reclamation.

R645-301-533. IMPOUNDMENTS

See R645-301-733..

R645-301-533.100. STABILITY

See R645-301-733..

R645-301-533.200. FOUNDATION DESIGN

Appendix K

R645-301-533.210. STABILITY

Appendix K

R645-301-533.220. PREPARATION

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Appendix K

R645-301-533.300. SLOPE PROTECTION

See R645-301-532.200.

R645-301-533.400. VEGETATION OF EMBANKMENTS

See R645-301-532.200.

R645-301-533.500. SUBMERGED HIGHWALLS

N/A

R645-301-533.600. MSHA IMPOUNDMENTS

N/A

R645-301-533.610. GEOTECHNICAL INVESTIGATIONS

N/A

R645-301-533.620. ENGINEERING DESIGN

See R645-301-733..

R645-301-533.700. NON-MSHA IMPOUNDMENTS DESIGN REQUIREMENTS

See R645-301-733..

R645-301-534. ROADS

See R645-301-512.250.

R645-301-534.100. DESIGN, USE AND RECLAMATION

See R645-301-512.250.

R645-301-534.110. DAMAGE TO PUBLIC OR PRIVATE PROPERTY

See R645-301-512.250.

R645-301-534.120. NON-ACID OR NONTOXIC FORMING SUBSTANCES IN ROAD SURFACING

No acid or toxic-forming substances will be used for road surfacing.

R645-301-534.130. FACTOR OF SAFETY FOR ROAD EMBANKMENTS

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See R645-301-512.250.

R645-301-534.200. SAFETY AND ENVIRONMENTAL PROTECTION

See R645-301-512.250.

R645-301-534.300. PRIMARY ROADS

See R645-301-512.250.

R645-301-534.310. LOCATION

See R645-301-512.250.

R645-301-534.320. SURFACING

See R645-301-512.250.

R645-301-534.330. MAINTENANCE

See R645-301-512.250.

R645-301-534.340. CULVERT DESIGN

See R645-301-512.250.

R645-301-535. SPOIL

See R645-301-513.300.

R645-301-535.100. DISPOSAL OF EXCESS SPOIL

See R645-301-513.300.

R645-301-535.110. MINIMUM FACTOR OF SAFETY

N/A

R645-301-535.111. LOCATION

N/A

R645-301-535.112. FOUNDATION INVESTIGATIONS

N/A

R645-301-535.113. **KEYWAY CUTS OR ROCK TOE BUTTRESSES**

N/A

R645-301-535.120. **EXCESS SPOIL DISPOSED OF IN UNDERGROUND MINE WORKINGS**

Return of Coal Processing Waste to Abandoned Underground Workings

As raw coal is hauled from the permit area, there will be no processing waste and no return of processing waste to underground workings. If in the future it is decided that a processing facility is to be incorporated, waste or reject would taken to an approved refuse disposal site. Please note that underground development waste rock generated by the Centennial Seam rock tunnels was disposed of underground in the existing Pinnacle Mine workings.

R645-301-535.130. **PLACEMENT OF EXCESS SPOIL**

There has been no development waste or excess spoil to date excepting sedimentation pond material.

Coal Processing Waste

The only coal processing waste to date is rock material manually separated from Andalex Resources' lump coal product at Wildcat. This is currently placed in an approved area at Wildcat Loadout. This MRP contains an Appendix Q. Appendix Q references the plan for reclamation of the waste rock pile at the Wildcat Loadout and should not be confused with the Centennial Reclamation Plan. Disposal of sediment pond material (temporary and permanent) is shown on Plate 5-7. ~~The only coal processing waste to date is rock material manually separated from Andalex Resources' lump coal product at Wildcat. This is currently placed in an approved area at Wildcat Loadout. This MRP contains an Appendix Q. Appendix Q references the plan for reclamation of the waste rock pile at the Wildcat Loadout and should not be confused with the Centennial Reclamation Plan. Disposal of sediment pond material (temporary and permanent) is shown on Plate 6.~~ Sediment pond waste has already been tested in one case to be non toxic and non acid forming and is being used currently in the Aberdeen Mine fill areas. Other material which is generated will be placed in temporary storage above the Apex Mine as shown on Plate ~~6~~5-7 and will be disposed of permanently as back fill in high walls upon final reclamation. This material will be tested prior to final reclamation if used for final reclamation purposes. Based on previous experience, Andalex estimates that up to 3,000 yards of material at most will be generated. This material is included in the earthwork estimates. Please note that the rock tunnels constructed to the Centennial coal seam generated significant amounts of waste rock. One hundred percent of this waste rock was disposed of underground in the existing Pinnacle Mine. None of the waste rock appeared at the surface.

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Coal Refuse

Please refer to Plate ~~6~~5-7 for location of disposal areas.

R645-301-535.140. SURFACE COAL OPERATIONS

N/A

R645-301-535.141. GEOLOGIC CONDITIONS

N/A

R645-301-535.142. SEEP AND SPRING SURVEY

N/A

R645-301-535.143. EFFECTS FROM SUBSIDENCE

N/A

R645-301-535.144. ROCK CHIMNEY CORES OR DRAINAGE BLANKETS

N/A

R645-301-535.145. STABILITY ANALYSIS

N/A

R645-301-535.150. SURFACE MINING OPERATIONS

N/A

R645-301-535.151. TEST BORINGS

N/A

R645-301-535.152. ENGINEERING SPECIFICATIONS FOR ROCK TOE BUTTRESS OR KEYWAY CUTS

N/A

R645-301-535.200. DISPOSAL OF EXCESS SPOIL: VALLEY FILLS / HEAD-OF-HOLLOW FILLS

N/A

R645-301-535.210. ROCK CORE CHIMNEY DRAINS

N/A

R645-301-535.220. DESIGN AND CONSTRUCTION OF THE FILL

N/A

R645-301-535.221. DESIGN REQUIREMENTS

N/A

R645-301-535.222. FILTER SYSTEM

N/A

R645-301-535.223. GRADING AND DRAINAGE

N/A

R645-301-535.300. DISPOSAL OF EXCESS SPOIL: DURABLE ROCK RILLS

N/A

R645-301-535.310. RESTRICTION

N/A

R645-301-535.320. REQUIREMENTS

N/A

R645-301-535.330. FACTOR OF SAFETY

N/A

R645-301-535.340. UNDERDRAIN SYSTEMS

N/A

R645-301-535.400. DISPOSAL OF EXCESS SPOIL: PRE-EXISTING BENCHES

N/A

R645-301-535.410. PLACEMENT

All disturbed areas will be backfilled and graded to as near as possible the approximate original contour, and to the most moderate slope possible. Slopes shall

not exceed the angle of repose or such lessor slopes as required by the regulatory authority to maintain stability. Fill material will be compacted to assure stability.

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Areas to be regraded include the portal site, surface facility site and roads. Because of the diversity of these areas, all regrading will conform to the specific site. Specific to high wall areas, some of the back filling will include excess spoil and underground development waste. We estimate this may be as much as 3000 yards of material. Please refer to Plate ~~15~~5-9 addendum for a detailed drawing on the high wall areas. The Aberdeen Mine high wall has been redrawn and back fills recalculated. Where slopes are greater than 2 to 1, before final reclamation is completed, slope stability studies will be performed as necessary. All information for slope stability studies will be included as part of the final reclamation package.

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R645-301-535.420. DESIGN

N/A

R645-301-535.430. GRADING AND HIGHWALL ELIMINATION

See R645-301-535.410.

R645-301-535.440. GRAVITY TRANSPORTATION

N/A

R645-301-535.441. HAZARDS

See R645-301-535.410.

R645-301-535.442. STABILITY

See R645-301-535.410.

R645-301-535.443. SAFETY BERMS

Appendix K

R645-301-535.444. FINAL DISPOSITION

See R645-301-535.410.

R645-301-535.500. FACEUP OPERATIONS

See R645-301-535.410.

R645-301-536. COAL MINE WASTE

See R645-301-528.300.

R645-301-536.100. DISPOSAL FACILITY

See R645-301-528.300.

R645-301-536.110. **STABILITY.**

N/A

R645-301-536.120. **FOUNDATION DESIGN.**

N/A

R645-301-536.200. **PLACEMENT.**

See R645-301-528.300.

R645-301-536.210. **CONSTRUCTION.**

See R645-301-528.300.

R645-301-536.220. **PUBLIC HAZARDS.**

See R645-301-528.300.

R645-301-536.230. **PREVENT COMBUSTION.**

See R645-301-528.300.

R645-301-536.300. **COAL MINE WASTE DISPOSED OF IN EXCESS SPOIL FILLS.**

See R645-301-528.300.

R645-301-536.310. **REQUIREMENTS.**

See R645-301-528.300.

R645-301-536.320. **NONTOXIC AND NON-ACID FORMING.**

See R645-301-528.300.

R645-301-536.330. **DESIGN STABILITY.**

See R645-301-528.300.

R645-301-536.400. **OTHER REQUIREMENTS.**

See R645-301-528.300.

R645-301-536.410. **RESTRICTIONS.**

N/A

R645-301-536.420. DESIGN PLAN

See R645-301-528.300.

R645-301-536.500. DISPOSAL OF COAL MINE WASTE IN SPECIAL AREAS

N/A

R645-301-536.510. OUTSIDE A PERMIT AREA

N/A

R645-301-536.520. UNDERGROUND DISPOSAL

See R645-301-528.300.

R645-301-536.600. UNDERGROUND DEVELOPMENT WASTE

See R645-301-528.300.

R645-301-536.700. COAL PROCESSING WASTE

See R645-301-528.300.

R645-301-536.800. COAL PROCESSING WASTE EMBANKMENTS

N/A

R645-301-536.810. REQUIREMENTS

N/A

R645-301-536.820. MSHA REQUIREMENTS

N/A

R645-301-821. BORINGS AND TEST PITS

N/A

R645-301-536.822. FOUNDATION DESIGN

N/A

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R645-301-536.823. SEEP AND SPRING SURVEYS

N/A

R645-301-536.824. HAZARDS

N/A

R645-301-536.900. REFUSE PILES

N/A

R645-301-537. REGRADED SLOPES

See R645-532.200.

R645-301-537.100. GEOTECHNICAL ANALYSIS

See R645-532.200.

R645-301-537.200. REGRADING SETTLED AND REVEGETATED FILLS

See R645-532.200.

R645-301-537.210. RESTRICTIONS

N/A

R645-301-537.220. LOCATION

See R645-532.200.

R645-301-537.230. ~~STABILITY~~STABILITY

See R645-532.200.

R645-301-537.240. VEGETATION AND SURFACE RUNOFF CONTROL

See R645-532.200.

R645-301-537.250. HAZARDOUS CONDITIONS

See R645-532.200.

R645-301-540. RECLAMATION PLAN

See R645-532.240.

R645-301-541. **GENERAL**

See R645-532.240.

R645-301-541.100. **CESSATION OF MINING OPERATIONS**

See R645-532.240.

R645-301-541.200. **REMOVAL OF FACILITIES**

See R645-532.240.

R645-301-541.300. **POSTMINING FACILITIES AND MONITORING**

See R645-301-711.500

R645-301-541.400. **COMPLIANCE REQUIREMENTS FOR RECLAMATION**

See R645-301-240.

R645-301-542. **NARRATIVES, MAPS AND PLANS**

See R645-301-510.

R645-301-542.100. **TIMETABLE**

See R645-301-240.

R645-301-542.200. **BACKFILLING AND GRADING PLAN**

See R645-301-532.200.

R645-301-542.300. **FINAL SURFACE CONFIGURATION MAPS**

Plates 16 & 17

R645-301-542.310. **CERTIFICATION REQUIREMENTS**

The maps and cross sections found in R645-301-521.140 have been certified as required.

R645-301-542.320. **PERMANENT FACILITIES**

R645-301-542.400. **FINAL ABANDONMENT OR BOND RELEASE**

R645-301-542.500. **IMPOUNDMENTS AND EMBANKMENTS**

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See R645-301-733.

R645-301-542.600. ROADS

Roads not to be retained for use under an approved post mining land use will be reclaimed immediately after it is no longer needed for mining and reclamation operations.

R645-301-542.610. CLOSURE

See R645-301-240.

R645-301-542.620. REMOVAL OF BRIDGES AND CULVERTS

Upon completion of mining activities, and following removal of surface structures, the earthwork portion of the reclamation plan will begin as described. The hydrologic portion of reclamation will take place in two phases including the left fork fan installation:

1. The main and side drainage channels will be restored as shown in the Sedimentation and Drainage Control Plan, and on Plate 16. Loose rock check dams will be placed at each side drainage entrance onto the reclaimed area, and at approximately 500' intervals along the restored main channel RC-1. (Typical sections of the loose rock check dams are shown in the Sedimentation and Drainage Control Plan).

   All disturbed diversions and sediment ponds "B" and "C" will also be removed at this time. Sediment Pond "E" will be enlarged, and the entire drainage above will flow into Pond "E-PM" through the restored channel RC-1.

2. Once revegetation and water quality standards are met, Pond "E-PM" will be removed, and the area reclaimed.

   Surface water monitoring will continue during this time as described. Please see Figure IV-11.

R645-301-542.630. TOPSOIL REPLACEMENT AND Revegetation

Backfilling, Grading, and Soil Replacement and Stabilization

All disturbed areas will be backfilled and graded to as near as possible the approximate original contour, and to the most moderate slope possible. Slopes shall not exceed the angle of repose or such lessor slopes as required by the regulatory authority to maintain stability. Fill material will be compacted to assure stability.

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R645-301-542.700. FINAL ABANDONMENT OF MINE OPENINGS AND DISPOSAL AREAS

Plates 6, 16, & 17

R645-301-542.710. DESCRIPTION

See R645-301-515.300.

R645-301-542.720. DISPOSAL OF EXCESS SPOIL

See R645-301-513.300.

R645-301-542.730. DISPOSAL OF COAL MINE WASTE

See R645-301-513.300.

R645-301-542.740. DISPOSAL OF NON-COAL MINE WASTES

See R645-301-513.300.

R645-301-542.741. PLACEMENT AND STORAGE

See R645-301-513.300.

R645-301-542.742. FINAL DISPOSAL

See R645-301-513.300.

R645-301-542.800. RECLAMATION COST ESTIMATE

See R645-301-240.

R645-301-550. RECLAMATION DESIGN CRITERIA AND PLANS

See R645-301-240.

R645-301-551. CASING AND SEALING OF UNDERGROUND OPENINGS

Casing and Sealing of Drill Holes

All exploratory drill holes have been sealed with cement and all water wells have been cased with steel casing and will be maintained. After mining is completed, the

water wells and monitoring wells will be sealed except in the event the state engineer allows them to remain opened for other purposes.

See R645-301-529.100.

R645-301-552. PERMANENT FEATURES

N/A

R645-301-552.100. SMALL DEPRESSIONS

Plates 16 & 17

R645-301-552.200. PERMANENT IMPOUNDMENTS

N/A

R645-301-553. BACKFILLING AND GRADING

See R645-301-532.200.

R645-301-553.100. DISTURBED AREAS

See R645-301-532.200.

R645-301-553.110. AOC REQUIREMENTS

See R645-301-532.200.

R645-301-553.120. HIGHWALL AND SPOILS PILE ELIMINATION

See R645-301-532.200.

R645-301-553.130. SLOPE PROTECTION AND STABILITY

See R645-301-532.200.

R645-301-553.140. EROSION AND WATER POLLUTION

See R645-301-532.200.

R645-301-553.150. SUPPORT POSTMINING LAND USE

Upon completion of Andalex Resources' mining operation, the land will continue to be used for grazing and hunting. The limited resources, both physical and scenic, will dictate no future change in the land status. The nature of an underground mine of this size requires minimal surface disturbance. All disturbed areas shall be restored in a

timely manner to conditions that are capable of supporting the uses which they were capable of supporting before any mining including high priority wildlife habitat. Andalex is not proposing an alternate post-mining land use. Andalex is not requesting an approval for an alternate post-mining land use. The anticipated post-mining land use is likely to be achieved and does not present any actual or probable hazard to public health or safety or threat of water diminution or pollution. The post-mining land use is practical and can be implemented immediately following reclamation and will not result in any violation of federal, state, or local law.

R645-301-553.200. SPOIL AND WASTE

See R645-301-513.300.

R645-301-553.210. REQUIREMENTS FOR DISPOSAL

See R645-301-513.300.

R645-301-553.221. CLEARING AND GRUBBING

N/A

R645-301-553.222. TOPSOIL REMOVAL AND STORAGE

See R645-301-231, -234.

R645-301-553.223. BACKFILLING AND GRADING

See R645-301-532.200.

R645-301-553.230. FINAL SURFACE GRADING

See R645-301-532.200.

R645-301-553.240. FINAL CONFIGURATION

Plates 16 & 17

R645-301-553.250. REFUSE PILES

N/A

R645-301-553.251. FINAL CONFIGURATION

N/A

R645-301-553.252. COVER REQUIREMENTS

N/A

R645-301-553.260. DISPOSAL OF COAL PROCESSING WASTES IN MINED-OUT SURFACE AREAS

N/A

R645-301-553.300. RESTRICTIONS AND REQUIREMENTS

N/A

R645-301-553.400. CUT-AND-FILL TERRACES

N/A

R645-301-553.410. COMPATIBILITY

N/A

R645-301-553.420. SPECIALIZED FACILITIES FOR IMPLEMENTING POSTMINING LAND USE

N/A

R645-301-553.500. PREVIOUSLY MINED AREAS

N/A

R645-301-553.510. RE-MINING AREAS CONTAINING HIGHWALLS

N/A

R645-301-553.520. HIGHWALL ELIMINATION

See R645-301-532.200.

R645-301-553.521. SPOIL AVAILABILITY

Old coal pads will be used for backfilling highwalls.

R645-301-553.522. BACKFILLING COMPATIBILITY

This is compatible with our refuse elimination plan.

R645-301-553.523. HIGHWALL REMNANTS

See R645-301-532.200.

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R645-301-553.524. **SPOIL PLACEMENT.**

See R645-301-553.221.

R645-301-553.600. **APPROXIMATE ORIGINAL CONTOUR.**

See R645-301-523.200.

R645-301-553.610. **VARIANCE REQUIREMENTS.**

See R645-301-523.200.

R645-301-553.620. **INCOMPLETE HIGHWALL ELIMINATION.**

See R645-301-523.200.

R645-301-553.630. **MOUNTAINTOP APPROVAL.**

N/A

R645-301-553.640. **SURFACE MINING OPERATIONS.**

N/A

R645-301-533.641. **THIN OVERBURDEN.**

N/A

R645-301-533.642. **THICK OVERBURDEN.**

N/A

R645-301-553.650. **UNDERGROUND MINING OPERATIONS.**

See R645-301-511.100.

R645-301-553.651. **RETAINED HIGHWALLS.**

See R645-301-532.200.

R645-301-553.652. **COMPATIBILITY.**

See R645-301-532.200.

R645-301-553.653. **GEOMORPHIC PROCESS.**

See R645-301-532.200.

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R645-301-553.700. **BACKFILLING AND GRADING: THIN OVERBURDEN**

N/A

R645-301-553.710. **AVAILABLE SPOIL MATERIALS**

N/A

R645-301-553.720. **REQUIREMENTS**

N/A

R645-301-553.800. **BACKFILLING AND GRADING: THICK OVERBURDEN**

N/A

R645-301-553.810. **FINAL GRADING**

N/A

R645-301-553.820. **REQUIREMENTS**

N/A

R645-301-553.830. **EXCESS SPOIL**

N/A

R645-301-553.900. **SETTLED AND REVEGETATED FILLS**

N/A

R645-301-560. **PERFORMANCE STANDARDS**

See R645-301-511.100.

ANDALEX RESOURCES, INC.
CENTENNIAL PROJECT

CHAPTER 6

Geology

C/007/019

~~(Revised)~~
~~July, 2014~~

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~~R645-301-600 GEOLOGY~~

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Table III-3 North American Drill Holes 6-8

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Plate 6-2 Geologic Cross Section References ~~6-19~~ and Drill Hole References

Plate 6-3 Cross Section A-A

Plate 6-4 Cross Section B-B

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Plate 6-5 Kenilworth Lease Geologic Cross Section

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R645-301-600. GEOLOGY

As the Mathis Tract and New Federal Summit Creek Lease boundary change is simply an extension of underground mine workings under roughly 2,500 feet of cover there will be absolutely no effect on geology other than as we proceed further to the north, the depth of cover increases.

The Kenilworth Tract will not require any changes to engineering practices currently employed at the Aberdeen Mine. The change simply involves an extension of underground mine workings and does not involve the surface in any way.

R645-301-610. INTRODUCTION

R645-301-611. GENERAL REQUIREMENTS

R645-301-611.100. GEOLOGY WITHIN AND ADJACENT TO THE PERMIT AREA

Introduction

The proposed permit area is in Book Cliffs which is the major physiographic feature in the region. The cliffs rise from a base at approximately 5,500 feet in elevation, to over 8,500 feet. Numerous canyons dissect the Book Cliffs. Soldier Creek and Coal Creek are the major area drainages. The permit area exhibits extreme topographic relief and is mountainous with steep cliffs and deeply incised drainages. With the exception of the Mancos Shale Formation, the Fiasco, Deadman, Straight Canyons, Hoffman Creek Canyon, Graves Lease and AEP Lease exhibit similar stratigraphic and topographic characteristics.

Tectonic Setting

The major coal seams of the Book Cliffs Coal Field lie within the Cretaceous Mesa Verde group which overlies the thick shales of the Cretaceous Mancos formation. The Mesa Verde group consists of the Star Point Sandstone, Blackhawk formation and Price River formation. The major coal seams lie within the Blackhawk formation.

The Tertiary Wasatch and Green River formations, along with the Price River formation, form the Roan Cliffs, the Tavaputs Plateau and the southern rim of the Uintah Basin. Lithologies present include fluvial, deltaic, and marine sandstones, mudstones, and shales.

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Geologic History

During the Triassic and Jurassic periods, the area of the Book Cliffs was relatively stable, but gradually subsided and received sediments. The area, assumed to have been a relatively flat lowland, was occasionally covered by a shallow sea of short geologic duration. A thick red bed sequence suggests tropical conditions and the great thickness of sand accumulation suggests
acid conditions. During Triassic times, the sediments probably came from all directions but, during the Jurassic time, the major source areas lay to the south and west.

During the early Cretaceous time, a trough developed in the Colorado Rockies area and the sea invaded. Gradually the sea crept westward as the trough continued to subside, reaching the east edge of the Colorado Plateau by the beginning of the Upper Cretaceous age.

Unconformities and thinning of various members indicate that volcanic activity to the west caused sediments to fill the basin faster than it could subside, causing the shoreline to be pushed eastward. When lulls in this activity developed, the incoming sediments diminished and the sea moved westward once more. With each pulse, the boundaries of the depositional environments moved eastward and then returned westward. The sandstone tongues of the Mesa Verde, which project into the Mancos, were deposited at these times.

After the sea retreated, the area continued to receive sediments under continental conditions which lasted well into Eocene time. In Oligocene time, the area began to rise in earnest. Erosion attacked the newly formed formation creating the present mountain ranges and cliffs.

Stratigraphy

The coal seams in the Blackhawk formation are listed stratigraphically:

- Upper Sunnyside Bed
- Lower Sunnyside Bed
- Centennial Bed
- Rock Canyon Bed
- Fishcreek Bed
- Gilson Bed
- Kenilworth Bed
- ~~Castlegate~~ Castle Gate "B" Bed
- ~~Castlegate~~ Castle Gate "A" Bed (Aberdeen)

Only the Lower Sunnyside, Centennial, Gilson, and ~~Castlegate~~Castle Gate "A" beds are formed in commercial thickness on the Centennial Property. Andalex has

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discovered a new coal seam which is referred to as the Centennial Seam. This coal was originally thought to have been in the Lower Sunnyside Seam. This coal has been accessed through rock tunnels from the existing Pinnacle Mine. Waste from these rock tunnels was disposed of in the Pinnacle Mine. The Mine in the Centennial Seam as well as the Mine in the Aberdeen Seam will both progress onto the Graves Lease. Andalex is applying for approval for the new AEP Lease in the Centennial and Aberdeen Seams only.

Stratigraphic sections of the coal beds are shown in Figures III-1 and III-2. Seam thicknesses are shown on Plates ~~26, 27, 28,~~ 5-3, 5-4, 5-5 and ~~29~~5-6.

Structure

The Book Cliffs are basically a homocline (dip slope) dipping into the Uintah Basin with the cliff front roughly paralleling the strike of the feature. The strike of the beds is generally parallel to the face of the Book Cliffs. The beds are mostly uniform with dips of from 3° to 8° to the north and northeast toward the Uintah Basin.

Occasional faults cut the coal measures but are of small displacement and have been of little consequence in mining. The most serious group of faults lies in the Sunnyside area. These faults, which have a maximum separation of 200 feet, effect mining, but, fortunately, are not closely spaced.

History of Mining

Mining has been the major industry in the region for many years. Coal was discovered in the Wasatch Plateau in 1874 and exploration soon spread to the Book Cliffs. Mines began operating in the area in 1889. The ~~castlegate~~Castle Gate and Sunnyside area was first developed, the areas in between being developed later. Coal was usually discovered away from settled areas and towns were built for employees by the companies.

Production from mines generally increased until 1920, but began to decline in the 1920's and 1930's. World War II brought production back to the 1920 levels and production continued to increase until 1957 when production again declined.

Book Cliff mines to present have produced about 75 percent of Utah's coal annually. Well over 200 million tons of coal have been extracted from the coal measures of the area. Much coal remains and numerous mines are presently operating in the area.

Geologic Hazard

There are occasional faults cutting the coal measures of the area. They are of relatively small displacement. The most serious faults occur in the Sunnyside area. There is no indication of faulting within our lease area.

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Faults in the Sunnyside district of the Book Cliffs field have been thought, by some, to have a causative relationship to the bounces experiences there. The outcrops on the lease premises and our own aerial photos have been carefully studied. In our judgement, no faults cut the lease area. There are also sandstone layers in excess of 150 feet in thickness that do not break up when mining. The ductile nature of the sandstone causes a buildup of energy in the coal layer. This energy buildup has the potential of being released violently. The bulk of the tonnage to be mined is under ~~less~~more than ~~1,500~~2,700 feet of cover, ~~with only a very limited amount of coal under cover,~~ increasing up to ~~2,700~~3,300 feet of cover. Water inflows have never been a problem in the Book Cliffs field. The dip of the coal measures prevents entrapment of personnel, in any event.

Structure

The structure between Deadman and Soldier Canyons is relatively simple. Structure contours are aligned basically east-west. The coal beds dip northward at approximately six degrees. No faults are thought to exist in the Deadman Canyon area.

History of Mining

Several small operations have mined a considerable amount of coal over the past 70 years in the Deadman Canyon Area. Mining ceased in the area in 1964. These mines, however, merely scratched the surface of the reserve. The remaining recoverable reserve is estimated to be greater than twenty-eight million tons and ranging in cover from 0 to 2,700 feet.

Identification of Strata

Strata disturbed by surface operations consist of sandstone and siltstone of a colluvial nature.

Statement of Borings and Samplings

Design of Boring and Sampling Program

Sites - Numbers, Location and Relationship to the Disturbed Area

The number, locations, and relationship of drill holes and sampling are indicated on Plates ~~26, 27~~5-3, 5-4, and ~~28~~5-5.

Methodology - Sample Collection, Compositing of Samples for Each Strata, Laboratory

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Samples of the immediate floor and roof below and above each seam were sampled using conventional core drilling equipment. Also, samples of the overburden which was disturbed in surface operation has been sampled by "grab" methods, as well as auger drilling.

Data

Field Log and Description of Samples - Lithologic Classification, Description, and Hydrologic Aspects

In November and December, 1971, a five-hole drilling program was conducted by Centennial Coal Associates, supplemented by mine samples and outcrop information, and the results used to estimate the coal reserves of the leases. Pertinent information on these drill holes is given in Table III-1 and Appendix E. Complete lithologic logs of each drill hole are included in Appendix E. Numerous samples were taken from the outcrops of the Lower Sunnyside, Gilson, and Aberdeen seams, as well as from mine faces in the Hileman, Olsen, Star Point, and Blue Flame No. 1 mines. Information from those samples as well as the location of the drill holes is shown on Plates ~~26, 27~~5-3, 5-4, and ~~28~~5-5.

TABLE III-1

Centennial Drill Holes

Number	Location	Total Depth	Coal Seams
DH-1	NW1/4 NW1/4 SE1/4 Sec. 8 T13S, R11E, SLBM Elevation - 7,230 ft.	516 ft.	Lower Sunnyside Gilson Aberdeen
DH-2	SW1/4 NW1/4 NW1/4 Sec. 7 T13S, R11E, SLBM Elevation - 7,275 ft.	580 ft.	Lower Sunnyside Gilson Aberdeen
DH-2-A	SW1/4 NW1/4 SE1/4 Sec. 7 T13S, R11E, SLBM Elevation - 7,165 ft.	303 ft.	Gilson Aberdeen
DH-5	SE1/4 SW1/4 NE1/4 Sec. 7 T13S, R11E, SLBM Elevation - 7,275 ft.	832 ft.	Lower Sunnyside Gilson Aberdeen
DH-6	NW1/4 SE1/4 SW1/4 Sec. 5 T13S, R11E, SLBM Elevation - 8,558 ft.	2,275 ft.	Lower Sunnyside Gilson Aberdeen

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In October and November, 1977, a seven-hole drilling program was conducted by Andalex in order to better define the coal reserves for mine planning on the Zion's fee. Pertinent information on these drill holes is presented in Table III-2. Complete lithologic logs of each drill hole are included in Appendix E. Locations are indicated on Plates ~~26, 27~~5-3, 5-4, and ~~28~~5-5. Andalex drilled six holes underground and one on the surface in the summer of 1989 (Drill hole numbers 89-1-AP, 89-2-AP, 89-3-AP, 89-1-PIN, 89-2-PIN, 89-3-PIN, 89-1-CP). These holes were primarily to substantiate the existence of the new Centennial Seam.

Andalex has also acquired lithologic logs of two drill holes completed by North American Coal Corp., in 1948 and one by Pacific Gas & Electric in 1980. Although these holes are not located within the permit area, but to the west and east of its boundary, the information has been utilized in estimating reserves. Pertinent information is given in Table III-3. Complete lithologic logs are included in Appendix E and their location is indicated on Plates ~~26, 27, 28,~~ 5-3, 5-4, 5-5 and ~~29~~5-6.

TABLE III-2
Andalex Drill Holes

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Number	Location	Total Depth	Coal Seams
77-1-CP	NE1/4 SE1/4 SW1/4	675 ft.	Gilson
	Sec. 7 T13S, R11E, SLBM		Aberdeen
	Elevation - 7,555 ft.		
77-2-CP	SE1/4 NE1/4 SW1/4	690 ft.	Gilson
	Sec. 7 T13S, R11E, SLBM		Aberdeen
	Elevation - 7,520 ft.		
77-3-CP	SE1/4 SE1/4 NW1/4	868 ft.	Lower Sunnyside
	Sec. 7 T13S, R11E, SLBM		Gilson
	Elevation - 7,425 ft.		Aberdeen
77-4-CP	SE1/4 SE1/4 SW1/4	105 ft.	Aberdeen
	Sec. 7 T13S, R11E, SLBM		
	Elevation - 7,070 ft.		

~~Table III-2 (Continued)~~

~~Number~~	~~Location~~	~~Total Depth~~	~~Coal Seams~~
77-5-CP	SE1/4 SE1/4 SW1/4	85 ft.	Aberdeen
	Sec. 7 T13S, R11E, SLBM		
	Elevation - 7,085 ft.		
77-6-CP	NE1/4 NE1/4 NW1/4	80 ft.	Aberdeen
	Sec. 18 T13S, R11E, SLBM		
	Elevation - 7,080 ft.		
77-7-CP	NE1/4 NE1/4 NW1/4	45 ft.	Aberdeen
	Sec. 18 T13S, R11E, SLBM		
	Elevation - 7,010 ft.		
89-1-AP	SW1/4 SE1/4 NW1/4	460 ft.	Centennial
	Sec. 7 T13S, R11E, SLBM		Aberdeen
	Elevation - 7,239 ft.		
89-2-AP	NE1/4 NW1/4 SW1/4	90 ft.	Centennial
	Sec. 7 T13S, R11E, SLBM		
	Elevation - 7,283 ft.		
89-3-AP	SW1/4 SE1/4 NW1/4	90 ft.	Centennial
	Sec. 7 T13S, R11E, SLBM		
	Elevation - 7,169 ft.		
89-1-PIN	SE1/4 NE1/4 SE1/4	260 ft.	Aberdeen
	Sec. 8 T13S, R11E, SLBM		
	Elevation - 6,951 ft.		
89-2-PIN	SW1/4 NW1/4 SW1/4	250 ft.	Aberdeen
	Sec. 8 T13S, R11E, SLBM		
	Elevation - 7,014		
89-3-PIN	NW1/4 SE1/4 SW1/4	240 ft.	Aberdeen
	Sec. 7 T13S, R11E, SLBM		

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	Elevation - 7,483 ft.		
89-1-CP	SE1/4 SE1/4 SW1/4 Sec. 6 T13S, R11E, SLBM Elevation - 8,307 ft.	1,880 ft.	Centennial Aberdeen

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TABLE III-3

North American Drill Holes

Number	Location	Total Depth	Coal Seams
DH-NACC-6	SE1/4 SE1/4 SE1/4 Sec. 1 T13S, R10E, SLBM ~~1,020 ft.~~ Elevation - 7,460 ft.	Approx. 1,020 ft	Centennial Gilson Aberdeen
DH-NACC-7	SW1/4 NE1/4 SE1/4 Sec. 12 T13S, R10E, SLBM Elevation - 7,192 ft.		Gilson Aberdeen

Pacific Gas and Electric Drill Hole

Number	Location	Total Depth	Coal Seams
CC9-1	NW1/4 NW1/4 NW1/4 Sec. 9 T13S, R11E, SLBM Elevation - 7,225 ft.	Approx. 930 ft.	Lower Sunnyside Gilson Aberdeen

Laboratory Analyses - Chemical Acidity, Toxicity, Alkalinity, and Physical (Erodibility and Compaction) Properties

Complete laboratory analysis is included in Appendix E. Appendix E has been updated to include coal quality information pertaining to the Centennial Seam.

Identification of Potential Acid, Toxic or Alkaline Producing Horizons

Refer to Appendix E for the laboratory analyses. Andalex has committed to sampling roof and floor material in all four coal seams in the most recently mine areas. This material will be analyzed for identification of Potential Acid, Toxic or Alkaline Producing Horizons. As this material is collected it will be placed into Appendix E with the rest of the laboratory data.

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Location of Subsurface Water at Face-Up Areas

No water was encountered at face-up areas.

Description of Coal Seams and Overburden - Mine Plan Area

General Description

Stratigraphy

There are four coal seams of minable thickness in the mine plan area. All four are part of the Blackhawk Formation of the Cretaceous Mesa Verde Group. The Blackhawk consists of three members. Stratigraphically, from bottom to top, they are the Aberdeen Member, the Kenilworth Member, and the Sunnyside Member (see Figure III-2).

The bottom coal seam is the Aberdeen (also known as the ~~castlegate~~Castle Gate "A" Seam). It is found in the Aberdeen Member of the Blackhawk. This coal seam rests directly on approximately 150 feet of basal sandstone. This sandstone is of littoral marine origin and is known as the Aberdeen Sandstone. The coal seam ranges from 4 feet to 13 feet in thickness over the property. Above the seam is approximately 90 feet of interbedded sandstone, siltstone, and carbonaceous shale containing coal riders.

The second seam is the Gilson Seam and ranges in thickness from 4 feet to 8 feet over the property. The Gilson is part of the Kenilworth Member of the Blackhawk. Directly below the Gilson is approximately 90 feet of interbedded sandstone, siltstone, and carbonaceous shale with coal riders. Below this is approximately 70 feet of barrier beach sandstone known as the Kenilworth Sandstone. Above the Gilson is approximately 100 feet of interbedded sandstone, siltstone, shale, and coal riders.

The third seam is the Centennial Seam ranging from 4' to 8' in thickness. The Centennial Seam is part of the Sunnyside member of the Blackhawk. The Centennial Seam lies approximately 40' below the Lower Sunnyside Sandstone. Below the Centennial Seam is approximately 130' of interbedded sandstone, siltstone, shale, and coal riders.

The top seam is the Lower Sunnyside Seam, ranging from 4 feet to 5 feet in thickness. The Lower Sunnyside is part of the Sunnyside Member of the Blackhawk. Below the coal seam is approximately 50 feet of barrier beach sandstone known as the Lower Sunnyside Sandstone. Above the coal seam is about 250 feet of interbedded sandstone, siltstone, shale, and coal riders.

Above the Blackhawk, the ~~castlegate~~Castle Gate Sandstone and Price River Formation of the Mesa Verde Group can be found over various parts of the property. The North Horn Formation is also present in certain areas of the property. Total overburden on the mine plan area ranges from 0 to ~~2,700 feet.~~3,300 feet. The bulk of overburden in the Kenilworth lease area ranges from 2,700 to 3,300 feet.

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There are unleased federally owned coal reserves adjacent to the permit area. Andalex has assumed ownership on part of this coal contained in the Graves Tract which is now a part of this MRP. Andalex will access this lease from the existing underground workings as has been done in the past when Andalex has added new leases. In addition to the Graves Tract there is still some unleased federal adjacent to the Centennial property which is of questionable value. The Centennial coal seam is accessed from the existing Pinnacle Mine which is in the Gilson Seam. It is accessed via rock tunnels which are approximately 500' in length. The Centennial and Aberdeen Seams on the AEP Lease will be accessed through an extension of existing underground workings.

The Aberdeen sandstone in our vicinity is 80 to 100 feet thick. Its lateral extent is from ~~Castlegate~~Castle Gate to well east of the Centennial property. It is a very well-known geologic marker in the Book Cliffs coal field. It is a medium grained, tightly cemented, cross bedded sandstone which contains very little or no water. It has been drilled into in every exploration hole in our leases. All other aquifers or water tables within our leases are perched.

Structure

Structure contours are aligned basically east-west. The coal beds dip northward at approximately six degrees. No faults are known to exist in the mine plan area. Overburden ranges from 0 to 2,700 feet.

Hydrologic Aspects

All groundwater exists as perched aquifers in the mine plan area. Due to the lenticular nature of the geology in the area, any groundwater is isolated and very limited. Please see Water Quality Data in Appendix L. Also, please note that the Sunedco property recently acquired by Andalex was included in the Vaughn Hansen/Andalex Hydrologic Inventory prepared for the original PAP and the emergency lease (please see Appendix L). Also included in Appendix L are the Graves and AEP PHC's.

The occurrence the Division has referred to where Andalex intercepted groundwater was actually not groundwater per se but water which had accumulated in old mine workings over a number of years (45 to 50 years). This was a one time occurrence. Water accumulates in small burned out voids because they are down dip from the burned outcrop. Andalex uses the practice of advanced drilling to avoid these areas. This is the only water which has been or will be encountered as the Andalex permit area is free from faulting or any other means of water conveyance.

Location of Subsurface Water

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Some of the sandstone beds of the Blackhawk Formation are water bearing in the mine plan area. Most of the beds are dry however, and partially drained of water near the cliff faces. Groundwater is perched due to the lenticular geology and any groundwater is isolated. The geology and specifically the lenticular nature of the beds on the new AEP lease are the same as what has been described in the original permit area. Also, any water bearing units are small in areal extent. The lowermost aquifer known in this area is the Aberdeen Sandstone, which is monitored below the lowermost coal seam. The newly acquired AEP Lease is included in the Andalex Hydrologic Inventory.

Detailed Analyses of Coal Seams and Surrounding Strata

Source of Data

Analysis was performed on rib samples and core samples obtained during the exploration activities described. Results of these analyses are listed according to seam in Appendix E.

Analysis was performed by: Commercial Testing and Engineering Company, 10775 East 51st Avenue, Denver, Colorado 80239, and other commercial testing laboratories.

Coal Seams

Total Sulfur Content

Please see Appendix E.

Other Characteristics

Please see Appendix E.

Stratum Immediately Overlying each Coal Seam to be Mined

Lithology (See Figure III-2)

Aberdeen Coal Seam (~~Castlegate~~Castle Gate "A") - overlying this seam is interbedded sandstone, siltstone, and carbonaceous shales of the Aberdeen Member of the Blackhawk.

Gilson Coal Seam - overlying this seam is interbedded sandstone, siltstone, and shale with coal riders of the Kenilworth Member of the Blackhawk.

Centennial Coal Seam - overlying is interbedded sandstone, siltstone, and shale, and coal riders of the Sunnyside Member of the Blackhawk.

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Lower Sunnyside Seam - overlying this seam is interbedded sandstone, siltstone, shale and coal riders of the Sunnyside Member of the Blackhawk.

It should be noted however, that the immediate "roof" over each seam is a sandstone unit, over which is found the silts, shales, and various coal riders.

Pyritic Content (Laboratory Analyses)

Complete analyses of these strata are included in Appendix E.

Potential Alkalinity (Laboratory Analyses)

Complete analyses of these strata are included in Appendix E.

Stratum Immediately Underlying Each Coal Seam to be Mined

Lithology (See Figure III-2)

Aberdeen (~~Castlegate~~Castle Gate "A" Seam) - underlying this seam is basal sandstone of littoral marine sandstone, the Aberdeen Sandstone of the Aberdeen Member.

Gilson Seam - underlying this seam is interbedded sandstone, siltstone, shale, and coal riders of the Kenilworth Member.

Centennial Seam - underlying this seam is interbedded sandstone, siltstone, and shale, and coal riders of the Kenilworth Member.

Lower Sunnyside Seam - underlying this seam is barrier beach sandstone, the Lower Sunnyside Sandstone of the Sunnyside Member.

It should be noted however, that the immediate "floor" below the seams is sandstone in the case of the Lower Sunnyside and Aberdeen; and beneath the Gilson, and Centennial, siltstone.

Pyritic Content (Laboratory Analyses)

Complete analyses of these strata are included in Appendix E.

Potential Alkalinity (Laboratory Analyses)

Complete analyses of these strata are included in Appendix E.

Clay Content (Laboratory Analyses)

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Complete analyses of these strata are included in Appendix E.

R645-301-611.200. PROPOSED OPERATIONS

See R645-301-551. and R645-301-529.100.

R645-301-612. CROSS SECTION, MAPS AND PLANS

See R645-301-510.

R645-301-620. ENVIRONMENTAL DESCRIPTION

See R645-301-510.

R645-301-621. GENERAL REQUIREMENTS

See R645-301-510.

R645-301-622. CROSS SECTIONS, MAPS AND PLANS

Plates ~~21, 22, 23 & 24~~6-1, 6-2, 6-3, and 6-4.

R645-301-662.100. TEST BORINGS AND CORE SAMPLINGS

Appendix E

R645-301-622.200. COAL SEAMS AND BURDEN

Appendix E

R645-301-622.300. COAL OUTCROPS

Plates ~~26, 27, 28, 29~~5-3, 5-4, 5-5, and 5-6.

R645-301-622.400. GAS AND OIL WELLS

N/A

R645-301-623. GEOLOGIC INFORMATION

See R645-301-611.100.

R645-301-623.100. POTENTIALLY ACID OR TOXIC FORMING STRATA

Appendix E

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R645-301-623.200. RECLAMATION REQUIREMENTS

See R645-301-240.

R645-301-623.300. SUBSIDENCE CONTROL PLAN

See R645-301-525.

R645-301-624. GEOLOGIC INFORMATION

See R645-301-611.100.

R645-301-624.100. DESCRIPTION

~~See R645-301-611.100.~~

~~**R645-301-624.100. DESCRIPTION**~~

See R645-301-611.100.

R645-301-624.110. CROSS SECTIONS, MAPS AND PLANS

See R645-301-510.

R645-301-624.120. OTHER INFORMATION

Alternative Water Supply Information

The underground coal mining activities will not result in any contamination, diminution, or interruption of any underground or surface water sources within the proposed mine plan or adjacent areas for domestic agricultural industry or any other legitimate use as the underground mining activities will not encounter any aquifers and there are no springs to interrupt.

There have been no changes in Andalex Resources' water rights. The wells, however, could be left open if a need other than Andalex's arose, with the permission of the State Engineer. Other water rights controlled by Andalex could be dedicated to a water right proven to be affected by Andalex's activities. Andalex controls 19 shares of primary water which could be used to supplement any interrupted water rights. There are no oil and gas wells in the vicinity of Andalex's permit area. There are no water wells in the area except on Andalex's surface facility, these are shown on figure 5 Appendix L, also in Appendix L tables 1 and 5 depict current existing water rights.

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R645-301-624.130. GEOLOGIC LITERATURE AND PRACTICES

See R645-301-611.100.

R645-301-624.200. SAMPLING AND ANALYSIS

Appendix E

R645-301-624.210. LOGS

Appendix E

R645-301-624.220. CHEMICAL ANALYSES

Appendix E

R645-301-624.230. ACID OR TOXIC FORMING MATERIALS

Appendix E, R645-301-513.300.

R645-301-624.300. TEST BORINGS AND DRILL CORES

Appendix E

R645-301-624.310. ~~LOGS~~LOGS

Appendix E

R645-301-624.320. ACID OR TOXIC FORMING MATERIALS

Appendix E, R645-301-513.300.

R645-301-624.330. CHEMICAL ANALYSES

Appendix E

R645-301-624.340. ROOF AND FLOOR MATERIALS

The Andalex mine property rarely encounters clays or clay-like rock in either the immediate roof or floor. The only clays encountered to date have been in the Aberdeen Seam where upon contact with water, the floor material became soft. The clay material in

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the floor has been local and temporary. To date, there has been no clay or clay-like material in the immediate roof of any of the coal seams.

Appendix E

R645-301-625. ADDITIONAL INFORMATION

Appendix E

R645-301-626. WAIVER FROM COLLECTION AND ANALYSIS

N/A

R645-301-627. OVERBURDEN

N/A

R645-301-630. OPERATION PLAN

See R645-301-511.100.

R645-301-631. CASING AND SEALING OF EXPLORATION HOLES AND BOREHOLES

See R645-301-551.

R645-301-631.100. TEMPORARY CASING AND SEALING OF DRILLED HOLES

N/A

R645-301-631.200. PERMANENT CASING AND SEALING OF EXPLORATION HOLES AND BOREHOLES

See R645-301-551.

R645-301-632. SUBSIDENCE MONITORING

See R645-301-525.

R645-301-632.100. DEGREE OF SUBSIDENCE

See R645-301-525.

R645-301-632.200. MONITORING LOCATIONS

See R645-301-525.

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R645-301-640. PERFORMANCE STANDARDS

See R645-301-551 and R645-301-529.100.

R645-301-641. ALL EXPLORATION HOLES AND BOREHOLES

See R645-301-551 and R645-301-529.100.

R645-301-642. MONUMENTS AND SURFACE MARKERS

See R645-301-525.170

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ANDALEX RESOURCES, INC.
CENTENNIAL PROJECT

CHAPTER 7

Hydrology

C/007/019

~~(Revised)~~
~~December 2014~~

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List of ~~Attachments~~Plates

~~Attachment~~**Plate 7-1** Watershed and Culvert Sizing and Revegetation Reference Areas

Plate 7-2 Support Facilities - Surface Area Drainage

Plate 7-3 Regional Surface and Ground Water Rights Map

Plate 7-4 Sediment Pond 'B' - As Constructed

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Plate 7-7 Seep / Spring Survey Map

Plate 7-8 Ground and Surface Water Monitoring Locations

Plate 7-9 Reclamation Watershed Map

Plate 7-10 Post Mining Hydrology ~~Calculations~~ - Final Reclamation Plan - Deadman Canyon Phase 1

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Plate 7-11 Post Mining Hydrology - Final Reclamation Plan - Deadman Canyon Phase 2

R645-301-700. HYDROLOGY

The Kenilworth Lease boundary change will not encroach into any new hydrologic basins which are not addressed in the existing MRP (see ~~plate 29~~Plate 1-2). Seeps located within this boundary change have been addressed in the new Kenilworth Lease PHC. (see PHC for the entire lease area).

SEE ALSO APPENDICES L, N, AND O

R645-301-710. INTRODUCTION

R645-301-711. GENERAL REQUIREMENTS

Hydrologic Protection Facilities

Sewage System

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The nature of the overburden in the area offers excellent drainage. As a result, a septic system with drain fields conforming to the state codes has been established to handle the waste water disposal from the bathhouse and office facilities. The drain fields are located in native material (valley fill) cast of the bath houses in the parking area. Enclosed as Appendix G are the two septic system plans as designed by a Utah Registered Professional Engineer and approved by the State of Utah Department of Health.

Water Treatment

Based on the State of Utah, Department of Health review of the septic systems, water treatment is not needed. (Personal communication, Mr. Gerald Story, Utah Department of Health, Price, Utah).

Drainage Control - Diversions, etc.

See R645-301-733.

Sediment Control

See R645-301-733.

R645-301-711.100. EXISTING HYDROLOGIC RESOURCES

Appendix L

R645-301-711.200. POTENTIAL IMPACTS TO THE HYDROLOGIC BALANCE

Appendix L - Potential Hydrologic Consequences

R645-301-711.300. COMPLIANCE WITH HYDROLOGIC DESIGN CRITERIA

Protection of Hydrologic Balance and Compliance with Water Quality Laws

Andalex will follow its approved "Sedimentation and Drainage Control Plan" and comply with the U.P.D.E.S. Permit UT0025674 (see Appendix J). Currently, this permit

authorizes four discharge points; two from sedimentation ponds (001, 003) and two from the underground mine (002 and 004). See IV-11

Andalex has approval from the State Engineer, Division of Water Rights, to collect runoff water from the disturbed area for use as a dust suppressant in the underground mining operation. This runoff is a result of direct precipitation with the runoff area.

Andalex will comply with the Clean Water Act (33 U.S.C. Sec. 1251 et seq.) and all other applicable water quality laws and health and safety standards.

Surface and Groundwater Monitoring

This monitoring plan is an up-to-date, comprehensive plan that describes all current water monitoring requirements. It supersedes all other versions of monitoring plans that have been previously developed for the Centennial Mine and that may be contained in various appendices to this MRP. In the past, as the mining area expanded, changes were made to the permit boundary, and new monitoring sites were added. As a result, several different monitoring plans have been developed for the Centennial Mine. These were described to varying extents in separate Probable Hydrologic Consequences (PHC) determinations that are appended to MRP.

The plan written here draws from the various monitoring plans that have previously been written and approved. It is also based upon an assessment of monitoring data collected to date, and accounts for the status of the mine as inoperable. It meets the requirements of R645-301-731.211 and R645-301-731.221, i.e., to document the suitability of water for current and approved postmining land uses and for protecting the hydrologic balance. Should operations be reinitiated, this monitoring plan will be reexamined for adequacy, and dropped monitoring sites may be picked back up and/or new sites may be added. Any such changes to the monitoring will be reflected in revisions to this section.

Removal of Monitoring Points

As allowed by R645-301-731.214 and R645-301-731.224, several sites that have been monitored for many years have been omitted from this plan. Sites in Hoffman Canyon (S25-1 and 25-2), Straight Canyon (8-1 and 17-2), and Star Point Fork (17-1 and 18-2) will no longer be monitored. All of these sites are located within or near the eastern portion of the MRP boundary, and were never undermined. The closest mining was completed in 1993 and was about half a mile away from the sites, as shown on Figure 7-1. Further, site 12-1, located in Alrad Canyon in the southwest corner of the permit area, has been omitted from this plan.

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In addition, there are numerous sites to the north and west of the permit area which have been omitted from this plan. As shown on Figure 7-1, stream ~~site~~sites B32, B263 ~~is~~and B262 are located ~~more than a~~approximately 1 mile away from the nearest current underground mining, and stream sites AC-1 and SC-1 are three-quarters of a mile from the closest mine works. ~~Four spring or seep sites (B351, B352, B261, and B362) are similarly located well away from any recent mining.~~ It should also be noted that at these sites the overburden is 3000' deep or greater. ~~All mining in the Aberdeen Mine (Tower Mine) was discontinued in mid-2007, the mine has been shut down and sealed up, and there are not any immediate plans to reopen the mine in the foreseeable future. Therefore, there is no continued need for monitoring.~~

If the Kenilworth lease is mined sites ~~B263,~~B261, and B362~~,~~ and ~~B351~~B33 will be monitored according to the recommendations found in the 4 December 2014 PHC.

Last, one other stream site and one stock pond site within the permit area is also being omitted from the monitoring plan. Ephemeral wash site 7-1 is located upstream of the main surface facilities and is typically dry. Because site 18-4 monitors the same stream further downstream and because operations have ceased, 18-4 is sufficient for tracking potential impacts in this drainage. Site 7-1 was never undermined, and the nearest second-mining (nearly one-half mile away) was completed in 1998. The stock pond site 31-1 is located over ~~a~~an inter-panel barrier pillar and was never undermined. The nearest second mining was done in 2004. Overburden cover at this location is 2500' and subsidence survey show that the area has not been subject to subsidence
Further justification for discontinuing monitoring at all of the above-mentioned sites is provided below.

As mentioned above, ANDALEX has long-completed mining under Hoffman Canyon; there were no surface facilities associated with mining in that area and there has been no subsidence reported during annual surveys. Because the spring (S25-1) flows only intermittently and the stream (25-2) flows only ephemerally, few samples have been collected. However, based upon the available data, there has not been any material damage to the hydrologic balance, and postmining land uses have not been compromised. Nor would there be any potential for this to occur in the future from these completed activities.

Similarly, ANDALEX completed mining under Straight Canyon (8-1) in 1995. Site 17-2 was never undermined, and the last mining in the area (nearly half mile away) was done in 1995. The situation is similar for sites in Starpoint Fork (17-1 and 18-2). These sites were originally designated for monitoring to indicate effects of proposed surface

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facilities in those canyons (Vaughn Hansen Associates 1981); these facilities were never constructed and are no longer proposed. Further, annual subsidence surveys have not indicated subsidence. Though there have been few opportunities to collect water quality samples from these ephemeral channels, available data has not indicated any material damage to the hydrologic balance, and postmining land uses have not been compromised. Nor would there be any potential for this to occur in the future from these completed activities. In addition, the same can be said for site 7-1 in Deadman Canyon above the surface facilities and the continuation of monitoring at site 18-4 ensures that water quality in this watershed is being tracked.

Site 12-1 is located in an ephemeral channel that drains Alrad Canyon. This site was added to the monitoring plan a number of years ago as part of a permit amendment; its purpose was to ensure that any surface runoff effects due to mining could be documented. The site has served its purpose and no effects have been noted during the many years of quaterly monitoring. Located in the southwest corner of the permit area, Alrad Canyon was never undermined, and the closest second-mining (a half-mile away) was completed in 2000.

The Deep Canyon site (B-263) is on an intermittently flowing stream that is more than 7500 feet north of the current second-mined area. It was added to the Centennial monitoring plan in 2005, but has been monitored by others as part of the Willow Creek MRP for many years. The Atone Creek site (AC-1) is also an intermittently flowing stream that was added to the monitoring plan in 2005; it is approximately 4500 feet north of the nearest second-mined area. The perennially flowing SC-1 is located below forks of Summit Creek, and is approximately 3800 feet north of the mined area. It has been monitored by ANDALEX since 2004. Although portions of the watersheds of these three streams have been undermined, surface effects from subsidence have not been noted, in part due to the fact that cover ranges from 2,500 to 3,000 feet in these areas.

~~If the Kenilworth lease is mined site AC-1, will be monitored according to the 4 December 2014 PHC.~~

Regarding the four above-mentioned spring or seep sites, similar rationale is used to justify their removal from the monitoring plan. In Mathis Canyon, B351 is a small perennially flowing spring which has been monitored by ANDALEX since 2002 and was previously monitored as part of the Willow Creek MRP. The closest that mining came to that water source was 3500 feet, and that occurred in mid-2007. B352 has a similar monitoring history, though this small seep is almost always dry; while somewhat closer to the mined area, there is no mining-related mechanism by which future impacts to its hydrologic balance could occur. A small seep (B261), which may at times support runoff

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flows stored in Pace Pond, is also a former Willow Creek MRP monitoring site, which was taken over by ANDALEX in 2005; it has been dry in recent years. It is located outside of the permit area and 5500 feet north of second-mined areas. Another seep, which has also been dry essentially throughout its monitoring history (beginning in 2005 for ANDALEX and previously by Willow Creek), is known as B362. It is located on the edge of the permit area, at 3000 feet cover, and has not been undermined.

Last, the stock pond 31-1 was monitored to track any subsidence-related damages. It collects surface runoff and during quarterly monitoring a qualitative record is simply made of whether inflow or outflow is occurring, and the approximately percentage of storage which is currently being used. The nearest mining was in 2004, and at a cover of 2500 feet, no effects from subsidence have been noted.

In addition to the monitoring points discussed above, if the Kenilworth lease is mined sites ~~B21,~~B121 (well), B353, B271, B341, and will be monitored according to the 4 December 2014 PHC recommendations.

~~In sum, none of the above mentioned sites are needed any longer to ensure protection of the hydrologic balance. Further, there is no mechanism by which future mining related impacts to these water sources could occur, given the current conditions. Should mining be planned for the future, all of these sites have a record with which background conditions could be demonstrated, and any or all of them could be placed back in the plan to collect more data in the future if need be.~~

The need for an in-mine well is not anticipated due to the history of the mine. Due to the terrain, and to ensure no further surface disturbance occurs, the section of the Kenilworth lease that is located west of B341 and B271, and below B341 will be monitored at the in-mine monitoring points UG-101, UG 102 and UG103. Any seepage, if any, found at these monitoring points underground will be monitored quarterly.

The following describes the monitoring plan currently in place, including designation of the sites remaining in the plan, as well as the monitoring methodology, parameter lists, and frequency.

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Location of Monitoring Points

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~~**Groundwater**~~

Table A Water Monitoring Sites

Site ID	UTM location	Description
Well No. 1	39°42.365' N 110°43.736' W	Well in Deadman Canyon, completed in Aberdeen Sandstone (first aquifer below coal seam
S18-1	39°41.581' N 110°43.959' W	Spring in Deadman Canyon below confluence with left and Right Forks Deadman Canyon; stratigraphically below coal seam
18-3	39°41.763' N 110°44.022' W	Left Fork Deadman Canyon above confluence with Right Fork Deadman Canyon, ephemeral stream
18-4	39°41.749' N 110°43.908' W	Right Fork Deadman Canyon below main surface facilities, ephemeral stream
B342	39° 44.612' N 110° 46.793' W	On top of Kenilworth- Small stream with man-made pipe diversions to cow troughs.
B352	39° 44.041' N 110° 45.595' W	On top of Kenilworth – Small seep in heavily brushy area.
B261	39° 45.012' N 110° 45.610' W	On top of Kenilworth – Small spring Located in Deep Canyon
B341	39° 44.417' N	On top of Kenilworth – a small 2' channel with a man- made stick dam

110° 46.967' W across it. The furthest west location on the permit area.

B271 39° 44.913' N On top of Kenilworth – Culvert along main road.
110° 47.132' W

B351 39° 44.188' N On top of Kenilworth – approximately 3' stream along
110° 46.182' W east side of Jeep Trail Road.

B353 39° 44.516' N On top of Kenilworth – Located on west side of Jeep
110° 46.378' W Trail Road

B121 39°42.686' N Well located in Alrad Canyon
110°45.484' W

B33 39°45.244' N On top of Kenilworth – Spring located on the
110°47.545' W outermost edge of the permit boundary.

B261 39°45.118' N Pace Pond - Deep Canyon
110°45.362' W

B362 39°44.741' N Antone Canyon
110°44.714' W

UG101 39°44.014' N In-Mine monitoring point - West Mains
110°46.540' W

UG102 39°44.345' N In-Mine monitoring point - North Mains
110°47.821' W

UG103 39°45.197' N In-Mine monitoring point - Gateroad
110°47.282' W

Groundwater monitoring includes two types of sites: underground water intercepted by a well; and springs representing surface expressions of natural groundwater discharge. Locations of these sites are depicted on ~~Figure IV-11 (and also Figure~~Plate 7-~~1), and they are briefly described below in Table a~~9.

~~**Table a Groundwater Monitoring Sites**~~

~~Site ID~~	~~UTM location~~	~~Description~~
~~Well No. 1~~	~~523236.53 N 4395172.22 E~~	~~Well in Deadman Canyon, completed in Aberdeen Sandstone (first aquifer below coal seam)~~

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S18-1	522923.25 N 4393720.43 E	Spring in Deadman Canyon below confluence with Left and Right Forks Deadman Canyon; stratigraphically below coal seam

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Surface Water

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All surface water monitoring locations are shown on Figure IV-11. These monitoring sites are listed and briefly described below in Table b. Further, four Plate 7-9. Four storm water or mine water discharge outfalls at the Centennial Mine are monitored as required under a UPDES Permit, administered by the Utah Division of Water Quality. They are also shown on Figure IV-11 Plate 7-9.

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Table b Surface Water Monitoring Sites

Site ID	UTM location	Description
18-3	522832.11 N 4394057.30 E	Left Fork Deadman Canyon above confluence with Right Fork Deadman Canyon, ephemeral stream
18-4	522995.07 N 4394031.23 E	Right Fork Deadman Canyon below main surface facilities, ephemeral stream

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Methodology and Parameters to be Monitored

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Flow rate will be measured at all spring and stream sites using equipment and methods that are appropriate for the amount of flow. Streams will typically be measured with a current meter using the velocity/area approach, a submerged float/area method, or with a portable, calibrated flume. Springs will typically be measured volumetrically with piping, a known-volume container, and a stopwatch. Notes on flow extent will be made if appropriate. If flow rate is so reduced that it is not possible to measure (i.e. at a seasonal spring where saturated areas are present but no flow is visible), or if no flow is occurring (i.e. at an ephemeral stream site), notes will be made describing the site condition (saturation, ponding, dry but recent flows apparent, etc.) Static water level will be recorded

at the monitoring well using a well sounder, and purged before samples are taken. Stock pond sites will be observed for incoming flow, outgoing flow, and approximate percentage of storage; these are reported qualitatively with no quantitative measurements made and no samples collected.

Water temperature, pH, and conductivity will be measured in the field using equipment that has been properly maintained and calibrated. Dissolved oxygen will also be measured in the field at all flowing stream sites. These field parameters will be measured at locations appropriate to the site: for streams, in mid-stream, non-stagnant water, with temperature measurements occurring in shaded areas where possible; and for springs, as near to the source as possible. The monitoring well will be purged prior to measuring field parameters.

Samples for chemical analysis follow requirements of UAC R645-301-723. The parameter list for surface waters (except stock ponds as described above) is shown in Table ~~c~~C (Page7-8), and the list for groundwater is shown in Table ~~d~~D (Page 7-8). Any samples collected at the four UPDES outfalls will analyzed for the parameters required by the UPDES permit.

When feasible, field filtering is done prior to filling a bottle for dissolved metals analysis. Samples are stored in iced coolers and submitted to a contract lab using proper chain-of-custody procedures. The lab will be certified for all parameters that it analyzes.

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Table C Surface Water Parameter List

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Field Parameters
pH Water temperature
Conductivity Dissolved oxygen
Flow rate
Laboratory Parameters
Bicarbonate Alkalinity
Carbonate TDS
Calcium (dissolved) Hardness
Chloride Iron (total and dissolved)
Magnesium (dissolved) Manganese (total and dissolved)
Potassium (dissolved) Oil & Grease
Sodium (dissolved) TSS
Sulfate Cation/anion balance

Table ~~e Surface Water Parameter List~~

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~~Field Parameters~~	
~~pH~~	~~Water temperature~~
~~Conductivity~~	~~Dissolved oxygen~~
~~Flow rate~~	
~~Laboratory Parameters~~	
~~Bicarbonate~~	~~Alkalinity~~
~~Carbonate~~	~~TDS~~
~~Calcium (dissolved)~~	~~Hardness~~
~~Chloride~~	~~Iron (total and dissolved)~~
~~Magnesium (dissolved)~~	~~Manganese (total and dissolved)~~

~~Potassium (dissolved)~~	~~Oil & Grease~~
~~Sodium (dissolved)~~	~~TSS~~
~~Sulfate~~	~~Cation/anion balance~~

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~~Table d~~D **Groundwater Parameter List**

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~~Field Parameters~~	
~~pH~~	~~Water Temperature~~
~~Conductivity~~	~~Static water level or flow rate~~
~~Laboratory Parameters~~	
~~Bicarbonate~~	~~Sulfate~~
~~Carbonate~~	~~Alkalinity~~
~~Calcium (dissolved)~~	~~TDS~~
~~Chloride~~	~~Hardness~~
~~Magnesium (dissolved)~~	~~Iron (total and dissolved)~~
~~Potassium (dissolved)~~	~~Manganese (total and dissolved)~~
~~Sodium (dissolved)~~	~~Cation/anion balance~~

Field Parameters
pH Water Temperature
Conductivity Static water level or flow rate
Laboratory Parameters
Bicarbonate Sulfate
Carbonate Alkalinity
Calcium (dissolved) TDS

Chloride Hardness
Magnesium (dissolved) Iron (total and dissolved)
Potassium (dissolved) Manganese (total and dissolved)
Sodium (dissolved) Cation/anion balance

Frequency

Surface water and groundwater monitoring sites will be ~~visited~~monitored quarterly, ~~when~~if accessible. Due to weather, the steep grade of the access road is impassible year-round. When flowing, field measurements will be made and samples are collected for lab analysis. When not flowing, condition will be documented and subsequently reported.

UPDES outfall sites will be on a monthly monitoring schedule, as required by the UPDES permit.

Quarterly monitoring results will be reported electronically to ~~UDOGM's~~UDOGM's on-line database.

Post-Mining Monitoring

During the reclamation period, Andalex Resources will establish an additional monitoring station at the entrance to the sedimentation pond (Pond E-PM). This station will be monitored on the same frequency and for the same parameters as the NPDES point to be maintained at the pond outlet. All other water monitoring sites will be maintained and monitored during the reclamation period. The sites will be monitored bi-annually for the parameters listed in the Division guidelines (1986), and reported to the Division bi-annually.

There are no acid or toxic-forming materials brought to the surface. No mine development waste is brought to the surface.

R645-301-711.400. APPLICABLE HYDROLOGIC PERFORMANCE STANDARDS

All applicable hydrologic performance standards will be met.

R645-301-711.500. RECLAMATION ACTIVITIES

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Post Mining Hydrology

Upon completion of mining activities, and following removal of surface structures, the earthwork portion of the reclamation plan will begin as described. The hydrologic portion of reclamation will take place in two phases.

~~**Post Mining Hydrology**~~

~~Upon completion of mining activities, and following removal of surface structures, the earthwork portion of the reclamation plan will begin as described. The hydrologic portion of reclamation will take place in two phases~~:

1. ~~1.~~ The main and side drainage channels will be restored as shown in the Sedimentation and Drainage Control Plan, and on ~~Plate 16~~7-12. Loose rock check dams will be placed at each side drainage entrance onto the reclaimed area, and at approximately 500' intervals along the restored main channel RC-1. (Typical sections of the loose rock check dams are shown in the Sedimentation and Drainage Control Plan).

All disturbed diversions and sediment ponds "B" and "C" will also be removed at this time. Sediment Pond "E" will be enlarged, and the entire drainage above will flow into Pond "E-PM" through the restored channel RC-1.

It should be noted that the main road going through the minesite and continuing on will be left intact as part of the post-mining use.

2. Once revegetation and water quality standards are met, Pond "E-PM" will be removed, and the area reclaimed.

Surface water monitoring will continue during this time as described. Please see ~~Figure IV-11~~Plate 7-9.

Surface water monitoring will continue during this time as described. Please see ~~Figure IV-11~~Plate 7-9.

R645-301-712. CERTIFICATION

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Construction Specifications for Sedimentation Ponds

All construction of sedimentation ponds have been performed under the direction of a qualified registered professional engineer.

Dams are constructed with primary overflows at least 2 ft. from the top, and emergency overflows at least 1.5 ft. from the top.

The areas of the pond construction had been examined for topsoil, and if present in removable quantities such soil was removed separately and stored in an approved topsoil storage location.

In areas where fill was to be placed, natural ground was removed for at least 12" below the base of the structure.

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Figure IV-11

Location of Ground Water &
Surface Water Monitoring Station

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Native materials were used where practical. Fill was placed in lifts not exceeding 15" and compacted prior to placement of the next lift. Compaction of all fill materials is at least 95%.

Grouted rip-rap or culverts have been placed at all inlets and outlets to prevent scouring.

Each pond is fitted with an inverted inlet to the primary overflow, to prevent the passage of oil into the discharge.

Slopes of the dams are not steeper than 2.0:1, inside and outside, with a total of the inslope and outslope not less than 5:1. The inside slope of Pond E exceeded the steepness of 2:1. In part these slopes are incised and in part are constructed in from fill. Because of the steepness of these side slopes an investigation of stability was performed by Palmer Wilding Engineers. The conclusion was that the stability analysis is adequate and a stable section with respect to shear under static loading conditions is indicated. Please Appendix K.

~~Slopes of the dams are not steeper than 2.0:1, inside and outside, with a total of the inslope and outslope not less than 5:1. The inside slope of Pond E exceeded the steepness of 2:1. In part these slopes are incised and in part are constructed in from fill. Because of the steepness of these side slopes an investigation of stability was performed by Palmer Wilding Engineers. The conclusion was that the stability analysis is adequate and a stable section with respect to shear under static loading conditions is indicated. Please Appendix K.~~

Tops and external slopes of the dams were planted with an approved seed mix to prevent erosion and promote stability. Compaction of the slopes were at least 95%.

Top width of dams are not less than (H + 35)/5.

R645-301-713. INSPECTION

Sedimentation Pond Specifications

Location

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~~Sedimentation Pond Specifications~~

~~Location~~

The ponds are located over the main drainage of the Right Fork of Deadman Canyon. The main canyon drainage is routed through a 36-42" culvert located under the ponds. The sites are located downslope of the disturbed areas to simplify collection of runoff water (please see Plate ~~8~~7-2).

Design

The ponds are designed to fully contain the expected runoff and sediment load from a 10-year 24-hour precipitation event in this area. Pond "C" has additionally been shown to fully contain the runoff from a 100-year 6-hour storm. The design has been certified by a registered professional engineer. A certification statement for the ponds can be found at the end of Appendix N.

Construction

The construction of the ponds have been completed as per the specifications set forth in the Construction Specifications sheet (part 2.3).

Capacity

Each pond is designed to contain the runoff and sediment load from a 10-year 24-hour precipitation event in the area of drainage. In addition, each pond has an overflow capacity in excess of that required for a 25-year 24-hour event. Pond "C" has been designed to contain and pass the runoff from a 100-year 6-hour event.

Safety Precautions

The ponds were built as per specifications and under supervision of a qualified, registered professional engineer. The ponds are inspected quarterly for safety and compliance. Inspection reports are maintained on-site, and submitted to the Division on an annual basis. Ponds will be cleaned at minimum when sediment reaches 60% of designed sediment volume. Measuring devices will be installed in the ponds to show when the ponds have filled with sediment to the clean-out level (please see plates ~~11, 12~~7-4, 7-5, and ~~13~~7-7). Drainage directly into the Pinnacle and Apex Portals is not part of the calculation for sediment pond sizing. (Pond C)

Monitoring

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Water monitoring stations will be established at the outlet of the ponds. Sample parameters and frequencies shall be as per specification of the NPDES permit.

Maintenance

The ponds shall be inspected after each storm and the sediment cleaned as necessary. In no event shall sediment be allowed to build beyond 60% of sediment design capacity.

Seeding

An approved seed mix will be applied to all feasible disturbed areas in an effort to minimize erosion and sediment loading to the ponds. The proper seed mixture for this area has been obtained through the local BLM.

Culverts

All culverts are shown on Plate ~~9~~7-1. Calculations for sizing are also included. It should be noted that all culvert sizes were arrived at and approved through consultation with the DOGM hydrologic engineer.

Calculations

The following reflects the calculations for sizing and details of each separate pond. Plates ~~6~~7-4 through ~~13~~7-7 show pond locations and volumes as well as watershed areas.

See R645-301-512-240, Construction Specifications for Sedimentation Ponds

R645-301-720. ENVIRONMENTAL DESCRIPTION

Appendix L

R645-301-721. GENERAL REQUIREMENTS

Appendix L

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R645-301-722. CROSS SECTIONS AND MAPS

See R645-301-510.

R645-301-722.100. LOCATION AND EXTENT OF SUBSURFACE WATER

Appendix L

R645-301-722.200. LOCATION OF SURFACE WATER BODIES

Appendix L

R645-301-722.300 MONITORING STATIONS

Protection of Hydrologic Balance and Compliance with Water Quality Laws

Andalex will follow its approved "Sedimentation and Drainage Control Plan" (please see R645-301-733.) and comply with the N.P.D.E.S. Permit No. UTG-040007 issued July, 1989 (see Appendix J). Please note this permit authorizes three discharge points; two from sedimentation ponds (001, 003) and one from the underground mine (002). See IV-11 and R645-301-711.300.

Andalex will comply with the Clean Water Act (33 U.S.C. Sec. 1251 et seq.) and all other applicable water quality laws and health and safety standards.

R645-301-722.400. WATER WELLS

See R645-301-711.300.

~~Andalex will comply with the Clean Water Act (33 U.S.C. Sec. 1251 et seq.) and all other applicable water quality laws and health and safety standards.~~

~~**R645-301-722.400. WATER WELLS**~~

~~See R645-301-711.300.~~

R645-301-722.500. EXISTING LAND SURFACE CONFIGURATION

Plate ~~6~~5-7

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R645-301-723. SAMPLING AND ANALYSIS

Appendix L

~~Appendix L~~

R645-301-724. BASELINE INFORMATION

Appendix L

R645-301-724.100. GROUND WATER INFORMATION

Appendix L

R645-301-724.200. SURFACE WATER INFORMATION

~~Appendix L~~

~~**R645-301-724.100. GROUND WATER INFORMATION**~~

~~Appendix L~~

~~**R645-301-724.200. SURFACE WATER INFORMATION**~~

Appendix L

R645-301-724.300. GEOLOGIC INFORMATION

Appendix L

~~Appendix L~~

R645-301-724.310. PROBABLE HYDROLOGIC CONSEQUENCES

Appendix L

~~Appendix L~~

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R645-301-724.320. RECLAIMABILITY

Post Mining Hydrology

Upon completion of mining activities, and following removal of surface structures, the earthwork portion of the reclamation plan will begin as described. The hydrologic portion of reclamation will take place in two phases

~~**Post Mining Hydrology**~~

~~Upon completion of mining activities, and following removal of surface structures, the earthwork portion of the reclamation plan will begin as described. The hydrologic portion of reclamation will take place in two phases~~ including the left hand fork fan installation:

1. The main and side drainage channels will be restored as shown in the Sedimentation and Drainage Control Plan, and on Plate ~~16~~7-12. Loose rock check dams will be placed at each side drainage entrance onto the reclaimed area, and at approximately 500' intervals along the restored main channel RC-1. (Typical sections of the loose rock check dams are shown in the Sedimentation and Drainage Control Plan).

All disturbed diversions and sediment ponds "B" and "C" will also be removed at this time. Sediment Pond "E" will be enlarged, and the entire drainage above will flow into Pond "E-PM" through the restored channel RC-1.

2. Once revegetation and water quality standards are met, Pond "E-PM" will be removed, and the area reclaimed.

Surface water monitoring will continue during this time as described. Please see ~~Figure IV-11~~Plate 7-9.

R645-301-724.400. CLIMATOLOGICAL INFORMATION

Introduction

The permit area, which is part of the Book Cliffs coal field, is located in a mid-latitude steppe climate with the land below the cliffs approaching desert conditions. The nearest weather recording station is located approximately 10 miles southwest of the Zion's fee in Price, Utah.

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Temperatures at the site are 3 to 5o F cooler than at Price, 10 miles south and 1,200 feet lower. Average monthly temperatures at Price range from 25o F in January to 70-75o in July and August. Extreme temperatures of record are -31o and 108o F. Due to the elevation, and a predominance of clear skies and dry air, daily temperature ranges are rather large, averaging 26 degrees in winter and 33 degrees in summer. Average annual precipitation is 12 inches at the portal and may be as much as 16 inches at the higher parts of the lease area. The 100-year 6-hour precipitation is about 2 inches. Snowfall is generally light, averaging less than 33 inches annually, at Price. Potential evaporation is about 36 inches per year. The area is almost completely surrounded by mountains which act as a barrier to storms approaching from every direction except south.

Source of Data

National Oceanic and Atmospheric ~~Administration~~Administration, National Climatic Center, Asheville, North Carolina.

Department of the Interior, 1979, Final Environmental Statement, Development of Coal Resources in Central Utah.

Climatological Factors

Precipitation

The precipitation in the area, which is largely controlled by elevation, varies from five inches to 20 inches.

The principal rainfall is in late summer when the area is occasionally subjected to thunderstorm activity associated with moisture-laden air masses moving in from the Gulf of Mexico.

Snowfall is generally light, averaging less than 33 inches annually; however, as much as 95 inches have been reported in a single winter season.

The greatest and least monthly precipitation totals for the period of record are shown on Table III-4 following this page.

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TABLE III-4

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~~TABLE III-4~~

Maximum and Minimum Monthly Precipitation

Month	Medium	Greatest	Year	Least	Year
January	0.60	2.50	1969	0	1948
February	0.61	2.44	1919	0	1967
March	0.83	2.58	1912	0	1934
April	0.47	2.22	1941	0	1948
May	0.46	2.19	1964	0	1927
June	0.54	3.69	1927	0	1950
July	0.73	3.84	1914	0.05	1963
August	1.05	4.32	1921	0	1911
September	0.60	5.91	1927	0	1934
October	0.90	4.34	1972	0	1952
November	0.38	2.84	1957	0	1932
December	0.60	2.86	1966	0	1930
Annual	9.47	19.55	1927	4.47	1942

The first column contains median precipitation values by month for the 30 year period from 1936-1965.

Extremes of precipitation occurring prior to 1936 are as follows:

Amount	Date
0.83	January, 1921
0.98	March, 1929
2.00	August, 1921
1.65	October, 1925

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~~Figure~~

Table III-4 (Continued)

~~Price~~ **Climatological Summary**

Monthly Average 1936-1965

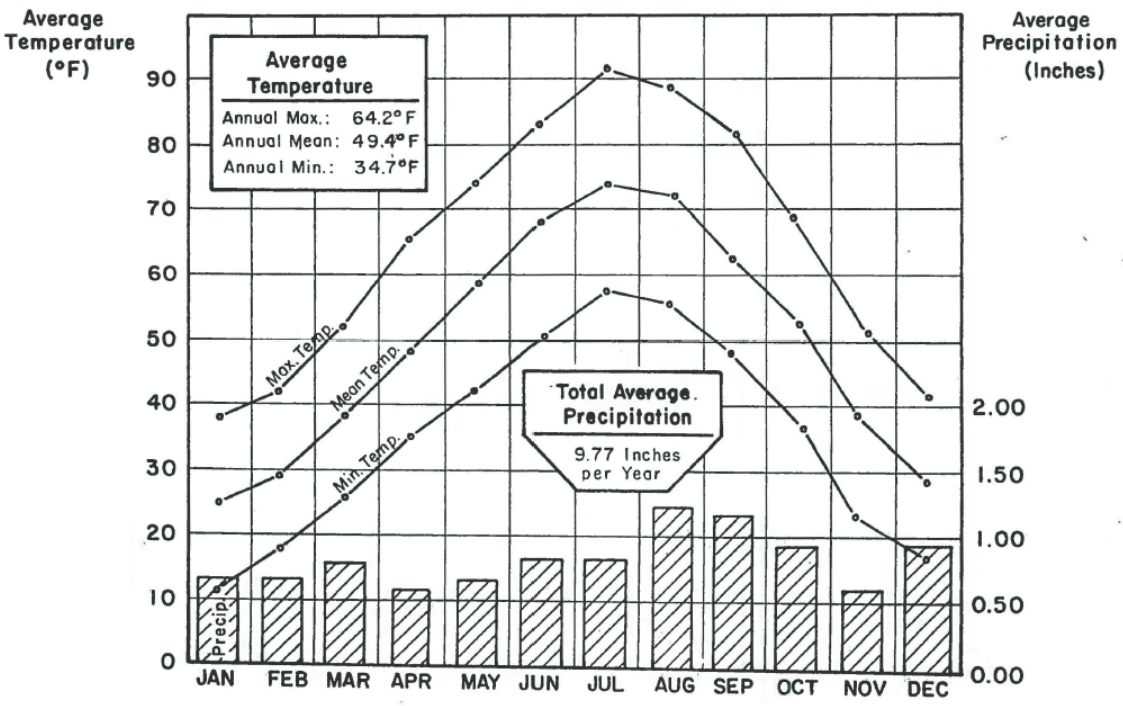

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TABLE III-5

ESTIMATED RETURN PERIODS FOR SHORT DURATION PRECIPITATION
(inches)

Station: Price Elevation: 5680
Latitude: 39° 37' Longitude: 110° 50'

DURATION

Years	5 Min	10 Min	15 Min	30 Min	1 Hr	2 Hr	3 Hr	6 Hr	12 Hr	24 Hr
1	.08	.13	.17	.23	.29	.37	.44	.62	.78	.95
2	.12	.18	.23	.32	.40	.49	.58	.80	1.00	1.20
5	.16	.25	.32	.44	.56	.68	.79	1.07	1.32	1.58
10	.20	.31	.39	.54	.68	.81	.94	1.25	1.53	1.82
25	.24	.37	.47	.65	.82	.98	1.13	1.50	1.83	2.18
50	.28	.43	.54	.75	.95	1.12	1.29	1.71	2.08	2.47
100	.31	.49	.62	.85	1.08	1.27	1.45	1.91	2.32	2.74

ESTIMATED RETURN PERIODS FOR SHORT DURATION PRECIPITATION
(Inches)

Station: Price Elevation: 5680
Latitude: 39* 37' Longitude: 110* 50'

Duration

YEARS	5 Min	10 Min	15 Min	30 Min	1Hour	2 Hour	3 Hour	6 Hour	12 Hour	24 Hour
1	0.08	0.13	0.17	0.23	0.29	0.37	0.44	0.62	0.78	0.95
2	0.12	0.18	0.23	0.32	0.40	0.49	0.58	0.80	1.00	1.20
5	0.16	0.25	0.32	0.44	0.56	0.68	0.79	1.07	1.32	1.58
10	0.20	0.31	0.39	0.54	0.68	0.81	0.94	1.25	1.53	1.82
25	0.25	0.37	0.47	0.65	0.82	0.98	1.13	1.50	1.83	2.18
50	0.28	0.43	0.54	0.75	0.95	1.12	1.29	1.71	2.08	2.47
100	0.31	0.49	0.62	0.85	1.08	1.27	1.45	1.91	2.32	2.74

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Table III-6 ~~shows the average~~
Average monthly precipitation for the period 1936-1976.

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Total Precipitation (Inches)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Annl
1936	0.51	1.21	0.54	0.15	0.20	0.55	2.73	1.72	0.70	1.00	0.05	2.08	11.44
1937	1.37	1.08	0.96	0.08	1.45	0.68	1.11	0.68	1.15	0.44	0.08	0.95	10.03
1938	0.56	0.39	1.81	0.13	1.12	1.22	0.91	1.05	1.57	1.53	0.20	0.58	11.07
1939	1.03	1.00	1.24	0.48	0.68	0.25	0.44	0.87	3.88	0.89	0.15	0.25	11.16
1940	1.77	1.40	0.15	0.57	0.21	0.50	0.10	1.12	4.39	0.76	0.32	0.83	12.12
1941	0.92	1.04	1.23	2.22	1.26	1.47	0.75	0.57	1.02	3.24	0.73	1.03	15.48
1942	0.16	0.23	0.43	0.72	0.04	0.00	0.33	0.59	0.40	1.14	0.25	0.18	4.47
1943	0.37	0.45	0.90	0.55	0.40	1.40	0.19	1.05	0.95	1.04	1.16	0.30	8.76
1944	1.38	0.62	1.29	1.86	0.80	1.10	0.35	0.30	0.02	0.31	0.56	0.18	8.77
1945	0.41	1.17	0.91	0.21	0.13	1.28	0.69	0.82	0.51	0.94	0.32	0.57	7.96
1946	0.44	T	1.04	0.23	0.24	0.02	0.38	1.06	0.05	1.76	1.45	0.92	7.59
1947	0.13	0.12	0.19	0.37	1.34	0.70	0.14	2.83	0.07	0.90	0.41	0.93	8.13
1948	0.00	0.59	0.40	0.00	0.07	1.41	0.90	0.66	0.22	1.58	0.09	1.55	7.47
1949	1.60	0.74	0.11	0.22	1.66	3.24	1.89	1.22	0.66	1.73	0.01	2.35	15.43
1950	0.92	0.27	0.37	0.08	0.14	0.00	1.98	0.11	0.70	T	0.56	0.49	5.62
1951	0.03	0.07	0.74	1.08	0.88	1.89	0.26	1.85	0.16	0.98	1.22	2.80	11.26
1952	1.09	0.17	1.97	0.81	0.79	1.06	0.27	1.59	0.37	0.00	0.21	1.58	9.91
1953	0.43	0.12	0.24	0.45	0.42	0.15	1.67	1.12	0.04	1.39	0.43	0.17	6.63
1954	0.76	T	0.80	0.57	0.35	0.52	1.80	0.92	2.38	0.79	0.49	0.62	10.00
1955	1.06	1.40	0.09	0.05	0.39	0.38	0.30	1.52	0.31	0.01	0.17	0.38	6.06
1956	1.44	0.15	0.00	0.35	0.44	T	0.69	0.42	0.15	0.50	0.00	0.19	4.33
1957	0.87	0.63	0.40	0.65	1.86	1.20	1.07	2.30	T	1.86	2.84	0.98	14.66
1958	0.10	1.17	2.12	0.81	1.19	0.12	0.10	0.83	1.41	0.22	0.43	0.06	8.56
1959	0.06	1.57	0.12	0.59	0.66	0.25	0.75	2.09	1.18	0.45	0.17	1.04	8.93
1960	0.98	1.20	-	0.51	0.40	0.31	0.54	0.23	1.35	2.93	0.67	0.00	-
1961	0.00	0.03	1.02	0.23	0.11	0.08	0.76	2.43	4.85	1.06	0.88	0.82	12.27
1962	0.92	2.36	0.58	0.13	0.23	0.26	0.70	0.00	2.07	1.05	0.03	0.05	8.38
1963	0.68	0.32	0.73	1.50	0.12	0.58	0.05	3.33	1.89	0.76	0.18	0.02	10.16
1964	0.12	0.06	1.06	1.05	2.19	0.76	-	1.26	0.33	0.01	0.69	2.29	-
1965	0.32	-	1.28	-	-	3.31	1.79	1.24	0.98	0.32	2.06	2.47	-

Total Precipitation (Inches)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Annl
1966	.00	.87	.12	.00	.57	.32	1.16	1.25	.50	1.14	.14	2.86	8.93
1967	1.06	.00	.29	.65	1.40	1.42	.84	.66	1.14	.08	.19	2.01	9.74
1968	.48	1.11	1.04	1.41	1.03	-----	.79	1.82	.29	.49	T	.96	-----
1969	2.50	1.37	.24	.28	.37	2.41	1.46	1.83	.59	.38	.33	.10	11.86
1970	.77	.01	.48	.12	.03	2.11	.65	.82	1.03	.56	.38	.38	7.34
1971	.22	.35	.03	.61	.80	.17	.68	.89	.24	3.26	.22	1.51	8.98
1972	.00	.00	.00	.19	.21	.66	.33	.91	1.33	4.34	.83	.68	9.48
1973	.62	.41	1.51	.84	1.15	1.40	1.97	1.17	.21	.56	.42	.36	10.62
1974	.81	.10	.07	.56	T	.04	2.12	.35	.21	4.08	.22	.53	9.09
1975	.76	.69	1.11	T	.74	.92	1.54	.06	1.26	.14	.45	.08	7.75
1976	T	1.16	.20	.91	.77	.13	.39	.30	1.62	.37	.03	.00	5.88

Source: National Oceanic and Atmospheric Administration,
National Climatic Center,
Asheville, North Carolina

Table III-~~6 Continued~~7:

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~~The climatology~~Climatology summary by month for period 1936-1965 ~~is given in Table III-7.~~

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Climatological Summary

Means and Extremes for Period 1936 - 1965

Month	Temperature (°F)							Precipitation Totals (Inches)								Mean Number of days				
				Extremes							Snow, Sleet						Temperatures			
																	Max.		Min.	
	Daily Maximum	Daily Minimum	Monthly	Record Highest	Year	Record Lowest	Year	Mean	Greatest Daily	Year	Mean	Maximum Monthly	Year	Greatest Daily	Year	Precip. + .1"	90° and above	32° and below	32° and below	0° and below
Jan.	37.1	11.0	24.1	58	1961	-29	1937	.68	.67	1956	9.2	21.5	1944	8.5	1956	2	0	8	31	4
Feb.	42.3	17.4	29.8	68	1958	-17	1963	.68	.80	1962	7.0	27.0	1939	13.0	1939	2	0	4	27	3
Mar.	51.6	25.2	38.4	75	1956	-7	1964	.78	.97	1938	3.9	26.0	1952	6.0	1963	3	0	-	27	-
Apr.	63.8	34.2	49.0	86	1946	8	1945	.57	.66	1944	0.1	2.0	1944	2.0	1944	2	0	0	12	0
May	74.1	42.9	58.5	94	1962	20	1959	.68	1.45	1937	0.4	10.0	1964	8.0	1964	2	1	0	2	0
June	83.6	50.0	66.9	101	1954	29	1939	.80	1.47	1941	0.0	T	1955	0.0		2	7	0	-	0
July	90.6	56.7	73.7	106	1938	40	1962	.82	1.05	1954	0.0	T	1954	0.0		2	20	0	0	0
Aug.	88.2	55.3	71.7	102	1940	32	1960	1.19	1.03	1949	0.0	0.0		0.0		3	12	0	-	0
Sep.	80.0	47.2	63.6	96	1950	23	1938	1.13	1.67	1962	0.1	2.5	1965	2.5	1965	3	2	0	6	0
Oct.	67.7	36.6	52.2	87	1963	15	1960	.99	1.75	1960	0.2	4.5	1949	3.5	1949	3	0	0	8	0
Nov.	50.5	23.7	37.1	73	1962	0	1959	.56	1.97	1957	2.4	12.5	1951	8.0	1951	2	0	-	26	-
Dec.	40.6	15.9	28.2	60	1962	-10	1948	.89	1.07	1964	8.8	42.0	1951	13.0	1951	3	0	6	28	2
Year	64.2	34.7	49.4	106	July 1938	-29	Jan. 1937	9.77	1.97	Nov. 1957	32.1	42.0	Dec. 1951	13.0	Dec. 1951	29	42	18	167	9

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Temperature

The average annual maximum temperature for the period 1936-1976 was 64.2 degrees. The annual mean temperature was 49.4 degrees and the annual minimum temperature was 34.7 degrees. See Figure III-4.

Summers are characterized by hot days and cool nights. However, the high temperatures are not oppressive since the relative humidity is low. The hottest month is July with the maximum temperature on most days nears 90 degrees and the lows in the upper 50's. The maximum temperature record was in July, 1925 at 108 degrees. Recorded summer lows have been 28 degrees in June, 1973 and 31 degrees in July, 1924.

The winters are cold and ~~uncomfortable~~uncomfortable, but usually not severe, due in part to the protecting influence of the mountain ranges to the north and east which prevent cold arctic air masses from moving into the area. The coldest temperature on record is minus 31 degrees in December, 1924.

Temperatures of 100 degrees or higher during summer or 15 degrees below zero or colder during winter are likely to occur once every three years.

The freeze-free period, or growing season, averages about five months in length, from early May to early October.

Average dates of occurrence of various temperature values are given on Table III-8.

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TABLE III-8

Occurrence of Various Temperatures

Temperature Equal to or Lower Than	Average Dates of Occurrence Last in Spring	First in Fall
32o	May 3	October 3
28o	April 27	October 15
24o	April 11	October 15
20o	March 29	November 7
16o	March 17	November 16

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TABLE III-9 ~~gives the average~~

Average monthly temperature for the area from 1936 - 1976.

Average Temperature (°F)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Annl
1936	23.8	31.6	41.0	52.0	61.6	70.2	73.0	71.3	-	-	-	27.6	-
1937	26.0	20.1	37.5	44.5	-	66.1	72.9	75.6	-	52.6	38.6	31.4	-
1938	27.0	32.4	39.0	48.7	55.4	69.4	73.7	73.2	64.8	50.4	29.8	28.4	49.4
1939	24.2	16.1	39.0	51.2	60.3	64.8	-	73.0	63.0	50.0	41.7	32.6	-
1940	23.0	32.2	40.7	50.0	65.6	72.7	73.2	74.4	62.5	54.5	33.3	27.6	50.7
1941	21.8	31.4	41.4	43.9	58.3	-	70.6	70.0	58.9	47.6	37.6	29.9	-
1942	23.4	27.0	35.6	49.0	54.6	67.8	73.2	70.8	61.4	-	-	-	-
1943	24.9	-	-	-	-	66.4	75.1	71.8	67.4	54.0	39.1	31.3	-
1944	23.8	28.2	37.8	46.5	68.9	62.8	73.6	72.6	66.4	55.1	38.6	31.2	49.6
1945	30.5	35.4	38.5	45.0	59.6	63.9	74.5	73.0	62.5	52.6	35.2	23.3	49.5
1946	22.8	31.0	42.7	56.0	57.2	69.8	75.7	72.6	65.4	46.8	36.3	33.6	50.8
1947	25.8	36.3	43.4	49.0	62.6	63.8	75.2	71.2	67.2	56.0	33.2	29.0	51.1
1948	28.6	29.0	34.2	49.1	60.2	67.2	74.0	72.4	67.4	51.1	33.5	25.1	49.3
1949	16.9	20.1	41.2	54.1	58.8	63.6	74.3	72.5	66.0	47.8	43.5	23.6	48.5
1950	17.6	30.5	39.5	51.2	56.2	67.4	69.7	71.1	62.7	56.1	40.9	34.4	49.8
1951	27.7	32.0	39.2	50.0	58.8	64.4	76.9	71.6	65.2	50.3	34.2	20.8	49.3
1952	19.9	25.6	32.4	52.0	61.1	67.9	74.9	72.7	65.9	56.0	35.3	23.9	49.0
1953	28.1	31.9	42.3	47.8	52.9	-	76.6	70.5	66.6	52.6	40.3	27.5	-
1954	30.5	40.6	38.7	54.4	63.2	67.7	76.9	71.3	64.1	53.5	42.5	25.4	52.4
1955	18.0	17.1	35.3	46.6	57.9	66.0	74.7	74.0	66.1	53.3	35.3	30.8	47.9
1956	33.1	28.2	42.2	50.0	61.3	72.1	74.8	70.4	67.7	52.4	33.2	26.3	51.0
1957	24.4	33.9	42.5	47.2	54.8	68.3	73.5	-	-	49.5	33.7	29.4	-
1958	28.8	37.3	35.9	44.8	60.3	67.4	70.7	73.7	62.6	52.9	36.8	33.7	50.4
1959	27.4	32.8	38.9	48.8	54.9	69.4	73.8	70.6	62.4	52.2	38.1	30.6	50.0
1960	19.4	23.2	-	50.8	57.4	67.9	74.1	71.2	64.2	52.6	39.4	31.7	49.3
1961	29.0	33.4	38.2	46.1	57.5	69.8	73.6	61.4	55.3	47.9	33.8	23.5	48.3
1962	24.3	32.7	34.6	52.3	55.3	66.2	71.4	69.6	61.8	52.4	42.3	29.8	49.4
1963	16.3	38.0	36.4	45.2	60.3	63.7	73.7	70.0	64.4	55.3	39.1	25.6	49.0
1964	23.3	27.5	30.4	45.0	55.1	63.2	-	68.9	60.8	53.4	32.6	23.9	-
1965	31.5	-	37.1	-	-	62.0	69.9	68.5	54.8	53.6	41.4	26.9	-
1966	M	25.6	38.8	48.6	58.7	63.5	73.1	70.1	60.7	51.5	39.7	26.2	----
1967	22.0	30.8	39.9	41.7	52.8	61.0	73.4	71.2	62.7	51.1	42.4	17.8	47.2
1968	15.8	32.2	40.7	42.5	53.3	----	73.7	67.3	62.6	53.1	39.3	23.8	----
1969	26.8	25.8	33.0	50.4	61.6	64.1	75.5	75.4	65.6	45.2	39.0	33.3	49.6
1970	28.6	37.7	38.2	43.0	59.1	67.5	75.4	75.4	60.6	48.1	39.7	28.3	50.1
1971	27.8	33.4	37.6	48.1	55.3	67.6	74.3	75.4	59.7	49.6	35.8	24.7	49.1
1972	27.8	35.6	47.4	48.3	59.7	68.4	76.7	73.9	63.9	52.3	35.0	22.0	50.9
1973	16.9	26.8	37.1	45.1	57.9	65.1	71.9	72.3	63.9	55.7	38.4	29.2	48.4
1974	18.6	23.2	42.1	45.0	61.6	74.2	78.0	73.6	68.4	M	M	31.3	----
1975	25.0	31.6	41.3	43.7	53.6	59.9	72.3	71.0	63.9	52.1	M	----	----
1976	25.5	36.2	38.2	46.8	58.1	65.4	76.0	70.4	64.0	50.5	-----	----	----

Source: National Oceanic and Atmospheric Administration,
National Climatic Center,
Asheville, North Carolina

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~~Table III-9 continued~~
~~Page Two~~

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Winds

Winds are light to moderate, although strong winds may occur. The average velocity of the prevailing southwest winds is below 20 mph with peak wind velocities occurring in June and July.

R645-301-724.410. CLIMATOLOGICAL FACTORS

See R645-301-724.400.

R645-301-724.411. AVERAGE SEASONAL PRECIPITATION

See R645-301-724.400.

R645-301-724.412. PREVAILING WINDS

See R645-301-724.400.

R645-301-724.413. SEASONAL TEMPERATURE RANGES

See R645-301-724.400.

R645-301-724.420. OTHER INFORMATION

N/A

R645-301-724.500. SUPPLEMENTAL INFORMATION

N/A

R645-301-724.600. SURVEY OF RENEWABLE RESOURCE LANDS

There are no structures present other than those constructed for mining operations, on the permit area. The land is presently used for grazing and wildlife habitat which constitutes a renewable resource area. It should be noted that geographic areas above Andalex's five-year mine plan do not include any area suitable for grazing, nor do they contribute significantly to the long-range productivity of water, food or fiber products. Andalex commits to mitigate all subsidence related damage to renewable resources including, but not limited to water, grazing, and wildlife habitat including raptor nests.

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R645-301-724.700. STREAMS

Appendix L

R645-301-725. BASELINE CUMULATIVE IMPACT AREA INFORMATION

Appendix L

R645-301-725.100. INFORMATION FROM FEDERAL OR STATE AGENCIES

Appendix L

~~**R645-301-725.100. INFORMATION FROM FEDERAL OR STATE AGENCIES**~~

~~Appendix L~~

R645-301-725.200. INFORMATION FROM APPLICANT

Appendix L

R645-301-725.300. RESTRICTIONS ON PERMIT

N/A

R645-301-726. MODELING

N/A

R645-301-727. ALTERNATIVE WATER SOURCE INFORMATION

Appendix L

R645-301-728. PROBABLE HYDROLOGIC CONSEQUENCES (PHC) DETERMINATION

Appendix L

R645-301-728.100. DETERMINATION OF PHC

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Appendix L

R645-301-728.200. BASIS OF DETERMINATION

Appendix L

R645-301-728.300. PHC DETERMINATION FINDINGS

Appendix L

R645-301-728.310. ADVERSE IMPACTS TO HYDROLOGIC BALANCE

Appendix L

R645-301-728.320. ACID FORMING OR TOXIC FORMING MATERIALS

Appendix L

R645-301-728.331. SEDIMENT YIELD FROM DISTURBED AREA

R645-301-733.

R645-301-728.332. WATER QUALITY PARAMETERS

R645-301-733.

R645-301-728.333. FLOODING OR STREAM-FLOW ALTERATION

N/A

R645-301-728.334. GROUND WATER AND SURFACE WATER AVAILABILITY

Appendix L

R645-301-728.335. OTHER CHARACTERISTICS

Appendix L

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R645-301-728.340. IMPACT ON SURFACE OR GROUND WATER

Appendix L

R645-301-728.400. PERMIT REVISIONS

Appendix L

R645-301-729. CUMULATIVE HYDROLOGIC IMPACT ASSESSMENT (CHIA~~)~~)

(BY DIVISION)

R645-301-729.100. DIVISION ASSESSMENT

(BY DIVISION)

R645-301-729.200. PERMIT REVISIONS

N/A

R645-301-730. OPERATION PLAN

See R645-301-511.100.

R645-301-731. GENERAL REQUIREMENTS

See R645-301-511.100.

R645-301-731.100. HYDROLOGIC BALANCE PROTECTION

See R645-301-711-300.

R645-301-731.110. GROUND WATER PROTECTION

Appendix L, See Appendix Y

R645-301-731.111. GROUND WATER QUALITY

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Appendix L

R645-301-731.112. SURFACE MINING OPERATIONS

N/A

R645-301-731.120. SURFACE WATER PROTECTIONS

Appendix L

R645-301-731.121. SURFACE WATER QUALITY

~~Appendix L~~

Appendix L. Historically, no treatment has been needed on mine discharge water. If water quality nears a point where treatment is needed, a treatment plan will be incorporated into the MRP at that time.

R645-301-731.122. SURFACE WATER QUANTITY PLAN

Appendix L

R645-301-731.200. WATER MONITORING

See R645-301-711.300.

R645-301-731.210. GROUND WATER MONITORING

See R645-301-711.300.

R645-301-731.211. GROUND WATER MONITORING PLAN

See R645-301-711.300.

~~See R645-301-711.300.~~

R645-301-731.212. SAMPLING AND REPORTING DATA

~~See R645-301-711.300.~~

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See R645-301-711.300.

R645-301-731.213. NON-ESSENTIAL AQUIFERS

N/A

R645-301-731.214. DURATION

See R645-301-711.300.

R645-301-731.214.1 SUITABILITY

See R645-301-711.300.

~~**R645-301-731.214.1 SUITABILITY**~~

~~See R645-301-711.300.~~

R645-301-731.214.2 COMPLIANCE

See R645-301-711.300.

R645-301-731.215. EQUIPMENT, STRUCTURES AND OTHER DEVICES USED IN CONJUNCTION WITH MONITORING

Appendix L

~~Appendix L~~

R645-301-731.220. SURFACE WATER MONITORING

See R645-301-711.300.

~~See R645-301-711.300.~~

R645-301-731.221. SURFACE WATER MONITORING PLAN

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See R645-301-711.300.

~~See R645-301-711.300.~~

R645-301-731.222 DESCRIPTION

See R645-301-711.300.

~~See R645-301-711.300.~~

R645-301-731.222.1 PARAMETERS

See R645-301-711.300.

R645-301-731.222.2 POINT SOURCE DISCHARGES

See R645-301-711.300.

R645-301-731.223. SAMPLING AND REPORTING DATA

See R645-301-711.300.

R645-301-731.224. DURATION

See R645-301-711.300.

R645-301-731.224.1 SUITABILITY

See R645-301-711.300.

~~**R645-301-731.224.1 SUITABILITY**~~

~~See R645-301-711.300.~~

R645-301-731.224.2 COMPLIANCE

See R645-301-711.300.

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R645-301-731.225. EQUIPMENT, STRUCTURES AND OTHER DEVICES USED IN CONJUNCTION WITH MONITORING

Appendix L

R645-301-731.300. ACID AND TOXIC FORMING MATERIALS

See R645-301-711.300.

R645-301-731.310. DRAINAGE INTO SURFACE AND GROUND WATER

~~**Post Mining Hydrology**~~

Post Mining Hydrology

Upon completion of mining activities, and following removal of surface structures, the earthwork portion of the reclamation plan will begin as described. The hydrologic portion of reclamation will take place in two phases:

1. The main and side drainage channels will be restored as shown in the Sedimentation and Drainage Control Plan, and on Plate ~~16~~7-12. Loose rock check dams will be placed at each side drainage entrance onto the reclaimed area, and at approximately 500' intervals along the restored main channel RC-1. (Typical sections of the loose rock check dams are shown in the Sedimentation and Drainage Control Plan).

All disturbed diversions and sediment ponds "B" and "C" will also be removed at this time. Sediment Pond "E" will be enlarged, and the entire drainage above will flow into Pond "E-PM" through the restored channel RC-1.

2. Once revegetation and water quality standards are met, Pond "E-PM" will be removed, and the area reclaimed.

Surface water monitoring will continue during this time as described. Please see ~~Figure IV-11~~Plate 7-9.

R645-301-731.311. MATERIAL ADVERSELY AFFECTING WATER QUALITY

See R645-301-731.310.

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R645-301-731.312. STORING MATERIALS

See R645-301-731.310.

R645-301-731.320. DISPOSAL PROVISIONS

See R645-301-731.310.

R645-301-731.400. TRANSFER OF WELLS

No transfer of wells has taken place, nor is any transfer anticipated.

R645-301-731.500. DISCHARGES

See R645-301-711.300.

R645-301-731.510. DISCHARGES INTO AN UNDERGROUND MINE

Andalex has approval from the State Engineer, Division of Water Rights, to collect the surface runoff from the disturbed area and discharge into the mine. This water is used for dust suppression underground. Water collected is a direct result of precipitation within the disturbed area. Although MSHA has verbally acknowledged the fact that some precipitation drains into the mine, they have not specifically required any type of approval for this occurrence.

R645-301-731.511. DEMONSTRATION

N/A

R645-301-731.511.1 PREVENTION OF DAMAGE

N/A

R645-301-731.511.2 VIOLATION OF WATER QUALITY STANDARDS OR EFFLUENT LIMITATIONS

N/A

R645-301-531.511.3 COMPLIANCE REQUIREMENTS

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N/A

R645-301-731.511.4 MEET WITH THE APPROVAL OF MSHA

N/A

R645-301-731.512. DISCHARGE LIMITATIONS

N/A

R645-301-731.512.1 WATER

~~N/A~~

N/A

R645-301-731.512.2 COAL PROCESSING WASTE

N/A

R645-301-731.512.3 FLY ASH

N/A

~~N/A~~

R645-301-731.512.4 SLUDGE FROM ACID MINE DRAINAGE TREATMENT

N/A

R645-301-731.512.5 FLUE-GAS DESULFURIZATION SLUDGE

N/A

R645-301-731.512.6 INERT MATERIALS USED FOR STABILIZING UNDERGROUND MINES

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N/A

R645-301-731.512.7 UNDERGROUND MINE DEVELOPMENT WASTE

N/A

R645-301-731.513. DIVERTING MINE WATER INTO UNDERGROUND WORKINGS

N/A

R645-301-731.520. GRAVITY DISCHARGES FROM MINE WORKINGS

If a discharge is found to occur after sealing, the water will be sampled quarterly for compliance with effluent standards of 817.42 and treated (if necessary) during the liability period. See Figures IV-1 and IV-2 for portal sealing details.

R645-301-731.521. DISCHARGE CONTROL

See R645-301-731.520.

R645-301-731.522. PREVENTION OF DISCHARGE

N/A

R645-301-731.600. STREAM BUFFER ZONES

R645-301-731.610. BUFFER ZONE LOCATIONS

The fan installation in the left hand fork of Deadman Canyon will require that the intermittent drainage is crossed. A 42-inch culvert will divert the natural runoff underneath the pad where the fan will be located. Since this activity is within 100 feet of an intermittent stream, the Division may authorize this activity by virtue of compliance with all R645-301-731.600 regulations. It should be emphasized that the stream buffer zones will not be adversely affected due to the installation of the culvert and the alternate sediment control measures. Also, travel on the access road and at the pad area will be restricted to times of no flow.

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It should be noted (R645-301-542.600) that the access road to the fan installation is already in existence; Andalex intends only to upgrade the road as needed and as described. This road will be reclaimed following cessation of mining to be consistent with the desires of the surface owners and management agencies.

The culvert will be removed upon cessation of mining. Sediment control measures downstream from this activity will be provided in the form of silt fences or straw dikes located in the drainage channel during the removal of the culvert. As there are no permanent water treatment facilities constructed for this fan installation, none need be removed. Typical designs for berms and diversions are shown on the Design Drawings. This includes the berm surrounding the topsoil pile. (See Plate "Aberdeen Mine Left Hand Fork Fan Installation, Sedimentation/Drainage Control".) These typical designs will adequately convey a two-year, ten-hour storm event. Sediment control during construction and reclamation will consist of straw bales or silt fences located downstream from the construction activity.

The same restrictions will also apply to the 48-inch culvert at the lower road / stream crossing and in places where the road will be improved within the stream buffer zone. That is, activities will be allowed only during periods of no flow. Also, and by the same token, the lower culvert will be removed upon final reclamation if is deemed appropriate by the surface land-owner or management agency.

Andalex will reclaim this road entirely if it is determined through communications with the surface owners and land management agencies that this is the appropriate action. Andalex has obtained official comments on the status of the road for post-mining landuse from the State of Utah, Gladys Artman and the Bureau of Land Management; all parties with the exception of Gladys Artman request that the road be abandoned and reclaimed. Mrs. Artman requested that the road remain status quo upon cessation of mining.

R645-301-731.611. VIOLATION OF WATER QUALITY STANDARDS OR EFFLUENT LIMITATIONS

Coal mining and reclamation operations 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 of other environmental resources of the stream.

R645-301-731.612. STREAM DIVERSIONS

See R645-301-733, Culvert Design

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This diversion will comply with all the requirements of R645-301-742.300 (diversion structures). Also, please refer to culvert sizing calculations in Appendix O.

R645-301-731.620. BUFFER ZONE SIGNS AND MARKERS

This buffer zone will be marked as specified in R645-301-521.260. Signs will be clearly marked to prevent additional disturbance by operations.

R645-301-731.700. CROSS SECTIONS AND MAPS

Plate ~~6~~5-7.

R645-301-731.710. WATER SUPPLY INTAKES

N/A

R645-301-731.720. WATER HANDLING AND STORAGE FACILITIES

Water is trucked from Price for culinary use and is stored in one of four 12,000-gallon tanks on the property. Each mine is equipped with a 12,000-gallon surface tank. All other mine water storage is underground.

R645-301-731.730. MONITORING LOCATIONS

~~Figure IV-11~~
Plate 7-9

R645-301-731.740. MAPS

See Volume II, R645-301-510.

R645-301-731.750. CROSS SECTIONS

See Volume II, R645-301-510.

R645-301-731.760. OTHER RELEVANT DRAWINGS

Figure IV-2 through IV-12

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R645-301-731.800. WATER RIGHTS AND REPLACEMENT

Appendix L

R645-301-732. SEDIMENT CONTROL MEASURES

See R645-301-733.

R645-301-732.100. SILTATION STRUCTURES

See R645-301-733.

~~See R645-301-733.~~

R645-301-732.200. SEDIMENTATION PONDS

See R645-301-733.

R645-301-732.210. COMPLIANCE REQUIREMENTS

See R645-301-733.

~~See R645-301-733.~~

R645-301-732.220. MSHA REQUIREMENTS

N/A

R645-301-732.300. DIVERSIONS

See R645-301-733.

R645-301-732.400. ROAD DRAINAGE

See R645-301-733., also R645-301-512.250.

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R645-301-732.410. ALTERATION OR RELOCATION OF A NATURAL DRAINAGEWAY

See R645-301-733.

~~See R645-301-733.~~

R645-301-732.420. INLET PROTECTIONS

See R645-301-733.

R645-301-733. IMPOUNDMENTS

See R645-301-733.

Three sedimentation ponds have been constructed so far as shown on Plate ~~6~~5-7. Pond A, as its capacity was not required, is now being used for snow storage and topsoil storage. The sedimentation and drainage control plan has been designed according to OSM regulations and the design and construction certified by a Utah Registered Professional Engineer. No other embankments, or other impoundments have been built nor are any proposed.

General ~~Description~~**Description**

The Andalex Deadman Canyon Project is comprised of three mines located closely together in Deadman Canyon. The Pinnacle Mine, Apex Mine, and the Aberdeen Mine are all presently in operation mining the Gilson and Lower Sunnyside Seams and the A Seam. The Centennial Seam is mined via rock tunnels from the existing Pinnacle Mine. Surface runoff from the Pinnacle Mine and Apex Mine is controlled by Settling Basin B and Pond C. Engineering Design for these ponds have been presented to the Division of Oil, Gas, and Mining on 4-3-80 and 8-21-81. Surface runoff from the Aberdeen Mine is controlled by Pond E. Designs for these basins and ponds are shown on Plates ~~11, 12~~7-4, 7-5, and ~~13~~7-7 included herein.

The mines are located in the Right Fork of Deadman Canyon. This is an ephemeral drainage flowing only from direct runoff and eventually reaches the Price River some 12 miles to the south. The major drainages in the minesite area will be routed under the site through large culverts. The existing minesite has a disturbed area of 34.2 acres. Please note that a certain percentage of the disturbed area does not report to sedimentation ponds. Please refer to ~~Plates~~Plate 7~~ and 8~~-2 for these areas. Actual disturbed area reporting to

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basins and ponds is approximately 26 acres. Sediment pond designs include undisturbed areas reporting to ponds. In order to minimize additional sediment loading to the main drainage, these ponds and basins will collect runoff from these approximately 27 acres. Berms will be placed on the lower edge of all disturbed areas to prevent runoff from reaching natural drainages before it has passed through the sedimentation ponds except in small area exemptions. Ponds are designed for maximum runoff including the chidister water. Areas draining to Pinnacle and Apex portals are to be included.

Sedimentation Pond Specifications

Location

The ponds are located over the main drainage of the Right Fork of Deadman Canyon. The main canyon drainage is routed through a 36-42" culvert located under the ponds. The sites are located downslope of the disturbed areas to simplify collection of runoff water (please see Plate 7-2).

Design

The ponds are designed to fully contain the expected runoff and sediment load from a 10-year 24-hour precipitation event in this area. Pond "C" has additionally been shown to fully contain the runoff from a 100-year 6-hour storm. The design has been certified by a registered professional engineer. A certification statement for the ponds can be found at the end of Appendix N.

Construction

The construction of the ponds have been completed as per the specifications set forth in the Construction Specifications sheet (part 2.3).

Capacity

Each pond is designed to contain the runoff and sediment load from a 10-year 24-hour precipitation event in the area of drainage. In addition, each pond has an overflow capacity in excess of that required for a 25-year 6-hour event. Pond "C" has been designed to contain and pass the runoff from a 100-year 6-hour event.

Safety Precautions

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The ponds were built as per specifications and under supervision of a qualified, registered professional engineer. The ponds are inspected quarterly for safety and compliance. Inspection reports are maintained on-site, and submitted to the Division on an annual basis. Ponds will be cleaned at minimum when sediment reaches 60% of designed sediment volume. Measuring devices will be installed in the ponds to show when the ponds have filled with sediment to the clean-out level (please see Plates 7-4, 7-5, and 7-7). Drainage directly into the Pinnacle and Apex Portals is not part of the calculation for sediment pond sizing. (Pond C)

~~Sedimentation Pond Specifications~~

~~**Location**~~

~~The ponds are located over the main drainage of the Right Fork of Deadman Canyon. The main canyon drainage is routed through a 36-42" culvert located under the ponds. The sites are located downslope of the disturbed areas to simplify collection of runoff water (please see Plate 8).~~

~~**Design**~~

~~The ponds are designed to fully contain the expected runoff and sediment load from a 10-year 24-hour precipitation event in this area. Pond "C" has additionally been shown to fully contain the runoff from a 100-year 6-hour storm. The design has been certified by a registered professional engineer. A certification statement for the ponds can be found at the end of Appendix N.~~

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~~Each pond is designed to contain the runoff and sediment load from a 10-year 24-hour precipitation event in the area of drainage. In addition, each pond has an overflow capacity in excess of that required for a 25-year 6-hour event. Pond "C" has been designed to contain and pass the runoff from a 100-year 6-hour event.~~

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~~**Safety Precautions**~~

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Monitoring

Water monitoring stations will be established at the outlet of the ponds. Sample parameters and frequencies shall be as per specification of the NPDES permit.

Maintenance

The ponds shall be inspected after each storm and the sediment cleaned as necessary. In no event shall sediment be allowed to build beyond 60% of sediment design capacity.

Seeding

An approved seed mix will be applied to all feasible disturbed areas in an effort to minimize erosion and sediment loading to the ponds. The proper seed mixture for this area has been obtained through the local BLM.

Culverts

~~Water monitoring stations will be established at the outlet of the ponds. Sample parameters and frequencies shall be as per specification of the NPDES permit.~~

~~**Maintenance**~~

~~The ponds shall be inspected after each storm and the sediment cleaned as necessary. In no event shall sediment be allowed to build beyond 60% of sediment design capacity.~~

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~~**Seeding**~~

~~An approved seed mix will be applied to all feasible disturbed areas in an effort to minimize erosion and sediment loading to the ponds. The proper seed mixture for this area has been obtained through the local BLM.~~

~~**Culverts**~~

All culverts are shown on Plate 7-1. Calculations for sizing are also included. It should be noted that all culvert sizes were arrived at and approved through consultation with the DOGM hydrologic engineer.

Calculations

~~9.~~ ~~Calculations for sizing are also included. It should be noted that all culvert sizes were arrived at and approved through consultation with the DOGM hydrologic engineer.~~

~~**Calculations**~~

The following reflects the calculations for sizing and details of each separate pond. Plates ~~6~~7-4 through 7-7 show pond locations and volumes as well as watershed areas.

Construction Specifications for Sedimentation Ponds

~~13.~~ ~~show pond locations and volumes as well as watershed areas.~~

~~**Construction Specifications for Sedimentation Ponds**~~

All construction of sedimentation ponds have been performed under the direction of a qualified registered professional engineer.

Dams are constructed with primary overflows at least 2 ft. from the top, and emergency overflows at least 1.5 ft. from the top. ~~Dams are constructed with primary overflows at least 2 ft. from the top, and emergency overflows at least 1.5 ft. from the top.~~ The areas of the pond construction had been examined for topsoil, and if present in removable quantities such soil was removed separately and stored in an approved topsoil storage location.

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In areas where fill was to be placed, natural ground was removed for at least 12" below the base of the structure.

Native materials were used where practical. Fill was placed in lifts not exceeding 15" and compacted prior to placement of the next lift. Compaction of all fill materials is at least 95%.

Grouted rip-rap or culverts have been placed at all inlets and outlets to prevent scouring. Each pond is fitted with an inverted inlet to the primary overflow, to prevent the passage of oil into the discharge.

Slopes of the dams are not steeper than 2.0:1, inside and outside, with a total of the inslope and outslope not less than 5:1. The inside slope of Pond E exceeded the steepness of 2:1. In part these slopes are incised and in part are constructed in from fill. Because of the steepness of these side slopes an investigation of stability was performed by Palmer Wilding Engineers. The conclusion was that the stability analysis is adequate and a stable section with respect to shear under static loading conditions is indicated. Please Appendix K.

~~Native materials were used where practical. Fill was placed in lifts not exceeding 15" and compacted prior to placement of the next lift. Compaction of all fill materials is at least 95%.~~

~~Grouted rip-rap or culverts have been placed at all inlets and outlets to prevent scouring. Each pond is fitted with an inverted inlet to the primary overflow, to prevent the passage of oil into the discharge.~~

~~Slopes of the dams are not steeper than 2.0:1, inside and outside, with a total of the inslope and outslope not less than 5:1. The inside slope of Pond E exceeded the steepness of 2:1. In part these slopes are incised and in part are constructed in from fill. Because of the steepness of these side slopes an investigation of stability was performed by Palmer Wilding Engineers. The conclusion was that the stability analysis is adequate and a stable section with respect to shear under static loading conditions is indicated. Please Appendix K.~~

Tops and external slopes of the dams were planted with an approved seed mix to prevent erosion and promote stability. Compaction of the slopes were at least 95%. Top width of dams are not less than (H + 35)/5.

Primary Settling Basins (Formerly Pond B)

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General Notes

The primary settling basins (formerly Pond B) are located above Pond "C". A disturbed area of 9.42 acres ~~drain~~drains into the settling basins as shown on Plate ~~8~~7-2. These basins collect sediment and runoff from this area; however, since they are a series of cells, any overflow from the basins will be cleaned and go into Pond "C".

It is proposed that 18" culverts be added between cells B-1 and B-2, and between B-2 and B-3. An 18" culvert already exists between cells B-3 and B-4. These culverts will prevent breaching of the dikes between cells during major runoff events. The inflow to the basins is from culverts CD-12 and CD-13, which is a total of 2.79 cfs, as shown on Table IV-3C. (Page 7-38). Based on the Manning's Equation for culverts (p.169-C), the required diameter to carry a flow of 2.79 ~~cfs~~CFS is only 0.95 feet; therefore, the 18" culvert overflows are more than adequate to pass the design flow. The placement of the culverts will not affect the maximum water levels or sediment storage capacity of the basins.

The basins are cleaned when sediment accumulations reach 50% of the original volume. The original volume was 0.540 acre feet, and the sediment cleanout level (0.270 acre feet) is at the culvert inlet level between cells B-2 and B-1 as shown on certified Plate ~~11~~7-4.

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Table IV-3C

Pond C

1. Use 1.82" for 10 year - 24 hour event
   Use 1.91" for 100 year - 6 hour event

*2. Disturbed Watershed - 14.79 acres

3. Runoff Curve No. = CN = 90

4. Area Runoff = Q (in.) = (P-0.2S)2/(P+0.8S); Where:

   S = (1,000/CN) - 10

   Q10/24 = 0.942 in./12 = 0.0785 ft.

   Q 100/6 = 1.018 in./12 = 0.0848 ft.

   Disturbed Volume 10/24 = 14.79 ac. x 0.0785 ft. = 1.161 ac. ft.

   Disturbed Volume 100/6 = 14.79 ac. x 0.0848 ft. = 1.254 ac. ft.

5. Undisturbed Watershed - 30.89 acres

6. Runoff Curve No. = CN = 70

7. Area Runoff:

   Q10/24 = 0.180 in./12 = 0.0150 ft.

   Q100/6 = 0.208 in./12 = 0.0173 ft.

   Undisturbed Volume 10/24 = 30.89 ac. x 0.0150 ft. = 0.463 ac. ft.

   Undisturbed Volume 100/6 = 30.89 ac. x 0.0173 ft. = 0.534 ac. ft.

8. Sediment Storage:

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**Disturbed Area 14.79 ac. x 0.05 ac. ft./ac. =
0.740 ac. ft.

***Undisturbed Area 30.89 ac. x 0.016 ac. ft./ac. =
0.494 ac. ft.

Total Sediment Storage Volume Required =
1.234 ac. ft.

60% Cleaning Point = 0.740 ac. ft.

9. Direct Precipitation into Pond

Area of Ponds = 0.39 acres

Volume 10/24 = 0.39 ac. x 1.82 in./12 in./ft. =
0.059 ac. ft.

Volume 100/6 = 0.39 ac. x 1.91 in./12 in./ft. =
0.062 ac. ft.
ft.

10. Total Required Pond Volume

Volume 10/24 = 1.161 + 0.463 + 1.234 + 0.059 =
2.917 ac. ft.

Volume 100/6 = 1.254 + 0.534 + 1.234 + 0.062 =
3.084 ac. ft.

11. Pond Volume at Outlet

18" cmp oil skimmer = 3.321 ac. ft.

36" cmp overflow = 4.264 ac. ft.

12. Conclusions:

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A. Pond size is adequate to contain the runoff and sediment load from a 10 year - 24 hour precipitation event.

B. Pond size is also adequate to contain the runoff and sediment load from a 100 year - 6 hour precipitation event.

* Includes runoff to "Primary Settling Basins" (Formerly Pond B)

** Does not include sediment to "Primary Settling Basins". The sediment factor of 0.05 acre-ft./acre is considered conservative due to the extensive paving (roads and loadout area), and the grouted or paved ditches to the pond.

The USLE calculation for Disturbed Areas ~~(Table IV-9)~~ shows the actual expected sediment yield to be much lower than the 0.05 figure used.

~~*** Sediment yield taken from the USLE calculations on Table IV-10, "Sediment Yield for Undisturbed Areas".~~

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POND C
1STAGE - VOLUME DATA

Stage	Elevation	Volume (Ac. Ft.)	Acc. Vol. (Ac. Ft.)
Bottom	7040.0	-	-
	7042.0	0.082	0.082
	7044.0	0.162	0.244
	7046.0	0.293	0.537
60% Sed.	7046.9	0.203	0.740
Cleanout			
	7048.0	0.266	1.006
Max. Sed.	7048.7	0.228	1.234
Level			
Decant	7049.7	0.330	1.564
Level			
	7050.0	0.099	1.663
	7052.0	0.862	2.525
10 yr.-24 hr.	7052.7	0.392	2.917
Volume			
100 yr.-6 hr.	7053.1	0.167	3.084
Volume			
18" Oil	7053.5	0.237	3.321
Skimmer			
	7054.0	0.297	3.618
36" CMP	7055.0	0.646	4.264
Overflow			
Crest of	7056.5	0.969	5.233
Embankment			

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~~Pond C~~

~~Stage - Volume Curve~~

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Pond "C" - General Notes

The sizing of Pond C is based on the drainage areas delineated on Plate ~~8~~7-2 - "Drainage Map". As can be seen from this Plate, a portion of the minesite drainage goes into the Pinnacle Mine, the old Chidister Portal, and the Apex Mine. The actual disturbed area draining directly to Pond "C" was planimetered from this Plate and determined to be 10.72 acres. The disturbed area flowing to the "Primary Settling Basins" was measured to be 4.07 acres. This flow drains to Pond "C" and is therefore considered in the sizing; however, the projected sediment load to the Primary Settling Basins is not considered in sizing Pond "C", since the basins could be completely full of sediment before it could impact Pond "C". As stated earlier, the Primary Settling Basins will be cleaned when sediment accumulation reaches one-half of the total basin volume; therefore, sediment from this area will not impact Pond "C".

In addition, a certain amount of undisturbed area does not flow into the undisturbed drainage culverts, and thus drains onto the mine site (see plates ~~8~~7-2 and ~~9~~7-1). The portion of this drainage that flows to Pond "C" was measured at 30.89 acres, and is included in the Pond "C" sizing calculations.

Runoff Curve numbers used in the calculations were: 90 for disturbed areas and 70 for undisturbed areas.

An "As-Constructed" plan and profile of Pond "C" is shown on Plate ~~12~~7-5. This plate has been certified by a registered, professional engineer. Also shown on this plate is a proposed sediment marker, and maximum and cleaning point depths for sediment. The cleaning point for sediment is at 60% of the maximum design depth for sediment storage. This point will be clearly marked on the sediment marker.

Also shown on Plate ~~12~~7-5, is the location of each of the pond inlets. Inlets are either grouted concrete or culvert, and do not require rip-rap or other additional erosion protection.

Pond "C" will be removed during the earthwork portion of reclamation. The culvert will also be removed and the main channel restored throughout the area. All reclaimed area above will then drain into Pond "E" below.

Decanting for Pond C, as needed, will be accomplished with pumps located at the minesite. Decanted water will be pumped into the primary spillway once the 24 hour

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retention time has been met. An access ramp will be constructed to allow for inspection and sampling at the overflow riser pipe.

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Pond E

1. Use 1.82" for 10 year - 24 hour event
2. Disturbed Watershed - 12.21 acres
3. Runoff Curve No. = CN = 90
4. Area Runoff = Q (in.) = (P-0.2S)2/(P+0.8S); Where:

   S = (1,000/CN) - 10

   P = 1.82"

   Q (in.) = [1.82-0.2(1.11)]2/[1.82+0.8(1.11)] =

   2.553 = .94 in. = .0785 ft.
   2.709

   Volume = 12.21 acres x 0.0785 ft. = 0.959 acre-ft.
5. Undisturbed Watershed - 12.20 acres
6. Runoff Curve No. = CN = 70
7. Area Runoff = 12.20 ac. x 0.2 in./12 = 0.203 acre-ft.
8. Sediment Storage Volume

   12.21 acres x 0.1 acre-ft./acre = 1.221 acre-ft. *

   60% Cleaning Point = 0.733 acre-ft.
9. Direct Precipitation into Pond

   Area of Ponds = 0.500 acres

   0.500 acres x 1.82 in. x 1/12 ft./in. = 0.076 acre-

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ft.

10. Total Required Pond Volume

0.959 + 0.203 + 1.221 + 0.076 = 2.459 acre-ft.

11. Pond Volume @ Outlet (Principle Spillway)

Total Pond Volume = 2.569 acre-ft. (As constructed)

12. Conclusion: Pond size is adequate to contain the runoff and sediment load from a 10 year - 24 hour precipitation event in the area of drainage to the pond.

* Due to the elevation of the decant inlet, the maximum sediment storage volume is .930 ac-ft. However the 60% cleanout level will not be exceeded and the total pond volume takes into account the disturbed area of 12.21 acres. See Plate 7-7.

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~~Stage-Volume Data~~
~~for~~
~~Pond "E"~~

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Pond "E" - PM

Post Mining Sediment Control

1. Use 1.82" for 10 year - 24 hour event.
2. Disturbed (Reclaimed) Watershed - 34.2 acres
   a. Runoff Curve No. = 90
   b. Runoff Volume = 2.740 ac. ft.
3. Undisturbed Watershed = 805.50 acres
   a. Runoff Curve No. = 70
   b. Runoff Volume = 13.425 ac. ft.
   4. Sediment Storage Volume = 0.150 ac. ft. (Upper Cell)
5. Direct Precipitation into Pond
   a. Use 0.5 acres
   b. 0.5 ac. x 1.82 in. x 1/12 = 0.076 ac. ft.
6. Expected Flow (10 yr. - 24 hr. event) = 88.94 cfs
7. Inflow Velocity (from RC-1) = 8.78 fps
8. Pond Configuration

   3 cells: 2 Gravel Filter Dikes and 1 Compacted Earthen Dam
9. Pond Capacity - 1.592 ac. ft.

Note: Pond is designed to clean and discharge runoff. Sediment will be removed by gravel filter dikes, and cleaned from pond when maximum sediment storage level is reached. Ponds will be cleaned when the 0.150 acre feet capacity of the upper cell is reached.

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Pond "E" - General Notes

Pond "E" is to control runoff from the Aberdeen Mine. The disturbed area to drain to this pond is 12.21 acres. Pond E for the Aberdeen minesite was constructed prior to any other disturbance of the drainage area which report to the ponds.

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Plate ~~13~~7-7 shows the plan and profile of the pond. Also shown on this plate is a sediment marker and the level of the sediment 60% cleaning point. The constructed height of the dam includes a 5% settling factor. The elevations on Plate ~~13~~7-7 are final.

Grouted rip-rap or culvert is used on all pond inlets; therefore, additional rip-rap or energy dissipators are not required.

Twelve 60" x 60" anti-seepage collars were installed on the main culvert beneath the pond. The collars are of concrete or a standard, manufactured design. Collar sizes and numbers are based on the following:

Flow length = 340'
Increase in flow length = 10% or 34'
Use 60" x 60" anti-seep collars
Each collar increases flow length by 2 x 8" or 3'; therefore, use 12 anti-seep collars.

An emergency spillway has been constructed to convey overflow from the pond into undisturbed diversion UD-4 as shown on Plates ~~8~~7-2 and ~~13~~7-7. This spillway consists of 12" D50 grouted rip-rap as shown on Figure IV-6. The dimensions of this spillway are shown ~~of Figure IV-6~~on Plate 7-7.

Pond E was constructed prior to any disturbance of the drainage area to the pond.

As built certified drawings of Sediment Pond E have been submitted.

Pond "E" - PM - General Notes

Upon reclamation, Pond "E" will be enlarged and left in place until revegetation standards are met, as shown on Plate ~~16~~7-12. The culvert will be removed, and the pond will be reconstructed to clean and discharge the entire runoff from the drainage area above. Pond sizing calculations are shown on the page entitled "Pond E - PM", "Post-Mining Sediment Control". Andalex will commit to the concept of allowing the entire undisturbed and reclaimed area to drain into this one structure if approved.

The rationale for removing all upper ponds and diversions is based on the following:

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1. Pond E is the lowermost structure, and can be rebuilt and later removed and reclaimed with minimum damage to the reclaimed site.

2. The upper site can be reclaimed in a more natural and permanent manner, as shown on the post-mining topography map, Plate ~~17~~7-13, without leaving temporary structures such as diversions, ponds, etc. Once vegetation is established, it will not have to be re-disturbed.

3. The extensive use of loose-rock check dams in the restored drainages will serve as effective sediment and erosion control, and will promote the establishment of a riparian area along the drainage.

Because of the large size of the undisturbed drainage above (805.5 acres), upon reclamation, it is proposed to construct a series of filtering ponds to clean and discharge the water rather than try to fully contain the runoff. The expected flow from a 10-year 24-hour event for the entire undisturbed and reclaimed area is 88.94 cfs at a velocity of 8.78 fps. The total volume of water would be approximately 16.2 acre-ft. It is proposed to build a 3-celled system with 2 gravel filter dikes and concrete grouted overflows. The upper 2 cells will act as filters for sediment removal, and the lower cell will become a settling basin for final cleaning prior to discharge. The pond discharge will be sampled per NPDES requirements to check for compliance with effluent standards.

It is expected that effluent standards will be met by this structure; similar filtering ponds have cleaned and discharged up to 1,000,000 gallons per day of sediment-laden mine water and remained in compliance.

The rationale for proposing such a filtering discharge system is based on the following:

1. The main purpose of sediment ponds or any other treatment facility is to control and minimize water pollution by causing the water to meet effluent standards; this type of system will accomplish this purpose:

2. Acceptable practices to control and minimize water pollution include:

(i) Stabilizing the disturbed area through land shaping;

(ii) Diverting runoff;

(iii) Achieving vegetation standards;

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(iv) Regulating channel velocity of water;

(v) Lining channels with rock or vegetation;

(vi) Mulching;

(vii) Selectively placing and sealing acid-forming and toxic-forming materials;

(viii) Designing mines to prevent gravity drainage of acid waters;

(ix) Sealing;

(x) Controlling subsidence; and

(xi) Preventing acid mine drainage.

The planned reclamation at this site will meet the above criteria;

3. All surface drainage from the disturbed area, including areas that have been graded, seeded, or planted, shall be passed through a sedimentation pond, a series of sedimentation ponds, or a treatment facility before leaving the permit area.

The proposed pond will be equipped with a sediment marker, and cleaned as needed. The pond will also be fitted with a combined primary and emergency spillway, sized and protected to handle the 25-year 6-hour event.

When revegetation standards are met on the reclaimed site, the Pond "E -PM" will be removed, the main channel restored, and the area reseeded according to the approved plan.

Pond Discharge Structures

Principle Spillways

Pond C has a single spillway consisting of a 36" cmp riser pipe located 1.5' below the top of the dam at elevation 7,055.0. This pipe discharges directly into the main 42" culvert located beneath the pond. An 18" cmp skimmer pipe is located in the side of the 36" riser 1.5' below the riser inlet at an elevation of 7,053.5. This pipe will be the first to discharge, and will act as an oil skimmer since the pipe inlet is inverted with the intake

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approximately 1' below water level. Pond C will be decanted as needed by the use of a pump. Decanted water will go into the 36" riser and be discharged into the 42" cmp passing beneath the disturbed area.

The Pond E principle spillway consists of a 30" riser pipe, connected to the 42" culvert beneath the ponds. A decant device is also attached to the riser pipe for de-watering, and is controlled by a hand-operated valve. Both the riser pipe and decant are constructed to minimize oil from entering the discharging water. Please see Plate ~~13~~7-7 for details on the spillway structures for Pond E.

Emergency Spillways

The emergency spillway for Pond E is the open notch type with a trapezoidal cross section. The spillway is of grouted rip-rap as shown on Figure IV-6. The spillway dimensions are as shown on the Figure IV-6. This is located 12" above the principal spillway and 2' below the top of the dam. This structure is rip-rapped through the point of discharge and into the main channel. This spillway provides an added safety factor to protect the dam in the event of overlad on the culvert discharge.

Pond E - PM Spillway

Pond E - PM will be constructed with an open-notch spillway in the lower cell to allow for safe discharge of runoff from the reclaimed area as well as the contributing undisturbed area. The spillway will be of grouted rip-rap and dimension as shown on Figure IV-6. Calculations for the spillway are shown.

The spillway for Pond C consists of an open 36" culvert which empties directly into the main 42" culvert which drains the main canyon. This spillway is open at the top and extends to within 2.5' of the top of the dam. At right angle to this spillway culvert is an 18" culvert to handle pre-design overflow conditions. This 18" pipe has an inverted inlet to skim oil and grease and flotsam from the water. This is considered a single spillway; however, the following discussion will explain how the pond meets the criteria for exemption of combination spillways required by R645-301-742-223.

Pond C - Exemption from R645-301-742-223

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The following will describe how Pond C meets the criteria for exemption of the combination spillway requirements of R645-301-742.223 as provided in R645-301-742.225.2:

1 - Storage - The pond has been shown to be adequately sized to safely control the 100 year - 6 hour precipitation event. The pond will not only contain the 100 year - 6 hour event (including sediment), but the overflow will safely pass the runoff from such an event if necessary.

2 - Dewatering - Water can be safely removed from the pond in accordance with current, prudent engineering practices. For this pond, water will be removed by the use of a portable pump system. The following is a description of details relating to the dewatering operation:

a - The pump to be used is an electric 220 volt unit. The pump will be powered by a portable generator set. These units will be available on an as-needed basis.

b - The pump will dewater at a rate of approximately 350 gallons per minute. At 1.0' above the maximum sediment elevation, the 10 year - 24 hour volume is 1.683 acre-feet. At the proposed pumping rate, the pond would be dewatered in approximately 26 hours.

c - The decant water will be discharged directly into the 36" cmp overflow. Any discharge will be done in accordance with the UPDES permit conditions. Samples will also be taken as required.

d - The pump inlet line will be equipped with a floating intake and an oil skimming device. A typical drawing is included as Figure IV-13.

e - The 36" outlet pipe will be visibly marked to show the limit of the decant level. This marker will be placed 2' above the maximum sediment level. This allows for the 18" oil skimmer shown on Figure IV-13, plus the required l' shutoff above maximum sediment elevation. The pump will be turned off when the water level is drawn down to this marker.

f - All storm water will be retained in the pond for a minimum of 24 hours, or until effluent limitations will be met prior to decanting.

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~~December 2014~~

g - Sedimentation Pond C to this date has never discharged. It is unlikely at any future date that the pond will discharge water. However, if a discharge ever occurs Andalex will construct an access ramp at that time. The access ramp will consist of a walk-way from the bank to the top of the stand-pipe. It will be equipped with hand rails and safety chains.

Certification Statement

A certification statement by a qualified, registered professional engineer that the pond will safely control the 100 year - 6 hour precipitation event, is included with this section.

~~Location~~

Location

The pond is located where failure could be expected to cause loss of life or serious property damage. In accordance with the requirements, the pond is designed and constructed to safely control the runoff from a 100 year - 6 hour precipitation event. (See related ~~table and~~Table And certification with this section for designs, and Plates ~~8~~7-2 and ~~12~~7-4 for location and "As-Constructed" details of the pond).

Calculations:

The following pond spillway calculations have been shown separately for each sediment pond at this site. Each of the sheets is separately certified by a registered professional engineer, as required. (appendix N)

Pond C - Spillway Calculations

Design Parameters

(1) Disturbed Drainage Area (a.c.) 14.79
(1) Undisturbed Drainage Area (a.c.) 30.89
Runoff Curve No. (Dist.) 90
Runoff Curve No. (Undist.) 70
(2) Time of Concentration (hrs.) 0.176
Land Slope (%) 6.25

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Hydraulic Length (ft.)	1200
Overflow	
10 yr. - 24 hr. Event (in.)	1.82
Peak Flow 10/24 (cfs)	27.56
25 yr. - 6 hr. Event (in.)	1.50
Peak Flow 25/6 (cfs)	18.06
100 yr. - 6 hr. Event (in.)	1.91
Peak Flow 100/6 (cfs)	30.35
(3) Oil Skimmer Diameter (in.)	18
Overflow Diameter (in.)	36
(4) Required Head 10/24 (ft.)	0.98
(4) Required Head 25/6 (ft.)	0.74
(4) Required Head 100/6 (ft.)	1.05

Notes: (1) Digitized from Plate ~~8~~7-2.

(2) Taken from ~~Table~~ IV-3A, (Pg. 7-75) (Pg. 7-75); Total Flows from DD-1, DD-2, & DD-3

(3) Reference Only - Not included in calculations.

(4) Taken from Stage Volume Curve - 36" riser only.

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Pond E - Spillway Calculations

Design Parameters

(1) Disturbed Drainage Area (ac.) 12.21
(1) Undisturbed Drainage Area (ac.) 12.20
Runoff Curve No. (Dist.) 90
Runoff Curve No. (Undist.) 70
(2) Time of Concentration (hrs.) 0.289
Land Slope (%) 8.00
Hydraulic Length (ft.) 1200

Primary Overflow

10 yr. - 24 hr. Event (in.) 1.82
Peak Flow 10/24 (cfs) 14.55
Riser Diameter (in.) 30"
Required Head (ft.) 0.73

Emergency Overflow

25 yr. - 6 hr. Event (in.) 1.50
Peak Flow 25/6 (cfs) 9.96
Structure Area Used (ft.2) 18.00
Required Structure Area (ft.2) 2.40
Depth of Flow (ft.) 0.41
Slope (%) 5.00
Velocity (fps) 4.15

Notes: (1) Digitized from Plate ~~8~~7-2.
(2) Taken from ~~Table~~ IV-3A, (Pg. 7-75); DD-4.

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Pond E - PM - Spillway Calculations

Design Parameters:

(1) Disturbed Drainage Area (ac.)	34.91
(1) Undisturbed Drainage Area (ac.)	805.50
Runoff Curve No. (Dist.)	90
Runoff Curve No. (Undist.)	70
(2) Time of Concentration (hrs.)	1.02
Land Slope (%)	19.83
Hydraulic Length (ft.)	10,200
(3) Overflow	
10 yr. - 24 hr. Event (in.)	1.82
Peak Flow 10/24 (cfs)	88.94
25 yr. - 6 hr. Event (in.)	1.50
Peak Flow 25/6 (cfs)	45.77
Structure Area Used (ft.2)	18.0
Slope of Spillway (%)	33.3
Required Structure Area 10/24 (ft.2)	5.58
Required Structure Area 25/6 (ft.2)	3.54
Depth of Flow 10/24 (ft.)	0.84
Depth of Flow 25/6 (ft.)	0.58
Velocity 10/24 (fps)	15.94
Velocity 25/6 (fps)	12.94

Notes: (1) From Plates ~~8 & 9~~7-2 & 7-1; Includes B.T.C.A. Areas
(2) Taken from Table IV-4 (Page 7-82)
~~(3) Single, open channel spillway~~

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Stage-Discharge Data
for
Sediment Pond "C"

INSERT ORIGINAL P.E. STAMPED TABLE

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~~Stage-Discharge~~

~~Centennial Pond C~~

~~INSERT ORIGINAL P.E. STAMPED GRAPH~~

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~~Certification Statement~~

~~INSERT ORIGINAL P.E. STAMPED STATEMENT~~

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CHANNEL FLOW CALCULATIONS

FOR: POND "E" - EMERGENCY SPILLWAY

~~Bed Slope =~~	~~.05~~	
~~Manning's N =~~	~~.04~~	
~~Bottom Width =~~	~~5~~	~~feet~~
~~Channel Side Slope =~~	~~.5~~	
~~Flow Depth =~~	~~.6950414~~	~~feet~~
~~Cross Sectional Area =~~	~~4.441372~~	~~square feet~~
~~Wetted Perimeter =~~	~~8.10832~~	~~feet~~
~~Hydraulic Radius =~~	~~.547755~~	~~feet~~
~~Discharge =~~	~~24.74~~	~~cubic feet / sec~~
~~Velocity =~~	~~5.570351~~	~~feet / sec~~

Bed Slope = .05
Manning's N = .04

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Bottom Width = 5 feet
Channel Side Slope = .5
Flow Depth = .6950414 feet
Cross Sectional Area = 4.441372 square feet
Wetted Perimeter = 8.10832 feet
Hydraulic Radius = .547755 feet
Discharge = 24.74 cubic feet / sec
Velocity = 5.570351 feet / sec

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Culverts

General

Culverts have been sized as per the designations on Plates ~~8~~7-1 and ~~9~~7-2, and are placed to drain on a minimum of .0556 (1 ft./18 ft.) slope. Undisturbed drainage culverts (shown on Plate ~~9~~7-1) are fitted with trash racks in drainages where introduction of rocks and other debris into the main culvert is foreseen as a problem. The main culvert inlet (C-1a) is fitted with a trash rack. All disturbed area culverts are designated with a CD- number as shown on Plate ~~8~~7-2. These culverts handle much smaller flows and are thus not fitted with trash racks in most cases.

The undisturbed area culverts (C-0 through C-13) flow into the main culvert. The main culvert outlets at section C-15, which is protected from erosion as described on Table IV-7. (Page 7-86) (Page 7-86). Disturbed area culverts (CD-1 through CD-7) as shown on Plate ~~8~~7-2 discharge onto grouted rip-rap surfaces for protection from erosion. Energy dissipators are also employed where necessary to reduce velocities and prevent erosion from culvert discharges (see Plate ~~8~~7-2).

Maintenance

Culverts shall be inspected regularly, and cleaned as necessary to provide for passage of designed flows. Inlets and outlets shall also be maintained so as to prevent plugging or undue restriction of water flow.

Size Justification

The following note on the undisturbed culverts is for reference only, to show the original design criteria. Due to the complicated nature of the undisturbed culvert flows, it was decided that a drainage system analysis would be used to demonstrate the ability of the system to pass the design event. This system analysis is provided in Appendix O and shows the existing system to be more than adequate for the design storm event.

Undisturbed Area Culvert Size Determination*

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"Applied Hydrology and Sedimentology for Disturbed Areas", Barfield, Warner and Haan, 1983.

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Peak Flow - SCS-TR-55 Method For Type II Storms:

qp = qp1AQ;

A = Watershed in square miles;

Q = Runoff volume in inches;

qp1= Discharge from Fig. 2.40

qp = Peak Discharge in cfs.

Source:

B.L.M. State Engineer

Manning Equation:

D = 2.16Qn 0.375

÷√s

D = Diameter (feet)

Q = QP = Peak Discharge (cfs)

n = roughness factor (0.02 for steel culvert)

s = slope (0.0556% = 1 foot for 18 feet)

Using the above formulas, minimum culvert sizes were calculated based on 100% runoff from a 10 year - 24 hour storm.

* Reference Only - See Appendix O for justification of culvert sizes.

Watershed and Culvert Sizing Map (Plate ~~9~~7-1)

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TABLE IV-2

Culvert	Watershed Area (acres)	Culvert Needed (in.)	Culvert Used (in.)
C-0	36.65	13	18
C-1a	469.51	22	36
C1	506.16	22	36
C2	23.03	12	18
C3	529.19	23	36
C4	77.29	16	30
C5	606.48	23	36
C6	26.87	12	18
C7	633.35	24	42
C8	45.25	14	30
C9	678.60	25	42
C10	18.16	10	18
C11	696.73	25	42
C12	55.31	14	18
C13	752.04	27	42
C15	752.04	27	42

Note: Culvert C14 flow has been routed to diversion UD-4, and C14 has been eliminated.

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Diversion Structures

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~~Diversion Structures~~

General

Diversion ditch locations are shown on the Surface Facilities Map and Drainage Map, Plate ~~8~~7-2. The direction of flow is also shown. All diversions are classed as temporary, and will be removed upon final reclamation.

Note: (1) The runoff curve number of 65 was used only for calculation of the undisturbed culvert diversions. All other diversions, culverts, and pond designs are based on a more conservative runoff curve number of 70 for undisturbed drainages.

(2) Brycan is Hydrologic Soil Group B, Datino (stoney) is also Hydrologic Soil Group B; reference "SCS, National Engineering Handbook, Section 4, 1972".

Specifications

Diversions along the upslope side of the road will be as per specifications on the haul road design. At a minimum, these, and any other diversions shown, will meet the minimum size specifications on the Diversion Ditch Summary sheet (Table IV-3B). Disturbed divisions DD-1 and DD-8 through DD-11 are sized to carry the runoff from a 2 year - 6 hour precipitation event in the area, per requirements of R645-301-742.330 "Division of Miscellaneous Flow". There are no divisions of intermittent or perennial flows.

Undisturbed diversions and drainage control for primary roads are sized to carry runoff from a 10 year - 6 hour precipitation event in the area.

Calculations for the 10 year - 24 hour runoff are included only for sediment pond sizing purposes.

Maintenance

All diversions will be maintained so as to pass the volumes of water for which they were designed. Sloughage will be cleaned out along with regular road maintenance procedures, and any blockage will be removed as soon as practicable after occurrence. Velocities will be controlled as needed to prevent excessive scouring.

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Diversions and Conveyance of Overland Flow

There are two types of diversions at this property: undisturbed and disturbed. The undisturbed diversions are labeled UD-1, through UD-5, and C-1 through C-15, and carry undisturbed drainage around and under the disturbed area. All undisturbed diversions are in place, and are shown on Plate ~~8~~7-2, along with respective drainage areas. Cross sections of the undisturbed diversions are shown on the "Undisturbed Diversion Ditch Typical" (Figure IV-4). Design calculations are shown on the tables entitled "Diversion Design" (Table IV-3), "Diversion Ditch Summary Sheet" (Table IV-3B) "Main Channel Culvert Design" (Table IV-4~~),~~ (Page 7-82)), and "Side Drainage Culvert Design" (Table IV-5).

The disturbed diversions carry disturbed drainage to the sediment ponds. The existing disturbed diversions are labeled DD-1, through DD-11 and are shown on Plate ~~6 "Support Facilities - As Constructed" and on Plate 8~~7-2 "Support Facilities - Surface Area Drainage and Topography". The diversion DD-4 is shown on Plate 7 "Aberdeen Mine Surface Facilities - As Constructed". Cross sections of the disturbed diversions are shown on the Division Ditch Typical" (Figure IV-3) Design calculations are shown on the table entitled "Disturbed Diversion Design" (~~Table~~ IV-3A Pg. 7-75) and on the "Diversion Ditch Summary" (Table IV-3B).

Peak flows for all diversions were calculated by the SCS-TR55 Method for Type II storms using the computer program: Office of Surface Mining Watershed Model, Version: Storm 6.20, by Gary E. McIntosh.

A runoff curve number of 70 was used for all undisturbed areas, except for the undisturbed culvert diversions, which use a CN of 65. A CN of 90 was used for the disturbed area.

The curve numbers are based on Table 2.20 "Runoff Curve Numbers for Selected Agricultural, Suburban, and Urban Land Use" (Antecedent Moisture Condition II), page 82 of "Applied Hydrology and Sedimentology for Disturbed Areas", Barfield, Warner, and Haan, 1983.

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A runoff curve number of 65 was selected for the undisturbed culvert diversion areas, based on the following:

(1) Land Use Description - Wood or Forest Land: thin stand, moderate to poor cover, no mulch.

(a) The above description was selected from SCS soils and vegetation data in Appendix M, wherein the site is described as not-desirable as rangeland due to the steep slopes and moderately sparse vegetative cover. The predominant vegetation is trees or large shrubs (pine, juniper, oak, sagebrush) with a mixture of grasses (wildrye, bluegrass, etc.). This land form and vegetation type best fits the Wood or Forest Land Category.

(2) Hydrologic Soil Group - B.

(a) The undisturbed soils of the permit area are predominantly bouldery loam or bouldery fine sandy loam, as described in the SCS report in Appendix M. These soils are further defined as deep and well-drained with moderate permeability and infiltration rates. This description fits the SCS Hydrologic Soil Group B very well.

(3) The runoff curve number of 65 is further supported by an on-site visit and professional judgement of a respected professional engineer/hydrologist from Horrocks, Carollo Engineers. In his opinion, a curve number of 65 best fits the site conditions, based on the site visit, and Richard H. McCuen's, "A Guide to Hydrologic Analysis Using SCS Methods".

(4) Appendix O, which is the calculations performed by Horrocks Engineering reflects a curve number of 65. Tables IV-4 and IV-5 are also included and use a curve number of 70. Both calculations show adequately sized culverts; the curve number of 70 is slightly more conservative.

The Curve Number of 90 for the disturbed area is based on Hydrologic Soil Group B, Streets and Roads, with a weighted average of 40% paved area and 60% gravel area.

The outlet of C-15 (Main-Channel Culvert) shows a velocity of 7.28 fps, which could be slightly erosive in this area; however, existing boulders at this outlet range from 12 to 36 inches in diameter and function as an adequate energy dissipator and erosion control device. Based on past history of storms with little or no evidence of erosion, at this point it is not felt necessary to install additional protection. Erosion protection parameters are shown on the "Erosion Protection" (Table IV-7~~).~~ (Page 7-86) (Page 7-86)), for reference only, to show that the existing natural rock is adequate size for erosion control.

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The culvert outlet will be visually examined after each major storm to ensure that erosion is not occurring. If erosion does become evident as determined by visual observation, protection will be installed according to the design on the table entitled "Erosion Protection" (Table IV-7~~,~~ (Page 7-86) (Page 7-86)).

Velocities on undisturbed diversions UD-1, UD-3 and UD-5 and portions of UD-2 and UD-4 are less than 6.0 fps, and are not considered erosive. Velocities on disturbed diversions DD-1, through DD-11 are also less than 6.0 fps, and are not considered erosive on this site.

Velocities on the upper and lower portion of UD-2 and the lower 150' of UD-4 and are greater than 6.0 fps, and are considered potentially erosive; therefore, rip-rap will be placed at these locations (see Plate ~~8~~7-2). Rip-rap or liner is placed as described in Table IV-7~~.~~ (Page 7-86) (Page 7-86), and is sized according to Figure IV-12. Diversion UD-2 has been observed to be non-erosive.

Undisturbed diversion UD-2 was resurveyed in November 1992. Based on this survey, the division can be divided into four separate components, as follows:

Upper Section - This is the extreme upper end of the division near the disturbed area boundary. This is a fairly steep, rocky area, and is quite inaccessible to equipment. The average grade through this section is 12.33%. the ditch is protected by a liner, which appears to have been effective in preventing erosion over the last 10 years. The liner will be maintained throughout this section;

Undisturbed Section - This is an area below the upper (lined) section and the office pad section. The drainage flows through an undisturbed, vegetated area for approximately 100 feet, at an average slope of 12.11%. There is no evidence of erosion through this area;

Office Pad Section - This is an extremely flat portion of the diversion with an average grade of 3.50% for approximately 200 feet. Velocities through this section are non-erosive, and this is the only portion of the diversion which has required periodic maintenance for silt cleaning;

Lower Section - This section is approximately 100 feet in length with an average slope of 41.60%. The ditch is rip-rapped through this section.

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Flow calculations are provided in Table IV-3 for the various sections, and erosion protection requirements are provided in Table IV-7. (Page 7-86) (Page 7-86). The diversion has been in place for approximately 10 years, and has required only minimal maintenance for silt clean out in that time. It has been designed, located, constructed, maintained, used and will be removed in accordance with requirements of R645-301-742.300.

A loose rock check dam will be placed at the discharge point of UD-4 for energy dissipation. The dam will be constructed as described in Figure IV-9 and located as shown on Plate ~~8~~7-2.

All diversion ditches are sized and maintained to at least the minimum requirements of R645-301-742.330 "Diversion of Miscellaneous Flows" and R645-301-742.423 "(Road) Drainage Control". There are no diversions of intermittent or perennial drainages at this minesite. Ditch sizes, including flow depths and minimum size for maintenance are summarized on Table IV-3B, "Division Ditch Summary". Computer backup sheets for all calculations are provided in Appendix O.

Stream Channel Diversions

Re-establishment of drainages is shown on ~~Plates 15 and 16~~Plate 7-12 which are reclamation contours and cross sections. The cross sections show cut and fill which has occurred on-site versus the original contours and reclaimed contours.

The reclamation plans for the drainage in the area consist of replacing each of the culverts C-1 through C-15 with restored channels. The undisturbed diversions UD-1 and UD-2 will also be removed and replaced with appropriate sized channels, corresponding to the channels at culverts C-4 and C-12 respectively. The restored channels are all sized to carry the runoff from a 100 year - 24 hour precipitation event. Cross sections of the restored channels are shown in the "Restored Channel Typicals" (Figure IV-10). Design calculations are summarized in the table entitled Restored Channel Designs" ~~(~~ Table IV-6 (Page 7-84).

Culverts C-1, C-3, C-5, C-7, C-9, C-11, C-13, and C-15 will be replaced by the Main Channel RC-1, and culverts C-2, C-4, C-6, C-8, C-10, C-12, and C-14 will be replaced by the Side Channels entitled RC-2, RC-4,....RC-14, respectively.

The only restored channels with erosive velocities for this area (greater than 4.5 fps) are RC-1, RC-4, and RC-12. Erosion protection is planned for these channels, as shown

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on the table entitled "Erosion Protection" (Table IV-7~~).~~ (Page 7-86) (Page 7-86)). All other restored channels are expected to have non-erosive velocities, and will not require erosion protection.

Loose rock check dams will be placed at the exit of each side drainage prior to entering RC-1. Please see Figure IV-9, for a typical section of the Loose Rock Check Dams.

Hydrologic Balance:

Sedimentation Ponds

The sedimentation ponds as constructed, are shown on Plates ~~11,12~~7-4, 7-5, and ~~13. Pond C is constructed as shown on Plate 6 "Support Facilities - As Built".~~7-7. There will be no Pond D. ~~Pond E has been constructed (Plate 13), and is shown on Plate 7 "Aberdeen Mine Surface Facilities - As Constructed". The plans and profiles shown on Plate 12 are for Pond C, as constructed. Plate 13 (Pond E) plans and profiles are as built.~~

All elevations of inflow and discharge are shown on the plates. Also, the embankment slopes are shown not to exceed 5:1 as required. The embankment widths are greater than the required width of height of embankment plus 35 feet divided by 5' as required. (Please note the different horizontal and vertical scales used on the section views of Pond C. Horizontal and vertical scales for Pond E are the same.)

Previous Pond "B" has been redesignated as "Primary Settling Basins" since all the runoff from the basins reports to Sediment Pond "C" (See Plate ~~11~~7-4).

Sediment Pond "C"

Design specifications for Sediment Pond "C" are shown in this submittal.

Sediment Pond "E"

Design specifications for Sediment Pond "E" are covered under this submittal.

Discharge Structures

Discharge structures from the sediment ponds have been included.

Permanent and Temporary Impoundments

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The sedimentation pond E will remain in place after reclamation, until adequate revegetation is established on the reseeded areas. At this time, the pond will be removed and reclaimed.

Discharge of Water into an Underground Mine

The Drainage Map, Plate ~~8~~7-2, delineates various drainage areas on the site. Based on planimeter areas from this map, the following areas are drained into the respective mines:

Mine	Disturbed (ac.)	Undisturbed (a.c)
Pinnacle Mine	0.81	0.13
Apex	1.23	2.06
Old Chidister Mine	4.53	16.21

The water flowing into the mines is strictly from surface runoff, and the quantity is thus highly variable. Because this is such a dry canyon, it is necessary to capture as much water as possible to allow for underground mining operations. The water is directed into storage sumps in the mine, where it is settled and used for dust suppression. Any water going into the mine is used in sprays or remains in the sumps. Water flowing into the mines is strictly from surface runoff, and the quantity is thus highly variable. Because this is such a dry canyon, it is necessary to capture as much water as possible to allow for underground mining operations. The water is directed into storage sumps in the mine, where it is settled and used for dust suppression. Any water going into the mine is used in sprays or remains in the sumps.

Andalex owns the rights to this water.

Hydrologic Balance:

Water Quality Standards and Limitations.

Sediment control for Office Facilities

The office facilities area is a small paved parking area and runoff from a portion of this area will report to Sediment Pond "E" as shown on Plate ~~8~~7-2. The remaining portion is classified as a B.T.C.A. Area (2.19-2).

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~~December 2014~~

Natural runoff from above the office area is diverted to the south of the pad, and flows in an open ditch down to the lower (road) level where it enters an 18" culvert going into the 42" culvert carrying undisturbed drainage off site. Straw bales are maintained in the open ditch to minimize sediment in the undisturbed flow.

Most of the office pad and access road are paved. Runoff from a portion of the pad and road flow down a grouted ditch along the north and south sides of the road, through a culvert and then down the east side of the main paved road. From here the runoff flows into Pond E. See Plate ~~8~~7-2. Sediment contributions from the office facilities area are negligible (if any) due to the pavement and concrete grouted ditch. Straw bales are also maintained along the main haul road to minimize sediment loading from this area.

Disturbed Area Drainage not Reporting to Sediment Ponds

Please refer to Plate ~~8~~7-2 in Volume II of the PAP for exempt "Alternate Sediment Control Area" or (ASCA) (areas not reporting to sedimentation ponds). There are 3 areas, 2 of which are shown on Plate ~~8~~7-2 as ASCA's and a third in Appendix U as an SAE, with a total area of 1.08 acres or 3.2% of the Disturbed Area:

(1) ASCA #1 - 0.72 acres - near the office, which includes a topsoil storage pile, UD-2, a portion of the main office pad and a portion of the weather station outslope.

(a) Treatment: As a result of a 10 year - 24 hour storm, there would potentially be a discharge of 2,462 cubic feet of runoff from this area. Alternate sediment controls consist of straw dikes, vegetation on the topsoil pile, chemically treated gravel parking areas and paved parking areas.

(2) ASCA #2 - 0.27 acres - Substation area.

(a) Treatment: A 10 year - 24 hour storm will potentially have a discharge of 923 cubic feet of runoff from this area. Alternate sediment controls on this site consist of a graveled surface, a straw dike and snow fences.

(3) Small Area Exemption (SAE) #1 - 0.09 acres - Left Fork Fan Powerline area.

(a) Treatment: A 10 year - 24 hour storm will potentially have a discharge of 308 cubic feet of runoff from this area. As these are power poles, there will be no sediment runoff.

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These three areas are exempt from the requirement that the drainage report to a sedimentation pond (817.42a) as provided for in 817.42b. The drainage from these areas will meet the effluent standards of 817.42 and State and Federal water quality standards for the receiving waters. In order to assure this, any discharge from these ASCA's will be monitored for suspended solids, total suspended solids and total dissolved solids.

There are three additional undisturbed diversions constructed just inside the disturbed area boundary (UD-1, UD-3 and UD-4). These ditches carry only undisturbed runoff from the areas above, are well vegetated, and discharge directly to the main channel undisturbed drainage without further treatment. Only undisturbed diversion UD-2 is included as a ASCA (#1), due to the fact that it also picks up drainage from a topsoil storage pile and a portion of the office pad as described on the previous page.

NPDES Permit

Three point sources are included in Andalex's new UPDES Permit ~~issued in May of 1989~~. Quarterly reports are submitted to the Utah Department of Health and the EPA.

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TYPICAL

SCS - TR55 Method of Diversion Calculation

1. Find Drainage Area - Plate ~~8~~7-2 or ~~9~~7-1

*2. Find Runoff from Appropriate Event:

$$Q = \frac{(P-0.2S)2}{(P+0.8S)}; \text{ where: } P = \text{Precip. in inches}$$

$$S = \frac{1{,}000}{CN} - 10$$

CN = 70 for Undisturbed
CN = 90 for Disturbed

3. Find Hydraulic Length of Watershed - Plate ~~8~~7-2 or ~~9~~7-1

4. Find Land Slope - Plate ~~8~~7-2 or ~~9~~7-1

5. Calculate Lag Time; $tL = \frac{L0.8(S+1)0.7}{1900\ y0.5}$

where: tL = Lag Time in Hrs.
L = Hydraulic Length in ft.
S = $\frac{(1{,}000 - 10)}{CN}$
y = Land Slope in %

6. Find Time of Concentration; $tc = \frac{tL}{0.6}$

**7. Find Peak Flow (qp) from: qp = qp1 AQ
where qp = Peak Flow in cfs
qp1= Peak Discharge from Figure 2.40, page 115***.
A = Drainage Area in Square Miles
Q = Runoff (from #2 above)

**8. Find Velocity of Flow from:

$$V = \frac{1.49\ R0.67S0.5}{n}$$

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where: V = Velocity in fps
n = Manning's Number for ditch
R = Hydraulic Radius in ft. = (Area)
Wetted Perim.
S = Slope in ft./ft.

**9. Find Required Ditch Area by dividing peak flow by the velocity.
Q = AV; A = Q

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V

**10. Find depth of flow by applying required area to ditch size.

* Where undisturbed and disturbed flows enter the same ditch, a weighted curve number is used, calculated by:

(Area Undisturbed)(70) + (Area Disturbed)(90)
(Total Area)

** Items 7 through 10 can also be calculated by the computer program "Office of Surface Mining Watershed Model", Version: Storm 6.20, by Gary E. McIntosh.

*** "Applied Hydrology and Sedimentology for Disturbed Areas", Barfield, Warner and Haan, 1983.

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TABLE IV-3

UNDISTURBED DIVERSION DESIGN

Structure		UD-1	UD-2	UD-3	UD-4	UD-5 (PAD)
Drainage Area (s)	87.78	56.20	23.87	26.14	16.90	
Time of Conc. (hours)		0.24	0.21	0.22	0.06	0.14
Runoff Curve Number (CN)			70	70	70	70	70
Manning's Number (n)		0.038	0.038	0.040	0.040	0.040
Ditch Slope (%)	6.75	3.50	6.75	4.50	3.79	
Hydraulic Length (ft.)		2850	2800	1400	600	1800
Land Slope (%)	47.22	58.33	56.67	66.67	62.50	
10 yr. 6 hr. Event (in.)		1.25	1.25	1.25	1.25	1.25
Time of Conc. (hrs.)	0.24	0.21	0.22	0.06	0.14	
Peak Flow 10/6 (cfs)		1.35	0.99	0.11	0.47	0.29
Required Area 10/6 (ft2)		0.37	0.37	0.06	0.20	0.15
Flow Depth 10/6 (ft)	0.61	0.61	0.24	0.45	0.39	
Velocity 10/6 (fps)	3.65	2.64	1.88	2.32	1.93	
10 yr.-24 hr. Event (in.)		1.82	1.82	1.82	1.82	1.82
Peak Flow 10/24 (cfs)		7.94	4.75	2.03	3.45	1.59
Req'd Area 10/24 (ft2)		1.40	1.21	0.52	0.90	0.54
Flow Depth 10/24 (ft2)		1.18	1.10	0.72	0.95	0.73
Velocity 10/24 (ft2)	5.69	3.91	3.90	3.82	2.95	

Notes: 1- Ditch slopes measured from Plate ~~8~~7-2.

2- UD-2 slope measured directly in field.

3- Peak flows by SCS-TR55 Method using "Storm 6.20" computer program.

4- Manning's number based on Table 3.1, p. 159, under Small Drainage Ditches - earth Lined, "Applied Hydrology and Sedimentology Disturbed Areas", Barfield, Warner and Haan, 1983.

5- See Appendix O for computer back-up.

6- All calculations are based on minimum ditch size - "V" shape with 1:1 side slopes. Ditch configurations may vary in field.

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TABLE IV-3 (cont'd)

UNDISTURBED DIVERSION DESIGN

Structure	UD-2 (upper)	UD-2 (lower)	UD-4 (max)	UD-5 (max)
Drainage Area (acres)	56.20	56.20	26.14	16.90
Time of Conc. (hrs.)	0.21	0.21	0.06	0.14
Runoff Curve Number (CN)	70	70	70	70
Manning's Number (n)	0.025	0.040	0.040	0.040
Ditch Slope (%)	12.33	42.60	20.00	17.75
Hydraulic Length (ft.)	2800	2800	600	1800
Land Slope (%)	58.33	58.33	66.67	62.50
10 yr.-6 hr. Event (in.)	1.25	1.25	1.25	1.25
Peak Flow 10/6 (cfs)	0.99	0.99	*10.43	0.29
Req'd Area 10/6 (ft.2)	0.17	0.15	1.18	0.08
Flow Depth 10/6 (ft.)	0.41	0.39	1.09	0.29
Velocity 10/6 (fps)	5.80	6.49	8.81	3.44
10 yr.-24 hr. Event (in)	1.82	1.82	1.82	1.82
Peak Flow (cfs)	4.75	4.75	*13.41	1.59
Req'd Area (ft.2)	0.55	0.49	1.43	0.30
Flow Depth 10/24 (ft)	0.74	0.70	1.20	0.55
Velocity 10/24 (fps)	8.59	9.61	9.38	5.27

* Includes discharge from Pond E Emergency Spillway.

Note: 1. Ditch slopes measured from Plate ~~8~~7-2.

2. UD-2 Slopes Measured Directly in Field; UD-2 (Upper) is a lined channel. UD-2 (lower) is rip-rapped.

3. Peak flows by SCS-TR55 Method using "Storm 6.20" computer program.

4. The Manning's number is based on Table 3.1, page 159, under Small Drainage Ditches - Earth Lined, "Applied Hydrology and Sedimentology for Disturbed Areas", Barfield, Warner, and Haan, 1983.

5. See Appendix O for computer back-up.

6. All calculations are based on minimum ditch size-"V" shape with 1:1 side slopes. Ditch Configurations may vary in field.

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~~December 2014~~

IV-3A (PG. 7-75)

DISTURBED DIVERSION DESIGN
(MISCELLANEOUS FLOWS-2YR.-6 HR. DESIGN)

Structure	DD-1	*DD-8	*DD-9	DD-10	DD-11
Drainage Area (acres)					
Disturbed	3.31	-	-	0.34	5.35
Undisturbed	5.40	-	-	-	6.12
Time of Conc. (hrs.)	0.08	0.327	0.327	0.11	0.08
Runoff Curve Number (CN)					
Disturbed	90	-	-	90	90
Undisturbed	70	-	-	-	70
Weighted CN	78	-	-	90	79
Manning's Number (n)	0.040	0.040	0.040	0.040	0.040
Ditch Slope (%)	6.25	6.25	6.25	6.25	5.25
Hydraulic Length (ft.)	200	1200	1200	300	800
Land Slope (%)	6.25	6.25	6.25	6.25	56.25
2 yr.-6 hr. Event (in)	0.80	0.80	0.80	0.80	0.80
Peak Flow 2/6 (cfs)	0.08	0.07	0.07	0.05	0.13
Required Area 2/6 (ft2)	0.05	0.04	0.04	0.03	0.07
Flow Depth 2/6 (ft.)	0.22	0.21	0.21	0.18	0.26
Velocity 2/6 (fps)	1.69	1.63	1.63	1.50	1.90
10 yr.-24 hr. Event (in.)	1.82	1.82	1.82	1.82	1.82
Peak Flow 10/24 (cfs)	3.49	2.88	2.88	0.31	4.75

* Based on ~~½~~½ flow from DD-3, which is 0.13 cfs for 2 yr.-6 hr.event. See Appendix O.

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IV-3A (PG. 7-75) (Continued)

DISTURBED DIVERSION DESIGN
(PRIMARY ROAD DRAINAGE - 10YR.-6HR. DESIGN)

Structure	DD-2 *	DD-3	DD-4	DD-6	DD-7
Drainage Area (acres)					
Disturbed	4.07	7.41	12.21	-	1.28
Undisturbed	-	25.49	12.20	-	6.12
Time of Conc. (hrs.)	0.04	0.327	0.289	0.289	0.08
Runoff Curve Number (CN)					
Disturbed	90	90	90	-	90
Undisturbed	-	70	70	-	70
Weighted CN	90	75	80	-	74
Manning's Number (n)	0.040	0.040	0.040	0.040	0.040
Ditch Slope (%)	6.25	6.25	6.25	5.95	5.56
Hydraulic Length (ft.)	200	1200	1200	-	800
Land Slope (%)	6.25	6.25	8.00	-	56.25
10 yr. -6 hr. Event (in)	1.25	1.25	1.25	1.25	1.25
Peak Flow 10/6 (cfs)	1.70	0.90	1.67	0.84	0.20
Required Area 10/6 (ft2)	0.47	0.30	0.40	0.28	0.10
Flow Depth 10/6 (ft.)	0.69	0.24	0.68	0.53	0.31
Velocity 10/6 (fps)	3.62	2.96	3.60	2.98	2.03
10yr.-24hr. Event (in.)	1.82	1.82	1.82	1.82	1.82
Peak Flow 10/24 (cfs)	3.50	5.75	8.06	4.03	1.92

* Based on ½½ flow for DD-4

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Notes:

1. Ditch Slopes measured from Plate ~~8~~7-2.
2. Peak flows by SCS-TR55 Method using "Storm 6.20" Computer program.
3. The Manning's Number is based on Table 3.1, page 159, under Small Drainage Ditches - Earth Lined, "Applied Hydrology and Sedimentology for Disturbed Areas", Barfield, Warner, and Haan, 1983.
4. See Appendix O for computer back-up.
5. All calculations are based on minimum ditch size- "V" shape with 1:1 side slopes, except DD-3 which has a 1' bottom width. Ditch configurations may vary in field.

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TABLE IV -3B

DIVERSION DITCH SUMMARY

DITCH NO.	FLOW (cfs)	REQ'D FLOW DEPTH (ft.)	REQ'D FLOW AREA (ft2)
UD-1	1.35	0.61	0.37
UD-2 (PAD)	0.99	0.61	0.37
UD-2 (UPPER)	0.99	0.41	0.17
UD-2 (LOWER)	0.99	0.39	0.15
UD-3	0.11	0.24	0.06
UD-4	0.47	0.45	0.20
UD-4 (MAX)	10.43	1.09	1.18
UD-5	0.29	0.39	0.15
UD-5 (MAX)	0.29	0.29	0.08
DD-1	0.08	0.22	0.05
DD-2	1.70	0.69	0.47
DD-3	0.90	0.24	0.30
DD-4	1.67	0.68	0.46
DD-6	0.84	0.53	0.28
DD-7	0.20	0.31	0.10
DD-8	0.07	0.21	0.04
DD-9	0.07	0.21	0.04
DD-10	0.05	0.18	0.03
DD-11	0.13	0.26	0.07

Notes: 1- Flows for UD ditches and primary road ditches (D-2 through DD-7) based on 10 yr.-6hr. event (1.25).

2- Flows for Ditches DD-1 and DD-8 through DD-11 based on 2yr.-6hr. event (0.80").

3- All calculations based on minimum ditch size - "V" ditch with 1:1 side slopes, except DD-3, which has a 1' bottom width. Ditch configurations may vary in field.

4- Ditches will be maintained to minimum depth and/or area shown in this table.

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~~December 2014~~

METHOD OF CULVERT CALCULATION
(TYPICAL)
See Appendix N for calculation reference

1. Find Drainage Area - Plate ~~9~~7-1

2. Find Runoff from Appropriate Event:
   Q = (P - 0.2S)2; Where: P = Precipitation in Inches.
   (P + 0.8S) S = 1,000 - 10
   CN
   or CN = 70

3. Find Hydraulic Length of Watershed - Plate ~~9~~7-1.

4. Find Land Slope - Plate ~~9~~7-1

5. Calculate Lag Time; tL = L0.8(S+1)0.7
   1,900 Y0.5
   where: tL = Lag Time in Hrs.
   L = Hydraulic Length in Ft.
   S = 1,000 - 10
   CN
   Y = Land Slope in %.

6. Find Time of Concentration; tc = tL
   0.6

**7. Find Peak Flow (qp) from: qp = qp1 AQ
   where: qp = Peak Flow
   qp1= Peak Discharge from Figure 2.40, page 115*.
   A = Drainage Area in Square Miles
   Q = Runoff (from #2 above)

8. Find Required Culvert Size by Manning's Equation:

   D = (2.16 Qn) 0.375
   ~~√~~√S
   where: D = Required Culvert Diameter in Ft.

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Q = Peak Flow (qp) from 7.
n = Manning's Number (0.025 for culv.)
s = Slope in ft./ft.

* "Applied Hydrology and Sedimentology for Disturbed Areas", Barfield, Warner and Haan, 1983.
** Item 7 can also be calculated by using the computer program "Office of Surface Mining Watershed Model", Version: Storm 6.20, by Gary E. McIntosh.

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TABLE IV-3C

DISTURBED AREA CULVERT DESIGN
(Drainage to Old Works)

Structure	CD-1	CD-2	CD-8
Drainage Area (ac.)	---	---	---
Undisturbed	10.09	6.12	10.09
Disturbed	3.25	1.28	3.25
10 yr. - 6 hr. event (in.)	1.25	1.25	1.25
Time of Conc. (hrs.)	0.10	0.10	0.10
Curve Number	---	---	---
Undisturbed	70	70	70
Disturbed	90	90	90
Manning's Number	0.025	0.025	0.025
Culvert Slope (%)	5.56	5.56	5.56
Peak Flow (cfs)	1.73	0.72	1.73
Velocity	4.41	3.49	3.08
D Req'd (ft.)	0.71	0.51	0.71
D in Place (ft.)	1.00	1.00	1.50

TABLE IV-3C (Continued)

DISTURBED AREA CULVERT DESIGN

Structure	CD-4	CD-5	CD-6	CD-7
10 yr. - 6 hr. Event (in.)	1.25	1.25	1.25	1.25
Manning's Number (n)	0.025	0.025	0.025	0.025
Culvert Slope (%)	5.56	5.56	5.56	5.56
Peak Flow	1.50	1.55	2.33	4.65
Velocity	4.26	4.29	4.75	5.65
D Req'd (ft.)	0.67	0.68	0.79	1.02
D in Place (ft.)	1.50	1.50	2.00	2.00

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Note: All culverts have adequate headwater to allow flow.

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TABLE IV-3C (Continued)

CULVERT CD-3
(Inlet to Sed. Pond "C")

10-yr.6-hr. Event 1.25"
Mannings Number 0.025
Culvert Slope 3.30%
Peak Flow 3.00 cfs
Velocity 4.16 fps
D. Required 0.96 ft.
D. In Place 1.50 ft.

NOTES: 1. Peak flow is based on entire flow from Diversion DD-3.
2. Details for Diversion DD-3 are on ~~Table~~ IV-3A~~.~~ (Pg. 7-75).
3. Culvert slope is based on actual field measurement.
4. A headwall of 4' exists at the culvert inlet, which is adequate to allow the calculated peak flow of 3.00 cfs.
5. Please refer to Plate ~~8~~7-2 for CD-3 location and drainage areas.

TABLE IV-3C (Continued)
DISTURBED AREA CULVERT DESIGN

STRUCTURE	CD-9	CD-10	CD-11	CD-12	CD-13
10yr.-6hr. Event (in)	1.25	1.25	1.25	1.25	1.25
Manning's Number (n)	0.025	0.025	0.025	0.025	0.025
Culvert Slope (%)	8.00	6.25	8.00	5.56	6.25
Peak Flow 10/6 (cfs)	0.31*	0.31*	0.31**	0.92**	1.87***
Velocity 10/6 (fps)	3.29	3.00	3.29	3.77	4.70
Diam. Req'd. (ft.)	0.35	0.36	0.35	0.56	0.71
Diam. In Place (ft.)	1.50	1.50	1.00	2.00	1.50

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* Based on 1/3 flow form DD-11.
** Based on entire flow from DD-11.
**** Based on entire flow from DD-2.

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TABLE IV-3C (Continued)
DISTURBED AREA CULVERT DESIGN

STRUCTURE	CD-14	CD-15	CD-16	CD-17	CD-18
10yr.-6hr. Event (in)	1.25	1.25	1.25	1.25	1.25
Manning's Number (n)	0.025	0.025	0.025	0.025	0.0025
Culvert Slope (%)	3.50	3.50	6.25	5.56	57.74
Peak Flow 10/6 (cfs)	1.35*	2.84**	4.65***	4.65***	0.29
Velocity 10/6 (fps)	3.51	4.20	5.90	5.65	6.79
Diam. Req'd. (ft.)	0.70	0.93	1.00	1.02	0.23
Diam. In Place (ft.)	1.50	1.50	2.00	2.00	1.50

* Based on entire flow from DD-1.
** Based on entire flows from DD-2, CD-10 & DD-11
*** Based on entire flow from DD-4.

TABLE IV-4 (PAGE 7-82)

MAIN CHANNEL CULVERT DESIGN

	(optional) C-1a
Structure	
Drainage Area	469.51
10 yr. - 24 hr. Event	1.82
Time of Conc. (hrs.)	1.02
Curve number	70
Manning's Number	0.025
Ditch Slope (%)	5.56
Peak Flow	22.12
Structure Area Used (ft.2)	7.07
Velocity (fps)	9.20
Hydraulic Length	10,200
Land Slope	19.83
Headwater Req'd (ft.)	2.22
D Req'd (ft.)	1.84

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D in Place 3.00

Note: See Appendix O for culvert justification.

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TABLE IV-4 (PAGE 7-82) (cont'd)

MAIN CHANNEL CULVERT DESIGN

Structure	C1	C3	C5	C7
Drainage Area	506.16	529.19	606.48	633.35
10 yr. - 24 hr. Event	1.82	1.82	1.82	1.82
Time of Conc. (hrs.)	-	-	-	-
Curve number	70	70	70	70
Manning's number	0.025	0.025	0.025	0.025
Ditch Slope (%)	5.56	5.56	5.56	5.56
Peak Flow	23.12	23.62	26.02	26.72
Structure Area Used (ft.2)	7.07	7.07	7.07	9.62
Velocity (fps)	9.20	9.20	9.20	9.20
Hydraulic Length	-	-	-	-
Land Slope	-	-	-	-
Headwater Req'd (ft.)	N/A	N/A	-	-
D Req'd (ft.)	1.86	1.88	1.95	1.97
D in Place	3.00	3.00	3.00	3.50

Note: See Appendix O for culvert justification.

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TABLE IV-4 (PAGE 7-82) (cont'd)

MAIN CHANNEL CULVERT DESIGN

Structure	C9	C11	C13	C15
Drainage Area	678.60	696.73	752.04	752.04
10 yr. - 24 hr. Event	1.82	1.82	1.82	1.82
Time of Conc. (hrs.)	-	-	-	-
Curve number	70	70	70	70
Manning's number	0.025	0.025	0.025	0.025
Ditch Slope (%)	5.56	5.56	5.56	5.56
Peak Flow	29.82	32.42	38.92*	38.92*
Structure Area Used (ft.2)	9.62	9.62	9.62	9.62
Velocity (fps)	9.20	9.20	9.20	9.20
Hydraulic Length	-	-	-	-
Land Slope	-	-	-	-
Headwater Req'd (ft.)	-	-	-	-
D Req'd (ft.)	2.06	2.12	2.27	2.27
D in Place	3.50	3.50	3.50	3.50

Note: See Appendix O for culvert justification.

Note: All culverts are within capacity for open-channel flow.

* If design peak flows for primary spillways from Ponds C and E are included, the peak flows for C-13 and C-15 are 65.6 cfs and 90.9 cfs respectively.

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TABLE IV-5

SIDE DRAINAGE CULVERT DESIGN

Structure	C-0	C-2	C-4	C-6
Drainage Area	36.65	23.03	77.29	26.87
10 yr. - 24 hr. Event	1.82	1.82	1.82	1.82
Time of Conc. (hrs.)	0.12	0.08	0.24	0.22
Curve number	70	70	70	70
Manning's number	0.025	0.025	0.025	0.025
Ditch Slope (%)	4.00	4.00	10.00	4.00
Peak Flow	5.65	3.90	8.77	4.17
Structure Area Used (ft.2)	1.767	1.767	1.767	1.767
Velocity (fps)	6.18	6.18	8.73	6.18
Hydraulic Length	1300	850	2850	1400
Land Slope	51.43	61.54	47.22	56.67
Headwater Req'd (ft.)	1.35	1.12	*2.40	1.02
D Req'd (ft.)	1.10	0.96	*1.30	0.98
D In Place (ft.)	1.50	1.50	1.50	1.50

* Available headwater at culvert inlet is greater than that required to allow for surge storage and passage of flows.

Headwater = distance from base of culvert to top of headwall.

SIDE DRAINAGE CULVERT DESIGN

Structure	C-8	C-10	C-12
Drainage Area	45.25	18.16	55.31
10 yr. - 24 hr. Event	1.82	1.82	1.82
Time of Conc. (hrs.)	0.14	0.11	0.21
Curve Number	70	70	70
Manning's Number	0.025	0.025	0.025
Ditch Slope (%)	4.00	4.00	10.00
Peak Flow	7.09	2.65	6.50
Structure Area Used (ft.2)	4.91	3.14	1.767
Velocity (fps)	6.18	4.90	9.77

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Hydraulic Length		1600	1250	2800
Land Slope	58.62	63.16	58.33	
Headwater Req'd (ft.)		1.25	0.98	1.60
D Req'd (ft.)	1.20	0.83	1.16	
D In Place (ft.)		2.50	2.00	1.5

TABLE IV-6

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RESTORED CHANNEL DESIGNS*

Structure	Main Channel RC-1	Side Channel* RC-O	RC-2	RC-4
Drainage Area	469.22	34.55	22.18	71.83
100 yr.- 6 hr. Event	1.91	1.91	1.91	1.91
Time of Conc. (hrs.)	3.19	0.18	0.09	0.44
Curve number	70	70	70	70
Manning's Number	0.040	0.040	0.040	0.040
Ditch Slope (%)	6.60	4.00	4.00	10.00
Peak Flow	60.31**	2.64	1.93	4.12
Min. Structure Area (ft.2)	27.00	8.00	8.00	8.00
Req'd Area (ft.2)	7.26	0.84	0.67	0.83
Depth of Flow (ft.)	1.03	0.35	0.30	0.35
Velocity (fps)	8.31	3.16	2.86	4.98
Hydraulic Length	10,200	1,300	850	2,400
Land Slope (%)	19.80	51.40	61.50	47.00
Erosion Protection (Y/N)	Y	N	N	Y

* In areas where these side drainages cross the road after final reclamation, road dips at least as substantial as the restored channels shown in Table IV-6 (Page 7-84) will be put in place. Locations of these are shown on Plate ~~17~~7-13.

** Includes Reclaimed Area.

Note: Ditch Slopes measured from Plate ~~17~~7-13.
Areas from Plate ~~17-A~~7-14

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TABLE IV-6 (cont'd)

RESTORED CHANNEL DESIGNS*

Structure	RC-6	RC-8	RC-10	RC-12	RC-14
Drainage Area			28.74	46.92	20.74	58.20	24.37
100 yr. - 6 hr. Event	1.91	1.91	1.91	1.91	1.91		
Time of Conc. (hrs.)	0.20	0.24	0.18	0.53	0.20		
Curve number			70	70	70	70	70
Manning's Number		0.040	0.040	0.040	0.040	0.040	
Ditch Slope (%)		4.00	4.00	4.00	10.00	4.00	
Peak Flow			2.15	3.39	1.60	3.12	1.82
Min. Structure Area (ft.2)	8.00	8.00	8.00	8.00	8.00		
Req'd Area (ft.2)		0.73	0.99	0.60	0.69	0.65	
Depth of Flow (ft.)		0.31	0.41	0.26	0.30	0.29	
Velocity (fps)		2.96	3.43	2.68	4.55	2.80	
Hydraulic Length		1,400	1,600	1,250	2,800	1,300	
Land Slope (%)			57.00	58.60	63.20	58.30	46.80
Erosion Protection (Y/N)	N	N	N	Y	N		

* In areas where these side drainages cross the road after final reclamation, road dips at least as substantial as the restored channels shown in Table IV-6 (Page 7-84) will be put in place. Locations of these are shown on Plate ~~17~~7-13.

Note: Ditch Slopes measured from Plate ~~17~~7-13.

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TABLE IV-6 (con't)
RESTORED CHANNEL DESIGNS
(Sub-Areas)*

Structure	1	2	3	4	5	6	7
Drainage Area (ac.)	4.72	1.09	8.73	24.37	4.37	24.00	12.74
100 yr.-6 hr. event (in.)	1.91	1.91	1.91	1.91	1.91	1.91	1.91
Time of Conc. (hrs.)	0.08	0.07	0.13	0.22	0.09	0.20	0.17
Curve Number	70	70	70	70	70	70	70
Peak Flow (cfs)	0.42	0.10	0.72	1.78	0.38	1.78	0.99
Hydraulic Length (ft.)	600	400	800	1,500	700	1,200	1,100
Land Slope (%)	66.67	55.17	58.33	66.67	60.00	60.87	60.00

* These areas drain directly to RC-1 by sheet flow, without entering other channels.
See Plate ~~17-A~~7-14.

TABLE IV-6 (con't)

RESTORED CHANNEL DESIGNS

Structure	*Reclaimed Area
Drainage Area (ac.)	32.34
100 yr.-6 hr. event (in.)	1.91
Time of Conc. (hrs.)	0.54
Curve Number	90
Peak Flow (cfs)	23.17
Hydraulic Length (ft.)	49.50
Land Slope (%)	6.60

* This area drains directly to RC-1 by sheet flow, without entering other channels.
See Plate ~~17-A~~7-14.

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RESTORED CHANNEL DESIGNS

Peak flow for RC-1 is based on the total of peak flows for RC-1 (Upper) plus channels RC-O through RC-14, plus sub-areas 1 through 7, plus the reclaimed area. Peak flows for each of these are shown in Appendix P.

TABLE IV-7

EROSION PROTECTION

Restored Side Channel Structure	Restored Side C-15	RC-1	Channel RC-4	*Main Channel RC-12	Restored Main Channel
Flow (cfs)	-	-	4.12	3.12	
Slope (%)	5.56	6.60	10.00	10.00	
Velocity (fps)	9.20	8.31	4.98	4.55	
Rip-rap Size (D50)	15"	12"	6"	6"	
Bedding (-3/4" gravel)	25"	20"	10"	10"	
Length of Protection (ft.)	20'	All	All	All	
Width of Protection (ft.)	10'	12'	6'	6'	
Rip-Rap Depth	18"	15"	8"	8"	

	UD-1	UD-4 (Max.)	UD-5 (Max.)	DD-3	DD-4 (Max.)
Flow (cfs)	20.57	14.82	4.75	15.18	14.55
Slope (%)	6.75	20.00	17.75	6.25	8.00
Velocity (fps)	7.25	9.67	6.98	6.28	6.82
Rip-rap Size (D50)	9"	15"	9"	9"	9"

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Bedding (-3/4" gravel)	15"	25"	15"	15"	15"
Length of Protection (ft.)	All	150'	150'	All	All
Width of Protection (ft.)	5'	5'	5'	4'	4'
Rip-Rap Depth	12"	18"	12"	12"	12"

* For Reference Only. Natural Rip-rap is more than adequate for erosion protection.

Note: Rip-Rap shall be graded according to the following:

D15 = 0.42D; D50 = 1D; D85 = 1.6D.

For Median Diameter of 12", D15 = 5", D50 = 12", D85 = 19.25".

For Median Diameter of 21", D15 = 9", D50 = 21", D85 = 34.00".

	UD-2 (upper)	UD-2 (lower)
Flow (cfs)	13.87	13.87
Slope (%)	12.33	42.60
Velocity (fps)	10.63	11.90
Rip-Rap Size (D50)	N/A**	12"
Bedding (-3/4" gravel)	N/A**	20"
Length of Protection (ft.)	150'	100'
Width of Protection (ft.)	5'	5'
Rip-Rap Depth	N/A**	15"

** UD-2 (upper) is protected by a channel liner.

During the earthwork portion of the reclamation suitable rip-rap will be segregated and stored on site for later use in the stream channel restorations it will not be necessary to haul rip-rap in from an outside source. Also native material will be used for the filter blanket

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under the rip-rap. This material can be used because of its sandy nature it will not be necessary to haul gravel in.

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TABLE IV-8

VALUES FOR MANNING'S N AND MAXIMUM PERMISSIBLE VELOCITY OF FLOW IN OPEN CHANNELS

Ditch lining			Manning's n	Vmaxfps1
1. Natural earth				
a. Without vegetation				
(1) Rock				
(a) Smooth and uniform			0.035-0.040	20
(b) Jagged & Irregular			0.040-0.045	15-18
(2) Soils				
Coarse grained				
Gravel and gravelly soils				
Unified	USDA			
GW	Gravel		0.022-0.024	6-7
GP	Gravel		0.023-0.026	7-8
GM	Loamy Gravel	d u	0.023-0.025 0.022-0.020	3-5 2-4
GC	Gravelly Loam Gravelly Clay		0.024-0.026	5-7
Coarse grained				
Sand and sandy soils				
SW	Sand		0.020-0.024	1-2
SP	Sand		0.022-0.024	1-2
SM	Loamy Sand	d u	0.020-0.023 0.021-0.023	2-3 2-3
SC	Sandy Loam		0.023-0.025	3-4
Fine grained				
Silts and clays				
50 CL	Clay Loam Sandy Clay Loam Silty Clay Silt Loam		0.022-0.024	2-3
LL ML	Very Fine Sand Silt		0.023-0.024	3-4

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50	OL	Mucky Loam	0.022-0.024	2-3
	CH	Clay	0.022-0.023	2-3
	MH	Silty Clay	0.023-0.024	3-5
LL	OH	Mucky Clay	0.022-0.024	2-3
Highly Organic				
	PT	Peat	0.022-0.025	2-3

1Maximum recommended velocities

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~~Table IV-9~~

Sediment Yield
for
Disturbed Area

Using the Universal Soil Loss Equation:
A = RKLSCP; Where:

R = 16.53 from R = ~~27P~~$^{27P2.2}$~~$^{-2}$~~$_{7.}$ P2,6 = 0.8 inches
2,6

K = 0.50 from Table 5.5 (Ref. Below)
LS = 2.5 Length/Slope factors from Fig. 5-15 (Ref. Below)
Average Length = 1200'
Average Slope = 6.25%
CP = 1.0 from Table 5.A.1 (Ref. Below)
Based on combination of compacted surface and pavement with grouted ditches.

*A = 16.53 x 0.50 x 2.5 x 1.0 = 20.6625 tons/acre/year
Sediment Yield = A = 0.010 ac./ft./acre/yr.

Notes: (1) Reference: "Applied Hydrology and Sedimentology for Disturbed Areas", Barfield, Warner and Haan, 1983.
(2) Sediment Yield based on a weight of 100 lbs./cu. ft.

* Included for reference only. A more conservative figure of 0.05 ac. ft./acre has been used for Pond C, and 0.1 ac. ft./acre has been used for Pond E sizing.

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Table IV-10

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December 2014

Table IV-10

Sediment Yield
for
Undisturbed Areas

Using the Universal Soil Loss Equation:

A = RKLSCP; Where:

R = 16.53 from $R = 27P_{2,6}^{2.2}$; P2,6 = 0.8 inches

K = 0.37 from Table 5.5 (Ref. Below)

LS = Average Length/Slope Factor from Equation = 56.04

$LS = \left(\frac{L}{72.6}\right)^{0.5} (430X^2 + 30X + 0.43)$;
6.613

L = Avg. Slope Length = 1,000'

X = Sin 0; 0 = Avg. Slope Angle = 26.57o (50%)

C = 0.1 from Table 5.A.3 (Ref. Below)
25% Canopy Cover; 40% Ground Cover

P = 1 (No. Control Practice)

A = 16.53 x 0.37 x 56.04 x 0.1 = 34.275 tons/acre/yr.

Sed. Yield = $\frac{34.275 \times 2{,}000}{100 \times 43{,}560}$ = 0.016 ac. ft./acre/yr.

Notes: (1) Reference: "Applied Hydrology and Sedimentology for Disturbed Areas", Barfield, Warner and Haan, 1983.

(2) Sediment yield based on a weight of 100 lbs./cu. ft.

Table IV-11
Minesite Drainage Area Summary

Drainage No.	Area (ac.)	Type	Drains To:

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1	4.23	Undisturbed	Pond E
2	5.40	"	Pond C
3	3.00	"	Old Works (Chidister Mine)
4	3.12	"	" " "
5	11.97	"	Pond C
6	2.06	"	Apex Mine
7	1.12	"	Old Works (Chidister Mine)
8	0.55	"	" " "
9	1.01	"	" " "
10	7.41	"	" " "
11	0.13	"	Pinnacle Mine
12	13.52	"	Pond C
13	6.20	"	Pond E
14	1.77	"	" "
15	12.21	Disturbed	" "
16	6.04	"	Pond C
17	4.07	"	Catch Basin B
18	1.28	"	Old Works (Chidister Mine)
19	0.81	"	Pinnacle Mine
20	4.68	"	Pond C
21	3.25	"	Old Works (Chidister Mine)
22	1.23	"	Apex Mine
Total =	95.06;		

Disturbed = 33.57 Acres;
Undisturbed = 61.49 Acres

Notes: (1) Areas disturbed from Plate ~~8~~7-2 (and Plate ~~9~~7-1 as necessary).

(2) Does not include diverted undisturbed drainage.

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Typical Diversion Ditch
Figure IV-3

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~~Typical Section for Trapezoidal Ditch~~
~~Figure IV-3A~~

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~~Undisturbed Diversion Typical~~
~~Figure IV-4~~

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~~Typical Section of Emergency Spillway~~
~~Figure IV-6~~

~~INSERT ORIGINAL DRAWING~~

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~~Loose Rock Check Dam~~
~~(Restored Main Drainage Channel)~~
~~Figure IV-8~~

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~~Loose Rock Check Dam~~
~~(Restored Side Drainage Channel)~~
~~Figure IV-9Restored Channel Typicals~~
~~Figure IV-09~~

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~~December 2014~~

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~~Restored Channel Typicals~~
~~Figure IV-10~~

~~INSERT ORIGINAL DRAWING~~

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~~Figure IV-12~~

~~INSERT ORIGINAL DRAWING~~

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~~Figure IV-13~~
~~Sampling Access Ramp~~

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Figure IV-14
Floating Decant Typical

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R645-301-733.100. GENERAL PLANS

See R645-301-733.

R645-301-733.110. CERTIFICATION

See R645-301-733.

R645-301-733.120. MAPS AND CROSS SECTIONS

See R645-301-733., also R645-301-510.

R645-301-733.130. NARRATIVE

See R645-301-733.

R645-301-733.140. SURVEY RESULTS

Appendix L

R645-301-733.150. HYDROLOGIC IMPACT

Appendix L

R645-301-733.160. DESIGN PLANS AND CONSTRUCTION SCHEDULE

See R645-301-733.

R645-301-733.200. PERMANENT AND TEMPORARY IMPOUNDMENTS

See R645-301-733.

R645-301-733.210. REQUIREMENTS

N/A

R645-301-733.220. DEMONSTRATION FOR PERMANENT IMPOUNDMENTS

N/A

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R645-301-733.221. ADEQUACY FOR INTENDED USE

N/A

R645-301-733.222. WATER QUALITY AND EFFLUENT LIMITATIONS

N/A

R645-301-733.223. WATER LEVEL

N/A

R645-301-733.224. FINAL GRADING

N/A

R645-301-733.225. DIMINUTION OF QUALITY AND QUANTITY OF WATER UTILIZED BY OTHERS

N/A

R645-301-733.226. SUITABILITY FOR POSTMINING LAND USE

N/A

R645-301-733.230. TEMPORARY IMPOUNDMENTS

See R645-301-733.

R645-301-733.240. HAZARD NOTIFICATIONS

See R645-301-733.

R645-301-734. DISCHARGE STRUCTURES

See R645-301-733.

R645-301-735. DISPOSAL OF EXCESS SPOIL

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See R645-301-513.300.

R645-301-736. COAL MINE WASTE

See R645-301-513.300.

R645-301-737. NON-COAL MINE WASTE

See R645-301-513.300.

~~**R645-301-737. NON-COAL MINE WASTE**~~

~~See R645-301-513.300.~~

R645-301-738. TEMPORARY CASING AND SEALING OF WELLS

All exploratory drill holes have been sealed with cement and all water wells have been cased with steel casing and will be maintained. After mining is completed, the water wells and monitoring wells will be sealed except in the event the state engineer allows them to remain opened for other purposes.

R645-301-740. DESIGN CRITERIA AND PLANS

See R645-301-733.

R645-301-741. GENERAL REQUIREMENTS

See R645-301-733.

R645-301-742. SEDIMENT CONTROL MEASURES

See R645-301-733.

R645-301-742.100. GENERAL REQUIREMENTS

See R645-301-733.

R645-301-742.110. DESIGN

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See R645-301-733.

R645-301-742.111. PREVENTION

See R645-301-733.

~~**R645-301-742.110. DESIGN**~~

~~See R645-301-733.~~

~~**R645-301-742.111. PREVENTION**~~

~~See R645-301-733.~~

R645-301-742.112. EFFLUENT LIMITATIONS

Appendix J

R645-301-742.113. EROSION PROTECTION

See R645-301-733.

R645-301-742.120. MEASURES AND METHODS

See R645-301-733.

R645-301-742.121. RETAINING SEDIMENT WITHIN DISTURBED AREAS

See R645-301-733.

R645-301-742.122. DIVERTING RUNOFF AWAY FROM DISTURBED AREAS

See R645-301-733.

R645-301-742.123. DIVERTING RUNOFF USING PROTECTED CHANNELS

See R645-301-733.

R645-301-724.124. PHYSICAL TREATMENT TO REDUCE FLOW OR TRAP SEDIMENT

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See R645-301-733.

R645-301-742.125. CHEMICAL TREATMENT

N/A

R645-301-742.126. IN-MINE TREATMENT

N/A

R645-301-742.200. SILTATION STRUCTURES

See R645-301-733.

R645-301-742.210. GENERAL REQUIREMENTS

See R645-301-733.

R645-301-742.211. DESIGN

See R645-301-733.

R645-301-742.212. REQUIREMENTS

See R645-301-733.

R645-301-742.213. SILTATION STRUCTURES WHICH IMPOUND WATER

See R645-301-733.

R645-301-742.214. POINT SOURCE DISCHARGES

See R645-301-711.300.

R645-301-742.220. SEDIMENTATION PONDS

See R645-301-733.

R645-301-742.221. USE

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See R645-301-733.

R645-301-742.221.1 INDIVIDUALLY OR IN SERIES

See R645-301-733.

~~**R645-301-742.221. USE**~~

~~See R645-301-733.~~

~~**R645-301-742.221.1 INDIVIDUALLY OR IN SERIES**~~

~~See R645-301-733.~~

R645-301-742.221.2 LOCATION

See R645-301-733., Plate ~~6~~5-7.

R645-301-742.221.3 DESIGN, CONSTRUCTION AND MAINTENANCE

See R645-301-733.

R645-301-742.221.31 SEDIMENT STORAGE VOLUME

See R645-301-733.

R645-301-742.221.32 DETENTION TIME

See R645-301-733.

R645-301-742.221.33 DESIGN EVENT

See R645-301-733.

R645-301-742.221.34 DEWATERING DEVICE

See R645-301-733.

R645-301-742.221.35 SHORT CIRCUITING

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See R645-301-733.

R645-301-742.221.36 SEDIMENT REMOVAL

See R645-301-733.

R645-301-742.221.37 EXCESSIVE SETTLEMENT

See R645-301-733.

R645-301-742.221.38 EMBANKMENT MATERIAL

See R645-301-733.

R645-301-742.221.39 COMPACTION

See R645-301-733.

R645-301-742.222. MSHA SEDIMENTATION PONDS

N/A

R645-301-742.223. OTHER SEDIMENTATION PONDS

See R645-301-733.

R645-301-745.223.1 OPEN CHANNEL SPILLWAY

See R645-301-733.

R645-301-742.223.2 LINING

See R645-301-733.

R645-301-742.230. OTHER TREATMENT FACILITIES

N/A

R645-301-742.231. DESIGN EVENT

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N/A

R645-301-742.232. REQUIREMENTS

N/A

R645-301-742.240. EXEMPTIONS

N/A

R645-301-742.300. DIVERSIONS

See R645-301-733.

R645-301-742.310. GENERAL REQUIREMENTS

See R645-301-733.

R645-301-742.311. REQUIREMENTS

See R645-301-733.

R645-301-742.312. DESIGN

See R645-301-733.

R645-301-742.312.1 STABILITY

See R645-301-733.

R645-301-742.312.2 FLOOD PROTECTION

See R645-301-733.

R645-301-742.312.3 SUSPENDED SOLIDS

See R645-301-733.

R645-301-742.312.4 COMPLY WITH OTHER REGULATIONS

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See R645-301-733.

R645-301-742.313. TEMPORARY AND PERMANENT DIVERSIONS.

See R645-301-733.

R645-301-742.314. ADDITIONAL DESIGN CRITERIA.

See R645-301-733.

R645-301-742.320. DIVERSION OF PERENNIAL AND INTERMITTENT STREAMS.

N/A

R645-301-742.321. BUFFER ZONE REQUIREMENTS.

N/A

R645-301-742.322. DESIGN CAPACITY.

N/A

R645-301-742.323. DESIGN EVENT.

N/A

R645-301-742.324. CERTIFICATION.

N/A

R645-301-742.330. DIVERSION OF MISCELLANEOUS FLOWS.

See R645-301-733.

R645-301-742.331. REQUIREMENTS.

See R645-301-733.

R645-301-742.332. DESIGN.

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See R645-301-733.

R645-301-742.333. DESIGN EVENT

See R645-301-733.

R645-301-742.400. ROAD DRAINAGE

See R645-301-733., .250.

R645-301-742.410. ALL ROADS

See R645-301-733., .250.

R645-301-742.411. PROTECTION AND SAFETY

See R645-301-733., .250.

R645-301-742.412. INTERMITTENT OR PERENNIAL STREAM RESTRICTION

N/A

R645-301-742.413. DOWNSTREAM SEDIMENTATION AND FLOODING

See R645-301-733.

R645-301-742.420. PRIMARY ROADS

See R645-301-733., .250.

R645-301-742.421. EROSION PROTECTION

See R645-301-733., .250.

R645-301-742.422. STREAM FORDS

N/A

R645-301-742.423. DRAINAGE CONTROL

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See R645-301-733.

R645-301-742.423.1 PRIMARY ROAD DESIGN CRITERIA

See R645-301-512.250.

R645-301-742.423.2 DRAINAGE PIPES AND CULVERTS

See R645-301-733.

R645-301-742.423.3 DRAINAGE DITCHES

See R645-301-733.

R645-301-742.423.4 NATURAL STREAM CHANNELS

See R645-301-733.

R645-301-742.423.5 REQUIREMENTS

See R645-301-733.

R645-301-743. IMPOUNDMENTS

See R645-301-733.

R645-301-743.100. GENERAL REQUIREMENTS

See R645-301-733.

~~**R645-301-743.100. GENERAL REQUIREMENTS**~~

~~See R645-301-733.~~

R645-301-743.110. MSHA IMPOUNDMENTS

N/A

R645-301-743.120. CERTIFICATION AND FREEBOARD REQUIREMENTS

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See R645-301-733.

~~See R645-301-733.~~

R645-301-743.130. SPILLWAYS

See R645-301-733.

~~See R645-301-733.~~

R645-301-743.140. INSPECTIONS

See R645-301-733.

R645-301-743.200. SPILLWAY DESIGN EVENT FOR PERMANENT IMPOUNDMENTS

N/A

R645-301-743.300. SPILLWAY DESIGN EVENT FOR TEMPORARY IMPOUNDMENTS

See R645-301-733.

R645-301-744. DISCHARGE STRUCTURES

See R645-301-733.

R645-301-744.~~100.~~ EROSION CONTROL
~~DISCHARGE STRUCTURES~~

See R645-301-733.

R645-301-744.~~100.~~ EROSION CONTROL200. DESIGN

~~See R645-301-733.~~

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~~R645-301-744.200. DESIGN~~

See R645-301-733.

R645-301-745. DISPOSAL OF EXCESS SPOIL

See R645-301-513.300.

R645-301-745.100. GENERAL REQUIREMENTS

See R645-301-513.300.

~~R645-301-745.100. GENERAL REQUIREMENTS~~

~~See R645-301-513.300.~~

R645-301-745.110. DISPOSAL AREA

See R645-301-513.300.

R645-301-745.111. EFFECTS ON SURFACE AND GROUND WATER

See R645-301-513.300.

R645-301-745.112. IMPOUNDMENTS ON FILL

N/A

R645-301-745.113. COVER

See R645-301-513.300.

~~R645-301-745.112. IMPOUNDMENTS ON FILL~~

~~N/A~~

~~R645-301-745.113. COVER~~

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~~See R645-301-513.300.~~

R645-301-745.120. DRAINAGE CONTROL.

N/A

R645-301-745.121. DIVERSIONS.

N/A

R645-301-745.122. UNDERDRAINS.

N/A

R645-301-745.200. VALLEY FILLS AND HEAD-OF-HOLLOW FILLS.

N/A

R645-301-745.210. REQUIREMENTS.

N/A

R645-301-745.220. DRAINAGE CONTROL.

N/A

R645-301-745.221. RESTRICTIONS.

N/A

R645-301-745.222. RUNOFF CONTROL.

N/A

R645-301-745.300. DURABLE ROCK FILLS.

N/A

R645-301-745.310. REQUIREMENTS.

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N/A

R645-301-745.320. UNDERDRAINS

N/A

R645-301-745.330. RUNOFF CONTROL

N/A

~~N/A~~

R645-301-745.400. PRE-EXISTING BENCHES

N/A

~~N/A~~

R645-301-746. COAL MINE WASTE

See R645-301-513.300.

R645-301-746.100. GENERAL REQUIREMENTS

See R645-301-513.300.

R645-301-746.~~100.~~ 110. PLACEMENT
~~GENERAL REQUIREMENTS~~

See R645-301-513.300.

~~**R645-301-746.110. PLACEMENT**~~

~~See R645-301-513.300.~~

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R645-301-746.120. EFFECTS ON SURFACE AND GROUND WATER

See R645-301-513.300.

R645-301-746.200. REFUSE PILES

N/A

R645-301-746.210. REQUIREMENTS

N/A

R645-301-746.211. SEEPS AND SPRINGS

N/A

R645-301-746.212. UNCONTROLLED SURFACE DRAINAGE

N/A

R645-301-746.213. UNDERDRAINS

N/A

R645-301-746.220. SURFACE AREA STABILIZATION

N/A

R645-301-746.221. SLOPE PROTECTION

N/A

R645-301-746.222. IMPOUNDMENT RESTRICTIONS

N/A

R645-301-746.300. IMPOUNDING STRUCTURES

N/A

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R645-301-746.310. COAL MINE WASTE

See R645-301-513.300.

R645-301-746.~~200.~~ 311. REQUIREMENTS~~REFUSE PILES~~

See R645-301-513.300.

R645-301-746.312. MSHA IMPOUNDING STRUCTURE

N/A

~~N/A~~

R645-301-746.320. SPILLWAYS AND OUTLET WORK

N/A

~~210. REQUIREMENTS~~R645-301-746.330. DRAINAGE CONTROL

~~N/A~~

N/A

R645-301-746.340. WATER STORAGE

N/A

~~211. SEEPS AND SPRINGS~~R645-301-746.400. RETURN OF COAL PROCESSING WASTE TO ABANDONED UNDERGROUND WORKINGS

~~N/A~~

N/A

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R645-301-746.410. HYDROLOGIC IMPACTS

N/A

~~212. UNCONTROLLED SURFACE DRAINAGE~~R645-301-746.420. MONITORING WELLS

N/A

~~N/A~~

R645-301-746.430. PNEUMATIC BACKFILLING~~213. UNDERDRAINS~~

~~N/A~~

N/A

R645-301-~~746.220. SURFACE AREA STABILIZATION~~

~~N/A~~

~~R645-301-746.221. SLOPE PROTECTION~~

~~N/A~~

747. DISPOSAL OF NON-~~R645-301-746.222. IMPOUNDMENT RESTRICTIONS~~

~~N/A~~

~~R645-301-746.300. IMPOUNDING STRUCTURES~~

~~N/A~~

~~R645-301-746.310.~~ **COAL MINE WASTE**

~~See R645-301-513.300.~~

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~~R645-301-746.~~311. REQUIREMENTS

See R645-301-513.300.

~~R645-301-746.312. MSHA IMPOUNDING STRUCTURE~~
R645-301-747.100. REQUIREMENTS

~~N/A~~

~~R645-301-746.320. SPILLWAYS AND OUTLET WORK~~

~~N/A~~

~~R645-301-746.330. DRAINAGE CONTROL~~

~~N/A~~

~~R645-301-746.340. WATER STORAGE~~

~~N/A~~

~~R645-301-746.400. RETURN OF COAL PROCESSING WASTE TO ABANDONED UNDERGROUND WORKINGS~~

~~N/A~~

~~R645-301-746.410. HYDROLOGIC IMPACTS~~

~~N/A~~

~~R645-301-746.420. MONITORING WELLS~~

~~N/A~~

~~R645-301-746.430. PNEUMATIC BACKFILLING~~

~~N/A~~

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~~R645-301-747. DISPOSAL OF NON-COAL MINE WASTE~~

See R645-301-513.300.

~~R645-301-747.100. REQUIREMENTS~~

~~See R645-301-513.300.~~

R645-301-747.200. PLACEMENT AND STORAGE

See R645-301-513.300

R645-301-747.300. FINAL DISPOSAL

See R645-301-513.300.

R645-301-748. CASING AND SEALING OF WELLS

All exploratory drill holes have been sealed with cement and all water wells have been cased with steel casing and will be maintained. After mining is completed, the water wells and monitoring wells will be sealed except in the event the state engineer allows them to remain opened for other purposes.

R645-301-750. PERFORMANCE STANDARDS

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

R645-301-751. WATER QUALITY STANDARDS AND EFFLUENT LIMITATIONS

Discharges or water from areas disturbed by coal mining and reclamation operations will be made in compliance with all Utah and federal water quality laws and regulations and with

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effluent limitations for coal mining promulgated by the U.S. Environmental Protection Agency set forth in 40 CFR Part 434.

R645-301-752. SEDIMENT CONTROL MEASURES

Sediment control measures must be located, maintained, constructed and reclaimed according to plans and designs given under R645-301-732, R645-301-742 and R645-301-760.

R645-301-752.100. SILTATION STRUCTURES AND DIVERSIONS

See R645-301-733.

R645-301-752.200. ROAD DRAINAGE

See R645-301-512.250.

R645-301-752.210. CONTROL OF EROSION AND POLLUTION

See R645-301-733.

R645-301-752.220. CONTROL OF SUSPENDED SOLIDS

See R645-301-733.

R645-301-752.230. COMPLIANCE WITH EFFLUENT STANDARDS

See R645-301-733.

R645-301-752.240. MINIMIZE DIMINUTION OF DEGRADATION OF WATER QUALITY

See R645-301-733.

R645-301-752.250. ALTERATION OF STREAM FLOW OR CHANNELS

See R645-301-733.

R645-301-753. IMPOUNDMENTS AND DISCHARGE STRUCTURES

See R645-301-733.

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R645-301-754. DISPOSAL OF EXCESS SPOIL, COAL MINE WASTE AND NON-COAL MINE WASTE

See R645-301-513.300.

R645-301-755. CASING AND SEALING OF WELLS

All exploratory drill holes have been sealed with cement and all water wells have been cased with steel casing and will be maintained. After mining is completed, the water wells and monitoring wells will be sealed except in the event the state engineer allows them to remain opened for other purposes.

R645-301-760. RECLAMATION

See R645-301-240.

R645-301-761. GENERAL REQUIREMENTS

See R645-301-240.

R645-301-762. ROADS

See R645-301-512.250.

R645-301-762.100. RESTORING NATURAL DRAINAGE PATTERS

Upon completion of mining activities, and following removal of surface structures, the earthwork portion of the reclamation plan will begin as described. The hydrologic portion of reclamation will take place in two phases:

1. The main and side drainage channels will be restored as shown in the Sedimentation and Drainage Control Plan, and on Plate ~~16~~7-12. Loose rock check dams will be placed at each side drainage entrance onto the reclaimed area, and at approximately 500' intervals along the restored main channel RC-1. (Typical sections of the loose rock check dams are shown in the Sedimentation and Drainage Control Plan).

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All disturbed diversions and sediment ponds "B" and "C" will also be removed at this time. Sediment Pond "E" will be enlarged, and the entire drainage above will flow into Pond "E-PM" through the restored channel RC-1.

2. Once revegetation and water quality standards are met, Pond "E-PM" will be removed, and the area reclaimed.

Surface water monitoring will continue during this time as described. Please see ~~Figure IV-11~~Plate 7-9.

R645-301-762.200. REGRADING

See R645-301-532.200.

R645-301-763. SILTATION STRUCTURES

See R645-301-733.

R645-301-763.100. RESTRICTIONS

See R645-301-733.

~~**R645-301-763.100. RESTRICTIONS**~~

~~See R645-301-733.~~

R645-301-763.200. REQUIREMENTS

See R645-301-733.

R645-301-764. STRUCTURE REMOVAL

See R645-301-240.

R645-301-765. PERMANENT CASING AND SEALING OF WELLS

All exploratory drill holes have been sealed with cement and all water wells have been cased with steel casing and will be maintained. After mining is completed, the water wells and monitoring wells will be sealed except in the event the state engineer allows them to remain opened for other purposes.

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ANDALEX RESOURCES, INC.
CENTENNIAL PROJECT

CHAPTER 1

Legal, Financial, Compliance And Related Information

C/007/019

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Plate 1-5 Surface Area Boundary - Deadman Canyon
Plate 1-6 GVH Locations Map

CHAPTER 1, LEGAL

R645-301-100. General

The Kenilworth Lease (UTU-81893),Boundary Change is simply an extension of our underground mine workings and will in no way involve any new surface facilities or otherwise have any effect on the surface. It does not involve any new hydrologic basins. It should be noted that UTU-81893 was previous included in the Willow Creek Mine Permit No. ACT/007/038 which was approved by DOGM. After the Willow Creek Mine was closed the Kenilworth lease was terminated. The area was subsequently re-leased by BLM in 1986 through the normal LBA process after an application by Andalex Resources. Refer to R645-301-200 through R645-301-800 for additional information.

R645-301-110. LEGAL, FINANCIAL, AND COMPLIANCE INFORMATION

Legal, Financial, Compliance and Information

The objective of this chapter is to set forth all relevant information concerning ownership and control of Andalex Resources, Inc., the ownership and control of the property to be affected by mining activities and all other information and documentation required.

Please note that right-of-entry information for all new Leases is included in Appendix J, "Other Approvals". This includes the short form of the Mathis lease recorded at Carbon County.

Compliance Information

a) Suspension and Revocation

Andalex Resources, Inc., affiliates or persons controlled by or under common control with Andalex haven't had a mining permit suspended or revoked within the last five years.

b) Forfeiture of Bond

Andalex Resources, Inc., affiliates or persons controlled by or under common control with Andalex have not forfeited a mining bond or similar security in lieu of bond.

c) History of Violations

Appendix 1, Part 3 contains a listing of all violations received within the last three years prior to the date of this application by Andalex and affiliated companies.

R645-301-111. INTRODUCTION

Overview and Summary of Project

Mining operations at the Pinnacle Mine began in the Gilson Seam on October 3, 1980, according to the Mining and Reclamation Plan approved by the State of Utah, Department of Natural Resources, Division of Oil, Gas, and Mining. The mining began on the Zion's fee lease and extended onto Andalex's federal leases according to federal approval granted in 1982. Andalex also opened the Apex Mine in the Lower Sunnyside Seam late in 1982. Mining commenced in the Aberdeen Mine in the Aberdeen Seam in mid 1988. The Pinnacle Mine, Apex Mine, and most recently the Aberdeen Mine are now essentially worked out. With the addition of the Kenilworth lease the Aberdeen could possibly reopen depending upon market conditions. The restart date of the Aberdeen mine has yet to be determined. The coal is classified as High Volatile B bituminous in the Lower Sunnyside and Gilson Seams and as High-volatile A bituminous in the Aberdeen Seam. The mine plan area is located approximately 10 miles north-northeast of Price, Utah in Carbon County in T12 and 13S and R10 and 11E (See Plate 1-1).

The Operator relinquished portions of the mined out Federal coal leases in two separate lease relinquishments. The first lease relinquishment approved 3/12/2012 reduced the Federal coal leased acreage from 5,436.24 down to 2,813.48. The second coal relinquishment reduced the Federal coal lease even further down to 894.55 acres. UEI retained all areas of surface disturbance conducted in association with the underground mining and surface access to the gob-vent holes was retained through surface use agreements.

With the relinquishments the permit acreage dropped from 6,516.91 down to 2,274.77 acres. When Kenilworth lease is added the permit acreage goes back up to 4,035.90 which is the new permit acreage. The disturbed area has not changed and remains at 47.19 acres. Since the disturbed area has not changed and the disturbed legal description stays the same the bond does not change with the addition of the Kenilworth lease. The breakdown of Federal, and Fee for both coal leases and surface leases are shown on Tables 1-1 for Coal leases and 1-2 for Surface leases.

The existing permit's property is located in the Book Cliffs coal field and includes Alrad Canyon, Deadman Canyon, Starpoint Canyon, Straight Canyon, and Hoffman Creek Canyon areas. The Kenilworth Tract occupies the area of Summit Creek, Deep Canyon and Mathis Canyon. The Coal outcrops along the cliffs between 7,000 feet and 7,700 feet elevations. The topography is very rugged, the Book Cliffs being dissected by box canyons created by ephemeral streams. Large sandstone boulders eroded from the cliffs are scattered along the sides of the canyons. The land is undeveloped, used primarily for grazing, and there are no areas of national importance in the region. Mountain-Brush vegetative type covers most of the area.

There are no perennial streams or bodies of water on the property. Ground water recharge is from precipitation in the vicinity. Water supply for mine development is from water encountered in the existing underground mine workings. Culinary usage is supplied by an independent contractor who hauls Price City culinary water to the mine on an as-needed basis. Historically, coal mining has been the only industry in the permit area and there are several abandoned mines located on the property. Other than the GVH holes, no oil or gas wells exist in the area.

Access to the existing mine surface facilities area is by way of the Airport Road, an existing paved county road which has been upgraded and is maintained by Carbon County. It is used as an access road as well as a haul road. All surface and support facilities necessary for present operations have been completed and are located on the Zion's fee or on rights-of-way granted by the Bureau of Land Management. This is also a small private easement granted to Andalex from David Cave for a small portion of pond E. Andalex has acquired all applicable state and federal licenses, permits, and rights-of-way necessary to conduct mining activities on all private (fee) and federal leases.

As of 7-6/2007 the Apex Mine and the Pinnacle Mine have been worked out. Also, The BLM has recently determined that the Aberdeen mine is mined out. The Apex Mine has been sealed at the portals. The Pinnacle mine is still being ventilated because the power to the Aberdeen mine runs into the Pinnacle mine from the substation and then drops down to the Aberdeen Mine through a borehole connecting the two mines. However, there are no plans to produce any more coal from the Pinnacle Mine. Therefore, all future mine production on the Centennial Project will be solely from the Kenilworth Lease in the Aberdeen Mine.

The mining method being employed in the Aberdeen Mine is gateroad development utilizing continuous miners with final extraction by longwall. Certain fringe area reserves, if any, inadequate for longwall panels, will be evaluated for possible room-and-pillar mining.

This operation does not face any of the mining complications caused by faults or other intrusive geologic features. The mine plan area is located in a region where mining has been the major industry; therefore, the nearby communities are geared for coal operations. The labor supply is excellent and well trained. With these considerations, and Andalex's prudent management, the Centennial Project will continue to be a model mining operation in the Carbon County area with very minimal environmental and socioeconomic impact.

Upon cessation of final mining activities, reclamation activities will commence as soon as is practicable, according to the plans outlined in this application. The land will be restored according to available technology to as nearly its original condition as is possible.

Organization of Application

This underground mining permit application has been organized in accordance with the general requirements for format and contents as outlined in the R645-Coal Mining Rules.

R645-301-111.100. OBJECTIVES

Objectives

The objective of this chapter is to set forth all relevant information concerning ownership and control of Andalex Resources, Inc., the ownership and control of the property to be affected by mining activities and all other information and documentation required.

Please note that right-of-entry information for all new Leases is included in Appendix J, "Other Approvals".

R645-301-111.200. RESPONSIBILITY

Andalex Resources, Inc., is responsible for submission of information and will pay abandoned mine reclamation fees.

R645-301-111.300. APPLICABILITY

The requirements of R645-301-100 apply to Andalex Resources, Inc.

R645-301-112. IDENTIFICATION OF INTERESTS

a) Permit Applicant

Andalex Resources, Inc.
Tower Division
P.O. Box 910
East Carbon, Utah 84520-0910
(801) 888-4000

b) Legal and Equitable Owners of Record

Earth work for the Aberdeen Mine was completed in 1989. Surface facilities for the Aberdeen Mine were completed early in 1990. All existing facilities are located either on land owned by Zions Securities Corporation or on federal land. The addresses of these owners of record are as follow:

Bureau of Land Management (801) 524-3004
Utah State Office
324 South State Street
Salt Lake City, Utah 84111

Zion Securities Corporation (801) 363-3841
10 East South Temple
Salt Lake City, Utah 84111

All coal to be mined on the permit area is owned by the federal government, Zion Securities Corporation, Sunedco Coal Company or AMCA Coal Leasing, Inc. The addresses of these owners of record are as follow:

Bureau of Land Management
Utah State Office
440 West 200 South, Suite 500
Salt Lake City, Utah 84101-1345

AMCA Coal Leasing, Inc.
PO Box 910
East Carbon, Utah 84520-0910

Zion Securities Corporation
10 East South Temple
Salt Lake City, Utah 84111
Sunedco Coal Company
7401 West Mansfield Avenue
Suite 418
P.O. Box 35-B
Lakewood, Colorado 80235

R645-301-112.100. TYPE OF BUSINESS

Andalex Resources is a corporation organized and existing under the laws of Delaware and qualified to do business in Utah. Andalex Resources, Inc, is a wholly owned subsidiary of UtahAmerican Energy Inc., which in turn is a wholly owned subsidiary of Murray Energy Corporation. Andalex began mining operations in the Pinnacle Mine October, 1980, and in the Apex Mine in late 1982. Mining commenced in the Aberdeen Mine in mid-1988. These mines are located on fee and federal lands in Carbon County, Utah. Andalex, the designated operator, along with AMCA Coal Leasing, Inc., its land acquisition and development branch, controls all federal and fee mining leases within the mine plan area. This underground mining permit application has been prepared by Andalex Resources and is being submitted for review and approval by the appropriate regulatory authorities.

R645-301-112.200. NAMES, LOCATIONS, RESIDENT AGENT

Resident Agent who will accept service of process for Andalex Resources, Inc., Tower Division, Centennial Mines, ACT/007/019:

Karin Madsen
Andalex Resources, Inc.
Tower Division
P.O. Box 910
East Carbon, Utah 84520-0910

Also, see Chapter 8, Page 24 for notarized statement pertaining to completeness and accuracy.

R645-301-112.300. OTHER THAN SINGLE PROPRIETORSHIPS

Andalex Resources, Inc., Tower Division, holds the exclusive coal operating interests in the permit area.

R645-301-112.310. OFFICERS AND SHAREHOLDERS

See Appendix 1, Part 1 for ownership and control information.

R645-301-112.320. OWNERSHIP AND CONTROL RELATIONSHIP TO APPLICANT

See Appendix 1, Part 1 for ownership and control information.

R645-301-112.400. PENDING, CURRENT AND PREVIOUS COAL PERMITS

See Appendix 1, Part 2 for current and previous coal mining permits

R645-301-112.500. SURFACE AND MINERAL OWNERSHIP

Owners of Record of Surface and Subsurface Contiguous Areas

Names and addresses of all owners of record for all surface and subsurface areas contiguous to and within the permit area are listed below and indicated on Plates 5-1 and 5-2.

Subsurface Owners (See Plate 5-2 for Mineral Ownership)

Franklin Real Estate Company (contiguous)
(American Electric Power)
#2 Broadway
New York, New York

Bureau of Land Management (contiguous & within)
Utah State Office
440 West 200 South, Suite 500
Salt Lake City, Utah 84101-1345

Andalex Resources, Inc. (within)
PO Box 910
East Carbon, Utah 84502-0910

Zion Security Corp. (within)
10 East South Temple
Salt Lake City, Utah 84111

Mathis Land Co. (contiguous & within)
Sunnyside Star Route
Price, Utah 84501

Surface Owners (See Plate 5-1 Surface Ownership)

Deseret Title Holding Corp (within)
50 E North Temple
Tax Div.-22nd Floor
Salt Lake City, Utah 84150

Bureau of Land Management (contiguous & within)
Utah State Office
440 West 200 South, Suite 500
Salt Lake City, Utah 84101-1345

Dave Cave et al (contiguous & within)
1220 South 530 West
Price, Utah 84501

Shimmin Investments Ltd (contiguous)
P.O. Box 785

Price, Utah 84501

Mathis Land Co. (contiguous & within)
2699 E Hwy 6
Price, Utah 84501

State of Utah (contiguous & within)
School Trust Lands Administration
355 West North Temple
3 Triad Center, Suite 400
Salt Lake City, Utah 84180

Scott W. Mathis, et al (contiguous and within)
1322 S Fairgrounds Rd
Price, Utah 84501

Scott W. And Donna Mathis,(contiguous and within)
1322 S Fairgrounds Rd
Price, Utah 84501

Mathis Canyon Inc (contiguous)
c/o Arnold Mathis
1366 South Fairgrounds
Price, Utah 84501

Blackhawk Coal Company (contiguous)
700 Morrison Road
Gahanna, Ohio 43232

Mary Frandsen Trust (contiguous)
506 S 100 W
American Fork, Utah 84003

R645-301-112.600. ADJACENT SURFACE AND MINERAL OWNERSHIP

Interests in Contiguous Lands

The Uintah-Southwest Utah Federal Coal Leasing Program has been dropped by the U.S. Department of Interior; therefore, previous expressions of interests by this company are no longer valid. However, existing unleased federally owned coal resources remain of interest to Andalex at such time as currently controlled reserves have been exhausted.

R645-301-112.700. MSHA NUMBERS FOR ALL MINE-ASSOCIATED STRUCTURES

The Centennial Project includes the development of three separate mines. All are currently in operation. The names and M.S.H.A. I.D. numbers for existing mines and all sections are as follow:

Pinnacle Mine - M.S.H.A. I.D. #42-01474
Apex Mine - M.S.H.A. I.D. #42-01750 -Inactive
Aberdeen Mine - M.S.H.A. I.D. #42-02028

R645-301-112.800. STATEMENT OF ALL LANDS AND INTERESTS IN LANDS

The Uintah-Southwest Utah Federal Coal Leasing Program has been dropped by the U.S. Department of Interior; therefore, previous expressions of interests by this company are no longer valid. However, existing unleased federally owned coal resources remain of interest to Andalex at such time as currently controlled reserves have been exhausted.

R645-301-113. VIOLATION INFORMATION

History of Violations

Appendix 1, Part 3 contains a listing of all violations received within the last three years prior to the date of this application by Andalex and affiliated companies.

R645-301-113.100. COMPLIANCE INFORMATION

Andalex Resources, Inc., affiliates or persons controlled by or under common control with Andalex haven't had a mining permit suspended or revoked within the last five years.

Andalex Resources, Inc., affiliates or persons controlled by or under common control with Andalex have not forfeited a mining bond or similar security in lieu of bond.

Appendix 1, Part 3 contains a listing of all violations received within the last three years prior to the date of this application by Andalex and affiliated companies.

R645-301-113.110. SUSPENDED OR REVOKED PERMITS

Andalex Resources, Inc., affiliates or persons controlled by or under common control with Andalex haven't had a mining permit suspended or revoked within the last five years.

R645-301-113.120. FORFEITED BONDS

Andalex Resources, Inc., affiliates or persons controlled by or under common control with Andalex have not forfeited a mining bond or similar security in lieu of bond.

R645-301-113.200. EXPLANATION OF PERMIT OF BOND FORFEITURE

N/A

R645-301-113.210 PERMIT AND BOND IDENTIFICATION

The following is a list of all other licenses and permits under applicable state and federal land-use, air and water quality, water rights and health and safety laws and regulations held by Andalex in order to conduct underground coal mining activities.
All permits listed are up to date and current. The NPDES Permit for the Centennial Project has been replaced by an individual UPDES permit, UT0025674.

1) State of Utah
Department of Natural Resources
Division of Oil, Gas and Mining
1594 West North Temple, Suite 1210
Salt Lake City, Utah 84114-5801

- Mining and Reclamation Plan for Andalex Resources' Centennial Project
Permit I.D. Number C/007/019
Approved January 4, 1982

2) State of Utah
Department of Environmental Quality
Division of Air Quality
150 North 1950 West
P.O. Box 144820
Salt Lake City, Utah 84114-4820

- Air Quality Approval Order, Permit No DAGE-977-96
Approved June 13, 1980

3) State of Utah
Department of Environmental Quality
Division of Water Quality
150 North 1950 West
P.O. Box 144820
Salt Lake City, Utah 84114-4820

- UPDES permit UT0025674

(Replaced previous EPA NPDES permit)

- Water Quality - Sediment and Drainage
  Approved May 14, 1980

- Septic and Culinary Plan (2)
  Approved September 17, 1980 (Office Site)
  Approved May 8, 1980 (Bathhouse Facility)

4) Bureau of Land Management
Utah State Office
440 West 200 South, Suite 500
Salt Lake City, Utah 84101-1345

- Access Road Right-of-Way
  Permit Number U-45966
  Granted September 1, 1980

- Buried Telephone Cable Right-of-Way
  Permit Number U-36739
  Granted November 20, 1978

- Power Transmission Line Right-of-Way
  Permit Number U-36741
  Granted November 20, 1978, assigned to UP&L

- Material Storage Site Right-of-Way
  Permit Number U-45965
  Granted September 11, 1980

- Aberdeen Mine Right-of-Way
  Permit Number UTU-62045
  Granted June 6, 1988

5) Mine Safety and Health Administration (M.S.H.A.)
P.O. Box 25367
Denver, Colorado 80225
(District 9)

Pinnacle Mine I.D. 42-01474
Apex Mine I.D. 42-01750 (inactive)
Aberdeen Mine I.D. 42-02028

- Roof Control Plan
  Reviewed and approved every six months

- Ventilation System and Methane and Dust Control Plan
  Reviewed and approved every six months

- Smoking Prohibition Plan
  Approved August 4,1992

- Training Plan
  Approved November 27, 1990

- Instruction Program: Firefighting and Evacuation Plan
  Approved August 4, 1992

- SCSR Storage Plan
  Approved May 18, 1992

- Chest X-Ray Plan
  Approved March 15, 1990

R645-301-113.220. REGULATORY AUTHORITIES INVOLVED

See above

R645-301-113.230. CURRENT STATUS OF PERMIT AND BOND

See above

R645-301-113.240. ADMINISTRATIVE OR JUDICIAL PROCEDURES

Appendix 1, Part 3

R645-301-113.250. CURRENT STATUS OF PROCEEDINGS

Appendix 1, Part 3

R645-301-113.300. LIST OF ALL VIOLATIONS NOTICES

Appendix 1, Part 3

R645-301-113.310. IDENTIFICATION OF VIOLATIONS

Appendix 1, Part 3

R645-301-113.320. DESCRIPTION OF VIOLATIONS

Appendix 1, Part 3

R645-301-113.330. LOCATION OF VIOLATIONS PROCEEDINGS

Appendix 1, Part 3

R645-301-113.340. STATUS OF VIOLATIONS PROCEEDINGS

Appendix 1, Part 3

R645-301-113.350. ACTIONS TAKEN TO ABATE VIOLATIONS

Appendix 1, Part 3

R645-301-114. RIGHT-OF-ENTRY INFORMATION

Andalex Resources, Inc., in sublease agreement with AMCA Coal Leasing, Inc., currently holds approximately 4,035.90 acres of private and federal coal leases and rights-of-way listed below, all of which are included in their entirety within the permit area. Andalex basis its legal right to enter and conduct mining activities in the permit area pursuant to the language contained in the Federal Coal Leases, Section 2, Rights of Lessee as follows:

> "The lessor, in consideration of any bonus paid (or to be paid if deferred), rents and royalties and other conditions hereinafter set forth, hereby grants and leases to the lessee the exclusive right and privilege to mine and dispose of all coal ... subject to the conditions, limitations and prohibitions provided in this lease and in applicable acts and regulations, the right to construct all works, buildings, structures, equipment, and appliances which may be necessary and convenient for the mining and preparation of the coal for market, and subject to the conditions herein provided, to use so much of the surface as may reasonably be required in the exercise of the rights and privileges herein granted..."

A similar right to enter and conduct underground mining activities is contained in the private lease agreement with the Zion Securities Corporation as follows:

> "During the life of the lease, so long as lessee is not in default hereunder, it may freely prospect, mine and develop the lease premises, extract and sell such coal therefrom as it may elect, and use the surface and underground thereof for all lawful purposes including the exploration and mining to be conducted therein and thereon. It may also use the leased lands in connection with the mining and development of other lands which it may own, lease, or acquire as a part of its general mining operations in the area."

Legal right-of-entry information for all federal and fee leases and rights-of-way are found in Appendix J, "Other Approvals". None of the leases' rights-of-entry is a subject of pending litigation.

The Federal and Fee Coal Leases: Federal and Fee Coal as well as ROW's and Easements are described in Table 1-1 Below: Plate 5-2 depicts on a map the Coal Leases:

TABLE 1-1
Andalex Resources, Inc.
Tower Division
Centennial Project Permit Coal Lease Areas

FEDERAL COAL LEASES

Federal Lease UTU-66060

T. 13 S., R. 10 E., SLM, Utah

Section 1

Lot 3	40.59	Acres
Lot 4	40.82	Acres
S1/2 SW1/4	80.00	Acres
Total	**161.41**	**Acres**

Federal Lease UTU-69600

T. 13 S., R.10 E., SLM, Utah

Section 1

SW1/4	160.00	Acres

Section 12

Lot 3	36.71	Acres
Lot 4	37.16	Acres
Lot 5	44.08	Acres
Lot 6	45.01	Acres
Lot 7	47.17	Acres
Lot 11	47.05	Acres
W1/2 NW	80.00	Acres
Total	**497.18**	**Acres**

Federal Lease UTU-010581

T. 13 S., R. 11 E., SLM, Utah

Section 7

NW SE	40.00	Acres
Total	**40.00**	**Acres**

Federal Lease UTSL-27304

T. 13 S., R. 11 E., SLM, Utah

Section 7
Lot 4 42.98 Acres

Section 18
Lot 1 42.98 Acres
NW NE 40.00 Acres
N1/2 NE NW 20.00 Acres
SW NE NW 10.00 Acres

Total **155.96** **Acres**

Federal Lease SL-63058

T. 13 S., R. 11 E., SLM, Utah

Section 18
SW NE 40.00 Acres

Total **40.00** **Acres**

Federal Lease UTU-81893 (Kenilworth Lease)

T. 12 S., R. 10 E., SLM, Utah

Section 26
N1/2 SW1/4 80.00 Acres
SE SW 40.00 Acres
SE 160.00 Acres

Section 27
S1/2 320.00 Acres

Section 34
S1/2 NE 80.00 Acres
NW NE 40.00 Acres
NW 160.00 Acres
S1/2 320.00 Acres

Section 35
NE 160.00 Acres
S1/2 NW 80.00 Acres

S1/2	320.00	Acres
Total	**1,760.00**	**Acres**

Total of Federal Leases **2,654.55 Acres**

FEE COAL LEASES

Mathis Fee Lease

T. 12 S., R. 10 E., SLM, Utah

Section 36

All	640.00	Acres
Total	**640.00**	**Acres**

Zion Fee Lease

T. 13 S., R. 11 E., SLM, Utah

Section 7

Lot 2	42.99	Acres
Lot 3	42.99	Acres
SE NW	40.00	Acres
E1/2 SW	80.00	Acres
Total	**205.98**	**Acres**

Total of Fee Leases **845.98 Acres**

ROW'S

Bureau of Land Management ROW U-62045

T. 13 S., R. 11 E., SLM, Utah

Section 18

Portion of NESENW	10.00	Acres
Total	**10.00**	**Acres**

Bureau of Land Management ROW UTU-64158

(Left fork fan and access road)

Located within:
T. 13 S., R. 10 E., SLM, Utah
Section 13
Lot 1

T. 13 S., R. 11 E., SLM, Utah
Section 18
Lot 2
NE SW

Total 1.45 Acres

Total of BLM R.O.W.'S 11.45 Acres

Private Easements

Cave Private Easement
Located within:
T. 13 S., R. 11 E., SLM, Utah
Section 18
SE NW 1.50 Acres

Total Cave 1.50 Acres

Total Private Easements 1.50 Acres

TABLE 1-2
Andalex Resources, Inc.
Centennial Project Surface Only Leases Within Permit Area

Federal Lease UTU-66060

T. 13 S., R. 10 E., SLM, Utah
Section 1

Lot 1	40.12	Acres
Lot 2	40.35	Acres

T. 12 S., R. 11 E., SLM, Utah
Section 31

Lot 3	7.58	Acres
Lot 4	7.60	Acres
Lot 5	7.17	Acres
Lot 12	40.00	Acres
Lot 13	1.13	Acres
Lot 14	40.00	Acres
Lot 15	40.00	Acres
Lot 16	40.00	Acres
Lot 21	22.86	Acres
Total	**286.81**	**Acres**

Federal Lease UTU-79975

T. 12 S., R. 11 E., SLM, Utah
Section 31

Lot 2	7.53	Acres
Lot 7	40.00	Acres
Lot 8	40.00	Acres
Lot 10	40.00	Acres
Lot 11	40.00	Acres
Total	**167.53**	**Acres**

Federal Lease UTU-010581

T. 13 S., R. 11 E., SLM, Utah
Section 7

SW NE	40.00	Acres
Total	**40.00**	**Acres**

Federal Lease UTSL-27304

T. 13 S., R. 11 E., SLM, Utah
Section 7

SW SE	40.00	Acres
Total	**40.00**	**Acres**

Surface Only Permit Area **534.34 Acres**

PERMIT AREA TABULATION

Federal Coal Leases:	2,654.55	Acres	(Including Kenilworth)
Fee Coal Leases:	845.98	Acres	
BLM Surface R.O.W.	11.45	Acres	
Private Easements:	1.50	Acres	
Surface Only Federal Leases:	534.34	Acres	
Permit Area Subtotal	4,047.82	Acres	
Less OSO Gaswell Area	-11.92	Acres	
Total Permit Area:	**4,035.90**	**Acres**	

R645-301-114.100. DOCUMENTATION

Appendix J

R645-301-114.200. SEVERED SURFACE AND MINERAL ESTATES

Appendix J

R645-301-114.210. WRITTEN SURFACE OWNER CONSENT FOR COAL EXTRACTION

Appendix R

R645-301-114.220. CONVEYANCE EXPRESSLY GRANTING RIGHT TO MINE COAL

Appendix J

R645-301-114.230. DOCUMENTATION OF LEGAL AUTHORITY TO MINE COAL

Appendix J

R645-301-114.300. ADJUDICATION OF PROPERTY RIGHTS DISPUTES

R645-301-114.300. ADJUDICATION OF PROPERTY RIGHTS DISPUTES

The Division does not have the authority to adjudicate property rights disputes.

R645-301-115. STATUS OF UNSUITABILITY CLAIMS

Carbon County has authorized mining and reclamation activities within 100 feet of County Road 299. (See Appendix B)

R645-301-115.100. IDENTIFICATION OF LANDS UNSUITABLE

The permit area is not within an area designated unsuitable for the surface effects of underground coal mining activities or under study for designation in an administrative proceeding initiated under those pasts. Further, there are no occupied dwellings within 300 feet of the permit area including the Hoffman Creek area.

R645-301-115.200. CLAIMS OF EXEMPTION BY COMMITMENT PRIOR TO JANUARY 4, 1977

None.

R645-301-115.300. MINING AND RECLAMATION OPERATIONS WITHIN 300 FEET OF AN OCCUPIED DWELLING OR WITHIN 100 FEET OF A PUBLIC ROAD

None.

R645-301-116. PERMIT TERM

The starting and termination dates as well as the horizontal and vertical extent of the proposed underground mining activities over the total life of the permit are indicated on the underground layout map for the Aberdeen Mine (see Plates 5-6).

R645-301-116.100. SCHEDULE OF PHASED MINING AND RECLAMATION ACTIVITIES

All surface facilities have been constructed for the Pinnacle, Apex and Aberdeen Mines. Earthwork for the Aberdeen Mine was completed in 1989. The surface facilities for the Aberdeen Mine were completed in early 1990. No additional surface facilities are required for any new leases.

Andalex has added a fan installation in the left-hand fork of Deadman Canyon. This installation was conducted according to measures outlined by the Bureau of Land Management as part of Right-of-Way U-64158. (Copy of Right-of-Way is included in Appendix B.) The location of this breakout is shown on Plate 5-6.

Andalex will fill, regrade and stabilize rills and gullies over 9 inches in depth. Further, Andalex has agreed to interim stabilization of all slopes and embankments within the disturbed area and has done so. One slope located at the bottom of the office driveway, has been attempted through hydroseeding, fertilizing and mulching techniques on three separate occasions. No significant erosion problems have occurred, Andalex will notify the Division in the event of any slides or other damage.

Andalex will cover acid or toxic forming materials if any are encountered. Andalex will advise the Division in the event of a temporary shutdown, such as a letter sent to the Division when Andalex's Apex Mine was temporarily closed.

R645-301-116.200. PERMIT TERM IN EXCESS OF FIVE YEARS

The requested term of this permit is five years. Andalex will then apply for five year extensions over the life of the mine.

R645-301-116.210. COMPLETENESS AND ACCURACY FOR LONGER TERM

N/A

R645-301-116.220. DEMONSTRATION OF NEED FOR LONGER TERM

N/A

R645-301-117. INSURANCE, PROOF OF PUBLICATION AND FACILITIES OR STRUCTURES USED IN COMMON

Certificate of liability insurance covering personal injury and property damage resulting from this operation can be found onsite in the inspection binder. Andalex commits to mitigate all subsidence related damage to renewable resources, including, but not limited to water, grazing, and wildlife habitat including raptor nests.

R645-301-117.200. NEWSPAPER PUBLICATION

A copy of the newspaper advertisement of this Mining and Reclamation Plan and proof of publication of the advertisement is filed with the Division and made part of the complete application.

R645-301-117.300. FACILITIES USED IN COMMON

The Centennial Project includes the development of three separate mines. All are currently in operation. The names and M.S.H.A. I.D. numbers for existing mines and all sections are as follow:

Pinnacle Mine - M.S.H.A. I.D. #42-01474
Apex Mine - M.S.H.A. I.D. #42-01750 (inactive)
Aberdeen Mine - M.S.H.A. I.D. #42-02028

All coal from the newly acquired AEP Lease will be mined simply as an underground extension of the existing Pinnacle and Aberdeen Mines.

R645-301-118. FILING FEE

N/A Page 1-27 of document

R645-301-120. PERMIT APPLICATION FORMAT AND CONTENTS

Summary of Table of Contents

R645-301-100. General

R645-301-200. Soils

R645-301-300. Biology

R645-301-400. Land Use and Air Quality

R645-301-500. Engineering

R645-301-600. Geology

R645-301-700. Hydrology

R645-301-800. Bonding and Insurance

R645-301-121. REQUIREMENTS

R645-301-121.100. CURRENT INFORMATION

Information is current.

R645-301-121.200. CLEAR AND CONCISE

Information is clear and concise.

R645-301-121.300. FORMAT REQUIREMENTS

To facilitate review of the application, each chapter listed above has been further divided into specific parts and sections. These can be found listed in the detailed table of contents appearing at the beginning of this text along with the page numbers on which they appear. This table of contents also contains lists of figures, tables, plates, exhibits, and appendices to facilitate cross referencing between chapters.

Exhibits include appropriate supporting documents, reports and publications and are included as appendices.

Maps which were not reduced to fit into the text are included in a separate volume as plates. All maps and plans are submitted in accordance with the requirements.

R645-301-123. APPLICATION FOR PERMITS, CHANGES, RENEWALS, OR TRANSFERS

Text deleted as instructed by Technical analysis.

R645-301-130. REPORTING AND TECHNICAL DATA

Persons and Consultants Involved

The following persons and/or organizations were involved in collection and analysis of the technical data set forth in this application.

1. In-House Consulting Services

a) Andalex Resources, Inc. - AMCA Coal Leasing, Inc.
Samuel C. Quigley - Western Project Manager (Former)
Michael W. Glasson - Senior Geologist (Former)
Allen D. Emmel - Environmental Planning Coordinator (Former)

2. Outside Consulting Services

a) Dan W. Guy - Registered Professional Engineer
(State of Utah No. 4548)
Price, Utah
-Sedimentation and Drainage Control Plan
(April, 1980)

- Wastewater Disposal System; Pinnacle Mine
(April, 1980)
Office Building (September, 1980)

b) Bruce T.S. Ware - Registered Land Surveyor
Price, Utah

c) A and W Surveying
Price, Utah

d) Commercial Testing & Engineering Co.
Denver, Colorado

e) Standard Laboratories
Huntington, Utah

f) Western Testing and Engineering
Helper, Utah

g) VanCott, Bagely, Cornwall and McCarthy
Attorneys at Law
Salt Lake City, Utah

h) Rollins, Brown, and Gunnel
Provo, Utah

i) Brigham Young University
Provo, Utah
Department of Zoology
Clayton M. White
(Raptor Study)
Department of Anthropology/Archaeology
Dr. Ray T. Matheny
(Archaeological Survey)

j) Earth Environmental Consultants
Albuquerque, New Mexico

k) Vaughn Hansen Associates
Salt Lake City, Utah
(Hydrology Study)

l) Horrocks Engineers
American Fork, Utah

Coordination and Consultation with Governmental Agencies

The following governmental agencies were consulted in the preparation of information set forth in this application.

U.S. Department of Agriculture
Soil Conservation Service
Price, Utah
(Soil and Vegetation Survey)

U.S. Department of the Interior
Bureau of Land Management
Price, Utah
Salt Lake City, Utah

Office of Surface Mining, Reclamation and Enforcement
Denver, Colorado

U.S. Geological Survey
Salt Lake City, Utah

State of Utah:
Department of Natural Resources
Division of Oil, Gas, and Mining
Salt Lake City, Utah

Antiquities Section (Consulting Services Branch)
Salt Lake City, Utah
(Archaeological Survey)

Department of Natural Resources
Division of Wildlife Resources
Salt Lake City, Utah

References:

AMCA Coal Leasing, Inc., 1978. Mining and Reclamation Plan, Zion's Fee. Submitted to the State of Utah, Department of Natural Resources, D.O.G.M.

Centennial Coal Associates, 1976. Mining Application. Submitted to the U.S. Geological Survey.

Doelling, H.H., 1972. Central Utah Coal Fields. U.G.M.S. Monograph Series No. 3.

U.S.D.A., 1978. Soil Survey and Interpretations of the Coal Creek Emery Portion of the Price River and Emery County Areas, Carbon and Emery Counties, Utah. S.C.S.

U.S.D.I., 1979. Final Environmental Statement, Development of Coal Resources in Central Utah, Parts 1 and 2.

U.G.M.S., 1966. Central Utah Coals. U.G.M.S. Bulletin No. 80.

R645-301-131. TECHNICAL DATA REQUIREMENTS

Where applicable, technical data submitted has been identified as to who prepared the information and is stamped by that registered professional engineer (P.E.).

R645-301-132. TECHNICAL ANALYSES REQUIREMENTS

Analyses are prepared by a qualified professional engineer.

R645-301-140. MAPS AND PLANS

R645-301-141. MAP FORMATS

R645-301-142. PHASES OF OPERATIONS AND MINING ACTIVITY

Mining operations at the Pinnacle Mine began in the Gilson Seam on October 3, 1980, according to the Mining and Reclamation Plan approved by the State of Utah, Department of Natural Resources, Division of Oil, Gas, and Mining. The mining began on the Zion's fee lease and extended onto Andalex's federal leases according to federal approval granted in 1982. Andalex also opened the Apex Mine in the Lower Sunnyside Seam late in 1982. Mining commenced in the Aberdeen Mine in the Aberdeen Seam in mid 1988. The Pinnacle Mine, Apex Mine, and most recently the Aberdeen Mine are now essentially worked out. With the addition of the Kenilworth lease the Aberdeen could possibly reopen depending upon market conditions. The restart date of the Aberdeen mine has yet to be determined. The

coal is classified as High Volatile B bituminous in the Lower Sunnyside and Gilson Seams and as High-volatile A bituminous in the Aberdeen Seam.

The mine plan area is located approximately 10 miles north-northeast of Price, Utah in Carbon County in T12 and 13S and R10 and 11E (See Figure 1-2. The existing permit property is located in the Book Cliffs coal field and includes Alrad Canyon, Deadman Canyon, Starpoint Canyon, Straight Canyon, and Hoffman Creek Canyon areas. The Kenilworth Tract occupies the area of Summit Creek, Deep Canyon and Mathis Canyon. The Coal outcrops along the cliffs between 7,000 feet and 7,700 feet elevations. The topography is very rugged, the Book Cliffs being dissected by box canyons created by ephemeral streams. Large sandstone boulders eroded from the cliffs are scattered along the sides of the canyons. The land is undeveloped, used primarily for grazing, and there are no areas of national importance in the region. Mountain-Brush vegetative type covers most of the area.

There are no perennial streams or bodies of water on the property. Ground water recharge is from precipitation in the vicinity. Water supply for mine development and culinary usage is supplied by wells that have been drilled.

Historically, coal mining has been the only industry in the permit area and there are several abandoned mines located on the property. No oil or gas wells exist in the area.

Access to the mine plan area is by an existing paved county road which has been upgraded and is maintained by Carbon County. Maintenance consists of paving, chipping, patching, culvert work, ditch work, signs, snow removal, painting, patrolling (county sheriff), etc., as needed. Andalex assumes no responsibility for road maintenance or repair. The road is used as an access road as well as a haul road. It should be noted that in the event of a catastrophic event which damaged the road, Andalex would pursue all avenues to assist Carbon County in reparation of the road. All surface and support facilities necessary for present operations have been completed and are located on the Zion's fee or on rights-of-way granted by the Bureau of Land Management. This is also a small private easement granted to Andalex from Gladys M. Artman for a small portion of pond E. All proposed facilities are indicated in this application. Andalex has acquired all applicable state and federal licenses, permits, and rights-of-way necessary to conduct mining activities on the Zion's fee property and contiguous federal leases.

As of 7-6/2007 the Apex Mine and the Pinnacle Mine have been worked out. The Apex Mine has been sealed at the portals. The Pinnacle mine is still being ventilated because the power to the Aberdeen mine runs into the Pinnacle mine from the substation and then drops down to the Aberdeen Mine through a borehole connecting the two mines. However, there are no plans to produce any more coal from the Pinnacle Mine. Therefore, all existing and future mine production from the Centennial Project will be solely from the Aberdeen Mine

Upon cessation of mining activities, reclamation activities will commence as soon as is practicable, according to the approved Mining and Reclamation Plan. The

land will be restored according to available technology to as nearly its original condition as is possible.

This operation does not face any of the mining complications caused by faults or intrusives. The mine plan area is located in a region where mining has been the major industry; therefore, the nearby communities are geared for coal operations. The labor supply is excellent and well trained. With these considerations, and Andalex's prudent management, the Centennial Project has become a model mining operation in the Carbon County area with very minimal environmental and socioeconomic impact.

R645-301-142.100. PRIOR TO AUGUST 3, 1977

None by Andalex Resources. Several mines were operated by other independent companies or individuals in areas presently consumed by Andalex's surface facilities. Andalex's encroachment onto these previously disturbed areas transferred the responsibility for reclamation to Andalex. The specific locations of disturbed areas prior to Andalex's mining activities is irrelevant.

R645-301-142.200. AFTER AUGUST 3, 1977

All of Andalex's surface facilities and mining operations began after August 3, 1977.

R645-301-142.210. PRIOR TO MAY 3, 1978

See R645-301-142.100.

R645-301-142.220. SMALL OPERATOR'S EXEMPTION PRIOR TO JANUARY 1, 1979

N/A

R645-301-142.300. AFTER MAY 3, 1978 (OR JANUARY 1, 1979 FOR SMALL OPERATOR'S EXEMPTION) AND PRIOR TO APPROVAL OF STATE PROGRAM

N/A

R645-301-142.400. AFTER ISSUANCE OF PERMIT BY THE DIVISION

The following is a list of all other licenses and permits under applicable state and federal land-use, air and water quality, water rights and health and safety laws and regulations held by Andalex in order to conduct underground coal mining activities.

All permits listed are up to date and current. The NPDES Permit for the Centennial Project has been replaced by

an individual UPDES permit, UT0025674.

1) State of Utah
Department of Natural Resources
Division of Oil, Gas and Mining
1594 West North Temple, Suite 1210
Salt Lake City, Utah 84114-5801

- Mining and Reclamation Plan for Andalex Resources' Centennial Project
Permit I.D. Number C/007/019
Approved January 4, 1982

2) State of Utah
Department of Environmental Quality
Division of Air Quality
150 North 1950 West
P.O. Box 144820
Salt Lake City, Utah 84114-4820

- Air Quality Approval Order, Permit No DAGE-977-96
Approved June 13, 1980

3) State of Utah
Department of Environmental Quality
Division of Water Quality
150 North 1950 West
P.O. Box 144820
Salt Lake City, Utah 84114-4820

- UPDES permit UT0025674
(Replaced previous EPA NPDES permit)

- Water Quality - Sediment and Drainage
Approved May 14, 1980

- Septic and Culinary Plan (2)
Approved September 17, 1980 (Office Site)
Approved May 8, 1980 (Bathhouse Facility)

4) Bureau of Land Management
Utah State Office
440 West 200 South, Suite 500
Salt Lake City, Utah 84101-1345

- Access Road Right-of-Way
Permit Number U-45966

Granted September 1, 1980

- Buried Telephone Cable Right-of-Way
  Permit Number U-36739
  Granted November 20, 1978

- Power Transmission Line Right-of-Way
  Permit Number U-36741
  Granted November 20, 1978, assigned to UP&L

- Material Storage Site Right-of-Way
  Permit Number U-45965
  Granted September 11, 1980

- Aberdeen Mine Right-of-Way
  Permit Number UTU-62045
  Granted June 6, 1988

5) Mine Safety and Health Administration (M.S.H.A.)
P.O. Box 25367
Denver, Colorado 80225
(District 9)

Pinnacle Mine I.D. 42-01474
Apex Mine I.D. 42-01750 (inactive)
Aberdeen Mine I.D. 42-02028

- Roof Control Plan
  Reviewed and approved every six months

- Ventilation System and Methane and Dust Control Plan
  Reviewed and approved every six months

- Smoking Prohibition Plan
  Approved August 4,1992

- Training Plan
  Approved November 27, 1990

- Instruction Program: Firefighting and Evacuation Plan
  Approved August 4, 1992

- SCSR Storage Plan
  Approved May 18, 1992

- Chest X-Ray Plan
  Approved March 15, 1990

R645-301-150. COMPLETENESS

Per Division.

ANDALEX RESOURCES, INC.
CENTENNIAL PROJECT

CHAPTER 2

Soils

C/007/019

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R645-301-200. SOILS

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R645-301-210. INTRODUCTION

The Kenilworth Lease (UTU-81893) Boundary Change is simply an extension to the Aberdeen Mine workings and will in no way involve any new surface facilities or otherwise have any effect on the surface. It does not involve any new hydrologic basins. It should be noted that UTU-81893 was previous included in the Willow Creek Mine Permit No. ACT/007/038, which was approved by DOGM. After the Willow Creek Mine was closed the Kenilworth lease was terminated. The area was subsequently re-leased by BLM in 1986 through the normal LBA process after an application by Andalex Resources. Refer to R645-301-200 through R645-301-800 for additional information.

Mining operations at the Pinnacle Mine began in the Gilson Seam on October 3, 1980, according to the Mining and Reclamation Plan approved by the State of Utah, Department of Natural Resources, Division of Oil, Gas, and Mining. The mining began on the Zion's fee lease and extended onto Andalex's federal leases according to federal approval granted in 1982. Andalex also opened the Apex Mine in the Lower Sunnyside Seam late in 1982. Mining commenced in the Aberdeen Mine in the Aberdeen Seam in mid 1988. The Pinnacle Mine, Apex Mine, and most recently the Aberdeen Mine are essentially worked out. With the addition of the Kenilworth lease the Aberdeen could possibly reopen depending upon market conditions. The restart date of the Aberdeen mine has yet to be determined. The coal is classified as High Volatile B bituminous in the Lower Sunnyside and Gilson Seams and as High-volatile A bituminous in the Aberdeen Seam. The mine plan area is located approximately 10 miles north-northeast of Price, Utah in Carbon County (See Plate 1-1).

The Operator relinquished portions of the mined out Federal coal leases in two separate lease relinquishments. The first lease relinquishment approved 3/12/2012 reduced the Federal coal leased acreage from 5,436.24 down to 2,813.48. The second coal relinquishment reduced the Federal coal lease even further down to 894.55 acres. UEI retained all areas of surface disturbance conducted in association with the underground mining and surface access to the gob-vent holes was retained through surface use agreements.

With the relinquishments the permit acreage dropped from 6,516.91 down to 2,274.77 acres. When Kenilworth lease is added the permit acreage goes back up to 4,035.90 which is the new permit acreage. The disturbed area has not changed and remains at 47.19 acres. Since the disturbed area has not changed and the disturbed legal description stays the same the bond does not change with the addition of the Kenilworth lease.

As the Kenilworth Tract is simply an extension of underground mine workings under roughly 2,000 to 3,000 feet of cover there will be absolutely no effect on soils.

R645-301-211. PREMINING SOIL RESOURCES

The Regional Soils Map, shown as Plate 2-1 in Volume II. EEC performed the work on the north and south one-thirds of the disturbed area and the SCS performed the work on the one-third in the middle. This was for the original Pinnacle Mine approval on the Zion's Fee area (please see second half of Appendix M.

The acreages given by EEC in their soils report does not include the entire disturbed area since we know that the SCS surveyed roughly one-third of the disturbed or "to be" disturbed area. The correct acreages as planimetered by Andalex staff is 47.19 acres including the GVH holes. This of course includes the area where the Aberdeen Mine has been developed. The area of disturbed Brycan is approximately 8 acres and the Datino is 4 acres within the SCS survey. EarthFax Engineering has performed the Order 1 soil survey for the left fork fan installation. (See Appendix M.)

R645-301-212. STOCKPILING AND REDISTRIBUTION

Topsoil Handling During Operations

Removal

The area from which topsoil was projected to be removed is 47.19 acres and includes poorly developed soils. Using dozers and front end loaders, the soil was scraped from the surface and dumped at a site near the facility location. The topsoil was removed as a separate operation from areas to be disturbed by surface installations such as roads and areas upon which support facilities are sited. The left fork topsoil will be salvaged according to EarthFax.

Storage

The topsoil storage areas are shown on Plate 5-7. The topsoil has been segregated, stockpiled, and protected from wind and water erosion and contaminants through revegetation and the use of berms.

Surveys conducted on the topsoil piles which were drawn into plans and profiles are now included in the plan in Volume II, Plates 2-3. This shows volumes stored currently.

The completed disturbance which reports to sedimentation Pond E is 9.96 acres. Please review the top soil summaries which show totals.

The new substitute topsoil pile plan and profile is included.

The new substitute topsoil will be protected by the use of vegetation.

Disturbed areas no longer required for the conduct of mining operations have been revegetated. Upon completion of mining activities, topsoil will be distributed and reclamation will commence as outlined. Andalex will adhere to all UDOGM guidelines.

R645-301-220. ENVIRONMENTAL DESCRIPTION

Regional soils information for the Kenilworth Tract is taken from the approved Willow Creek permit 007/0038, and is presented herein verbatim:

3.1.1.3 Regional Soils Information

The USDA-SCS General Soils Map - Carbon County Area, Utah, shows the following three general soils types as
occurring within the boundaries of the permit area:

* Type 7 - Strych-Gerst-Travessilla: Shallow to very deep, well drained, nearly level to moderately
steep soils, on outwash plains, benches and mesas

* Type 10 - Travessilla-Rock Outcrop-Midfork Family: Shallow to very deep, well drained, steep and
very steep, soils; and rock outcrop, on mountain slopes and canyonsides

* Type 14 - Beje-Trag-Senchert: Shallow to very deep, well drained, gently sloping to moderately steep
soils, on plateaus and mountain valley floors

Type 10 is found over approximately 85 percent of the permit area and is found in nearly all areas except a portion of
the extreme northeast comer of the permit area and a narrow tier along the southern edge of the permit area.
Descriptions of each of these primary soil types as contained in the USDA-SCS Soils Survey are as follows:

Additional information can be found in Appendix M.

R645-301-221. PRIME FARMLAND INVESTIGATION

The land within the Kenilworth lease area has not been historically used as cropland, contains steep slopes, and the area is not conducive to intensive agricultural uses and no surface disturbance. The Permittee does not believe that any Prime Farmland exists with the permit revision area, Kenilworth lease, being added to the Mine and Reclamation Plan. The Kenilworth lease has been previously permitted under the Willow Creek Mine Permit ACT/007/0038. Since Kenilworth lease is found in T12S R10E Section 26, the Willow Creek Permit information found below is pertinent. Prime farmland information for the Kenilworth Tract is taken from the Willow Creek permit presented herein verbatim:

3.1.1.6 Prime Farm Land

Several previous investigations have been conducted for the permit area to determine whether any prime farmlands exist in the area. Each of these investigations involved formal consultation with the USDA-SCS. The initial determination, included in PRCCs Mining and Reclamation Permit application, was provided by Mr. George D. McMillan, USDA-SCS State Conservationist in a

letter dated July 16, 1979. This letter concluded that, based upon the absence of any irrigation, and excessive slopes, no prime farmlands existed in the area corresponding to Townships 12 & 13 South, Ranges 8, 9 and 10 East. A second negative determination for prime farmlands in the permit area was issued in connection with the permitting efforts for the CGCC Permit submitted to UDOGM in February 1991. The CGCC permit application contains a letter dated May 21, 1991 from Mr. Ferris P. Allgood, USDA-SCS State Soil Scientist, stating that due to the excessive amount of rock fragments, high erodibility and lack of a reliable source of irrigation waters for lands within the CGCC Mine Permit area, the soils within this area are excluded from consideration as important farmlands. Confirmation of these negative determinations was included in the findings documents issued by UDOGM for both permit applications and documentation is provided in Exhibit 5, Soils Information. Since the limitations which exclude these soils for consideration as prime farmlands still exist, and all surface disturbance associated with the mining and reclamation activities will occur on either previously disturbed areas or on slopes greater than ten percent, UDOGM is requested to reaffirm the negative determination regarding the presence of prime farmland soils in the permit area.

Additional information can be found in Appendix M.

R645-301-222. SOIL SURVEY

Appendix M

R645-301-222.100. SOIL MAP

Plate 2-1

R645-301-222.200. SOIL IDENTIFICATION

Appendix M

R645-301-222.300. SOIL DESCRIPTION

Appendix M

R645-301-222.400. SOIL PRODUCTIVITY

Appendix M

R645-301-223. SOIL CHARACTERIZATION

Appendix M

R645-301.224. SUBSTITUTE TOPSOIL

Two test plot locations were decided upon based on certain known parameters. The 5,240 yard substitute material area chosen was once designated as substitute topsoil. Now that the shop building is in place, this should not have any impact on the suitability of the material. The second location depicted on Plate 5-7 near the Apex Truck Loadout is very similar, if not identical material, to the shop pad material (the revegetation test will ultimately prove this). To prove the materials suitability, Andalex has proposed to test the material using the approved seed mixture on the locations

shown on Plate 5-7. The area of the test plots are both currently heavily vegetated indicating good potential. These test plots will be monitored for two years and evaluated for growth and species success. It is anticipated that these areas will succeed and solve the deficit problem.

These pads were constructed in 1982 during the construction of the Apex Mine. The Shop pad and the Apex truck loadout pad both have out-slopes which we currently feel contain suitable topsoil substitute material. In 1982 these slopes were groomed with heavy equipment and graded prior to being hydroseeded with the interim seed mixture and then hydromulched. Mulch in the amount of one ton per acre was used at the time. In 1990 the approved seed mixture was hand broadcasted onto these same slopes which were already fairly heavily vegetated. The seed was raked in to the extent possible and no additional mulch was used because of the vegetative cover in place. Also, samples have been taken of this substitute material (three separate locations at each site) and have been sent in to a qualified soil testing laboratory. These samples will be tested for parameters outlined in Table 6 "Guidelines for Overburden and Topsoil Management", 1988. Results of these tests will be included in the permit as soon as they are available.

Topsoil Pile Summary, Existing
(See Plates 5-7 and 2-3)

Topsoil Pile A	35,731 cubic feet
Topsoil Pile C	6,829 cubic feet
Topsoil Pile F	60,290 cubic feet
Topsoil Pile G	167,980 cubic feet
Topsoil Pile J	94,500 cubic feet

Topsoil Pile Summary, Proposed
(See Plates 5-7 and 2-3)

Topsoil Piles J contains 94,500 cubic feet which includes the original Topsoil Pile B which was moved during the construction of the Aberdeen Mine.

Based on the size of the disturbed area and the amount of topsoil required (6"), we have calculated that there is a 8,000 $yd.^3$ topsoil deficit. The topsoil substitutes will make up this deficit.

The test plots previously discussed regarding the topsoil deficit is further discussed here.

Two test plot locations were decided upon based on certain known parameters. The first location is south of the shop building and contains 5,240 cubic yards. The second location is southwest of the Apex Mine truck loadout and contains 1,700 cubic yards (see Plate 5-7). The 5,240 yard substitute material area chosen was once

designated as substitute topsoil. Now that the shop building is in place, this should not have any impact on the suitability of the material. The second location depicted on Plate 5-7 near the Apex Truck Loadout is very similar, if not identical material, to the shop pad material (the revegetation test will ultimately prove this). To prove the materials suitability, Andalex has proposed to test the material using the approved seed mixture on the locations shown on Plate 5-7. The area of the test plots are both currently heavily vegetated indicating good potential. These test plots will be monitored for two years and evaluated for growth and species success. It is anticipated that these areas will succeed and solve the deficit problem. The first quantitative monitoring study will take place in the summer of 1992.

Topsoil substitute storage area signs have been placed strategically at the two substitute storage areas at the minesite. They will clearly mark the location of these storage area.

R645-301-230. OPERATION PLAN

Topsoil Handling During Operations

Removal

The area from which topsoil has been removed is 47.19 acres and includes poorly developed soils. Using dozers and front end loaders, the soil was scraped from the surface and dumped at a site near the facility location. The topsoil was removed as a separate operation from areas to be disturbed by surface installations such as roads and areas upon which support facilities are sited. Approximately 750 cubic yards of topsoil will be stored in the left hand fork of Deadman Canyon for use during reclamation of the left fork fan installation. (See Plate LF-1.)

Storage

The topsoil storage areas are shown on Plate 5-7. The topsoil has been segregated, stockpiled, and protected from wind and water erosion and contaminants through revegetation and the use of berms.

Surveys conducted on the topsoil piles which were drawn into plans and profiles are now included in the plan in Volume II, Plate 2-3. This shows volumes stored currently.

The completed disturbance which reports to sedimentation Pond E is 9.96 acres. Please review the top soil summaries which show totals and deficiencies in R645-301-224.

The new substitute topsoil pile plan and profile is included.

The new substitute topsoil will be protected by the use of vegetation.

R645-301-231. GENERAL REQUIREMENTS

R645-301-231.100 REMOVAL AND STORAGE

See R645-301-212.

R645-301-231.200. SUITABILITY OF TOPSOIL SUBSTITUTES

See R645-301-224.

R645-301-231.300. TESTING PLAN

See R645-301-224.

R645-301-231.400. TOPSOIL HANDLING AND STORAGE AREAS

See R645-301-212.

R645-301-232. TOPSOIL AND SUBSOIL REMOVAL

See R645-301-212.

R645-301-232.100. TOPSOIL SEGREGATION

See R645-301-212.

R645-301-232.200. INSUFFICIENT QUANTITY OR POOR QUALITY

See R645-301-224.

R645-301-232.300. TOPSOIL LESS THAN SIX INCHES THICK

N/A

R645-301-232.400. TOPSOIL REMOVAL FOR MINOR DISTURBANCES

N/A

R645-301-232.410. SMALL STRUCTURES

N/A

R645-301-232.420. PROTECTION OF EXISTING VEGETATION AND EROSION PROTECTION

Disturbed areas no longer required for the conduct of mining operations have been revegetated. Upon completion of mining activities, topsoil will be distributed and reclamation will commence as outlined in re Reclamation. Andalex will adhere to all UDOGM guidelines.

R645-301-232.500. SUBSOIL SEGREGATION

N/A

R645-301-232.600. TIMING

All soils have been removed.

R645-301-232.700. TOPSOIL AND SUBSOIL REMOVAL UNDER ADVERSE CONDITIONS

N/A

R645-301-232.710. IMPRACTICABILITY

N/A

R645-301-232.720. IMPORTING TOPSOIL MATERIAL

N/A

R645-301-233. TOPSOIL SUBSTITUTES AND SUPPLEMENTS

See R645-301-224.

R645-301-233.100. SELECTED OVERBURDEN MATERIALS

See R645-301-224.

R645-301-233.200. SUITABILITY OF TOPSOIL SUBSTITUTES AND SUPPLEMENTS

See R645-301-224.

R645-301-233.300. PHYSICAL AND CHEMICAL ANALYSES

Appendix M

R645-301-233.310. SCS PUBLISHED DATA

Appendix M

R645-301-233.320. SCS TECHNICAL GUIDES

Appendix M

R645-301-233.330. OTHER PUBLISHED DATA

Appendix M

R645-301-233.340. RESULTS OF FIELD-SITE TRAILS OR GREENHOUSE TESTS

Appendix M

R645-301-233.400. DEMONSTRATION OF INSUFFICIENT TOPSOIL AND SUITABILITY OF SUBSTITUTE MATERIALS

See R645-301-224.

R645-301-234. TOPSOIL STORAGE

See R645-301-212,224.

R645-301-234.100. STOCKPILING AND REDISTRIBUTION

See R645-301-212.

R645-301-234.200. STOCKPILING REQUIREMENTS

See R645-301-212.

R645-301-234.210. PLACEMENT

See R645-301-212.

R645-301-234.220. PROTECTION

See R645-301-212.

R645-301-234.230. VEGETATIVE COVER

Appendix M

R645-301-234.240. REHANDLING

N/A

R645-301-234.300. LONG-TERM STORAGE AND DISTRIBUTION

See R645-301-212.

R645-301-234.310. CAPABILITY OF HOST SITE

R645-301-234.320. SUITABILITY FOR REDISTRIBUTION

See R645-301-212.

R645-301-240. RECLAMATION PLAN

Timetable of Major Reclamation Steps

Introduction

As this is an underground mine, there will be a limited amount of surface disturbance, consequently, reclamation will be uncomplicated.

All disturbed areas no longer required for the conduct of mining operations were immediately revegetated. In the future, any areas no longer required for operations will also be immediately reclaimed and revegetated. The only new surface disturbance required at this time will be for a mine-fan break-out in the left fork of Deadman Canyon.

When buildings and final site preparation had been completed, the soil was revegetated to prevent erosion.

When the project is expired, all buildings and extraneous material will be removed, all mine openings will be covered and sealed, roads will be regraded and using the most advanced technology at the time, Andalex will re-establish the terrain to as nearly the original as practical. The area will be reseeded and vegetation re-established in accordance with recommendations from the regulatory authorities.

Reclamation Timetable

This timetable represents the general sequence which will be used for final reclamation. The bond estimate has the costs broken down on a site by site basis; however, actual work will be performed simultaneously at all the sites. For example, all structures and buildings will be removed prior to any recontouring. This will allow us to have certain equipment for certain jobs the shortest time possible. Detail of work involved in various jobs (portal seals, revegetation, etc.) can be found in Appendix C. The addition of the Kenilworth Lease will have no impact on the reclamation schedule or cost.

Phase I

Job 1. Portal Seals (include fan removal)

a. 4 Apex
b. 7 Pinnacle
c. 7 Aberdeen (includes left fork)
d. 5 Wells

Job 2. Building Removal

a. 1 Shop
b. 1 Main Office
c. 3 Trailers (2 warehouse, 1 lab)
d. 3 Lamphouses
e. 3 Bathhouses

Job 3. Structure Removal

a. 3 Mine Conveyor Structures
b. 3 Truck Loadouts

c. 1 Substation
d. Power distribution lines
e. 4 Water Tanks
f. 5 Fuel Tanks
g. Main and Side Culverts *

Job 4. Recontouring & Regrading*
a. 105,500 yds.^{3} fill material
b. Enlarge Pond E, Remove B and C

Job 5. Compaction, Scarification
a. 33.5 acres (not including Pond E)
b. Additional sediment measures,
i.e., check dams

Job 6. Topsoil Redistribution
a. 47.19 acres (additional approved substitute hauled in if necessary)

* Culverts will be removed starting at the north end so that natural drainage may be re-established as the culvert is removed.

Job 7. REVEGATATION
a. 2.15 acres shrubs
b. 14.32 acres drainage (except Pond E)
c. 17.03 acres slopes

Job 8. Commence Monitoring
a. REVEGATATION
1. Woody plants will be quantitatively monitored in years 4 and 8
2. Success for woody plants will be based on a minimum 2,000 plants-per-acre in stream bottoms and on east-facing slopes; 1,500 plants-per-acre on west-facing slopes.
b. Slope Stability
c. Water Monitoring including inlet and discharge at Pond E**

** Sampling of this water will consist of grab samples taken quarterly if any runoff occurs. Andalex's experience with this drainage is that runoff may occur every several years so that monitoring of this runoff will take place infrequently. Quarterly reports will indicate whether or not any runoff has occurred. The samples will be tested to assure that state and federal water quality requirements are being met.

Phase II

Starts When Phase I Monitoring Allows. Sedimentation Pond E will not be removed until the revegetation requirements of 817.111-.117 are met. This includes the revegetation of the entire disturbed area with the exception of Pond E. Also, Pond E will not be removed until the drainage entering the ponds meets applicable state and federal limitations. When Pond E is removed and revegetated, additional sediment control measures will be placed downstream from the revegetated area such as straw dikes until revegetation has been deemed complete by Phase II Monitoring.

Job 1. Done Simultaneously
- a. Remove (recontour) Pond E
- b. Remove remaining culvert

Job 2. Compact & Scarify Location

Job 3. Distribute Remaining Topsoil

Job 4. Revegetate

Job 5. Continue Monitoring until Bond is released

Please note that the earthwork involved will be done during the dry season to avoid unnecessary erosion of regraded areas. Water will be implemented if dust becomes a problem.

Reclamation Cost and Bonding

Introduction

An estimate for the reclamation costs is provided in appendix B. Andalex has provided, as Plate 5-9, accurate as built versus reclaimed cross sections which show the mass balance for earthwork. The approximate original contours will be achieved using the material cut out to create the fill areas. No material will be hauled in. Maps depicting accurately the surface facilities including topsoil areas, structures and facilities are included in Volume II and also specific topsoil maps and cross sections are included. Andalex expects to return topsoil to a depth of up to 6" around the surface area of 47.19 acres.

Phase I of the reclamation will include, chronologically, structure removal including culverts, portal sealing, well sealing, regrading, recontouring, distribution of topsoil and revegetation. Additional sediment control during Phase I such as straw dikes and rock check dams will be implemented as shown on Plate 7-12. Once Phase I is adequately achieved, Phase II will commence which includes the removal of sediment structure E and revegetation of this area. This is followed by monitoring, noting that monitoring had begun during Phase I. See 5.8 re Monitoring. This section discusses

the extended period of liability as being ten years if necessary. The entire permit area receives less than 26 inches of annual precipitation; therefore, it is generally accepted that Andalex is subject to an extended period of liability. Obviously if revegetation is deemed successful prior to this ten year period, Andalex will request bond release. Andalex has not proposed any selective husbandry practices.

Cost of Reclamation

Detailed Estimate

A detailed cost projection is included in Appendices B and C.

Calculations

Calculations of the estimate reclamation costs are included in Appendices A and B. Calculations for cuts and fills were made and are included. This summary shows the mass balance for the entire disturbed area, as taken from Plates 5-9 and 5-9. Station numbers are referenced on Plate 5-8 and cross sections are shown on sheets 1, 2, and 3 of Plate 5-9. Similarly, topsoil piles have been surveyed for the existing minesite and are summarized following the cut and fill summary. Because of deficits Andalex has committed to testing topsoil substitute areas.

Bond or Surety Arrangement

Andalex currently holds a bond, approved by UDOGM in the amount shown in Appendix B.

Regarding the left hand fork fan installation, the specific time table for this project will coincide with the reclamation of the right hand fork minesite. The specific schedule for reclamation of the fan will begin with the cut slope backfill, followed by removal of the culvert from the left fork drainage and, finally, by streambed reclamation the same as will be performed in the right hand fork. According to comments received by the majority of the surface lands managers, the access road to the left hand fork fan installation will be reclaimed by recontouring to the extent possible (this road has been in existence for over 50 years) and revegetated. One of the surface owners (Gladys Artman) has specifically indicated her desire to leave the road in place, therefore, her permission will be required to reclaim the road. Topsoil redistribution and revegetation will follow the culvert removal. During both construction and reclamation phases, Andalex will provide adequate supplementary sediment control in the form of silt fences and/or straw berms to prevent additional sediment loads to the drainage.

Andalex has supplied the Division with a Drawing entitled "Left Hand Fork Cut/Fill". This drawing has a notation which indicates that the existing contours will reflect the reclamation contours (post-mining).

MASS BALANCE SUMMARY

Station	CUT		FILL		
	ft^2	yds^3	ft^2	yds^3	
-1 + 00	520	963	160	2148	
0 + 00	0	815	1000	1889	
1 + 00	440	1000	20	407	
2 + 00	100	1074	200	1259	
3 + 00	480	3333	480	1519	
4 + 00	1320	2593	340	2259	
5 + 00	80	2889	880	1852	
6 + 00	1480	6778	120	2704	
7 + 00	2180	9037	1340	4074	
8 + 00	2700	8259	860	2556	
9 + 00	1760	6000	520	4297	
10 + 00	1480	6444	1800	6519	
11 + 00	2000	6259	1720	5593	
12 + 00	1380	9222	1300	5074	
13 + 00	3600	7037	1440	6148	
14 + 00	200	370	1880	8852	
15 + 00	0	370	2900	5815	
16 + 00	200	407	240	2111	
17 + 00	20	1889	900	5593	
18 + 00	1000	2889	2120	8185	
19 + 00	560	2000	2300	5319	
20 + 00	520	4444	572	3059	
21 + 00	1880	8704	1080	3185	
22 + 00	2820	8556	640	3037	
23 + 00	1800	3741	1000	3370	
24 + 00	220	1148	820	2963	
25 + 00	400	926	780	4519	
26 + 00	100	2630	1660	10222	
27 + 00	1320	4444	3860	7407	
28 + 00	1080	3111	140	1741	
29 + 00	600	2222	800	2815	
30 + 00	600	2074	720	2222	
31 + 00	520	1889	480	1741	
32 + 00	500	1482	460	2185	
33 + 00	300	2037	720	1815	
34 + 00	800	3111	260	852	
35 + 00	880	3185	200	1630	
36 + 00	840	1963	680	3482	
37 + 00	220	1741	1200	5407	
38 + 00	720	2741	1720	4037	
39 + 00	760	3000	460	6111	
40 + 00	860	2704	2840	5593	

41 + 00	600	1444	180	1148
42 + 00	180	482	440	963
43 + 00	80	148	80	148

* Total Cut = 147,555 yds^3; * Total Fill = 163,825 yds^3

* Ratio of fill to cut = 1.11:1.00. This allows for an expansion factor of 1.11 or 11% on the cut material.

As Constructed Earthwork Volume (Aberdeen Mine)

Cut 63,506 yds.^{3}
Fill 66,625 yds.^{3}
Topsoil 3,500 yds.^{3} (Piles H & J)

As Constructed Earthwork Volumes
(including Aberdeen Site)

Cut 117,273 yds.^{3}
Fill 112,969 yds.^{3}
Topsoil 8,500 yds.^{3}

For purposes of reclamation costs for earthwork, the following estimates can be used. Please keep in mind that as built cross sections for the Aberdeen Mine will aid in the final earthwork estimates.

There is a 8,000 yd.^{3} topsoil deficit. The topsoil substitutes will make up this deficit.

The test plots previously discussed regarding the topsoil deficit is further discussed here.

Two test plot locations were decided upon based on certain known parameters. The 5,240 yard substitute material area chosen was once designated as substitute topsoil. Now that the shop building is in place, this should not have any impact on the suitability of the material. The second location depicted on Plate 5-7 near the Apex Truck Loadout is very similar, if not identical material, to the shop pad material (the revegetation test will ultimately prove this). To prove the materials suitability, Andalex has proposed to test the material using the approved seed mixture on the locations shown on Plate 5-7. The area of the test plots are both currently heavily vegetated indicating good potential. These test plots will be monitored for two years and evaluated for growth and species success. It is anticipated that these areas will succeed and solve the deficit problem.

R645-301-241. GENERAL REQUIREMENTS

R645-301-242. SOIL REDISTRIBUTION

Soil is to be redistributed to a depth of 6-inches across the entire 47.19 acre disturbed area.

R645-301-242.100. CRITERIA FOR REDISTRIBUTION

The only criteria is that it will be redistributed to a depth of 6 inches.

R645-301-242.110. UNIFORMITY AND CONSISTENCY

The soil will be redistributed uniformly and consistent with the regraded contours.

R645-301-242.120. PREVENTION OF COMPACTION

Once redistributed, unnecessary compaction from equipment will be avoided.

R645-301-242.130. PROTECTION FROM WIND AND WATER EROSION

The topsoil will be protected from wind and water erosion through mulching.

R645-301-242.200. REGRADING AND TREATMENT

Not applicable, unless unacceptable rills and gullies are observed.

R645-301-242.300. EMBANKMENTS OF PERMANENT IMPOUNDMENTS OR ROADS

N/A

R645-301-242.310. PREVENTION OF SEDIMENTATION

Pond E will be in place until the release of Phase I reclamation.

R645-301-242.320. OTHER METHODS OF STABILIZATION

Other methods may include excelsior matting on steep slopes and rip-rap.

R645-301-243. SOIL NUTRIENTS AND AMENDMENTS

As needed to be determined through Phase I monitoring.

R645-301-244. SOIL STABILIZATION

See R645-301-242.

R645-301-244.100. EROSION CONTROL AND AIR POLLUTION

See R645-301-242.

R645-301-244.200. SOIL STABILIZING PRACTICES

See R645-301-242.

R645-301-244.300. RILLS AND GULLIES

See R645-301-242.

R645-301-244.310. DISRUPTION OF POSTMINING LAND USE OR ESTABLISHMENT OF VEGETATIVE COVER

Vegetative cover will be in accordance with revegetation practices found in R645-301-331.

R645-301-244.320. CAUSE OR CONTRIBUTE TO A VIOLATION OF WATER QUALITY STANDARDS

Andalex will not violate water quality standards. This will be demonstrated through monitoring practices.

R645-301-250. PERFORMANCE STANDARDS

All performance standards will be adhered to.

R645-301-251. SOIL REMOVAL

See R645-301-212.

R645-301-252. SOIL STORAGE AND REDISTRIBUTION

See R645-301-212.

ANDALEX RESOURCES, INC.
CENTENNIAL PROJECT

CHAPTER 3

Biology

C/007/019

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310. Introduction

At present the Mining and Reclamation Plan for the Centennial Project includes 2,274.77 acres under permit (see Plate 5-2). This permit is now being amended to include the Kenilworth Federal Lease UTU-81893 (1760.0 acres), bringing the total permit area to 4,034.77 acres (see Plate 5-2). Lease UTU-81893 was acquired in 2006. Mining activity within the Kenilworth lease area will be an extension of the underground workings of the existing Aberdeen Mine. Therefore there will be no new surface facilities associated with mining in the new lease areas (other than additional Gob Gas Vent holes, if needed, which will be permitted on a site-specific basis in the future). It should be noted that UTU-81893 was previous included in the Willow Creek Mine Permit No. ACT/007/038 which has been previously approved by DOGM. After the Willow Creek Mine was closed the Kenilworth lease was terminated. The area was subsequently re-leased by BLM in 2006 through the normal LBA process after an application by Andalex Resources.

Since the Kenilworth Lease is simply an extension of underground mine workings under roughly 2,000 to 3,000 feet of cover, it is unlikely there will be any effect on vegetation, fish or wildlife. Raptor surveys will be conducted while active mining takes place. Because there will be no additional surface disturbance on the lease area, a First Order Survey is not deemed necessary.

311. Vegetative, fish, and wildlife resources of the permit area and adjacent areas are described in section 320.

312. Potential impacts to vegetative, fish and wildlife resources and methods proposed to minimize these impacts during coal mining and reclamation operations are described in sections 330 and 340.

313. Proposed reclamation designed to restore or enhance vegetative, fish and wildlife resources to a condition suitable for the designated post-mining land use are described under section 340.

320. Environmental Description

321. Vegetation Information

Vegetative Types: Please see Soil Survey & Vegetation Inventory in Appendix M.

The vegetative types include Mountain Brush, Pinion-Juniper Woodland, Sagebrush-Grass, and Conifer-Aspen. The Sunedco Lease as well as the Graves Lease are located primarily in the Mountain Brush and Conifer-Aspen communities.

321.100

Reference Areas

The reference areas to be used by Andalex Resources in Revegetation are shown on Plate 7-1, which is a Watershed and Revegetation Reference Areas Map. These reference areas have been described by the Soil Conservation Service with regard to condition and production. This description can be found in Appendix M following EEC's soils and vegetation survey.

There are three reference areas, each one acre in size, two of which are located on slopes and one in a drainage area. Reference area R-1 will be used in conjunction with the seed mixture for drainage areas. Areas R-3 and R-4 will be used in conjunction with the seed mixture for slopes and will also be used in conjunction with drainage areas to establish the success of Gamble's Oak. See plate 9. Additionally, a "**Reference Area**" for the GVH's with the same plant community was sampled. The Reference Area was used for comparisons of the proposed disturbed site at that time and will also be used at the time of final reclamation of the GVH's for standards of final revegetation success.

Each reference area established will be re-evaluated every five years prior to permitting.

Mountain-Brush, Desert Shrub, Pinion-Juniper Woodland, Sagebrush-Grass, Conifer-Aspen, and minor stream-side vegetative types cover the total mine plan area. Most of the area is covered by the Mountain-Brush type while the Pinion-Juniper Woodland type is predominant in the mine mouth area as well as the access routes and utility corridors; this area has been reseeded with a mixture as recommended by the U.S.D.A. S.C.S. (please see Soil Survey and Vegetation Inventory in Appendix M).

Andalex has selected and marked three reference areas in the field for vegetation. The Division has reviewed and approved these reference areas (plate 7-1). Areas chosen include all types of vegetation conditions such as drainage areas, shallow slopes and steep slopes. Andalex contacted the SCS to help evaluate the condition of these sites. Please see SCS letter in Appendix M. It should be noted that Andalex does have the benefit of a revegetation test plot located on one of the topsoil piles. The drainage area reference area is the most adaptable to the left fork fan installation.

Source of Data

Department of the Interior, 1979. Final Environmental Statement, Development of Coal Resources in Central Utah; Part 1 Regional Analysis; Part 2 Site Specific Analysis.

United States Department of Agriculture, Soil Conservation Service, May, 1980. Soil Survey and Interpretations, Vegetation Survey.

Centennial Coal Associates, May, 1976 Mining Application. Submitted to the United States Geologic Survey, Conservation Branch.

A.M.C.A. Coal Leasing, June, 1978 Mining and Reclamation Plan (Zion's fee). Submitted to the State of Utah, Department of Natural Resources, Division of Oil, Gas, and Mining.
Revised 8/8/95

Earth Environmental Consultants
September, 1981
Soil Survey and Vegetation Inventory
(Appendix M)

Plateau Mining Corporation
Willow Creek Permit #007/0038
Map #5

Plant Communities: Please see Soil Survey and Vegetation Inventory in Appendix M.

The Mountain Brush type is the largest in the area. It is found predominately at elevations of about 7,500 feet. This community consists of sage, mountain mahogany, serviceberry, snowberry, squaw apple, gambels oak, and maple. Minor amounts of rabbitbrush, cliffrose, and bitterbrush can be found. Associated grass species are wildrye, Indian ricegrass, wheat grass, bull grass, and blue grass.

The Sagebrush-Grass group is present from 7,200 to 9,000 feet on and in the low benches below the cliffs. Sage and rabbit brush appear associated with the common grasses occurring in other communities such as curly grass, indian rice grass, and bull grass. Fourwing and saltbrush is found on better drained soils. Shad scale and curly grass associations are found on the heavier clay soils.

The Pinion-Juniper Woodland community occurs in the area from an elevation of 5,600 to 8,000 feet and dominates the area below the escarpment of the Book Cliffs. Pinion pine and Utah juniper are the dominant species with bull grass, indian rice grass, and birch leaf mahogany as associated species.

The Conifer-Aspen becomes fairly extensive in the more moist sites and at higher elevations. Elevations range from about 7,000 to 9,000 feet. Aspen predominates at the lower elevations with associated species being serviceberry, snowberry, Oregon grape, mountain brome, and peavine. Douglas fir is scattered throughout the area above 7,500 feet elevation. A few big red pine, white pine, and fir are found in the upper canyon bottoms. Understory grasses present include curly grass, indian rice grass, shadscale, black sage, and crested wheatgrass.

Identified species of noxious or poisonous weeds in the area are halogeton, cockleburr, loco, and copperweed. There are no concentrated areas or serious problems from these poisonous plants.

Some of the most important vegetation species are listed in Table III-10 following this page.

TABLE III-10

Vegetation Possibly Occurring in Area

Common Name	Scientific Name
Grasses:	
Curly Grass	Hilaria Jamesii
Indian Rice Grass	Oryzopsis Hymenoides
Squirreltail	Sitanian Hystix
Needle and Thread Grass	Stipa Commata
No Eatum Grass	Aristida Fendleriana
Western Wheat Grass	Agropyron Smithii
Bull Grass	Elymus Salinus
Shrubs:	
Nuttal Saltbush	Atriplex Nuttallii
Mat Saltbush	Atriplex Corrugata
Shadscale	Atriplex Confertifoldia
Fourwing Saltbush	Atriplex Canecens
Big Sagebrush	Artemisia Tridentate
Black Sagebrush	Artemisia Arbuscula Nova
Greasewood	Sarobatus Vermiculatus
Small Rabbitbrush	Chrysothamnus Viscidiflorus
Big Rabbitbrush	Chrysothamnus Nauseosus
Mountain-Mahogany	Cercocarpus Montanus
Serviceberry	Amelanchief Alnifolia
Curlleaf Mahogany	Cercocarpus ledifolius
Squaw Apple	Peraphyllum Ramosissimum
Snowberry	Symphoricarpos Oreophilus
Trees:	
Juniper	Juniperus Osteosperma
Pinion	Pinus Edulis
Ponderosa Pine	Pinus Ponderosa
Aspen	Populus Temuloides
Limber Pine	Pinus Flexilis
Douglas Fir	Pseudotsuga Menziesii
Gambel Oak	Quercus Gambelii

Extent of Cover

Since the elevations and terrain varies drastically from steep walled canyons to high ridges, vegetation density also varies. Percent cover is greater at the higher elevations and on the gentler topography. The Bureau of Land Management estimates cover of 25 to 30 percent at the higher elevations and 10 to 12 percent on the lower canyon sides and bottoms.

Shrub Height

Shrub height varies over the lease area. Topography, aspect, elevation, and soil cause these modifications.

322. Fish and Wildlife Information

Introduction

The mine plan area is located in the West Tavaputs Plateau, a region which supports about 360 vertebrate wildlife species. The abundance and distribution of wildlife in the lease area is directly related to present land use activities and capabilities. Use of this area by certain species is limited to lack of perennial water. Mammal and bird species possibly occurring in the lease area are listed in Table III-11. Please refer to Plates 3-3A, 3-3B, 3-3C, and 3-3D, which have been revised to include the Kenilworth Lease. A "Species List of Vertebrate Wildlife that Inhabit Southeastern Utah", compiled by the Utah State Division of Wildlife Resources, can now be found in Appendix A.

Source of Data

Department of the Interior, 1979. Final Environmental Statement - Development of Coal Resources in Central Utah, Parts 1 and 2.

Utah Department of Natural Resources, Division of Wildlife Resources.

322.100

Habitats

Previously described vegetation provides fair to excellent habitat for a variety of wildlife species.

Animal Species (See Table III-11)

Mammals

Mammals occurring in the area can be divided into two groups, game species and non-game species.

The main game species include mule deer, mountain lion, black bear, elk, and cottontail rabbits. Mule deer, however, are the most important wildlife resources in the area. Mountain lion are present but little information is available due to their ranging habits. Generally, their movement coincides with the migration of deer. Black bear may occasionally be found in the vegetated canyons, usually along the cliff face. They normally inhabit the Book Cliffs to the north but little data is available on their populations. The permit area is within the lower limits of the elk range, however, elk are generally found north of the mine plan area at higher elevations. Cottontail rabbits are distributed throughout the area.

Non-game mammals include several species of small animals inhabiting the area. Predator species such as coyote and bobcat occasionally are found in the area and depend on small rodents and rabbits for their source of food. Information on non-game species is generally unavailable.

Additional information on species, habitat, and status, can be found in Appendix A. New habitat maps have been completed and can be found as Plates 3-3A, 3-3B, 3-3C, and 3-3D.

TABLE III-11

List of Animals Possibly Occurring in Lease Area

Common Name	Scientific Name
Mammals:	
Badger	Taxidea Taxus
Black Bear	Ursus Americanus
Bobcat	Lynx Rufus
Coyote	Canis Latrans
Deer mouse	Peromyscus Maniculatus
Desert Cottontail	Sylvilagus Audubonni
Elk	Cervus Elaphus
Ground Squirrel	Spermophillus Tridecelineatus
Least Chipmunk	Eutomias Minimus
Mountain Lion	Felis Concolor
Mule Deer	Odocoileus Hemionus
Porcupine	Evethizon Dorsatum
Striped Skunk	Mephitus Mephitus
White-tailed Jackrabbit	Lepus Townsendii
Birds:	
Brewers Sparrow	Spizella Breweri
Blue Grouse	Dendragapus Obscurus
Common Nighhawk	Chordeiles Minor
House Sparrow	Passer Domesticus
Lark Sparrow	Chondestes Grammacus
Magpie	Pica Pica
Mourning Dove	Zenaidura Macroura
Pinion Jay	Gymnorhinus Cyanocephala
Red-tailed Hawk	Buteo Jamaicenis
Robin	Turdus Migratorius
Ruffed Grouse	Bonasa Umbellus
Sage Grouse	Centrocercus Urophasianus
Sparrow Hawk	Falco Sparverius
Turkey Vulture	Cathartes Aura
Vesper Sparrow	Pooecetes Gromineus

Birds

Raptors

The turkey vulture and red-tailed hawk frequent the area. A variety of other raptors breed in the Price area; however there is a poor density of raptors throughout the mine plan area. A raptor survey performed for Andalex Resources of the proposed permit area by Clayton M. White of Brigham Young University is attached as Appendix D. Please see Plate 3-3A in the confidential binder for the raptor survey done in 2007 on the Kenilworth Lease. These Plates now include information from the raptor survey performed in May, 1994, by the Utah DWR and the Utah DOGM. Also refer to letter from USFWS found in Appendix J indicating clearance for our powerline distribution regarding raptors.

Other

Sage grouse inhabit the sagebrush flats at the foot of the cliffs (Plate 3-3D). Blue and ruffed grouse may occasionally be found in the vegetated canyons of the area. Chukkars can be found around the cliffs. Mourning doves are generally distributed throughout the area, however, the lack of perennial water limits dove nesting habitat in the area. Other representative birds include the magpie, bluebird, robin, and several species of sparrow.

Reptiles and Amphibians

The most prominent species of reptiles include the rattlesnake and sagebrush lizard. No aquatic fauna are present in the area.

Snake dens will be reported to the DWR.

Fish

There are no active fisheries as there are no permanent bodies of water or perennial streams in the area. No aquatic fauna are found.

322.210

Threatened or Endangered Species

There are 6 threatened or endangered species on or near the lease area according to a survey conducted by the Utah Division of Wildlife Resources.

A listing of threatened or endangered plant species known to occur in Carbon County is included in Appendix M.

There have 6 threatened or endangered species observed in the lease area. Additionally, Representative from Fish and Wildlife Services does not believe the habitat exists for these species within the permit area.

322.220

It should be noted that no wetland or riparian areas are on the current permit or on the Kenilworth Lease Area, will be affected due to no additional surface disturbance being needed.

330. OPERATION PLAN

Maps and Plans

Most of the maps and plans previously submitted as part of the approved Mining and Reclamation Plan, are applicable. Where necessary, the original maps have been revised to indicate the addition of new leases and rights-of-ways and the revisions are indicated in this submittal.

1) All necessary maps and plans to complete this section are found in Volume II of the submittal and also in the appendices, specifically,

   a) Underground coal mining activities to be conducted and lands to be affected by surface facilities are shown on Plates 5-7, and 5-6.

   b-1) Buildings, utilities, and facilities are depicted on Plates 5-7.

2) The area to be affected is shown on several plates, including 7-11, 7-3, 7-9. These last four plates show the sequence of mining in the four seams over the five year term of the permit. Plate 5-6 has been revised to show immediate development in the Gilson Seam as soon as approval is achieved. Reclamation will not take place until after all four seams are mined out. This activity is depicted on Plates 5-9, 7-12, 7-13, 3-2.

3) Plate 5-7 depicts the entire disturbed area for which a performance bond is posted. The acreage is shown on Plate 1-5.

4) Coal storage and loading areas are shown on Plate 5-7. No cleaning takes place.

5) Plate 5-7 shows a non-coal waste storage area as well as topsoil storage areas. Plate 2-3 show the topsoil piles in detail.

6) All water diversions and other water facilities are shown on Plates 5-7, 7-2, 7-1, 7-4, 7-5, and 7-7. Also, typical diversions for disturbed area and undisturbed areas are shown in the Sedimentation and Drainage Control.

Diversion ditches as they exist are shown on Revised Plate 5-7. Topographic detail has been added to Plate 7-2 to allow determination of watershed slopes within the disturbed area.

Topographic detail has been added to Plate 7-2 to allow determination of watershed slopes within the disturbed area. Plate 7-12 has been revised to show drainage during the reclamation period before and after removal of sediment ponds (Phase I).

Plate 7-13 shows final drainage details.

Plate 7-1 shows delineations of watershed areas.

The main culvert will be removed entirely during the reclamation/earthwork phase except under Pond E. Pond "E" will be enlarged, and the entire drainage area above will flow into the restored channel RC-1 and through Pond "E-PM". Once Revegetation and water quality standards have been met, Pond "E-PM" will be removed and reclaimed.

7) There is no coal processing waste at the Centennial facility. There are no pollution control facilities other than sedimentation ponds on the permit area. Waste rock from the Centennial Mine rock tunnels has been disposed of underground in the Pinnacle Mine.

8) Specific facilities are not used to protect or enhance wildlife with the exception of the powerline which was built according to strict guidelines issued by the Division of Wildlife Resources and the U.S. Fish and Wildlife Service regarding raptor protection. The powerline design is included in Volume I as Appendix I (powerline design). Also, speed limits are posted within the permit area.

9) The two powder magazines are shown on Plate 5-7.

10) Plates 6, 7, 8, and 9 show these facilities associated with protection of the hydrologic balance including sedimentation ponds and storage of non-coal waste. There are no permanent impoundments, coal processing wastes or underground development wastes. Any underground development waste or excess spoil which was generated while putting in the Aberdeen portals, has been used as stock pile pad material at the Aberdeen Minesite. The volume of this material is minimal.

11) Plates 16 and 17 show the final reclamation contours and configuration of the surface for Phases I and II respectively.

12) Subsidence monitoring points are shown on Plate 25. Water monitoring locations are shown on Figure IV-11 and on Plates found in Chapter 7.

13) There will be no facilities left on the permit area permanently with the exception of the roads through the right fork of Deadman Canyon. The left hand fork road will be reclaimed. After the completion of underground mining, all facilities will be removed with the exception of one downstream sedimentation pond. This pond will be removed upon final reclamation.

c) Maps, plans, and cross sections required under

b) (5),(6),(10), and (11) have been prepared under the direction of, and certified by a registered professional engineer. Assistance has come from a registered land surveyor.

1) Detailed maps, plans, and cross sections for our sediment ponds, Plates 11, 12, and 13 have been certified by a registered professional engineer.

2) Andalex has not used any excess spoil or underground development waste maps or cross sections. A map depicting the location of non-coal waste storage is included as Plate 6.

Andalex will endeavor to use the best technology current available to enhance wildlife habitat during the reclamation phase of its operation. This will include, but not be limited to water sources (if available), thermal cover, escapeways, hiding and loafing places, and travelways. ANDALEX will consult with the Division of Wildlife Resources, at the time of final reclamation, to determine exactly what reclamation designs, planting arrangements, and artificial structures would best enhance a wildlife habitat.

330.331 MINIMIZING IMPACT AND SURFACE EROSION

REVEGATATION and Interim Revegetation

Revegetation will be accomplished by Andalex or under Andalex's direct supervision and under the recommendations of the regulatory authority (see Plates 3-1 and 3-2).

Interim Revegetation for stabilization of disturbed areas will take place on all disturbed slopes within the disturbed area. These slopes will be hydroseeded using the approved final reclamation seed mixture and rate of application along with hydromulch at the rate of one-and-one-half tons per acre. The vegetation cover will be maintained as necessary and slope stability will be measured by visual inspection.

Schedule of Revegetation

The seeding of native flora (consisting where possible of deer browse species), will commence as soon as is practical following shutdown and abandonment to stabilize erosion. Agencies such as the B.L.M., O.S.M., and Utah Department of Natural Resources will be consulted at the time for recommendations on recontouring, soil reconditioning, and Revegetation. Revegetation will be accomplished by Andalex or under Andalex's direct supervision and under the recommendations of the regulatory authorities.

The first normal planting season will be used for Revegetation following the removal of all structures and regrading. The season for normal planting of seed mixtures is the fall, prior to snowfall and after October 1st. The normal season for shrub plantings is the spring after thawing while moisture is available.

The new Left Hand Fork fan installation will have its own separate topsoil storage area. Andalex will utilize this topsoil storage area to test shrub species in the coming years beginning in the fall of 1995.

Standards for success for woody species is 2000 woody plants-per-acre for stream bottom areas and east-facing slopes; 1500 woody plants-per-acre for west-facing slopes.

Sediment Pond E - PM will be maintained until removal is authorized by the Division and the disturbed area has been stabilized and revegetated. In no case will the structure be removed sooner than two years after the last augmented seeding

Soil Testing Plan and Soil Preparation

Where possible the soil will be distributed along the contour. The thickness of the re-established soil will be sufficient to support vegetation equal to or superior to pre-mining history (6"). Soils will be tested according to the most advanced technology. Samples will be taken to determine any deficiencies which would affect the growth of newly revegetated areas. Any deficiencies will be corrected by adding to the soil chemical fertilizers, organic mulch, or any other substances recommended by the regulatory authority. Preparation techniques such as disking will be incorporated.

Species and Amounts of Seeds and Seedlings

The seed mixtures outlined for steep slopes and drainage areas developed by UDOGM (12-10-86) will be used. Shrub clumps will be planted as shown on Plate 20. This constitutes an area of 2.15 acres (Drainage areas are 15.02 and Slopes are 17.03). Species shall include serviceberry, mountain big sagebrush, squawbush, blue elderberry, mountain snowberry, and mountain mahogany. They will be planted at a rate of 1,000 containerized plants per acre using fertilizer and crimped straw for stabilization. Drainage area seed mix will be used around and among the shrub clumps

beneath the straw stabilization. Re Reference Areas. Plate 20 in Volume II shows that Andalex will plant the drainage mixture around and beneath the shrub clumps (transplants). These transplants listed above will be used in the drainage areas as depicted on Plate 20.

Planting and Seeding Methods

Where possible the areas will be disked using conventional farm equipment. Andalex will make every effort to leave surfaces to be reseeded as rough as possible (one method could be gouging by a trackhoe). The seed will be spread using a rangeland drill where possible. Areas which cannot be seeded mechanically will be hand seeded or hydroseeded. Steeper slopes will be raked to provide a slight soil cover for the seed. Steep slopes may also be hydroseeded and hydromulched.

Mulching Techniques

Vegetative cover will be promptly re-established following cessation of mining activities to stabilize erosion. Mulch will be used and re-seeding will occur during the first normal period for favorable growth following regrading. Mulch will be applied to all reseeded areas. Where hydromulching cannot be used, straw mulch (at the rate of 1-1/2 to 2 tons/acre) will be crimped either mechanically or by hand. Hydromulch will be used on steep slopes and straw will be used wherever possible.

Andalex would plan on using organic mulch (wood fiber). It will be used wherever seeds are planted. These areas are shown on Plate 20 and constitute 47.19 acres. The rate of application will be one ton per acre. The remaining acres are shrub plantings which will be stabilized with the drainage area seed mix and crimped straw.

Management Practices, e.g., Irrigation, Pest, and Disease Control

Andalex does not anticipate irrigation will be used because of the lack of water in the area. Vegetative growth will be subject to normal rainfall and winter snowfall. As a contingency irrigation by mechanical methods could be used if Revegetation of the transplants is unsuccessful. Vegetation will be protected from both wildlife and livestock by drift-fences until the reclaimed areas have been adequately re-established. Upon approval, the fences will be removed. Pesticides and herbicides will be used as necessary. Should any persistent pesticides be needed, the Division's approval will be obtained prior to their use.

Measures to Determine Success

Revegetation will be closely monitored. Areas which fail to support sufficient growth to stabilize conditions will be tested and reseeded until a proper cover is established. Vegetation reference areas will be consulted to determine success.

Physical examinations will be conducted to note any species which are not thriving or regenerating. If this occurs, species will be substituted at the recommendation of the regulatory authority. Any other species will be added at the time of reclamation upon recommendation of the regulatory authority. The company will maintain close contact with the Bureau of Land Management in all of its Revegetation efforts, and incorporate their suggestions into its over all plan. All reclaimed areas will be monitored and maintained by the constant observation of Andalex until the surety release is granted.

Revegetation monitoring parameters to be measured are growth rate, plant density and percent cover. We would expect to monitor or supervise monitoring at least monthly during the first two growing seasons. From experience with interim Revegetation at the minesite, we have learned that two growing seasons are needed to establish any success. After this we would know whether reclamation was progressing successfully.

Monitoring will take place during years 1, 2, 5, 9, and 10. Years 9 and 10 will include estimates of cover, wood density, productivity, and composition, both on reclaimed areas and on reference areas. Parameters sampled on reclaimed areas will meet or exceed 90% of the reference area standard with a 90% confidence level. Andalex will use approved sampling methods and will use the same method for both reclaimed and reference areas.
In 1983, Andalex planted several shrub species which are part of our approved transplant mixture on topsoil pile F. These plantings were not performed under the direction of the Division and were merely for Andalex's reference. Andalex will attempt a new test plot with our approved transplant mixture in 1992 in the same area. Monitoring, both qualitative and quantitative, will be performed in years 1, 2, 5, 9, and 10. Data will be submitted to the Division as part of the annual report starting in 1993.

Area to be Disturbed

The surface area disturbed is very minimal, 47.19 acres as shown on Plate 7. It should be again stressed that there will be no additional surface disturbances and no additional surface facility construction on the new Kenilworth Lease area. Mining on the Kenilworth Lease will simply be an extension of existing underground workings. Site of the present surface facilities is located in an area that has been previously impacted by mining activities. Actual plant communities which have been disturbed are the Pinion-Juniper and associated species and similar impact is foreseen on vegetation overlying the remainder of the lease area at the proposed surface facilities' sites. Extreme care will be taken however, to disturb as little vegetation as possible and revegetation has been immediately carried out on all disturbed areas no longer needed for the mining operation.

Andalex has maintained small islands of natural vegetation within the site, but upon final reclamation, we do not intend to remove natural vegetation from other sites and

transplant it. Andalex does not intend to encapsulate seed and fertilizer for release over several years. All disturbed slopes have been revegetated.

Berry producing shrubs have naturally re-occurred within the disturbed area for avifauna species. No avifauna will be disturbed within Andalex's minesite and in particular, raptors and their nests. Andalex's powerline was constructed under the guidance of the Utah DWR.

330.332 IMPACTS OF SUBSIDENCE ON RENEWABLE RESOURCE LANDS

Subsidence

Survey of Structures and Renewable Resource Lands

There are no structures present other than those constructed for mining operations, on the permit area. The land is presently used for grazing and wildlife habitat which constitutes a renewable resource area. It should be noted that geographic areas above Andalex's 5 year mine plan do not include any area suitable for grazing, nor do they contribute significantly to the long-range productivity of water, food or fiber products. Andalex commits to mitigate all subsidence related damage to renewable resources including, but not limited to water, grazing, and wildlife habitat including raptor nests.

Andalex, through raptor surveys conducted, has identified Golden Eagle nests which could be impacted by subsidence. Andalex is committed to acquiring necessary take permits prior to longwall mining under these sites. Andalex is also committed to additional mitigation which might include measures to prevent nesting on those nests which could be affected by subsidence or removal of nests for scientific study. Please refer to Plate 3-3A for the most current raptor nesting information including the raptor survey conducted in May, 1994, and Plate 3-3A in the Confidential Binder for the Kenilworth lease. Three nests have been identified as being located within potential subsidence impact zones. They are identified on Plate 3-3 and a take permit application for these nests is on file with the U.S. Fish and Wildlife Service. The longwall panel affecting these nests will not be removed prior to the acquisition of this permit. There are no known raptor nests located on the Kenilworth Lease Area. (See Plate 3-3A in the Confidential File)

Andalex has committed to compensation for livestock lost as a result of subsidence which in turn is a direct result of underground mining activities. Also, major cracks caused by subsidence which are demonstrated to be a direct result of underground mining will be repaired.

330.333 USING THE BEST TECHNOLOGY CURRENTLY AVAILABLE TO MINIMIZE DISTURBANCE AND IMPACT

As the Kenilworth Lease is simply an extension of our underground mine workings under roughly 2,600 to 3,000 of cover, there will be likely be no effect to the surface biology of the area.

Preventive Measures

Subsidence due to mining on the Andalex property will not occur outside of the approved permit area. Stations have been set up as required for constant monitoring of subsidence movements. (See 6., Monitoring.) The only absolute preventive measure possible is to leave coal in place. This is in direct contrast to maximum economic coal recovery.

Resources on the lands above Andalex's mining plan consist only of wildlife habitat with very limited grazing access.

Subsidence monitoring stations will be established as necessary along the first proposed longwall mining. (See 6., Monitoring and Plate 25.) The results of this monitoring program will define monitoring and permitting needs in the future.

In the event problems should occur, which are verified by the company and the Division to be the result of mining, the company will develop a mitigation plan with the Division of Wildlife Resources.

Impacts of Operation

Construction of all roads, powerlines, and surface facilities has been completed. The earthwork and surface facilities for the Aberdeen Mine are complete. The fish and wildlife information contained in this MRP pertains to the entire permit area including the Kenilworth Lease. The only potential impact to wildlife as a result of construction (golden eagle nests) has been addressed thoroughly and a negative impact determination was made (Plate 3-3A). Regarding temporary interruption of wildlife habitat, this has also been addressed in the Fish and Wildlife Plan and the Reclamation Plan. Therefore, no additional impact of operations on wildlife is anticipated. Wildlife education has been implemented through the training department. All new employees will receive wildlife education training.

Fish & Wildlife Plan (please see Appendix A).

There will be no additional surface disturbance required on the new Kenilworth coal lease. Consequently, there will be no additional disturbance or adverse impacts on

fish and wildlife or related environmental values. New habitat maps have been completed and can be found as Plates 3-3A (Confidential binder) 34B, 34C and 34D.

Andalex will make every possible effort to minimize disturbances to wildlife habitat in the area and where possible enhance that habitat during reclamation. It should be noted that there is no aquatic life in the permit area as these canyons are dry except as a result of direct precipitation (ephemeral streams). Straight, Mathis and Alrad Canyons are ephemeral drainages. Andalex has performed numerous mitigative measures including extensive revegetation. Andalex has performed all mitigative measures outlined in the Fish and Wildlife Plan (Appendix A) with the exception of the use of swareflex reflectors.

Andalex has advised and encouraged employees to avoid unnecessary disturbances to all wildlife regardless of the season, but especially the depleted winter season or the breeding season. Hunting and all wildlife regulations are adhered to.

The largest part of Andalex's road is screened from view by vegetative cover. During Revegetation, Andalex will use seed mixtures which are favorable for wildlife enhancement.

To date, Andalex has had no use for poisons for rodent control or any other use.

Lodges, nests, and dens for all mammals will be protected from disturbance. Andalex has reduced speed limits posted within the minesite and the entire length of the haulroad year-round (20 mph and 40 mph). Swareflex reflectors will not be implemented.

There are no unpaved sections of the haul road and swareflex reflectors are not being used. Andalex has demonstrated mitigation of impacted habitat through revegetation efforts on areas in and outside the permit area. We have had employee wildlife education sessions in the past and may perhaps in the future. A description of the values of wildlife as well as methods for avoiding impacts to wildlife could be written into a form which could be passed out during annual employee training. The Division of Wildlife Resources may be able to assist Andalex with this idea. The powerline was constructed under strict guidelines and has been thoroughly checked by both the Utah DWR and the U.S. Fish and Wildlife Service. Both agencies are pleased with the design and the as-built facilities. Andalex is willing to adhere to reasonable and practical recommendations given by any agency and has for the most part taken the advice of the DWR on most all occasions as outlined in the Wildlife Resources, Appendix A. Special condition #7 was answered by posting 40 mph speed limits, year round.

To the extent possible, Andalex will commit to prevent, control, and suppress range, forest, and coal fires within the permit area. The control of range and forest fires may very well be out of Andalex's hands and it may only be possible for Andalex to

report these incidences to organizations such as the BLM who are equipped to handle these situations.

Andalex has committed to continuing wildlife education as part of its employee training. This will be coordinated with the local office of UDWR through the use of videos and possibly guest speakers.

333.200

There have been 6 threatened or endangered species on or near the lease area according to a survey conducted by the Utah Division of Wildlife Resources.

333.300

Calculations have been performed to evaluate the potential water depletion to the Colorado River system as a result of the mining at this site. The calculations are shown on Table III-12, and indicate a net increase of approximately 47.61 acre-feet of water per year to the Colorado River.

Table III-12
Potential Water Depletion
To
Colorado River Drainage

The following calculations are intended to define the potential depletion or addition of water to the Colorado River Drainage System, as a result of mining at this operation. It should be noted that the criteria is based on the U.S. Fish and Wildlife Service Windy Gap Process, and only those parameters that apply to this operation have been calculated.

Projected Water Depletion

1- Bathhouse/Office
   a. 140 people @ 35 ngpd/ea x 240 days/yr = 1,176,000,gal/yr

2- Ventilation
   a. Evaporation
      1) 450,000 cfm = 236,520 M cf/yr
      2) 2.5 gallon/M cf = 591,300 gal/yr

Total Loss = 1,767,300 gal/yr
5.424 ac ft/yr

Projected Water Addition

1- Mine Discharge

a. 100gpm x 120 days/yr = 17,280,000 gal/yr

Total Gain =	17,280,000 gal/yr 53.034 ac ft/yr

Summary

Projected Depletion =	-5.424 ac ft/yr
Projected Addition =	+53.034 ac ft/yr
Total Addition =	+ 47.61 ac ft/yr

Note: Moisture loss from mined coal and use of sprays have not been included, since the spray water is derived from perched aquifers and is recycled within the mine. Any excess water from the perched aquifers is eventually discharged, resulting in the addition to stream flow.

340. Reclamation Plan

340.341. Revegetation

The revegetation map now shows the original permit acreages for the three range types. Shrub clumps make up 2.15 acres, drainage areas make up 15.02 acres and steep slopes make up 17.03 acres. Total disturbed area, including the Aberdeen Mine left fork fan and road is 47.19 acres.

Vegetation mapping has been created for the entire permit area of the Centennial Mine by Mt. Nebo Scientific, Inc. Springville, Utah. EarthFax Engineering did the Vegetation mapping for the Kenilworth Lease. See Plate 3-1 for vegetation mapping for the disturbed area.

The vegetation map was created by using new and/or current available aerial photography with field work accomplished as a means for ground-truthing. Field verification work was conducted during the growing season of 2002. Vegetation maps were consolidated and expanded and a new total permit vegetation map was created in 2014 as Plate 3-1.

The life of the mine is estimated to be at least 5 years after the continuation of mining, therefore, a detailed schedule and timetable for the completion of each major step in the revegetation plan will be completed at a time nearer to the end of the mine's life. Reclamation Phase 1 and Phase 2 can be found on plate 3-2.

340.341.210

Table III-13

Recommended Seed Mix for Steep Slope Areas

SPECIES	# PLS/Acre
Grasses :	
Agropyron Smithii	
Western Wheatgrass	3.0
Agropyron Spicatum	
Bluebunch Wheatgrass	2.0
Agropyron Trachycaulum	
Slender Wheatgrass	2.0
Bromus Marginatus	
Mountain Brome	3.0
Oryzopsis Hymenoides	
Indian Ricegrass	2.0
Poa sandbergii (Secunda)	
Sandberg Bluegrass	0.25
Forbs:	
Artemisia ludoviciana	
Louisiana Sagebrush	0.1
Hedysarum Borealis	
Northern Sweetvetch	1.0
Linum Lewisii	
Lewis Flax	1.0
Melilotus Officinalis	
Yellow Sweetclover	0.5
Penstemon Strictus	
'Bandera' Rocky Mtn. Penstemon	0.25
Shrubs:	
Amelanchier Alnifolia	
Serviceberry	1.0
Artemisia Tridentara Vaseyana	
Mountain Big Sagebrush	0.2
Cercocarpus Ledifolius	
Curlleaf Mountain Mahogany	1.0
Cercopcarpus Montanus	
True Mountain Mahogany	1.0
Chrysothamnus Nauseosus Albicaulis	
Whitestem Rubber Rabbitbrush	1.0
Purshia Tridentata	
Bitterbrush	3.0
Symphoricarpos Oreophilus	
Mountain Snowberry	1.0
Total	**23.3**

Rate is pounds Pure Live Seed/Acre for drill seeding. Broadcast seeding is double the drill rate.
12-10-86

Table III-14
Recommended Seed Mix for Drainage Areas
Andalex Resources, Inc.

SPECIES (DRAINAGE AREAS)	# PLS/acre
Grasses:	
Agropyron Riparium Western Wheatgrass	2.0
Agropyron Trachycaulum Slender Wheatgrass	2.0
Bromus marginatus Mountain Brome	3.0
Elymus cinereus Great Basin Wildrye	2.0
Phalaris Arundinacea Reed Canarygrass	0.5
Poa Pratensis Sandberg Bluegrass**	0.1
Forbs:	
Achillea Millifolum Yarrow	0.1
Artemisia Ludoviciana Louisiana Sagebrush**	0.1
Hedysarum Borealis Northern Sweetvetch	1.0
Melilotus Officinalis Yellow Sweetclover	0.5
Osmorhiza Occidentalis Sweet Anise	2.0
Shrubs:	
Amelanchier Alnifolia Serviceberry	1.0
Artemisia Tridentata Vaseyana Mountain Big Sagebrush**	0.1
Rhus Trilobata Squawbush	1.0
Sambucus Cerulea Blue Elderberry	1.0
Symphoricarpos Oreophilus Mountain Snowberry	1.0
Total	**17.4**

Trees (transplants):	**#/Acre**
Populus Angustifolia (Narrowleaf Cottonwood)	250
Acer Negundo (Box Elder)	250
Prunus Virginiana (Chokecherry)	250
Quercus Gambelii (Gambel Oak)	250
Total	**1000**

Rate is pounds Pure Live Seed/Acre for drill seeding. Broadcast seeding is double the drill rate.

*This seed mixture and shrub list will be used for interim reclamation in the left hand fork fan installation and on the new topsoil pile. This seed mixture and shrub list will also be used for final reclamation. Also, this shrub list will be attempted on the new topsoil pile in the left hand fork.

**Big sage, Louisiana sage, rabbit brush and bluegrass will be broadcast behind the drill where possible.

300.350. Performance Standards

353.120.

An evaluation of species composition will be made, including species present, form and diversity.

353.210

For a postmining land use of grazing and wildlife habitat, the ground cover and production will be equal to or greater that a reference area. The Division's "Vegetation Information Guidelines", Appendix A will be utilized for the evaluation of the success of Revegetation. Appendix B will be references for calculating diversity.

356.110.

Ground cover will be estimated by using one of the methods listed in "Vegetation Information Guidelines" Appendix A.

Andalex does not propose to stock shrubs or trees during interim or final Revegetation.

Production measurements will be made in accordance with DOGM's "Vegetation Information Guidelines" Appendix A. Estimates may be made by the methodology which the vegetation consultant feels is the most suitable method to used for the work being performed.

Sampling Techniques - Andalex Resources, Inc. will comply with the standards for success, statistically valid sampling techniques for measuring success, and the approved methods outline in the Division's "Vegetation Information Guidelines, Appendix A" for sampling.

The sampling methods to be used during reclamation will be specific to the requirements at the time of reclamation. Nonetheless, according to the currently approved UDOGM guidelines, these sampling methods would be used: sample adequacy, cover (line interception), density (belt transects or plots) and productivity (clipping). The Jaccard's Community Coefficient will be used to calculate acceptable plant similarity and diversity.

356.120.

The vegetative cover will be diverse, effective and permanent. Standards for reclamation success will be evaluated accordance with DOGM's "Vegetation Information and Monitoring Guidelines", Appendix A. The success of final reclamation will be judged on the effectiveness of the vegetation for the postmining land use and the extent of cover compared to the extent of cover for the reference area. Ground cover,

production or stocking will be considered equal to the approved success standard when it reaches 90% of the success standard. Statistical adequacy of all statistical sampling will be determined using the following formula:

$$N_{min} - \frac{t^2 S^2}{(dx)^2}$$

Where: t = the value from appropriate t-table*, (2-tail test for pre-mine studies, 1-tail test for success studies)
s = the sample standard deviation,
d = the desired change in the mean,
x = the sample mean of the parameter in question
* = All parameters are to be tested at the 90% confidence level with a 10% change in the mean (d = .1).

356.210

Grazing Land and Pasture Land - The ground cover and production of living plants on the revegetated area will be at least equal to the reference area.

356.220

Andalex Resources, Inc. will be responsible for the success of revegetation for a period of 10 years following seeding of the reclaimed area or upon Diviison bond release.

356.230

Fish and Wildlife Habitat - The postmining land use for the degas well sites will be wildlife habitat on pre-existing roads. Pre-existing roads will be returned to their approximate original contour and compacted.

356.240

Industrial, Commercial or Residential - The postmining land use for the permit area is not designated for industrial, commercial, or residential use.

356.250

Previously Disturbed Areas - N/A

356.300

Siltation structures will be maintained until the disturbed area is revegetated and stabilized. They will remain in place at least two years after the last augmented seeding. Siltation structures may include straw bales, silt fences or filter baskets. Removal will be contingent upon Revegetation and stabilization of the area as well as

DOGM concurrence. Following removal, the area will be revegetated in accordance with the reclamation plan.

358.100

There have been 6 threatened or endangered species observed in the lease area. A study was conducted in the Left Hand Fork for both the access road and the fan installation site to determine the presence of Canyon Sweetvetch.

358.510.

State or federally listed endangered or threatened species will be reported to the Division upon its discovery. It is listed in Appendix M.

358.520.

Electric Power Lines - No utilities will exist at the well sites.

Potential Barriers - No potential barriers will exist in the permit area.

R645-301-320. ENVIRONMENTAL DESCRIPTION

Appendices A, D and M.

R645-301-321. VEGETATION INFORMATION

Appendix M.

R645-301-321.100. POTENTIAL FOR RE-ESTABLISHING VEGETATION

Appendix M

R645-301-321.200. PRE-MINING PRODUCTIVITY

Appendix M

R645-301-322. FISH AND WILDLIFE INFORMATION

Appendices A, D, and M.

R645-301-322.100. PROTECTION AND ENHANCEMENT PLAN

Appendix A

R645-301-322.200. SITE-SPECIFIC RESOURCE INFORMATION

Appendix A

R645-301-322.210. THREATENED OR ENDANGERED SPECIES

R645-301-322.220. HABITATS OF UNUSUALLY HIGH VALUE FOR FISH AND WILDLIFE

R645-301-322.230. OTHER SPECIES OR HABITATS REQUIRING SPECIAL PROTECTION

N/A

R645-301-322.300. FISH AND WILDLIFE SERVICE REVIEW

Appendix A

R645-301-323. MAPS AND AERIAL PHOTOGRAPHS

Appendix A

R645-301-323.100. REFERENCE AREAS

See R645-301-331 "Reference Areas".

R645-301-323.200. MONITORING STATIONS

N/A

R645-301-323.300. ENHANCEMENT FACILITIES

N/A

R645-301-323.400. PLANT COMMUNITIES

R645-301-333.200. SITE-SPECIFIC PROTECTION OF THREATENED AND ENDANGERED SPECIES

R645-301-333.300. PROTECTIVE MEASURES DURING ACTIVE PHASES OF MINING OPERATIONS

Appendix A

R645-301-340. RECLAMATION PLAN

See R645-301-240.

R645-301-341. REVEGATATION

See R645-301-240.

R645-301-341.100 SCHEDULE AND TIMETABLE

See R645-301-240.

R645-301-341.200. DESCRIPTION

See R645-301-240.

R645-301-341.220. METHODS USED IN PLANTING AND SEEDING

See R645-301-240.

R645-301-341.230. MULCHING TECHNIQUES

See R645-301-240.

R645-301-341.240. IRRIGATION AND PEST CONTROL MEASURES

See R645-301-240.

R645-301-341.250. METHODS USED TO DETERMINE REVEGATATION SUCCESS

See R645-301-240.

R645-301-341.300. STUDIES AND TESTING TO DEMONSTRATE FEASIBILITY OF REVEGATATION PLAN

See R645-301-240.

R645-301-342. FISH AND WILDLIFE

Appendices A and D.

R645-301-342.100. ENHANCEMENT MEASURES

R645-301-342.200. PLANT SPECIES SELECTION

See R645-301-341.210.

R645-301-342.210. NUTRITIONAL VALUE

Appendix A

R645-301-342.220. COVER AND PROTECTION

Appendix A

R645-301-342.230. ABILITY TO SUPPORT AND ENHANCE HABITAT

Appendix A

R645-301-342.300. CROPLAND

N/A

R645-301-350 PERFORMANCE STANDARDS

R645-301-351 General

R645-301-352 Contemporaneous Reclamation

See R645-301-331

R645-301-353. REVEGATATION: GENERAL REQUIREMENTS

R645-301-353.100. VEGETATIVE COVER

The vegetative cover will be as stated in the following categories.

R645-301-353.110. DIVERSITY, EFFECTIVENESS AND PERMANENCE

The vegetative cover will be diverse, effective and permanent.

R645-301-353.120. NATIVE OR DESIRABLE INTRODUCED SPECIES

The vegetative cover will be comprised of species native to the area, or of introduced species where desirable and necessary to achieve the approved postmining land use and approved by the Division.

R645-301-353.130. EXTENT OF COVER

The vegetative cover will be at least equal in extent of cover to the natural vegetation of the area.

R645-301-353.140. STABILIZING SOIL FROM SURFACE EROSION

The vegetative cover will be capable of stabilizing the soil surface from erosion.

R645-301-353.200. REESTABLISHED PLANT SPECIES

The reestablished plant species will:

R645-301-353.210. COMPATIBILITY WITH APPROVED POST-MINING LAND USE

The reestablished plant species will be compatible with the approved postmining land use.

R645-301-353.220. SEASONAL CHARACTERISTICS OF GROWTH

The reestablished plant species will have the same seasonal characteristics of growth as the original vegetation.

R645-301-353.230. SELF-REGENERATION AND PLANT SUCCESSION

The reestablished plant species will be capable of self-regeneration and plant succession.

R645-301-353.240. COMPATIBILITY WITH AREA PLANT AND ANIMAL SPECIES

The reestablished plant species will be compatible with the plant and animal species of the area.

R645-301-353.250. COMPLIANCE WITH OTHER APPLICABLE LAWS OR REGULATIONS

The reestablished plant species will meet the requirements of applicable Utah and federal seed, poisonous and noxious plant; and introduced species laws or regulations.

R645-301-353.250 Vegetative Exception

Andalex Resources, Inc. does not require vegetative exception at this time.

R645-301-353.400 Cropland

The permit area contains no land designated as cropland.

R645-301-354 Revegetation: Timing

Andalex Resources, Inc. will follow the recommended guidelines for revegetation and planting during the first normal period for favorable planting conditions after replacement of the topsoil. In Utah the planting period is usually Fall due to the precipitation events.

R645-301-355 Revegetation: Mulching and Other Soil Stabilizing Practices

Mulch and/or other soil stabilizing practices (roughing, etc.) Will be used on all areas that have been regraded and covered by topsoil (Section 341.200). Andalex, Resources, Inc. will exercise care to guard against erosion during and after application of topsoil.

R645-301-356 Revegetation: Standards for Success

R645-301-356.100 Success of Revegetation

The success of revegetation will be judged on the effectiveness of the vegetation for post-mining land use, the extent of cover on each degassification well site compared to their respective reference areas as described in Section 321.

R645-356.200 Standards for Success

Standards of success will be applied in accordance with the approved postmining land use as described in this section.

R645-356.300 Siltation Structures

Siltation structures will be maintained until the disturbed areas have been stabilized and revegetated. For additional details on siltation structures, see Sections 542 and 763.

R645-356.400 Removal of Siltation Structures

The land on which siltation structures are located will be revegetated in accordance with the reclamation plan discussed in Section 353 and 357. Refer to Section 763 for additional information pertaining to the removal of siltation structures.

R645-357 Revegetation: Extended Responsibility Period

R645-357.100 Extended Period Begins

The period of extended responsibility will begin after disturbed areas have been reseeded.

R645-357.200 Vegetation Parameters

Vegetation parameters will equal or exceed the approved success standard during the last 2 years of the responsibility period. The success standards are outlined in Section 356 of this application.

R645-357.300 Husbandry Practices

The use of husbandry practices are not being requested.

R645-358 Protection of Fish, Wildlife, and Related Environmental Values

Andalex Resources, Inc. will minimize disturbances and adverse impacts on wildlife and their related environments as outlined in Section 333 of the approved M&RP and Section 342 of this submittal. See Chapter 7, Section 731.100 of the approved M&RP for methods to protect water sources in the area.

R645-358.100 Existence of Endangered or Threatened Species

A listing of threatened or endangered plant species known to occur in Carbon County is included in Appendix M.

R645-358.200 Bald and Golden Eagles

Andalex Resources, Inc. understands that there is no permission implied by these regulations for taking of bald or golden eagles, their nest, or eggs. If found, nests will be reported to the Division.

R645-358.300 Taking of Endangered or Threatened Species

Andalex Resources, Inc. understands that there is no permission implied by these regulations for taking of endangered or threatened species, their nests, or eggs. Annual Raptor surveys will be conducted to monitor any nest activity to prevent any takings.

R645-358.400 Replacement of Wetland or Riparian Vegetation

No wetland or riparian vegetation will be disturbed during mining.

R645-358.500 Manmade Wildlife Protection Measure

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CHAPTER 4

Land Use and Air Quality

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R645-301-400. LAND USE AND AIR QUALITY

R645-301-410. LAND USE

At present the Mining and Reclamation Plan for the Centennial Project includes 2,274.77 acres under permit (see Plate 5-2). This permit is now being amended to include the Kenilworth Federal Lease UTU-81893 (1760.0 acres), bringing the total permit area to 4,034.77 acres (see Plate 5-2). Lease UTU-81893 was acquired in 2006. Mining activity within the Kenilworth lease area will be an extension of the underground workings of the existing Aberdeen Mine. Therefore there will be no new surface facilities associated with mining in the new lease areas (other than additional Gob Gas Vent holes, if needed, which will be permitted on a site-specific basis in the future). It should be noted that UTU-81893 was previous included in the Willow Creek Mine Permit No. ACT/007/038 which has been previously approved by DOGM. After the Willow Creek Mine was closed the Kenilworth lease was terminated. The area was subsequently re-leased by BLM in 2006 through the normal LBA process after an application by Andalex Resources.

Since the Kenilworth Lease is simply an extension of underground mine workings under roughly 2,000 to 3,000 feet of cover there will be absolutely no effect on Land use or air quality. Because there will be no additional surface disturbance on the lease area, a First Order Survey is not deemed necessary.

R645-301-411. ENVIRONMENTAL DESCRIPTION

Due to the rugged topography and sparse rainfall, the land area is presently used only for grazing, wildlife habitat, and outdoor recreation. Historically, the land has also been used for coal mining.

R645-301-411.100. PREMINING LAND USE INFORMATION

The initial development of the Book Cliffs Coal Field was started in the early 1890's. By the early 1900's practically the entire field had been prospected. Mines in the lease area were not active until the 1920's because the cliffs were less accessible and the coal beds were thinner.

The Knight-Ideal mines, relinquished by Andalex Resources are located adjacent to the Hoffman Creek lease area. Initial prospecting took place at this location in 1906 and extensive
mining began in 1948 and ceased in 1958. During this period, 1,680,000 tons of coal were produced from the Gilson seam. The Knight-Ideal Mine is contiguous to our

relinquished Sunedco leases (U-05067) in Hoffman Creek. By mining this lease, Andalex recovered all minable coal between Centennial and Knight-Ideal.

Three mines on or adjacent to the lease area in Deadman Canyon were the Zion, Olsen, and Sutton (Blue Flame) mines. The Zion was located on the Zion's fee lease and the Olsen and Sutton were on SL-027304. The first two produced from the Gilson seam and the last produced from the Aberdeen or Castlegate "A" seam. Production figures are not reliable but it is estimated that between 216,000 tons and 720,000 tons may have been produced from the Sutton mines. The Olsen mines produced about 18,000 tons and the Zion mine around 240,000 tons, between 1924 and 1944.

There was also a prospect entry driven in the Lower Sunnyside Seam (the Hileman) on lease U-010581 from which production was insignificant, approximately 1,400 tons. Mining ceased in the area in 1964.

R645-301-411.110. USES OF THE LAND AT THE TIME OF FILING APPLICATION

The Deadman Canyon area as well as the Straight and Hoffman Canyons would fall into two land use categories: 1) Fish and Wildlife habitat and recreation lands, and 2) Range Lands. County zoning regulations (1974) indicate all lands involved in the lease application area are within zone M and G1 which is for mining and grazing. Current land use consists of grazing and deer hunting. For recreational purposes the land is suitable for deer hunting. Other recreational uses for the permit area could include hiking, cross-country skiing, four wheeling, camping, and snowmobiling in winters with adequate snow cover. The lack of water prevents the establishment of a chukker/partridge population. Usually there are no elk in the area although an animal or two may occasionally wander onto the area.

There are no oil and gas wells or water wells other than those water wells drilled by Andalex for use in mining activities, on the lease area. Also, there are no oil and gas wells or water wells in adjacent areas.

The area is eight air miles from Price, but the unavailability of water precludes any development for residential or summer homes.

See Figure 4-1 for a Regional Land Use Map.

R645-301-411.120. LAND USE DESCRIPTION IN CONJUNCTION WITH OTHER ENVIRONMENTAL RESOURCES INFORMATION

Livestock grazing has been the most intense use of the lease area. However, due to the expansive cliff formations and the roughness of the canyon walls, grazing has been principally limited to the canyon bottoms and extreme tops to the north of the lease boundary.

Mule deer are found within the lease area as well as the usual small mammals, predators, and passerine and raptorial birds.

Outdoor recreation in the lease area is limited and usually related to enjoyment of the open space and associated scenic facilities and hunting for wild animals. The number of people using the area is small due to the rough terrain, poor roads, and lack of water.

The AEP Lease Area has the same land-use as that of the original permit area.

R645-301-411.130. EXISTING LAND USES AND LAND USE CLASSIFICATION

No existing land use under local law.

R645-301-411.140. CULTURAL AND HISTORIC RESOURCES INFORMATION

Most of the maps previously submitted as part of the Mining and Reclamation Plan are applicable. Where necessary, original maps have been revised to indicate the newly acquired lease areas and these revisions are included with this submittal as figures or as plates in Volume II. An archaeological clearance for the Left Hand Fork fan installation can be found in Appendix C along with all other previously conducted archaeological surveys. An archaeological survey, prepared by professional Archaeologist J Terry Walker of the Department of Anthropology at Brigham Young University, for the Kenilworth Lease can be found in the confidential binder, Appendix C.

R645-301-411.141. CULTURAL AND HISTORIC RESOURCES MAPS

All maps included in Appendix C were prepared by J Terry Walker, a professional Archaeologist of the Department of Anthropology and Archaeology at Brigham Young University in 1976, and deemed accurate.

R645-301-411.141.1 PUBLIC PARKS AND LOCATIONS OF ANY CULTURAL OR HISTORICAL RESOURCES

N/A

R645-301-411.141.2 CEMETERIES

There are no cemeteries or burial grounds in or within 100 feet of the permit area.

R645-301-411.141.3 NATIONAL SYSTEM OF TRAILS OR THE WILD AND SCENIC RIVERS SYSTEM

N/A

R645-301-411.142. COORDINATION WITH THE STATE HISTORIC PRESERVATION OFFICER (SHPO)

Appendix C.

R645-301-411.142.1 PREVENTION OF ADVERSE IMPACTS

Appendix C.

R645-301-411.142.2 VALID EXISTING RIGHTS OR JOINTS AGENCY APPROVAL

Appendix C.

R645-301-411.143. IMPORTANT HISTORIC AND ARCHAEOLOGICAL RESOURCES THAT MAY BE ELIGIBLE FOR LISTING ON THE NATIONAL REGISTER OF HISTORIC PLACES

Appendix C.

R645-301-411.143.1 COLLECTION OF ADDITIONAL INFORMATION

Appendix C.

R645-301-411.143.2 CONDUCTING FIELD INVESTIGATIONS

Appendix C.

R645-301-411.143.3 OTHER APPROPRIATE ANALYSES

Appendix C.

R645-301-411.144. APPROPRIATE MITIGATION AND TREATMENT MEASURES

Appendix C. Annual Subsidence Surveys will include Kenilworth area.

R645-301-411.145. EXCEPTIONS

Appendix C.

R645-301-411.200. PREVIOUS MINING ACTIVITY

Previous activity consisted of small "dog hole" punch mines used for domestic coal in the 1930's, 1940's and 1950's.

R645-301-411.210. TYPE OF MINING METHOD USED

Previous mining was using conventional sections.

R645-301-411.220. COAL SEAMS OR OTHER MINERAL STRATA MINED

The coal seams previously mined were Lower Sunnyside, Gilson and Aberdeen.

R645-301-411.230. EXTENT OF COAL OR OTHER MINERALS REMOVED

The extent of removed coal was not significant, roughly 2,000,000 tons over 30 years.

R645-301-411.240. APPROXIMATE DATES OF PAST MINING

Approximately 1930-1960.

R645-301-411.250. USES OF LAND PRECEDING MINING

See R645-301-411.140.

R645-301-412. RECLAMATION PLAN

See R645-301-240.

R645-301-412.100. POSTMINING LAND USE PLAN

The post-mining land use will consist of livestock grazing with wildlife habitat and some recreation.

R645-301-412.110. ACHIEVEMENT OF PROPOSED POSTMINING LAND USE

See R645-301-412.100.

R645-301-412.120. RANGE OR GRAZING LAND USE

See R645-301-412.100.

R645-301-412.130. ALTERNATE POSTMINING LAND USE

N/A

R645-301-412.140. CONSISTENCY WITH SURFACE OWNER PLANS AND APPLICABLE UTAH AND LOCAL LAND USE PLANS

Socioeconomic Impacts

The proposed project is located in an area where coal mining is the major industry, therefore, the community is geared for coal operations. The labor supply is excellent, well-trained, and available. Most people in this area have a very favorable attitude towards the increased coal activity. They look forward to growth in the area which will increase population, home construction, and provide other facilities for community use.

The need for development of additional housing, school space, and changes in present community services would be among the greatest impacts, due to the increase in population. Positive effects of the project will be to increase the number of jobs, payroll, and taxes thus helping to build the community.

Land Use Changes

The nature of an underground mine of this type and size requires minimal surface disturbance. There will be no additional surface disturbance whatsoever with the addition of any new leases, except for possible GVH holes if required. There will be no change in land-use status from pre-mining to post-mining use. The limited resources both physical and scenic will dictate no future change in land status. Considering the extent and nature of similar lands in the Book Cliffs, no uses other than those previously discussed can be forecast.

Deadman Canyon has been unsightly since the earliest mining began in the 1920's, the new mine surface facility and portal site will be in the same area as the old

mine tipples and waste dumps. These waste dumps are numerous and located throughout the canyon bottom and consist of coal fines which were unmarketable during the earlier mining history. This coal waste has been recovered, reprocessed, and cleaned up during the new operation. This new operation will actually be a significant reclamation phase to the canyon area.

During and after completion of mining operations, the land will continue to be used for grazing and hunting. No future change is dictated in the land status. Please refer to Appendix R for surface owner comments. Existing surface owners did not feel any change in postmining land use was dictated. Surface disturbances will be very minimal and all disturbed land will be restored in a timely manner, according to the Reclamation Plan to conditions that are capable of supporting the uses they were capable of supporting before mining.

No grazing land has been impacted by Andalex's minesite or permit area as none exists within the disturbed area. As far as wildlife habitat is concerned, two things should be pointed out. First, Andalex has successfully provided new vegetation and food sources through revegetation within the deer winter range in acreages greatly exceeding the disturbed or "impacted" area. These areas include large acreages along the haul road and powerline corridor. Second, and perhaps more importantly, on Andalex's minesite, wildlife abounds. There are large numbers of small mammals of many varieties including, but not limited to, squirrels, chipmunks, mice and rabbits. There are large numbers of all types of birds, including large and small raptors hunting in the area. The DWR has indicated that our powerline has provided important hunting opportunities for large raptors. Deer are commonly observed within our disturbed area feeding on revegetated slopes. Revegetation within our disturbed area is mitigation in itself to the impacted area.

R645-301-412.200. LAND OWNER OR SURFACE MANAGER COMMENTS

Appendix R.

R645-301-413.300. SUITABILITY AND COMPATIBILITY

Appendix R.

R645-301-413. PERFORMANCE STANDARDS

R645-301-413.100. POSTMINING LAND USE

See R645-301-412.100.

R645-301-413.110. CAPABILITY OF SUPPORTING POSTMINING LAND USE

See R645-301-412.100.

R645-301-413.120. HIGHER OR BETTER USES

See R645-301-412.100.

R645-301-413.200. DETERMINING PREMINING USES OF LAND

See R645-301-412.100.

R645-301-413.210. PREMINING USES OF LAND NOT PREVIOUSLY MINED

See R645-301-412.100.

R645-301-413.220. POSTMINING LAND USE FOR LAND THAT HAS BEEN PREVIOUSLY MINED AND NOT RECLAIMED

See R645-301-412.100.

R645-301-413.300. CRITERIA FOR ALTERNATIVE POSTMINING LAND USES

N/A

R645-301-413.310. LIKELIHOOD FOR ACHIEVEMENT LAND USE

Post-mining land use as proposed shall be achieved.

R645-301-413.320. HAZARDS TO PUBLIC HEALTH OR SAFETY, OR THREAT OF WATER DIMINUTION OR POLLUTION

This section deleted as instructed in the Technical Analysis.

R645-301-413.330. PROHIBITED LAND USES

N/A

R645-301-413.331. IMPRACTICAL OR UNREASONABLE

N/A

R645-301-413.332. INCONSISTENT WITH APPLICABLE LAND USE POLICIES

N/A

R645-301-413.333. UNREASONABLE DELAY IN IMPLEMENTATION

N/A

R645-301-413.334. VIOLATION OF FEDERAL, UTAH OR LOCAL LAW

N/A

R645-301-414. PERMIT REVISIONS REQUESTING APPROVAL OF ALTERNATE POSTMINING LAND USE

N/A

R645-301-414.100. FILING DEADLINES

N/A

R645-301-414.200. SIGNIFICANT ALTERATION FROM MINING OPERATIONS IN THE ORIGINAL PERMIT

N/A

R645-301-414.300. OTHER REQUIREMENTS

N/A

R645-301-420. AIR QUALITY

As the Kenilworth Lease is simply an extension of underground mine workings under roughly 2,600 to 3,000 feet of cover there will be absolutely no effect on air quality.

Air Pollution Control Plan and Compliance with Air Quality Laws

Existing Environment

The permit area is located in a Class II air quality area.

Air Quality Impact Analysis

Please see the following section, section 3 re Emission Estimates.

Emission Estimates

Emission estimates are included as Appendix F in the form of an emission inventory. This inventory has been reviewed and approved by the Utah Bureau of Air Quality and the E.P.A. It has been re-approved to increase our production restriction on the basis the haul road has been paved by Carbon County. Air quality permit in appendix F.

Proposed Controls

Since this is an underground operation, no air quality problems are anticipated. The only changes in air quality will be attributable to minor road dust and exhaust mine dust. Methods of control are spray systems, chemical treatment, enclosures, pavement, and other fugitive dust control practices outlined in 30 CFR 817.95.

There will be no additional fugitive emissions or air pollution associated with the newly acquired Kenilworth Lease.

PSD Permit and Compliance with Air Quality Laws

The Environmental Protection Agency has determined that this project does not need a PSD air quality permit. This is based on our fugitive and non fugitive dust emissions inventory which assumes facilities necessary for 1.5 mm tons per year production. Further, the mine is not subject to the PSD regulations because of the new definition of a major source. (Refer to letter dated March 21, 1980 in Appendix J). All applicable air quality laws will be complied with and fugitive dust control practices, as required under 30 CFR 817.95, will be followed.

Andalex has been issued a new approval order for the mines and the Wildcat Loadout for 1.5 million tons per year. These were inspected and met compliance during the summers of 1989-1992.

R645-301-421. CLEAN AIR ACT AND OTHER APPLICABLE LAWS

See R645-301-420.

R645-301-422. UTAH BUREAU OF AIR QUALITY

See R645-301-420.

R645-301-423. SURFACE COAL MINING AND RECLAMATION ACTIVITIES EXCEEDING 1,000,000 TONS PER YEAR

See R645-301-420.

R645-301-423.100. COMPLIANCE WITH FEDERAL AND UTAH AIR QUALITY STANDARDS

See R645-301-420.

R645-301-424 FUGITIVE DUST CONTROL PLAN

See also Appendix J

R645-301-425 ADDITIONAL DIVISION REQUIREMENTS

NA

ANDALEX RESOURCES, INC.
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CHAPTER 5

Engineering

C/007/019

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R645-301-500. ENGINEERING

The Kenilworth Tract will not require any changes to engineering practices currently employed at the Aberdeen Mine. The change simply involves an extension of underground mine workings and does not involve the surface in any way. See 522-301 and 525-301 for additional comments on subsidence.

510. INTRODUCTION

At present the Mining and Reclamation Plan for the Centennial Project includes 2,274.77 acres under permit (see Plate 5-2). This permit is now being amended to include the Kenilworth Federal Lease UTU-81893 (1760.0 acres), bringing the total permit area to 4,034.77 acres (see Plate 5-2). Lease UTU-81893 was acquired in 2006. Mining activity within the Kenilworth lease area will be an extension of the underground workings of the existing Aberdeen Mine. Therefore there will be no new surface facilities associated with mining in the new lease areas (other than additional Gob Gas Vent holes, if needed, which will be permitted on a site-specific basis in the future). It should be noted that UTU-81893 was previous included in the Willow Creek Mine Permit No. ACT/007/038 which has been previously approved by DOGM. After the Willow Creek Mine was closed the Kenilworth lease was terminated. The area was subsequently re-leased by BLM in 2006 through the normal LBA process after an application by Andalex Resources.

Since the Kenilworth Lease is simply an extension of underground mine workings under roughly 2,000 to 3,000 feet of cover there will be absolutely no effect on Engineering except for additional subsidence points. (Plate 5-11)

Most of the maps previously submitted as part of the Mining and Reclamation Plan are applicable. Where necessary, original maps have been revised to indicate the newly acquired lease area and these revisions are included with this submittal.

It should be noted that no man made surface features are located in or around the Kenilworth Lease UTU 81893 shown on Plate 5-11 and others.

All categories within this section have been addressed in the MRP and plates.

a) Surface and subsurface ownership of lands contiguous to the permit area are shown on Plates 5-1 and 5-2.

b) The leases for which we have the legal right of entry are shown on Plate 5-2.

c) Andalex has submitted a permit modification to include the new Kenilworth Lease recently acquired.

d) There are no buildings within 1,000 feet of the permit area except those used as part of the existing mining operation. They are shown on Plate 5-7.

e) There are no surface or subsurface man-made features within, passing through or passing over the permit area except the powerline, telephone cables, culverts, and etc., installed for the operation of this mine. See Plate 5-7 for their locations.

f) Reference areas are shown on Plate 7-1 as R-1, R-3 and R-4. They are each 200 feet square approximately.

g) Surface water users within this immediate hydrologic area are shown on Plate 7-3 (Refer to Appendix L, which shows additional water use on Emma Park in the form of stock watering). Water rights for this area are found in Appendix L and on Plate 7-3. The intake location for this water into the mine is located on Plate 5-7. Disturbed area runoff is collected in a culvert and taken directly into the mine. Andalex controls this water right. If a discharge were to occur from any sediment pond (this has yet to occur), it would discharge into the Deadman Canyon drainage (Plate 7-2) which is ephemeral.

h) County Road 299 starts at highway 6 in Price and terminates at Andalex Resources' mine site (Plate 1-1).

i) There are no public parks nor any cultural or historical sites eligible for listing in the National Register in or adjacent to the mine plan area.

j) There are no cemeteries or burial grounds in or within 100 feet of the permit area.

k) There is no land which is within the boundaries of any units of the National System of Trails or the Wild and Scenic Rivers System including study rivers.

Cross Sections, Maps, and Plans

Most of the cross sections, maps, and plans of the approved plan remain applicable. Where necessary, original maps have been revised to indicate the addition of the newly acquired lease area and are included in this submittal.

All categories within this section have been addressed. Specifically,

a) Plates 5-3, 5-4, and 5-5 show all the test borings locations and elevations. Specific information relating to these drill holes and the strata encountered can be found in Appendix E (coal quality, description of other strata). Into regarding roof & floor analyses is in Appendix E.

b) Monitoring stations for water quality are shown on Figure 7-8. Fish and wildlife monitoring stations were not set up for this application. However, refer to Plates

3-4A, 3-4B, 3-4C, and 3-4D, which depicts wildlife distribution. Air quality monitoring was not required for this application. Plate 7-8 shows proposed monitoring stations. Andalex has adhered to the locations shown on Plate 7-8 which is included in Andalex's operating plan.

c) Refer to Appendix E for specific drill hole lithologies as well as data on quality and chemical characteristics.

d) Crop lines and strikes and dips can be found on the coal thickness isopachs in Volume II, Plates 5-3, 5-4 and 5-5 and 5-6.

e) All old workings in the three coal seams to be mined are shown on Plate 5-6. There are no old workings in the Centennial Seam.

f) All subsurface water on the permit area exists in perched aquifers. The Aberdeen sandstone is the lowest water bearing unit within the permit area and is discussed in this chapter, Geology. The only water well drilled on the property which has been used with any frequency (well #1) has not depicted any seasonal variation. It is always a low producer.

g) There are no surface waters within the permit area. All drainages (natural) are shown on the topography on Plate 5-11. All constructed drainages are shown on Plate 5-7. There are no irrigation ditches. Appendix L, which is the Hydrologic Inventory, contains Figure 4 , and Plate 7-7 which clearly depicts the location of springs in the permit area and adjacent areas. Plate 7-7 depict the areal extent of the inventory.

h) N/A

i) Plate 5-7 shows the location of temporary storage for underground development waste and excess spoil which can be stored in an area which was previously used as a sediment pond. Plate 5-7 now also shows the location of a new area above the Apex Mine which can be used for temporary and permanent storage of coal mine development waste such as sediment pond material. All dams and impoundments are shown on Plates 5-7 and 7-2, and detailed on Plates 7-4, 7-5, and 7-6. There are no other water treatment or air pollution control facilities on the permit area.

j) There are no oil or gas wells within the permit area. Three water wells are shown on Plate 5-7. Well number 1 is 220 feet deep; number 2 is 100 feet deep, and number 3 is 120 feet deep. Also, there are no oil or gas wells located in the adjacent areas.

k) Plates 5-7 and 7-10, and 7-11 accurately depict the area currently affected by mining as well as the area to be affected. They show the slopes as they exist as well as upon final reclamation.

511. GENERAL REQUIREMENTS

See R645-301-510.

R645-301-511.100. PROPOSED COAL MINING AND RECLAMATION PERATIONS

The permit application includes a description of the proposed coal mining and reclamation operations with appropriate maps, plans, and cross sections.

R645-301-511.200. POTENTIAL IMPACTS TO THE ENVIRONMENT

See R645-301-510.

R645-301-511.300. RECLAMATION

See R645-301-240.

R645-301-512. CERTIFICATION

See Volume II and R645-301-510.

R645-301-512.100. CROSS SECTIONS AND MAPS

See R645-301-510.

R645-301-512.110. MINE WORKINGS TO THE EXTENT KNOWN

Introduction

Mine Property

The coal leases owned by Andalex Resources are located in the Deadman Canyon area of the Book Cliffs coal field. The property is located about 10 miles north-northeast of Price, Utah in Carbon County. Mining has progressed onto all of Andalex's federal leases except the Kenilworth Lease. As is shown on the enclosed Plate 5-7, development into all seams involves separate surface facilities which are located adjacent to each other in Deadman Canyon. The Centennial coal seam which is an isolated pocket of recoverable coal was accessed from the Pinnacle Mine via rock slopes, which is now closed and sealed. The three rock slopes constructed each of which was be approximately 500' in length. The three tunnels are for intake air, return air, and belt line. No waste rock was removed from the Pinnacle Mine either during or after construction. All waste rock will be disposed of underground.

Economic Geology

This project is located in a region where coal mining has historically been the only industry. The main coal-bearing rocks occur in the Blackhawk Formation of the Upper Cretaceous Mesa Verde Group. Several small operations have mined coal in the Deadman Canyon area over the past 70 years. These mines, however, merely scratched the surface of the estimated reserve. There are no other economically recoverable, replenishible or non-replenishible resources within this property.

Exploration

All exploration and drilling programs have been completed. The drilling and exploration activities were supplemented by mine samples and outcrop information, and the results used to estimate the coal reserves of the lease area. Numerous samples were taken from the outcrops of the Lower Sunnyside, Gilson, and Aberdeen seams, as well as from mine faces in the Hileman, Zion's, Star Point, and Blue Flame No. 1 mines. Samples have been taken from the Centennial Seam at 89-1-CP and underground. See appendix E.

A five hole drilling program was conducted by Centennial Coal Associates in 1971. A seven hole drilling program was conducted by Andalex in 1977. These programs were supplemented by two holes drilled west of the property by North American Coal Company in 1948 and one drilled by Pacific, Gas and Electric in 1980. All drill sites are shown on Plates 26, 27, and 28. Refer to Appendix E.

Reserves

By U.S. Geological Survey definition, approximately 30% of the entire reserve is classified as "measured". The remainder is classified as indicated, based on all available measurements.

Total coal reserves in the four seams have been estimated at 50.8 million tons. Recoverable coal has been estimated at 30.5 million tons. Andalex expects an initial recovery rate of about 35 percent and upon final pillar extraction, total recovery is expected to be more than 65 percent. Cover ranges from 0 feet to more than 3,000 feet on the northern end of the property.

Underground Operation and Facilities

Mine Layout(Refer to Plates 5-3, 5-4, 5-5, and 5-6).
Multiple Seam Considerations

There were four economic seams present on the property. The uppermost seam is the Lower Sunnyside which varies from four to six feet thick. The second highest seam is the Centennial Seam which varies from four to eight feet thick. The third seam is the Gilson Seam which also varies from 4' to 8' thick. The lowermost seam is the Aberdeen which varies from four to thirteen feet in thickness. The bottom two seams

are separated by a 200 foot interval which includes a massive sandstone. The Gilson and the Centennial Seams are separated by approximately 130' and the Centennial and Lower Sunnyside Seams are separated by 80' including a massive sandstone. It should be noted that the area in which the Centennial Seam is to mined does not contain any reserves in either the Lower Sunnyside nor the Gilson Seams. Only the Aberdeen Seam is present where the Centennial Seam is to be mined. The mine plans for each seam are shown on Plates 5-3, 5-4, 5-5, and 5-6.

Portals

Portals for the present mining operations in the Aberdeen, Gilson and Lower Sunnyside seams are located in Deadman Canyon as shown on Plate 5-7. The portal areas consist of a conveyor portal, two air intake portals, and an 88" fan portal.

Portals have been enlarged above the coal seam to facilitate men and equipment at the mine opening. Steel sets have been used to support mine roof in the portal areas. The Aberdeen portals have been constructed in a similar fashion, facilitating air intake, conveyor, and an exhaust fan.

The portals are generally 6' high and 20' wide in the Pinnacle and Aberdeen Mines and 4.5' high in the Apex Mine. The portal mine pads consist of approximately one acre. Located on these pads are the fans, conveyor portals, air intake portals, and mine water storage tanks. It should be noted that the mining of the Centennial Seam did not require new portals on the surface. The Centennial Seam is accessed via rock tunnels from the existing Pinnacle Mine.

The Apex, and Pinnacle mines are now closed and sealed.

Mains, Submains, and Slopes

A five entry system is being used (two intake portals) and using a continuous miner, the entries are being driven to the property line. Generally, entries on 80 foot centers with crosscuts every 80 feet are being driven on the strike and dip of the coal seam. Development mining for the longwall panels are on 5th entry and 3rd entry systems. Refer to Plate 5-6. There exists only one return air portal on the surface, however, two exist underground making the five entry system.

Shafts and Interconnecting of Slopes

Mining plans called for rock tunnels to be constructed from the existing Pinnacle Mine up to the Centennial Seam mining area. These rock slopes are each approximately 500' in length. The three tunnels consist of an intake air tunnel, a return air tunnel, and a belt tunnel. Coal is transported via the belt tunnel and transferred on to

the existing Pinnacle Mine conveyor belts. These tunnels were constructed in the Spring of 1990 and mining has commenced.

Longwall Panels

The mining sequence calls for the development of panels longwall using 2, 3 and 5 entry systems. These panels will be generally 650 to 800 feet in width and up to 800 feet in length.

Barrier Pillars

A barrier pillar will be left between the bleeders and the longwall panels. A barrier will also be left wherever old mine workings are skirted such as the Olsen Mine on the east side of Deadman Canyon in the Gilson Seam. Due to resent MSHA requirements a barrier pillar will be left between longwall panels at depths deeper than 1,500 feet.

Bleeder System

A bleeder system will be maintained and pillars left to provide for ventilation, eventually extending around all mined out areas.

Ventilation

The ventilation plan calls for a fan of sufficient capacity to provide air to each working section to control methane and dust; there has been small amounts only found to date in any of the old works or new faces. The longwall faces will be ventilated with a live brattice system consisting of a line curtains. The conveyor systems will be isolated from intake and return except in 2 entry gate systems when the belt will double as the intake. All ventilation requirements of the Coal Mine Health and Safety Act will be met. This ventilation plan will be strictly adhered to, in order to insure safety of all personnel. Please note that the Centennial Seam mining area is ventilated by the existing Pinnacle Mine fan system. The new left fork fan installation will provide additional required ventilation for the Aberdeen Mine longwall faces.

Roof Control

All Andalex Mines operate under an approved M.S.H.A. roof support plan which calls for bolting on five foot centers with a minimum 42" bolt length in our development entries. Roof control in the longwall faces will be accomplished using hydraulic shields. The roof in all four seams is a massive sandstone (60'+) and offers excellent support in itself. The old mine workings which were rehabilitated for the Pinnacle Mine main entries had stood unsupported for 40 years. This roof control plan will be strictly adhered to, in order to insure the safety of all personnel.

Explosives and Blasting

All blasting performed underground will conform to both state and federal regulations governing explosives and blasting in underground coal mines. The rock tunnels to the Centennial Seam were constructed by professional hard rock mining company.

All surface blasting activities necessary for present operations have been completed in compliance with sections 817.61 through 817.68 of Chapter VIII of Title 30 of the Code of Federal Regulations.

Blasting consisted of portal highwall construction for purposes of stability. A powder magazine has been set up on one of the surface pads, located in a remote area. It is built to conform to all regulations, such as segregation, regarding such a structure (see Plate 5-7). All blasting operations shall be conducted by experienced, trained, and competent persons who understand the hazards involved and who possess a valid certificate as required by Title 30 of the Code of Federal Regulations.

General Safety Measures

A great emphasis is put on assuring a safe mine operation and the mine and surface facilities will be operated within prudent standards to insure the health and safety of all employees. The facilities will be carefully inspected by company-trained safety engineers and state and federal mine inspectors.

The operation will abide by Utah State Coal Mine Regulations and the 1969 Federal Coal Mine Health and Safety Act. In addition, these regulations will be supplemented by a company safety policy. Various training programs will be utilized such as the following:

Methane Measurements
Roof and Rib Control
Oxygen Deficiency Testing
Ventilation
First Aid
Mine Rescue
Mine Electrical Certification
Self Rescue Training
Use of Personal Protective Equipment
Recognition of Electrical Hazards
General Accident Prevention
Mine Communications
Job Safety Training

Many of the training programs will run continuously, such as those involving roof control and ventilation. Other programs are held annually with many oriented toward new employees.

Mine Development (Refer to Plates 5-3, 5-4, 5-5, and 5-6).

Room and Pillar

Room and pillar design will be employed in fringe areas surrounding the longwall panels as conditions allow.

Pillar Extraction

Once development in fringe areas is completed, pillar extraction will commence as conditions permit. Final pillar extraction will result in a total recovery rate of approximately 65 percent.

Cycle and Sequence of Mining

As mining progresses, the following equipment was added to start up additional mining areas and increase production (currently four units have been employed):

4th Mining Unit - January, 1990
Longwall - August, 1994

As there was four coal seams of minable thickness on the leases, a systematic plan of mining will be followed to assure maximum recovery of the coal reserves. When mining is progressing concurrently in two seams, the room and pillar design and layout will be columnized to assure maximum roof support.

Underground Equipment

Production Units

In each mine, the longwall development entry systems, will be mined with a drum-type continuous miner similar to the Joy 12 CM. Presently, Joy 12 CM-11's and 14 CM's are being used in the operation. Coal is transported by shuttle car (Joy) to a loading point consisting of a Long Airdox Feeder Breaker or similar machine, which will discharge onto a 42" panel conveyor or a 42" main conveyor. Roofbolting is and will be accomplished by a Lee Norse Roof Bolter or a similar type machine. The longwall panels will employ a Joy, 4-LS or similar shearer. Coal will be discharged into a pan face conveyor which will carry the coal to a crusher 1 stage loader for transportation by belt conveyor to the surface. Roof support will be by hydraulic shields. Additional production units will be added as previously outlined.

Belt Conveyors

The feeder breaker or stage loader will discharge the coal onto either a 48" panel conveyor or a 42" main conveyor. The conveyor will transport the coal to the outside,

where it will be discharged to a live stockpile, (see Plate 5-7). Currently, Long Airdox conveyor belt drives are being used. For the longwall installations, the same, or similar drives will be employed.

Water System

Water for mining use, such as for providing face fire protection and dust suppression, will be obtained from Water Well No. 1, shown on Plate 5-7. Water is also collected from the disturbed area via a system of culverts to underground workings connected to the Pinnacle Mine. This water will be pumped to the Mine Water Storage Tank and from there into the mine using a high pressure pump. Several sumps have been cut in the mine for the purpose of reclaiming water as most available water will be needed. Enough water is currently generated from the formation and coal seam that Andalex currently discharges approximately 50% of the time through approved UPDES point 002.

Power System and Communication Facilities

A 7200 volt, 3 phase, 60 hertz power distribution system has been taken underground from a 2500 KW substation located on the surface plant area. The primary feed into the substation is 46,000 volts from the Utah Power and Light Company transmission system located approximately 6 miles south, adjacent to the airport. This 46 KV line taps Utah Power and Light's Helper - Columbia 46 KV line, at structure #89. The powerline was designed according to Utah Power and Light's specifications. After approval by Utah Power and Light, it was installed by a private local contractor at the expense of Andalex Resources. Within the minesite area, the power is reduced to 7200 volts for the primary underground usage. This is fracture reduced up to 2300 to 6000, 480 and 240 volts for equipment operation. Surface power is on a 480 volt system. Electrical Specifications for the Deadman Canyon Mine Substation are included as Appendix I.

A 25-pair telephone communications cable is buried along the existing Deadman Canyon road, with its origin at Carbon County Airport approximately 7.5 miles from the minesite. Currently, 13 pairs are in use with additional capacity to add as the mine facilities expand. This cable was designed, supplied and installed by Mountain Bell Telephone at the expense of Andalex Resources. Mountain Bell is responsible for maintenance

The mine permit area has no utilities or services through it other than those which are accurately depicted on Plate 5-7. All utilities have been constructed under the close scrutiny of the Utah DWR and the U.S. Fish and Wildlife Service.

Other Equipment

Other equipment being utilized includes mantrips, rock dusters, tractors, rubber tired scoops, power cables, communication equipment, and miscellaneous section

tools. The mine is also equipped with emergency tools and necessary supplies in the unlikely event that a fire or explosion should occur, in accordance with M.S.H.A. regulations.

Surface Equipment

Surface equipment includes a Cat 980-B front-end loader. Also, there is a grader for road maintenance. Other equipment such as diesel scoops and tractors will be utilized on the surface from time to time for material haulage. There are two bulk rock dust silos on the surface.

Employment

Andalex Resources is an Equal Employment Opportunity Employer. The type of hourly employees to be hired are highly skilled personnel, including miner operators, shuttle car operators, roof bolters, mechanics, and electricians. All hourly employees will be properly trained and certified where necessary in accordance with M.S.H.A. regulations. Currently, Andalex Resources' employs 75 hourly wage earners. Employment at the mine will not change significantly with the installation of the longwall. The Pinnacle Andalex's Mines, are located in Carbon County near the town of Price. Since this area is supported to a large degree by coal mining and other related industries, it is anticipated that a labor force will always be readily available.

Management and other salaried employees will consist of the Manager of Mines, the General Superintendent, the Mine Superintendents, the Mine Foremen, Safety Personnel, Secretarial and Clerical, Geologists, and Engineers (see Table IV-1).

Schedule of Development and Mining

There are four economic seams present on the property; mining plans are based on simultaneously developing longwall panels in 3 of the 4 seams. The incremental increases listed below represent the first eight years of production (from 1982):

Year	Production Rate Tons/Year
1st year (1982)	700,000
2nd year (1983)	350,000
3rd year (1984)	300,000
4th year (1985)	650,000
5th year (1986)	700,000
6th year (1987)	400,000
7th year (1988)	700,000
8th year (1989)	1,100,000

Mining progression for the life of the mine is shown on Plates 26, 27, 28, and 29, and will increase from 1,100,000 tpy current to 1.5 mm tpy by 1995 and will stay at this rate until mining is completed making a mine life of approximately 15-20 years.

Year	Estimated Production	Recoverable Tons Remaining
1993	1,200,000	21.2 million
1994	1,200,000	20.0
1995	1,500,000	18.5
1996	1,500,000	17.0
1997	2,000,000	15.5
Duration	2,000,000	10 years

To date, Andalex has mined approximately 20% of its Lower Sunnyside Reserve, 80% of its Gilson Reserve, 5% of its Aberdeen Reserve and 20% of its Centennial Reserve (The Centennial Reserve consisted originally of approximately 2.5 million recoverable tons). All seams within the current leases have been mined out. The addition of the Kenilworth lease will provide some coal for future recovery.

Support Structures and Buildings

Support structures and buildings are shown on Plate 5-7.

Parking Areas

Parking areas have been covered with gravel and magnesium chloride and will be maintained. These are shown on Plate 5-7. The main office parking area is paved.

Storage Areas

There are several storage areas at the site. These include the Material Storage Area No. 1, Raw Coal Pile Area, Material Storage Area No. 2, and the Topsoil Storage Area. All areas are shown on Plate 5-7.

Water Supply

Water for use in the mine is described. Water for culinary use is hauled in approved water haulers from Price City. There is a sump cut in the mine from which water can be reclaimed as all available water will be needed. Since all mining is down dip from the portals, little water will exit from the mine. Information concerning the wells and water analysis is presented as Appendix L.

Landscaping

All disturbed areas have been graded to the most moderate slope possible to assure stability. Vegetative cover has been promptly re-established to stabilize erosion. Revegetation was accomplished by Andalex under the recommendations of the U.S. Department of Agriculture, Soil Conservation Service and the Division of Oil, Gas, and Mining.

Signs, Markers, Fences, and Gates

Signs of a uniform design, showing the company name, business address, and telephone number as well as the identification number of the current regulatory program permit authorizing the underground mining activities, have been placed at all access points to the permit area. These signs have been placed to be easily seen, are made of a durable material, and conform to local laws and regulations. The topsoil storage area is clearly marked.

As this is an underground mine, there will be no blasting conducted on the surface with the exception of highwall construction. When blasting for highwall construction does occur, conspicuous signs and flagging will be posted as required by 30 CFR Parts 817.11 (f) and 817.65 (e).

As the Left Hand Fork is classified as a intermittent drainage, stream buffer zone markers will be placed within 100 feet of the drainage disallowing access except for the disturbed site.

As there are no perennial streams or a stream with a biological community on the permit area, buffer zone markers will not be necessary. The perimeters of all areas affected by surface operations and facilities are clearly marked. These signs and markers shall be maintained during all activities and retained and maintained until after the release of all bonds for the permit area.

R645-301-512.120. SURFACE FACILITIES AND OPERATIONS

See Volume II.

Support structures and buildings are shown on Plate 5-7, and LF-1.

Parking Areas

Parking areas have been covered with gravel and magnesium chloride and will be maintained. These are shown on Plate 5-7. The main office parking area is paved.

Storage Areas

There are several storage areas at the site. These include the Material Storage Area No. 1, Raw Coal Pile Area, Material Storage Area No. 2, and the Topsoil Storage Area. All areas are shown on Plate 5-7.

R645-301-512.130. SURFACE CONFIGURATIONS

See Volume II, Plates 5-7.

R645-301-512.140 HYDROLOGY

See Sections R645-301-711, R645-301-722, R645-301-700 through R645-301-731.740

Drainage Control - Diversions, etc.

The drainage control plan is presented in this Chapter.

Sediment Control

The sedimentation plan is presented in this Chapter.

R645-301-512.150. GEOLOGIC CROSS SECTIONS AND MAPS

See R645-301-622

R645-301-512.200 PLANS AND ENGINEERING DESIGNS

R645-301-512.210. EXCESS SPOIL

N/A

R645-301-512.220. DURABLE ROCK FILLS

N/A

R645-301-512.230. COAL MINE WASTE

There has been no development waste or excess spoil to date excepting sedimentation pond material. In the event sediment pond material were to catch fire, it would be compacted. MSHA and the Division have approved the disposal of sediment pond material (coal mine wash) underground. Therefore, inspections are not required.

Coal Processing Waste

N/A - Text removed as directed in Technical Analysis Requirements.

Coal Refuse

Please refer to Plate 5-7 for location of disposal areas.

R645-301-512.240. IMPOUNDMENTS

See R645-301-733.

R645-301-512.250. PRIMARY ROADS

All Primary Road Design and construction has been certified by a Professional Engineer.

R645-301-512.260. VARIANCE FROM APPROXIMATE ORIGINAL CONTOUR

No variance has been granted at this time.

R645-301-513. COMPLIANCE WITH MSHA REGULATIONS AND MSHA APPROVALS

Ventilation

The ventilation plan calls for a fan of sufficient capacity to provide air to each working section to control methane and dust; there has been small amounts only found to date in any of the old works or new faces. The longwall faces will be ventilated with a live brattice system consisting of a line curtains. The conveyor systems will be isolated from intake and return except in 2-entrygate systems when the belt will double as the intake. All ventilation requirements of the Coal Mine Health and Safety Act will be met. This ventilation plan will be strictly adhered to, in order to insure safety of all personnel. Please note that the Centennial Seam mining area is ventilated by the existing Pinnacle Mine fan system.

General Safety Measures

A great emphasis is put on assuring a safe mine operation and the mine and surface facilities will be operated within prudent standards to insure the health and safety of all employees. The facilities will be carefully inspected by company-trained safety engineers and state and federal mine inspectors.

The operation will abide by Utah State Coal Mine Regulations and the 1969 Federal Coal Mine Health and Safety Act. In addition, these regulations will be supplemented by a company safety policy. Various training programs will be utilized such as the following:

Methane Measurements
Roof and Rib Control
Oxygen Deficiency Testing
Ventilation

First Aid
Mine Rescue
Mine Electrical Certification
Self Rescue Training
Use of Personal Protective Equipment
Recognition of Electrical Hazards
General Accident Prevention
Mine Communications
Job Safety Training

Many of the training programs will run continuously, such as those involving roof control and ventilation. Other programs are held annually with many oriented toward new employees.

All Andalex Mines operate under an approved M.S.H.A. roof support plan which calls for bolting on five foot centers with a minimum 42" bolt length in our development entries. Roof control in the longwall faces will be accomplished using hydraulic shields. The roof in all four seams is a massive sandstone (60'+) and offers excellent support in itself. The old mine workings which were rehabilitated for the Pinnacle Mine main entries had stood unsupported for 40 years. This roof control plan will be strictly adhered to, in order to insure the safety of all personnel.

R645-301-513.100. COAL PROCESSING WASTE DAMS AND EMBANKMENTS

N/A

R645-301-513.200. IMPOUNDMENTS AND SEDIMENTATION PONDS MEETING MSHA CRITERIA

N/A

R645-301-513.300. WASTE DISPOSED IN UNDERGROUND MINE WORKINGS

Return of Coal Processing Waste to Abandoned Underground Workings

As raw coal is hauled from the permit area, there will be no processing waste and no return of processing waste to underground workings. If in the future it is decided that a processing facility is to be incorporated, waste or reject material would be taken to an approved refuse disposal site. Please note that underground development waste rock generated by the Centennial Seam rock tunnels was disposed of underground in the existing Pinnacle Mine workings.

R645-301-513.400. REFUSE PILES

There has been no development waste or excess spoil to date excepting sedimentation pond material.

Coal Processing Waste

The only coal processing waste to date is rock material manually separated from Andalex Resources' lump coal product at Wildcat. This is currently placed in an approved area at Wildcat Loadout. This MRP contains an Appendix Q. Appendix Q references the plan for reclamation of the waste rock pile at the Wildcat Loadout and should not be confused with the Centennial Reclamation Plan. Disposal of sediment pond material (temporary and permanent) is shown on Plate 5-7. Sediment pond waste has already been tested in one case to be nontoxic and non-acid forming and is being used currently in the Aberdeen Mine fill areas. Other material which is generated will be placed in temporary storage above the Apex Mine as shown on Plate 5-7 and will be disposed of permanently as back fill in high walls upon final reclamation. This material will be tested prior to final reclamation if used for final reclamation purposes. Based on previous experience, Andalex estimates that up to 3,000 yards of material at most will be generated. This material is included in the earthwork estimates. Please note that the rock tunnels constructed to the Centennial coal seam generated significant amounts of waste rock. One hundred percent of this waste rock was disposed of underground in the existing Pinnacle Mine. None of the waste rock appeared at the surface.

Coal Refuse

Please refer to Plate 5-7 for location of disposal areas.

R645-301-513.500. MINE OPENINGS

Portals

Portals for the present mining operations in the Aberdeen, Gilson and Lower Sunnyside seams are located in Deadman Canyon as shown on Plate 5-7. The portal areas consist of a conveyor portal, two air intake portals, and an 88" fan portal.

Portals have been enlarged above the coal seam to facilitate men and equipment at the mine opening. Steel sets have been used to support mine roof in the portal areas. The Aberdeen portals have been constructed in a similar fashion, facilitating air intake, conveyor, and an exhaust fan.

The portals are generally 6' high and 20' wide in the Pinnacle and Aberdeen Mines and 4.5' high in the Apex Mine.

The portal mine pads consist of approximately one acre. Located on these pads are the fans, conveyor portals, air intake portals, and mine water storage tanks. It should be noted that the mining of the Centennial Seam did not require new portals on the surface. The Centennial Seam is accessed via rock tunnels from the existing Pinnacle Mine.

R645-301-513.600. DISCHARGES INTO AN UNDERGROUND MINE

Andalex has approved water rights for collection of disturbed area drainage for collection in the underground workings. This is used as needed.

R645-301-513.700. SURFACE COAL MINING CLOSER THAN 500 FEET TO AN ACTIVE UNDERGROUND MINE

N/A

R645-301-513.800. COAL MINE WASTE FIRES

N/A

R645-301-514. INSPECTIONS

N/A

R645-301-514.100. EXCESS SPOIL

N/A

R645-301-514.110. QUARTERLY INSPECTIONS AND CRITICAL CONSTRUCTION PERIODS

N/A

R645-301-514.111. FOUNDATION PREPARATION, TOPSOIL REMOVAL

N/A

R645-301-514.112. UNDERDRAINS AND PROTECTIVE FILTER SYSTEMS

N/A

R645-301-514.113. FINAL SURFACE DRAINAGE SYSTEMS

N/A

R645-301-514.114. FINAL GRADED AND REVEGETATED FILL

N/A

R645-301-514.120. CERTIFIED REPORTS

N/A

R645-301-514.130. CERTIFIED REPORTS ON DRAINAGE SYSTEM AND PROTECTIVE FILTERS

N/A

R645-301-514.131. PHASES OF CERTIFICATION

N/A

R645-301-514.132. UNDERDRAINS

N/A

R645-301-514.133. PHOTOGRAPHS

N/A

R645-301-514.140. INSPECTION REPORTS

N/A

R645-301-514.200. REFUSE PILES

N/A

R645-301-514.210. REGULAR INSPECTIONS

N/A

R645-301-514.220. CRITICAL CONSTRUCTION PERIODS

Construction of the left fork break-out and fan will occur during the Golden Eagle off-nesting period (January 15 through July 15).

R645-301-514.221. FOUNDATION PREPARATION AND TOPSOIL REMOVAL

N/A

R645-301-514.222. UNDERDRAINS

N/A

R645-301-514.223. FINAL SURFACE DRAINAGE SYSTEMS

N/A

R645-301-514.224. FINAL GRADING AND Revegetation

N/A

R645-301-514.230. CERTIFIED REPORT

N/A

R645-301-514.240. SEPARATE CERTIFICATION FOR EACH PHASE OF CONSTRUCTION

N/A

R645-301-514.250. ON-SITE COPY OF CERTIFICATION REPORTS

N/A

R645-301-514.300. IMPOUNDMENTS

See R645-301-733..

R645-301-514.310. CERTIFIED INSPECTION

This is performed annually by a registered P.E.

R645-301-514.311. COMPLETION OF CONSTRUCTION AND YEARLY INSPECTIONS

See R645-301-514.310.

R645-301-514.312. CERTIFIED REPORTS

Certified reports are kept on-site.

R645-301-514.313. ON-SITE COPY OF CERTIFICATION REPORTS

See R645-301-514.312.

R645-301-514.320. WEEKLY INSPECTIONS

N/A

R645-301-514.330. QUARTERLY INSPECTIONS

These are conducted quarterly by on-site personnel to evaluate erosion, stability, and other items.

R645-301-515. REPORTING AND EMERGENCY PROCEDURES

R645-301-515.100. SLIDES AND OTHER DAMAGE

Schedule of Construction, Mine Development, Mining and Reclamation

All surface facilities have been constructed for the Pinnacle, Apex and Aberdeen Mines. Earthwork for the Aberdeen Mine was completed in 1989. The surface facilities for the Aberdeen Mine were completed in early 1990. No additional surface facilities are required for any new leases. There will be no additional construction activities or surface disturbance whatsoever in Hoffman Creek or Alrad Canyon.

However, Andalex does intend to add a fan installation in the left-hand fork of Deadman Canyon at some point in time. This installation will be according to measures outlined by the Bureau of Land Management as part of Right-of-Way U-64158. (Copy of Right-of-Way is included in Appendix B.) Andalex will submit detailed plans for this installation at the appropriate time. The location of this breakout is shown on Plate 5-19 (R.O.W.).
Mining in the Gilson seam began in October, 1980 with a single unit's production. As mining progresses, additional units will be added with three production units and the longwall scheduled to be operating by mid-1994. A systematic mining plan will be followed to assure maximum recovery. All planning and scheduled production, however, will be contingent upon the coal market. Upon the conclusion of mining activities in the area, the scheduled reclamation phase will begin immediately.

Andalex will fill, regrade and stabilize rills and gullies over 9 inches in depth. Further, Andalex has agreed to interim stabilization of all slopes and embankments within the disturbed area and has done so. One slope located at the bottom of the office driveway, has been attempted through hydroseeding, fertilizing and mulching techniques on three separate occasions. Although no significant erosion problems have occurred, Andalex will notify the Division by the fastest available means of any slides or other damage and comply with any remedial measures required by the Division (generally, reporting will be accomplished by telephone).

Andalex will cover acid or toxic forming materials if any are encountered.

Andalex will advise the Division in the event of a temporary shutdown, such as a letter sent to the Division when Andalex's Apex Mine was temporarily closed.

R645-301-515.200. IMPOUNDMENT HAZARDS

Safety Precautions

The ponds were built as per specifications and under supervision of a qualified, registered professional engineer. The ponds are inspected quarterly for safety and compliance. Inspection reports are maintained on-site, and submitted to the Division on an annual basis. Ponds will be cleaned at minimum when sediment reaches 60% of

designed sediment volume. Measuring devices will be installed in the ponds to show when the ponds have filled with sediment to the clean-out level (please see plates 11, 12, and 13). Drainage directly into the Pinnacle and Apex Portals is not part of the calculation for sediment pond sizing (Pond C).

R645-301-515.300. TEMPORARY CESSATION OF OPERATIONS

Whenever it is known that operations are to be temporarily ceased for more than 30 days, Andalex Resources will submit to the Division a notice of intention to cease or abandon the operations, in accordance with R645-301-515.320 and to MSHA standards.

This notice will describe mitigation measures to be employed in accordance with the terms and conditions of the permit approval, such as a statement of the number of surface areas involved in the cessation, extent of sub-surface strata, prior reclamation efforts accomplished on the property, and identification of all backfilling, regrading, revegetation, environmental monitoring, underground opening closures and water treatment activities that will continue during the temporary cessation.

Temporary closing of underground workings will be accomplished with chain link fence material as recommended by MSHA. This prevents access by unauthorized individuals during idol periods. It is not anticipated that once Andalex reaches its peak production that this will occur.

If underground openings are to remain inactive for a period greater than 90 days, such openings will be temporarily closed off from access. Such closures will consist of a chain link or other substantial wire mesh fabric fence placed over the portals to prevent public access while allowing for air flow. Locked gates may be installed in the portal to allow for mine inspection.

HISTORICAL NOTE: On June 11, 2008 the company requested permission from the BLM to modify the R2P2 to allow the mine to be temporarily idled due to economic factors. The BLM approved the modification on June 20, 2008. The portals were then sealed to prevent public access. The idle status has continued for more than 30 days. The surface facilities are secured by a security guard at all times. At the time of the temporary idling, the permit area included 6516.91 acres, and the total disturbed area included 47.19 acres (minesite = 34.2 acres, Left Fork fan and access road = 1.45 acres, and GVH sites = 11.54 acres). The subsurface strata extends from zero at the outcrop to more than 3000' under the northernmost longwall panels, and the horizontal extent of the subsurface strata over the permit area is about 21,432' measured north-south and about 21,768' measured east-west. There has been no reclamation done at the site as a result of the temporary closure, although two GVH sites were reclaimed in the meantime. There are no water treatment activities going on at the mine.

The normal required environmental monitoring has continued since the mine has been idled, including hydrologic monitoring of springs, seeps and wells, UPDES

monitoring, subsidence monitoring, and raptor surveys. The UPDES outfall points continue to be monitored but there has been no reported flow since the mine was shut down and the pumps were shut off. Nearly all water in the mine was created from the floor strata as mining occurred, and would normally dry up after the mine advanced several hundred feet. None of the flow was attributed to geological structures such as faults or dikes. Since all mining was advancing down-dip the water had to be continually pumped out to the surface since there were no sumps constructed below the workings to collect and store the water. Now that mining has stopped there is no reason to believe that the floor strata will continue to make water, especially at the liberation rate of 800 gpm typical of the operational period. Also, since all the water was being made in the extreme down-dip section of the mine, the water that does continue out of the floor will fill up the bottom of the mine until it reaches a level of potentiometric equilibrium. The portals are at the highest end of the mine, and are 1,640' vertically above the impounding area, and more than 14,000' vertically separated. This situation is very different than, for example the Crandall Mine where water is presently discharging from the portals. There, the mine is essentially flat and the source of the water is likely the Joe's Valley Fault which probably serves as a direct conduit for surface water draining through Joe's Valley above down to the mine workings. At the Tower Mine there is no primary recharge mechanism, and the vertical dip should serve to allow the water level to stabilize within the mine without discharging from the portals.

R645-301-515.310. TEMPORARY ABANDONMENT

See R645-301-515.300.

R645-301-515.311. SUPPORT AND MAINTENANCE

See R645-301-515.300.

R645-301-515.312. SECURING SURFACE FACILITIES

See R645-301-515.300.

R645-301-515.320. NOTICE OF INTENT TO CEASE OR ABANDON OPERATIONS

See R645-301-515.300.

R645-301-515.321. STATEMENT OF CONDITIONS PRIOR TO CESSATION OR ABANDONMENT, UNDERGROUND

See R645-301-515.300.

R645-301-515.322. STATEMENT OF CONDITIONS PRIOR TO CESSATION OR ABANDONMENT, SURFACE

See R645-301-515.300.

R645-301-516. PREVENTION OF SLIDES

Andalex has agreed to interim stabilization of all slopes and embankments within the disturbed area and has done so. One slope located at the bottom of the office driveway, has been attempted through hydroseeding, fertilizing and mulching techniques on three separate occasions. No significant erosion problems have occurred, Andalex will notify the Division in the event of any slides or other damage.

R645-301-520. OPERATION PLAN

R645-301-521. GENERAL

Requirements for Reclamation and Operation Plan

Operation Plan: General Requirements

Andalex Resources, Inc. has added 802 acres in the AEP lease #UTU 69600 to its currently approved Centennial Project. The lease contains 3.0 million tons of recoverable coal in the Centennial and Aberdeen Seams. All reserves will be mined simply as an underground extension of the existing, approved, and currently operating Pinnacle and Aberdeen Mines. As such, no additional surface facilities are required. Access to and handling and extraction of all coal will be through the existing Pinnacle and Aberdeen Mines.

All necessary surface and support facilities have been constructed, approved, and are currently in operation for the Pinnacle, Apex and Aberdeen Mines. There will be no change in the currently approved Environmental Protection Plan.

Overview of Project

Type of Mine

The initial underground mining operation known as the Pinnacle Mine, located on the Zion's fee property, began production on October 3, 1980. It consisted of a single unit's production with an output projected to be approximately 200,000 tons per year and with 20 employees. The mine moved onto the federal leases and with the addition of the Apex Mine in 1982, the Centennial Project now has a production capacity of 1,200,000 tons per year. As there are four minable seams present, the Aberdeen, Gilson, Centennial, and Lower Sunnyside, in ascending order, mining plans call for

simultaneous operation of a mine in each seam. The existing operations are in all four seams. The Centennial Seam has been accessed via rock tunnels from the existing Pinnacle Mines (Gilson Seam).

Mining will consist of the underground method of coal extraction using continuous miners and longwall. Room and pillar longwall panel development will be employed with final overall extraction estimated to be about 80 percent of the reserve.

Coal is presently being loaded into 40-ton coal trucks and hauled to Wildcat Jct. near Helper. All seams will be mined using continuous miners and longwall extraction. Because there is deep cover over the reserves on portions of the Graves Lease, it is likely that first mining only will be possible. Please refer to Plate 5-16, 27, 28, & 29 which show depth of cover over the seams.

Area of Operations

Mine Plan Area

The mine plan area is limited to and contained within the proposed permit area. Mine plans for each of the minable seams are included as Plates 29, 30, 31 and 41.

Permit Area

The permit area consists of seven federal leases and two fee leases, all controlled by Andalex Resources. The Hoffman Creek federal coal Lease (U-52341) has been relinquished although the acreage still remains in the permit area. Presently, mining operations are taking place on five federal coal leases. Federal leases are U-010581, SL-027304, SL-063058, #U-05067 and UTU-66060. These leases are shown on Plate 4. Mining commenced on #U-05067 in July of 1989. Mining commenced on #UTU-66060 in late 1990. Mining will commence on UTU-69600 in June of 1993.

Disturbed Surface Area

Surface disturbances are minimal due to the nature of the mining activities. The permit area has been previously impacted by mining. Surface disturbances will be limited to the existing facilities which have been constructed. The total existing surface area disturbed is 34.2 acres. Existing facilities are indicated on Plate 5-7 and 7.

The land affected by mining operations which shall be reclaimed, in compliance with the Mining and Reclamation Plan and all requirements of the Mined Land Reclamation Act and Rules and Regulations adopted in accordance therewith, can be described as follows:

47.19 acres located in T13S, R11E, S.L.B.&M., Carbon County, Utah and contained within,
SE 1/4 SW 1/4 Section 7
NE 1/4 SW 1/4 Section 7
SW 1/4 SE 1/4 Section 7

NW 1/4 SE 1/4 Section 7
SW 1/4 NE 1/4 Section 7
NE 1/4 NW 1/4 Section 18
NW 1/4 NE 1/4 Section 18

Reserves, Production, and Life of Mine

Andalex's most recent reserve estimates, using the longwall mining method, are calculated at 23 million recoverable tons. This includes all seams on all leases.

If the extraction rate of 1.5 million tons is accomplished according to schedule, the project life will be about 15 years. The theoretical life could be closer to 25 years however due to the existence of unleased federal coal logically accessible through only the existing and future Andalex mine workings.

R645-301-521.100. CROSS SECTIONS AND MAPS

See R645-301-510, Volume II

R645-301-532.110. PREVIOUSLY MINED AREAS

See R645-301-510, Volume II

R645-301-521.111. LOCATION AND EXTENT OF KNOWN WORKINGS

See R645-301-510, Volume II

R645-301-521.112. EXISTING OR PREVIOUSLY SURFACE MINED AREAS

N/A

R645-301-521.120. EXISTING SURFACE AND SUBSURFACE FACILITIES AND FEATURES

See R645-301-510.

R645-301-521.121. BUILDINGS IN AND WITHIN 1000 FEET OF THE PERMIT AREA

There are no buildings within 1,000 feet of the permit area except those used as part of the mining operation. They are shown on Plate 5-7.

R645-301-521.122. SURFACE AND SUBSURFACE MAN-MADE FEATURES WITHIN THE PERMIT AREA

There are no surface or subsurface man-made features within, passing through or passing over the permit area except the powerline, telephone cables, culverts, and etc., installed for the operation of this mine. See Plate 5-7 for their locations.

R645-301-521.123. PUBLIC ROADS IN OR WITHIN 100 FEET OF THE PERMIT AREA

County Road 299 starts at highway 6 in Price and terminates at Andalex Resources' minesite (Plate 1).

R645-301-521.124. EXISTING FACILITIES WITHIN THE PERMIT AREAS

There are no surface or subsurface man-made features within, passing through or passing over the permit area except the powerline, telephone cables, culverts, and etc., installed for the operation of this mine. See Plate 5-7 for their locations.

R645-301-521.125. SEDIMENTATION PONDS AND IMPOUNDMENTS

See R645-301-733..

R645-301-521.130. LANDOWNERS AND RIGHT OF ENTRY AND PUBLIC INTEREST MAPS

The leases for which we have the legal right of entry are shown on Plate 4. See Appendix R.

R645-301-521.131. SURFACE AND SUBSURFACE OWNERS

Owners of Record of Surface and Subsurface Contiguous Areas

See R645-301-112.500

R645-301-521.132. RIGHT TO ENTER AND CONDUCT MINING ACTIVITIES

See R645-301-114.230.

R645-301-521.133.1 OPERATIONS WITHIN 100 FEET OF ROAD RIGHT-OF-WAY

County Road 299 starts at highway 6 in Price and terminates at Andalex Resources' minesite (Plate 1).

R645-301-521.133.2 RELOCATING A PUBLIC ROAD

N/A

R645-301-521.140. MINE AND PERMIT AREA MAPS

Cross Sections, Maps, and Plans

Most of the cross sections, maps, and plans previously submitted as part of the approved Mining and Reclamation Plan, are applicable. Where necessary, the original maps have been revised to indicate the lease in Hoffman Creek and the revisions are included in this submittal in Volume II.

All categories within this section have been addressed. Specifically,

a) Plates 26, 27, and 28 and 40 show all the test borings locations and elevations. Specific information relating to these drill holes and the strata encountered can be found in Appendix E (coal quality, description of other strata).

b) Monitoring stations for water quality are shown on Figure IV-11. Including the new 12-11 in Alrad Canyon. Fish and wildlife monitoring stations were not set up for this application. However, refer to Plate 5-24 which depicts wildlife distribution. Air quality monitoring was not required for this application. Figure 6 in Appendix L shows proposed monitoring stations. Andalex has adhered to the locations shown on Figure IV-11 which is included in Andalex's operating plan.

c) Refer to Appendix E for specific drill hole lithologies as well as data on quality and chemical characteristics.

d) Crop lines and strikes and dips can be found on the coal thickness isopachs in Volume II, Plates 26, 27, and 28.

e) All old workings in the three coal seams to be mined are shown on Plates 29, 30, and 31. There are no old workings in the Centennial Seam.

f) All subsurface water on the permit area exists in perched aquifers. The Aberdeen sandstone is the lowest water bearing unit within the permit area and is discussed in Geology. The only water well drilled on the property which has been used with any frequency (well #1) has not depicted any seasonal variation. It is always a low producer.

g) There are no surface waters within the permit area. All drainages (natural) are shown on the topography on Plate 5-11. All constructed drainages are shown on Plate 5-7. There are no irrigation ditches. Appendix L, which is the Hydrologic Inventory, contains Figure 4 which clearly depicts the location of springs in the permit area and adjacent areas. This figure, along with Figures 5 and 6, depict the areal extent of the inventory.

h) N/A

i) Plate 5-7 shows the location of development waste stored in an area which was previously used as a sediment pond. Plate 5-7 now also shows the location of a new area above the Apex Mine which can be used for temporary and permanent

storage of development waste such as sediment pond material. All dams and impoundments are shown on Plate 5-7, and detailed on Plates 11, 12, and 13. There are no other water treatment or air pollution control facilities on the permit area.

j) There are no oil or gas wells within the permit area. Three water wells are shown on Plate 5-7. Well number 1 is 220 feet deep; number 2 is 100 feet deep, and number 3 is 120 feet deep.

k) Plates 14 and 15 accurately depict the area currently affected by mining as well as the area to be affected. They show the slopes as they exist as well as after construction and upon final reclamation.

Operation Plan: Maps and Plans

1) Most of the maps and plans previously submitted as part of the approved Mining and Reclamation Plan, are applicable. Where necessary, the original maps have been revised to indicate the lease in Hoffman Creek and the revisions are included in this submittal in Volume II.

   All necessary maps and plans to complete this section are found in Volume II of the submittal and also in the appendices of Volume I specifically,

   a) Underground coal mining activities to be conducted and lands to be affected by surface facilities are shown on Plates 6, 29, 30, 31 and 41.

   b-1) Buildings, utilities, and facilities are depicted on Plates 6 and Plate LF-1.

2) The area to be affected is shown on several plates, including 4, 5, 6, 29, 30, 31 and 41. These last four plates show the sequence of mining in the four seams over the five year term of the permit. Plate 5-20 has been revised to show immediate development in the Gilson Seam as soon as approval is achieved. Reclamation will not take place until after all four seams are mined out. This activity is depicted on Plates 15, 16, 17, and 20.

3) Plates 5 depict the entire disturbed area for which a performance bond is posted. The acreage is shown on Plate 5.

4) Coal storage and loading areas are shown on Plates 6. No cleaning takes place.

5) Plates 6 show a non-coal waste storage area as well as topsoil storage areas. Plates 36 and 37 show the topsoil piles in detail.

6) All water diversions and other water facilities are shown on Plates 6, 8, 9, 11, 12, and 13. Also, typical diversions for disturbed area and undisturbed areas are shown in the Sedimentation and Drainage Control Plan.

Diversion ditches as they exist are shown on Revised Plate 5-7. Topographic detail has been added to Plate 8 to allow determination of watershed slopes within the disturbed area.

Diversions and other hydrologic controls are shown on Plates 6, 7, 8, 11, 12 and 13, for the Aberdeen Mine. Topographic detail has been added to Plate 8 to allow determination of watershed slopes within the disturbed area.

Plate 16 has been revised to show drainage during the reclamation period before and after removal of sediment ponds (Phase I).

Plate 17 shows final drainage details.

Plate 9 shows delineations of watershed areas.

The main culvert will be removed entirely during the reclamation-earthwork phase except under Pond "E". Pond "E" will be enlarged, and the entire drainage area above will flow into the restored channel RC-1 and through Pond "E-PM". Once revegetation and water quality standards have been met, Pond "E-PM" and the culvert will be removed and reclaimed.

7) There is no coal processing waste at the Centennial facility There are no pollution control facilities other than sedimentation ponds on the permit area. Please note that waste rock generated by the Centennial Seam rock tunnels was disposed of underground in the existing Pinnacle Mine workings.

8) Specific facilities are not used to protect or enhance wildlife with the exception of the powerline which was built according to strict guidelines issued by the Division of Wildlife Resources and the U.S. Fish and Wildlife Service regarding raptor protection. The powerline design is included in Volume I as Appendix I (powerline design). Also, speed limits are posted within the permit area.

9) The two powder magazines are shown on Plates 6.

10) Plates 6, 8, and 9 show these facilities associated with protection of the hydrologic balance including sedimentation ponds and storage of non-coal waste. There are no permanent impoundments, or coal processing wastes. Underground development waste has been generated while putting in the Aberdeen portals, and has been used as stock pile pad material at the Aberdeen Minesite. The volume of this material is minimal.

11) Plates 16 and 17 show the final reclamation contours and configuration of the surface for Phases I and II respectively.

12) Subsidence monitoring points are shown on Plate 5-15. Additional stations have been added to Plate 5-15 to cover long wall mining on the new Kenilworth Lease. Water monitoring locations are shown on Plate 7-1.

13) There will be no facilities left on the permit area permanently excepting possibly the road through the site. After the completion of underground mining, all facilities will be removed with the exception of one downstream sedimentation pond. This pond will be removed upon final reclamation.

c) Maps, plans, and cross sections required under b)(5),(6),(10), and (11) have been prepared under the direction of, and certified by a registered professional engineer. Assistance has come from a registered land surveyor.

1) Detailed maps, plans, and cross sections for our sediment ponds, Plates 11, 12, and 13 have been certified by a registered professional engineer.

2) Andalex has not used any excess spoil or underground development waste maps or cross sections. A map (uncertified) depicting the location of non-coal waste storage is included as Plate 5-7.

R645-301-521.141. AFFECTED AREA

R645-301-521.142. UNDERGROUND WORKINGS AND SUBSIDENCE AREAS

See R645-301-510, Volume II.

R645-301-521.143. WASTE DISPOSAL SITES

See R645-301-510, Volume II.

R645-301-521.150. LAND SURFACE CONFIGURATION MAPS

See R645-301-510, Volume II.

R645-301-521.151. REQUIREMENTS

See R645-301-510, Volume II.

R645-301-521.152. PREVIOUSLY MINED AREAS

See R645-301-510, Volume II.

R645-301-521.160. MAPS OR CROSS SECTIONS OR PROPOSED FEATURES

See R645-301-510, Volume II.

R645-301-521.161. BUILDINGS, UTILITY CORRIDORS AND FACILITIES

See R645-301-510, Volume II.

R645-301-521.162. AREA AFFECTED ACCORDING TO SEQUENCE AND TIMING OF OPERATIONS

See R645-301-510, Volume II.

R645-301-521.163. BONDED AREA

See R645-301-510, Volume II.

R645-301-521.164. COAL HANDLING FACILITIES

See R645-301-510, Volume II.

R645-301-521.165. TOPSOIL AND WASTE STORAGE AREAS

See R645-301-510, Volume II.

R645-301-521.166. WASTE SOURCES AND DISPOSAL FACILITIES

See R645-301-510, Volume II.

R645-301-521.167. EXPLOSIVES STORAGE AND HANDLING FACILITIES

See R645-301-510, Volume II.

R645-301-521.168. AIR POLLUTION CONTROL FACILITIES

N/A

R645-301-521.169. COAL PROCESSING WASTE FACILITIES

N/A

R645-301-521.170. TRANSPORTATION FACILITIES MAPS

See R645-301-510, Volume II.

R645-301-521.180. OTHER INFORMATION

See R645-301-510, Volume II.

R645-301-521.200. SIGNS AND MARKERS SPECIFICATIONS

Signs of a uniform design, showing the company name, business address, and telephone number as well as the identification number of the current regulatory program

permit authorizing the underground mining activities, have been placed at all access points to the permit area. These signs have been placed to be easily seen, are made of a durable material, and conform to local laws and regulations. The topsoil storage area is clearly marked.

As this is an underground mine, there will be no blasting conducted on the surface with the exception of highwall construction. When blasting for highwall construction does occur, conspicuous signs and flagging will be posted as required by 30 CFR Parts 817.11 (f) and 817.65 (e).

As there are no perennial streams or a stream with a biological community on the permit area, buffer zone markers will not be necessary. The perimeters of all areas affected by surface operations and facilities are clearly marked. These signs and markers shall be maintained during all activities and retained and maintained until after the release of all bonds for the permit area.

R645-301-521.210. PLACEMENT AND REMOVAL

See R645-301-521.200.

R645-301-521.220. DESIGN

See R645-301-521.200.

R645-301-521.230. MAINTENANCE

See R645-301-521.200.

R645-301-521.240. MINE AND PERMIT IDENTIFICATION SIGNS

See R645-301-521.200.

R645-301-521.241. LOCATION, UNDERGROUND MINING

See R645-301-521.200.

R645-301-521.242. LOCATION, SURFACE MINING

N/A

R645-301-521.243. INFORMATION

See R645-301-521.200.

R645-301-521.244. REQUIREMENTS

See R645-301-521.200.

R645-301-521.250. PERIMETER MARKERS

See R645-301-521.200.

R645-301-521.251. SURFACE AFFECTED AREAS FOR UNDERGROUND MINING OPERATIONS

See R645-301-521.200.

R645-301-521.252. PERMIT AREA PERIMETER FOR SURFACE MINING OPERATIONS

N/A

R645-301-521.260. BUFFER ZONE MARKERS

N/A

R645-301-521.261. BOUNDARY MARKERS FOR SURFACE ACTIVITIES OF UNDERGROUND OPERATIONS

They consist of orange "Tee" posts which are clearly visible from one marker to the next.

R645-301-521.262. BOUNDARY MARKERS FOR SURFACE MINING OPERATIONS

N/A

R645-301-521.270. TOPSOIL MARKERS

See R645-301-521.200.

R645-301-522. COAL RECOVERY

Cycle and Sequence of Mining

The panel-barrier-panel mine design is the only feasible and approvable mine plan. The BLM and MSHA have agreed and the R2P2 reflects this design The R2P2 Plan contains specific timing, sequence and method details for recovery of this resource. The panel-barrier design will minimize probability of subsidence.

R645-301-523. MINING METHOD

The initial underground mining operation known as the Pinnacle Mine, located on the Zion's fee property, began production on October 3, 1980. It consisted of a single unit's production with an output projected to be approximately 200,000 tons per year and with 20 employees. The mine moved onto the federal leases and with the addition of the Apex Mine in 1982, the Centennial Project now has a production capacity of

1,800,000 tons per year. As there are four minable seams present, the Aberdeen, Gilson, Centennial, and Lower Sunnyside, in ascending order, mining plans call for simultaneous operation of a mine in each seam. The existing operations are in all four seams. The Centennial Seam has been accessed via rock tunnels from the existing Pinnacle Mines.

Mining will consist of the underground method of coal extraction using continuous miners, shuttle cars, roof bolters and feeders and longwall equipment consisting of a shearer, armored face conveyor and shield type roof supports. Room and pillar longwall panel development will be employed with final overall extraction estimated to be about 60 percent of the reserve. See Plate 5-19 for cover isopachs.

Coal will be loaded into 40-ton coal trucks and hauled to a unit train loadout in the near vicinity.

R645-301-523.100. SURFACE MINING OPERATIONS WITHIN 500 FEET OF AN UNDERGROUND MINE

N/A

R645-301-523.200. EXCEPTIONS TO SURFACE MINING OPERATIONS WITHIN 500 FEET OF UNDERGROUND WORKINGS

N/A

R645-301-523.210. RESOURCE RECOVERY OF ELIMINATION OF HAZARDS

N/A

R645-301-523.220. APPROVAL BY DIVISION AND MSHA

Appendix B; Appendix J

R645-301-524. BLASTING AND EXPLOSIVES

All blasting performed underground will conform to both state and federal regulations governing explosives and blasting in underground coal mines.

A powder magazine has been set up on one of the surface pads, located in a remote area. It is built to conform to all regulations, such as segregation, regarding such a structure (see Plate 5-7). All blasting operations shall be conducted by experienced, trained, and competent persons who understand the hazards involved and who possess a valid certificate as required by Title 30 of the Code of Federal Regulations. If any additional surface blasting is required, powder magazines at that location will be in a remote site and will comply with all federal and state regulations.

If required, MSHA will be notified if surface blasting will be performed within 500 feet of an active coal mine. If necessary, joint approval will be obtained from the Division and MSHA.
Revised 9/12/95

R645-301-524.100. BLASTER CERTIFICATION

All blasting conducted on the surface will be performed by a DOGM- certified blaster.

R645-301-524.110. CERTIFIED BLASTER

See 301-524.100.

R645-301-524.120. BLASTING CERTIFICATES

Blasting certificates will be kept on site during blasting operations.

R645-301-524.130. FIRING OF A BLAST

A blaster and at least one other person will be present at the firing of the blast.

R645-301-524.140. RESPONSIBILITY

The certified blaster will be familiar with the blasting plan and performance standards, and will give on-the-job training to uncertified persons.

R645-301-524.200. BLAST DESIGN

A blast design will be submitted prior to blasting.

R645-301-524.210. ALL BLASTING OPERATIONS

See 301-524.200.

R645-301-524.211. BUILDINGS WITHIN 1000 FEET OUTSIDE THE PERMIT AREA

See 301-524.200.

R645-301-524.212. WITHIN 500 FEET OF UNDERGROUND MINE

See 301-524.200.

R645-301-524.220. BLAST DESIGN APPROVAL PRIOR TO BLAST

See 301-524.200.

R645-301-524.230. BLAST DESIGN CRITERIA

See 301-524.200. All blasts will meet the requirements of 301-524.600.

R645-301-524.240. CERTIFICATION

The blast design will be prepared and signed by a certified blaster.

R645-301-524.250. CHANGES TO BLAST DESIGN

All blasts will comply with requirements of the Division.

R645-301-524.300. PRE-BLASTING SURVEY

See 301-524.200

R645-301-524.310. NOTIFICATION OF RESIDENTS

See 301-524.200

R645-301-524.320. REQUESTS FOR PRE-BLASTING SURVEY

See 301-524.200

R645-301-524.330. ASSESSMENT OF FACILITIES

See 301-524.200

R645-301-524.340. REPORT OF SURVEY

See 301-524.200

R645-301-524.350. COMPLETION OF SURVEY PRIOR TO BLAST

See 301-524.200

R645-301-524.400. BLAST SCHEDULE

A schedule will be contained in the permit if required.

R645-301-524.410. UNSCHEDULED BLASTS

There will be no unscheduled blasts.

R645-301-524.420. TIME PERIODS FOR BLASTING

All blasting will be conducted between sunrise and sunset hours.

R645-301-524.430. BLASTING NOTICES FOR UNDERGROUND MINING OPERATIONS

See 301-524.200. Local governments will be notified that blasting may be conducted in the Left Hand Fork.

R645-301-524.450. BLASTING SCHEDULE PUBLICATION AND DISTRIBUTION

There will be one blast conducted in the Left Hand Fork between sunrise and sunset September 13, 1995.

R645-301-524.451. NEWSPAPER PUBLICATION

Appropriate publications will be made regarding surface blasting.

R645-301-524.452. DISTRIBUTION OF NOTICES

There are no requirements for distribution due the remote location (greater than ½ mile) of the blast. Local government will be notified.

R645-301-524.453. REPUBLISHING AND REDISTRIBUTION

Not applicable. This is a one-time blast and there will be no new requirements for distribution of notices.

R645-301-524.460. BLASTING SCHEDULE CONTENTS

See 301-524.200

R645-301-524.461. OPERATOR IDENTIFICATION

See 301-524.200

R645-301-524.462. BLASTING LOCATION

See 301-524.200

R645-301-524.463. DATES AND TIME PERIODS OF DETONATIONS

See 301-524.200

R645-301-524.464. ACCESS CONTROL METHODS

See 301-524.200

R645-301-524.465. WARNING SIGNALS

See 301-524.200

R645-301-524.500. DESCRIPTION OF BLASTING SAFEGUARDS

See 301-524.200

R645-301-524.510. BLASTING SIGNS

See 301-524.200

R645-301-524.511. CONSPICUOUSLY PLACED SIGNS

See 301-524.200

R645-301-524.512. ENTRANCES FROM PUBLIC ROADS OR HIGHWAYS

See 301-524.200

R645-301-524.520. WARNINGS

See 301-524.200

R645-301-524.530. ACCESS CONTROL

See 301-524.200

R645-301-524.531. UNUSUAL HAZARDS

No unusual hazards exist.

R645-301-524.532. ACCESS WITHIN THE BLASTING AREA

See 301-524.200

R645-301-524.600. CONTROL OF ADVERSE BLASTING EFFECTS

The blast planned in the Left Hand Fork is a one-time blast consisting of a pre-split shot and will be totally contained. The nature of this type of blast will contain both noise and particles. It will have no affect on underground mining, channels, surface or ground water outside the permit area. The location of this blast is a minimum of 7 miles from any public building, church or occupied dwelling.

R645-301-524.610. GENERAL REQUIREMENTS

See 301-524.600.

R645-301-524.620. AIR BLAST LIMITS

See 301-524.600.

R645-301-524.621. MAXIMUM AIR BLAST LIMITS

See 301-524.600. Air blasts will not exceed the maximum limits at the location of any dwelling, public building, school, church, or community or institutional building

outside the permit area. The blast will be located in a remote steep-sided canyon and will not allow air blasts to affect any of the above items.

R645-301-524.622. PREVENTION OF DAMAGE

See 301-524.600. and 621.

R645-301-524.630. MONITORING

See 301-524.600. Monitoring will be conducted if required by the Division.

R645-301-524.631. MEASUREMENTS AND LOCATIONS

See 301-524.630.

R645-301-524.632 MEASURING SYSTEMS

See 301-524.630.

R645-301-524.633. FLY ROCK

The blast is designed to contain all fly rock and cannot travel beyond the permit boundary.

R645-301-524.640. GROUND VIBRATION

Due to the location of the blast there is no potential for damage to any structure as the result of ground vibration.

R645-301-524.641. GENERAL

See 301-524.633.

R645-301-524.642. MAXIMUM PEAK-PARTICLE VELOCITY

See 301-524.633.

R645-301-524.643. SEISMOGRAPHIC RECORD

A seismographic record will be kept if required by the Division.

R645-301-524.650. ALLOWABLE CHARGE WEIGHT

See 301-524.643.

R645-301-524.652. MODIFIED SCALED-DISTANCE FACTOR

See 301-524.643.

R645-301-524.660. BLASTING-LEVEL CHART

See 301-524.643.

R645-301-524.661. GROUND VIBRATION LIMITS

See 301-524.643.

R645-301-524.662. PARTICLE VELOCITY AND VIBRATION FREQUENCY LEVELS

See 301-524.643.

R645-301-524.670. DAMAGE PROTECTION

See 301-524.643.

R645-301-524.680. SEISMIC MONITORING

See 301-524.643.

R645-301-524.690. STRUCTURES NOT SUBJECT TO AIR BLAST AND GROUND VIBRATION LIMITS

See 301-524.643.

R645-301-524.700. RECORDS OF BLASTING OPERATIONS

Records will be kept of all blasting operations as required by the regulations.

R645-301-524.710. RECORDS

See R645-301-524.700

R645-301-524.711. OPERATOR IDENTIFICATION

See R645-301-524.700

R645-301-524.712. BLAST LOCATION AND SCHEDULE

See R645-301-524.700

R645-301-524.713. BLASTER CERTIFICATION

See R645-301-524.700

R645-301-524.720. NEAREST DWELLING OR FACILITY OUTSIDE THE PERMIT AREA

See R645-301-524.700

R645-301-524.730. WEATHER CONDITIONS

See R645-301-524.700

R645-301-524.740. BLASTING RECORD

See R645-301-524.700

R645-301-524.741. TYPE OF MATERIAL BLASTED

See R645-301-524.700

R645-301-524.742. BLASTING PATTERN

See R645-301-524.700

R645-301-524.743. DIAMETER AND DEPTH OF HOLES

See R645-301-524.700

R645-301-524.744. TYPES OF EXPLOSIVES USED

See R645-301-524.700

R645-301-524.745. TOTAL WEIGHT OF EXPLOSIVES USED PER HOLE

See R645-301-524.700

R645-301-524.746. MAXIMUM WEIGHT OF EXPLOSIVES DETONATED IN AN EIGHT-MILLISECOND PERIOD

See R645-301-524.700

R645-301-524.747. INITIATION SYSTEM

See R645-301-524.700

R645-301-524.748. STEMMING

See R645-301-524.700

R645-301-524.749. MATS OR OTHER PROTECTIONS USED

See R645-301-524.700

R645-301-524.750. SEISMOGRAPHIC AND AIR BLAST INFORMATION

See R645-301-524.700

R645-301-524.751. INSTRUMENTATION

See R645-301-524.700

R645-301-524.752. LOCATION OF INSTRUMENTATION

See R645-301-524.700

R645-301-524.753. PERSONS COLLECTING DATA

See R645-301-524.700

R645-301-524.754. PERSONS ANALYZING DATA

See R645-301-524.700

R645-301-524.755. VIBRATION AND/OR AIR BLAST LEVEL RECORDED

See R645-301-524.700

R645-301-524.760. UNSCHEDULED BLASTS

See R645-301-524.700

R645-301-524.800. COMPLIANCE WITH OTHER APPROPRIATE REGULATIONS

Andalex Resources will comply with appropriate Utah and federal regulations in the use of explosives.

R645-301-525. SUBSIDENCE

Survey of Structures and Renewable Resource Lands

There are no structures present other than those constructed for mining operations, on the permit area. The land is presently used for grazing and wildlife habitat which constitutes a renewable resource area. It should be noted that geographic areas above Andalex's 5 year mine plan do not include any area suitable for grazing, nor do they contribute significantly to the long-range productivity of water, food or fiber products. Andalex commits to mitigate all subsidence related damage to renewable resources including, but not limited to water, grazing, and wildlife habitat including raptor nests.

Mining Method

Mining will consist of the underground method of coal extraction using the longwall method, continuous miners on fringe areas, and conveyor haulage. Continuous miners will be employed for longwall development with longwall extraction completing the operation.

Geologic Factors

The Pinnacle Mine is located within the Blackhawk formation of the upper Cretaceous Mesa Verde Group. As is the case with all the active mines in the Book Cliffs coal field, the Pinnacle Mine drifts in from the outcrop and immediately the cover drastically increases as there are very steep sided canyons. Naturally, the same factors are present in the Lower Sunnyside, Aberdeen and the Centennial Seams. There are small areas of multiple seam extraction where a total thickness of up to 16 feet of coal could be removed. From a geologic standpoint, the following conclusion can be drawn: as mining progresses and the longwall panels are pulled the roof will cave in behind the shields as they advance. This is the normal scheme in this type of mining. In our longwall mining sequence, average cover over the coal seams is 2,700 feet or more. Use of longwall mining on the Andalex property will minimize the surface disturbance while enhancing safety underground.

Subsidence has not been detected at any monitoring location currently in place at Andalex, including two pillar extraction sections in close proximity to our initial longwall panel in the Gilson Seam. These pillar sections extracted 90% of the coal which is similar to longwall (See IBC PHC for additional comments on subsidence. The panel-barrier design will minimize the probability of subsidence. This fact, in combination with research performed by the Bureau of Mines will justify Andalex using a maximum angle of draw on this property of 20°. The Bureau of Mines performed extensive research at Price River Coal Co. (AEP) in the early 1980's at the #5 and #3 Mines where longwall mining was taking place.

That mining property is in the Book Cliffs Coal field as is Andalex's and is within seven miles. The Bureau's data showed a maximum draw angle over longwall extraction of (+) 15.2° and a minimum of (-) 7.4°. (See App. T.) The massive sandstones and geologic conditions above the Price River Coal mine are the same as those found above the Andalex permit area. Therefore, similar subsidence results will occur.

Preventive Measures

Subsidence due to mining on the Andalex property will not occur outside of the approved permit area. Stations have been set up as required for constant monitoring of subsidence movements. (See 6., Monitoring.) The only absolute preventive measure possible is to leave coal in place. This is in direct contrast to maximum economic coal recovery.

Resources on the lands above Andalex's mining plan consist only of wildlife habitat with very limited grazing access.

Subsidence monitoring stations will be established were established along the first proposed longwall mining (Plate 5-15). The results of this monitoring program define monitoring and permitting needs in the future.

Mitigative Measures

If minor subsidence would occur, there would be no material damage or diminution of valuable or foreseeable use of lands including wildlife habitat. It should be noted that subsidence has been occurring in the Book Cliffs coal field for decades with no diminution of resources. The Bureau of Mines Subsidence Study over the #3 Mine longwall panels has substantiated this. (See App. T.) There are no man-made structures or hydrologic concerns located within the affected area of Andalex's mining plan. It has been demonstrated that broad areas of subsidence over longwall panels do not represent adverse impact, if they are even noticeable. Smaller cracks, should they occur, heal themselves quickly and thoroughly.

The one spring located in Hoffman Creek was located stratigraphically well below the lowest coal to be mined. Springs above the seams outside the permit area will not be affected due to their distance from mining activity. Andalex has committed to replacing water should it be proven that mining has disrupted water flow at any location.

In the event mining related subsidence should cause material damage to the land, Andalex Resources, Inc. Will take appropriate steps to mitigate or repair such damage. Such repairs or mitigation may consist of one or more of the following steps:

(1) Filling of hazardous subsidence cracks;
(2) Leveling or regrading of subsidence damaged areas;
(3) Reseeding of repaired areas;
(4) Purchase of damaged site

In the event mining related activities should be shown to adversely affect State-appropriated water supplies, Andalex Resources, Inc. will attempt to repair and restore the affected supply; however, in the event, the supply cannot be restored, the loss may be mitigated by replacement of equivalent water rights from the 19 shares of primary water owned by Andalex Resources, Inc.

Methods to be used to repair damaged supplies may include installation of pipes and/or spring boxes, concreting or filling of cracks with impervious material, reconstructing ponds or damaged channels, or other methods of repair found to be acceptable and based on consultation with the Division and water right owner. It should be noted that any work performed on such hydrologic structures will be first permitted as necessary (i.e. Stream Alteration Permits, etc.).

Monitoring

There are no structures or surface features which could be affected adversely by subsidence. Monitoring stations, however, have been set up at the locations shown on Plate 7-1. Locations over the first longwall mining are also shown on Plate 5-18.

The purpose of the detailed monitoring program over the initial longwall mining is to establish baseline information which is useful in the long-term operation of the Andalex mines. This program will consist of surveyable monuments (nail, rebar, etc.) established on 100-foot centers (where possible) over the lines designated on Plate 5-18. Where 100-foot spacing is not possible due to topographic or other obstacles, spacing will be as near 100-foot as possible, particularly along potential tension areas

above the panel. Distances between points within the compression area of the longwall panel may be increased up to 500-feet depending on accessibility. Also, Andalex will conduct visual inspections over the first panel prior to and subsequent to mining the panel.

In addition, Andalex is committed to establishing subsidence monitoring programs over successive longwall panels which will consist of up to two monuments per panel and will also include visual inspections annually on active panels.

R645-301-525.100.

SUBSIDENCE CONTROL PLAN

See R645-301-525.

R645-301-525.110. MINING METHODS

See R645-301-525.

R645-301-525.120. LIKELIHOOD OF SUBSIDENCE

See R645-301-525.

R645-301-525.130. SUBSIDENCE CONTROL MEASURES

See R645-301-525.

R645-301-525.131. BACKSTOWING OR BACKFILLING OF VOIDS

N/A

R645-301-525.132. LEAVING SUPPORT PILLARS OF COAL

See R645-301-525.

R645-301-525.133. BARRIER PILLARS

See R645-301-525.

R645-301-525.134. MEASURES TO PREVENT DAMAGE

See R645-301-525.

R645-301-525.140. MONITORING

See R645-301-525.

R645-301-525.150. ANTICIPATED EFFECTS OF PLANNED SUBSIDENCE

See R645-301-525.

R645-301-525.160. MITIGATION OR REMEDY OF SUBSIDENCE-RELATED DAMAGE

See R645-301-525.

R645-301-525.170. OTHER INFORMATION

Upon completion of mining and following all required subsidence monitoring, subsidence monitoring stations (which consist of cemented rebar) will be removed.

R645-301-525.200. SUBSIDENCE CONTROL

See R645-301-525.

R645-301-525.210. SUBSIDENCE DESIGN

N/A

R645-301-525.220. COMPLIANCE WITH SUBSIDENCE CONTROL PLAN

See R645-301-525.

R645-301-525.230. OPERATOR REQUIREMENTS

See R645-301-525.

R645-301-525.231. SUBSIDENCE MITIGATION

See R645-301-525.

R645-301-525.232. COMPENSATION

N/A

R645-301-525.240. RESTRICTED FACILITIES

N/A

R645-301-525.241. DETAILED UNDERGROUND MINE PLANS

Underground Operation and Facilities

Mine Layout (Refer to Plate 5-19).

Multiple Seam Considerations

There was four economic seams present on the property. The uppermost seam is the Lower Sunnyside which varies from four to six feet thick. The second highest seam is the Centennial Seam which varies from four to eight feet thick. The third seam is the Gilson Seam which also varies from 4' to 8' thick. The lowermost seam is the Aberdeen, the only seam with coal remaining, which varies from four to thirteen feet in

thickness. The bottom two seams are separated by a 200 foot interval which includes a massive sandstone. The Gilson and the Centennial Seams are separated by approximately 130' and the Centennial and Lower Sunnyside Seams are separated by 80' including a massive sandstone. It should be noted that the area in which the Centennial Seam is to mined does not contain any reserves in either the Lower Sunnyside nor the Gilson Seams. Only the Aberdeen Seam is present where the Centennial Seam is to be mined. The mine plan for the aberdeen seam is shown on Plate 5-19.

Portals

Portals for the present mining operations in the Aberdeen, Gilson and Lower Sunnyside seams are located in Deadman Canyon as shown on Plate 5-7. The portal areas consist of a conveyor portal, two air intake portals, and an 88" fan portal.

Portals have been enlarged above the coal seam to facilitate men and equipment at the mine opening. Steel sets have been used to support mine roof in the portal areas. The Aberdeen portals have been constructed in a similar fashion, facilitating air intake, conveyor, and an exhaust fan.

The portals are generally 6' high and 20' wide in the Pinnacle and Aberdeen Mines and 4.5' high in the Apex Mine.

The portal mine pads consist of approximately The portal mine pads consist of approximately one acre. Located on these pads are the fans, conveyor portals, air intake portals, and mine water storage tanks. It should be noted that the mining of the Centennial Seam did not require new portals on the surface. The Centennial Seam is accessed via rock tunnels from the existing Pinnacle Mine.

Mains, Submains, and Slopes

A five to seven entry system is being used (two intake portals) and using a continuous miner, the entries are being driven to the property line. Generally, entries on 80 foot centers with crosscuts every 80 feet are being driven on the strike and dip of the coal seam. Development mining for the longwall panels are on 5th entry and 3rd entry systems. Refer to Plates 26 through 29. There exists only one return air portal on the surface, however, two exist underground making the five entry system. A seven entry system is used under shallow cover.

Shafts and Interconnecting of Slopes

Mining plans called for rock tunnels to be constructed from the existing Pinnacle Mine up to the Centennial Seam mining area. These rock slopes are each approximately 500' in length. The three tunnels consist of an intake air tunnel, a return air tunnel, and a belt tunnel. Coal is transported via the belt tunnel and transferred on to the existing Pinnacle Mine conveyor belts. These tunnels were constructed in the Spring of 1990 and mining has commenced.

Longwall Panels

The mining sequence calls for the development of panels longwall using 2, 3 and 5 entry systems. These panels will be generally 650 to 800 feet in width and up to 8,000 feet in length.

Barrier Pillars

A barrier pillar will be left between the bleeders and the longwall panels. A barrier will also be left wherever old mine workings are skirted such as the Olsen Mine on the east side of Deadman Canyon in the Gilson Seam._The approved R2P2 also places barrier pillars between longwall panels to maintain safe working conditions. This was the only mine design approvable by ANDALEX and the BLM.

Bleeder System

A bleeder system will be maintained and pillars left to provide for ventilation, eventually extending around all mined out areas.

R645-301-525.300. PUBLIC NOTICE OF PROPOSED MINING

A copy of the newspaper advertisement of this Mining and Reclamation Plan and proof of publication of the advertisement is filed with the Division and made part of the complete application.

525.400. DETAILS OF THE SUBSIDENCE CONTROL PLAN

Since state-appropriated water supplies exist on the surface, 525.400 has been addressed.

525.410 Coal will be removed using a combination of continuous miner and long wall methods as described in sections 522 and 523. Sequence and timing for the development of underground workings are also discussed in sections 522 and 523.

525.420 Plate 5-6 shows the underground workings and depicts areas where first mining or partial mining will be utilized to protect the escarpment and raptor nests that may exist on the escarpment, and to insure that subsidence remains within the permit area. State-appropriated water rights are shown on Plates 7-3.

525.430 No major impacts of subsidence to the surface caused by the underground mining methods proposed during the permit term are anticipated.

The coal seam is approximately 10 to 13 feet thick with only about 10.5 feet being extracted, and the depth of cover ranges from 1,500' to approximately 3,000. The rocks overlaying the coal seam are sandstones and mudstones with some thin bands of coal. Due to the strength of the overburden and depth of workings, even with full seam extraction, only minimal subsidence if any is anticipated.

525.440 Aerial subsidence monitoring will be done annually while the significant subsidence is taking place. The subsidence monitoring will be initiated in an area prior to any 2nd mining being done within that area. Initially a 200 foot grid along with baseline photograph will be established prior to any 2nd mining. Approximately 12-16 control points will be needed to cover the total mining area. Six of these points will be located outside of the subsidence zone. The accuracy of this survey will be plus or minus 6" horizontally and vertically. From this data a map will be created that will show subsided areas. Once per year a follow up aerial will be performed to determine the extent and degree of active subsidence. Subsidence monitoring will continue for a minimum of 5 years after the mining ceases. If at the end of the 5 year period the annual subsidence in any of the 3 prior years measures more than 10 percent of the highest annual subsidence amount, subsidence monitoring will continue until there are 3 consecutive years where the annual subsidence amount is less than 10 percent of the highest annual subsidence amount. If for three years in a row the subsidence is measured to be less than 10% of the highest subsidence year, subsidence will be determined to be complete, and no additional monitoring for that area will be required.

"A ground survey of the mine permit area 'where secondary extraction has occurred over the last year' will be conducted in conjunction with the quarterly water monitoring program." Identified features will be monitored until they are repaired or self-healed. The survey will be conducted on roads, adjacent to stock watering ponds, and in drainage channels where they cross tension areas relative to the underground extraction areas."

"The results of this survey will be documented quarterly in a written report which provides global positioning co-ordinates as well as the following information;

A) a description of the identified subsidence related feature,
B) length, and width measurements, and compass bearing,
C) dated photographic documentation,
D) located on a topographic overlay map of the underground disturbed area.
E) if the feature is determined as significant, the Division will be notified within a 48 hour period.
F) A written report, compiling the four quarterly reports for the monitoring year, will be submitted as part of the Annual Report required by the Division.
G) The commitment "to restore the land where subsidence damage has affected the use of the surface" must be revised to read "to restore the land where subsidence damage has been determined as significant enough to require repair, as determined by the Division".

The ground survey will consist of walking and photographing the various areas of the surface over the mine where subsidence might occur. If evidence of subsidence is identified, the area of subsidence will be surveyed and the extent of the disruption identified. Depending on the extent and location of the damage, mitigation measures will be reviewed and implemented. Due to the fact that mitigation options change with time as new technology and measures are developed, better options may be implemented in the future. However, UEI provides a commitment that where subsidence

damage affects uses of the surface, the land will be restored to a condition capable of maintaining the value and reasonable foreseeable uses which it was capable of supporting before the subsidence. The surface effects will be repairs as described in Section 525.500.

525.450 Subsidence control measures.

525.451. No backstowing or backfilling of voids used as a subsidence control measure is planned at this time. Therefore, this section is not applicable.

525.452. Support pillars as a subsidence control measure is not anticipated at this time. However, an area of partial mining where an unmined coal block will be left for subsidence control is shown on Plate 5-6. Both first mining and partial mining will leave support that can be used to control subsidence.

525.453. Mining in the Kenilworth Lease is not near the outcrop of the area.

525.454 No surface disturbance is planned. No measures will be taken on the surface to prevent material damage or lessening of the value or reasonable foreseeable use of the surface.

525.460. Anticipated effects of planned subsidence may include tension cracks, fissures, or sink holes. Areas of minimal ground lowering may be anticipated. The chances of subsidence-related damage to any perceived renewable resource is minimal.

525.470. Since no urbanized areas, cities, towns, public buildings, facilities, churches, schools, or hospitals exist within the permit area this section does not apply.

525.480. There are no plans to change or modify the mining plan to protect any springs or seeps. Springs with water rights will be monitored for flow and quality as described in Chapter 7 Section 731.211. UEI has committed to provide for mitigation of any lost water rights as per Chapter 7 Section 727.

525.490. Other information specified by the Division as necessary to demonstrate that the operation will be conducted in accordance with R645-301-525.300 will be provided.

525.500. Repair of damage.

525.510. If effects of subsidence are confirmed, any material damage to the surface lands will be restored to the extent technologically and economically feasible. The land will be restored to a condition capable of maintaining the value and reasonable foreseeable uses which it was capable of supporting before the subsidence.

525.520. Since no structures exist within or adjacent to the permit area which could be damaged by subsidence, should it occur, this section does not apply.

525.530. No structures, facilities, or county roads exist on the Kenilworth Lease area and no subsidence damage is expected.

525.600 Compliance

UEI agrees to comply with all provisions of the approved subsidence control plan.

525.700. Public Notice.

At least six months prior to mining, or within that period if approved by the Division, the underground mine operator will mail a notification to all owners and occupants of surface property and structures above the underground workings. The notification oil include, at a minimum, identification of specific areas in which mining will take placce, dates that specific areas will be undermined, and the location or locations where the operator's subsidence control plan may be examined.

R645-301-526. MINE FACILITIES

Support Structures and Buildings

Support structures and buildings are shown on Plate 5-7.

Parking Areas

Parking areas have been covered with gravel and magnesium chloride and will be maintained. These are shown on Plate 5-7. The main office parking area is paved.

Storage Areas

There are several storage areas at the site. These include the Material Storage Area No. 1, Raw Coal Pile Area, Material Storage Area No. 2, and the Topsoil Storage Area. All areas are shown on Plate 5-7.

R645-301-526.100. MINE STRUCTURES AND FACILITIES

See Volume II.

R645-301-526.110. EXISTING STRUCTURES

Operation Plan: Existing Structures

Construction and Design of Surface Facilities

Existing Structures

It should be noted that there are no existing structures located in the Mathis Tract I.B.C. area or on adjacent proposed Federal Lease Applications shown on Plate I-A.

All existing structures are situated on the Zion's fee land, on federal lease SL-027304, or on right-of-way UTU-62045 and are shown on Plate 5-7. There are no structures existing as part as Andalex's facility which were constructed prior to 1980. Originally it was anticipated that all buildings and structures were to be completed during the first five year permit term. Obviously this is not the case since the Aberdeen Mine has only recently been completely finished to this date. Plate 5-7 depicts the Aberdeen Mine with the surface facilities completed in early 1990. No new structures on the surface will be required to mine the Kenilworth Lease.

Underground rock tunnels access the Centennial Seam. See 1.1, 2.1-1, 2.1-4. Existing structures include the following:

Bathhouse (5)	14' x 60'
Mine Water Storage Tanks (3)	12' x 16'
Warehouse (1)	14' x 60'
Lamphouse (2)	40' x 40'
Substations (2)	60' x 100'
Office Building	28' x 60'
Mine Fans (4)	88"
Portals (15)	6' x 20'
Culinary Water Tanks (3)	12' x 10'
Shop	80' x 120'
Guard Shack	8' x 8'

The Aberdeen Mine surface facilities will include one additional bathhouse, and one lamphouse.

Upon completion of mining activities, the portals will be sealed according to existing state and federal regulations and all buildings and structures not being utilized as part of the reclamation sequence, will be removed.

R645-301-526.111. LOCATION

See R645-301-110.

R645-301-526.112. PLANS OR PHOTOGRAPHS

See R645-301-110.

R645-301-526.113. DATES OF CONSTRUCTION OF EXISTING STRUCTURES

See R645-301-110.

R645-301-526.114. MONITORING DATA

N/A

R645-301-526.115. COMPLIANCE PLAN

N/A

R645-301-526.115.1 DESIGN SPECIFICATION

See R645-301-525.110.

R645-301-526.115.2 CONSTRUCTION SCHEDULE

Construction Schedule

All of the above structures have been completed. The earthwork for the Aberdeen Mine was completed in 1989. The surface facilities were in early 1990. Construction has been located and carried out so as to prevent and control erosion, siltation, water pollution, and damage to property. All facilities have been designed and constructed and will be maintained and used in a manner which prevents damage to wildlife and related environmental values. Any future construction will be conducted in a similar manner according to regulations regarding protection of the hydrologic system, etc. The rock tunnels for the Centennial Seam development were constructed in the spring of 1990 and completed late in 1990. As previously discussed this mining will require no new surface facilities.

R645-301-526.115.3 MONITORING SCHEDULES

General Requirements

Most of the maps and plans previously submitted as part of the approved Mining and Reclamation Plan, are applicable. Where necessary, the original maps have been revised to indicate the lease in Hoffman Creek and the revisions are included in this submittal as figures or as plates in Volume II.

All categories within this section have been addressed, primarily in Volume II of the MRP which contains most of the plates.

a) Surface and subsurface ownership of lands contiguous to the permit area are shown on Plates 2 and 3.

b) The leases for which we have the legal right of entry are shown on Plate 4.

c) At this time all plates and maps have been revised to include all new leases and beyond these leases Andalex does not anticipate making application for additional permits in this five year permit term with the possible exception of a breakout and fan installation on a newly acquired right-of-way in the left fork of Deadman Canyon. The sequence of mining for the next five year permit term as it relates to

the entire permit area is shown on revised Plates 29, 30, 31, 41 to include the Hoffman lease, the Graves Lease and the AEP Lease.

d) There are no buildings within 1,000 feet of the permit area except those used as part of the mining operation. They are shown on Plate 5-7.

e) There are no surface or subsurface man-made features within, passing through or passing over the permit area except the powerline, telephone cables, culverts, and etc., installed for the operation of this mine. See Plate 5-7 for their locations.

f) These reference areas are shown on Plate 9 as R-1, R-3 and R-4. They are each 200 feet square approximately.

g) The only user of surface water within this hydrologic area is Andalex. The intake location for this water into the mine is located on Plate 5-7. Disturbed area runoff is collected in a culvert and taken directly into the mine. Andalex controls this water right. If a discharge were to occur from any sediment pond (this has yet to occur), it would discharge into the Deadman Canyon drainage (Plate 5-11) which is ephemeral.

h) County Road 299 starts at highway 6 in Price and terminates at Andalex Resources' minesite (Plate 1).

i) There are no public parks nor any cultural or historical sites eligible for listing in the National Register in or adjacent to the mine plan area.

j) There are no cemeteries or burial grounds in or within 100 feet of the permit area.

k) There is no land which is within the boundaries of any units of the National System of Trails or the Wild and Scenic Rivers System including study rivers.

R645-301-526.115.4 MINIMIZING RISK OR HARM TO ENVIRONMENT, HEALTH OR PUBLIC SAFETY

R645-301-526.116. PROTECTION OF PUBLIC AND LANDOWNERS

See R645-301-525 and R645-301-510.

R645-301-526.116.1 MINING OPERATIONS WITHIN 100 FEET OF THE RIGHT-OF-WAY OF A PUBLIC ROAD

County Road 299 begins at Highway 6 in Price and terminates at the minesite.

R645-301-526.116.2 RELOCATING A PUBLIC ROAD

N/A

R645-301-526.200. UTILITY INSTALLATION AND SUPPORT FACILITIES

Appendices G & I

R645-301-526.210. DESCRIPTION

Appendices G & I

R645-301-526.220. COMPLIANCE REQUIREMENTS

Appendices G & I

R645-301-526.221. PROTECTION

Appendices G & I

R645-301-526.222. MINIMIZATION OF ENVIRONMENTAL IMPACT AND COMPLIANCE WITH EFFLUENT LIMITATIONS

Appendices G & I

R645-301-526.300. WATER POLLUTION CONTROL FACILITIES

See R645-301-733..

R645-301-526.400. AIR POLLUTION CONTROL FACILITIES

Air Pollution Control Plan and Compliance with Air Quality Laws

Existing Environment

The permit area is located in a Class II air quality area.

Air Quality Impact Analysis

Please see the following section on Emission Estimates.

Emission Estimates

Emission estimates are included as Appendix F in the form of an emission inventory. This inventory has been reviewed and approved by the Utah Bureau of Air Quality and the E.P.A. It has been reapproved to increase our production restriction on the basis the haul road has been paved by Carbon County. Air quality permit in appendix F.

Proposed Controls

Since this is an underground operation, no air quality problems are anticipated. The only changes in air quality will be attributable to minor road dust and exhaust mine

dust. Methods of control are spray systems, chemical treatment, enclosures, pavement, and other fugitive dust control practices outlined in 30 CFR 817.95.

There will be no additional fugitive emissions or air pollution associated with the newly acquired AEP Lease.

PSD Permit and Compliance with Air Quality

Laws

The Environmental Protection Agency has determined that this project does not need a PSD air quality permit. This is based on our fugitive and non fugitive dust emissions inventory which assumes facilities necessary for 1.5 mm tons per year production. Further, the mine is not subject to the PSD regulations because of the new definition of a major source. (Refer to letter dated March 21, 1980 in Appendix J). All applicable air quality laws will be complied with and fugitive dust control practices, as required under 30 CFR 817.95, will be followed.

Andalex has been issued a new approval order for the mines and the Wildcat Loadout for 1.5 million tons per year. These were inspected and met compliance during the summers of 1989-1992.

Since this is an underground operation, no air quality problems are anticipated. The only changes in air quality will be attributable to minor road dust and exhaust mine dust. Methods of control are spray systems, chemical treatment, enclosures, pavement, and other fugitive dust control practices outlined in 30 CFR 817.95.

There will be no additional fugitive emissions or air pollution associated with the newly acquired AEP Lease.

R645-301-527. TRANSPORTATION FACILITIES

R645-301-527.100. ROAD CLASSIFICATION

All roads within the permit area are classified as "Primary Roads" in accordance with R614-301-527.100 or "Ancillary Roads" in accordance with R645-301-527.130. Roads on the site are of 2 typical designs:

1. Single-lane, gravel or asphalt surfaced roads approximately 12 - 15' wide; and

2. Double-lane, either gravel or asphalt surfaced roads, approximately 26' wide.

Although all roads on site are not used for coal hauling, each primary road is constructed to the respective typical design and dimensions shown on Plate 5-25.

All roads are shown on Plate 5-7 and Plate 8. Specifics about the road are described individually and include road widths, gradients and surfaces. Drainage ditches and drainage structures for each road (disturbed area ditches or culverts) can be found in Tables IV-2 through IV-8.

Because of the variance in road types, widths and lengths, the roads have been designated on Plate 5-7 with numbers (i.e. PR-1= Primary Road 1, Ar-1= Ancillary Road 1) to facilitate the description of each:

Primary Road 1 (PR-1) - This road connects Carbon County Road 199 to the two lane paved road which travels past the Aberdeen Mine facilities, past the office driveway and bath house drive ways and past the Pinnacle truck loadout. This is an asphalt surfaced road approximately 26 feet wide and 2700 feet long. The grade on PR-1 ranges from 4% to 8%. It is used for hauling coal and for men and material access to the mines.

Primary Road 2 (PR-2) - This road begins at the end of PR-1 and continues north past the shop/warehouse and ends at the eastern side of the Apex Mine stockpile. This is a two lane gravel surfaced road which is approximately 26 feet wide and 1400 feet long. It is treated annually with Magnesium Chloride. The grade on this stretch of road ranges from 5% to 9%. It is used for hauling coal and equipment as well as providing men and materials access to the mines.

Primary Road 3 (PR-3) - This road provides access to the Aberdeen Mine truck loadout. It is a single lane gravel surface road approximately 15 feet wide and 590 feet long. It is treated with Magnesium Chloride annually. The grade on this road ranges from 0% to 4%.

Primary Road 4 (PR-4) - This road provides access for the coal haul trucks to the Pinnacle Mine truck loadout. It is also crossed to access the bath house parking area. This is a single lane, paved surface road which is approximately 15 feet wide and 500 feet long. The grade on this loop ranges from 0% to 9%.

Primary Road 5 (PR-5) - This road provides access for the coal haul trucks coming off of PR-2 to the Apex Mine truck loadout. It is a single lane gravel surfaced road approximately 15 feet wide and 425 feet in length. The grade on this road ranges from 0% to 7%. It is treated annually with Magnesium Chloride. The three truck loadout roads are also accessed by front-end loaders for the purpose of cleaning up occasional coal spills.

Primary Road 6 (PR-6) - This is an access road which leads to the main office parking area. It is a single lane, paved surface road which is approximately 15 feet wide and 600 feet long. The average grade of this road is 5% to 7%.

Primary Road 7 (PR-7) - This is an access road for mining equipment. It provides heavy equipment access to and from the Aberdeen Mine. It begins at the south inlet to pond C and it ends at the bath house parking area. It is a gravel surfaced road and is approximately 12 feet wide and 450 feet long. It has grades which range from 4% to 14%. Magnesium Chloride is applied annually.

Primary Road 8 (PR-8) - This road leads from the fuel storage area at the Pinnacle Mine facility to the oil storage area near the upper Pinnacle portals. This is a single lane, gravel surface road approximately 15 feet wide and 325 feet long. The grade on this road has a range of 9% to 11%. It is treated with Magnesium Chloride annually.

Primary Road 9 (PR-9) - This road leads from PR-2 and turns west over the top of the Apex Mine conveyor belt. The road leads to the Apex Mine material storage area, adjacent to the mine fan. This is a single lane gravel surfaced road which is approximately 15 feet wide and 200 feet long and includes a steel deck bridge over the mine conveyor. The grade on this road ranges between 0% and 8%, and the gravel is treated with Magnesium Chloride.

Primary Road 10 (PR-10) - This is an access road which leads from the upper Aberdeen Mine material storage area down to the Aberdeen Mine stockpile pad. This is a short stretch of road which is approximately 12 feet wide and 150 feet long. It is a single lane road with an average grade of 12% to 15%.

Primary Road 11 (PR-11) - This is a very short access road which accesses the bath house pad from two directions; both from PR-1 and from PR-4. This road is approximately 12 feet wide and 150 feet long. It is a single lane road with a grade of 0% to 6%. This road is treated with magnesium chloride annually.

Ancillary Road 1 (AR-1) - This is an access road which leads from the south Aberdeen intake portal to the Aberdeen mine fan. It is a single lane road which has a surface of sandstone. The road is used primarily for access to the fan, water system and conveyor. This road is approximately 20 feet wide and 400 feet long. There is a steel deck bridge over the Aberdeen mine conveyor. The grade on this road ranges from 8% to 10%.

Ancillary Road 2 (AR-2) - This road leads from the upper Pinnacle Mine intake portals to the Pinnacle Mine fan. It is a single lane gravel surfaced road which has a steel deck bridge where the road crosses the Pinnacle Mine conveyor. Its primary use is to access the Pinnacle Mine fan. It is approximately 12 feet wide and 250 feet long. The grade on this road ranges from 0% to 12%.

Ancillary Road 3 (AR-3) - This road leads from PR-2 up to the Apex material storage area (Gun range). This is a single lane gravel surface road which is approximately 12 feet wide and 175 feet long. The grade on this road is on an average of 9%. It is treated with Magnesium Chloride annually. It is used primarily for access.

Ancillary Road 4 (AR-4) - This road is access from the upper Apex material storage area to the Powder Magazines. This road continues beyond the north end of our permit area but it becomes a private road beyond the permit area. This

is a single lane dirt road which is approximately 12 feet wide and 150 feet long. The grade on this short stretch of road is 5% to 8%.

Ancillary Road 5 (AR-5) - This road is access from Carbon County Road 299 to the left hand fork installation. This existing road will be upgraded adequately for maintenance and emergency access only. It will be equipped with a locked gate. This is a single lane dirt road which is approximately 15 feet wide and 4000 feet long. There will be 3 or 4 locations specifically widened so that two vehicles may pass. The grade on this stretch of road ranges from 0% to 15%. This road will be reclaimed upon cessation of mining pending the approval of Mrs. Gladys Artman.

Andalex commits to repair roads damaged by a catastrophic event as soon as practical according to R645-301-527.240. According to R645-301-534.100 Andalex has located, designed, constructed, used and maintained Primary Roads so as to prevent or control damage to private and public property. Andalex has used non-acid or non-toxic forming materials in road surfacing. Roads have, at a minimum a static safety factor of 1.3 on embankments. Andalex has a schedule and plan to remove roads that will not be retained as part of the approved post mining land use. Ancillary roads will be traveled only by light vehicles for routine access. Occasionally, they will be traveled by larger equipment but probably only in emergency or repair situations, as 2 of the 4 Ancillary Roads lead to fan installations. All Primary Roads will meet the requirements of R645-301-358, R645-301.527.100, R645-301-527.230, R645-301-534.100, R645-301-534.200, R645-301-542.600 and R645-301-762. Primary Roads will be located in so far as practical on the most stable available surfaces. The roads are surfaced with rock, gravel or asphalt according to R645-301-534.320. They will be routinely maintained, and have culverts which are designed and installed as necessary according to the requirements of R645-301-534.340.

Railroad

There are no existing or proposed railroad spurs on the property.

Other Transportation Facilities

The conveyor structures at the minesite are very standard cross member, bent designs. The Pinnacle conveyor is 180 feet in length and uses a 42" conveyor belt. It is covered with galvanized corrugated sheeting. The Pinnacle Truck Loadout is an under pile gravity feed reclaim system in 8 foot diameter sectioned steel tunnel for 90 feet and surfaces on the typical bent, steel structure for an additional 110 feet. The Apex truck loadout is identical to Pinnacle. The mine conveyor is also the same bent/cross member design with a 42" conveyor; however, it is 250 feet in length. The Aberdeen facility is equipped with conveyor facilities similar to that of Pinnacle with only slight variations in exact length anticipated or possible. These facilities will be completed in early 1990.

Revised 8/8/95

Transportation facilities such as roads have been addressed. The roads, Class II and I are to be removed upon cessation of mining by simple regrading and re-establishment of contours, unless surface owners request access through the mine area might remain.

Protection of the environment through the use of these facilities is achieved by speed controls (20 mph minesite). The conveyor structures as such do not impose environmental problems. Public safety obviously is a requirement of law including MSHA but also public safety is a requirement of Andalex Resources. Also the minesite is not frequented by any public outside of normal, weekly business hours.

R645-301-527.110. DESIGNATION OF ALL ROADS

See R645-301-527.

R645-301-527.120. PRIMARY ROADS

See R645-301-527.

R645-301-527.122. FREQUENT USE OR FOR PERIODS IN EXCESS OF 6 MONTHS

See R645-301-527.

R645-301-527.123. RETAINED FOR POSTMINING LAND USE

See R645-301-527.

R645-301-527.130. ANCILLARY ROADS

See R645-301-527.

R645-301-527.200. TRANSPORTATION FACILITIES

Revised 8/8/95

R645-301-527.210. DESIGNS AND SPECIFICATIONS

See R645-301-527.

R645-301-527.220. RELOCATION OF A NATURAL DRAINAGEWAY

N/A

R645-301-527.230. MAINTENANCE AND REPAIRS

N/A

R645-301-527.240. GEOTECHNICAL ANALYSIS

Roads and road cuts in this permit area are typical of others within the county and other mine access roads. No alternative specifications have been requested, therefore the geotechnical analysis is not required.

R645-301-528. HANDLING AND DISPOSAL OF COAL, OVERBURDEN, EXCESS SPOIL, AND COAL MINE WASTE

As raw coal is hauled from the permit area, there will be no processing waste and no return of processing waste to underground workings. If in the future it is decided that a processing facility is to be incorporated, waste or reject would taken to an approved refuse disposal site. Please note that underground development waste rock generated by the Centennial Seam rock tunnels was disposed of underground in the existing Pinnacle Mine workings.
See R645-301-528.300.

R645-301-528.100. COAL REMOVAL, HANDLING, STORAGE, CLEANING, AND TRANSPORTATION AREAS AND STRUCTURES

Coal Handling Facilities

Stockpiles

Coal is discharged from the conveyor onto a coal stockpile in the Raw Coal Stockpile Area indicated as on Plate 5-7. This is a live stockpile as opposed to a storage pile. It should be noted that when the Centennial Seam is mined it is transferred underground to existing Pinnacle Mine conveyors and therefore, ends up in the Pinnacle Mine stockpile.

Loadout

Coal is loaded from the stockpile by an electronic automatic loadout into 40 ton coal trucks and hauled to Wildcat Jct. which is on the Utah Railroad.

Preparation Plant

A coal cleaning facility will not be used. However, by the new definition of a preparation plant, the Wildcat Loadout now comes under the SMCRA and a plan has been approved under ACT 007/033.

Removal of Surface Structures

Upon completion of mining activities, all surface facilities will be removed. The coal pile area will be filled, the slope contoured, compacted, topsoil replaced, regraded, and revegetated. In the materials storage and building areas, all structures and foundations including the shop, office building, bathhouse, substation, and water storage tanks, will be removed, re-contoured, compacted, topsoil replaced and graded, and revegetated according to revegetation procedures described in this chapter.

R645-301-528.200. OVERBURDEN

R645-301-528.300. SPOIL, COAL PROCESSING WASTE, MINE DEVELOPMENT WASTE, AND NON-COAL WASTE REMOVAL

Underground Development Waste

There has been no development waste or excess spoil to date excepting sedimentation pond material.

Coal Waste

Coal Processing Waste

The only coal processing waste to date is rock material manually separated from Andalex Resources' lump coal product at Wildcat. This is currently placed in an approved area at Wildcat Loadout. This MRP contains an Appendix Q. Appendix Q references the plan for reclamation of the waste rock pile at the Wildcat Loadout and should not be confused with the Centennial Reclamation Plan. Disposal of sediment pond material (temporary and permanent) is shown on Plate 5-7. Sediment pond waste has already been tested in one case to be non toxic and non acid forming and is being used currently in the Aberdeen Mine fill areas. Other material which is generated will be placed in temporary storage above the Apex Mine as shown on Plate 5-7 and will be disposed of permanently as back fill in high walls upon final reclamation. This material will be tested prior to final reclamation if used for final reclamation purposes. Based on previous experience, Andalex estimates that up to 3,000 yards of material at most will be generated. This material is included in the earthwork estimates. Please note that the rock tunnels constructed to the Centennial coal seam generated significant amounts of waste rock. One hundred percent of this waste rock was disposed of underground in the existing Pinnacle Mine. None of the waste rock appeared at the surface.

Coal Refuse

Please refer to Plate 5-7 for location of disposal areas.

Acid and Toxic-Forming Materials

The only spoil material which has been developed from the minesite is sediment pond waste. It has been determined that this material is non-toxic or acid-forming and that it may be used in a fill situation (see Appendix H). Samples are currently being further analyzed to determine whether they are toxic or acid forming. These materials include mid seam, roof, and floor material. Appendices E and H currently contain the majority of the information necessary to determine whether roof, floor, or mid seam material is acid or toxic forming. If any roof rock from the Aberdeen Mine is developed, it will be disposed of underground or in one of the underground development waste storage areas depicted on Plate 5-7. Some coal development waste has been used as a stock pile pad for the Aberdeen Mine. This material will be treated as coal mine development waste upon reclamation and back filled into our high wall areas.

Future pond accumulations for the entire mine site will be stored at least temporarily on the material storage site located above the Apex Mine or in the now

defunct Pond A. depicted as "temporary excess spoil and mine development waste" and shown on Plate 5-7. Please see Plate 5-7.
Andalex will analyze the mid-seam of all four coal seams in addition to the roof and floor material on an annual basis or more frequently if mining operations change which could result in a modification to the roof floor or the mid-seam. Andalex will use this monitoring program in conjunction with the new AEP Lease. Andalex will make an effort to sample the material in the vicinity of section corners which occur within our leases.
Andalex agrees to monitor for acid or toxic forming materials according to Table 6, "Guidelines for Management of Topsoil and Overburden for Underground and Surface Coal Mining". These parameters will prove pH, Electrical Conductivity, Saturation Percentage, Particle Size Analysis, Soluble Ca, Mg and Na, Sodium Adsorption Ratio, Selenium, Total N, Nitrate-N, Boron, Maximum Acid Potential, Neutralization Potential, Organic Carbon, Exchangeable Sodium, Available Water Capacity, and Rock Fragments. These parameters will be measured by acceptable methods at a qualified commercial testing laboratory.
There is no equipment located within our permit area which contain any of the substances listed by the Toxic Substances and Control Act, particularly PCB's. All transformers and OCB's are relatively new and are PCB free.
The storage of petroleum products on site is done in such a manner that hazards from spillage are minimal. Andalex operates with an SPCC Plan approved by a registered professional engineer (Appendix S). It is inevitable that during the course of operations, small amounts of oil and fuel will be accidently spilled and soaked up by soils and gravels. Andalex proposes to designate a specific area within our disturbed area at which contaminated soils or gravels will be brought, spread out, and aerated using only solar heat. We propose this area to be south of the Aberdeen truck loadout. The area will be small, however, it will be bermed to avoid runoff while the aeration process is ongoing. Once the aeration process is complete and the material is satisfactorily decontaminated, it will be used again as fill or hauled to our waste disposal area.
Another possibility is the use of bioremediation. As this process is still being tested, Andalex does not propose to use this method at this time. However, should the method prove successful and acceptable, Andalex will consider using the process.

At the time of final reclamation, Andalex will need to treat or dispose of small quantities of soils and gravels which have been contaminated with oil and/or fuel. At final reclamation, Andalex will utilize the best available technology (BAT) to treat this quantity of soil and gravel in order that it is suitable for fill material. This would include methods for removing volatile matter and other contaminants. Should it prove at that time that best available technology is inadequate for decontamination, Andalex will dispose of this material at an approved disposal site (not within the permit area). This site would be approved by State Health and EPA for the disposal of this type of material.

Non-Coal Waste

Non-coal waste consists of lubricants, paints garbage, timber, and other waste generated during mining. Please refer to Plate 5-7 for the location of non-coal waste disposal (dumpsters).

Combustible Materials

No special measures are required. All combustibles (paper, etc.), are collected in trash containers and hauled to local city and land fill areas. Andalex currently operates under an SPCC Plan approved by a registered professional engineer. All materials such as oil and grease will be disposed of according to specific local requirements. All used motor oil is collected in 55 gallon drums and is recycled by local oil distributors. All used oils are recycled.

Contingency Plans to Prevent Sustained Combustion

All which could burn would be small in quantity and consist of mine trash. The trash facility is segregated and if ignited accidentally, could be extinguished using either water or fire extinguishers.

R645-301-528.310. EXCESS SPOIL

See R645-301-528.300.

R645-301-528.320. COAL MINE WASTE

See R645-301-528.300.

R645-301-528.321. RETURN OF COAL PROCESSING WASTE TO ABANDONED UNDERGROUND WORKINGS

See R645-301-528.300.

R645-301-528.322. REFUSE PILES

N/A

R645-301-528.323. BURNING AND BURNED WASTE UTILIZATION

N/A

R645-301-528.323.1 COAL MINE WASTE FIRES

In the unlikely event that any coal mine waste, including boney material or fine coal waste, were to ignite the fire would be extinguished in the same way that coal stockpile fires are extinguished. That is, the material will be dug out with front-end loaders, spread out on the ground inside the permit area, and be compacted. The material would then be returned to the waste storage area.

R645-301-528.323.2 BURNING OR BURNED COAL MINE WASTE REMOVAL PLAN

N/A

R645-301-528.330. NON-COAL MINE WASTE

See R645-301-528.300.

R645-301-528.331. DESIGNATION OF NON-COAL MINE WASTE MATERIALS

See R645-301-528.300.

R645-301-528.332. FINAL DISPOSAL OF NON-COAL MINE WASTES

See R645-301-528.300.

R645-301-528.333. RESTRICTIONS ON DISPOSAL ON NON-COAL MINE WASTE MATERIAL

See R645-301-528.300.

R645-301-528.334. HAZARDOUS WASTE MATERIALS

See R645-301-528.300.

R645-301-528.340. UNDERGROUND DEVELOPMENT WASTE

See R645-301-528.300.

R645-301-528.350. DISPOSAL REQUIREMENTS

See R645-301-528.300.

R645-301-528.400. DAMS, EMBANKMENTS AND OTHER IMPOUNDMENTS

See R645-301-528.300.

R645-301-529. MANAGEMENT OF MINE OPENINGS

See R645-301-528.300.

R645-301-529.100. CLOSURE OF MINE OPENINGS

Abandonment of Portals and Underground Workings

Introduction

Upon completion of mining activities, the portals will be sealed according to existing state and federal regulations. Conveyors will be removed and pads filled. The slope will be contoured, compacted, and topsoil replaced and graded.

The final sealing of mine openings will be accomplished by placing a recessed concrete block seal 25 to 50 feet from the mouth of the portal. Since a portion of the mine slopes towards the portals, and mine water is present, seals will be constructed with at least one drainage pipe in the lowest portal. This pipe shall be a schedule 80 - 4" PVC, with a U-tube water trap and a valve or cap on the end. The pipe will be extended beyond the portal backfill. The area from the seals to the mouth of the portals will be backfilled. The portal structures will be removed and the exposed coal seam, including portal area, will be covered during reclamation. Please note that the Centennial Seam Mine will not require any new portals on the surface.

If a discharge is found to occur after sealing, the water will be sampled quarterly for compliance with effluent standards of 817.42 and treated (if necessary) during the liability period. See Figures IV-1 and IV-2 for portal sealing details.

It is very unlikely that a mine discharge will occur from any of the permanently sealed mine portals, although each seal will be equipped with a drainage pipe described above. To date, Andalex has encountered dry mining conditions and all portals in all three mines drift into the mountain in a down dip direction. If a discharge were to occur, it would only be after the entire pillared out workings had filled first. Then only would the static head against the seal allow any discharge. There is no way of knowing or estimating the mine discharge rate.

As maintained above, Andalex will monitor any discharge. Andalex's existing NPDES allows for a certain volume of mine discharge. This permit will be maintained after cessation of mining for the liability period until the bond is released.

The blowing fan ventilation shaft will be sealed by completely backfilling it from bottom to top. This shaft is 370' deep by 16' diameter, and will require approximately 2,755 cubic yards of backfill material. This backfill material will be hauled in from an offsite commercial gravel pit. See Appendix Y for reclamation information regarding the Ventilation Shaft/Blowing Fan Installation.

Temporary Cessation

Whenever it is known that operations are to be temporarily ceased for more than 30 days, Andalex Resources will submit to the Division a notice of intention to cease or abandon the operations, in accordance with MSHA standards.

Figure IV-1
Typical Portal Sealing

INSERT ORIGINAL DRAWING

Typical Portal Seal
Figure IV-2

INSERT ORIGINAL DRAWING

This notice will describe mitigation measures to be employed in accordance with the terms and conditions of the permit approval, such as a statement of the number of surface areas involved in the cessation, extent of sub-surface strata, prior reclamation efforts accomplished on the property, and identification of all backfilling, regrading, revegetation, environmental monitoring, underground opening closures and water treatment activities that will continue during the temporary cessation.

Temporary closing of underground workings will be accomplished with chain link fence material as recommended by MSHA. This prevents access by unauthorized individuals during idol periods. It is not anticipated that once Andalex reaches its peak production that this will occur.

If underground openings are to remain inactive for a period greater than 90 days, such openings will be temporarily closed off from access. Such closures will consist of a chain link or other substantial wire mesh fabric fence placed over the portals to prevent public access while allowing for air flow. Locked gates may be installed in the portal to allow for mine inspection.

Casing and Sealing of Drill Holes

All exploratory drill holes have been sealed with cement and all water wells have been cased with steel casing and will be maintained. After mining is completed, the water wells and monitoring wells will be sealed except in the event the state engineer allows them to remain opened for other purposes.

R645-301-529.200. UNDERGROUND MINING OPERATIONS

R645-301-529.210. TEMPORARILY INACTIVE OPERATIONS

See R645-301-515.300.

R645-301-529.220. RETURN UNDERGROUND DEVELOPMENT WASTE, COAL PROCESSING WASTE OR WATER TO UNDERGROUND WORKINGS

See R645-301-515.300.

R645-301-529.300. HOLES USED FOR BLASTING

N/A

R645-301-529.400. SURFACE MINING OPERATIONS

N/A

R645-301-530. OPERATIONAL DESIGN CRITERIA AND PLANS

R645-301-531. GENERAL

Schedule of Construction, Mine Development, Mining and Reclamation

All surface facilities have been constructed for the Pinnacle, Apex and Aberdeen Mines. Earthwork for the Aberdeen Mine was completed in 1989. The surface facilities for the Aberdeen Mine were completed in early 1990. No additional surface facilities are required for any new leases. There will be no additional construction activities or surface disturbance whatsoever in Hoffman Creek or Alrad Canyon.

However, Andalex does intend to add a fan installation in the left-hand fork of Deadman Canyon at some point in time. This installation will be according to measures outlined by the Bureau of Land Management as part of Right-of-Way U-64158. (Copy of Right-of-Way is included in Appendix B.) Andalex will submit detailed plans for this installation at the appropriate time. The location of this breakout is shown on Plate 5-19 (R.O.W.).

Mining in the Gilson seam began in October, 1980 with a single unit's production. As mining progresses, additional units will be added with three production units and the longwall scheduled to be operating by mid-1994. A systematic mining plan will be followed to assure maximum recovery. All planning and scheduled production, however, will be contingent upon the coal market. Upon the conclusion of mining activities in the area, the scheduled reclamation phase will begin immediately.

Andalex will fill, regrade and stabilize rills and gullies over 9 inches in depth. Further, Andalex has agreed to interim stabilization of all slopes and embankments within the disturbed area and has done so. One slope located at the bottom of the office driveway, has been attempted through hydroseeding, fertilizing and mulching techniques on three separate occasions. No significant erosion problems have occurred, Andalex will notify the Division in the event of any slides or other damage immediately by telephone and in writing.

Andalex will cover acid or toxic forming materials if any are encountered.

Andalex will advise the Division in the event of a temporary shutdown, such as a letter sent to the Division when Andalex's Apex Mine was temporarily closed.

R645-301-532. SEDIMENT CONTROL

See R645-301-733.

R645-301-532.100. MINIMIZING DISTURBANCES

Surface disturbances are minimal due to the nature of the mining activities. The permit area has been previously impacted by mining. Surface disturbances will be limited to the existing facilities which have been constructed. The total existing surface area disturbed is 47.19

Existing facilities are indicated on Plate 5-7 and 7.

The land affected by mining operations which shall be reclaimed, in compliance with the Mining and Reclamation Plan and all requirements of the Mined Land Reclamation Act and Rules and Regulations adopted in accordance therewith, can be described as follows:

47.19 acres located in T13S, R11E, S.L.B.&M., Carbon County, Utah and contained within,
SE 1/4 SW 1/4 Section 7
NE 1/4 SW 1/4 Section 7
SW 1/4 SE 1/4 Section 7
NW 1/4 SE 1/4 Section 7
SW 1/4 NE 1/4 Section 7
NE 1/4 NW 1/4 Section 18
NW 1/4 NE 1/4 Section 18

R645-301-532.200. STABILIZING BACKFILLED MATERIAL

Backfilling, Grading, and Soil Replacement and Stabilization

All disturbed areas will be backfilled and graded to as near as possible the approximate original contour, and to the most moderate slope possible. Slopes shall not exceed the angle of repose or such lessor slopes as required by the regulatory authority to maintain stability. Fill material will be compacted to assure stability.

Andalex has had a slope stability study performed on a fill pad with a slope greater than 2h:1v and it was determined, even prior to compaction, that the fill had an adequate safety factor. Refer to Appendix K for this study done at the Pinnacle Mine. Andalex has committed to five years of monitoring of this site or whatever amount of time is necessary to assure stability of slopes has been achieved. It should be noted that all highwalls on Andalex's minesite are in or will be in bedrock. This is a steep sided, narrow canyon and Andalex will not be relieved of liability until reasonable stability has been achieved through compaction and revegetation. Steep slopes will be reclaimed according to the approved plan shown on Plates 14 and 15.

Areas to be regraded include the portal site, surface facility siteand roads. Because of the diversity of these areas, all regrading will conform to the specific site. Specific to high wall areas, some of the back filling will include excess spoil and underground development waste. We estimate this may be as much as 3000 yards of material. Please refer to Plate 5-9 addendum for a detailed drawing on the high wall areas. The Aberdeen Mine high wall has been redrawn and back fills recalculated. Where slopes are greater than 2 to 1, before final reclamation is completed, slope stability studies will be performed as necessary. All information for slope stability studies will be included as part of the final reclamation package.

Where possible, all final grading and placement of topsoil will be done along the contour to minimize erosion. In all cases, grading will be conducted in a manner which minimizes erosion and provides a stable surface for the placement of topsoils.

Topsoil existing on site will be spread using a grader. Where possible, the soil will be distributed along the contour. The thickness of the re-established soil will be consistent with soils in the vicinity and will be sufficient to support vegetation equal to or superior to pre-mining history, 6".

Andalex will rip the subsurface material to 6" using most likely a toothed motor grader or a disc, prior to soil redistribution.

Andalex will mix one ton of alfalfa per acre with its topsoil material to aid in aeration, microbiological community development, and water holding capacity.

Andalex will distribute topsoil to a minimum depth of 6" as previously stated.

Andalex has already committed to testing of redistributed soil and fill material and has committed to use proper additives if it is discovered necessary. Specifically, Andalex will test for organic matter, phosphorous, potassium, pH, conductivity, and texture. The samples will be taken at 0-6 inches, 6-12 inches, and 12-24 inches at least 90 days prior to final reclamation.

R645-301-533. IMPOUNDMENTS

See R645-301-733..

R645-301-533.100. STABILITY

See R645-301-733..

R645-301-533.200. FOUNDATION DESIGN

Appendix K

R645-301-533.210. STABILITY

Appendix K

R645-301-533.220. PREPARATION

Appendix K

R645-301-533.300. SLOPE PROTECTION

See R645-301-532.200.

R645-301-533.400. VEGETATION OF EMBANKMENTS

See R645-301-532.200.

R645-301-533.500. SUBMERGED HIGHWALLS

N/A

R645-301-533.600. MSHA IMPOUNDMENTS

N/A

R645-301-533.610. GEOTECHNICAL INVESTIGATIONS

N/A

R645-301-533.620. ENGINEERING DESIGN

See R645-301-733..

R645-301-533.700. NON-MSHA IMPOUNDMENTS DESIGN REQUIREMENTS

See R645-301-733..

R645-301-534. ROADS

See R645-301-512.250.

R645-301-534.100. DESIGN, USE AND RECLAMATION

See R645-301-512.250.

R645-301-534.110. DAMAGE TO PUBLIC OR PRIVATE PROPERTY

See R645-301-512.250.

R645-301-534.120. NON-ACID OR NONTOXIC FORMING SUBSTANCES IN ROAD SURFACING

No acid or toxic-forming substances will be used for road surfacing.

R645-301-534.130. FACTOR OF SAFETY FOR ROAD EMBANKMENTS

See R645-301-512.250.

R645-301-534.200. SAFETY AND ENVIRONMENTAL PROTECTION

See R645-301-512.250.

R645-301-534.300. PRIMARY ROADS

See R645-301-512.250.

R645-301-534.310. LOCATION

See R645-301-512.250.

R645-301-534.320. SURFACING

See R645-301-512.250.

R645-301-534.330. MAINTENANCE

See R645-301-512.250.

R645-301-534.340. CULVERT DESIGN

See R645-301-512.250.

R645-301-535. SPOIL

See R645-301-513.300.

R645-301-535.100. DISPOSAL OF EXCESS SPOIL

See R645-301-513.300.

R645-301-535.110. MINIMUM FACTOR OF SAFETY

N/A

R645-301-535.111. LOCATION

N/A

R645-301-535.112. FOUNDATION INVESTIGATIONS

N/A

R645-301-535.113. KEYWAY CUTS OR ROCK TOE BUTTRESSES

N/A

R645-301-535.120. EXCESS SPOIL DISPOSED OF IN UNDERGROUND MINE WORKINGS

Return of Coal Processing Waste to Abandoned Underground Workings

As raw coal is hauled from the permit area, there will be no processing waste and no return of processing waste to underground workings. If in the future it is decided that a processing facility is to be incorporated, waste or reject would taken to an approved refuse disposal site. Please note that underground development waste rock generated

by the Centennial Seam rock tunnels was disposed of underground in the existing Pinnacle Mine workings.

R645-301-535.130. PLACEMENT OF EXCESS SPOIL

There has been no development waste or excess spoil to date excepting sedimentation pond material.

Coal Processing Waste

The only coal processing waste to date is rock material manually separated from Andalex Resources' lump coal product at Wildcat. This is currently placed in an approved area at Wildcat Loadout. This MRP contains an Appendix Q. Appendix Q references the plan for reclamation of the waste rock pile at the Wildcat Loadout and should not be confused with the Centennial Reclamation Plan. Disposal of sediment pond material (temporary and permanent) is shown on Plate 5-7. Sediment pond waste has already been tested in one case to be non toxic and non acid forming and is being used currently in the Aberdeen Mine fill areas. Other material which is generated will be placed in temporary storage above the Apex Mine as shown on Plate 5-7 and will be disposed of permanently as back fill in high walls upon final reclamation. This material will be tested prior to final reclamation if used for final reclamation purposes. Based on previous experience, Andalex estimates that up to 3,000 yards of material at most will be generated. This material is included in the earthwork estimates. Please note that the rock tunnels constructed to the Centennial coal seam generated significant amounts of waste rock. One hundred percent of this waste rock was disposed of underground in the existing Pinnacle Mine. None of the waste rock appeared at the surface.

Coal Refuse

Please refer to Plate 5-7 for location of disposal areas.

R645-301-535.140. SURFACE COAL OPERATIONS

N/A

R645-301-535.141. GEOLOGIC CONDITIONS

N/A

R645-301-535.142. SEEP AND SPRING SURVEY

N/A

R645-301-535.143. EFFECTS FROM SUBSIDENCE

N/A

R645-301-535.144. **ROCK CHIMNEY CORES OR DRAINAGE BLANKETS**

N/A

R645-301-535.145. **STABILITY ANALYSIS**

N/A

R645-301-535.150. **SURFACE MINING OPERATIONS**

N/A

R645-301-535.151. **TEST BORINGS**

N/A

R645-301-535.152. **ENGINEERING SPECIFICATIONS FOR ROCK TOE BUTTRESS OR KEYWAY CUTS**

N/A

R645-301-535.200. **DISPOSAL OF EXCESS SPOIL: VALLEY FILLS / HEAD-OF-HOLLOW FILLS**

N/A

R645-301-535.210. **ROCK CORE CHIMNEY DRAINS**

N/A

R645-301-535.220. **DESIGN AND CONSTRUCTION OF THE FILL**

N/A

R645-301-535.221. **DESIGN REQUIREMENTS**

N/A

R645-301-535.222. **FILTER SYSTEM**

N/A

R645-301-535.223. **GRADING AND DRAINAGE**

N/A

R645-301-535.300. **DISPOSAL OF EXCESS SPOIL: DURABLE ROCK RILLS**

N/A

R645-301-535.310. RESTRICTION

N/A

R645-301-535.320. REQUIREMENTS

N/A

R645-301-535.330. FACTOR OF SAFETY

N/A

R645-301-535.340. UNDERDRAIN SYSTEMS

N/A

R645-301-535.400. DISPOSAL OF EXCESS SPOIL: PRE-EXISTING BENCHES

N/A

R645-301-535.410. PLACEMENT

All disturbed areas will be backfilled and graded to as near as possible the approximate original contour, and to the most moderate slope possible. Slopes shall not exceed the angle of repose or such lessor slopes as required by the regulatory authority to maintain stability. Fill material will be compacted to assure stability.

Andalex has had a slope stability study performed on a fill pad with a slope greater than 2h:1v and it was determined, even prior to compaction, that the fill had an adequate safety factor. Refer to Appendix K for this study done at the Pinnacle Mine. Andalex has committed to five years of monitoring of this site or whatever amount of time is necessary to assure stability of slopes has been achieved. It should be noted that all highwalls on Andalex's minesite are in or will be in bedrock. This is a steep sided, narrow canyon and Andalex will not be relieved of liability until reasonable stability has been achieved through compaction and revegetation.

Areas to be regraded include the portal site, surface facility site and roads. Because of the diversity of these areas, all regrading will conform to the specific site. Specific to high wall areas, some of the back filling will include excess spoil and underground development waste. We estimate this may be as much as 3000 yards of material. Please refer to Plate 5-9 addendum for a detailed drawing on the high wall areas. The Aberdeen Mine high wall has been redrawn and back fills recalculated. Where slopes are greater than 2 to 1, before final reclamation is completed, slope stability studies will be performed as necessary. All information for slope stability studies will be included as part of the final reclamation package.

Where possible, all final grading and placement of topsoil will be done along the contour to minimize erosion. In all cases, grading will be conducted in a manner which minimizes erosion and provides a stable surface for the placement of topsoils.

Topsoil existing on site will be spread using a grader. Where possible, the soil will be distributed along the contour. The thickness of the re-established soil will be consistent with soils in the vicinity and will be sufficient to support vegetation equal to or superior to pre-mining history, 6".

Andalex will rip the subsurface material to 6" using most likely a toothed motor grader or a disc, prior to soil redistribution.

Andalex will mix one ton of alfalfa per acre with its topsoil material to aid in aeration, microbiological community development, and water holding capacity.

Andalex will distribute topsoil to a minimum depth of 6" as previously stated.

Andalex has already committed to testing of redistributed soil and fill material and has committed to use proper additives if it is discovered necessary. Specifically, Andalex will test for organic matter, phosphorous, potassium, pH, conductivity, and texture. The samples will be taken at 0-6 inches, 6-12 inches, and 12-24 inches at least 90 days prior to final reclamation.

R645-301-535.420. DESIGN

N/A

R645-301-535.430. GRADING AND HIGHWALL ELIMINATION

See R645-301-535.410.

R645-301-535.440. GRAVITY TRANSPORTATION

N/A

R645-301-535.441. HAZARDS

See R645-301-535.410.

R645-301-535.442. STABILITY

See R645-301-535.410.

R645-301-535.443. SAFETY BERMS

Appendix K

R645-301-535.444. FINAL DISPOSITION

See R645-301-535.410.

R645-301-535.500. FACEUP OPERATIONS

See R645-301-535.410.

R645-301-536. COAL MINE WASTE

See R645-301-528.300.

R645-301-536.100. DISPOSAL FACILITY

See R645-301-528.300.

R645-301-536.110. STABILITY

N/A

R645-301-536.120. FOUNDATION DESIGN

N/A

R645-301-536.200. PLACEMENT

See R645-301-528.300.

R645-301-536.210. CONSTRUCTION

See R645-301-528.300.

R645-301-536.220. PUBLIC HAZARDS

See R645-301-528.300.

R645-301-536.230. PREVENT COMBUSTION

See R645-301-528.300.

R645-301-536.300. COAL MINE WASTE DISPOSED OF IN EXCESS SPOIL FILLS

See R645-301-528.300.

R645-301-536.310. REQUIREMENTS

See R645-301-528.300.

R645-301-536.320. NONTOXIC AND NON-ACID FORMING

See R645-301-528.300.

R645-301-536.330. DESIGN STABILITY

See R645-301-528.300.

R645-301-536.400. OTHER REQUIREMENTS

See R645-301-528.300.

R645-301-536.410. RESTRICTIONS

N/A

R645-301-536.420. DESIGN PLAN

See R645-301-528.300.

R645-301-536.500. DISPOSAL OF COAL MINE WASTE IN SPECIAL AREAS

N/A

R645-301-536.510. OUTSIDE A PERMIT AREA

N/A

R645-301-536.520. UNDERGROUND DISPOSAL

See R645-301-528.300.

R645-301-536.600. UNDERGROUND DEVELOPMENT WASTE

See R645-301-528.300.

R645-301-536.700. COAL PROCESSING WASTE

See R645-301-528.300.

R645-301-536.800. COAL PROCESSING WASTE EMBANKMENTS

N/A

R645-301-536.810. REQUIREMENTS

N/A

R645-301-536.820. MSHA REQUIREMENTS

N/A

R645-301-821. BORINGS AND TEST PITS

N/A

R645-301-536.822. FOUNDATION DESIGN

N/A

R645-301-536.823. SEEP AND SPRING SURVEYS

N/A

R645-301-536.824. HAZARDS

N/A

R645-301-536.900. REFUSE PILES

N/A

R645-301-537. REGRADED SLOPES

See R645-532.200.

R645-301-537.100. GEOTECHNICAL ANALYSIS

See R645-532.200.

R645-301-537.200. REGRADING SETTLED AND REVEGETATED FILLS

See R645-532.200.

R645-301-537.210. RESTRICTIONS

N/A

R645-301-537.220. LOCATION

See R645-532.200.

R645-301-537.230. STABILITY

See R645-532.200.

R645-301-537.240. VEGETATION AND SURFACE RUNOFF CONTROL

See R645-532.200.

R645-301-537.250. HAZARDOUS CONDITIONS

See R645-532.200.

R645-301-540. RECLAMATION PLAN

See R645-532.240.

R645-301-541. GENERAL

See R645-532.240.

R645-301-541.100. CESSATION OF MINING OPERATIONS

See R645-532.240.

R645-301-541.200. REMOVAL OF FACILITIES

See R645-532.240.

R645-301-541.300. POSTMINING FACILITIES AND MONITORING

See R645-301-711.500

R645-301-541.400. COMPLIANCE REQUIREMENTS FOR RECLAMATION

See R645-301-240.

R645-301-542. NARRATIVES, MAPS AND PLANS

See R645-301-510.

R645-301-542.100. TIMETABLE

See R645-301-240.

R645-301-542.200. BACKFILLING AND GRADING PLAN

See R645-301-532.200.

R645-301-542.300. FINAL SURFACE CONFIGURATION MAPS

Plates 16 & 17

R645-301-542.310. CERTIFICATION REQUIREMENTS

The maps and cross sections found in R645-301-521.140 have been certified as required.

R645-301-542.320. PERMANENT FACILITIES

R645-301-542.400. FINAL ABANDONMENT OR BOND RELEASE

R645-301-542.500. IMPOUNDMENTS AND EMBANKMENTS

See R645-301-733.

R645-301-542.600. ROADS

Roads not to be retained for use under an approved post mining land use will be reclaimed immediately after it is no longer needed for mining and reclamation operations.

R645-301-542.610. CLOSURE

See R645-301-240.

R645-301-542.620. REMOVAL OF BRIDGES AND CULVERTS

Upon completion of mining activities, and following removal of surface structures, the earthwork portion of the reclamation plan will begin as described. The hydrologic portion of reclamation will take place in two phases including the left fork fan installation:

1. The main and side drainage channels will be restored as shown in the Sedimentation and Drainage Control Plan, and on Plate 16. Loose rock check dams will be placed at each side drainage entrance onto the reclaimed area, and at approximately 500' intervals along the restored main channel RC-1. (Typical sections of the loose rock check dams are shown in the Sedimentation and Drainage Control Plan).

   All disturbed diversions and sediment ponds "B" and "C" will also be removed at this time. Sediment Pond "E" will be enlarged, and the entire drainage above will flow into Pond "E-PM" through the restored channel RC-1.

2. Once revegetation and water quality standards are met, Pond "E-PM" will be removed, and the area reclaimed.

   Surface water monitoring will continue during this time as described. Please see Figure IV-11.

R645-301-542.630. TOPSOIL REPLACEMENT AND Revegetation

Backfilling, Grading, and Soil Replacement and Stabilization

All disturbed areas will be backfilled and graded to as near as possible the approximate original contour, and to the most moderate slope possible. Slopes shall not exceed the angle of repose or such lessor slopes as required by the regulatory authority to maintain stability. Fill material will be compacted to assure stability.

Andalex has had a slope stability study performed on a fill pad with a slope greater than 2h:1v and it was determined, even prior to compaction, that the fill had an adequate safety factor. Refer to Appendix K for this study done at the Pinnacle Mine. Andalex has committed to five years of monitoring of this site or whatever amount of time is necessary to assure stability of slopes has been achieved. It should be noted that all highwalls on Andalex's minesite are in or will be in bedrock. This is a steep sided, narrow canyon and Andalex will not be relieved of liability until reasonable stability has been achieved through compaction and revegetation.

Areas to be regraded include the portal site, surface facility site and roads. Because of the diversity of these areas, all regrading will conform to the specific site. Specific to high wall areas, some of the back filling will include excess spoil and underground development waste. We estimate this may be as much as 3000 yards of material. Please refer to Plate 5-9 addendum for a detailed drawing on the high wall areas. The Aberdeen Mine high wall has been redrawn and back fills recalculated. Where slopes are greater than 2 to 1, before final reclamation is completed, slope stability studies will be performed as necessary. All information for slope stability studies will be included as part of the final reclamation package.

Where possible, all final grading and placement of topsoil will be done along the contour to minimize erosion. In all cases, grading will be conducted in a manner which minimizes erosion and provides a stable surface for the placement of topsoils.

Topsoil existing on site will be spread using a grader. Where possible, the soil will be distributed along the contour. The thickness of the re-established soil will be consistent with soils in the vicinity and will be sufficient to support vegetation equal to or superior to pre-mining history, 6".

Andalex will rip the subsurface material to 6" using most likely a toothed motor grader or a disc, prior to soil redistribution.

Andalex will mix one ton of alfalfa per acre with its topsoil material to aid in aeration, microbiological community development, and water holding capacity.

Andalex will distribute topsoil to a minimum depth of 6" as previously stated.

Andalex has already committed to testing of redistributed soil and fill material and has committed to use proper additives if it is discovered necessary. Specifically, Andalex will test for organic matter, phosphorous, potassium, pH, conductivity, and texture. The samples will be taken at 0-6 inches, 6-12 inches, and 12-24 inches at least 90 days prior to final reclamation.

R645-301-542.700. FINAL ABANDONMENT OF MINE OPENINGS AND DISPOSAL AREAS

Plates 6, 16, & 17

R645-301-542.710. DESCRIPTION

See R645-301-515.300.

R645-301-542.720. DISPOSAL OF EXCESS SPOIL

See R645-301-513.300.

R645-301-542.730. DISPOSAL OF COAL MINE WASTE

See R645-301-513.300.

R645-301-542.740. DISPOSAL OF NON-COAL MINE WASTES

See R645-301-513.300.

R645-301-542.741. PLACEMENT AND STORAGE

See R645-301-513.300.

R645-301-542.742. FINAL DISPOSAL

See R645-301-513.300.

R645-301-542.800. RECLAMATION COST ESTIMATE

See R645-301-240.

R645-301-550. RECLAMATION DESIGN CRITERIA AND PLANS

See R645-301-240.

R645-301-551. CASING AND SEALING OF UNDERGROUND OPENINGS

Casing and Sealing of Drill Holes

All exploratory drill holes have been sealed with cement and all water wells have been cased with steel casing and will be maintained. After mining is completed, the water wells and monitoring wells will be sealed except in the event the state engineer allows them to remain opened for other purposes.

See R645-301-529.100.

R645-301-552. PERMANENT FEATURES

N/A

R645-301-552.100. SMALL DEPRESSIONS

Plates 16 & 17

R645-301-552.200. PERMANENT IMPOUNDMENTS

N/A

R645-301-553. BACKFILLING AND GRADING

See R645-301-532.200.

R645-301-553.100. DISTURBED AREAS

See R645-301-532.200.

R645-301-553.110. AOC REQUIREMENTS

See R645-301-532.200.

R645-301-553.120. HIGHWALL AND SPOILS PILE ELIMINATION

See R645-301-532.200.

R645-301-553.130. SLOPE PROTECTION AND STABILITY

See R645-301-532.200.

R645-301-553.140. EROSION AND WATER POLLUTION

See R645-301-532.200.

R645-301-553.150. SUPPORT POSTMINING LAND USE

Upon completion of Andalex Resources' mining operation, the land will continue to be used for grazing and hunting. The limited resources, both physical and scenic, will dictate no future change in the land status. The nature of an underground mine of this size requires minimal surface disturbance. All disturbed areas shall be restored in a

timely manner to conditions that are capable of supporting the uses which they were capable of supporting before any mining including high priority wildlife habitat. Andalex is not proposing an alternate post-mining land use. Andalex is not requesting an approval for an alternate post-mining land use. The anticipated post-mining land use is likely to be achieved and does not present any actual or probable hazard to public health or safety or threat of water diminution or pollution. The post-mining land use is practical and can be implemented immediately following reclamation and will not result in any violation of federal, state, or local law.

R645-301-553.200. SPOIL AND WASTE

See R645-301-513.300.

R645-301-553.210. REQUIREMENTS FOR DISPOSAL

See R645-301-513.300.

R645-301-553.221. CLEARING AND GRUBBING

N/A

R645-301-553.222. TOPSOIL REMOVAL AND STORAGE

See R645-301-231, -234.

R645-301-553.223. BACKFILLING AND GRADING

See R645-301-532.200.

R645-301-553.230. FINAL SURFACE GRADING

See R645-301-532.200.

R645-301-553.240. FINAL CONFIGURATION

Plates 16 & 17

R645-301-553.250. REFUSE PILES

N/A

R645-301-553.251. FINAL CONFIGURATION

N/A

R645-301-553.252. COVER REQUIREMENTS

N/A

R645-301-553.260. DISPOSAL OF COAL PROCESSING WASTES IN MINED-OUT SURFACE AREAS

N/A

R645-301-553.300. RESTRICTIONS AND REQUIREMENTS

N/A

R645-301-553.400. CUT-AND-FILL TERRACES

N/A

R645-301-553.410. COMPATIBILITY

N/A

R645-301-553.420. SPECIALIZED FACILITIES FOR IMPLEMENTING POSTMINING LAND USE

N/A

R645-301-553.500. PREVIOUSLY MINED AREAS

N/A

R645-301-553.510. RE-MINING AREAS CONTAINING HIGHWALLS

N/A

R645-301-553.520. HIGHWALL ELIMINATION

See R645-301-532.200.

R645-301-553.521. SPOIL AVAILABILITY

Old coal pads will be used for backfilling highwalls.

R645-301-553.522. BACKFILLING COMPATIBILITY

This is compatible with our refuse elimination plan.

R645-301-553.523. HIGHWALL REMNANTS

See R645-301-532.200.

R645-301-553.524. SPOIL PLACEMENT

See R645-301-553.221.

R645-301-553.600. APPROXIMATE ORIGINAL CONTOUR

See R645-301-523.200.

R645-301-553.610. VARIANCE REQUIREMENTS

See R645-301-523.200.

R645-301-553.620. INCOMPLETE HIGHWALL ELIMINATION

See R645-301-523.200.

R645-301-553.630. MOUNTAINTOP APPROVAL

N/A

R645-301-553.640. SURFACE MINING OPERATIONS

N/A

R645-301-533.641. THIN OVERBURDEN

N/A

R645-301-533.642. THICK OVERBURDEN

N/A

R645-301-553.650. UNDERGROUND MINING OPERATIONS

See R645-301-511.100.

R645-301-553.651. RETAINED HIGHWALLS

See R645-301-532.200.

R645-301-553.652. COMPATIBILITY

See R645-301-532.200.

R645-301-553.653. GEOMORPHIC PROCESS

See R645-301-532.200.

R645-301-553.700. BACKFILLING AND GRADING: THIN OVERBURDEN

N/A

R645-301-553.710. **AVAILABLE SPOIL MATERIALS**

N/A

R645-301-553.720. **REQUIREMENTS**

N/A

R645-301-553.800. **BACKFILLING AND GRADING: THICK OVERBURDEN**

N/A

R645-301-553.810. **FINAL GRADING**

N/A

R645-301-553.820. **REQUIREMENTS**

N/A

R645-301-553.830. **EXCESS SPOIL**

N/A

R645-301-553.900. **SETTLED AND REVEGETATED FILLS**

N/A

R645-301-560. **PERFORMANCE STANDARDS**

See R645-301-511.100.

ANDALEX RESOURCES, INC.
CENTENNIAL PROJECT

CHAPTER 6

Geology

C/007/019

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Plate 6-5 Kenilworth Lease Geologic Cross Section

R645-301-600. GEOLOGY

As the Mathis Tract and New Federal Summit Creek Lease boundary change is simply an extension of underground mine workings under roughly 2,500 feet of cover there will be absolutely no effect on geology other than as we proceed further to the north, the depth of cover increases.

The Kenilworth Tract will not require any changes to engineering practices currently employed at the Aberdeen Mine. The change simply involves an extension of underground mine workings and does not involve the surface in any way.

R645-301-610. INTRODUCTION

R645-301-611. GENERAL REQUIREMENTS

R645-301-611.100. GEOLOGY WITHIN AND ADJACENT TO THE PERMIT AREA

Introduction

The proposed permit area is in Book Cliffs which is the major physiographic feature in the region. The cliffs rise from a base at approximately 5,500 feet in elevation, to over 8,500 feet. Numerous canyons dissect the Book Cliffs. Soldier Creek and Coal Creek are the major area drainages. The permit area exhibits extreme topographic relief and is mountainous with steep cliffs and deeply incised drainages. With the exception of the Mancos Shale Formation, the Fiasco, Deadman, Straight Canyons, Hoffman Creek Canyon, Graves Lease and AEP Lease exhibit similar stratigraphic and topographic characteristics.

Tectonic Setting

The major coal seams of the Book Cliffs Coal Field lie within the Cretaceous Mesa Verde group which overlies the thick shales of the Cretaceous Mancos formation. The Mesa Verde group consists of the Star Point Sandstone, Blackhawk formation and Price River formation. The major coal seams lie within the Blackhawk formation.

The Tertiary Wasatch and Green River formations, along with the Price River formation, form the Roan Cliffs, the Tavaputs Plateau and the southern rim of the Uintah Basin. Lithologies present include fluvial, deltaic, and marine sandstones, mudstones, and shales.

Geologic History

During the Triassic and Jurassic periods, the area of the Book Cliffs was relatively stable, but gradually subsided and received sediments. The area, assumed to have been a relatively flat lowland, was occasionally covered by a shallow sea of short geologic duration. A thick red bed sequence suggests tropical conditions and the great thickness of sand accumulation suggests
acid conditions. During Triassic times, the sediments probably came from all directions but, during the Jurassic time, the major source areas lay to the south and west.

During the early Cretaceous time, a trough developed in the Colorado Rockies area and the sea invaded. Gradually the sea crept westward as the trough continued to subside, reaching the east edge of the Colorado Plateau by the beginning of the Upper Cretaceous age.

Unconformities and thinning of various members indicate that volcanic activity to the west caused sediments to fill the basin faster than it could subside, causing the shoreline to be pushed eastward. When lulls in this activity developed, the incoming sediments diminished and the sea moved westward once more. With each pulse, the boundaries of the depositional environments moved eastward and then returned westward. The sandstone tongues of the Mesa Verde, which project into the Mancos, were deposited at these times.

After the sea retreated, the area continued to receive sediments under continental conditions which lasted well into Eocene time. In Oligocene time, the area began to rise in earnest. Erosion attacked the newly formed formation creating the present mountain ranges and cliffs.

Stratigraphy

The coal seams in the Blackhawk formation are listed stratigraphically:

Upper Sunnyside Bed
Lower Sunnyside Bed
Centennial Bed
Rock Canyon Bed
Fishcreek Bed
Gilson Bed
Kenilworth Bed
Castle Gate "B" Bed
Castle Gate "A" Bed (Aberdeen)

Only the Lower Sunnyside, Centennial, Gilson, and Castle Gate "A" beds are formed in commercial thickness on the Centennial Property. Andalex has discovered a new coal seam which is referred to as the Centennial Seam. This coal was originally thought to have been in the Lower Sunnyside Seam. This coal has been accessed through rock tunnels from the existing Pinnacle Mine. Waste from these rock tunnels was

disposed of in the Pinnacle Mine. The Mine in the Centennial Seam as well as the Mine in the Aberdeen Seam will both progress onto the Graves Lease. Andalex is applying for approval for the new AEP Lease in the Centennial and Aberdeen Seams only.

Stratigraphic sections of the coal beds are shown in Figures III-1 and III-2. Seam thicknesses are shown on Plates 5-3, 5-4, 5-5 and 5-6.

Structure

The Book Cliffs are basically a homocline (dip slope) dipping into the Uintah Basin with the cliff front roughly paralleling the strike of the feature. The strike of the beds is generally parallel to the face of the Book Cliffs. The beds are mostly uniform with dips of from 3° to 8° to the north and northeast toward the Uintah Basin.

Occasional faults cut the coal measures but are of small displacement and have been of little consequence in mining. The most serious group of faults lies in the Sunnyside area. These faults, which have a maximum separation of 200 feet, effect mining, but, fortunately, are not closely spaced.

History of Mining

Mining has been the major industry in the region for many years. Coal was discovered in the Wasatch Plateau in 1874 and exploration soon spread to the Book Cliffs. Mines began operating in the area in 1889. The Castle Gate and Sunnyside area was first developed, the areas in between being developed later. Coal was usually discovered away from settled areas and towns were built for employees by the companies.

Production from mines generally increased until 1920, but began to decline in the 1920's and 1930's. World War II brought production back to the 1920 levels and production continued to increase until 1957 when production again declined.

Book Cliff mines to present have produced about 75 percent of Utah's coal annually. Well over 200 million tons of coal have been extracted from the coal measures of the area. Much coal remains and numerous mines are presently operating in the area.

Geologic Hazard

There are occasional faults cutting the coal measures of the area. They are of relatively small displacement. The most serious faults occur in the Sunnyside area. There is no indication of faulting within our lease area.

Faults in the Sunnyside district of the Book Cliffs field have been thought, by some, to have a causative relationship to the bounces experiences there. The outcrops on the lease premises and our own aerial photos have been carefully studied. In our judgement, no faults cut the lease area. There are also sandstone layers in excess of 150 feet in

thickness that do not break up when mining. The ductile nature of the sandstone causes a buildup of energy in the coal layer. This energy buildup has the potential of being released violently. The bulk of the tonnage to be mined is under more than 2,700 feet of cover, increasing up to 3,300 feet of cover. Water inflows have never been a problem in the Book Cliffs field. The dip of the coal measures prevents entrapment of personnel, in any event.

Structure

The structure between Deadman and Soldier Canyons is relatively simple. Structure contours are aligned basically east-west. The coal beds dip northward at approximately six degrees. No faults are thought to exist in the Deadman Canyon area.

History of Mining

Several small operations have mined a considerable amount of coal over the past 70 years in the Deadman Canyon Area. Mining ceased in the area in 1964. These mines, however, merely scratched the surface of the reserve. The remaining recoverable reserve is estimated to be greater than twenty-eight million tons and ranging in cover from 0 to 2,700 feet.

Identification of Strata

Strata disturbed by surface operations consist of sandstone and siltstone of a colluvial nature.

Statement of Borings and Samplings

Design of Boring and Sampling Program

Sites - Numbers, Location and Relationship to the Disturbed Area

The number, locations, and relationship of drill holes and sampling are indicated on Plates 5-3, 5-4, and 5-5.

Methodology - Sample Collection, Compositing of Samples for Each Strata, Laboratory

Samples of the immediate floor and roof below and above each seam were sampled using conventional core drilling equipment. Also, samples of the overburden which was disturbed in surface operation has been sampled by "grab" methods, as well as auger drilling.

Data

Field Log and Description of Samples - Lithologic Classification, Description, and Hydrologic Aspects

In November and December, 1971, a five-hole drilling program was conducted by Centennial Coal Associates, supplemented by mine samples and outcrop information, and the results used to estimate the coal reserves of the leases. Pertinent information on these drill holes is given in Table III-1 and Appendix E. Complete lithologic logs of each drill hole are included in Appendix E. Numerous samples were taken from the outcrops of the Lower Sunnyside, Gilson, and Aberdeen seams, as well as from mine faces in the Hileman, Olsen, Star Point, and Blue Flame No. 1 mines. Information from those samples as well as the location of the drill holes is shown on Plates 5-3, 5-4, and 5-5.

TABLE III-1

Centennial Drill Holes

Number	Location	Total Depth	Coal Seams
DH-1	NW1/4 NW1/4 SE1/4 Sec. 8 T13S, R11E, SLBM Elevation - 7,230 ft.	516 ft.	Lower Sunnyside Gilson Aberdeen
DH-2	SW1/4 NW1/4 NW1/4 Sec. 7 T13S, R11E, SLBM Elevation - 7,275 ft.	580 ft.	Lower Sunnyside Gilson Aberdeen
DH-2-A	SW1/4 NW1/4 SE1/4 Sec. 7 T13S, R11E, SLBM Elevation - 7,165 ft.	303 ft.	Gilson Aberdeen
DH-5	SE1/4 SW1/4 NE1/4 Sec. 7 T13S, R11E, SLBM Elevation - 7,275 ft.	832 ft.	Lower Sunnyside Gilson Aberdeen
DH-6	NW1/4 SE1/4 SW1/4 Sec. 5 T13S, R11E, SLBM Elevation - 8,558 ft.	2,275 ft.	Lower Sunnyside Gilson Aberdeen

In October and November, 1977, a seven-hole drilling program was conducted by Andalex in order to better define the coal reserves for mine planning on the Zion's fee. Pertinent information on these drill holes is presented in Table III-2. Complete lithologic logs of each drill hole are included in Appendix E. Locations are indicated on Plates 5-3, 5-4, and 5-5. Andalex drilled six holes underground and one on the surface in the summer of 1989 (Drill hole numbers 89-1-AP, 89-2-AP, 89-3-AP, 89-1-PIN, 89-2-PIN, 89-3-PIN, 89-1-CP). These holes were primarily to substantiate the existence of the new Centennial Seam.

Andalex has also acquired lithologic logs of two drill holes completed by North American Coal Corp., in 1948 and one by Pacific Gas & Electric in 1980. Although these holes are not located within the permit area, but to the west and east of its boundary, the information has been utilized in estimating reserves. Pertinent information is given in Table III-3. Complete lithologic logs are included in Appendix E and their location is indicated on Plates 5-3, 5-4, 5-5 and 5-6.

TABLE III-2
Andalex Drill Holes

Number	Location	Total Depth	Coal Seams
77-1-CP	NE1/4 SE1/4 SW1/4 Sec. 7 T13S, R11E, SLBM Elevation - 7,555 ft.	675 ft.	Gilson Aberdeen
77-2-CP	SE1/4 NE1/4 SW1/4 Sec. 7 T13S, R11E, SLBM Elevation - 7,520 ft.	690 ft.	Gilson Aberdeen
77-3-CP	SE1/4 SE1/4 NW1/4 Sec. 7 T13S, R11E, SLBM Elevation - 7,425 ft.	868 ft.	Lower Sunnyside Gilson Aberdeen
77-4-CP	SE1/4 SE1/4 SW1/4 Sec. 7 T13S, R11E, SLBM Elevation - 7,070 ft.	105 ft.	Aberdeen
77-5-CP	SE1/4 SE1/4 SW1/4 Sec. 7 T13S, R11E, SLBM Elevation - 7,085 ft.	85 ft.	Aberdeen
77-6-CP	NE1/4 NE1/4 NW1/4 Sec. 18 T13S, R11E, SLBM Elevation - 7,080 ft.	80 ft.	Aberdeen
77-7-CP	NE1/4 NE1/4 NW1/4 Sec. 18 T13S, R11E, SLBM Elevation - 7,010 ft.	45 ft.	Aberdeen
89-1-AP	SW1/4 SE1/4 NW1/4 Sec. 7 T13S, R11E, SLBM Elevation - 7,239 ft.	460 ft.	Centennial Aberdeen
89-2-AP	NE1/4 NW1/4 SW1/4 Sec. 7 T13S, R11E, SLBM Elevation - 7,283 ft.	90 ft.	Centennial
89-3-AP	SW1/4 SE1/4 NW1/4 Sec. 7 T13S, R11E, SLBM Elevation - 7,169 ft.	90 ft.	Centennial
89-1-PIN	SE1/4 NE1/4 SE1/4 Sec. 8 T13S, R11E, SLBM Elevation - 6,951 ft.	260 ft.	Aberdeen
89-2-PIN	SW1/4 NW1/4 SW1/4 Sec. 8 T13S, R11E, SLBM Elevation - 7,014	250 ft.	Aberdeen
89-3-PIN	NW1/4 SE1/4 SW1/4 Sec. 7 T13S, R11E, SLBM Elevation - 7,483 ft.	240 ft.	Aberdeen
89-1-CP	SE1/4 SE1/4 SW1/4 Sec. 6 T13S, R11E, SLBM Elevation - 8,307 ft.	1,880 ft.	Centennial Aberdeen

TABLE III-3

North American Drill Holes

Number	Location	Total Depth	Coal Seams
DH-NACC-6	SE1/4 SE1/4 SE1/4 Sec. 1 T13S, R10E, SLBM Elevation - 7,460 ft.	Approx. 1,020 ft	Centennial Gilson Aberdeen
DH-NACC-7	SW1/4 NE1/4 SE1/4 Sec. 12 T13S, R10E, SLBM Elevation - 7,192 ft.		Gilson Aberdeen

Pacific Gas and Electric Drill Hole

Number	Location	Total Depth	Coal Seams
CC9-1	NW1/4 NW1/4 NW1/4 Sec. 9 T13S, R11E, SLBM Elevation - 7,225 ft.	Approx. 930 ft.	Lower Sunnyside Gilson Aberdeen

Laboratory Analyses - Chemical Acidity, Toxicity, Alkalinity, and Physical (Erodibility and Compaction) Properties

Complete laboratory analysis is included in Appendix E. Appendix E has been updated to include coal quality information pertaining to the Centennial Seam.

Identification of Potential Acid, Toxic or Alkaline Producing Horizons

Refer to Appendix E for the laboratory analyses. Andalex has committed to sampling roof and floor material in all four coal seams in the most recently mine areas. This material will be analyzed for identification of Potential Acid, Toxic or Alkaline Producing Horizons. As this material is collected it will be placed into Appendix E with the rest of the laboratory data.

Location of Subsurface Water at Face-Up Areas

No water was encountered at face-up areas.

Description of Coal Seams and Overburden - Mine Plan Area

General Description

Stratigraphy

There are four coal seams of minable thickness in the mine plan area. All four are part of the Blackhawk Formation of the Cretaceous Mesa Verde Group. The Blackhawk consists of three members. Stratigraphically, from bottom to top, they are the Aberdeen Member, the Kenilworth Member, and the Sunnyside Member (see Figure III-2).

The bottom coal seam is the Aberdeen (also known as the Castle Gate "A" Seam). It is found in the Aberdeen Member of the Blackhawk. This coal seam rests directly on approximately 150 feet of basal sandstone. This sandstone is of littoral marine origin and is known as the Aberdeen Sandstone. The coal seam ranges from 4 feet to 13 feet in thickness over the property. Above the seam is approximately 90 feet of interbedded sandstone, siltstone, and carbonaceous shale containing coal riders.

The second seam is the Gilson Seam and ranges in thickness from 4 feet to 8 feet over the property. The Gilson is part of the Kenilworth Member of the Blackhawk. Directly below the Gilson is approximately 90 feet of interbedded sandstone, siltstone, and carbonaceous shale with coal riders. Below this is approximately 70 feet of barrier beach sandstone known as the Kenilworth Sandstone. Above the Gilson is approximately 100 feet of interbedded sandstone, siltstone, shale, and coal riders.

The third seam is the Centennial Seam ranging from 4' to 8' in thickness. The Centennial Seam is part of the Sunnyside member of the Blackhawk. The Centennial Seam lies approximately 40' below the Lower Sunnyside Sandstone. Below the Centennial Seam is approximately 130' of interbedded sandstone, siltstone, shale, and coal riders.

The top seam is the Lower Sunnyside Seam, ranging from 4 feet to 5 feet in thickness. The Lower Sunnyside is part of the Sunnyside Member of the Blackhawk. Below the coal seam is approximately 50 feet of barrier beach sandstone known as the Lower Sunnyside Sandstone. Above the coal seam is about 250 feet of interbedded sandstone, siltstone, shale, and coal riders.

Above the Blackhawk, the Castle Gate Sandstone and Price River Formation of the Mesa Verde Group can be found over various parts of the property. The North Horn Formation is also present in certain areas of the property. Total overburden on the mine plan area ranges from 0 to 3,300 feet. The bulk of overburden in the Kenilworth lease area ranges from 2,700 to 3,300 feet.

There are unleased federally owned coal reserves adjacent to the permit area. Andalex has assumed ownership on part of this coal contained in the Graves Tract which is now a part of this MRP. Andalex will access this lease from the existing underground workings as has been done in the past when Andalex has added new leases. In addition to the Graves Tract there is still some unleased federal adjacent to the Centennial property which is of questionable value. The Centennial coal seam is accessed from the existing Pinnacle Mine which is in the Gilson Seam. It is accessed via rock tunnels which are approximately 500' in length. The Centennial and Aberdeen Seams on the AEP Lease will be accessed through an extension of existing underground workings.

The Aberdeen sandstone in our vicinity is 80 to 100 feet thick. Its lateral extent is from Castle Gate to well east of the Centennial property. It is a very well-known geologic marker in the Book Cliffs coal field. It is a medium grained, tightly cemented, cross bedded sandstone which contains very little or no water. It has been drilled into in every exploration hole in our leases. All other aquifers or water tables within our leases are perched.

Structure

Structure contours are aligned basically east-west. The coal beds dip northward at approximately six degrees. No faults are known to exist in the mine plan area. Overburden ranges from 0 to 2,700 feet.

Hydrologic Aspects

All groundwater exists as perched aquifers in the mine plan area. Due to the lenticular nature of the geology in the area, any groundwater is isolated and very limited. Please see Water Quality Data in Appendix L. Also, please note that the Sunedco property recently acquired by Andalex was included in the Vaughn Hansen/Andalex Hydrologic Inventory prepared for the original PAP and the emergency lease (please see Appendix L). Also included in Appendix L are the Graves and AEP PHC's.

The occurrence the Division has referred to where Andalex intercepted groundwater was actually not groundwater per se but water which had accumulated in old mine workings over a number of years (45 to 50 years). This was a one time occurrence. Water accumulates in small burned out voids because they are down dip from the burned outcrop. Andalex uses the practice of advanced drilling to avoid these areas. This is the only water which has been or will be encountered as the Andalex permit area is free from faulting or any other means of water conveyance.

Location of Subsurface Water

Some of the sandstone beds of the Blackhawk Formation are water bearing in the mine plan area. Most of the beds are dry however, and partially drained of water near the

cliff faces. Groundwater is perched due to the lenticular geology and any groundwater is isolated. The geology and specifically the lenticular nature of the beds on the new AEP lease are the same as what has been described in the original permit area. Also, any water bearing units are small in areal extent. The lowermost aquifer known in this area is the Aberdeen Sandstone, which is monitored below the lowermost coal seam. The newly acquired AEP Lease is included in the Andalex Hydrologic Inventory.

Detailed Analyses of Coal Seams and Surrounding Strata

Source of Data

Analysis was performed on rib samples and core samples obtained during the exploration activities described. Results of these analyses are listed according to seam in Appendix E.

Analysis was performed by: Commercial Testing and Engineering Company, 10775 East 51st Avenue, Denver, Colorado 80239, and other commercial testing laboratories.

Coal Seams

Total Sulfur Content

Please see Appendix E.

Other Characteristics

Please see Appendix E.

Stratum Immediately Overlying each Coal Seam to be Mined

Lithology (See Figure III-2)

Aberdeen Coal Seam (Castle Gate "A") - overlying this seam is interbedded sandstone, siltstone, and carbonaceous shales of the Aberdeen Member of the Blackhawk.

Gilson Coal Seam - overlying this seam is interbedded sandstone, siltstone, and shale with coal riders of the Kenilworth Member of the Blackhawk.

Centennial Coal Seam - overlying is interbedded sandstone, siltstone, and shale, and coal riders of the Sunnyside Member of the Blackhawk.

Lower Sunnyside Seam - overlying this seam is interbedded sandstone, siltstone, shale and coal riders of the Sunnyside Member of the Blackhawk.

It should be noted however, that the immediate "roof" over each seam is a sandstone unit, over which is found the silts, shales, and various coal riders.

Pyritic Content (Laboratory Analyses)

Complete analyses of these strata are included in Appendix E.

Potential Alkalinity (Laboratory Analyses)

Complete analyses of these strata are included in Appendix E.

Stratum Immediately Underlying Each Coal Seam to be Mined

Lithology (See Figure III-2)

Aberdeen (Castle Gate "A" Seam) - underlying this seam is basal sandstone of littoral marine sandstone, the Aberdeen Sandstone of the Aberdeen Member.

Gilson Seam - underlying this seam is interbedded sandstone, siltstone, shale, and coal riders of the Kenilworth Member.

Centennial Seam - underlying this seam is interbedded sandstone, siltstone, and shale, and coal riders of the Kenilworth Member.

Lower Sunnyside Seam - underlying this seam is barrier beach sandstone, the Lower Sunnyside Sandstone of the Sunnyside Member.

It should be noted however, that the immediate "floor" below the seams is sandstone in the case of the Lower Sunnyside and Aberdeen; and beneath the Gilson, and Centennial, siltstone.

Pyritic Content (Laboratory Analyses)

Complete analyses of these strata are included in Appendix E.

Potential Alkalinity (Laboratory Analyses)

Complete analyses of these strata are included in Appendix E.

Clay Content (Laboratory Analyses)

Complete analyses of these strata are included in Appendix E.

R645-301-611.200. PROPOSED OPERATIONS

See R645-301-551. and R645-301-529.100.

R645-301-612. CROSS SECTION, MAPS AND PLANS

See R645-301-510.

R645-301-620. ENVIRONMENTAL DESCRIPTION

See R645-301-510.

R645-301-621. GENERAL REQUIREMENTS

See R645-301-510.

R645-301-622. CROSS SECTIONS, MAPS AND PLANS

Plates 6-1, 6-2, 6-3, and 6-4.

R645-301-662.100. TEST BORINGS AND CORE SAMPLINGS

Appendix E

R645-301-622.200. COAL SEAMS AND BURDEN

Appendix E

R645-301-622.300. COAL OUTCROPS

Plates 5-3, 5-4, 5-5, and 5-6.

R645-301-622.400. GAS AND OIL WELLS

N/A

R645-301-623. GEOLOGIC INFORMATION

See R645-301-611.100.

R645-301-623.100. POTENTIALLY ACID OR TOXIC FORMING STRATA

Appendix E

R645-301-623.200. RECLAMATION REQUIREMENTS

See R645-301-240.

R645-301-623.300. SUBSIDENCE CONTROL PLAN

See R645-301-525.

R645-301-624. GEOLOGIC INFORMATION

See R645-301-611.100.

R645-301-624.100. DESCRIPTION

See R645-301-611.100.

R645-301-624.110. CROSS SECTIONS, MAPS AND PLANS

See R645-301-510.

R645-301-624.120. OTHER INFORMATION

Alternative Water Supply Information

The underground coal mining activities will not result in any contamination, diminution, or interruption of any underground or surface water sources within the proposed mine plan or adjacent areas for domestic agricultural industry or any other legitimate use as the underground mining activities will not encounter any aquifers and there are no springs to interrupt.

There have been no changes in Andalex Resources' water rights. The wells, however, could be left open if a need other than Andalex's arose, with the permission of the State Engineer. Other water rights controlled by Andalex could be dedicated to a water right proven to be affected by Andalex's activities. Andalex controls 19 shares of primary water which could be used to supplement any interrupted water rights. There are no oil and gas wells in the vicinity of Andalex's permit area. There are no water wells in the area except on Andalex's surface facility, these are shown on figure 5 Appendix L, also in Appendix L tables 1 and 5 depict current existing water rights.

R645-301-624.130. GEOLOGIC LITERATURE AND PRACTICES

See R645-301-611.100.

R645-301-624.200. SAMPLING AND ANALYSIS

Appendix E

R645-301-624.210. LOGS

Appendix E

R645-301-624.220. CHEMICAL ANALYSES

Appendix E

R645-301-624.230. ACID OR TOXIC FORMING MATERIALS

Appendix E, R645-301-513.300.

R645-301-624.300. TEST BORINGS AND DRILL CORES

Appendix E

R645-301-624.310. LOGS

Appendix E

R645-301-624.320. ACID OR TOXIC FORMING MATERIALS

Appendix E, R645-301-513.300.

R645-301-624.330. CHEMICAL ANALYSES

Appendix E

R645-301-624.340. ROOF AND FLOOR MATERIALS

The Andalex mine property rarely encounters clays or clay-like rock in either the immediate roof or floor. The only clays encountered to date have been in the Aberdeen Seam where upon contact with water, the floor material became soft. The clay material in the floor has been local and temporary. To date, there has been no clay or clay-like material in the immediate roof of any of the coal seams.

Appendix E

R645-301-625. ADDITIONAL INFORMATION

Appendix E

R645-301-626. WAIVER FROM COLLECTION AND ANALYSIS

N/A

R645-301-627. OVERBURDEN

N/A

R645-301-630. OPERATION PLAN

See R645-301-511.100.

R645-301-631. CASING AND SEALING OF EXPLORATION HOLES AND BOREHOLES

See R645-301-551.

R645-301-631.100. TEMPORARY CASING AND SEALING OF DRILLED HOLES

N/A

R645-301-631.200. PERMANENT CASING AND SEALING OF EXPLORATION HOLES AND BOREHOLES

See R645-301-551.

R645-301-632. SUBSIDENCE MONITORING

See R645-301-525.

R645-301-632.100. DEGREE OF SUBSIDENCE

See R645-301-525.

R645-301-632.200. MONITORING LOCATIONS

See R645-301-525.

R645-301-640. PERFORMANCE STANDARDS

See R645-301-551 and R645-301-529.100.

R645-301-641. ALL EXPLORATION HOLES AND BOREHOLES

See R645-301-551 and R645-301-529.100.

R645-301-642. MONUMENTS AND SURFACE MARKERS

See R645-301-525.170

ANDALEX RESOURCES, INC.
CENTENNIAL PROJECT

CHAPTER 7

Hydrology

C/007/019

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R645-301-700. HYDROLOGY

The Kenilworth Lease boundary change will not encroach into any new hydrologic basins which are not addressed in the existing MRP (see Plate 1-2). Seeps located within this boundary change have been addressed in the new Kenilworth Lease PHC. (see PHC for the entire lease area).

SEE ALSO APPENDICES L, N, AND O

R645-301-710. INTRODUCTION

R645-301-711. GENERAL REQUIREMENTS

Hydrologic Protection Facilities

Sewage System

The nature of the overburden in the area offers excellent drainage. As a result, a septic system with drain fields conforming to the state codes has been established to handle the waste water disposal from the bathhouse and office facilities. The drain fields are located in native material (valley fill) cast of the bath houses in the parking area. Enclosed as Appendix G are the two septic system plans as designed by a Utah Registered Professional Engineer and approved by the State of Utah Department of Health.

Water Treatment

Based on the State of Utah, Department of Health review of the septic systems, water treatment is not needed. (Personal communication, Mr. Gerald Story, Utah Department of Health, Price, Utah).

Drainage Control - Diversions, etc.

See R645-301-733.

Sediment Control

See R645-301-733.

R645-301-711.100. EXISTING HYDROLOGIC RESOURCES

Appendix L

R645-301-711.200. POTENTIAL IMPACTS TO THE HYDROLOGIC BALANCE

Appendix L - Potential Hydrologic Consequences

R645-301-711.300. COMPLIANCE WITH HYDROLOGIC DESIGN CRITERIA

Protection of Hydrologic Balance and Compliance with Water Quality Laws

Andalex will follow its approved "Sedimentation and Drainage Control Plan" and comply with the U.P.D.E.S. Permit UT0025674 (see Appendix J). Currently, this permit authorizes four discharge points; two from sedimentation ponds (001, 003) and two from the underground mine (002 and 004). See IV-11

Andalex has approval from the State Engineer, Division of Water Rights, to collect runoff water from the disturbed area for use as a dust suppressant in the underground mining operation. This runoff is a result of direct precipitation with the runoff area.

Andalex will comply with the Clean Water Act (33 U.S.C. Sec. 1251 et seq.) and all other applicable water quality laws and health and safety standards.

Surface and Groundwater Monitoring

This monitoring plan is an up-to-date, comprehensive plan that describes all current water monitoring requirements. It supersedes all other versions of monitoring plans that have been previously developed for the Centennial Mine and that may be contained in various appendices to this MRP. In the past, as the mining area expanded, changes were made to the permit boundary, and new monitoring sites were added. As a result, several different monitoring plans have been developed for the Centennial Mine. These were described to varying extents in separate Probable Hydrologic Consequences (PHC) determinations that are appended to MRP.

The plan written here draws from the various monitoring plans that have previously been written and approved. It is also based upon an assessment of monitoring data collected to date, and accounts for the status of the mine as inoperable. It meets the requirements of R645-301-731.211 and R645-301-731.221, i.e., to document the suitability of water for current and approved postmining land uses and for protecting the hydrologic balance. Should operations be reinitiated, this monitoring plan will be reexamined for adequacy, and dropped monitoring sites may be picked back up and/or new sites may be added. Any such changes to the monitoring will be reflected in revisions to this section.

Removal of Monitoring Points

As allowed by R645-301-731.214 and R645-301-731.224, several sites that have been monitored for many years have been omitted from this plan. Sites in Hoffman Canyon (S25-1 and 25-2), Straight Canyon (8-1 and 17-2), and Star Point Fork (17-1 and 18-2) will no longer be monitored. All of these sites are located within or near the

eastern portion of the MRP boundary, and were never undermined. The closest mining was completed in 1993 and was about half a mile away from the sites, as shown on Figure 7-1. Further, site 12-1, located in Alrad Canyon in the southwest corner of the permit area, has been omitted from this plan.

In addition, there are numerous sites to the north and west of the permit area which have been omitted from this plan. As shown on Figure 7-1, stream sites B32, B263 and B262 are located approximately 1 mile away from the nearest current underground mining, and stream sites AC-1 and SC-1 are three-quarters of a mile from the closest mine works. It should also be noted that at these sites the overburden is 3000' deep or greater.

If the Kenilworth lease is mined sites B261, and B362 and B33 will be monitored according to the recommendations found in the 4 December 2014 PHC.

Last, one other stream site and one stock pond site within the permit area is also being omitted from the monitoring plan. Ephemeral wash site 7-1 is located upstream of the main surface facilities and is typically dry. Because site 18-4 monitors the same stream further downstream and because operations have ceased, 18-4 is sufficient for tracking potential impacts in this drainage. Site 7-1 was never undermined, and the nearest second-mining (nearly one-half mile away) was completed in 1998. The stock pond site 31-1 is located over an inter-panel barrier pillar and was never undermined. The nearest second mining was done in 2004. Overburden cover at this location is 2500' and subsidence survey show that the area has not been subject to subsidence Further justification for discontinuing monitoring at all of the above-mentioned sites is provided below.

As mentioned above, ANDALEX has long-completed mining under Hoffman Canyon; there were no surface facilities associated with mining in that area and there has been no subsidence reported during annual surveys. Because the spring (S25-1) flows only intermittently and the stream (25-2) flows only ephemerally, few samples have been collected. However, based upon the available data, there has not been any material damage to the hydrologic balance, and postmining land uses have not been compromised. Nor would there be any potential for this to occur in the future from these completed activities.

Similarly, ANDALEX completed mining under Straight Canyon (8-1) in 1995. Site 17-2 was never undermined, and the last mining in the area (nearly half mile away) was done in 1995. The situation is similar for sites in Starpoint Fork (17-1 and 18-2). These sites were originally designated for monitoring to indicate effects of proposed surface facilities in those canyons (Vaughn Hansen Associates 1981); these facilities were never constructed and are no longer proposed. Further, annual subsidence surveys have not indicated subsidence. Though there have been few opportunities to collect water quality samples from these ephemeral channels, available data has not indicated any material damage to the hydrologic balance, and postmining land uses have not been compromised. Nor would there be any potential for this to occur in the future from

these completed activities. In addition, the same can be said for site 7-1 in Deadman Canyon above the surface facilities and the continuation of monitoring at site 18-4 ensures that water quality in this watershed is being tracked.

Site 12-1 is located in an ephemeral channel that drains Alrad Canyon. This site was added to the monitoring plan a number of years ago as part of a permit amendment; its purpose was to ensure that any surface runoff effects due to mining could be documented. The site has served its purpose and no effects have been noted during the many years of quaterly monitoring. Located in the southwest corner of the permit area, Alrad Canyon was never undermined, and the closest second-mining (a half-mile away) was completed in 2000.

The Deep Canyon site (B-263) is on an intermittently flowing stream that is more than 7500 feet north of the current second-mined area. It was added to the Centennial monitoring plan in 2005, but has been monitored by others as part of the Willow Creek MRP for many years. The Atone Creek site (AC-1) is also an intermittently flowing stream that was added to the monitoring plan in 2005; it is approximately 4500 feet north of the nearest second-mined area. The perennially flowing SC-1 is located below forks of Summit Creek, and is approximately 3800 feet north of the mined area. It has been monitored by ANDALEX since 2004. Although portions of the watersheds of these three streams have been undermined, surface effects from subsidence have not been noted, in part due to the fact that cover ranges from 2,500 to 3,000 feet in these areas.

Regarding the four above-mentioned spring or seep sites, similar rationale is used to justify their removal from the monitoring plan. In Mathis Canyon, B351 is a small perennially flowing spring which has been monitored by ANDALEX since 2002 and was previously monitored as part of the Willow Creek MRP. The closest that mining came to that water source was 3500 feet, and that occurred in mid-2007. B352 has a similar monitoring history, though this small seep is almost always dry; while somewhat closer to the mined area, there is no mining-related mechanism by which future impacts to its hydrologic balance could occur. A small seep (B261), which may at times support runoff flows stored in Pace Pond, is also a former Willow Creek MRP monitoring site, which was taken over by ANDALEX in 2005; it has been dry in recent years. It is located outside of the permit area and 5500 feet north of second-mined areas. Another seep, which has also been dry essentially throughout its monitoring history (beginning in 2005 for ANDALEX and previously by Willow Creek), is known as B362. It is located on the edge of the permit area, at 3000 feet cover, and has not been undermined.

Last, the stock pond 31-1 was monitored to track any subsidence-related damages. It collects surface runoff and during quarterly monitoring a qualitative record is simply made of whether inflow or outflow is occurring, and the approximately percentage of storage which is currently being used. The nearest mining was in 2004, and at a cover of 2500 feet, no effects from subsidence have been noted.

In addition to the monitoring points discussed above, if the Kenilworth lease is mined sites B121 (well), B353, B271, B341, and will be monitored according to the 4 December 2014 PHC recommendations.

The need for an in-mine well is not anticipated due to the history of the mine. Due to the terrain, and to ensure no further surface disturbance occurs, the section of the Kenilworth lease that is located west of B341 and B271, and below B341 will be monitored at the in-mine monitoring points UG-101, UG 102 and UG103. Any seepage, if any, found at these monitoring points underground will be monitored quarterly.

The following describes the monitoring plan currently in place, including designation of the sites remaining in the plan, as well as the monitoring methodology, parameter lists, and frequency.

Location of Monitoring Points
Table A Water Monitoring Sites

Site ID	UTM location	Description
Well No. 1	39°42.365' N 110°43.736' W	Well in Deadman Canyon, completed in Aberdeen Sandstone (first aquifer below coal seam
S18-1	39°41.581' N 110°43.959' W	Spring in Deadman Canyon below confluence with left and Right Forks Deadman Canyon; stratigraphically below coal seam
18-3	39°41.763' N	Left Fork Deadman Canyon above confluence with

	110°44.022’ W	Right Fork Deadman Canyon, ephemeral stream
18-4	39°41.749’ N 110°43.908’ W	Right Fork Deadman Canyon below main surface facilities, ephemeral stream
B342	39° 44.612' N 110° 46.793' W	On top of Kenilworth- Small stream with man-made pipe diversions to cow troughs.
B352	39° 44.041' N 110° 45.595' W	On top of Kenilworth – Small seep in heavily brushy area.
B261	39° 45.012' N 110° 45.610' W	On top of Kenilworth – Small spring Located in Deep Canyon
B341	39° 44.417' N 110° 46.967' W	On top of Kenilworth – a small 2’ channel with a man- made stick dam across it. The furthest west location on the permit area.
B271	39° 44.913' N 110° 47.132' W	On top of Kenilworth – Culvert along main road.
B351	39° 44.188' N 110° 46.182' W	On top of Kenilworth – approximately 3’ stream along east side of Jeep Trail Road.
B353	39° 44.516' N 110° 46.378' W	On top of Kenilworth – Located on west side of Jeep Trail Road
B121	39°42.686’ N 110°45.484’ W	Well located in Alrad Canyon
B33	39°45.244’ N 110°47.545’ W	On top of Kenilworth – Spring located on the outermost edge of the permit boundary.
B261	39°45.118' N 110°45.362' W	Pace Pond - Deep Canyon
B362	39°44.741' N 110°44.714' W	Antone Canyon
UG101	39°44.014' N 110°46.540' W	In-Mine monitoring point - West Mains
UG102	39°44.345' N 110°47.821' W	In-Mine monitoring point - North Mains
UG103	39°45.197' N 110°47.282' W	In-Mine monitoring point - Gateroad

Groundwater monitoring includes two types of sites: underground water intercepted by a well; and springs representing surface expressions of natural groundwater discharge. Locations of these sites are depicted on Plate 7-9.

Surface water monitoring locations are shown on Plate 7-9. Four storm water or mine water discharge outfalls at the Centennial Mine are monitored as required under a

UPDES Permit, administered by the Utah Division of Water Quality. They are also shown on Plate 7-9.

Methodology and Parameters to be Monitored

Flow rate will be measured at all spring and stream sites using equipment and methods that are appropriate for the amount of flow. Streams will typically be measured with a current meter using the velocity/area approach, a submerged float/area method, or with a portable, calibrated flume. Springs will typically be measured volumetrically with piping, a known-volume container, and a stopwatch. Notes on flow extent will be made if appropriate. If flow rate is so reduced that it is not possible to measure (i.e. at a seasonal spring where saturated areas are present but no flow is visible), or if no flow is occurring (i.e. at an ephemeral stream site), notes will be made describing the site condition (saturation, ponding, dry but recent flows apparent, etc.) Static water level will be recorded at the monitoring well using a well sounder, and purged before samples are taken. Stock pond sites will be observed for incoming flow, outgoing flow, and approximate percentage of storage; these are reported qualitatively with no quantitative measurements made and no samples collected.

Water temperature, pH, and conductivity will be measured in the field using equipment that has been properly maintained and calibrated. Dissolved oxygen will also be measured in the field at all flowing stream sites. These field parameters will be measured at locations appropriate to the site: for streams, in mid-stream, non-stagnant water, with temperature measurements occurring in shaded areas where possible; and for springs, as near to the source as possible. The monitoring well will be purged prior to measuring field parameters.

Samples for chemical analysis follow requirements of UAC R645-301-723. The parameter list for surface waters (except stock ponds as described above) is shown in Table C (Page7-8), and the list for groundwater is shown in Table D (Page 7-8). Any samples collected at the four UPDES outfalls will analyzed for the parameters required by the UPDES permit.

When feasible, field filtering is done prior to filling a bottle for dissolved metals analysis. Samples are stored in iced coolers and submitted to a contract lab using proper chain-of-custody procedures. The lab will be certified for all parameters that it analyzes.

Table C Surface Water Parameter List

Field Parameters
pH Water temperature
Conductivity Dissolved oxygen
Flow rate
Laboratory Parameters
Bicarbonate Alkalinity
Carbonate TDS
Calcium (dissolved) Hardness
Chloride Iron (total and dissolved)
Magnesium (dissolved) Manganese (total and dissolved)
Potassium (dissolved) Oil & Grease
Sodium (dissolved) TSS
Sulfate Cation/anion balance

Table D Groundwater Parameter List

Field Parameters
pH Water Temperature
Conductivity Static water level or flow rate
Laboratory Parameters
Bicarbonate Sulfate
Carbonate Alkalinity
Calcium (dissolved) TDS
Chloride Hardness
Magnesium (dissolved) Iron (total and dissolved)
Potassium (dissolved) Manganese (total and dissolved)
Sodium (dissolved) Cation/anion balance

Frequency

Surface water and groundwater monitoring sites will be monitored quarterly, if accessible. Due to weather, the steep grade of the access road is impassible year-round. When flowing, field measurements will be made and samples are collected for lab analysis. When not flowing, condition will be documented and subsequently reported.

UPDES outfall sites will be on a monthly monitoring schedule, as required by the UPDES permit.

Quarterly monitoring results will be reported electronically to UDOGM's on-line database.

Post-Mining Monitoring

During the reclamation period, Andalex Resources will establish an additional monitoring station at the entrance to the sedimentation pond (Pond E-PM). This station will be monitored on the same frequency and for the same parameters as the NPDES point to be maintained at the pond outlet. All other water monitoring sites will be maintained and monitored during the reclamation period. The sites will be monitored bi-annually for the parameters listed in the Division guidelines (1986), and reported to the Division bi-annually.

There are no acid or toxic-forming materials brought to the surface. No mine development waste is brought to the surface.

R645-301-711.400. APPLICABLE HYDROLOGIC PERFORMANCE STANDARDS

All applicable hydrologic performance standards will be met.

R645-301-711.500. RECLAMATION ACTIVITIES

Post Mining Hydrology

Upon completion of mining activities, and following removal of surface structures, the earthwork portion of the reclamation plan will begin as described. The hydrologic portion of reclamation will take place in two phases:

1. The main and side drainage channels will be restored as shown in the Sedimentation and Drainage Control Plan, and on 7-12. Loose rock check dams will be placed at each side drainage entrance onto the reclaimed area, and at approximately 500' intervals along the restored main channel RC-1. (Typical sections of the loose rock check dams are shown in the Sedimentation and Drainage Control Plan).

All disturbed diversions and sediment ponds "B" and "C" will also be removed at this time. Sediment Pond "E" will be enlarged, and the entire drainage above will flow into Pond "E-PM" through the restored channel RC-1.

It should be noted that the main road going through the minesite and continuing on will be left intact as part of the post-mining use.

2. Once revegetation and water quality standards are met, Pond "E-PM" will be removed, and the area reclaimed.

Surface water monitoring will continue during this time as described. Please see Plate 7-9.

Surface water monitoring will continue during this time as described. Please see Plate 7-9.

R645-301-712. CERTIFICATION

Construction Specifications for Sedimentation Ponds

All construction of sedimentation ponds have been performed under the direction of a qualified registered professional engineer.

Dams are constructed with primary overflows at least 2 ft. from the top, and emergency overflows at least 1.5 ft. from the top.

The areas of the pond construction had been examined for topsoil, and if present in removable quantities such soil was removed separately and stored in an approved topsoil storage location.

In areas where fill was to be placed, natural ground was removed for at least 12" below the base of the structure.

Native materials were used where practical. Fill was placed in lifts not exceeding 15" and compacted prior to placement of the next lift. Compaction of all fill materials is at least 95%.

Grouted rip-rap or culverts have been placed at all inlets and outlets to prevent scouring.

Each pond is fitted with an inverted inlet to the primary overflow, to prevent the passage of oil into the discharge.

Slopes of the dams are not steeper than 2.0:1, inside and outside, with a total of the inslope and outslope not less than 5:1. The inside slope of Pond E exceeded the steepness of 2:1. In part these slopes are incised and in part are constructed in from fill. Because of the steepness of these side slopes an investigation of stability was performed by Palmer Wilding Engineers. The conclusion was that the stability analysis is adequate and a stable section with respect to shear under static loading conditions is indicated. Please Appendix K.

Tops and external slopes of the dams were planted with an approved seed mix to prevent erosion and promote stability. Compaction of the slopes were at least 95%.

Top width of dams are not less than (H + 35)/5.

R645-301-713. INSPECTION

Sedimentation Pond Specifications

Location

The ponds are located over the main drainage of the Right Fork of Deadman Canyon. The main canyon drainage is routed through a 36-42" culvert located under the ponds. The sites are located downslope of the disturbed areas to simplify collection of runoff water (please see Plate 7-2).

Design

The ponds are designed to fully contain the expected runoff and sediment load from a 10-year 24-hour precipitation event in this area. Pond "C" has additionally been shown to fully contain the runoff from a 100-year 6-hour storm. The design has been certified by a registered professional engineer. A certification statement for the ponds can be found at the end of Appendix N.

Construction

The construction of the ponds have been completed as per the specifications set forth in the Construction Specifications sheet (part 2.3).

Capacity

Each pond is designed to contain the runoff and sediment load from a 10-year 24-hour precipitation event in the area of drainage. In addition, each pond has an overflow capacity in excess of that required for a 25-year 24-hour event. Pond "C" has been designed to contain and pass the runoff from a 100-year 6-hour event.

Safety Precautions

The ponds were built as per specifications and under supervision of a qualified, registered professional engineer. The ponds are inspected quarterly for safety and compliance. Inspection reports are maintained on-site, and submitted to the Division on an annual basis. Ponds will be cleaned at minimum when sediment reaches 60% of designed sediment volume. Measuring devices will be installed in the ponds to show when the ponds have filled with sediment to the clean-out level (please see plates 7-4, 7-5, and 7-7). Drainage directly into the Pinnacle and Apex Portals is not part of the calculation for sediment pond sizing. (Pond C)

Monitoring

Water monitoring stations will be established at the outlet of the ponds. Sample parameters and frequencies shall be as per specification of the NPDES permit.

Maintenance

The ponds shall be inspected after each storm and the sediment cleaned as necessary. In no event shall sediment be allowed to build beyond 60% of sediment design capacity.

Seeding

An approved seed mix will be applied to all feasible disturbed areas in an effort to minimize erosion and sediment loading to the ponds. The proper seed mixture for this area has been obtained through the local BLM.

Culverts

All culverts are shown on Plate 7-1. Calculations for sizing are also included. It should be noted that all culvert sizes were arrived at and approved through consultation with the DOGM hydrologic engineer.

Calculations

The following reflects the calculations for sizing and details of each separate pond. Plates 7-4 through 7-7 show pond locations and volumes as well as watershed areas.

See R645-301-512-240, Construction Specifications for Sedimentation Ponds

R645-301-720. ENVIRONMENTAL DESCRIPTION

Appendix L

R645-301-721. GENERAL REQUIREMENTS

Appendix L

R645-301-722. CROSS SECTIONS AND MAPS

See R645-301-510.

R645-301-722.100. LOCATION AND EXTENT OF SUBSURFACE WATER

Appendix L

R645-301-722.200. LOCATION OF SURFACE WATER BODIES

Appendix L

R645-301-722.300 MONITORING STATIONS

Protection of Hydrologic Balance and Compliance with Water Quality Laws

Andalex will follow its approved "Sedimentation and Drainage Control Plan" (please see R645-301-733.) and comply with the N.P.D.E.S. Permit No. UTG-040007 issued July, 1989 (see Appendix J). Please note this permit authorizes three discharge points; two from sedimentation ponds (001, 003) and one from the underground mine (002). See IV-11 and R645-301-711.300.

Andalex will comply with the Clean Water Act (33 U.S.C. Sec. 1251 et seq.) and all other applicable water quality laws and health and safety standards.

R645-301-722.400. WATER WELLS

See R645-301-711.300.

R645-301-722.500. EXISTING LAND SURFACE CONFIGURATION

Plate 5-7

R645-301-723. SAMPLING AND ANALYSIS

Appendix L

R645-301-724. BASELINE INFORMATION

Appendix L

R645-301-724.100. GROUND WATER INFORMATION

Appendix L

R645-301-724.200. SURFACE WATER INFORMATION

Appendix L

R645-301-724.300. GEOLOGIC INFORMATION

Appendix L

R645-301-724.310. PROBABLE HYDROLOGIC CONSEQUENCES

Appendix L

R645-301-724.320. RECLAIMABILITY

Post Mining Hydrology

Upon completion of mining activities, and following removal of surface structures, the earthwork portion of the reclamation plan will begin as described. The hydrologic portion of reclamation will take place in two phases including the left hand fork fan installation:

1. The main and side drainage channels will be restored as shown in the Sedimentation and Drainage Control Plan, and on Plate 7-12. Loose rock check dams will be placed at each side drainage entrance onto the reclaimed area, and at approximately 500' intervals along the restored main channel RC-1. (Typical sections of the loose rock check dams are shown in the Sedimentation and Drainage Control Plan).

All disturbed diversions and sediment ponds "B" and "C" will also be removed at this time. Sediment Pond "E" will be enlarged, and the entire drainage above will flow into Pond "E-PM" through the restored channel RC-1.

2. Once revegetation and water quality standards are met, Pond "E-PM" will be removed, and the area reclaimed.

Surface water monitoring will continue during this time as described. Please see Plate 7-9.

R645-301-724.400. CLIMATOLOGICAL INFORMATION

Introduction

The permit area, which is part of the Book Cliffs coal field, is located in a mid-latitude steppe climate with the land below the cliffs approaching desert conditions. The nearest weather recording station is located approximately 10 miles southwest of the Zion's fee in Price, Utah.

Temperatures at the site are 3 to 5o F cooler than at Price, 10 miles south and 1,200 feet lower. Average monthly temperatures at Price range from 25o F in January to 70-75o in July and August. Extreme temperatures of record are -31o and 108o F. Due to the elevation, and a predominance of clear skies and dry air, daily temperature ranges are rather large, averaging 26 degrees in winter and 33 degrees in summer. Average annual precipitation is 12 inches at the portal and may be as much as 16 inches at the higher parts of the lease area. The 100-year 6-hour precipitation is about

2 inches. Snowfall is generally light, averaging less than 33 inches annually, at Price. Potential evaporation is about 36 inches per year. The area is almost completely surrounded by mountains which act as a barrier to storms approaching from every direction except south.

Source of Data

National Oceanic and Atmospheric Administration, National Climatic Center, Asheville, North Carolina.

Department of the Interior, 1979, Final Environmental Statement, Development of Coal Resources in Central Utah.

Climatological Factors

Precipitation

The precipitation in the area, which is largely controlled by elevation, varies from five inches to 20 inches.

The principal rainfall is in late summer when the area is occasionally subjected to thunderstorm activity associated with moisture-laden air masses moving in from the Gulf of Mexico.

Snowfall is generally light, averaging less than 33 inches annually; however, as much as 95 inches have been reported in a single winter season.

The greatest and least monthly precipitation totals for the period of record are shown on Table III-4 following this page.

TABLE III-4

Maximum and Minimum Monthly Precipitation

Month	Medium	Greatest	Year	Least	Year
January	0.60	2.50	1969	0	1948
February	0.61	2.44	1919	0	1967
March	0.83	2.58	1912	0	1934
April	0.47	2.22	1941	0	1948
May	0.46	2.19	1964	0	1927
June	0.54	3.69	1927	0	1950
July	0.73	3.84	1914	0.05	1963
August	1.05	4.32	1921	0	1911
September	0.60	5.91	1927	0	1934
October	0.90	4.34	1972	0	1952
November	0.38	2.84	1957	0	1932
December	0.60	2.86	1966	0	1930
Annual	9.47	19.55	1927	4.47	1942

The first column contains median precipitation values by month for the 30 year period from 1936-1965.

Extremes of precipitation occurring prior to 1936 are as follows:

Amount	Date
0.83	January, 1921
0.98	March, 1929
2.00	August, 1921
1.65	October, 1925

Table III-4 (Continued)
Climatological Summary
Monthly Average 1936-1965

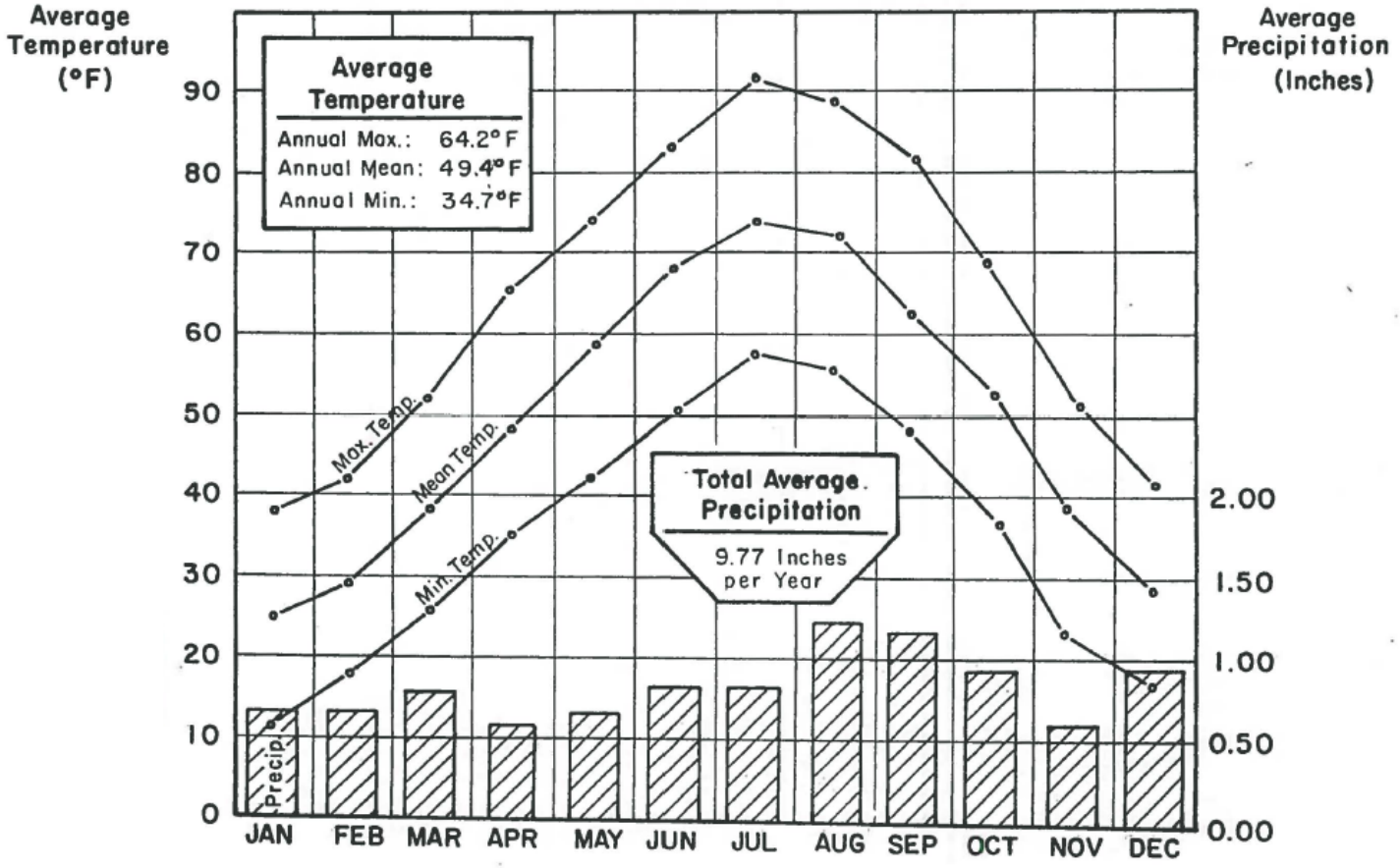

TABLE III-5

ESTIMATED RETURN PERIODS FOR SHORT DURATION PRECIPITATION
(Inches)

Station: Price Elevation: 5680
Latitude: 39* 37' Longitude: 110* 50'

Duration

YEARS	5 Min	10 Min	15 Min	30 Min	1Hour	2 Hour	3 Hour	6 Hour	12 Hour	24 Hour
1	0.08	0.13	0.17	0.23	0.29	0.37	0.44	0.62	0.78	0.95
2	0.12	0.18	0.23	0.32	0.40	0.49	0.58	0.80	1.00	1.20
5	0.16	0.25	0.32	0.44	0.56	0.68	0.79	1.07	1.32	1.58
10	0.20	0.31	0.39	0.54	0.68	0.81	0.94	1.25	1.53	1.82
25	0.25	0.37	0.47	0.65	0.82	0.98	1.13	1.50	1.83	2.18
50	0.28	0.43	0.54	0.75	0.95	1.12	1.29	1.71	2.08	2.47
100	0.31	0.49	0.62	0.85	1.08	1.27	1.45	1.91	2.32	2.74

Table III-6

Average monthly precipitation for the period 1936-1976.

Total Precipitation (Inches)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Annl
1936	0.51	1.21	0.54	0.15	0.20	0.55	2.73	1.72	0.70	1.00	0.05	2.08	11.44
1937	1.37	1.08	0.96	0.08	1.45	0.68	1.11	0.68	1.15	0.44	0.08	0.95	10.03
1938	0.56	0.39	1.81	0.13	1.12	1.22	0.91	1.05	1.57	1.53	0.20	0.58	11.07
1939	1.03	1.00	1.24	0.48	0.68	0.25	0.44	0.87	3.88	0.89	0.15	0.25	11.16
1940	1.77	1.40	0.15	0.57	0.21	0.50	0.10	1.12	4.39	0.76	0.32	0.83	12.12
1941	0.92	1.04	1.23	2.22	1.26	1.47	0.75	0.57	1.02	3.24	0.73	1.03	15.48
1942	0.16	0.23	0.43	0.72	0.04	0.00	0.33	0.59	0.40	1.14	0.25	0.18	4.47
1943	0.37	0.45	0.90	0.55	0.40	1.40	0.19	1.05	0.95	1.04	1.16	0.30	8.76
1944	1.38	0.62	1.29	1.86	0.80	1.10	0.35	0.30	0.02	0.31	0.56	0.18	8.77
1945	0.41	1.17	0.91	0.21	0.13	1.28	0.69	0.82	0.51	0.94	0.32	0.57	7.96
1946	0.44	T	1.04	0.23	0.24	0.02	0.38	1.06	0.05	1.76	1.45	0.92	7.59
1947	0.13	0.12	0.19	0.37	1.34	0.70	0.14	2.83	0.07	0.90	0.41	0.93	8.13
1948	0.00	0.59	0.40	0.00	0.07	1.41	0.90	0.66	0.22	1.58	0.09	1.55	7.47
1949	1.60	0.74	0.11	0.22	1.66	3.24	1.89	1.22	0.66	1.73	0.01	2.35	15.43
1950	0.92	0.27	0.37	0.08	0.14	0.00	1.98	0.11	0.70	T	0.56	0.49	5.62
1951	0.03	0.07	0.74	1.08	0.88	1.89	0.26	1.85	0.16	0.98	1.22	2.80	11.26
1952	1.09	0.17	1.97	0.81	0.79	1.06	0.27	1.59	0.37	0.00	0.21	1.58	9.91
1953	0.43	0.12	0.24	0.45	0.42	0.15	1.67	1.12	0.04	1.39	0.43	0.17	6.63
1954	0.76	T	0.80	0.57	0.35	0.52	1.80	0.92	2.38	0.79	0.49	0.62	10.00
1955	1.06	1.40	0.09	0.05	0.39	0.38	0.30	1.52	0.31	0.01	0.17	0.38	6.06
1956	1.44	0.15	0.00	0.35	0.44	T	0.69	0.42	0.15	0.50	0.00	0.19	4.33
1957	0.87	0.63	0.40	0.65	1.86	1.20	1.07	2.30	T	1.86	2.84	0.98	14.66
1958	0.10	1.17	2.12	0.81	1.19	0.12	0.10	0.83	1.41	0.22	0.43	0.06	8.56
1959	0.06	1.57	0.12	0.59	0.66	0.25	0.75	2.09	1.18	0.45	0.17	1.04	8.93
1960	0.98	1.20	-	0.51	0.40	0.31	0.54	0.23	1.35	2.93	0.67	0.00	-
1961	0.00	0.03	1.02	0.23	0.11	0.08	0.76	2.43	4.85	1.06	0.88	0.82	12.27
1962	0.92	2.36	0.58	0.13	0.23	0.26	0.70	0.00	2.07	1.05	0.03	0.05	8.38
1963	0.68	0.32	0.73	1.50	0.12	0.58	0.05	3.33	1.89	0.76	0.18	0.02	10.16
1964	0.12	0.06	1.06	1.05	2.19	0.76	-	1.26	0.33	0.01	0.69	2.29	-
1965	0.32	-	1.28	-	-	3.31	1.79	1.24	0.98	0.32	2.06	2.47	-

Total Precipitation (Inches)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Annl
1966	.00	.87	.12	.00	.57	.32	1.16	1.25	.50	1.14	.14	2.86	8.93
1967	1.06	.00	.29	.65	1.40	1.42	.84	.66	1.14	.08	.19	2.01	9.74
1968	.48	1.11	1.04	1.41	1.03	----	.79	1.82	.29	.49	T	.96	----
1969	2.50	1.37	.24	.28	.37	2.41	1.46	1.83	.59	.38	.33	.10	11.86
1970	.77	.01	.48	.12	.03	2.11	.65	.82	1.03	.56	.38	.38	7.34
1971	.22	.35	.03	.61	.80	.17	.68	.89	.24	3.26	.22	1.51	8.98
1972	.00	.00	.00	.19	.21	.66	.33	.91	1.33	4.34	.83	.68	9.48
1973	.62	.41	1.51	.84	1.15	1.40	1.97	1.17	.21	.56	.42	.36	10.62
1974	.81	.10	.07	.56	T	.04	2.12	.35	.21	4.08	.22	.53	9.09
1975	.76	.69	1.11	T	.74	.92	1.54	.06	1.26	.14	.45	.08	7.75
1976	T	1.16	.20	.91	.77	.13	.39	.30	1.62	.37	.03	.00	5.88

Source: National Oceanic and Atmospheric Administration,
National Climatic Center,
Asheville, North Carolina

Table III-7:

Climatology summary by month for period 1936-1965

Climatological Summary

Means and Extremes for Period 1936 - 1965

Month	Temperature (°F)							Precipitation Totals (Inches)								Mean Number of days				
				Extremes							Snow, Sleet						Temperatures			
																	Max.		Min.	
	Daily Maximum	Daily Minimum	Monthly	Record Highest	Year	Record Lowest	Year	Mean	Greatest Daily	Year	Mean	Maximum Monthly	Year	Greatest Daily	Year	Precip. + .1"	90° and above	32° and below	32° and below	0° and below
Jan.	37.1	11.0	24.1	58	1961	-29	1937	.68	.67	1956	9.2	21.5	1944	8.5	1956	2	0	8	31	4
Feb.	42.3	17.4	29.8	68	1958	-17	1963	.68	.80	1962	7.0	27.0	1939	13.0	1939	2	0	4	27	3
Mar.	51.6	25.2	38.4	75	1956	-7	1964	.78	.97	1938	3.9	26.0	1952	6.0	1963	3	0	-	27	-
Apr.	63.8	34.2	49.0	86	1946	8	1945	.57	.66	1944	0.1	2.0	1944	2.0	1944	2	0	0	12	0
May	74.1	42.9	58.5	94	1962	20	1959	.68	1.45	1937	0.4	10.0	1964	8.0	1964	2	1	0	2	0
June	83.6	50.0	66.9	101	1954	29	1939	.80	1.47	1941	0.0	T	1955	0.0		2	7	0	-	0
July	90.6	56.7	73.7	106	1938	40	1962	.82	1.05	1954	0.0	T	1954	0.0		2	20	0	0	0
Aug.	88.2	55.3	71.7	102	1940	32	1960	1.19	1.03	1949	0.0	0.0		0.0		3	12	0	-	0
Sep.	80.0	47.2	63.6	96	1950	23	1938	1.13	1.67	1962	0.1	2.5	1965	2.5	1965	3	2	0	6	0
Oct.	67.7	36.6	52.2	87	1963	15	1960	.99	1.75	1960	0.2	4.5	1949	3.5	1949	3	0	0	8	0
Nov.	50.5	23.7	37.1	73	1962	0	1959	.56	1.97	1957	2.4	12.5	1951	8.0	1951	2	0	-	26	-
Dec.	40.6	15.9	28.2	60	1962	-10	1948	.89	1.07	1964	8.8	42.0	1951	13.0	1951	3	0	6	28	2
Year	64.2	34.7	49.4	106	July 1938	-29	Jan. 1937	9.77	1.97	Nov. 1957	32.1	42.0	Dec. 1951	13.0	Dec. 1951	29	42	18	167	9

Temperature

The average annual maximum temperature for the period 1936-1976 was 64.2 degrees. The annual mean temperature was 49.4 degrees and the annual minimum temperature was 34.7 degrees. See Figure III-4.

Summers are characterized by hot days and cool nights. However, the high temperatures are not oppressive since the relative humidity is low. The hottest month is July with the maximum temperature on most days nears 90 degrees and the lows in the upper 50's. The maximum temperature record was in July, 1925 at 108 degrees. Recorded summer lows have been 28 degrees in June, 1973 and 31 degrees in July, 1924.

The winters are cold and uncomfortable, but usually not severe, due in part to the protecting influence of the mountain ranges to the north and east which prevent cold arctic air masses from moving into the area. The coldest temperature on record is minus 31 degrees in December, 1924.

Temperatures of 100 degrees or higher during summer or 15 degrees below zero or colder during winter are likely to occur once every three years.

The freeze-free period, or growing season, averages about five months in length, from early May to early October.

Average dates of occurrence of various temperature values are given on Table III-8.

TABLE III-8

Occurrence of Various Temperatures

Temperature Equal to or Lower Than	Average Dates of Occurrence	
	Last in Spring	First in Fall
32o	May 3	October 3
28o	April 27	October 15
24o	April 11	October 15
20o	March 29	November 7
16o	March 17	November 16

TABLE III-9

Average monthly temperature for the area from 1936 - 1976

Average Temperature (°F)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Annl
1936	23.8	31.6	41.0	52.0	61.6	70.2	73.0	71.3	-	-	-	27.6	-
1937	26.0	20.1	37.5	44.5	-	66.1	72.9	75.6	-	52.6	38.6	31.4	-
1938	27.0	32.4	39.0	48.7	55.4	69.4	73.7	73.2	64.8	50.4	29.8	28.4	49.4
1939	24.2	16.1	39.0	51.2	60.3	64.8	-	73.0	63.0	50.0	41.7	32.6	-
1940	23.0	32.2	40.7	50.0	65.6	72.7	73.2	74.4	62.5	54.5	33.3	27.6	50.7
1941	21.8	31.4	41.4	43.9	58.3	-	70.6	70.0	58.9	47.6	37.6	29.9	-
1942	23.4	27.0	35.6	49.0	54.6	67.8	73.2	70.8	61.4	-	-	-	-
1943	24.9	-	-	-	-	66.4	75.1	71.8	67.4	54.0	39.1	31.3	-
1944	23.8	28.2	37.8	46.5	68.9	62.8	73.6	72.6	66.4	55.1	38.6	31.2	49.6
1945	30.5	35.4	38.5	45.0	59.6	63.9	74.5	73.0	62.5	52.6	35.2	23.3	49.5
1946	22.8	31.0	42.7	56.0	57.2	69.8	75.7	72.6	65.4	46.8	36.3	33.6	50.8
1947	25.8	36.3	43.4	49.0	62.6	63.8	75.2	71.2	67.2	56.0	33.2	29.0	51.1
1948	28.6	29.0	34.2	49.1	60.2	67.2	74.0	72.4	67.4	51.1	33.5	25.1	49.3
1949	16.9	20.1	41.2	54.1	58.8	63.6	74.3	72.5	66.0	47.8	43.5	23.6	48.5
1950	17.6	30.5	39.5	51.2	56.2	67.4	69.7	71.1	62.7	56.1	40.9	34.4	49.8
1951	27.7	32.0	39.2	50.0	58.8	64.4	76.9	71.6	65.2	50.3	34.2	20.8	49.3
1952	19.9	25.6	32.4	52.0	61.1	67.9	74.9	72.7	65.9	56.0	35.3	23.9	49.0
1953	28.1	31.9	42.3	47.8	52.9	-	76.6	70.5	66.6	52.6	40.3	27.5	-
1954	30.5	40.6	38.7	54.4	63.2	67.7	76.9	71.3	64.1	53.5	42.5	25.4	52.4
1955	18.0	17.1	35.3	46.6	57.9	66.0	74.7	74.0	66.1	53.3	35.3	30.8	47.9
1956	33.1	28.2	42.2	50.0	61.3	72.1	74.8	70.4	67.7	52.4	33.2	26.3	51.0
1957	24.4	33.9	42.5	47.2	54.8	68.3	73.5	-	-	49.5	33.7	29.4	-
1958	28.8	37.3	35.9	44.8	60.3	67.4	70.7	73.7	62.6	52.9	36.8	33.7	50.4
1959	27.4	32.8	38.9	48.8	54.9	69.4	73.8	70.6	62.4	52.2	38.1	30.6	50.0
1960	19.4	23.2	-	50.8	57.4	67.9	74.1	71.2	64.2	52.6	39.4	31.7	49.3
1961	29.0	33.4	38.2	46.1	57.5	69.8	73.6	61.4	55.3	47.9	33.8	23.5	48.3
1962	24.3	32.7	34.6	52.3	55.3	66.2	71.4	69.6	61.8	52.4	42.3	29.8	49.4
1963	16.3	38.0	36.4	45.2	60.3	63.7	73.7	70.0	64.4	55.3	39.1	25.6	49.0
1964	23.3	27.5	30.4	45.0	55.1	63.2	-	68.9	60.8	53.4	32.6	23.9	-
1965	31.5	-	37.1	-	-	62.0	69.9	68.5	54.8	53.6	41.4	26.9	-
1966	M	25.6	38.8	48.6	58.7	63.5	73.1	70.1	60.7	51.5	39.7	26.2	----
1967	22.0	30.8	39.9	41.7	52.8	61.0	73.4	71.2	62.7	51.1	42.4	17.8	47.2
1968	15.8	32.2	40.7	42.5	53.3	----	73.7	67.3	62.6	53.1	39.3	23.8	----
1969	26.8	25.8	33.0	50.4	61.6	64.1	75.5	75.4	65.6	45.2	39.0	33.3	49.6
1970	28.6	37.7	38.2	43.0	59.1	67.5	75.4	75.4	60.6	48.1	39.7	28.3	50.1
1971	27.8	33.4	37.6	48.1	55.3	67.6	74.3	75.4	59.7	49.6	35.8	24.7	49.1
1972	27.8	35.6	47.4	48.3	59.7	68.4	76.7	73.9	63.9	52.3	35.0	22.0	50.9
1973	16.9	26.8	37.1	45.1	57.9	65.1	71.9	72.3	63.9	55.7	38.4	29.2	48.4
1974	18.6	23.2	42.1	45.0	61.6	74.2	78.0	73.6	68.4	M	M	31.3	----
1975	25.0	31.6	41.3	43.7	53.6	59.9	72.3	71.0	63.9	52.1	M	----	----
1976	25.5	36.2	38.2	46.8	58.1	65.4	76.0	70.4	64.0	50.5	----	----	----

Source: National Oceanic and Atmospheric Administration,
National Climatic Center,
Asheville, North Carolina

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Winds

Winds are light to moderate, although strong winds may occur. The average velocity of the prevailing southwest winds is below 20 mph with peak wind velocities occurring in June and July.

R645-301-724.410. CLIMATOLOGICAL FACTORS

See R645-301-724.400.

R645-301-724.411. AVERAGE SEASONAL PRECIPITATION

See R645-301-724.400.

R645-301-724.412. PREVAILING WINDS

See R645-301-724.400.

R645-301-724.413. SEASONAL TEMPERATURE RANGES

See R645-301-724.400.

R645-301-724.420. OTHER INFORMATION

N/A

R645-301-724.500. SUPPLEMENTAL INFORMATION

N/A

R645-301-724.600. SURVEY OF RENEWABLE RESOURCE LANDS

There are no structures present other than those constructed for mining operations, on the permit area. The land is presently used for grazing and wildlife habitat which constitutes a renewable resource area. It should be noted that geographic areas above Andalex's five-year mine plan do not include any area suitable for grazing, nor do they contribute significantly to the long-range productivity of water, food or fiber products. Andalex commits to mitigate all subsidence related damage to renewable resources including, but not limited to water, grazing, and wildlife habitat including raptor nests.

R645-301-724.700. STREAMS

Appendix L

R645-301-725. BASELINE CUMULATIVE IMPACT AREA INFORMATION

Appendix L

R645-301-725.100. INFORMATION FROM FEDERAL OR STATE AGENCIES

Appendix L

R645-301-725.200. INFORMATION FROM APPLICANT

Appendix L

R645-301-725.300. RESTRICTIONS ON PERMIT

N/A

R645-301-726. MODELING

N/A

R645-301-727. ALTERNATIVE WATER SOURCE INFORMATION

Appendix L

R645-301-728. PROBABLE HYDROLOGIC CONSEQUENCES (PHC) DETERMINATION

Appendix L

R645-301-728.100. DETERMINATION OF PHC

Appendix L

R645-301-728.200. BASIS OF DETERMINATION

Appendix L

R645-301-728.300. PHC DETERMINATION FINDINGS

Appendix L

R645-301-728.310. ADVERSE IMPACTS TO HYDROLOGIC BALANCE

Appendix L

R645-301-728.320. ACID FORMING OR TOXIC FORMING MATERIALS

Appendix L

R645-301-728.331. SEDIMENT YIELD FROM DISTURBED AREA

R645-301-733.

R645-301-728.332. WATER QUALITY PARAMETERS

R645-301-733.

R645-301-728.333. FLOODING OR STREAM-FLOW ALTERATION

N/A

R645-301-728.334. GROUND WATER AND SURFACE WATER AVAILABILITY

Appendix L

R645-301-728.335. OTHER CHARACTERISTICS

Appendix L

R645-301-728.340. IMPACT ON SURFACE OR GROUND WATER

Appendix L

R645-301-728.400. PERMIT REVISIONS

Appendix L

R645-301-729. CUMULATIVE HYDROLOGIC IMPACT ASSESSMENT (CHIA)

(BY DIVISION)

R645-301-729.100. DIVISION ASSESSMENT

(BY DIVISION)

R645-301-729.200. PERMIT REVISIONS

N/A

R645-301-730. OPERATION PLAN

See R645-301-511.100.

R645-301-731. GENERAL REQUIREMENTS

See R645-301-511.100.

R645-301-731.100. HYDROLOGIC BALANCE PROTECTION

See R645-301-711-300.

R645-301-731.110. GROUND WATER PROTECTION

Appendix L, See Appendix Y

R645-301-731.111. GROUND WATER QUALITY

Appendix L

R645-301-731.112. SURFACE MINING OPERATIONS

N/A

R645-301-731.120. SURFACE WATER PROTECTIONS

Appendix L

R645-301-731.121. SURFACE WATER QUALITY

Appendix L. Historically, no treatment has been needed on mine discharge water. If water quality nears a point where treatment is needed, a treatment plan will be incorporated into the MRP at that time.

R645-301-731.122. SURFACE WATER QUANTITY PLAN

Appendix L

R645-301-731.200. WATER MONITORING

See R645-301-711.300.

R645-301-731.210. GROUND WATER MONITORING

See R645-301-711.300.

R645-301-731.211. GROUND WATER MONITORING PLAN

See R645-301-711.300.

R645-301-731.212. SAMPLING AND REPORTING DATA

See R645-301-711.300.

R645-301-731.213. NON-ESSENTIAL AQUIFERS

N/A

R645-301-731.214. DURATION

See R645-301-711.300.

R645-301-731.214.1 SUITABILITY

See R645-301-711.300.

R645-301-731.214.2 COMPLIANCE

See R645-301-711.300.

R645-301-731.215. EQUIPMENT, STRUCTURES AND OTHER DEVICES USED IN CONJUNCTION WITH MONITORING

Appendix L

R645-301-731.220. SURFACE WATER MONITORING

See R645-301-711.300.

R645-301-731.221. SURFACE WATER MONITORING PLAN

See R645-301-711.300.

R645-301-731.222 DESCRIPTION

See R645-301-711.300.

R645-301-731.222.1 PARAMETERS

See R645-301-711.300.

R645-301-731.222.2 POINT SOURCE DISCHARGES

See R645-301-711.300.

R645-301-731.223. SAMPLING AND REPORTING DATA

See R645-301-711.300.

R645-301-731.224. DURATION

See R645-301-711.300.

R645-301-731.224.1 SUITABILITY

See R645-301-711.300.

R645-301-731.224.2 COMPLIANCE

See R645-301-711.300.

R645-301-731.225. EQUIPMENT, STRUCTURES AND OTHER DEVICES USED IN CONJUNCTION WITH MONITORING

Appendix L

R645-301-731.300. ACID AND TOXIC FORMING MATERIALS

See R645-301-711.300.

R645-301-731.310. DRAINAGE INTO SURFACE AND GROUND WATER

Post Mining Hydrology

Upon completion of mining activities, and following removal of surface structures, the earthwork portion of the reclamation plan will begin as described. The hydrologic portion of reclamation will take place in two phases:

1. The main and side drainage channels will be restored as shown in the Sedimentation and Drainage Control Plan, and on Plate 7-12. Loose rock check dams will be placed at each side drainage entrance onto the reclaimed area, and at approximately 500' intervals along the restored main channel RC-1. (Typical sections of the loose rock check dams are shown in the Sedimentation and Drainage Control Plan).

All disturbed diversions and sediment ponds "B" and "C" will also be removed at this time. Sediment Pond "E" will be enlarged, and the entire drainage above will flow into Pond "E-PM" through the restored channel RC-1.

2. Once revegetation and water quality standards are met, Pond "E-PM" will be removed, and the area reclaimed.

Surface water monitoring will continue during this time as described. Please see Plate 7-9.

R645-301-731.311. MATERIAL ADVERSELY AFFECTING WATER QUALITY

See R645-301-731.310.

R645-301-731.312. STORING MATERIALS

See R645-301-731.310.

R645-301-731.320. DISPOSAL PROVISIONS

See R645-301-731.310.

R645-301-731.400. TRANSFER OF WELLS

No transfer of wells has taken place, nor is any transfer anticipated.

R645-301-731.500. DISCHARGES

See R645-301-711.300.

R645-301-731.510. DISCHARGES INTO AN UNDERGROUND MINE

Andalex has approval from the State Engineer, Division of Water Rights, to collect the surface runoff from the disturbed area and discharge into the mine. This water is used for dust suppression underground. Water collected is a direct result of precipitation within the disturbed area. Although MSHA has verbally acknowledged the fact that some precipitation drains into the mine, they have not specifically required any type of approval for this occurrence.

R645-301-731.511. DEMONSTRATION

N/A

R645-301-731.511.1 PREVENTION OF DAMAGE

N/A

R645-301-731.511.2 VIOLATION OF WATER QUALITY STANDARDS OR EFFLUENT LIMITATIONS

N/A

R645-301-531.511.3 COMPLIANCE REQUIREMENTS

N/A

R645-301-731.511.4 MEET WITH THE APPROVAL OF MSHA

N/A

R645-301-731.512. DISCHARGE LIMITATIONS

N/A

R645-301-731.512.1 WATER

N/A

R645-301-731.512.2 COAL PROCESSING WASTE

N/A

R645-301-731.512.3 FLY ASH

N/A

R645-301-731.512.4 SLUDGE FROM ACID MINE DRAINAGE TREATMENT

N/A

R645-301-731.512.5 FLUE-GAS DESULFURIZATION SLUDGE

N/A

R645-301-731.512.6 INERT MATERIALS USED FOR STABILIZING UNDERGROUND MINES

N/A

R645-301-731.512.7 UNDERGROUND MINE DEVELOPMENT WASTE

N/A

R645-301-731.513. DIVERTING MINE WATER INTO UNDERGROUND WORKINGS

N/A

R645-301-731.520. GRAVITY DISCHARGES FROM MINE WORKINGS

If a discharge is found to occur after sealing, the water will be sampled quarterly for compliance with effluent standards of 817.42 and treated (if necessary) during the liability period. See Figures IV-1 and IV-2 for portal sealing details.

R645-301-731.521. DISCHARGE CONTROL

See R645-301-731.520.

R645-301-731.522. PREVENTION OF DISCHARGE

N/A

R645-301-731.600. STREAM BUFFER ZONES

R645-301-731.610. BUFFER ZONE LOCATIONS

The fan installation in the left hand fork of Deadman Canyon will require that the intermittent drainage is crossed. A 42-inch culvert will divert the natural runoff underneath the pad where the fan will be located. Since this activity is within 100 feet of an intermittent stream, the Division may authorize this activity by virtue of compliance with all R645-301-731.600 regulations. It should be emphasized that the stream buffer zones will not be adversely affected due to the installation of the culvert and the alternate sediment control measures. Also, travel on the access road and at the pad area will be restricted to times of no flow.

It should be noted (R645-301-542.600) that the access road to the fan installation is already in existence; Andalex intends only to upgrade the road as needed and as described. This road will be reclaimed following cessation of mining to be consistent with the desires of the surface owners and management agencies.

The culvert will be removed upon cessation of mining. Sediment control measures downstream from this activity will be provided in the form of silt fences or straw dikes located in the drainage channel during the removal of the culvert. As there are no permanent water treatment facilities constructed for this fan installation, none need be removed. Typical designs for berms and diversions are shown on the Design Drawings. This includes the berm surrounding the topsoil pile. (See Plate "Aberdeen Mine Left Hand Fork Fan Installation, Sedimentation/Drainage Control".) These typical designs will adequately convey a two-year, ten-hour storm event. Sediment control

during construction and reclamation will consist of straw bales or silt fences located downstream from the construction activity.

The same restrictions will also apply to the 48-inch culvert at the lower road / stream crossing and in places where the road will be improved within the stream buffer zone. That is, activities will be allowed only during periods of no flow. Also, and by the same token, the lower culvert will be removed upon final reclamation if is deemed appropriate by the surface land-owner or management agency.

Andalex will reclaim this road entirely if it is determined through communications with the surface owners and land management agencies that this is the appropriate action. Andalex has obtained official comments on the status of the road for post-mining landuse from the State of Utah, Gladys Artman and the Bureau of Land Management; all parties with the exception of Gladys Artman request that the road be abandoned and reclaimed. Mrs. Artman requested that the road remain status quo upon cessation of mining.

R645-301-731.611. VIOLATION OF WATER QUALITY STANDARDS OR EFFLUENT LIMITATIONS

Coal mining and reclamation operations 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 of other environmental resources of the stream.

R645-301-731.612. STREAM DIVERSIONS

See R645-301-733, Culvert Design

This diversion will comply with all the requirements of R645-301-742.300 (diversion structures). Also, please refer to culvert sizing calculations in Appendix O.

R645-301-731.620. BUFFER ZONE SIGNS AND MARKERS

This buffer zone will be marked as specified in R645-301-521.260. Signs will be clearly marked to prevent additional disturbance by operations.

R645-301-731.700. CROSS SECTIONS AND MAPS

Plate 5-7.

R645-301-731.710. WATER SUPPLY INTAKES

N/A

R645-301-731.720. WATER HANDLING AND STORAGE FACILITIES

Water is trucked from Price for culinary use and is stored in one of four 12,000-gallon tanks on the property. Each mine is equipped with a 12,000-gallon surface tank. All other mine water storage is underground.

R645-301-731.730. MONITORING LOCATIONS

Plate 7-9

R645-301-731.740. MAPS

See Volume II, R645-301-510.

R645-301-731.750. CROSS SECTIONS

See Volume II, R645-301-510.

R645-301-731.760. OTHER RELEVANT DRAWINGS

Figure IV-2 through IV-12

R645-301-731.800. WATER RIGHTS AND REPLACEMENT

Appendix L

R645-301-732. SEDIMENT CONTROL MEASURES

See R645-301-733.

R645-301-732.100. SILTATION STRUCTURES

See R645-301-733.

R645-301-732.200. SEDIMENTATION PONDS

See R645-301-733.

R645-301-732.210. COMPLIANCE REQUIREMENTS

See R645-301-733.

R645-301-732.220. MSHA REQUIREMENTS

N/A

R645-301-732.300. DIVERSIONS

See R645-301-733.

R645-301-732.400. ROAD DRAINAGE

See R645-301-733., also R645-301-512.250.

R645-301-732.410. ALTERATION OR RELOCATION OF A NATURAL DRAINAGEWAY

See R645-301-733.

R645-301-732.420. INLET PROTECTIONS

See R645-301-733.

R645-301-733. IMPOUNDMENTS

See R645-301-733.

Three sedimentation ponds have been constructed so far as shown on Plate 5-7. Pond A, as its capacity was not required, is now being used for snow storage and topsoil storage. The sedimentation and drainage control plan has been designed according to OSM regulations and the design and construction certified by a Utah Registered Professional Engineer. No other embankments, or other impoundments have been built nor are any proposed.

General Description

The Andalex Deadman Canyon Project is comprised of three mines located closely together in Deadman Canyon. The Pinnacle Mine, Apex Mine, and the Aberdeen Mine are all presently in operation mining the Gilson and Lower Sunnyside Seams and the A Seam. The Centennial Seam is mined via rock tunnels from the existing Pinnacle Mine. Surface runoff from the Pinnacle Mine and Apex Mine is controlled by Settling Basin B and Pond C. Engineering Design for these ponds have been presented to the Division of Oil, Gas, and Mining on 4-3-80 and 8-21-81. Surface runoff from the Aberdeen Mine is controlled by Pond E. Designs for these basins and ponds are shown on Plates 7-4, 7-5, and 7-7 included herein.

The mines are located in the Right Fork of Deadman Canyon. This is an ephemeral drainage flowing only from direct runoff and eventually reaches the Price River some 12 miles to the south. The major drainages in the minesite area will be routed under the site through large culverts. The existing minesite has a disturbed area of 34.2 acres. Please note that a certain percentage of the disturbed area does not

report to sedimentation ponds. Please refer to Plate 7-2 for these areas. Actual disturbed area reporting to basins and ponds is approximately 26 acres. Sediment pond designs include undisturbed areas reporting to ponds. In order to minimize additional sediment loading to the main drainage, these ponds and basins will collect runoff from these approximately 27 acres. Berms will be placed on the lower edge of all disturbed areas to prevent runoff from reaching natural drainages before it has passed through the sedimentation ponds except in small area exemptions. Ponds are designed for maximum runoff including the chidister water. Areas draining to Pinnacle and Apex portals are to be included.

Sedimentation Pond Specifications

Location

The ponds are located over the main drainage of the Right Fork of Deadman Canyon. The main canyon drainage is routed through a 36-42" culvert located under the ponds. The sites are located downslope of the disturbed areas to simplify collection of runoff water (please see Plate 7-2).

Design

The ponds are designed to fully contain the expected runoff and sediment load from a 10-year 24-hour precipitation event in this area. Pond "C" has additionally been shown to fully contain the runoff from a 100-year 6-hour storm. The design has been certified by a registered professional engineer. A certification statement for the ponds can be found at the end of Appendix N.

Construction

The construction of the ponds have been completed as per the specifications set forth in the Construction Specifications sheet (part 2.3).

Capacity

Each pond is designed to contain the runoff and sediment load from a 10-year 24-hour precipitation event in the area of drainage. In addition, each pond has an overflow capacity in excess of that required for a 25-year 6-hour event. Pond "C" has been designed to contain and pass the runoff from a 100-year 6-hour event.

Safety Precautions

The ponds were built as per specifications and under supervision of a qualified, registered professional engineer. The ponds are inspected quarterly for safety and compliance. Inspection reports are maintained on-site, and submitted to the Division on an annual basis. Ponds will be cleaned at minimum when sediment reaches 60% of designed sediment volume. Measuring devices will be installed in the ponds to show

when the ponds have filled with sediment to the clean-out level (please see Plates 7-4, 7-5, and 7-7). Drainage directly into the Pinnacle and Apex Portals is not part of the calculation for sediment pond sizing. (Pond C)

Monitoring

Water monitoring stations will be established at the outlet of the ponds. Sample parameters and frequencies shall be as per specification of the NPDES permit.

Maintenance

The ponds shall be inspected after each storm and the sediment cleaned as necessary. In no event shall sediment be allowed to build beyond 60% of sediment design capacity.

Seeding

An approved seed mix will be applied to all feasible disturbed areas in an effort to minimize erosion and sediment loading to the ponds. The proper seed mixture for this area has been obtained through the local BLM.

Culverts

All culverts are shown on Plate 7-1. Calculations for sizing are also included. It should be noted that all culvert sizes were arrived at and approved through consultation with the DOGM hydrologic engineer.

Calculations

The following reflects the calculations for sizing and details of each separate pond. Plates 7-4 through 7-7 show pond locations and volumes as well as watershed areas.

Construction Specifications for Sedimentation Ponds

All construction of sedimentation ponds have been performed under the direction of a qualified registered professional engineer.

Dams are constructed with primary overflows at least 2 ft. from the top, and emergency overflows at least 1.5 ft. from the top. The areas of the pond construction had been examined for topsoil, and if present in removable quantities such soil was removed separately and stored in an approved topsoil storage location.

In areas where fill was to be placed, natural ground was removed for at least 12" below the base of the structure.

Native materials were used where practical. Fill was placed in lifts not exceeding 15" and compacted prior to placement of the next lift. Compaction of all fill materials is at least 95%.

Grouted rip-rap or culverts have been placed at all inlets and outlets to prevent scouring. Each pond is fitted with an inverted inlet to the primary overflow, to prevent the passage of oil into the discharge.

Slopes of the dams are not steeper than 2.0:1, inside and outside, with a total of the inslope and outslope not less than 5:1. The inside slope of Pond E exceeded the steepness of 2:1. In part these slopes are incised and in part are constructed in from fill. Because of the steepness of these side slopes an investigation of stability was performed by Palmer Wilding Engineers. The conclusion was that the stability analysis is adequate and a stable section with respect to shear under static loading conditions is indicated. Please Appendix K.

Tops and external slopes of the dams were planted with an approved seed mix to prevent erosion and promote stability. Compaction of the slopes were at least 95%. Top width of dams are not less than (H + 35)/5.

Primary Settling Basins (Formerly Pond B)

General Notes

The primary settling basins (formerly Pond B) are located above Pond "C". A disturbed area of 9.42 acres drains into the settling basins as shown on Plate 7-2. These basins collect sediment and runoff from this area; however, since they are a series of cells, any overflow from the basins will be cleaned and go into Pond "C".

It is proposed that 18" culverts be added between cells B-1 and B-2, and between B-2 and B-3. An 18" culvert already exists between cells B-3 and B-4. These culverts will prevent breaching of the dikes between cells during major runoff events. The inflow to the basins is from culverts CD-12 and CD-13, which is a total of 2.79 cfs, as shown on Table IV-3C (Page 7-38). Based on the Manning's Equation for culverts (p.169-C), the required diameter to carry a flow of 2.79 CFS is only 0.95 feet; therefore, the 18" culvert overflows are more than adequate to pass the design flow. The placement of the culverts will not affect the maximum water levels or sediment storage capacity of the basins.

The basins are cleaned when sediment accumulations reach 50% of the original volume. The original volume was 0.540 acre feet, and the sediment cleanout level (0.270 acre feet) is at the culvert inlet level between cells B-2 and B-1 as shown on certified Plate 7-4.

Table IV-3C

Pond C

1. Use 1.82" for 10 year - 24 hour event
   Use 1.91" for 100 year - 6 hour event

*2. Disturbed Watershed - 14.79 acres

3. Runoff Curve No. = CN = 90

4. Area Runoff = Q (in.) = (P-0.2S)2/(P+0.8S); Where:

   S = (1,000/CN) - 10

   Q10/24 = 0.942 in./12 = 0.0785 ft.

   Q 100/6 = 1.018 in./12 = 0.0848 ft.

   Disturbed Volume 10/24 = 14.79 ac. x 0.0785 ft. = 1.161 ac. ft.

   Disturbed Volume 100/6 = 14.79 ac. x 0.0848 ft. = 1.254 ac. ft.

5. Undisturbed Watershed - 30.89 acres

6. Runoff Curve No. = CN = 70

7. Area Runoff:

   Q10/24 = 0.180 in./12 = 0.0150 ft.

   Q100/6 = 0.208 in./12 = 0.0173 ft.

   Undisturbed Volume 10/24 = 30.89 ac. x 0.0150 ft. = 0.463 ac. ft.

   Undisturbed Volume 100/6 = 30.89 ac. x 0.0173 ft. = 0.534 ac. ft.

8. Sediment Storage:

   **Disturbed Area 14.79 ac. x 0.05 ac. ft./ac. = 0.740 ac. ft.

   ***Undisturbed Area 30.89 ac. x 0.016 ac. ft./ac. = 0.494 ac. ft.

Total Sediment Storage Volume Required =
1.234 ac. ft.

60% Cleaning Point = 0.740 ac. ft.

9. Direct Precipitation into Pond

Area of Ponds = 0.39 acres

Volume 10/24 = 0.39 ac. x 1.82 in./12 in./ft. =
0.059 ac. ft.

Volume 100/6 = 0.39 ac. x 1.91 in./12 in./ft. =
0.062 ac. ft.
ft.

10. Total Required Pond Volume

Volume 10/24 = 1.161 + 0.463 + 1.234 + 0.059 =
2.917 ac. ft.

Volume 100/6 = 1.254 + 0.534 + 1.234 + 0.062 =
3.084 ac. ft.

11. Pond Volume at Outlet
18" cmp oil skimmer = 3.321 ac. ft.

36" cmp overflow = 4.264 ac. ft.

12. Conclusions:

A. Pond size is adequate to contain the runoff and sediment load from a 10 year - 24 hour precipitation event.

B. Pond size is also adequate to contain the runoff and sediment load from a 100 year - 6 hour precipitation event.

* Includes runoff to "Primary Settling Basins" (Formerly Pond B)

** Does not include sediment to "Primary Settling Basins". The sediment factor of 0.05 acre-ft./acre is considered conservative due to the extensive paving (roads and loadout area), and the grouted or paved ditches to the pond.

The USLE calculation for Disturbed Areas shows the actual expected sediment yield to be much lower than the 0.05 figure used.

POND C
1STAGE - VOLUME DATA

Stage	Elevation	Volume (Ac. Ft.)	Acc. Vol. (Ac. Ft.)
Bottom	7040.0	-	-
	7042.0	0.082	0.082
	7044.0	0.162	0.244
	7046.0	0.293	0.537
60% Sed. Cleanout	7046.9	0.203	0.740
	7048.0	0.266	1.006
Max. Sed. Level	7048.7	0.228	1.234
Decant Level	7049.7	0.330	1.564
	7050.0	0.099	1.663
	7052.0	0.862	2.525
10 yr.-24 hr. Volume	7052.7	0.392	2.917
100 yr.-6 hr. Volume	7053.1	0.167	3.084
18" Oil Skimmer	7053.5	0.237	3.321
	7054.0	0.297	3.618
36" CMP Overflow	7055.0	0.646	4.264
Crest of Embankment	7056.5	0.969	5.233

Pond "C" - General Notes

The sizing of Pond C is based on the drainage areas delineated on Plate 7-2 - "Drainage Map". As can be seen from this Plate, a portion of the minesite drainage goes into the Pinnacle Mine, the old Chidister Portal, and the Apex Mine. The actual disturbed area draining directly to Pond "C" was planimetered from this Plate and determined to be 10.72 acres. The disturbed area flowing to the "Primary Settling Basins" was measured to be 4.07 acres. This flow drains to Pond "C" and is therefore considered in the sizing; however, the projected sediment load to the Primary Settling Basins is not considered in sizing Pond "C", since the basins could be completely full of sediment before it could impact Pond "C". As stated earlier, the Primary Settling Basins will be cleaned when sediment accumulation reaches one-half of the total basin volume; therefore, sediment from this area will not impact Pond "C".

In addition, a certain amount of undisturbed area does not flow into the undisturbed drainage culverts, and thus drains onto the mine site (see plates 7-2 and 7-1). The portion of this drainage that flows to Pond "C" was measured at 30.89 acres, and is included in the Pond "C" sizing calculations.

Runoff Curve numbers used in the calculations were: 90 for disturbed areas and 70 for undisturbed areas.

An "As-Constructed" plan and profile of Pond "C" is shown on Plate 7-5. This plate has been certified by a registered, professional engineer. Also shown on this plate is a proposed sediment marker, and maximum and cleaning point depths for sediment. The cleaning point for sediment is at 60% of the maximum design depth for sediment storage. This point will be clearly marked on the sediment marker.

Also shown on Plate 7-5, is the location of each of the pond inlets. Inlets are either grouted concrete or culvert, and do not require rip-rap or other additional erosion protection.

Pond "C" will be removed during the earthwork portion of reclamation. The culvert will also be removed and the main channel restored throughout the area. All reclaimed area above will then drain into Pond "E" below.

Decanting for Pond C, as needed, will be accomplished with pumps located at the minesite. Decanted water will be pumped into the primary spillway once the 24 hour retention time has been met. An access ramp will be constructed to allow for inspection and sampling at the overflow riser pipe.

Pond E

1. Use 1.82" for 10 year - 24 hour event

2. Disturbed Watershed - 12.21 acres

3. Runoff Curve No. = CN = 90

4. Area Runoff = Q (in.) = (P-0.2S)2/(P+0.8S); Where:

   S = (1,000/CN) - 10

   P = 1.82"

   Q (in.) = [1.82-0.2(1.11)]2/[1.82+0.8(1.11)] =

   2.553 = .94 in. = .0785 ft.
   2.709

   Volume = 12.21 acres x 0.0785 ft. = 0.959 acre-ft.

5. Undisturbed Watershed - 12.20 acres

6. Runoff Curve No. = CN = 70

7. Area Runoff = 12.20 ac. x 0.2 in./12 = 0.203 acre-ft.

8. Sediment Storage Volume

   12.21 acres x 0.1 acre-ft./acre = 1.221 acre-ft. *

   60% Cleaning Point = 0.733 acre-ft.

9. Direct Precipitation into Pond

   Area of Ponds = 0.500 acres

   0.500 acres x 1.82 in. x 1/12 ft./in. = 0.076 acre-ft.

10. Total Required Pond Volume

    0.959 + 0.203 + 1.221 + 0.076 = 2.459 acre-ft.

11. Pond Volume @ Outlet (Principle Spillway)

Total Pond Volume = 2.569 acre-ft. (As constructed)

12. Conclusion: Pond size is adequate to contain the runoff and sediment load from a 10 year - 24 hour precipitation event in the area of drainage to the pond.

* Due to the elevation of the decant inlet, the maximum sediment storage volume is .930 ac-ft. However the 60% cleanout level will not be exceeded and the total pond volume takes into account the disturbed area of 12.21 acres. See Plate 7-7.

Pond "E" - PM

Post Mining Sediment Control

1. Use 1.82" for 10 year - 24 hour event.
2. Disturbed (Reclaimed) Watershed - 34.2 acres
    a. Runoff Curve No. = 90
    b. Runoff Volume = 2.740 ac. ft.
3. Undisturbed Watershed = 805.50 acres
    a. Runoff Curve No. = 70
    b. Runoff Volume = 13.425 ac. ft.
    4. Sediment Storage Volume = 0.150 ac. ft. (Upper Cell)
5. Direct Precipitation into Pond
    a. Use 0.5 acres
    b. 0.5 ac. x 1.82 in. x 1/12 = 0.076 ac. ft.
6. Expected Flow (10 yr. - 24 hr. event) = 88.94 cfs
7. Inflow Velocity (from RC-1) = 8.78 fps
8. Pond Configuration

    3 cells: 2 Gravel Filter Dikes and 1 Compacted Earthen Dam
9. Pond Capacity - 1.592 ac. ft.

Note: Pond is designed to clean and discharge runoff. Sediment will be removed by gravel filter dikes, and cleaned from pond when maximum sediment storage level is reached. Ponds will be cleaned when the 0.150 acre feet capacity of the upper cell is reached.

Pond "E" - General Notes

Pond "E" is to control runoff from the Aberdeen Mine. The disturbed area to drain to this pond is 12.21 acres. Pond E for the Aberdeen minesite was constructed prior to any other disturbance of the drainage area which report to the ponds.

Plate 7-7 shows the plan and profile of the pond. Also shown on this plate is a sediment marker and the level of the sediment 60% cleaning point. The constructed height of the dam includes a 5% settling factor. The elevations on Plate 7-7 are final.

Grouted rip-rap or culvert is used on all pond inlets; therefore, additional rip-rap or energy dissipators are not required.

Twelve 60" x 60" anti-seepage collars were installed on the main culvert beneath the pond. The collars are of concrete or a standard, manufactured design. Collar sizes and numbers are based on the following:

Flow length = 340'
Increase in flow length = 10% or 34'
Use 60" x 60" anti-seep collars
Each collar increases flow length by 2 x 8" or 3'; therefore, use 12 anti-seep collars.

An emergency spillway has been constructed to convey overflow from the pond into undisturbed diversion UD-4 as shown on Plates 7-2 and 7-7. This spillway consists of 12" D50 grouted rip-rap as shown on Figure IV-6. The dimensions of this spillway are shown on Plate 7-7.

Pond E was constructed prior to any disturbance of the drainage area to the pond.

As built certified drawings of Sediment Pond E have been submitted.

Pond "E" - PM - General Notes

Upon reclamation, Pond "E" will be enlarged and left in place until revegetation standards are met, as shown on Plate 7-12. The culvert will be removed, and the pond will be reconstructed to clean and discharge the entire runoff from the drainage area above. Pond sizing calculations are shown on the page entitled "Pond E - PM", "Post-Mining Sediment Control". Andalex will commit to the concept of allowing the entire undisturbed and reclaimed area to drain into this one structure if approved.

The rationale for removing all upper ponds and diversions is based on the following:

1. Pond E is the lowermost structure, and can be rebuilt and later removed and reclaimed with minimum damage to the reclaimed site.

2. The upper site can be reclaimed in a more natural and permanent manner, as shown on the post-mining topography map, Plate 7-13, without leaving temporary structures such as diversions, ponds, etc. Once vegetation is established, it will not have to be re-disturbed.

3. The extensive use of loose-rock check dams in the restored drainages will serve as effective sediment and erosion control, and will promote the establishment of a riparian area along the drainage.

Because of the large size of the undisturbed drainage above (805.5 acres), upon reclamation, it is proposed to construct a series of filtering ponds to clean and discharge the water rather than try to fully contain the runoff. The expected flow from a 10-year 24-hour event for the entire undisturbed and reclaimed area is 88.94 cfs at a velocity of 8.78 fps. The total volume of water would be approximately 16.2 acre-ft. It is proposed to build a 3-celled system with 2 gravel filter dikes and concrete grouted overflows. The upper 2 cells will act as filters for sediment removal, and the lower cell will become a settling basin for final cleaning prior to discharge. The pond discharge will be sampled per NPDES requirements to check for compliance with effluent standards.

It is expected that effluent standards will be met by this structure; similar filtering ponds have cleaned and discharged up to 1,000,000 gallons per day of sediment-laden mine water and remained in compliance.

The rationale for proposing such a filtering discharge system is based on the following:

1. The main purpose of sediment ponds or any other treatment facility is to control and minimize water pollution by causing the water to meet effluent standards; this type of system will accomplish this purpose:

2. Acceptable practices to control and minimize water pollution include:

(i) Stabilizing the disturbed area through land shaping;

(ii) Diverting runoff;

(iii) Achieving vegetation standards;

(iv) Regulating channel velocity of water;

(v) Lining channels with rock or vegetation;

(vi) Mulching;

(vii) Selectively placing and sealing acid-forming and toxic-forming materials;

(viii) Designing mines to prevent gravity drainage of acid waters;

(ix) Sealing;

(x) Controlling subsidence; and

(xi) Preventing acid mine drainage.

The planned reclamation at this site will meet the above criteria;

3. All surface drainage from the disturbed area, including areas that have been graded, seeded, or planted, shall be passed through a sedimentation pond, a series of sedimentation ponds, or a treatment facility before leaving the permit area.

The proposed pond will be equipped with a sediment marker, and cleaned as needed. The pond will also be fitted with a combined primary and emergency spillway, sized and protected to handle the 25-year 6-hour event.

When revegetation standards are met on the reclaimed site, the Pond "E -PM" will be removed, the main channel restored, and the area reseeded according to the approved plan.

Pond Discharge Structures

Principle Spillways

Pond C has a single spillway consisting of a 36" cmp riser pipe located 1.5' below the top of the dam at elevation 7,055.0. This pipe discharges directly into the main 42" culvert located beneath the pond. An 18" cmp skimmer pipe is located in the side of the 36" riser 1.5' below the riser inlet at an elevation of 7,053.5. This pipe will be the first to discharge, and will act as an oil skimmer since the pipe inlet is inverted with the intake approximately 1' below water level. Pond C will be decanted as needed by the use of a pump. Decanted water will go into the 36" riser and be discharged into the 42" cmp passing beneath the disturbed area.

The Pond E principle spillway consists of a 30" riser pipe, connected to the 42" culvert beneath the ponds. A decant device is also attached to the riser pipe for de-watering, and is controlled by a hand-operated valve. Both the riser pipe and decant are constructed to minimize oil from entering the discharging water. Please see Plate 7-7 for details on the spillway structures for Pond E.

Emergency Spillways

The emergency spillway for Pond E is the open notch type with a trapezoidal cross section. The spillway is of grouted rip-rap as shown on Figure IV-6. The spillway dimensions are as shown on the Figure IV-6. This is located 12" above the principal spillway and 2' below the top of the dam. This structure is rip-rapped through the point of discharge and into the main channel. This spillway provides an added safety factor to protect the dam in the event of overlad on the culvert discharge.

Pond E - PM Spillway

Pond E - PM will be constructed with an open-notch spillway in the lower cell to allow for safe discharge of runoff from the reclaimed area as well as the contributing undisturbed area. The spillway will be of grouted rip-rap and dimension as shown on Figure IV-6. Calculations for the spillway are shown.

The spillway for Pond C consists of an open 36" culvert which empties directly into the main 42" culvert which drains the main canyon. This spillway is open at the top and extends to within 2.5' of the top of the dam. At right angle to this spillway culvert is an 18" culvert to handle pre-design overflow conditions. This 18" pipe has an inverted inlet to skim oil and grease and flotsam from the water. This is considered a single spillway; however, the following discussion will explain how the pond meets the criteria for exemption of combination spillways required by R645-301-742-223.

Pond C - Exemption from R645-301-742-223

The following will describe how Pond C meets the criteria for exemption of the combination spillway requirements of R645-301-742.223 as provided in R645-301-742.225.2:

1 - Storage - The pond has been shown to be adequately sized to safely control the 100 year - 6 hour precipitation event. The pond will not only contain the 100 year - 6 hour event (including sediment), but the overflow will safely pass the runoff from such an event if necessary.

2 - Dewatering - Water can be safely removed from the pond in accordance with current, prudent engineering practices. For this pond, water will be removed by the use of a portable pump system. The following is a description of details relating to the dewatering operation:

a - The pump to be used is an electric 220 volt unit. The pump will be powered by a portable generator set. These units will be available on an as-needed basis.

b - The pump will dewater at a rate of approximately 350 gallons per minute. At 1.0' above the maximum sediment elevation, the 10 year - 24 hour volume is

1.683 acre-feet. At the proposed pumping rate, the pond would be dewatered in approximately 26 hours.

c - The decant water will be discharged directly into the 36" cmp overflow. Any discharge will be done in accordance with the UPDES permit conditions. Samples will also be taken as required.

d - The pump inlet line will be equipped with a floating intake and an oil skimming device. A typical drawing is included as Figure IV-13.

e - The 36" outlet pipe will be visibly marked to show the limit of the decant level. This marker will be placed 2' above the maximum sediment level. This allows for the 18" oil skimmer shown on Figure IV-13, plus the required l' shutoff above maximum sediment elevation. The pump will be turned off when the water level is drawn down to this marker.

f - All storm water will be retained in the pond for a minimum of 24 hours, or until effluent limitations will be met prior to decanting.

g - Sedimentation Pond C to this date has never discharged. It is unlikely at any future date that the pond will discharge water. However, if a discharge ever occurs Andalex will construct an access ramp at that time. The access ramp will consist of a walk- way from the bank to the top of the stand-pipe. It will be equipped with hand rails and safety chains.

Certification Statement

A certification statement by a qualified, registered professional engineer that the pond will safely control the 100 year - 6 hour precipitation event, is included with this section.

Location

The pond is located where failure could be expected to cause loss of life or serious property damage. In accordance with the requirements, the pond is designed and constructed to safely control the runoff from a 100 year - 6 hour precipitation event. (See related Table And certification with this section for designs, and Plates 7-2 and 7-4 for location and "As-Constructed" details of the pond).

Calculations:

The following pond spillway calculations have been shown separately for each sediment pond at this site. Each of the sheets is separately certified by a registered professional engineer, as required. (appendix N)

Pond C - Spillway Calculations

Design Parameters

(1) Disturbed Drainage Area (a.c.) 14.79
(1) Undisturbed Drainage Area (a.c.) 30.89
Runoff Curve No. (Dist.) 90
Runoff Curve No. (Undist.) 70
(2) Time of Concentration (hrs.) 0.176
Land Slope (%) 6.25
Hydraulic Length (ft.) 1200

Overflow

10 yr. - 24 hr. Event (in.) 1.82
Peak Flow 10/24 (cfs) 27.56
25 yr. - 6 hr. Event (in.) 1.50
Peak Flow 25/6 (cfs) 18.06
100 yr. - 6 hr. Event (in.) 1.91
Peak Flow 100/6 (cfs) 30.35

(3) Oil Skimmer Diameter (in.)	18
Overflow Diameter (in.)	36
(4) Required Head 10/24 (ft.)	0.98
(4) Required Head 25/6 (ft.)	0.74
(4) Required Head 100/6 (ft.)	1.05

Notes: (1) Digitized from Plate 7-2.
(2) Taken from IV-3A (Pg. 7-75) (Pg. 7-75); Total Flows from DD-1, DD-2, & DD-3
(3) Reference Only - Not included in calculations.
(4) Taken from Stage Volume Curve - 36" riser only.

Pond E - Spillway Calculations

Design Parameters

(1) Disturbed Drainage Area (ac.)	12.21
(1) Undisturbed Drainage Area (ac.)	12.20
Runoff Curve No. (Dist.)	90
Runoff Curve No. (Undist.)	70
(2) Time of Concentration (hrs.)	0.289
Land Slope (%)	8.00
Hydraulic Length (ft.)	1200

Primary Overflow

10 yr. - 24 hr. Event (in.)	1.82
Peak Flow 10/24 (cfs)	14.55
Riser Diameter (in.)	30"
Required Head (ft.)	0.73

Emergency Overflow

25 yr. - 6 hr. Event (in.)	1.50
Peak Flow 25/6 (cfs)	9.96
Structure Area Used (ft.2)	18.00
Required Structure Area (ft.2)	2.40
Depth of Flow (ft.)	0.41
Slope (%)	5.00
Velocity (fps)	4.15

Notes: (1) Digitized from Plate 7-2.
(2) Taken from IV-3A (Pg. 7-75); DD-4.

Pond E - PM - Spillway Calculations

Design Parameters:

(1) Disturbed Drainage Area (ac.) 34.91
(1) Undisturbed Drainage Area (ac.) 805.50
Runoff Curve No. (Dist.) 90
Runoff Curve No. (Undist.) 70
(2) Time of Concentration (hrs.) 1.02
Land Slope (%) 19.83
Hydraulic Length (ft.) 10,200

(3) Overflow

10 yr. - 24 hr. Event (in.) 1.82
Peak Flow 10/24 (cfs) 88.94
25 yr. - 6 hr. Event (in.) 1.50
Peak Flow 25/6 (cfs) 45.77
Structure Area Used (ft.2) 18.0
Slope of Spillway (%) 33.3
Required Structure Area 10/24 (ft.2) 5.58
Required Structure Area 25/6 (ft.2) 3.54
Depth of Flow 10/24 (ft.) 0.84
Depth of Flow 25/6 (ft.) 0.58
Velocity 10/24 (fps) 15.94
Velocity 25/6 (fps) 12.94

Notes: (1) From Plates 7-2 & 7-1; Includes B.T.C.A. Areas
(2) Taken from Table IV-4 (Page 7-82)

CHANNEL FLOW CALCULATIONS

FOR: POND "E" - EMERGENCY SPILLWAY

Bed Slope = .05
Manning's N = .04
Bottom Width = 5 feet
Channel Side Slope = .5
Flow Depth = .6950414 feet
Cross Sectional Area = 4.441372 square feet
Wetted Perimeter = 8.10832 feet
Hydraulic Radius = .547755 feet
Discharge = 24.74 cubic feet / sec
Velocity = 5.570351 feet / sec

Culverts

General

Culverts have been sized as per the designations on Plates 7-1 and 7-2, and are placed to drain on a minimum of .0556 (1 ft./18 ft.) slope. Undisturbed drainage culverts (shown on Plate 7-1) are fitted with trash racks in drainages where introduction of rocks and other debris into the main culvert is foreseen as a problem. The main culvert inlet (C-1a) is fitted with a trash rack. All disturbed area culverts are designated with a CD-number as shown on Plate 7-2. These culverts handle much smaller flows and are thus not fitted with trash racks in most cases.

The undisturbed area culverts (C-0 through C-13) flow into the main culvert. The main culvert outlets at section C-15, which is protected from erosion as described on Table IV-7 (Page 7-86) (Page 7-86). Disturbed area culverts (CD-1 through CD-7) as shown on Plate 7-2 discharge onto grouted rip-rap surfaces for protection from erosion. Energy dissipators are also employed where necessary to reduce velocities and prevent erosion from culvert discharges (see Plate 7-2).

Maintenance

Culverts shall be inspected regularly, and cleaned as necessary to provide for passage of designed flows. Inlets and outlets shall also be maintained so as to prevent plugging or undue restriction of water flow.

Size Justification

The following note on the undisturbed culverts is for reference only, to show the original design criteria. Due to the complicated nature of the undisturbed culvert flows, it was decided that a drainage system analysis would be used to demonstrate the ability of the system to pass the design event. This system analysis is provided in Appendix O and shows the existing system to be more than adequate for the design storm event.

Undisturbed Area Culvert Size Determination*

Source:

"Applied Hydrology and Sedimentology for Disturbed Areas", Barfield, Warner and Haan, 1983.

Peak Flow - SCS-TR-55 Method For Type II Storms:

qp = qp1AQ;

A = Watershed in square miles;

Q = Runoff volume in inches;

qp1= Discharge from Fig. 2.40

qp = Peak Discharge in cfs.

Source:

B.L.M. State Engineer

Manning Equation:

$$D = \frac{2.16Qn}{\sqrt{s}}^{0.375}$$

D = Diameter (feet)

Q = QP = Peak Discharge (cfs)

n = roughness factor (0.02 for steel culvert)

s = slope (0.0556% = 1 foot for 18 feet)

Using the above formulas, minimum culvert sizes were calculated based on 100% runoff from a 10 year - 24 hour storm.

* Reference Only - See Appendix O for justification of culvert sizes.

Watershed and Culvert Sizing Map (Plate 7-1)

TABLE IV-2

Culvert	Watershed Area (acres)	Culvert Needed (in.)	Culvert Used (in.)
C-0	36.65	13	18
C-1a	469.51	22	36
C1	506.16	22	36
C2	23.03	12	18
C3	529.19	23	36
C4	77.29	16	30
C5	606.48	23	36
C6	26.87	12	18
C7	633.35	24	42
C8	45.25	14	30
C9	678.60	25	42
C10	18.16	10	18
C11	696.73	25	42
C12	55.31	14	18
C13	752.04	27	42
C15	752.04	27	42

Note: Culvert C14 flow has been routed to diversion UD-4, and C14 has been eliminated.

Diversion Structures

General

Diversion ditch locations are shown on the Surface Facilities Map and Drainage Map, Plate 7-2. The direction of flow is also shown. All diversions are classed as temporary, and will be removed upon final reclamation.

Note: (1) The runoff curve number of 65 was used only for calculation of the undisturbed culvert diversions. All other diversions, culverts, and pond designs are based on a more conservative runoff curve number of 70 for undisturbed drainages.

(2) Brycan is Hydrologic Soil Group B, Datino (stoney) is also Hydrologic Soil Group B; reference "SCS, National Engineering Handbook, Section 4, 1972".

Specifications

Diversions along the upslope side of the road will be as per specifications on the haul road design. At a minimum, these, and any other diversions shown, will meet the minimum size specifications on the Diversion Ditch Summary sheet (Table IV-3B). Disturbed divisions DD-1 and DD-8 through DD-11 are sized to carry the runoff from a 2 year - 6 hour precipitation event in the area, per requirements of R645-301-742.330 "Division of Miscellaneous Flow". There are no divisions of intermittent or perennial flows.

Undisturbed diversions and drainage control for primary roads are sized to carry runoff from a 10 year - 6 hour precipitation event in the area.

Calculations for the 10 year - 24 hour runoff are included only for sediment pond sizing purposes.

Maintenance

All diversions will be maintained so as to pass the volumes of water for which they were designed. Sloughage will be cleaned out along with regular road maintenance procedures, and any blockage will be removed as soon as practicable after occurrence. Velocities will be controlled as needed to prevent excessive scouring.

Diversions and Conveyance of Overland Flow

There are two types of diversions at this property: undisturbed and disturbed. The undisturbed diversions are labeled UD-1, through UD-5, and C-1 through C-15, and carry undisturbed drainage around and under the disturbed area. All undisturbed diversions are in place, and are shown on Plate 7-2, along with respective drainage areas. Cross sections of the undisturbed diversions are shown on the "Undisturbed Diversion Ditch Typical" (Figure IV-4). Design calculations are shown on the tables entitled "Diversion Design" (Table IV-3), "Diversion Ditch Summary Sheet" (Table IV-3B) "Main Channel Culvert Design" (Table IV-4 (Page 7-82)), and "Side Drainage Culvert Design" (Table IV-5).

The disturbed diversions carry disturbed drainage to the sediment ponds. The existing disturbed diversions are labeled DD-1, through DD-11 and are shown on Plate 7-2 "Support Facilities - Surface Area Drainage and Topography". The diversion DD-4 is shown on Plate 7 "Aberdeen Mine Surface Facilities - As Constructed". Cross sections of the disturbed diversions are shown on the Division Ditch Typical" (Figure IV-3) Design calculations are shown on the table entitled "Disturbed Diversion Design" (IV-3A Pg. 7-75) and on the "Diversion Ditch Summary" (Table IV-3B).

Peak flows for all diversions were calculated by the SCS-TR55 Method for Type II storms using the computer program: Office of Surface Mining Watershed Model, Version: Storm 6.20, by Gary E. McIntosh.

A runoff curve number of 70 was used for all undisturbed areas, except for the undisturbed culvert diversions, which use a CN of 65. A CN of 90 was used for the disturbed area.

The curve numbers are based on Table 2.20 "Runoff Curve Numbers for Selected Agricultural, Suburban, and Urban Land Use" (Antecedent Moisture Condition II), page 82 of "Applied Hydrology and Sedimentology for Disturbed Areas", Barfield, Warner, and Haan, 1983.

A runoff curve number of 65 was selected for the undisturbed culvert diversion areas, based on the following:

(1) Land Use Description - Wood or Forest Land: thin stand, moderate to poor cover, no mulch.

(a) The above description was selected from SCS soils and vegetation data in Appendix M, wherein the site is described as not-desirable as rangeland due to the steep slopes and moderately sparse vegetative cover. The predominant vegetation is trees or large shrubs (pine, juniper, oak, sagebrush) with a mixture of grasses (wildrye, bluegrass, etc.). This land form and vegetation type best fits the Wood or Forest Land Category.

(2) Hydrologic Soil Group - B.

(a) The undisturbed soils of the permit area are predominantly bouldery loam or bouldery fine sandy loam, as described in the SCS report in Appendix M. These soils are further defined as deep and well-drained with moderate permeability and infiltration rates. This description fits the SCS Hydrologic Soil Group B very well.

(3) The runoff curve number of 65 is further supported by an on-site visit and professional judgement of a respected professional engineer/hydrologist from Horrocks, Carollo Engineers. In his opinion, a curve number of 65 best fits the site conditions, based on the site visit, and Richard H. McCuen's, "A Guide to Hydrologic Analysis Using SCS Methods".

(4) Appendix O, which is the calculations performed by Horrocks Engineering reflects a curve number of 65. Tables IV-4 and IV-5 are also included and use a curve number of 70. Both calculations show adequately sized culverts; the curve number of 70 is slightly more conservative.

The Curve Number of 90 for the disturbed area is based on Hydrologic Soil Group B, Streets and Roads, with a weighted average of 40% paved area and 60% gravel area.

The outlet of C-15 (Main-Channel Culvert) shows a velocity of 7.28 fps, which could be slightly erosive in this area; however, existing boulders at this outlet range from 12 to 36 inches in diameter and function as an adequate energy dissipator and erosion control device. Based on past history of storms with little or no evidence of erosion, at this point it is not felt necessary to install additional protection. Erosion protection parameters are shown on the "Erosion Protection" (Table IV-7 (Page 7-86) (Page 7-86)), for reference only, to show that the existing natural rock is adequate size for erosion control.

The culvert outlet will be visually examined after each major storm to ensure that erosion is not occurring. If erosion does become evident as determined by visual

observation, protection will be installed according to the design on the table entitled "Erosion Protection" (Table IV-7 (Page 7-86) (Page 7-86)).

Velocities on undisturbed diversions UD-1, UD-3 and UD-5 and portions of UD-2 and UD-4 are less than 6.0 fps, and are not considered erosive. Velocities on disturbed diversions DD-1, through DD-11 are also less than 6.0 fps, and are not considered erosive on this site.

Velocities on the upper and lower portion of UD-2 and the lower 150' of UD-4 and are greater than 6.0 fps, and are considered potentially erosive; therefore, rip-rap will be placed at these locations (see Plate 7-2). Rip-rap or liner is placed as described in Table IV-7 (Page 7-86) (Page 7-86), and is sized according to Figure IV-12. Diversion UD-2 has been observed to be non-erosive.

Undisturbed diversion UD-2 was resurveyed in November 1992. Based on this survey, the division can be divided into four separate components, as follows:

Upper Section - This is the extreme upper end of the division near the disturbed area boundary. This is a fairly steep, rocky area, and is quite inaccessible to equipment. The average grade through this section is 12.33%. the ditch is protected by a liner, which appears to have been effective in preventing erosion over the last 10 years. The liner will be maintained throughout this section;

Undisturbed Section - This is an area below the upper (lined) section and the office pad section. The drainage flows through an undisturbed, vegetated area for approximately 100 feet, at an average slope of 12.11%. There is no evidence of erosion through this area;

Office Pad Section - This is an extremely flat portion of the diversion with an average grade of 3.50% for approximately 200 feet. Velocities through this section are non-erosive, and this is the only portion of the diversion which has required periodic maintenance for silt cleaning;

Lower Section - This section is approximately 100 feet in length with an average slope of 41.60%. The ditch is rip-rapped through this section.

Flow calculations are provided in Table IV-3 for the various sections, and erosion protection requirements are provided in Table IV-7 (Page 7-86) (Page 7-86). The diversion has been in place for approximately 10 years, and has required only minimal maintenance for silt clean out in that time. It has been designed, located, constructed, maintained, used and will be removed in accordance with requirements of R645-301-742.300.

A loose rock check dam will be placed at the discharge point of UD-4 for energy dissipation. The dam will be constructed as described in Figure IV-9 and located as shown on Plate 7-2.

All diversion ditches are sized and maintained to at least the minimum requirements of R645-301-742.330 "Diversion of Miscellaneous Flows" and R645-301-742.423 "(Road) Drainage Control". There are no diversions of intermittent or perennial drainages at this minesite. Ditch sizes, including flow depths and minimum size for maintenance are summarized on Table IV-3B, "Division Ditch Summary". Computer backup sheets for all calculations are provided in Appendix O.

Stream Channel Diversions

Re-establishment of drainages is shown on Plate 7-12 which are reclamation contours and cross sections. The cross sections show cut and fill which has occurred on-site versus the original contours and reclaimed contours.

The reclamation plans for the drainage in the area consist of replacing each of the culverts C-1 through C-15 with restored channels. The undisturbed diversions UD-1 and UD-2 will also be removed and replaced with appropriate sized channels, corresponding to the channels at culverts C-4 and C-12 respectively. The restored channels are all sized to carry the runoff from a 100 year - 24 hour precipitation event. Cross sections of the restored channels are shown in the "Restored Channel Typicals" (Figure IV-10). Design calculations are summarized in the table entitled Restored Channel Designs" Table IV-6 (Page 7-84).

Culverts C-1, C-3, C-5, C-7, C-9, C-11, C-13, and C-15 will be replaced by the Main Channel RC-1, and culverts C-2, C-4, C-6, C-8, C-10, C-12, and C-14 will be replaced by the Side Channels entitled RC-2, RC-4,....RC-14, respectively.

The only restored channels with erosive velocities for this area (greater than 4.5 fps) are RC-1, RC-4, and RC-12. Erosion protection is planned for these channels, as shown on the table entitled "Erosion Protection" (Table IV-7 (Page 7-86) (Page 7-86)). All other restored channels are expected to have non-erosive velocities, and will not require erosion protection.

Loose rock check dams will be placed at the exit of each side drainage prior to entering RC-1. Please see Figure IV-9, for a typical section of the Loose Rock Check Dams.

Hydrologic Balance:

Sedimentation Ponds

The sedimentation ponds as constructed, are shown on Plates 7-4, 7-5, and 7-7. There will be no Pond D.

All elevations of inflow and discharge are shown on the plates. Also, the embankment slopes are shown not to exceed 5:1 as required. The embankment widths are greater than the required width of height of embankment plus 35 feet divided by 5' as required. (Please note the different horizontal and vertical scales used on the section views of Pond C. Horizontal and vertical scales for Pond E are the same.)

Previous Pond "B" has been redesignated as "Primary Settling Basins" since all the runoff from the basins reports to Sediment Pond "C" (See Plate 7-4).

Sediment Pond "C"

Design specifications for Sediment Pond "C" are shown in this submittal.

Sediment Pond "E"

Design specifications for Sediment Pond "E" are covered under this submittal.

Discharge Structures

Discharge structures from the sediment ponds have been included.

Permanent and Temporary Impoundments

The sedimentation pond E will remain in place after reclamation, until adequate revegetation is established on the reseeded areas. At this time, the pond will be removed and reclaimed.

Discharge of Water into an Underground Mine

The Drainage Map, Plate 7-2, delineates various drainage areas on the site. Based on planimeter areas from this map, the following areas are drained into the respective mines:

Mine	Disturbed (ac.)	Undisturbed (a.c)
Pinnacle Mine	0.81	0.13
Apex	1.23	2.06
Old Chidister Mine	4.53	16.21

The water flowing into the mines is strictly from surface runoff, and the quantity is thus highly variable. Because this is such a dry canyon, it is necessary to capture as much water as possible to allow for underground mining operations. The water is directed into storage sumps in the mine, where it is settled and used for dust suppression. Any water going into the mine is used in sprays or remains in the sumps. Water flowing into the mines is strictly from surface runoff, and the quantity is thus highly variable. Because this is such a dry canyon, it is necessary to capture as much

water as possible to allow for underground mining operations. The water is directed into storage sumps in the mine, where it is settled and used for dust suppression. Any water going into the mine is used in sprays or remains in the sumps.

Andalex owns the rights to this water.

Hydrologic Balance:

Water Quality Standards and Limitations.

Sediment control for Office Facilities

The office facilities area is a small paved parking area and runoff from a portion of this area will report to Sediment Pond "E" as shown on Plate 7-2. The remaining portion is classified as a B.T.C.A. Area (2.19-2).

Natural runoff from above the office area is diverted to the south of the pad, and flows in an open ditch down to the lower (road) level where it enters an 18" culvert going into the 42" culvert carrying undisturbed drainage off site. Straw bales are maintained in the open ditch to minimize sediment in the undisturbed flow.

Most of the office pad and access road are paved. Runoff from a portion of the pad and road flow down a grouted ditch along the north and south sides of the road, through a culvert and then down the east side of the main paved road. From here the runoff flows into Pond E. See Plate 7-2. Sediment contributions from the office facilities area are negligible (if any) due to the pavement and concrete grouted ditch. Straw bales are also maintained along the main haul road to minimize sediment loading from this area.

Disturbed Area Drainage not Reporting to Sediment Ponds

Please refer to Plate 7-2 in Volume II of the PAP for exempt "Alternate Sediment Control Area" or (ASCA) (areas not reporting to sedimentation ponds). There are 3 areas, 2 of which are shown on Plate 7-2 as ASCA's and a third in Appendix U as an SAE, with a total area of 1.08 acres or 3.2% of the Disturbed Area:

(1) ASCA #1 - 0.72 acres - near the office, which includes a topsoil storage pile, UD-2, a portion of the main office pad and a portion of the weather station outslope.

(a) Treatment: As a result of a 10 year - 24 hour storm, there would potentially be a discharge of 2,462 cubic feet of runoff from this area. Alternate sediment controls consist of straw dikes, vegetation on the topsoil pile, chemically treated gravel parking areas and paved parking areas.

(2) ASCA #2 - 0.27 acres - Substation area.

(a) Treatment: A 10 year - 24 hour storm will potentially have a discharge of 923 cubic feet of runoff from this area. Alternate sediment controls on this site consist of a graveled surface, a straw dike and snow fences.

(3) Small Area Exemption (SAE) #1 - 0.09 acres - Left Fork Fan Powerline area.

(a) Treatment: A 10 year - 24 hour storm will potentially have a discharge of 308 cubic feet of runoff from this area. As these are power poles, there will be no sediment runoff.

These three areas are exempt from the requirement that the drainage report to a sedimentation pond (817.42a) as provided for in 817.42b. The drainage from these areas will meet the effluent standards of 817.42 and State and Federal water quality standards for the receiving waters. In order to assure this, any discharge from these ASCA's will be monitored for suspended solids, total suspended solids and total dissolved solids.

There are three additional undisturbed diversions constructed just inside the disturbed area boundary (UD-1, UD-3 and UD-4). These ditches carry only undisturbed runoff from the areas above, are well vegetated, and discharge directly to the main channel undisturbed drainage without further treatment. Only undisturbed diversion UD-2 is included as a ASCA (#1), due to the fact that it also picks up drainage from a topsoil storage pile and a portion of the office pad as described on the previous page.

NPDES Permit

Three point sources are included in Andalex's new UPDES Permit. Quarterly reports are submitted to the Utah Department of Health and the EPA.

TYPICAL

SCS - TR55 Method of Diversion Calculation

1. Find Drainage Area - Plate 7-2 or 7-1

*2. Find Runoff from Appropriate Event:

$$Q = \frac{(P-0.2S)2}{(P+0.8S)}$$ where: P = Precip. in inches

$$S = \frac{1,000}{CN} - 10$$

CN = 70 for Undisturbed
CN = 90 for Disturbed

3. Find Hydraulic Length of Watershed - Plate 7-2 or 7-1

4. Find Land Slope - Plate 7-2 or 7-1

5. Calculate Lag Time; $tL = \frac{L0.8(S+1)0.7}{1900\ y0.5}$

where: tL = Lag Time in Hrs.
L = Hydraulic Length in ft.
$S = \frac{(1,000 - 10)}{CN}$
y = Land Slope in %

6. Find Time of Concentration; $tc = \frac{tL}{0.6}$

**7. Find Peak Flow (qp) from: qp = qp1 AQ
where qp = Peak Flow in cfs
qp1= Peak Discharge from Figure 2.40, page 115***.
A = Drainage Area in Square Miles
Q = Runoff (from #2 above)

**8. Find Velocity of Flow from:

$$V = \frac{1.49\ R0.67S0.5}{n}$$

where: V = Velocity in fps
n = Manning's Number for ditch
$R = \text{Hydraulic Radius in ft.} = \left(\frac{\text{Area}}{\text{Wetted Perim.}}\right)$
S = Slope in ft./ft.

**9. Find Required Ditch Area by dividing peak flow by the velocity.

$$Q = AV; \quad A = \frac{Q}{V}$$

**10. Find depth of flow by applying required area to ditch size.

* Where undisturbed and disturbed flows enter the same ditch, a weighted curve number is used, calculated by:

$$\frac{(\text{Area Undisturbed})(70) + (\text{Area Disturbed})(90)}{(\text{Total Area})}$$

** Items 7 through 10 can also be calculated by the computer program "Office of Surface Mining Watershed Model", Version: Storm 6.20, by Gary E. McIntosh.

*** "Applied Hydrology and Sedimentology for Disturbed Areas", Barfield, Warner and Haan, 1983.

TABLE IV-3

UNDISTURBED DIVERSION DESIGN

Structure		UD-1	UD-2	UD-3	UD-4 (PAD)	UD-5	
Drainage Area (s)	87.78	56.20	23.87	26.14	16.90		
Time of Conc. (hours)		0.24	0.21	0.22	0.06	0.14	
Runoff Curve Number (CN)		70	70	70	70	70	
Manning's Number (n)		0.038	0.038	0.040	0.040	0.040	
Ditch Slope (%)	6.75	3.50	6.75	4.50	3.79		
Hydraulic Length (ft.)		2850	2800	1400	600	1800	
Land Slope (%)	47.22	58.33	56.67	66.67	62.50		
10 yr. 6 hr. Event (in.)		1.25	1.25	1.25	1.25	1.25	
Time of Conc. (hrs.)	0.24	0.21	0.22	0.06	0.14		
Peak Flow 10/6 (cfs)		1.35	0.99	0.11	0.47	0.29	
Required Area 10/6 (ft2)		0.37	0.37	0.06	0.20	0.15	
Flow Depth 10/6 (ft)	0.61	0.61	0.24	0.45	0.39		
Velocity 10/6 (fps)	3.65	2.64	1.88	2.32	1.93		
10 yr.-24 hr. Event (in.)		1.82	1.82	1.82	1.82	1.82	
Peak Flow 10/24 (cfs)		7.94	4.75	2.03	3.45	1.59	
Req'd Area 10/24 (ft2)		1.40	1.21	0.52	0.90	0.54	
Flow Depth 10/24 (ft2)		1.18	1.10	0.72	0.95	0.73	
Velocity 10/24 (ft2)	5.69	3.91	3.90	3.82	2.95		

Notes: 1- Ditch slopes measured from Plate 7-2.

2- UD-2 slope measured directly in field.

3- Peak flows by SCS-TR55 Method using "Storm 6.20" computer program.

4- Manning's number based on Table 3.1, p. 159, under Small Drainage Ditches - earth Lined, "Applied Hydrology and Sedimentology Disturbed Areas", Barfield, Warner and Haan, 1983.

5- See Appendix O for computer back-up.

6- All calculations are based on minimum ditch size - "V" shape with 1:1 side slopes. Ditch configurations may vary in field.

TABLE IV-3 (cont'd)

UNDISTURBED DIVERSION DESIGN

Structure	UD-2 (upper)	UD-2 (lower)	UD-4 (max)	UD-5 (max)
Drainage Area (acres)	56.20	56.20	26.14	16.90
Time of Conc. (hrs.)	0.21	0.21	0.06	0.14
Runoff Curve Number (CN)	70	70	70	70
Manning's Number (n)	0.025	0.040	0.040	0.040
Ditch Slope (%)	12.33	42.60	20.00	17.75
Hydraulic Length (ft.)	2800	2800	600	1800
Land Slope (%)	58.33	58.33	66.67	62.50
10 yr.-6 hr. Event (in.)	1.25	1.25	1.25	1.25
Peak Flow 10/6 (cfs)	0.99	0.99	*10.43	0.29
Req'd Area 10/6 (ft.2)	0.17	0.15	1.18	0.08
Flow Depth 10/6 (ft.)	0.41	0.39	1.09	0.29
Velocity 10/6 (fps)	5.80	6.49	8.81	3.44
10 yr.-24 hr. Event (in)	1.82	1.82	1.82	1.82
Peak Flow (cfs)	4.75	4.75	*13.41	1.59
Req'd Area (ft.2)	0.55	0.49	1.43	0.30
Flow Depth 10/24 (ft)	0.74	0.70	1.20	0.55
Velocity 10/24 (fps)	8.59	9.61	9.38	5.27

* Includes discharge from Pond E Emergency Spillway.

Note: 1. Ditch slopes measured from Plate 7-2.

2. UD-2 Slopes Measured Directly in Field; UD-2 (Upper) is a lined channel. UD-2 (lower) is rip-rapped.

3. Peak flows by SCS-TR55 Method using "Storm 6.20" computer program.

4. The Manning's number is based on Table 3.1, page 159, under Small Drainage Ditches - Earth Lined, "Applied Hydrology and Sedimentology for Disturbed Areas", Barfield, Warner, and Haan, 1983.

5. See Appendix O for computer back-up.

6. All calculations are based on minimum ditch size-"V" shape with 1:1 side slopes. Ditch Configurations may vary in field.

IV-3A (PG. 7-75)

DISTURBED DIVERSION DESIGN
(MISCELLANEOUS FLOWS-2YR.-6 HR. DESIGN)

Structure	DD-1	*DD-8	*DD-9	DD-10	DD-11
Drainage Area (acres)					
Disturbed	3.31	-	-	0.34	5.35
Undisturbed	5.40	-	-	-	6.12
Time of Conc. (hrs.)	0.08	0.327	0.327	0.11	0.08
Runoff Curve Number (CN)					
Disturbed	90	-	-	90	90
Undisturbed	70	-	-	-	70
Weighted CN	78	-	-	90	79
Manning's Number (n)	0.040	0.040	0.040	0.040	0.040
Ditch Slope (%)	6.25	6.25	6.25	6.25	5.25
Hydraulic Length (ft.)	200	1200	1200	300	800
Land Slope (%)	6.25	6.25	6.25	6.25	56.25
2 yr.-6 hr. Event (in)	0.80	0.80	0.80	0.80	0.80
Peak Flow 2/6 (cfs)	0.08	0.07	0.07	0.05	0.13
Required Area 2/6 (ft2)	0.05	0.04	0.04	0.03	0.07
Flow Depth 2/6 (ft.)	0.22	0.21	0.21	0.18	0.26
Velocity 2/6 (fps)	1.69	1.63	1.63	1.50	1.90
10 yr.-24 hr. Event (in.)	1.82	1.82	1.82	1.82	1.82
Peak Flow 10/24 (cfs)	3.49	2.88	2.88	0.31	4.75

* Based on ½ flow from DD-3, which is 0.13 cfs for 2 yr.-6 hr.event. See Appendix O.

IV-3A (PG. 7-75) (Continued)

DISTURBED DIVERSION DESIGN
(PRIMARY ROAD DRAINAGE - 10YR.-6HR. DESIGN)

Structure	DD-2	DD-3	DD-4 *	DD-6	DD-7
Drainage Area (acres)					
Disturbed	4.07	7.41	12.21	-	1.28
Undisturbed	-	25.49	12.20	-	6.12
Time of Conc. (hrs.)	0.04	0.327	0.289	0.289	0.08
Runoff Curve Number (CN)					
Disturbed	90	90	90	-	90
Undisturbed	-	70	70	-	70
Weighted CN	90	75	80	-	74
Manning's Number (n)	0.040	0.040	0.040	0.040	0.040
Ditch Slope (%)	6.25	6.25	6.25	5.95	5.56
Hydraulic Length (ft.)	200	1200	1200	-	800
Land Slope (%)	6.25	6.25	8.00	-	56.25
10 yr. -6 hr. Event (in)	1.25	1.25	1.25	1.25	1.25
Peak Flow 10/6 (cfs)	1.70	0.90	1.67	0.84	0.20
Required Area 10/6 (ft2)	0.47	0.30	0.40	0.28	0.10
Flow Depth 10/6 (ft.)	0.69	0.24	0.68	0.53	0.31
Velocity 10/6 (fps)	3.62	2.96	3.60	2.98	2.03
10yr.-24hr. Event (in.)	1.82	1.82	1.82	1.82	1.82
Peak Flow 10/24 (cfs)	3.50	5.75	8.06	4.03	1.92

* Based on ½ flow for DD-4

Notes:

1. Ditch Slopes measured from Plate 7-2.
2. Peak flows by SCS-TR55 Method using "Storm 6.20" Computer program.
3. The Manning's Number is based on Table 3.1, page 159, under Small Drainage Ditches - Earth Lined, "Applied Hydrology and Sedimentology for Disturbed Areas", Barfield, Warner, and Haan, 1983.
4. See Appendix O for computer back-up.
5. All calculations are based on minimum ditch size- "V" shape with 1:1 side slopes, except DD-3 which has a 1' bottom width. Ditch configurations may vary in field.

TABLE IV -3B
DIVERSION DITCH SUMMARY

DITCH NO.	FLOW (cfs)	REQ'D FLOW DEPTH (ft.)	REQ'D FLOW AREA (ft2)
UD-1	1.35	0.61	0.37
UD-2 (PAD)	0.99	0.61	0.37
UD-2 (UPPER)	0.99	0.41	0.17
UD-2 (LOWER)	0.99	0.39	0.15
UD-3	0.11	0.24	0.06
UD-4	0.47	0.45	0.20
UD-4 (MAX)	10.43	1.09	1.18
UD-5	0.29	0.39	0.15
UD-5 (MAX)	0.29	0.29	0.08
DD-1	0.08	0.22	0.05
DD-2	1.70	0.69	0.47
DD-3	0.90	0.24	0.30
DD-4	1.67	0.68	0.46
DD-6	0.84	0.53	0.28
DD-7	0.20	0.31	0.10
DD-8	0.07	0.21	0.04
DD-9	0.07	0.21	0.04
DD-10	0.05	0.18	0.03
DD-11	0.13	0.26	0.07

Notes: 1- Flows for UD ditches and primary road ditches (D-2 through DD-7) based on 10 yr.-6hr. event (1.25).

2- Flows for Ditches DD-1 and DD-8 through DD-11 based on 2yr.-6hr. event (0.80").

3- All calculations based on minimum ditch size - "V" ditch with 1:1 side slopes, except DD-3, which has a 1' bottom width. Ditch configurations may vary in field.

4- Ditches will be maintained to minimum depth and/or area shown in this table.

METHOD OF CULVERT CALCULATION
(TYPICAL)
See Appendix N for calculation reference

1. Find Drainage Area - Plate 7-1

2. Find Runoff from Appropriate Event:
   $Q = \frac{(P - 0.2S)2}{(P + 0.8S)}$; Where: P = Precipitation in Inches.
   $S = \frac{1,000}{CN} - 10$
   or CN = 70

3. Find Hydraulic Length of Watershed - Plate 7-1.

4. Find Land Slope - Plate 7-1

5. Calculate Lag Time; $tL = \frac{L0.8(S+1)0.7}{1,900\ Y0.5}$
   where: tL = Lag Time in Hrs.
   L = Hydraulic Length in Ft.
   $S = \frac{1,000}{CN} - 10$
   Y = Land Slope in %.

6. Find Time of Concentration; $tc = \frac{tL}{0.6}$

**7. Find Peak Flow (qp) from: qp = qp1 AQ
where: qp = Peak Flow
qp1= Peak Discharge from Figure 2.40, page 115*.
A = Drainage Area in Square Miles
Q = Runoff (from #2 above)

8. Find Required Culvert Size by Manning's Equation:

$$D = \left(\frac{2.16\ Qn}{\sqrt{s}} \right)^{0.375}$$

where: D = Required Culvert Diameter in Ft.
Q = Peak Flow (qp) from 7.
n = Manning's Number (0.025 for culv.)
s = Slope in ft./ft.

* "Applied Hydrology and Sedimentology for Disturbed Areas", Barfield, Warner and Haan, 1983.
** Item 7 can also be calculated by using the computer program "Office of Surface Mining Watershed Model", Version: Storm 6.20, by Gary E. McIntosh.

TABLE IV-3C

DISTURBED AREA CULVERT DESIGN
(Drainage to Old Works)

Structure	CD-1	CD-2	CD-8
Drainage Area (ac.)	---	---	---
Undisturbed	10.09	6.12	10.09
Disturbed	3.25	1.28	3.25
10 yr. - 6 hr. event (in.)	1.25	1.25	1.25
Time of Conc. (hrs.)	0.10	0.10	0.10
Curve Number	---	---	---
Undisturbed	70	70	70
Disturbed	90	90	90
Manning's Number	0.025	0.025	0.025
Culvert Slope (%)	5.56	5.56	5.56
Peak Flow (cfs)	1.73	0.72	1.73
Velocity	4.41	3.49	3.08
D Req'd (ft.)	0.71	0.51	0.71
D in Place (ft.)	1.00	1.00	1.50

TABLE IV-3C (Continued)

DISTURBED AREA CULVERT DESIGN

Structure	CD-4	CD-5	CD-6	CD-7
10 yr. - 6 hr. Event (in.)	1.25	1.25	1.25	1.25
Manning's Number (n)	0.025	0.025	0.025	0.025
Culvert Slope (%)	5.56	5.56	5.56	5.56
Peak Flow	1.50	1.55	2.33	4.65
Velocity	4.26	4.29	4.75	5.65
D Req'd (ft.)	0.67	0.68	0.79	1.02
D in Place (ft.)	1.50	1.50	2.00	2.00

Note: All culverts have adequate headwater to allow flow.

TABLE IV-3C (Continued)

CULVERT CD-3
(Inlet to Sed. Pond "C")

10-yr.6-hr. Event	1.25"
Mannings Number	0.025
Culvert Slope	3.30%
Peak Flow	3.00 cfs
Velocity	4.16 fps
D. Required	0.96 ft.
D. In Place	1.50 ft.

NOTES: 1. Peak flow is based on entire flow from Diversion DD-3.
2. Details for Diversion DD-3 are on IV-3A (Pg. 7-75).
3. Culvert slope is based on actual field measurement.
4. A headwall of 4' exists at the culvert inlet, which is adequate to allow the calculated peak flow of 3.00 cfs.
5. Please refer to Plate 7-2 for CD-3 location and drainage areas.

TABLE IV-3C (Continued)
DISTURBED AREA CULVERT DESIGN

STRUCTURE	CD-9	CD-10	CD-11	CD-12	CD-13
10yr.-6hr. Event (in)	1.25	1.25	1.25	1.25	1.25
Manning's Number (n)	0.025	0.025	0.025	0.025	0.025
Culvert Slope (%)	8.00	6.25	8.00	5.56	6.25
Peak Flow 10/6 (cfs)	0.31*	0.31*	0.31**	0.92**	1.87***
Velocity 10/6 (fps)	3.29	3.00	3.29	3.77	4.70
Diam. Req'd. (ft.)	0.35	0.36	0.35	0.56	0.71
Diam. In Place (ft.)	1.50	1.50	1.00	2.00	1.50

* Based on 1/3 flow form DD-11.
** Based on entire flow from DD-11.
**** Based on entire flow from DD-2.

TABLE IV-3C (Continued)
DISTURBED AREA CULVERT DESIGN

STRUCTURE	CD-14	CD-15	CD-16	CD-17	CD-18
10yr.-6hr. Event (in)	1.25	1.25	1.25	1.25	1.25
Manning's Number (n)	0.025	0.025	0.025	0.025	0.0025
Culvert Slope (%)	3.50	3.50	6.25	5.56	57.74
Peak Flow 10/6 (cfs)	1.35*	2.84**	4.65***	4.65***	0.29
Velocity 10/6 (fps)	3.51	4.20	5.90	5.65	6.79
Diam. Req'd. (ft.)	0.70	0.93	1.00	1.02	0.23
Diam. In Place (ft.)	1.50	1.50	2.00	2.00	1.50

* Based on entire flow from DD-1.
** Based on entire flows from DD-2, CD-10 & DD-11
*** Based on entire flow from DD-4.

TABLE IV-4 (PAGE 7-82)

MAIN CHANNEL CULVERT DESIGN

	(optional)
Structure	C-1a
Drainage Area	469.51
10 yr. - 24 hr. Event	1.82
Time of Conc. (hrs.)	1.02
Curve number	70
Manning's Number	0.025
Ditch Slope (%)	5.56
Peak Flow	22.12
Structure Area Used (ft.2)	7.07
Velocity (fps)	9.20
Hydraulic Length	10,200
Land Slope	19.83
Headwater Req'd (ft.)	2.22
D Req'd (ft.)	1.84
D in Place	3.00

Note: See Appendix O for culvert justification.

TABLE IV-4 (PAGE 7-82) (cont'd)

MAIN CHANNEL CULVERT DESIGN

Structure	C1	C3	C5	C7
Drainage Area	506.16	529.19	606.48	633.35
10 yr. - 24 hr. Event	1.82	1.82	1.82	1.82
Time of Conc. (hrs.)	-	-	-	-
Curve number	70	70	70	70
Manning's number	0.025	0.025	0.025	0.025
Ditch Slope (%)	5.56	5.56	5.56	5.56
Peak Flow	23.12	23.62	26.02	26.72
Structure Area Used (ft.2)	7.07	7.07	7.07	9.62
Velocity (fps)	9.20	9.20	9.20	9.20
Hydraulic Length	-	-	-	-
Land Slope	-	-	-	-
Headwater Req'd (ft.)	N/A	N/A	-	-
D Req'd (ft.)	1.86	1.88	1.95	1.97
D in Place	3.00	3.00	3.00	3.50

Note: See Appendix O for culvert justification.

TABLE IV-4 (PAGE 7-82) (cont'd)

MAIN CHANNEL CULVERT DESIGN

Structure	C9	C11	C13	C15
Drainage Area	678.60	696.73	752.04	752.04
10 yr. - 24 hr. Event	1.82	1.82	1.82	1.82
Time of Conc. (hrs.)	-	-	-	-
Curve number	70	70	70	70
Manning's number	0.025	0.025	0.025	0.025
Ditch Slope (%)	5.56	5.56	5.56	5.56
Peak Flow	29.82	32.42	38.92*	38.92*
Structure Area Used (ft.2)	9.62	9.62	9.62	9.62
Velocity (fps)	9.20	9.20	9.20	9.20
Hydraulic Length	-	-	-	-
Land Slope	-	-	-	-
Headwater Req'd (ft.)	-	-	-	-
D Req'd (ft.)	2.06	2.12	2.27	2.27
D in Place	3.50	3.50	3.50	3.50

Note: See Appendix O for culvert justification.

Note: All culverts are within capacity for open-channel flow.

* If design peak flows for primary spillways from Ponds C and E are included, the peak flows for C-13 and C-15 are 65.6 cfs and 90.9 cfs respectively.

TABLE IV-5

SIDE DRAINAGE CULVERT DESIGN

Structure	C-0	C-2	C-4	C-6
Drainage Area	36.65	23.03	77.29	26.87
10 yr. - 24 hr. Event	1.82	1.82	1.82	1.82
Time of Conc. (hrs.)	0.12	0.08	0.24	0.22
Curve number	70	70	70	70
Manning's number	0.025	0.025	0.025	0.025
Ditch Slope (%)	4.00	4.00	10.00	4.00
Peak Flow	5.65	3.90	8.77	4.17
Structure Area Used (ft.2)	1.767	1.767	1.767	1.767
Velocity (fps)	6.18	6.18	8.73	6.18
Hydraulic Length	1300	850	2850	1400
Land Slope	51.43	61.54	47.22	56.67
Headwater Req'd (ft.)	1.35	1.12	*2.40	1.02
D Req'd (ft.)	1.10	0.96	*1.30	0.98
D In Place (ft.)	1.50	1.50	1.50	1.50

* Available headwater at culvert inlet is greater than that required to allow for surge storage and passage of flows.

Headwater = distance from base of culvert to top of headwall.

SIDE DRAINAGE CULVERT DESIGN

Structure	C-8	C-10	C-12
Drainage Area	45.25	18.16	55.31
10 yr. - 24 hr. Event	1.82	1.82	1.82
Time of Conc. (hrs.)	0.14	0.11	0.21
Curve Number	70	70	70
Manning's Number	0.025	0.025	0.025
Ditch Slope (%)	4.00	4.00	10.00
Peak Flow	7.09	2.65	6.50
Structure Area Used (ft.2)	4.91	3.14	1.767
Velocity (fps)	6.18	4.90	9.77
Hydraulic Length	1600	1250	2800
Land Slope	58.62	63.16	58.33
Headwater Req'd (ft.)	1.25	0.98	1.60
D Req'd (ft.)	1.20	0.83	1.16
D In Place (ft.)	2.50	2.00	1.5

TABLE IV-6

RESTORED CHANNEL DESIGNS*

	Main Channel	Side Channel*		
Structure	RC-1	RC-O	RC-2	RC-4
Drainage Area	469.22	34.55	22.18	71.83
100 yr.- 6 hr. Event	1.91	1.91	1.91	1.91
Time of Conc. (hrs.)	3.19	0.18	0.09	0.44
Curve number	70	70	70	70
Manning's Number	0.040	0.040	0.040	0.040
Ditch Slope (%)	6.60	4.00	4.00	10.00
Peak Flow	60.31**	2.64	1.93	4.12
Min. Structure Area (ft.2)	27.00	8.00	8.00	8.00
Req'd Area (ft.2)	7.26	0.84	0.67	0.83
Depth of Flow (ft.)	1.03	0.35	0.30	0.35
Velocity (fps)	8.31	3.16	2.86	4.98
Hydraulic Length	10,200	1,300	850	2,400
Land Slope (%)	19.80	51.40	61.50	47.00
Erosion Protection (Y/N)	Y	N	N	Y

* In areas where these side drainages cross the road after final reclamation, road dips at least as substantial as the restored channels shown in Table IV-6 (Page 7-84) will be put in place. Locations of these are shown on Plate 7-13.

** Includes Reclaimed Area.

Note: Ditch Slopes measured from Plate 7-13.
Areas from Plate 7-14

TABLE IV-6 (cont'd)

RESTORED CHANNEL DESIGNS*

Structure	RC-6	RC-8	RC-10	RC-12	RC-14
Drainage Area			28.74	46.92	20.74	58.20	24.37
100 yr. - 6 hr. Event	1.91	1.91	1.91	1.91	1.91		
Time of Conc. (hrs.)	0.20	0.24	0.18	0.53	0.20		
Curve number			70	70	70	70	70
Manning's Number		0.040	0.040	0.040	0.040	0.040	
Ditch Slope (%)		4.00	4.00	4.00	10.00	4.00	
Peak Flow			2.15	3.39	1.60	3.12	1.82
Min. Structure Area (ft.2)	8.00	8.00	8.00	8.00	8.00		
Req'd Area (ft.2)		0.73	0.99	0.60	0.69	0.65	
Depth of Flow (ft.)		0.31	0.41	0.26	0.30	0.29	
Velocity (fps)		2.96	3.43	2.68	4.55	2.80	
Hydraulic Length		1,400	1,600	1,250	2,800	1,300	
Land Slope (%)			57.00	58.60	63.20	58.30	46.80
Erosion Protection (Y/N)	N	N	N	Y	N		

* In areas where these side drainages cross the road after final reclamation, road dips at least as substantial as the restored channels shown in Table IV-6 (Page 7-84) will be put in place. Locations of these are shown on Plate 7-13.

Note: Ditch Slopes measured from Plate 7-13.

TABLE IV-6 (con't)
RESTORED CHANNEL DESIGNS
(Sub-Areas)*

Structure	1	2	3	4	5	6	7
Drainage Area (ac.)	4.72	1.09	8.73	24.37	4.37	24.00	12.74
100 yr.-6 hr. event (in.)	1.91	1.91	1.91	1.91	1.91	1.91	1.91
Time of Conc. (hrs.)	0.08	0.07	0.13	0.22	0.09	0.20	0.17
Curve Number	70	70	70	70	70	70	70
Peak Flow (cfs)	0.42	0.10	0.72	1.78	0.38	1.78	0.99
Hydraulic Length (ft.)	600	400	800	1,500	700	1,200	1,100
Land Slope (%)	66.67	55.17	58.33	66.67	60.00	60.87	60.00

* These areas drain directly to RC-1 by sheet flow, without entering other channels. See Plate 7-14.

TABLE IV-6 (con't)

RESTORED CHANNEL DESIGNS

Structure	*Reclaimed Area
Drainage Area (ac.)	32.34
100 yr.-6 hr. event (in.)	1.91
Time of Conc. (hrs.)	0.54
Curve Number	90
Peak Flow (cfs)	23.17
Hydraulic Length (ft.)	49.50
Land Slope (%)	6.60

* This area drains directly to RC-1 by sheet flow, without entering other channels. See Plate 7-14.

TABLE IV-6 (con't)

RESTORED CHANNEL DESIGNS

Peak flow for RC-1 is based on the total of peak flows for RC-1 (Upper) plus channels RC-O through RC-14, plus sub-areas 1 through 7, plus the reclaimed area. Peak flows for each of these are shown in Appendix P.

TABLE IV-7

EROSION PROTECTION

Restored Side Channel Structure	Restored Side C-15	RC-1	RC-4	RC-12	*Main Channel	Restored Main Channel
Flow (cfs)	-	-	4.12	3.12		
Slope (%)	5.56	6.60	10.00	10.00		
Velocity (fps)	9.20	8.31	4.98	4.55		
Rip-rap Size (D50)	15"	12"	6"	6"		
Bedding (-3/4" gravel)	25"	20"	10"	10"		
Length of Protection (ft.)	20'	All	All	All		
Width of Protection (ft.)	10'	12'	6'	6'		
Rip-Rap Depth	18"	15"	8"	8"		

	UD-1	UD-4 (Max.)	UD-5 (Max.)	DD-3	DD-4
Flow (cfs)	20.57	14.82	4.75	15.18	14.55
Slope (%)	6.75	20.00	17.75	6.25	8.00
Velocity (fps)	7.25	9.67	6.98	6.28	6.82
Rip-rap Size (D50)	9"	15"	9"	9"	9"
Bedding (-3/4" gravel)	15"	25"	15"	15"	15"
Length of Protection (ft.)	All	150'	150'	All	All
Width of Protection	5'	5'	5'	4'	4'

(ft.)					
Rip-Rap Depth	12"	18"	12"	12"	12"

* For Reference Only. Natural Rip-rap is more than adequate for erosion protection.

Note: Rip-Rap shall be graded according to the following:

D15 = 0.42D; D50 = 1D; D85 = 1.6D.

For Median Diameter of 12", D15 = 5", D50 = 12", D85 = 19.25".

For Median Diameter of 21", D15 = 9", D50 = 21", D85 = 34.00".

		UD-2 (upper)	UD-2 (lower)	
Flow (cfs)	13.87	13.87		
Slope (%)		12.33	42.60	
Velocity (fps)	10.63	11.90		
Rip-Rap Size (D50)	N/A**	12"		
Bedding (-3/4" gravel)		N/A**	20"	
Length of Protection (ft.)		150'		100'
Width of Protection (ft.)		5'		5'
Rip-Rap Depth		N/A**	15"	

** UD-2 (upper) is protected by a channel liner.

During the earthwork portion of the reclamation suitable rip-rap will be segregated and stored on site for later use in the stream channel restorations it will not be necessary to haul rip-rap in from an outside source. Also native material will be used for the filter blanket under the rip-rap. This material can be used because of its sandy nature it will not be necessary to haul gravel in.

TABLE IV-8

VALUES FOR MANNING'S N AND MAXIMUM PERMISSIBLE VELOCITY OF FLOW IN OPEN CHANNELS

Ditch lining			Manning's n	Vmaxfps1
1. Natural earth				
a. Without vegetation				
(1) Rock				
(a) Smooth and uniform			0.035-0.040	20
(b) Jagged & Irregular			0.040-0.045	15-18
(2) Soils				
Coarse grained				
Gravel and gravelly soils				
Unified	USDA			
GW	Gravel		0.022-0.024	6-7
GP	Gravel		0.023-0.026	7-8
GM	Loamy Gravel Gravelly Loam	d u	0.023-0.025 0.022-0.020	3-5 2-4
GC	Gravelly Clay		0.024-0.026	5-7
Coarse grained				
Sand and sandy soils				
SW	Sand		0.020-0.024	1-2
SP	Sand		0.022-0.024	1-2
SM	Loamy Sand	d u	0.020-0.023 0.021-0.023	2-3 2-3
SC	Sandy Loam		0.023-0.025	3-4
Fine grained				
Silts and clays				
50 CL	Clay Loam Sandy Clay Loam Silty Clay Silt Loam		0.022-0.024	2-3
LL ML	Very Fine Sand Silt		0.023-0.024	3-4
50 OL	Mucky Loam		0.022-0.024	2-3
CH	Clay		0.022-0.023	2-3
MH	Silty Clay		0.023-0.024	3-5
LL OH	Mucky Clay		0.022-0.024	2-3
Highly Organic				
PT	Peat		0.022-0.025	2-3

1Maximum recommended velocities

Table IV-9
Sediment Yield
for
Disturbed Area

Using the Universal Soil Loss Equation:
A = RKLSCP; Where:

R = 16.53 from $R = 27P_{2,6}^{2.2}$; $P_{2,6}$ = 0.8 inches
K = 0.50 from Table 5.5 (Ref. Below)
LS = 2.5 Length/Slope factors from Fig. 5-15 (Ref. Below)
Average Length = 1200'
Average Slope = 6.25%
CP = 1.0 from Table 5.A.1 (Ref. Below)
Based on combination of compacted surface and pavement with grouted ditches.

*A = 16.53 x 0.50 x 2.5 x 1.0 = 20.6625 tons/acre/year
Sediment Yield = A = 0.010 ac./ft./acre/yr.

Notes: (1) Reference: "Applied Hydrology and Sedimentology for Disturbed Areas", Barfield, Warner and Haan, 1983.
(2) Sediment Yield based on a weight of 100 lbs./cu. ft.

* Included for reference only. A more conservative figure of 0.05 ac. ft./acre has been used for Pond C, and 0.1 ac. ft./acre has been used for Pond E sizing.

Table IV-10
Sediment Yield
for
Undisturbed Areas

Using the Universal Soil Loss Equation:

A = RKLSCP; Where:

R = 16.53 from R = 27P,2.2,; P2,6 = 0.8 inches
2,6

K = 0.37 from Table 5.5 (Ref. Below)

LS = Average Length/Slope Factor from Equation = 56.04

$$LS = \left(\frac{L}{72.6}\right)^{0.5} \left(430X^2 + 30X + 0.43\right) ; \quad 6.613$$

L = Avg. Slope Length = 1,000'

X = Sin 0; 0 = Avg. Slope Angle = 26.57o (50%)

C = 0.1 from Table 5.A.3 (Ref. Below)
25% Canopy Cover; 40% Ground Cover

P = 1 (No. Control Practice)

A = 16.53 x 0.37 x 56.04 x 0.1 = 34.275 tons/acre/yr.

Sed. Yield = 34.275 x 2,000 = 0.016 ac. ft./acre/yr.
100 x 43,560

Notes: (1) Reference: "Applied Hydrology and Sedimentology for Disturbed Areas", Barfield, Warner and Haan, 1983.

(2) Sediment yield based on a weight of 100 lbs./cu. ft.

Table IV-11
Minesite Drainage Area Summary

Drainage No.	Area (ac.)	Type	Drains To:
1	4.23	Undisturbed	Pond E
2	5.40	"	Pond C
3	3.00	"	Old Works (Chidister Mine)
4	3.12	"	" " "
5	11.97	"	Pond C
6	2.06	"	Apex Mine

7	1.12	"	Old Works (Chidister Mine)
8	0.55	"	" " "
9	1.01	"	" " "
10	7.41	"	" " "
11	0.13	"	Pinnacle Mine
12	13.52	"	Pond C
13	6.20	"	Pond E
14	1.77	"	" "
15	12.21	Disturbed	" "
16	6.04	"	Pond C
17	4.07	"	Catch Basin B
18	1.28	"	Old Works (Chidister Mine)
19	0.81	"	Pinnacle Mine
20	4.68	"	Pond C
21	3.25	"	Old Works (Chidister Mine)
22	1.23	"	Apex Mine
Total =	95.06;		

Disturbed = 33.57 Acres;
Undisturbed = 61.49 Acres

Notes: (1) Areas disturbed from Plate 7-2 (and Plate 7-1 as necessary).

(2) Does not include diverted undisturbed drainage.

R645-301-733.100. GENERAL PLANS

See R645-301-733.

R645-301-733.110. CERTIFICATION

See R645-301-733.

R645-301-733.120. MAPS AND CROSS SECTIONS

See R645-301-733., also R645-301-510.

R645-301-733.130. NARRATIVE

See R645-301-733.

R645-301-733.140. SURVEY RESULTS

Appendix L

R645-301-733.150. HYDROLOGIC IMPACT

Appendix L

R645-301-733.160. DESIGN PLANS AND CONSTRUCTION SCHEDULE

See R645-301-733.

R645-301-733.200. PERMANENT AND TEMPORARY IMPOUNDMENTS

See R645-301-733.

R645-301-733.210. REQUIREMENTS

N/A

R645-301-733.220. DEMONSTRATION FOR PERMANENT IMPOUNDMENTS

N/A

R645-301-733.221. ADEQUACY FOR INTENDED USE

N/A

R645-301-733.222. WATER QUALITY AND EFFLUENT LIMITATIONS

N/A

R645-301-733.223. WATER LEVEL

N/A

R645-301-733.224. FINAL GRADING

N/A

R645-301-733.225. DIMINUTION OF QUALITY AND QUANTITY OF WATER UTILIZED BY OTHERS

N/A

R645-301-733.226. SUITABILITY FOR POSTMINING LAND USE

N/A

R645-301-733.230. TEMPORARY IMPOUNDMENTS

See R645-301-733.

R645-301-733.240. HAZARD NOTIFICATIONS

See R645-301-733.

R645-301-734. DISCHARGE STRUCTURES

See R645-301-733.

R645-301-735. DISPOSAL OF EXCESS SPOIL

See R645-301-513.300.

R645-301-736. COAL MINE WASTE

See R645-301-513.300.

R645-301-737. NON-COAL MINE WASTE

See R645-301-513.300.

R645-301-738. TEMPORARY CASING AND SEALING OF WELLS

All exploratory drill holes have been sealed with cement and all water wells have been cased with steel casing and will be maintained. After mining is completed, the water wells and monitoring wells will be sealed except in the event the state engineer allows them to remain opened for other purposes.

R645-301-740. DESIGN CRITERIA AND PLANS

See R645-301-733.

R645-301-741. GENERAL REQUIREMENTS

See R645-301-733.

R645-301-742. SEDIMENT CONTROL MEASURES

See R645-301-733.

R645-301-742.100. GENERAL REQUIREMENTS

See R645-301-733.

R645-301-742.110. DESIGN

See R645-301-733.

R645-301-742.111. PREVENTION

See R645-301-733.

R645-301-742.112. EFFLUENT LIMITATIONS

Appendix J

R645-301-742.113. EROSION PROTECTION

See R645-301-733.

R645-301-742.120. MEASURES AND METHODS

See R645-301-733.

R645-301-742.121. RETAINING SEDIMENT WITHIN DISTURBED AREAS

See R645-301-733.

R645-301-742.122. DIVERTING RUNOFF AWAY FROM DISTURBED AREAS

See R645-301-733.

R645-301-742.123. DIVERTING RUNOFF USING PROTECTED CHANNELS

See R645-301-733.

R645-301-724.124. PHYSICAL TREATMENT TO REDUCE FLOW OR TRAP SEDIMENT

See R645-301-733.

R645-301-742.125. CHEMICAL TREATMENT

N/A

R645-301-742.126. IN-MINE TREATMENT

N/A

R645-301-742.200. SILTATION STRUCTURES

See R645-301-733.

R645-301-742.210. GENERAL REQUIREMENTS

See R645-301-733.

R645-301-742.211. DESIGN

See R645-301-733.

R645-301-742.212. REQUIREMENTS

See R645-301-733.

R645-301-742.213. SILTATION STRUCTURES WHICH IMPOUND WATER

See R645-301-733.

R645-301-742.214. POINT SOURCE DISCHARGES

See R645-301-711.300.

R645-301-742.220. SEDIMENTATION PONDS

See R645-301-733.

R645-301-742.221. USE

See R645-301-733.

R645-301-742.221.1 INDIVIDUALLY OR IN SERIES

See R645-301-733.

R645-301-742.221.2 LOCATION

See R645-301-733., Plate 5-7

R645-301-742.221.3 DESIGN, CONSTRUCTION AND MAINTENANCE

See R645-301-733.

R645-301-742.221.31 SEDIMENT STORAGE VOLUME

See R645-301-733.

R645-301-742.221.32 DETENTION TIME

See R645-301-733.

R645-301-742.221.33 DESIGN EVENT

See R645-301-733.

R645-301-742.221.34 DEWATERING DEVICE

See R645-301-733.

R645-301-742.221.35 SHORT CIRCUITING

See R645-301-733.

R645-301-742.221.36 SEDIMENT REMOVAL

See R645-301-733.

R645-301-742.221.37 EXCESSIVE SETTLEMENT

See R645-301-733.

R645-301-742.221.38 EMBANKMENT MATERIAL

See R645-301-733.

R645-301-742.221.39 COMPACTION

See R645-301-733.

R645-301-742.222. MSHA SEDIMENTATION PONDS

N/A

R645-301-742.223. OTHER SEDIMENTATION PONDS

See R645-301-733.

R645-301-745.223.1 OPEN CHANNEL SPILLWAY

See R645-301-733.

R645-301-742.223.2 LINING

See R645-301-733.

R645-301-742.230. OTHER TREATMENT FACILITIES

N/A

R645-301-742.231. DESIGN EVENT

N/A

R645-301-742.232. REQUIREMENTS

N/A

R645-301-742.240. EXEMPTIONS

N/A

R645-301-742.300. DIVERSIONS

See R645-301-733.

R645-301-742.310. GENERAL REQUIREMENTS

See R645-301-733.

R645-301-742.311. REQUIREMENTS

See R645-301-733.

R645-301-742.312. DESIGN

See R645-301-733.

R645-301-742.312.1 STABILITY

See R645-301-733.

R645-301-742.312.2 FLOOD PROTECTION

See R645-301-733.

R645-301-742.312.3 SUSPENDED SOLIDS

See R645-301-733.

R645-301-742.312.4 COMPLY WITH OTHER REGULATIONS

See R645-301-733.

R645-301-742.313. TEMPORARY AND PERMANENT DIVERSIONS

See R645-301-733.

R645-301-742.314. ADDITIONAL DESIGN CRITERIA

See R645-301-733.

R645-301-742.320. DIVERSION OF PERENNIAL AND INTERMITTENT STREAMS

N/A

R645-301-742.321. BUFFER ZONE REQUIREMENTS

N/A

R645-301-742.322. DESIGN CAPACITY

N/A

R645-301-742.323. DESIGN EVENT

N/A

R645-301-742.324. CERTIFICATION

N/A

R645-301-742.330. DIVERSION OF MISCELLANEOUS FLOWS

See R645-301-733.

R645-301-742.331. REQUIREMENTS

See R645-301-733.

R645-301-742.332. DESIGN

See R645-301-733.

R645-301-742.333. DESIGN EVENT

See R645-301-733.

R645-301-742.400. ROAD DRAINAGE

See R645-301-733., .250.

R645-301-742.410. ALL ROADS

See R645-301-733., .250.

R645-301-742.411. PROTECTION AND SAFETY

See R645-301-733., .250.

R645-301-742.412. INTERMITTENT OR PERENNIAL STREAM RESTRICTION

N/A

R645-301-742.413. DOWNSTREAM SEDIMENTATION AND FLOODING

See R645-301-733.

R645-301-742.420. PRIMARY ROADS

See R645-301-733., .250.

R645-301-742.421. EROSION PROTECTION

See R645-301-733., .250.

R645-301-742.422. STREAM FORDS

N/A

R645-301-742.423. DRAINAGE CONTROL

See R645-301-733.

R645-301-742.423.1 PRIMARY ROAD DESIGN CRITERIA

See R645-301-512.250.

R645-301-742.423.2 DRAINAGE PIPES AND CULVERTS

See R645-301-733.

R645-301-742.423.3 DRAINAGE DITCHES

See R645-301-733.

R645-301-742.423.4 NATURAL STREAM CHANNELS

See R645-301-733.

R645-301-742.423.5 REQUIREMENTS

See R645-301-733.

R645-301-743. IMPOUNDMENTS

See R645-301-733.

R645-301-743.100. GENERAL REQUIREMENTS

See R645-301-733.

R645-301-743.110. MSHA IMPOUNDMENTS

N/A

R645-301-743.120. CERTIFICATION AND FREEBOARD REQUIREMENTS

See R645-301-733.

R645-301-743.130. SPILLWAYS

See R645-301-733.

R645-301-743.140. INSPECTIONS

See R645-301-733.

R645-301-743.200. SPILLWAY DESIGN EVENT FOR PERMANENT IMPOUNDMENTS

N/A

R645-301-743.300. SPILLWAY DESIGN EVENT FOR TEMPORARY IMPOUNDMENTS

See R645-301-733.

R645-301-744. DISCHARGE STRUCTURES

See R645-301-733.

R645-301-744.100. EROSION CONTROL

See R645-301-733.

R645-301-744.200. DESIGN

See R645-301-733.

R645-301-745. DISPOSAL OF EXCESS SPOIL

See R645-301-513.300.

R645-301-745.100. GENERAL REQUIREMENTS

See R645-301-513.300.

R645-301-745.110. DISPOSAL AREA

See R645-301-513.300.

R645-301-745.111. EFFECTS ON SURFACE AND GROUND WATER

See R645-301-513.300.

R645-301-745.112. IMPOUNDMENTS ON FILL

N/A

R645-301-745.113. COVER

See R645-301-513.300.

R645-301-745.120. DRAINAGE CONTROL

N/A

R645-301-745.121. DIVERSIONS

N/A

R645-301-745.122. UNDERDRAINS

N/A

R645-301-745.200. VALLEY FILLS AND HEAD-OF-HOLLOW FILLS

N/A

R645-301-745.210. REQUIREMENTS

N/A

R645-301-745.220. DRAINAGE CONTROL

N/A

R645-301-745.221. RESTRICTIONS

N/A

R645-301-745.222. RUNOFF CONTROL

N/A

R645-301-745.300. DURABLE ROCK FILLS

N/A

R645-301-745.310. REQUIREMENTS

N/A

R645-301-745.320. UNDERDRAINS

N/A

R645-301-745.330. RUNOFF CONTROL

N/A

R645-301-745.400. PRE-EXISTING BENCHES

N/A

R645-301-746. COAL MINE WASTE

See R645-301-513.300.

R645-301-746.100. GENERAL REQUIREMENTS

See R645-301-513.300.

R645-301-746.110. PLACEMENT

See R645-301-513.300.

R645-301-746.120. EFFECTS ON SURFACE AND GROUND WATER

See R645-301-513.300.

R645-301-746.200. REFUSE PILES

N/A

R645-301-746.210. REQUIREMENTS

N/A

R645-301-746.211. SEEPS AND SPRINGS

N/A

R645-301-746.212. UNCONTROLLED SURFACE DRAINAGE

N/A

R645-301-746.213. UNDERDRAINS

N/A

R645-301-746.220. SURFACE AREA STABILIZATION

N/A

R645-301-746.221. SLOPE PROTECTION

N/A

R645-301-746.222. IMPOUNDMENT RESTRICTIONS

N/A

R645-301-746.300. IMPOUNDING STRUCTURES

N/A

R645-301-746.310. COAL MINE WASTE

See R645-301-513.300.

R645-301-746.311. REQUIREMENTS

See R645-301-513.300.

R645-301-746.312. MSHA IMPOUNDING STRUCTURE

N/A

R645-301-746.320. SPILLWAYS AND OUTLET WORK

N/A

R645-301-746.330. DRAINAGE CONTROL

N/A

R645-301-746.340. WATER STORAGE

N/A

R645-301-746.400. RETURN OF COAL PROCESSING WASTE TO ABANDONED UNDERGROUND WORKINGS

N/A

R645-301-746.410. HYDROLOGIC IMPACTS

N/A

R645-301-746.420. MONITORING WELLS

N/A

R645-301-746.430. PNEUMATIC BACKFILLING

N/A

R645-301-747. DISPOSAL OF NON-COAL MINE WASTE

See R645-301-513.300.

R645-301-747.100. REQUIREMENTS

See R645-301-513.300.

R645-301-747.200. PLACEMENT AND STORAGE

See R645-301-513.300

R645-301-747.300. FINAL DISPOSAL

See R645-301-513.300.

R645-301-748. CASING AND SEALING OF WELLS

All exploratory drill holes have been sealed with cement and all water wells have been cased with steel casing and will be maintained. After mining is completed, the water

wells and monitoring wells will be sealed except in the event the state engineer allows them to remain opened for other purposes.

R645-301-750. PERFORMANCE STANDARDS

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

R645-301-751. WATER QUALITY STANDARDS AND EFFLUENT LIMITATIONS

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

R645-301-752. SEDIMENT CONTROL MEASURES

Sediment control measures must be located, maintained, constructed and reclaimed according to plans and designs given under R645-301-732, R645-301-742 and R645-301-760.

R645-301-752.100. SILTATION STRUCTURES AND DIVERSIONS

See R645-301-733.

R645-301-752.200. ROAD DRAINAGE

See R645-301-512.250.

R645-301-752.210. CONTROL OF EROSION AND POLLUTION

See R645-301-733.

R645-301-752.220. CONTROL OF SUSPENDED SOLIDS

See R645-301-733.

R645-301-752.230. COMPLIANCE WITH EFFLUENT STANDARDS

See R645-301-733.

R645-301-752.240. MINIMIZE DIMINUTION OF DEGRADATION OF WATER QUALITY

See R645-301-733.

R645-301-752.250. ALTERATION OF STREAM FLOW OR CHANNELS

See R645-301-733.

R645-301-753. IMPOUNDMENTS AND DISCHARGE STRUCTURES

See R645-301-733.

R645-301-754. DISPOSAL OF EXCESS SPOIL, COAL MINE WASTE AND NON-COAL MINE WASTE

See R645-301-513.300.

R645-301-755. CASING AND SEALING OF WELLS

All exploratory drill holes have been sealed with cement and all water wells have been cased with steel casing and will be maintained. After mining is completed, the water wells and monitoring wells will be sealed except in the event the state engineer allows them to remain opened for other purposes.

R645-301-760. RECLAMATION

See R645-301-240.

R645-301-761. GENERAL REQUIREMENTS

See R645-301-240.

R645-301-762. ROADS

See R645-301-512.250.

R645-301-762.100. RESTORING NATURAL DRAINAGE PATTERS

Upon completion of mining activities, and following removal of surface structures, the earthwork portion of the reclamation plan will begin as described. The hydrologic portion of reclamation will take place in two phases:

1. The main and side drainage channels will be restored as shown in the Sedimentation and Drainage Control Plan, and on Plate 7-12. Loose rock check dams will be placed at each side drainage entrance onto the reclaimed area, and at approximately 500' intervals along the restored main channel RC-1. (Typical sections of the loose rock check dams are shown in the Sedimentation and Drainage Control Plan).

All disturbed diversions and sediment ponds "B" and "C" will also be removed at this time. Sediment Pond "E" will be enlarged, and the entire drainage above will flow into Pond "E-PM" through the restored channel RC-1.

2. Once revegetation and water quality standards are met, Pond "E-PM" will be removed, and the area reclaimed.

Surface water monitoring will continue during this time as described. Please see Plate 7-9.

R645-301-762.200. REGRADING

See R645-301-532.200.

R645-301-763. SILTATION STRUCTURES

See R645-301-733.

R645-301-763.100. RESTRICTIONS

See R645-301-733.

R645-301-763.200. REQUIREMENTS

See R645-301-733.

R645-301-764. STRUCTURE REMOVAL

See R645-301-240.

R645-301-765. PERMANENT CASING AND SEALING OF WELLS

All exploratory drill holes have been sealed with cement and all water wells have been cased with steel casing and will be maintained. After mining is completed, the water wells and monitoring wells will be sealed except in the event the state engineer allows them to remain opened for other purposes.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Utah Ecological Services Field Office
2369 WEST ORTON CIRCLE, SUITE 50
WEST VALLEY CITY, UT 84119
PHONE: (801)975-3330 FAX: (801)975-3331
URL: www.fws.gov; www.fws.gov/utahfieldoffice/

Consultation Code: 06E23000-2016-SLI-0153 February 18, 2016
Event Code: 06E23000-2016-E-00318
Project Name: Centennial- Kenilworth Lease Addition

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment

United States Department of Interior
Fish and Wildlife Service

Project name: Centennial- Kenilworth Lease Addition

Official Species List

Provided by:

Utah Ecological Services Field Office
2369 WEST ORTON CIRCLE, SUITE 50
WEST VALLEY CITY, UT 84119
(801) 975-3330
http://www.fws.gov
http://www.fws.gov/utahfieldoffice/

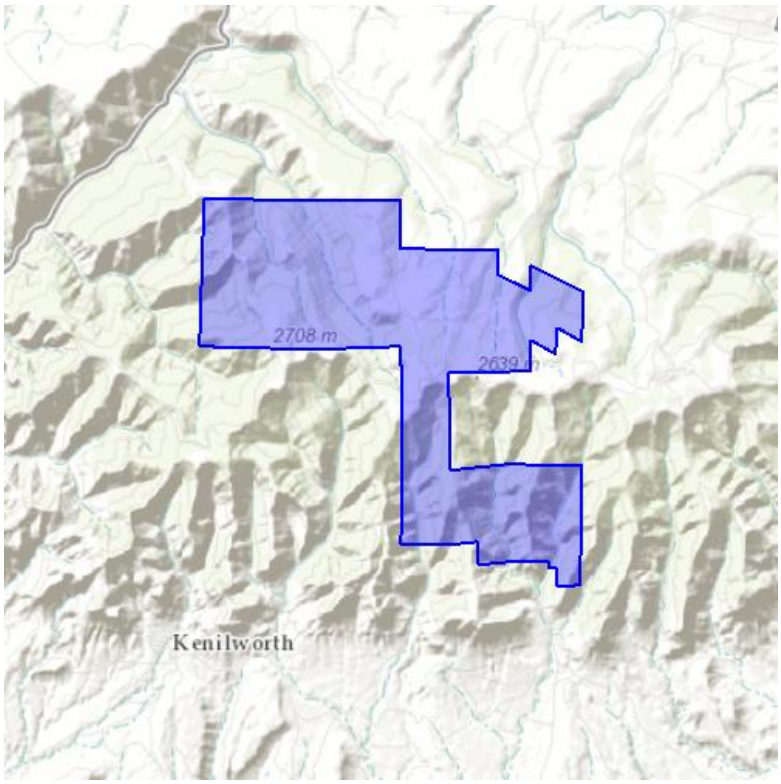
Consultation Code: 06E23000-2016-SLI-0153
Event Code: 06E23000-2016-E-00318

Project Type: MINING

Project Name: Centennial- Kenilworth Lease Addition
Project Description: Underground coal mining

Please Note: The FWS office may have modified the Project Name and/or Project Description, so it may be different from what was submitted in your previous request. If the Consultation Code matches, the FWS considers this to be the same project. Contact the office in the 'Provided by' section of your previous Official Species list if you have any questions or concerns.

Project Location Map:



Project Coordinates: The coordinates are too numerous to display here.

Project Counties: Carbon, UT

Endangered Species Act Species List

There are a total of 6 threatened or endangered species on your species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Critical habitats listed under the **Has Critical Habitat** column may or may not lie within your project area. See the **Critical habitats within your project area** section further below for critical habitat that lies within your project. Please contact the designated FWS office if you have questions.

Birds	**Status**	**Has Critical Habitat**	**Condition(s)**
Mexican Spotted owl *(Strix occidentalis lucida)* Population: Entire	Threatened	Final designated	
Yellow-Billed Cuckoo *(Coccyzus americanus)* Population: Western U.S. DPS	Threatened	Proposed	
Fishes			
Bonytail chub *(Gila elegans)* Population: Entire	Endangered	Final designated	
Colorado pikeminnow *(Ptychocheilus lucius)* Population: Entire, except EXPN	Endangered	Final designated	
Humpback chub *(Gila cypha)* Population: Entire	Endangered	Final designated	
Razorback sucker *(Xyrauchen texanus)* Population: Entire	Endangered	Final designated	

Critical habitats that lie within your project area

There are no critical habitats within your project area.

Guidelines for the identification of suitable habitat for WYBCU in Utah

The purpose of this guidance is to assist agencies and project proponents in identifying areas that meet minimum criteria as potentially suitable breeding and nesting habitat for yellow-billed cuckoo in Utah. Areas that meet the minimum criteria should be (1) avoided by 0.5 mile[1], or (2) surveyed, and/or (3) carried forward for evaluation of potential effects.

Step 1: Identify and delineate all riparian habitats within 0.5 mile of the proposed action, below the elevation of 8,500 feet.

Step 2: Identify suitable cuckoo breeding and nesting habitat, including associated foraging areas.

Riparian patches used by breeding and nesting cuckoos vary in size and shape, ranging from a relatively contiguous stand of mixed native/exotic[2] vegetation to an irregularly shaped mosaic of dense vegetation with open areas. The following parameters characterize suitable breeding and nesting cuckoo habitat:

- Vegetation[3] that is predominantly multi-layered, with riparian canopy trees and at least one layer of understory shrubby vegetation;
- Patches of multi-layered vegetation (as described above) that are at least 12 acres (5 ha) or greater in extent and separated from other patches of suitable habitat by at least 300 meters;
- Somewhere within a patch, the multi-layered riparian vegetation (as described above) should be at least 100 meters wide by 100 meters long. This is to avoid patches that may be long enough to meet the minimum area (12 acres) but are so narrow that they are unsuitable-- 750 m x 75 m (length x width) for example; and,
- Open areas, or gaps of multi-layered vegetation within a patch are less than 300 meters.

Breeding and nesting cuckoos will forage in riparian patches that have an overstory canopy *only* and are within 300 meters (m) of the edge of suitable breeding and nesting habitat. Identify suitable foraging habitat of nesting cuckoo to include single layer overstory canopy that is within 300 meters of suitable breeding and nesting habitat.

References

Halterman, M., M.J. Johnson, J.A. Holmes and S.A. Laymon. 2015. A Natural History Summary and Survey Protocol for the Western Distinct Population Segment of the Yellow-billed Cuckoo: U.S. Fish and Wildlife Techniques and Methods, 45 p.

Laymon, S. 2015. Personal Communication. Senior Wildlife Biologist, Sacramento Fish & Wildlife Service Office.

U.S. Fish and Wildlife Service. 2014. Final rule determining threatened status for the western yellow-billed cuckoo. Federal Register 79: 59992-60038.

[1] A 0.5-mile buffer is likely the largest buffer necessary to preclude impacts to the species from noise, light and human disturbance. Regardless, this buffer could be adjusted according to the type of activity and noise that is generated (for example, oil well drilling as opposed to construction vehicle traffic).

[2] Western yellow-billed cuckoo have been documented nesting in tamarisk, consequently, the presence of tamarisk should not eliminate a vegetation patch from a suitability determination. However the odds of cuckoo occurrence decrease rapidly as the amount of tamarisk cover increases.

[3] Riparian overstory and understory vegetation that supports suitable cuckoo habitat may include: cottonwood (*Populus spp*), willow (*Salix* spp), alder (*Alnus spp*), walnut (*Juglans spp*), boxelder (*Acer spp*), sycamore (*Plantanus spp*), ash (*Fraxinus spp*), mesquite (*Prosopis spp*), tamarisk (*Tamarix spp*), and Russian olive (*Elaeagnus angustifolia*). Suitable understory vegetation does not include grasses or forbs although herbaceous vegetation is often present alongside shrubby understory.

0005

General Correspondence Incoming
cc: Dana
Joe
Ingrid K

United States Department of the Interior
FISH AND WILDLIFE SERVICE
UTAH FIELD OFFICE
2369 WEST ORTON CIRCLE, SUITE 50
WEST VALLEY CITY, UTAH 84119

In Reply Refer To
FWS/R6
ES/UT
10-TA-0005

January 22, 2010

Daron Haddock
Permit Supervisor; Coal Program
Utah Department of Natural Resources
Division of Oil, Gas & Mining
1594 West North Temple, Suite 1210
PO Box 145801
Salt Lake City, Utah 84114-5801

RE: Satisfying the 1996 Biological Opinion on Surface Coal Mining and Reclamation Operations for Impacts to Federally Listed Colorado River Fish Species in the Green and Colorado River Basins, Utah

Dear Mr. Haddock:

The purpose of this letter is to establish species-specific standards and procedures to protect federally listed Colorado River fish species from impacts related to coal mining operations in the upper Colorado River basin of Utah. The species-specific standards and procedures described in this letter are designed to fulfill the requirements under the 1996 Biological Opinion on Surface Coal Mining and Reclamation Operations (1996 BO), satisfying the responsibilities of the Utah Division of Oil, Gas, and Mining (UDOGM) and the US Fish and Wildlife Service (Service). The standards and procedures will provide minimum permitting and performance standards for protection and enhancement of the federally endangered Colorado pikeminnow (*Ptychocheilus lucius*), humpback chub (*Gila cypha*), bonytail (*Gila elegans*), and razorback sucker (*Xyrauchen texanus*) and their designated critical habitat (Colorado River fish species) when coal operations occur in the Green and Colorado River basins and are greater than 10 miles from designated critical habitat. This letter does not discuss standards and procedures for any other species, nor does it discuss standards and procedures for coal operations less than 10 miles from designated critical habitat. Projects that are within 10 miles of critical habitat may have additional impacts that would not be covered under the 1996 BO.

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JAN 26 2010
DIV. OF OIL, GAS & MINING

The 1996 Biological Opinion

On March 21, 1995, the Office of Surface Mining (OSM) requested formal consultation regarding the continuation and approval of surface coal mining and reclamation operations under State and Federal regulatory programs. A Biological Opinion and Conference Report were completed by the Service on September 24, 1996. The 1996 BO established guidance for complying with both the Surface Mining Control and Reclamation Act of 1977 (SMCRA) and the Endangered Species Act of 1973 (ESA). The Service concluded that the implementation of surface mining activities consistent with regulations (30 CFR Part 700 to end) is not likely to jeopardize the continued existence of any threatened, endangered, or proposed species or result in adverse modification of designated or proposed critical habitats. This conclusion was predicated on implementation of the requirements described in the document and the terms and conditions set forth in the incidental take statement. Fulfilling the responsibilities outlined in the 1996 BO achieves ESA compliance for all federally-related activities by the Regulatory Authority, be it the State or OSM.

The following is a summary of the requirements of the 1996 Biological Opinion on Surface Coal Mining and Reclamation Operations:

A. General Requirements

1. The review and issuance of permits must include the consideration of listed resources.

B. Pre-Application

1. The Service Field offices will distribute and update a list of species and critical habitat and specific protection measures needed for these species and critical habitat to OSM and the Regulatory Authority.
2. The Regulatory Authority will determine whether a listed species or critical habitat is present in a proposed permit area or adjacent area based on the list provided by the Service.
3. When listed species or critical habitat are present in the permit area or adjacent area, the Regulatory Authority will coordinate with the Service and State Wildlife Agency to determine the scope and level of detail of resource information contained in a permit application.
4. The Regulatory Authority will provide to the applicant an explanation of the scope and level of detail necessary to complete the resource information in the permit application.

C. Permit application package

1. The Applicant shall include the following resource information in permit applications for listed or proposed species or their critical habitat:
    a. Site-specific resource information.
    b. A protection and enhancement plan that describes how the operator will minimize disturbances and adverse impacts:
        i. Protective measures during the active mining phases of the operation.

ii. Enhancement measures during the reclamation and post-mining phase of the operation.

2. The Service will review the resource information in the permit application. The Service requests the information from the Regulatory Authority which is to be provided within 10 days of the request.
3. OSM, State Regulatory Authorities, and the Service must develop additional species-specific or site-specific standards and procedures to protect listed resources.
4. The Regulatory Authority will quantify take of listed species resulting from mining operations. Quantification of take occurs on a permit-by-permit basis.
5. The Service will develop, in close coordination with OSM and the State regulatory Authority, any necessary site-specific measures to minimize potential take. The measures must be enforceable under the mining permit.
6. The Regulatory Authority will provide to the Service a written explanation whenever the authority decides not to implement species-specific measures recommended by the Service. The Service provides a concurrence letter to the Regulatory Authority if the Service concurs with the Regulatory Authority's action. If the Service does not concur with the Regulatory Agency's action an, elevation process will be used to reach agreement on the implementation of the species-specific measures.

D. Notification of Receipt of Complete Permit Application and Subsequent Permitting Actions

1. The Regulatory Authority will notify the Service of completed application, a significant revision to a permit, or a renewal of a permit.

E. Written Findings

1. As a precondition for approval of a permit application, the Regulatory authority will find, in writing, that the mining operation will not jeopardize listed species or result in adverse modification of critical habitat, based on the information in the mining application.
2. The Regulatory Authority will make a written finding that the exploration and reclamation activities will not jeopardize the continued existence of an endangered species or threatened species or result in destruction or adverse modification of critical habitat of those species.

F. Notification of Decision

1. The Regulatory Authority will notify the Service, in writing, concerning decision made on permit issued that the Service has offered comments.

G. Performance Standards

1. The Operator determines whether a listed species is present in the permit area or adjacent area during the pre-application phase of the operation or, if new information is presented at any time during the mining operation.
2. The Regulatory Authority consults with the State and the Service when the Operator determines that a listed species occurs in the permit area. The Regulatory Authority, in consultation with the Service, must identify whether, and under what conditions, the operator may proceed with the operation if listed species occur in the permit area.

3. The Operator shall use the best available technology to minimize disturbance of and adverse impacts to fish, wildlife, and related environmental values and shall achieve enhancement of these same resources where practicable.
4. The Operator will not jeopardize listed species or adversely modify critical habitat during mining operations.
5. The Regulatory Authority must notify the Service within one working day if a dead or impaired individual of a listed species is found in the permit area or in adjacent areas.
6. OSM and the Regulatory Authority must regulate the mining activity covered by the incidental take statement in the 1996 BO and in site-specific incidental take statements. The protective coverage for the operator against the unlawful take of listed species may lapse if the regulatory authority fails to require permittees to adhere to, or if OSM fails to monitor compliance with, the terms and conditions of the incidental take statement.
7. The Regulatory Authority must implement any species-specific protective measures to minimize anticipated incidental take. The Regulatory Authority must also require compliance by the operator with the species-specific protective measures.

H. Coal Exploration

1. The Applicant will include a description of any listed species within proposed exploration areas in exploration permits.
2. The Regulatory Authority shall only approve coal exploration permits if the Applicant has demonstrated that the action will not jeopardize listed species or adversely modify critical habitat.
3. The Operator will not disturb critical habitat during coal exploration as part of the performance standards.

I. Midterm Permit Review and Permit Renewal

1. The Regulatory Authority must require a reasonable revision of a permit at any time if the operation is not in compliance with the species protection provisions of the approved regulatory program.

J. Conservation Recommendations

1. The Service will recommend discretionary conservation recommendations to OSM in order to minimize or avoid adverse effects of the mining operation to listed species.

K. Reinitiation of Consultation

1. Reinitiation of consultation may be requested by OSM or the Service if
   a. new information indicates that the approval or conducting of mining operation and reclamation is affecting listed species or modifying critical habitat in a manner or extent not considered in the 1996 BO or
   b. the approval or conducting of mining operation and reclamation is modified in a manner not considered in the 1996 BO that causes an adverse effect to listed species or critical habitat.

L. Cumulative Effects

1. The Applicant, in cooperation with the regulatory authority, must analyze cumulative impacts of mining operations at the site-specific level if listed resources are present in the action area.

In fulfillment of A.1, this letters communicates the processes that must occur to meet the above requirements for federally listed Colorado River fish species in Utah.

Endangered Colorado River Fishes

The Colorado pikeminnow, razorback sucker, humpback chub and bonytail are endangered fish species that once thrived in the Colorado River system. These fish species are now endangered in part because of human impacts on their habitat over the past 100 years. The two types of habitat alterations that appear to have had the greatest impact on the endangered fish species have been water development and introduction of non-native fishes. Specifically, hundreds of dams, diversions and other barriers have been constructed, river flows have been cut by a third, and more than 40 species of non-native fish have been introduced in the upper Colorado River basin.

Critical habitat for these species was established on March 21, 1994 (59 FR 13374). In Utah, designated critical habitat includes portions of the San Juan, Green, Colorado, White and Duchesne Rivers and their 100-year floodplains (Appendix A). All four of the listed Colorado River fish require the same Primary Constituent Elements (PCEs) of critical habitat essential for their survival: water, physical habitat, and the biological environment. This includes a quantity of water of sufficient quality that is delivered to a specific location in accordance with a hydrologic regime that is required for the particular life stage for each species. The physical habitat includes areas of the Colorado River system that are inhabited or potentially habitable for use in spawning and feeding, as a nursery, or serve as corridors between these areas. In addition, oxbows, backwaters, and other areas in the 100-year floodplain, when inundated, provide access to spawning, nursery, feeding, and rearing habitats. Food supply, predation, and competition are important elements of the biological environment.

Upper Colorado River Endangered Fish Recovery Program

Because water depletions from the upper Colorado River basin are a major factor in the decline of the endangered fishes, the Service initially determined that any depletion will jeopardize their continued existence and will likely contribute to the destruction or adverse modification of their critical habitat (US Fish and Wildlife Service, Region 6 Memorandum, dated July 8, 1997). To address depletion issues, the Department of the Interior, the states of Wyoming, Colorado and Utah, and the Western Area Power Administration established the Recovery Implementation Program for Endangered Fish Species in 1988.

Called the Upper Colorado River Endangered Fish Recovery Program (Recovery Program), this effort involves federal, state and private organizations and agencies in Colorado, Utah, and Wyoming. The program complies with all applicable laws, including the federal Endangered

Species Act, state water laws, river laws, and interstate water compacts. Recovery strategies include conducting research, improving river habitat, providing adequate stream flows, managing non-native fish, and raising endangered fish in hatcheries for stocking.

In order to further define and clarify the process in the Recovery Program, a section 7 agreement (Agreement) was implemented by the Recovery Program participants on October 15, 1993. The agreement stipulated that the Recovery Program acts as the reasonable and prudent alternative (RPA) for depletion impacts in the Upper Colorado River Basin, in order to avoid jeopardy to the endangered fishes. Incorporated into this agreement is a Recovery Implementation Program Recovery Action Plan which identifies actions required to recover the endangered fishes in the most expeditious manner.

After many years of successful implementation of the Recovery Program and Agreement, federal action agencies have come to anticipate Recovery Program activities and a requirement of a financial contribution (also known as a depletion fee) toward these activities serving as the RPA that must be included in their project planning to avoid jeopardy to listed species. Thus, the RPA has essentially become part of the proposed action. Consequently, the Recovery Program activities now serve as conservation measures within the proposed action and minimize adverse effects to listed species or critical habitat. Because of this conservation measure, the Service can now make the determination that water depletions in the Colorado River basin may affect and are likely to adversely affect the Colorado River fish species, which is a non-jeopardy determination.

As mentioned above, included in the Recovery Program was the requirement that a one-time depletion fee would be paid to help support the Recovery Program. This figure was set at $10.00 per acre-foot (AF) based on the average annual depletion of the project and is adjusted annually for inflation (the FY2010 figure is $18.99 per AF). However, on July 8, 1997, the Service issued an intra-Service biological opinion determining that the depletion fee for average annual depletions of 100 AF or less are no longer required because the Recovery Program has made sufficient progress and now is the reasonable and prudent alternative to avoid the likelihood of jeopardy to the endangered fishes and to avoid destruction or adverse modification of their critical habitat. It is important to note that these provisions of the Recovery Program were based on appropriate legal protection of the instream flow needs of the endangered Colorado River fishes.

Satisfying the 1996 BO for Federally Listed Colorado River Fishes in Utah

Using the requirements summary above, the following standards and procedures will satisfy the 1996 BO for federally listed Colorado River fishes in Utah.

A. General Requirements

The Service and UDOGM have cooperatively discussed instituting a clear, standardized system for considering impacts to the federally listed Colorado River fish species from coal-mining operations, satisfying requirement A.1. This letter describes the outcomes of these discussions and the specific steps each agency must take to meet the above requirements.

B. Pre-Application

Satisfying requirement B.1, the Service maintains a list of endangered, threatened, proposed, and candidate species that occur in each Utah county. This list can be accessed on the internet at http://www.fws.gov/mountain-prairie/endspp/countylists/utah.pdf. For Colorado River fish species, UDOGM must determine in what river basin coal-mining operations occur. If operations occur in any part of the Green or upper Colorado River basins (Appendix A), UDOGM shall then determine that operations could have impacts to Colorado River fish species (B.2). UDOGM shall then follow the guidance in this letter to determine the scope and level of resource information contained in a permit application (B.3) and will provide an explanation of this to the applicant (B.4).

C. Permit Application Package

The Service and UDOGM have agreed on site-specific standards and procedures to protect the Colorado River fish species (C.3). The vast majority of coal mining occurs in headwater areas, far from designated critical habitat. Impacts to the fish species from these operations are limited to water depletions and possible water discharges. Standards and procedures that relate to water depletions are in accord with the Recovery Program and are consistent with Service consultation processes for other industries (agriculture, oil and gas developments, etc.). Standards and procedures that relate to possible water discharges are consistent with state water quality requirements. However, in the event that a coal mining operation occurs within 10 miles of designated critical habitat, which includes the 100-year floodplain, the simplified process described below does not apply and individual project consultation must occur.

For operations occurring within the Green or Colorado River basins, the Service requires that specific resource information be provided in the permit-application package. Site specific resource information (C.1.a) must include a complete description of:

- The project's water right, including source (if leased from another water right holder), duration of use, and amount (calculated for annual use in acre-feet);
- Any planned changes to the hydrologic condition of the site outside of the water right consumption, such as planned water discharges (amount and duration), known aquifer encounters, de-waterings of streams and changes in channel course; and
- The project location, which should include:
    - A site map with project boundaries and areas of disturbance clearly marked;
    - USGS 8-digit Hydrologic Unit Code (HUC) of all watersheds in which the project will occur[1]; and
    - Distance (in river-miles) from project location to nearest designated critical habitat reach.

[1] A description of the HUC system can be found at http://water.usgs.gov/GIS/huc.html and a list of HUCs for the state of Utah can be found at http://water.usgs.gov/GIS/huc_name.html

A protection and enhancement plan describing the minimization of disturbances and adverse impact must be filed with the permit application package (C.1.b). Information that must be included in the plan's description (C.1.b.i) includes:

- Protective measures describing the water quality of all water (planned or potential) that is released during the operation of the mine.
    - For example, a description of state water quality requirements for released water will allow the Service to determine if water quality is ecologically suitable for aquatic species;
- Enhancement measures describing the reclamation of mining sites and mine closure.
    - Disturbed areas (work site(s), stockpile site(s), pit) should be revegetated when appropriate after operations with native plants or certified weed-free native seed. The planting should be monitored for success. If the planting fails it should be reseeded/planted;
- Protective measures describing response to accidental pollution spills; and
- Enhancement measures describing how local water quality will be maintained after mine closure, including the prevention of mine drainage.

Conservation measures (C.3) implemented to offset water depletions in the upper Colorado River basin will follow the Upper Colorado Basin Endangered Fish Recovery Program, under the following procedure:

I. The Service and UDOGM will assume that the coal mining operations will fully use their allotted annual water right. They will calculate the project's annual depletion as that amount for Section 7 of the Endangered Species Act purposes and in order to calculate the depletion fee.
    a. Although a coal operation may use less water than this amount, it is very difficult to calculate a coal operation's annual water usage in advance because coal operations may change as conditions warrant. Because Section 7 consultation must occur before a project may begin and because a depletion increase of 10% will re-initiate consultation, it is likely that a project may require multiple consultations. Consulting on the maximum possible annual depletion allowed under the applicant's water right will serve to reduce the number of consultations, cover all projects activities, and simplify the process.

II. If the operations will occur in the Green or upper Colorado River Basins, the coal operator will submit the one-time depletion fee before operations may begin. The depletion fee only serves as a conservation measure for the project's depletion. Additional conservation measures (C.3) must be enacted if further project related impacts are present. Payment must be made to the National Fish and Wildlife Foundation and mailed to:

National Fish and Wildlife Foundation
1133 15th Street, NW
Suite 1100
Washington, DC 20005

a. Annual water depletions under 100 AF do not require a depletion payment, as described above.
b. Annual water depletions above 100 AF and less than 4500 AF will be charged the fiscal year rate (adjusted annually). For FY 2010 the rate is $18.99 per AF. UDOGM will check with the Service in August of each year for the new fiscal year rate.
c. Annual depletions above 4500 AF will require an individual project consultation, as the depletion fee does not serve as a conservation measure for such large depletions.

III. The Service will be notified of all depletions, whether they require a fee or not, in order to continue to track the total depletions occurring in Utah.

IV. The applicant may use discharged water to offset depletion amounts. In order for a discharge to have no effect on the Colorado River fish species, and therefore be allowed to offset any project depletions, the water must be of suitable quality for aquatic species. The applicant must document the following:

a. The volume of expected mine water discharge;
b. The stream course into which the water is released, ensuring that the water is discharged in a manner that contributes to upper Colorado River basin flows;
c. The discharged water conforms to all applicable water right law; and
d. The discharged water meets all state and federal water quality parameters, thus making the water suitable for aquatic species:
    i. Water Quality of the State (Utah Administrative Code: Rule R317-2[2]) for each individual surface water body based on Use Designations (R317-2-6) and corresponding Numeric Criteria (R317-2-14);
    ii. Utah Division of Water Quality Ground Water Quality Standards[3]; and
    iii. Utah Pollution Discharge Elimination System (UPDES) permits.

V. UDOGM has the discretion to determine whether a proposed coal mining activity constitutes a depletion. A guide for determining depletions is provided by UDOGM's "Water Depletion For Coal Mining Operations". When these determinations are made, UDOGM will provide the Service with a brief description of the reasons behind the determination.

UDOGM shall quantify take (C.4) as the level of water reduction from the upper Colorado River basin. Estimating the number of individuals of these species that would be taken as a result of the water depletions is difficult for a number of reasons, therefore it is standard Service practice to quantify take as a measure of the water depletion.

---

[2] Available at http://www.rules.utah.gov/publicat/code/r317/r317-002.htm#T16
[3] Available at http://www.waterquality.utah.gov/GroundWater/gwstandards.htm

D. Notifications and Subsequent Permitting Actions

UDOGM will notify the Service of a complete application, a significant revision to a permit, or a renewal of a permit.

E. *Written Findings*

For proposed permit applications, UDOGM will submit a written finding stating that the proposed mining operations, exploration and reclamation will not jeopardize the continued existence of listed species or adversely modify critical habitat.

F. *Notification of Decision*

UDOGM will notify the Service concerning any decisions made concerning permits on which the Service has commented. UDOGM will also notify the Service of any significant pollution spills that occur, so that the Service can assess the impacts of the spill. The Service will provide UDOGM a written letter either concurring with UDOGM's written findings or providing additional conservation methods within 30 days of receipt of UDOGM's letter.

G. Performance Standards.

For coal operations that occur greater than 10 miles from designated critical habitat for Colorado River Fish Species, following the depletion and discharge guidelines outlined in this document will satisfy the requirement of G.4, in which the operator must not jeopardize listed species or adversely affect critical habitat.

H. Coal Exploration

The Applicant will include a description of any listed species within proposed exploration areas in exploration permits. UDOGM shall only approve coal exploration permits if the Applicant has demonstrated that the action will not jeopardize listed species or adversely modify critical habitat. The Operator will not disturb critical habitat during coal exploration as part of the performance standards.

I. Midterm Permit Review and Permit Renewal

UDOGM must require a reasonable revision of a permit at any time if the operation is not in compliance with the species protection provisions of the approved regulatory program.

J. Conservation Recommendations

The Service has no specific discretionary conservation measures that apply to all projects that have not already been discussed in this document.

K. Reinitiation of Consultation

Consultation will be reinitiated under guidelines K.1.a & b (found above) and under 50 CFR 402.16, which states:

> "Reinitiation of formal consultation is required and shall be requested by the Federal agency or by the Service, where discretionary Federal involvement or control over the action has been retained or is authorized by law and:
>
> a) If the amount or extent of taking specified in the incidental take statement is exceeded;
> b) If new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered;
> c) If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion; or
> d) If a new species is listed or critical habitat designated that may be affected by the identified action."

Under reinitiation criteria b, if a permitted coal operation plans to increase the water depletion by more than 10% of that already approved in the Mining and Reclamation Plan, then reinitiation must occur unless a mine water discharge offset can be demonstrated. (C-IV, page 10)

Cumulative Effects

The Applicant, in cooperation with UDOGM, must analyze cumulative impacts of mining operations at the site-specific level if listed resources are present in the permit or adjacent area.

Other Requirements

Some projects may not be covered under this guidance document and will require separate consultation. This includes, but is not limited to coal operations that may jeopardize the species through impacts not covered in this document and that occur within 10 miles of designated habitat.

Conclusion

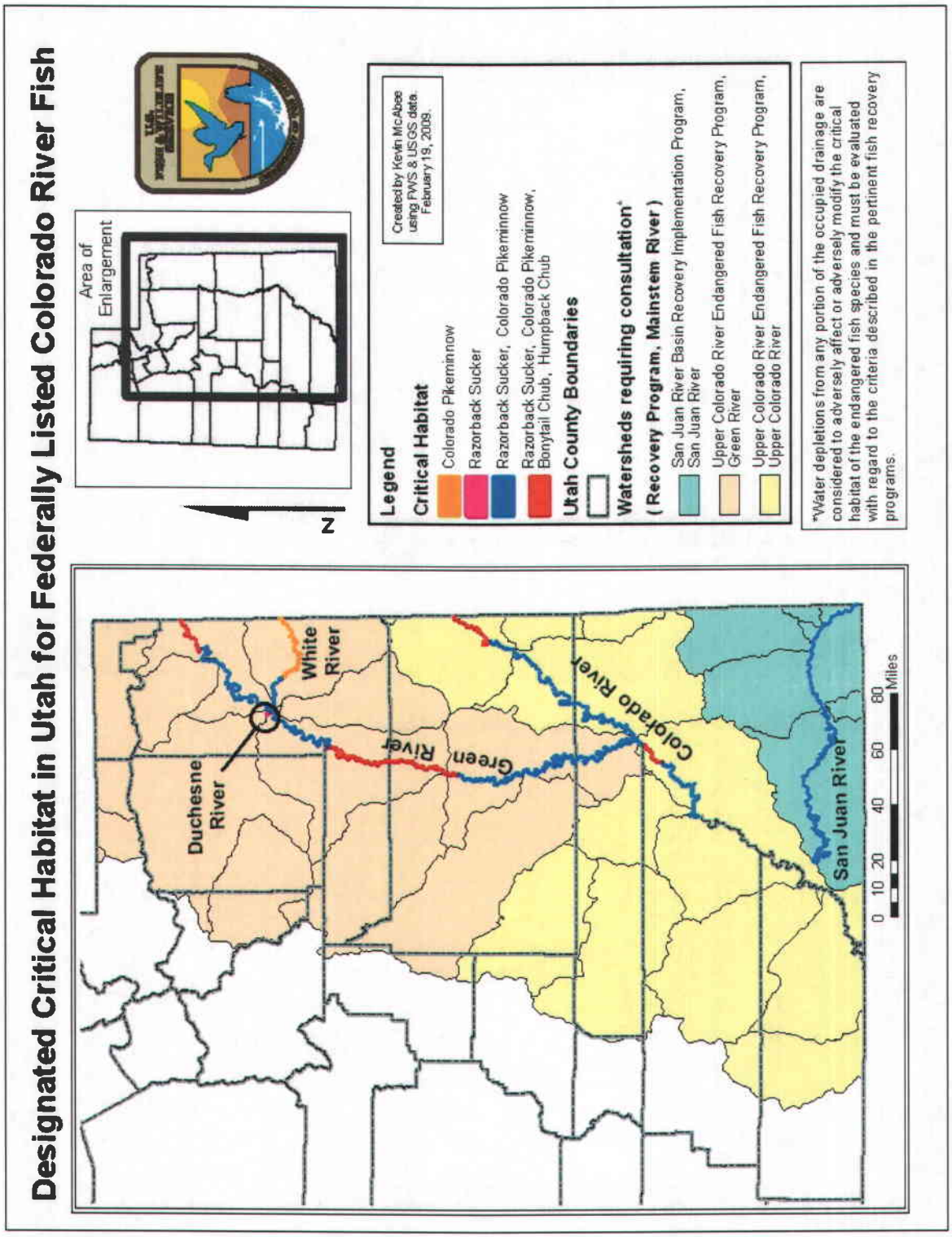
This completes the Service's communication of standards and procedures required to satisfy the 1996 BO for Colorado River Fishes. We appreciate UDOGM's commitment in the conservation

of endangered species. If you require further assistance or have any questions, please contact Kevin McAbee, at (801) 975-3330 extension 143.

Sincerely,

Larry Crist
Utah Field Supervisor

Appendix A


Designated Critical Habitat in Utah for Federally Listed Colorado River Fish
Area of Enlargement
N
Legend
Critical Habitat
Colorado Pikeminnow
Razorback Sucker
Razorback Sucker, Colorado Pikeminnow
Razorback Sucker, Colorado Pikeminnow, Bonytail Chub, Humpback Chub
Utah County Boundaries
Watersheds requiring consultation*
(Recovery Program, Mainstem River)
San Juan River Basin Recovery Implementation Program, San Juan River
Upper Colorado River Endangered Fish Recovery Program, Green River
Upper Colorado River Endangered Fish Recovery Program, Upper Colorado River
Created by Kevin McAbee using FWS & USGS data. February 19, 2009.
*Water depletions from any portion of the occupied drainage are considered to adversely affect or adversely modify the critical habitat of the endangered fish species and must be evaluated with regard to the criteria described in the pertinent fish recovery programs.
White River
Duchesne River
Green River
Colorado River
San Juan River
0 10 20 40 60 80
Miles

Water Depletion For Coal Mining Operations

Utah Division of Oil Gas and Mining

07/28/09

Introduction

The following set of instructions/calculations is designed to provide standard methods to calculate water consumption due to coal mining activities. These calculations may be used to determine if the consumption of water from coal mining is contributing or will contribute to water depletion that may affect endangered fish in the Upper Colorado River. **The Division, in consultation with the U. S. Fish and Wildlife Service (USFWS), recommends that water depletion be calculated based on water rights. Should a mine choose to use the following calculations to determine water depletion, it should only be in the event that a mine is not discharging water or is discharging water unsuitable to the endangered Colorado River fish[1].** Water Depletion can be defined as any water that would have been available to the endangered fish in the Upper Colorado River that is not available as a result of mining activities. The following was created for compliance with the Colorado Endangered Fish Recovery Program.

Overview

These analyses are designed to simplify and standardize the methods for calculating water consumption. For that purpose, all consumption uses have been categorized into four main areas (listed below). It is understood that the water depletion estimates will vary for each mine site, but in general, water usage should be determined factoring in the following uses:

1 – Surface Dust Suppression

Includes: Haul road dust suppression.
Access road dust suppression.
Stockpile dust suppression.
Surface conveyor system sprays
Other dust suppression activities

2 – Surface Facility Demands

Includes: Bathhouse/office/mechanic shop consumption.
Domestic/potable water uses.
Preparation plants/processing/etc. consumption (if applicable)
Other civil water usage activities

3 – Surface Water Evaporation

Includes: Sediment pond evaporation.

4 – Underground Suppression and Production Demands

[1] The USFWS Salt Lake City field office will provide a guidance letter on what is considered water suitable for the endangered Colorado River fish.

Includes: Mining dust suppression.
Underground conveyor dust suppression
Bolting flushing

Surface Dust Suppression

Commonly, water that is used for surface dust suppression is attained through water rights, water pumped from streams/rivers, and alluvial aquifers (including deep level aquifers) that are connected to surface waters. If such is the case, the water used for surface dust suppression should be considered water depletion. Though details of the activities, which involve surface dust suppression may vary, the following calculations provide a simple and standard method to calculation the depletion.

A. Haul road/access road dust suppression calculations (SDS_1):

Calculating (SDS_1):

g_t = gallons / truckload
L_d = truckloads / day
d_y = days used / year

$SDS_1 = g_t * L_d * d_y$

Example:
g_t = 4000 gallons / truckload
L_d = 3 truckloads / day
d_y = 50 days used / year

$SDS_1 = g_t * L_d * d_y$
$SDS_1 = 4000 * 3 * 50$

SDS_1 = 600,000 gal/yr = 1.842 acre feet/yr

B. Stockpile dust suppression and surface conveyor system sprays (SDS_2):

Calculating (SDS_2):

g_{ss} = capacity for stockpile sprinkler (in gallons / hour)
g_{cs} = capacity for conveyor sprays (in gallons / hour)
t = hours used / day
d_y = days used / year

$SDS_2 = (g_{ss} + g_{cs}) * t * d_y$

Example:
g_{ss} = 200 gallons / hour
g_{cs} = 150 gallons / hour
t = 12 hours/day
d_y = 185 days used / year

$SDS_2 = (g_{ss} + g_{cs}) * t * d_y$
$SDS_2 = (200 + 150) * 12 * 185$

SDS_2 = 777,000 gal/yr = 2.385 acre feet/yr

C. Total water consumption from Surface Dust Suppression (SDS_T):

$$SDS_T = SDS_1 + SDS_2$$

Example:
$SDS_T = SDS_1 + SDS_2$
SDS_T = 600,000 gal/yr. + 777,000 gal/yr.

SDS_T = 1,377,000 gal/yr = 4.227 acre feet/yr

Surface Facility Demands

Commonly, water that is used for surface facility demands is also attained through water rights, water pumped from streams/rivers, and aquifers should be considered a water depletion. The following calculations provide a simple and standard method to calculation the depletion.

A. Bathhouse/office/mechanic shops/domestic & potable water consumption (SFD_1):

Calculating (SFD_1):

g_{pd} = gallons / day / person
p = number of persons using facility
d_y = days used / year

$$SFD_1 = g_{pd} * p * d_y$$

Example:
g_{pd} = 40 gallons / day / person
p = 350 persons
d_y = 360 days used / year

$SFD_1 = g_{pd} * p * d_y$
$SFD_1 = 40 * 350 * 300$

SFD_1 = 5,040,000 gal/yr = 15.472 acre feet/yr

B. Preparation plants/processing/etc. (SFD_2):

Calculating (SFD_2):

g_{sn} = capacity for spray nozzles (in gallons / hour)
t = hours used / day
d_y = days used / year

$$SFD_2 = g_{sn} * t * d_y$$

Example:
g_{sn} = 500 gallons / hour
t = 12 hours/day
d_y = 185 days used / year

$SFD_2 = g_{ss} * t * d_y$
$SFD_2 = 500 * 12 * 185$

SFD_2 = 1,110,000 gal/yr = 3.407 acre feet/yr

C. Total water consumption from Surface Facility Demands (SFD_T):

$SFD_T = SFD_1 + SFD_2$

Example:
$SFD_T = SFD_1 + SFD_2$
$SFD_T = 5{,}040{,}000$ gal/yr. + 1,110,000 gal/yr.

SFD_T = 6,150,000 gal/yr = 18.880 acre feet/yr

Surface Water Evaporation

Sediment ponds are used to accumulate precipitation runoff that flows over distributed areas. Once the sediment is accumulated and dropped out, the water discharges into a river or stream. Water that evaporates from sediment ponds should be considered water depletion.

The rate of evaporation of water depends on many factors. Scientific calculations for evaporation rates in large bodies of water require detailed psychrometric data, altitudes, wet and dry bulb temperatures, relative an specific humidity, enthalpy values, vapor pressures, partial ambient air pressures, specific volume, air specific weight, latent heat, air velocity, radiation heat gains, and thermal variance.

For a sediment pond, the amount of water that might be depleted is significantly less in relation to large water bodies that have extended holding periods; therefore, simplified methods for evaporation calculation can be utilized.

A. Sediment pond evaporation (SWE_T):

The simplified method of calculating evaporation of sediment pond water depends mainly on the differential between the vapor pressure of the water and the vapor pressure of the surrounding air, the surface area, and the speed of the air flowing over the water.

The amount of water evaporated from a body of water in contact with circulating air can be calculated with the following set of equations:

Calculating (SWE_T):

v = average velocity of air above the water surface (m/s)
k = (25 + 19 v) = evaporation coefficient (kg/m^2h)
A = water surface area (m^2)
xs = humidity ratio in saturated air at the same temperature as the water surface (kg/kg)
x = humidity ratio in the air (kg/kg)
$E = k * A * (xs - x)$
Solve for $E = (25+19v) * A * (xs - x)$ (amount of evaporated water (kg/h))

$SWE_T = 229.5 * E$ (amount of evaporated water (gal/yr))

Example:
v = 3.57(m/s)
k = (25 + 19 v) = 92.83 (kg/m^2h)
A = 20 (m^2)
xs = .3 (kg/kg)
x = .2 (kg/kg)

Solve for E: = k A (xs – x) = (kg/h)
E: = k A (xs – x) = (kg/h)
*E: = 92.3 * 20 * (.3 – .2)* = *185.66* (kg/h)

$SWE_T = 229.5 * E$ (amount of evaporated water (gal/yr))
$SWE_T = 229.5 * 185.66$

SWE_T = 42,608.97* gal/yr = *0.130 acre feet/yr

Underground Suppression and Production Demands

If water is present in an underground coal mine, it can be classified in one of the following categories:

Category 1) Water that has been attained through water rights and has been pumped into the mine from sources such as streams, rivers, or alluvial aquifers that are connected to surface waters.

Category 2) Water that entered the mine from an underground aquifer, or water from ancient water pockets or deep level aquifers.

All Category 1 water is assumed to be used for dust suppression on long-walls, continuous miners, conveyors, roadways, bolting purposes, etc. and is considered water depletion. **Any water that is evacuated from the mine by ventilation evaporation can be neglected due to the fact that all of the depletion would be accounted for in calculating the water used by the underground equipment.**

Category 2 water pumped from the mine may be used as mitigation for water depletion or a depletion offset.

The amount of water used by underground equipment can be calculated with the following set of equations:

A. Longwall Water Use (UGU_1):

Calculating (UGU_1):

g_{lw} = capacity for 1 longwall spray (in gallons / hour)
n_{lw} = number of longwall sprays
t = hours used / day
d_y = days used / year

$UGU_1 = g_{lw} * n_{lw} * t * d_y$

Example:
g_{lw} = 95 gallons / hour / spray
n_{lw} = 90 sprays
t = 20 hours / day
d_y = 275 days used / year

$UGU_1 = g_{lw} * n_{lw} * t * d_y$
$UGU_1 = 95 * 90 * 20 * 275$

UGU_1 = 47,025,000 gal/yr = 144.366 acre feet/yr

B. Continuous Miner (CM) Use (UGU_2):

Calculating (UGU_2):

g_{lw} = capacity for 1 CM spray (in gallons / hour)
n_{lw} = number of CM sprays
t = hours used / day
d_y = days used / year

$UGU_2 = g_{cm} * n_{cm} * t * d_y$

Example:
g_{cm} = 20 gallons / hour / spray
n_{cm} = 25 sprays
t = 20 hours / day
d_y = 300 days used / year

$UGU_2 = g_{cm} * n_{cm} * t * d_y$
$UGU_2 = 20 * 25 * 20 * 300$

UGU_2 = 3,000,000 gal/yr = 9.21 acre feet/yr

C. UG Conveyor Dust Suppression Use (UGU_3):

Calculating (UGU_3):

g_{ds} = capacity for 1 spray (in gallons / hour)
n_{gs} = number of sprays
t = hours used / day
d_y = days used / year

$UGU_3 = g_{ds} * n_{ds} * t * d_y$

Example:
g_{ds} = 20 gallons / hour / spray
n_{ds} = 150 sprays
t = 12 hours / day
d_y = 360 days used / year

$UGU_3 = g_{lw} * n_{lw} * t * d_y$
$UGU_3 = 20 * 150 * 12 * 360$

UGU_3 = 12,960,000 gal/yr = 39.787 acre feet/yr

D. Bolting Flushing Use (UGU_4):

Calculating (UGU_4):

g_{bf} = capacit (in gallons / hour)
t = hours used / day
d_y = days used / year

$UGU_4 = g_{bf} * t * d_y$

Example:
g_{bf} = 50 gallons / hour
t = 16 hours / day
d_y = 300 days used / year

$UGU_4 = g_{bf} * t * d_y$
$UGU_4 = 50 * 16 * 300$

UGU_4 = 240,000 gal/yr = 0.736 acre feet/yr

E. Total water consumption from Underground Usage (UGU_T):

$UGU_T = UGU_1 + UGU_2 + UGU_3 + UGU_4$

Example:
$UGU_T = UGU_1 + UGU_2 + UGU_3 + UGU_4$
UGU_T = 47,025,000gal/yr. + 3,000,000 gal/yr. + 12,960,000 gal/yr. + 240,000 gal/yr.

UGU_T = 63,225,000 gal/yr = 194.100 acre feet/yr

Summary Calculations

For each of the depletion categories defined in the Overview section of this analysis, depletions were calculated and totaled and the depletion offset water subtracted as follows:

Surface Dust Suppression = SDS_T = 1,377,000 gal/yr = 4.227 acre feet/yr
Surface Facility Demands = SFD_T = 6,150,000 gal/yr = 18.880 acre feet/yr
Surface Water Evaporation = SWE_T = 42,608.97 gal/yr = 0.130 acre feet/yr
UG Suppression and Production = UGU_T = 63,225,000 gal/yr = 194.100 acre feet/yr
Subtract any depletion offset water (must be based on actual discharge) = 0 acre feet/yr

Total Water Depletion = 217.337 acre feet/yr

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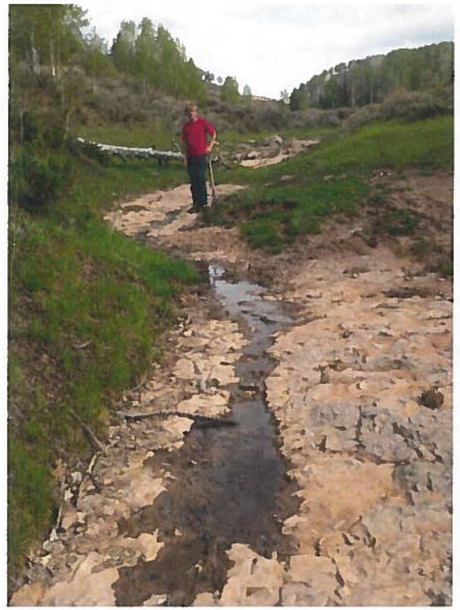
Baseline Hydrologic Monitoring And Determination of Probable Hydrologic Consequences of Coal Mining in the Kenilworth Addition Area; Recommended Monitoring Plan at the Andalex Resources, Inc. Tower Mine, Carbon County, Utah



4 December 2014

Andalex Resources, Inc.
Price, Utah

PETERSEN HYDROLOGIC, LLC
CONSULTANTS IN HYDROGEOLOGY

Baseline Hydrologic Monitoring And Determination of Probable Hydrologic Consequences of Coal Mining in the Kenilworth Addition Area; Recommended Monitoring Plan at the Andalex Resources, Inc. Tower Mine, Carbon County, Utah

4 December 2014

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Price, Utah

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1.0 Introduction

The Andalex Resources, Inc. Tower Mine is located in the Book Cliffs coal field, approximately 10 miles east of Price, Utah (Figure 1). Andalex Resources has acquired the coal mining rights on new mining lands within the Kenilworth Addition area (Figure 2), which are contiguous with the existing mine permit area. The Tower Mine (Centennial Project) is unique in that it is among the deepest coal mining operations in the United States, with past mining taking place at depths of up to 3,000 feet below the overlying ground surface.

As required by Utah coal mining rule R645-301.724, each permit application shall include baseline hydrologic information for groundwaters and surface-waters from the proposed permit and adjacent area. Additionally, Utah coal mining rule R645-301-728 specifies that the applicant for a mining permit is required to prepare a determination of the probable hydrologic consequences (PHC) of coal mining prior to the approval of a mine permit application. The PHC determination is based on the baseline hydrologic, geologic, and climatic information and from other pertinent sources information.

This document presents the baseline hydrologic information for the Kenilworth Addition and adjacent area, including seasonal quantity and quality of groundwaters and surface-waters. This document also presents a determination of the probable hydrologic consequences of coal mining in the Kenilworth Addition area. Prior to the performance of the PHC determination presented

here, a site reconnaissance and supplemental hydrologic baseline data collection program was performed during the second quarter of 2014. The PHC determination presented herein is based on an analysis of the available geologic, hydrologic, and hydrogeologic information from the Kenilworth Addition and adjacent area. The information provided in this document is supplemental to the large amount of related information previously submitted to the Division of Oil, Gas and Mining by Andalex Resources, Inc.

Including this introduction, this document contains the following sections

1.0 Introduction
2.0 Methods of Study
3.0 Overview of Mining Operations
4.0 Physiography and Geology
5.0 Presentation of Data
6.0 Climate
7.0 Description of Groundwater and Surface-Water Systems
8.0 Probable Hydrologic Consequences Determination
9.0 Recommended Monitoring Plan
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2.0 Methods of Study

Baseline hydrologic monitoring of groundwaters and surface-waters in the Kenilworth Addition and adjacent areas has been performed in the area for many years by several different entities. Among these entities are the Castle Gate Mine, the RAG Willow Creek Mine, the Andalex Resources, Inc. Tower Mine, Mayo and Associates, LC, and Petersen Hydrologic, LLC. For

this investigation, hydrologic information in the public domain on file with the Utah Division of Oil, Gas and Mining public information center was reviewed and incorporated into this analysis. This included information from previous mining and permitting activities in the surrounding areas, including information from the RAG Willow Creek Mine MRP. Much of this information was obtained from the Utah Division of Oil, Gas and Mining web-site (scanned MRP files available at: http://linux1.ogm.utah.gov/WebStuff/wwwroot/coal/files.html) and also from the Utah Division of Oil, Gas and Mining Utah Coal Mining Water Quality Database (an on-line electronic database of water quality and water quantity data freely available to the public at: http://linux1.ogm.utah.gov/cgibin/appx-ogm.cgi). Other information was obtained directly from Tower Mine personnel. A supplemental site reconnaissance and baseline monitoring program was performed during the second quarter of 2014 in the Kenilworth Addition and adjacent area. The hydrologic information from all sources for the Kenilworth Addition and adjacent area was compiled into an electronic database for analysis.

Hydrologic data were analyzed using graphical and statistical methods. Groundwater mineral saturation indices were calculated using WATEQF (Plummer and others, 1976).

Groundwater samples from the Tower Mine were collected for isotopic analysis. Tritium analyses were performed using electrolytic enrichment and low level counting methods by the Tritium Laboratory, University of Miami, Florida. Radiocarbon analyses used for radiometric dating were performed by Geochron Laboratories of Cambridge, Massachusetts. Solute analyses of groundwater samples collected in conjunction with isotopic sampling were performed by

David Tingey Analytical Consulting of Springville, Utah. Groundwater mean residence times were determined using methods described by Pearson and Hanshaw (1970), Fontes (1980), and Mookes (1980).

3.0 Overview of Mining Operations

The Aberdeen Mine has been in operation since 1990. Coal mining operations at the mine are carried out in the Aberdeen Seam (also known as the Castlegate A Seam) using longwall mining methods. Continuous mining methods are used primarily for development of longwall mining panels. The Tower Mine (Centennial Project) is unique in that it is among the deepest coal mining operations in the United States, with past mining taking place at depths of up to 3,000 feet below the overlying ground surface. Historically, the Tower Mine has experienced difficulties in roof control because of the geologic conditions at the mine. Under such large thicknesses of overburden, the existence of strong, massive sandstone units a few tens of feet above the mined coal seam results in the establishment of rock stresses that are not favorable to longwall-mining operations. Consequently, mining at the Tower Mine is carried out using a barrier–panel longwall design. Using this technique, substantial barriers of undisturbed coal are left between adjacent longwall panels. Because of the support of the unmined coal barriers and the structural strength of the overlying massive sandstone units, subsidence at the land surface is minimal or non-existent. It has been the experience at the Tower Mine that in areas where the overburden exceeds approximately 1,000 feet, no measurable subsidence at the land surface occurs (Tower Mine subsidence data, 2002). Mining in the Kenilworth Addition area will occur

under more than 2,000 feet of cover. Thus, no appreciable subsidence in the Kenilworth Addition area is anticipated.

Historically, the Tower Mine has been relatively dry and has only occasionally discharged water to the surface. As mining has progressed deeper into the mountain, discharges to the surface could possibly become somewhat more frequent. Most groundwater encountered in the mine discharges from sandstone channels in the mine roof. As is typical with other coal mines in the region, these roof drips commonly dry-up rapidly after first being encountered and the total water discharged from individual sandstone channels is not of significant consequence. Seasonal variations in mine-water in-flow rates are not apparent (Personal communication, Mike Glassen, 2002).

4.0 Physiography and Geology

The Kenilworth Addition area is situated in the high plateau region along the upper rim of the Book Cliffs Escarpment. The maximum elevations in the Kenilworth Addition area exceed 8,700 feet along the crest of the Book Cliffs escarpment. The mine surface facilities are located to the south along the base of the escarpment at elevations of about 7,200 feet. The land surface in the Kenilworth Addition area consists of rolling hills and gullies that are vegetated primarily with sagebrush with interspersed stands of quaking aspens. The land surface slopes moderately to the north toward the Emma Park region.

Six Cretaceous- to Tertiary-age bedrock formations crop out in the Kenilworth Addition and adjacent Tower Mine area. These include, in descending order, the Flagstaff Limestone, North Horn Formation, Price River Formation, Castlegate Sandstone, Blackhawk Formation, and the Mancos Shale. These bedrock formations were deposited during transgressions and regressions of the shoreline of the Western Cretaceous Interior Seaway during the Late Cretaceous and Early Tertiary. This ancient shoreline was located along the eastern edge of the tectonically uplifted mountains of the Sevier Orogenic Belt. Sediments eroded from the uplifted mountains were carried toward the seaway by fluvial systems and deposited as terrestrial, shoreline, marine, and interfingered non-marine and marine sedimentary sequences. The surface geology in the Kenilworth Addition area is shown on Plate 21 of the MRP. A geologic map of the Kenilworth Addition area is shown in Figure 3. (Note that in Figure 3 the Flagstaff Limestone and North Horn Formations are mapped as a single unit). The bedrock formations in the Kenilworth Addition and adjacent Tower Mine areas are described below.

Flagstaff Limestone

The Flagstaff Limestone is a freshwater limestone that contains some marls and thin sandstone stringers. Groundwater movement in the Flagstaff Limestone generally occurs in fractures or along bedding planes. Due to the low primary porosity, the groundwater storage potential of the Flagstaff Limestone is small. Consequently, springs in the Flagstaff Limestone commonly discharge only briefly in response to the annual snowmelt event and these springs dry-out rapidly after the winter snowpack diminishes. During dry years, springs in the Flagstaff Limestone may not discharge at any time during the year.

North Horn Formation

The North Horn Formation consists predominantly of shale with lesser amounts of sandstone, limestone, and conglomerate. Sandstone paleochannels exist throughout the formation. The sandstone channels are isolated vertically and horizontally by mudstone deposits and lacustrian clays that are common throughout the formation. The North Horn Formation contains hydrophyllic clays that swell when wetted. Where exposed at the surface, it commonly forms slopes. In the vicinity of the Tower Mine permit area, the North Horn Formation is approximately 600 feet thick. The Flagstaff Limestone and the North Horn Formation are exposed at the surface over most of the Kenilworth Addition area.

Price River Formation

The Price River Formation consists of two or more thick sandstone layers interbedded with subordinate shale and sandy shale. The formation commonly forms a moderately steep ledge and slope hillside above the precipitous cliffs of the underlying Castlegate Sandstone. Within the Kenilworth Addition area, the Price River Formation is exposed at the surface where rocks of the overlying Flagstaff Limestone and North Horn Formation have been removed by erosion along the Mathis Canyon and Dry Canyon drainages (Figure 3).

Castlegate Sandstone

The Castlegate Sandstone consists of predominantly coarse-grained sandstone with occasional siltstone and claystone interbeds. The sandstone was deposited in a fluvial system and the lenticular sandstone channels are varied in size and interpenetrate. Although the primary porosity is high, the existence of mudstone drapes and pervasive carbonate and silica cement

greatly reduces the ability of the formation to transmit water. The Castlegate Sandstone forms a prominent cliff above the underlying Blackhawk Formation where it is exposed at the surface. Within the Kenilworth Addition area the Castlegate does not crop out at the surface.

Blackhawk Formation

The Blackhawk Formation consists of interbedded sandstone, mudstone, claystone, and coal. In the vicinity of the Tower Mine, the massive Aberdeen Sandstone is present at the base of the formation. The Aberdeen Seam (Castlegate A Seam), in which mine workings at the Tower Mine are present, is present immediately above this sandstone. The massive Kenilworth Sandstone is present approximately 75 feet above the Aberdeen Seam. Sandstone Paleochannels (sinusoidal fluvial sandstones interpenetrating with the surrounding fine-grained rocks) are present in the Blackhawk Formation. The Blackhawk Formation is approximately 1,000 feet thick in the vicinity of the Tower Mine.

Mancos Shale

The Mancos Shale is over 4,000 feet thick and underlies vast portions of the Colorado Plateau. The low-permeability marine shale unit is carbonaceous, gypsiferous, and slightly calcareous. Because of the low permeability of the shale rocks, the migration of appreciable amounts of groundwater through the formation generally does not occur in the region. Thus, the formation usually acts as a barrier to groundwater flow. Because of the pervasive presence of soluble minerals in the marine shale unit, groundwaters that do come into contact with the Mancos Shale or Mancos Shale-derived sediments generally acquire elevated concentrations of dissolved salts (high TDS).

Structure

Rock strata in the Tower Mine and Kenilworth Addition area dip to the northeast at approximately 6°. Consequently, the overburden overlying the mineable coal seams in the region generally increases as the distance from the Book Cliffs escarpment increases in the northeast direction. No appreciable faulting has been identified within the Tower Mine permit area.

5.0 Presentation of Data

Baseline hydrologic monitoring sites in the Kenilworth Addition and adjacent area are shown on Figure 2. Baseline monitoring site details are presented in Table 1. Springs and seeps identified in the Kenilworth Addition and adjacent area are shown on Figure 2. Surface water drainage divides are also shown on Figure 2. Information on the identified seeps and springs, including locations, geologic occurrence, and use are also presented in Table 1. Baseline hydrologic information for groundwaters and surface-waters in the Kenilworth Addition and adjacent area, including information on seasonal water quantity and quality, are presented in Table 2. Climatic information for the region, as reflected by the Palmer Hydrologic Drought Index, is presented as a plot of the PHDI for Utah Region 6 in Figure 4. Supplemental isotopic information for groundwaters and surface-waters, including stable deuterium, oxygen-18, and carbon-13 ratios, and tritium and carbon-14 age dating information, is provided in Table 3

(including public information obtained from the Willow Creek Mine MRP). Radiocarbon mean residence times ("ages") of groundwaters in the Tower Mine are also presented in Table 3.

Laboratory reporting sheets for the groundwater and surface-water samples collected during the 2nd quarter 2014 baseline monitoring activities are provided in the Appendix.

6.0 Climate

Average precipitation at the Tower Mine portal area averages approximately 11 inches. Precipitation in the highest portions of the permit area, including the Kenilworth Addition area, may be up to approximately 15 inches per year. Average monthly temperatures at the mine range from about 20 °F in January to 70 °F in July and August (Andalex Resources, 1995).

Climatic conditions in the vicinity of the Tower Mine have varied significantly during the past several decades. This is illustrated in a plot of the Palmer Hydrologic Drought Index (PHDI) for Utah Region 6 (Figure 4). The PHDI is a monthly value generated by the National Climatic Data Center that indicates wet and dry spells. The PHDI is calculated from several hydrologic parameters including precipitation, temperature, evapotranspiration, soil water recharge, soil water loss, and runoff. Consequently, it is a useful tool for evaluating the relationship between climate and groundwater and surface water discharge data. It is apparent from Figure 4 that during the period from 1980 to 2014, the region has experienced alternating periods of wetness and drought. Notable periods of extreme wetness occurred during 1983-1984, 1997-1998, 2004-

2005, and 2011. Notable periods of drought occurred during 1988-1993, 2000-2004, and 2012 to the present. Alternating periods of wetness and drought of shorter durations have also been observed. It is interesting to note that periods of near-normal wetness (PHDI values of -1 to 1) have been relatively infrequent.

7.0 Description of Surface-Water and Groundwater Systems

Surface-water drainage patterns in the Kenilworth Addition and adjacent area are shown in Figure 2. Surface waters in the Kenilworth Addition area drain into the Willow Creek drainage through the Dry Creek, Mathis Creek, Antone Creek, Deep Creek, and Summit Creek sub-drainages. Surface waters to the south of the Kenilworth Addition area drain southward down the precipitous slopes of the Book Cliffs escarpment through a series of sub-drainages which ultimately flow into the Price River. Discharge rates in the mountain streams peak during the springtime runoff event and wane during the summer months as the melt of the winter snowpack is completed (Table 2). It is common for high flows to occur in mountain streams regionally in response to periodic torrential precipitation events that produce large amounts of surface runoff during the summertime monsoon season.

Groundwater naturally discharges from the Flagstaff Limestone/ North Horn Formation, and from the Price River Formation in the Kenilworth Addition area. Seeps and springs in the Kenilworth Addition area show rapid responses to both season and climate, suggesting short flowpaths and shallow circulation depths. It is not uncommon for many springs to cease flowing

during the late summer or fall season, particularly during drought conditions (Table 2). The groundwater systems that support the seeps and springs in the Kenilworth Addition and adjacent area exist primarily in shallow alluvial and colluvial deposits and likely in the shallow bedrock underlying these deposits. The shallow nature of these groundwater systems is largely because the abundant shale and mudstone horizons in the North Horn and Price River Formations effectively prohibit the downward migration of appreciable quantities of groundwater into underlying deeper horizons. The fact that seeps in the Kenilworth Addition area commonly cease flowing during the summer and fall months indicates that the groundwater travel time from recharge area to discharge area in these groundwater systems is likely less than one year. This also suggests that groundwater recharge locations are situated near the groundwater recharge areas (i.e., there is no regional type aquifer supporting these seeps and springs). Because shallow alluvial and colluvial groundwater systems are constrained by local surface topography, recharge and discharge areas for these systems generally must occur within the local surface-water sub-drainage in which the seep or spring is located.

Tritium and radiocarbon analysis (Table 3) was performed on three springs from the Kenilworth Addition and adjacent area (B341 and B262 from the North Horn/Flagstaff, B41 from the Price River Formation). The tritium contents from these groundwaters ranged from 8.17 to 19.6 TU, clearly indicating a substantial modern recharge component for these groundwaters. The carbon-14 compositions of these waters ranged from 55.85 to 101.2 pmC, indicating a modern radiocarbon age for these waters.

Both groundwaters and surface waters in the Kenilworth Addition area are of the calcium-bicarbonate or calcium-magnesium-bicarbonate type, with average TDS concentrations of 325 and 335 mg/l, respectively (Table 2). This solute composition is consistent with the dissolution of carbonate minerals in the presence of soil-zone CO_2 gas. Elevated concentrations of chloride, sulfate, and sodium, which commonly occur in groundwaters that circulate deeply through rocks of marine origin in the western United States, are not observed in the groundwaters or surface waters data for the Kenilworth Addition area (Table 2). This suggests that groundwater circulation depths in the systems that support these springs are not deep.

In contrast to the shallow groundwater systems that support springs and seeps and provide baseflow to streams in the region, the Blackhawk Formation groundwater systems encountered in the Tower Mine workings do not have good hydraulic communication with shallow, active recharge sources. This is evidenced by the lack of seasonal discharge variability and the short durations of in-mine groundwater inflows. Groundwaters sampled in the Tower Mine have mean residence times from 13,000 to 15,000 years (Table 3). Tritium contents, which indicate whether groundwater has received recharge in the past approximately 50 years, are near the lower laboratory detection limits using low-level detection methods (Table 3). The lack of hydraulic communication between the inactive groundwater systems encountered in the mine and shallow, near-surface recharge sources is primarily the result of heterogeneity of the rock sequence in the mine area. Although lenticular rock bodies that have the potential to transmit water exist in the Blackhawk and overlying formations (i.e. aquifer-quality sandstones), these lenticular rock bodies are of limited extent and are encased both vertically and horizontally in low-permeability fine-grained rocks. Thus, the potential for groundwater migration through these rocks, both

vertically and horizontally, is limited. Groundwater in the mine environment commonly occurs in vertically and horizontally isolated, perched groundwater systems.

8.0 Probable Hydrologic Consequences Determination

728.100, 728.200 Quality and quantity of surface water and groundwater under seasonal flow conditions and baseline hydrologic information

Water quality and discharge data for seeps, springs, and streams in the Kenilworth Addition and adjacent areas are presented in Table 2. Both groundwater discharges and surface-water flows respond rapidly to climate and season. Both groundwaters discharging from springs and surface waters flowing in streams in the Kenilworth Addition and adjacent area are of the calcium-bicarbonate or calcium-magnesium-bicarbonate type (Table 2).

The average TDS concentration of groundwaters discharging from springs and seeps in the area is 325 mg/L (Table 2). The average TDS concentrations for all springs and seeps in the area ranged from 160 to 394 mg/L. TDS concentrations at surface water monitoring stations are similar, ranging from 309 mg/L to 398 mg/L, averaging 335 mg/L.

The average specific conductance value for springs in the Kenilworth Addition and adjacent area is 585 uS/cm, ranging from a low of 499 uS/cm to a high of 689 uS/cm. The average specific conductance for surface water monitoring stations is very similar to that for springs at 572

uS/cm. The average specific conductance for surface water monitoring stations ranges from a low of 540 uS/cm to a high of 679 uS/cm.

Average pH values for springs in the Kenilworth Addition area are near neutral to slightly alkaline, ranging from 7.48 to 8.12 and averaging 7.84. For surface waters, the average pH is more alkaline than is the groundwater, ranging from 8.17 to 8.46, averaging 8.34.

Total suspended solids concentrations in surface waters at the Kenilworth Addition area show considerable variability (Table 2). Commonly, the greatest suspended solids concentrations occur during periods of high flow when stream velocities are greatest and erosion from high surface flows is occurring, with lower concentrations during the low-flow season (Table 2).

Average discharge temperatures at spring monitoring stations ranged from 5.6 to 13.9 degrees C, averaging 9.0 degrees C. The considerable variability in these measurements is likely due to the low-flows commonly present at many spring and seep monitoring sites. Spring water temperatures are readily influenced by ambient air temperatures, particularly when the flow rates are low (i.e. stagnant conditions). Average discharge temperatures at surface-water monitoring sites ranged from 9.1 to 14.2 degrees C, averaging 11.6 degrees C.

728.310 Whether adverse impacts may occur to the hydrologic balance

The likelihood of adverse impacts occurring to the hydrologic balance as a result of Coal mining and reclamation activities in the Kenilworth Addition area is considered low. As discussed previously, groundwater encountered in the mine workings occurs under isolated, perched

conditions. This groundwater is not in hydraulic communication with the shallow bedrock and alluvial groundwater systems from which groundwater seepage to seeps and springs in the Kenilworth Addition area occurs. Thus, the interception of the ancient, perched groundwater in the mine should not impact the overlying shallow groundwater systems in the Kenilworth Addition or surrounding areas.

In the general sense, subsidence above mining areas at longwall mining operations has the potential to alter pre-mining groundwater flow characteristics. For several reasons, the potential for this impact to affect groundwater and surface-water resources in the Kenilworth Addition area is minimal. The United States Mine Safety and Health Administration (MSHA 2009) describes zones of disturbance of geologic strata over mine workings (Figure 5). These zones include:

- Floor heave – Upward thrust of the floor in the mine working area.
- Caved zone – Caving of the overburden directly over a mine void and bulking of the caved material leading to support of overlying strata generally extending to a height of 3 to 10 times the extraction thickness. Assuming an extraction thickness of 10 feet, the caved zone would extend from 30 to 100 feet above the mining interval.
- Fractured zone – A zone of vertical fracturing and bed separations. Overburden in this zone moves vertically in large blocks along existing joints and new vertical fractures. Typically this zone extends no more than 24 times the extraction thickness above the mine, but can reach 30 times the extraction thickness. Assuming an extraction thickness

of 10 feet, the Fractured zone would be anticipated to extend no more than 240 feet above the mine, possibly reaching 300 feet above the mine level.

- Main roof – This zone, which is sometimes subdivided into the Dilated Zone and the Constrained Zone, is an area of no significant increase in vertical hydraulic conductivity. This zone has been characterized as extending above the Fractured Zone up to 60 times the extraction thickness. Assuming a coal extraction thickness of 10 feet, the Main roof zone would extend for 600 feet above the mine level.

- Surface zone – Surface cracks are typically present in this zone and are generally limited to areas placed in tension by subsidence. Cracks can be created in dry clayey soil and joints can open in massive sandstones. Such cracks can extend downward to a depth of 50 feet.

Similarly, the Society for Mining, Metallurgy, and Exploration (SME, 2011) has developed empirical relationships between the thickness of the extracted coal seam and the upward fracture propagation distances (see SME Chapter 10.6, "Mine Subsidence"). Utilizing these relationships, the Mining Engineers Handbook recommends that a minimum vertical distance between the mine and an overlying water body with the potential for causing *catastrophic damage* should be a minimum of 60 times the coal mining height. The same minimum vertical separation distance is recommended for protection of aquifers overlying total extraction mining areas.

Overburden thicknesses in mining areas at the Kenilworth Addition area are large (<2,000 feet). Because of this large overburden thickness, a thickness of relatively unfractured, low-permeability bedrock that is more than 1,000 feet thick will be present in the interval between the base of a potential near-surface cracking zone and the uppermost extent of the upwardly propagating fractured zone above longwall mining areas. The presence of such a thick zone of unfractured, low-permeability bedrock prevents the downward migration of active-zone groundwaters into the deeper subsurface. Hydrophilic swelling clays are present in the fine-grained lithologies within the overburden. Sealing of subsidence cracks by clays in the Blackhawk is expected to minimize long term effects of subsidence on the hydrologic system (UDOGM, 1996). For these reasons, subsidence-related impacts to shallow groundwater systems that support springs and provide baseflow to streams in the Kenilworth Addition area are not anticipated.

Where tension cracks at the surface do form, they can temporarily divert shallow, active-zone groundwaters and cause minor changes to groundwater discharge locations. Spring discharge locations could be moved a short distance down gradient as a result of groundwater flow path alterations. However, as discussed previously, because of the barrier-pillar longwall design utilized at the Tower Mine, the thickness of the overburden (>2,000 feet), and because of the presence of strong, massive sandstone units overlying the coal seams to be mined, appreciable subsidence of the overlying land surface as a consequence of proposed mining activities in the Kenilworth Addition area is not anticipated. Therefore, the potential for surface cracking to impact shallow groundwater systems is considered very low. For the same reasons, the potential

for surface-cracking to impact surface water channels overlying longwall mined areas is considered low.

728.320 Whether acid-forming or toxic-forming materials are present that could result in the contamination of surface-water or groundwater supplies

It is anticipated that the rocks in the Kenilworth Addition area will have acid- and toxic-forming potential similar to that in the rocks in the immediately adjacent existing Tower Mine permit area. No new topsoil or waste rock piles are planned as a consequence of mining in the Kenilworth Addition area. Historically, no contamination of surface-water or groundwater supplies has occurred at the Tower Mine as a result of the presence of acid-forming or toxic-forming materials. Consequently, no adverse impacts are anticipated as a result of mining in the Kenilworth Addition area.

Although iron-sulfide minerals such as iron pyrite are known to exist in the Book Cliffs and Wasatch Plateau coal fields, these materials typically do not cause contamination of surface-water or groundwater supplies. The oxidation of sulfide minerals, when exposed to water and air, releases H^+ ions (acid), which temporarily decreases the pH of the water. However, acid produced from this reaction is rapidly consumed through reactions with carbonate minerals that are pervasive in the rocks of the Utah coal district. Thus, acid mine discharge does not occur. The dissolved iron in the water is rapidly precipitated as iron-hydroxides as the water encounters oxygen (Hem, 1985). Consequently, while pools of water impounded in sulfide-rich underground mine workings can potentially have elevated iron concentrations and lowered pH

levels in-situ as a result of pyrite oxidation, such geochemical conditions are not stable in the oxygen-rich, carbonate-rich surface environment, and thus contamination of groundwater or surface-water supplies does not occur (i.e. the water is oxygenated and iron is rapidly removed by mineral precipitation reactions and the pH typically becomes neutral to moderately alkaline after interacting with carbonate minerals).

Historically, significant impacts to groundwater and surface-water supplies at the Tower Mine have not been observed. The potential for contamination of surface-water or groundwater supplies as a result of interaction with acid-forming or toxic-forming materials in the Kenilworth Addition area is considered to be low.

728.331 What impact the proposed coal mining and reclamation operation will have on sediment yield from the disturbed areas

No appreciable subsidence of the land surface overlying mining areas is anticipated as a result of the proposed mining and reclamation activities in the Kenilworth Addition area. No new surface disturbances are planned in conjunction with the mining of the Kenilworth Addition area. Thus the potential for sediment yield from disturbed areas is considered negligible.

728.332 What impact the proposed coal mining and reclamation operation will have on acidity, total suspended and dissolved solids and other important water quality parameters of local impact

No new mine discharges or surface facilities are planned as a result of mining in the Kenilworth Addition area. The chemical character of water encountered in the Kenilworth Addition area will likely be similar to that encountered previously in the Tower Mine permit area. No appreciable impacts to acidity TDS, TSS, or other important water quality impacts have been observed during historic mining operations at the Tower Mine. Thus, the potential for increases in these water quality parameters above current levels as a result of mining in the Kenilworth Addition area is considered negligible.

728.333 What impact the proposed coal mining and reclamation operation will have on flooding or streamflow alteration

No new mine discharges or surface facilities are planned as a result of mining in the Kenilworth Addition area. It is anticipated that the nature of future groundwater inflows into the Kenilworth Addition area will be similar to those encountered previously in the Tower Mine permit area. Historically, no flooding or streamflow alteration has occurred as a result of discharge from the Tower Mine. Because no subsidence is anticipated in the Kenilworth Addition area, no subsidence-related changes to stream morphology are anticipated. The potential for flooding or streamflow alteration as a result of mining in the Kenilworth Addition area is considered negligible.

728.334 What impact the proposed coal mining and reclamation operation will have on groundwater and surface-water availability

As discussed previously, the shallow alluvial and colluvial groundwater systems that support seeps in the Kenilworth Addition and adjacent area are hydraulically isolated from the deep, inactive groundwater systems encountered during mining operations. When mining in the underlying coal seam occurs, the shallow systems will be isolated from the mine environment in the Kenilworth Addition area by more than 1,000 of undamaged, low-permeability bedrock. Because of the barrier-pillar design and the geologic conditions in the Kenilworth Addition area, no appreciable subsidence is anticipated. As is common on lands used for livestock grazing, impoundments have been created in the surface drainages in the Kenilworth Addition and adjacent area to capture snowmelt and rainwater for livestock watering. Because no subsidence is anticipated in the Kenilworth Addition area, these stock-watering ponds should not be impacted.

Thus, the potential for adverse impacts to groundwater and surface-water availability as a result of mining and reclamation activities in the Kenilworth Addition area is low. Mining in the Kenilworth Addition area may make available groundwater from perched, inactive groundwater systems that would otherwise have been unavailable.

728.350 Whether the underground coal mining and reclamation activities may result in contamination, diminution or interruption of State-appropriated water

As discussed previously, mining in the Kenilworth Addition area will occur under greater than 2,000 feet of overburden. Shallow bedrock groundwater systems and alluvial and colluvial groundwater systems that support springs and seeps in the Kenilworth Addition area are

hydraulically isolated from the deep groundwater systems that will be encountered during mining operations. No subsidence of the land surface above the Kenilworth Addition area is anticipated. Thus the potential for contamination, diminution or interruption of State-appropriated water is considered low.

However, if in the unlikely event that that contamination, diminution, or interruption of State-appropriated water did occur, Andalex Resources would be required under Utah Coal Mining Rule R731.530 to replace any State-appropriated water supply that is contaminated, diminished, or interrupted by underground coal mining and reclamation activities.

9.0 Recommended Monitoring Plan

The recommended monitoring plan for groundwaters and surface waters at the Kenilworth Addition area is presented in Tables 4, 5, 6, and 7 is summarized below. Recommended water monitoring locations are shown on Figure 6. The purposes of the recommended groundwater and surface-water monitoring plan are to 1) document the effects of seasonal and climatic variability on groundwater and surface-water resources, 2) collect data to document that the shallow, active-zone groundwater systems in the Kenilworth Addition area operate independently of the deep, inactive-zone groundwater systems encountered in the Tower Mine, 3) to provide verification that mining-related impacts to groundwater and surface-water systems do not occur and 4) to determine the magnitude and character of any potential impacts to water quantity or water quality if such were to occur.

Springs

We recommend the monitoring of six springs in the Kenilworth Addition area. The springs recommended for monitoring have been selected to provide hydrologic information distributed over the extent of the proposed permit area and also to provide information from the two geologic formations exposed within the Kenilworth Addition area. These include five springs that discharge from the Flagstaff Limestone/North Horn Formation (B261, B271, B341, B342, and B362), and one spring (B351) that discharges from the Price River Formation.

We recommend that these springs be monitored during the 2nd, 3rd, and 4th quarters when reasonably accessible for discharge rate, field water quality parameters, and laboratory water quality parameters for two years beginning at least 6 months prior to the commencement of underground mining activities in the Kenilworth Addition area. After two years of operational laboratory water quality monitoring has been completed, we recommend that the springs then be monitored for discharge rate and field water quality parameters only. If significant changes to water quality are identified through the field water-quality monitoring that could be attributed to mining activities, operational laboratory water quality monitoring will resume.

Streams

We recommend monitoring at four surface-water monitoring locations in the Kenilworth Addition and adjacent area. The stream monitoring sites recommended for monitoring have been selected to provide hydrologic information for each of the primary surface-water drainages within the Kenilworth Addition area. Surface waters in the Kenilworth Addition area drain northward to the greater Willow Creek surface-water drainage (Figure 6). The proposed stream

monitoring sites include AC-1 (Antone Creek drainage), B211 and B353 (Mathis Creek drainage), and B263 (Deep Canyon drainage). We recommend that these sites be monitored during the 2nd, 3rd, and 4th quarters when reasonably accessible for discharge rate, field water-quality parameters, and laboratory water-quality parameters for two years beginning at least 6 months prior to the commencement of underground mining activities in the Kenilworth Addition area. After two years of operational laboratory water-quality monitoring has been completed, we recommend that the springs be monitored for discharge rate and field water-quality parameters only. If significant changes to water quality are identified through the field water-quality monitoring that could be attributed to mining activities, operational laboratory water quality monitoring will resume.

In the event that groundwater is intercepted by the mine workings in the proposed Kenilworth Addition area in quantities such that discharge of these waters becomes necessary, such waters will be monitored and discharged to the surface in compliance with the stipulations of the Tower Mine UPDES discharge permit.

Use of the Groundwater and Surface-Water Monitoring Plans

The purposes of the proposed monitoring plans for groundwaters and surface waters at the Kenilworth Addition area are to provide verification that mining-related impacts to groundwater and surface-water systems do not occur, and to determine the magnitude and character of potential impacts if they do occur. Comparisons between monitoring data (for the parameter of interest or concern) collected during baseline, pre-mining conditions should be made with monitoring data (for the same parameter of interest or concern) collected during the operational

and/or reclamation phase of mining to determine impacts. When changes to monitored parameters subsequent to mining in an area are observed in the monitoring data, an analysis of all relevant data should be performed to determine the cause(s) of the change in the hydrologic condition. In utilizing the monitoring data to detect or quantify potential mining-related impacts, it is necessary to evaluate all factors relevant to the prevailing hydrologic conditions together with the monitoring data. This is because other factors, which are not related to the mining activity, may cause changes in the prevailing hydrologic conditions. In particular, climatic variability (which may result in increased or decreased groundwater and surface-water flow rates, changes in water levels in wells, and changes in water quality) should be carefully evaluated together with the monitoring data. Other factors that may influence coal mine hydrology include grazing practices, land use, and range condition. A convenient and useful means of evaluating regional climatic data is through the use of the Palmer Hydrologic Drought Index, which is a monthly value that indicates the severity of wet and dry spells that is generated by the National Climatic Data Center and available on-line at http://www1.ncdc.noaa.gov/pub/data/cirs/drd964x.phdi.txt.

The use of Stiff (1951) diagrams is a useful technique that is frequently used to analyze and compare groundwater and surface-water quality characteristics from various sources. Information required to create Stiff diagrams is available from the Division of Oil, Gas and Mining Coal Water Quality Database, which is freely accessible at: http://ogm.utah.gov/coal/edi/wqdb.htm. Additional information on coal mining hydrology and potential mining-related impacts, which can be used to assist in the evaluation of monitoring data

and potential mining-related impacts, is provided on the Utah Division of Oil, Gas and Mining web page at http://ogm.utah.gov/coal/water/default.htm.

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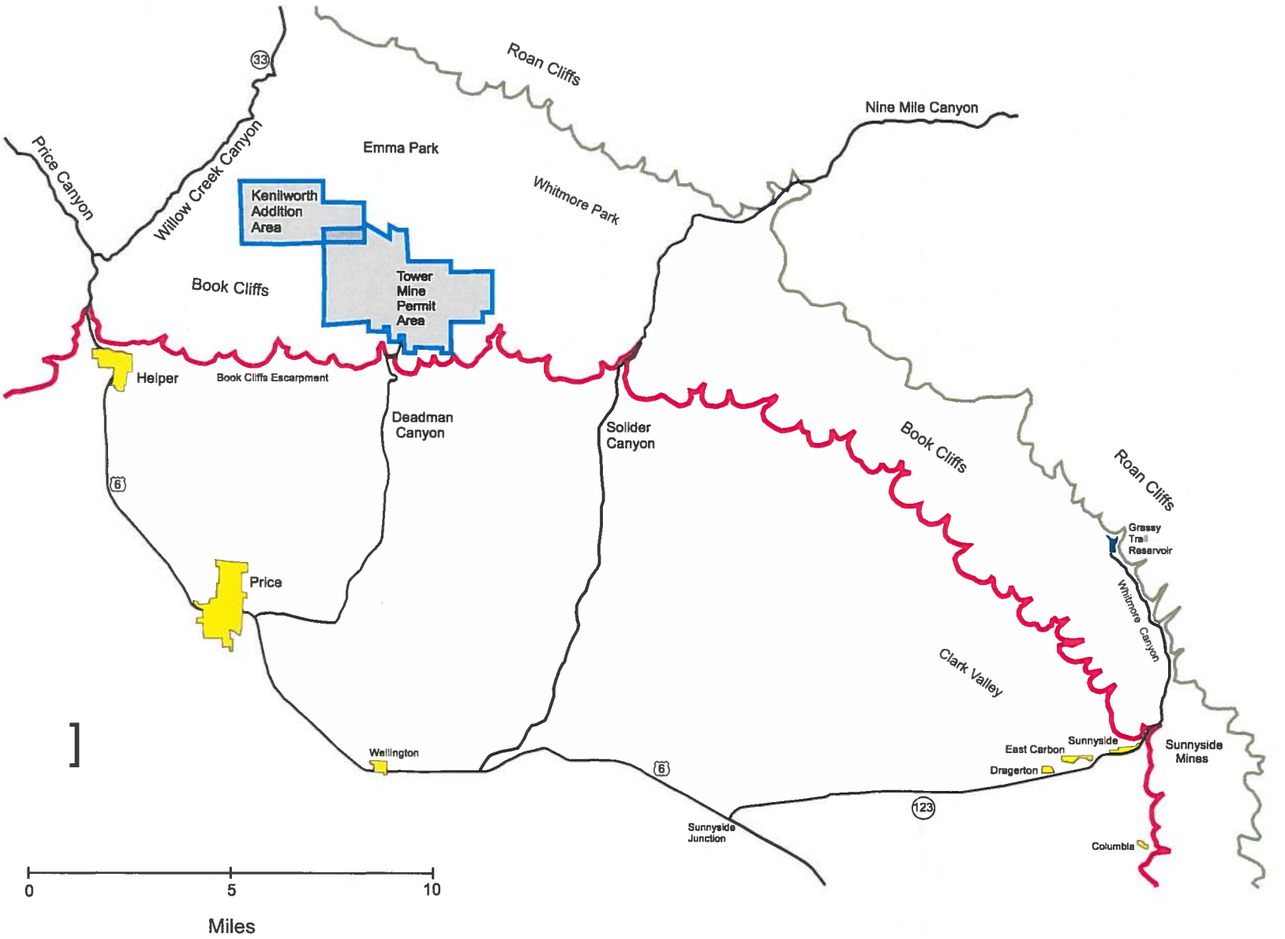
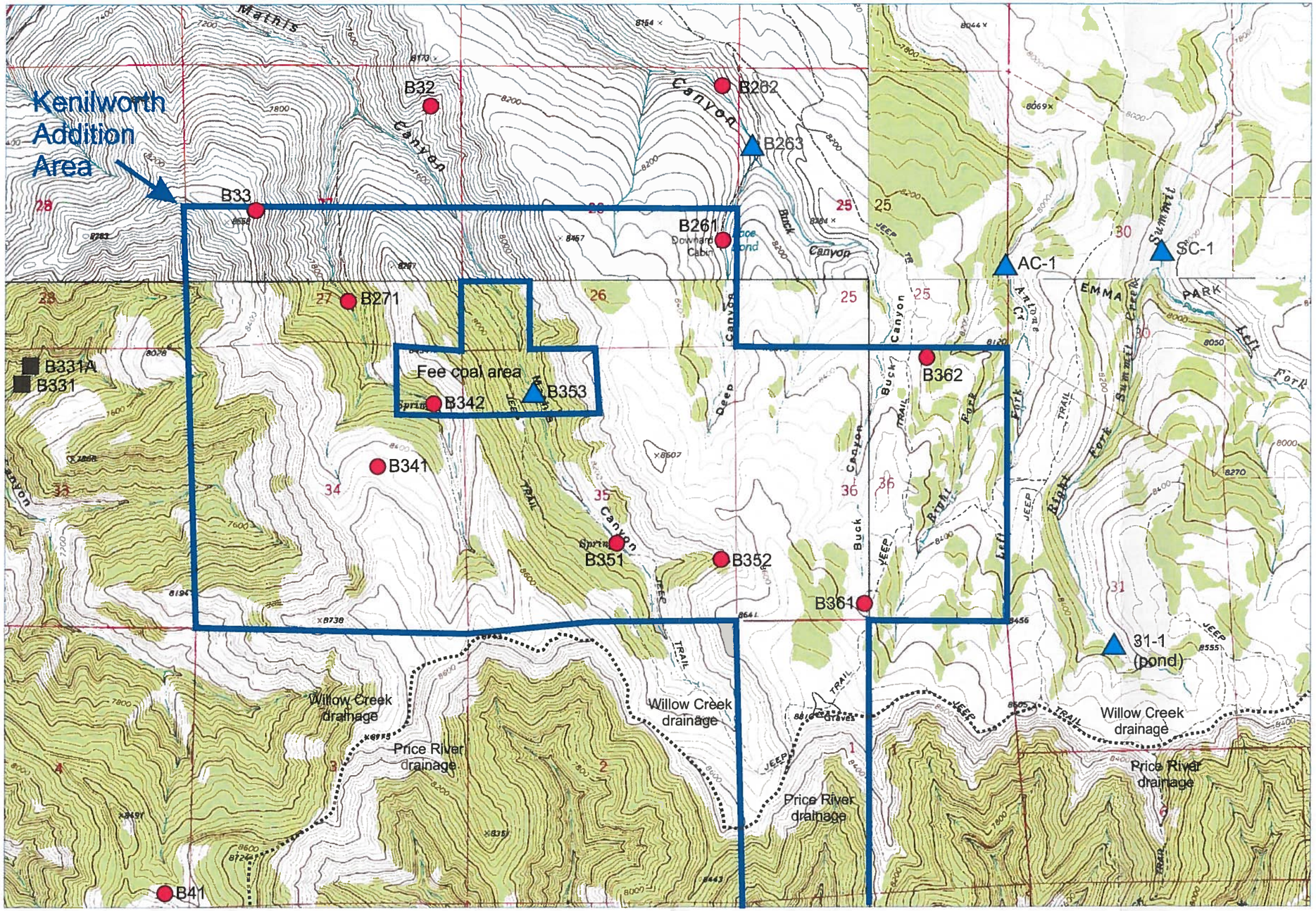


Figure 1 Location map showing the Kenilworth Addition area at the Tower Mine.



Note: B211 is located on Mathis Creek at confluence with Willow Creek 0.37 miles north of map extent.

- Spring monitoring station
- Stream monitoring station
- Well monitoring station

2014 Declination at Sheet Center
TN to MN 0.000° (0° 0' 0") (0 mils)
TN to UTM GN 0.151° (0° 9' 2") (3 mils)

0 ¼ ½ 1 Mile

0 1000 2000 3000 5000 Feet

0 0.5 1 Kilometer

Figure 2 Baseline hydrologic monitoring locations for the Kenilworth Addition area.

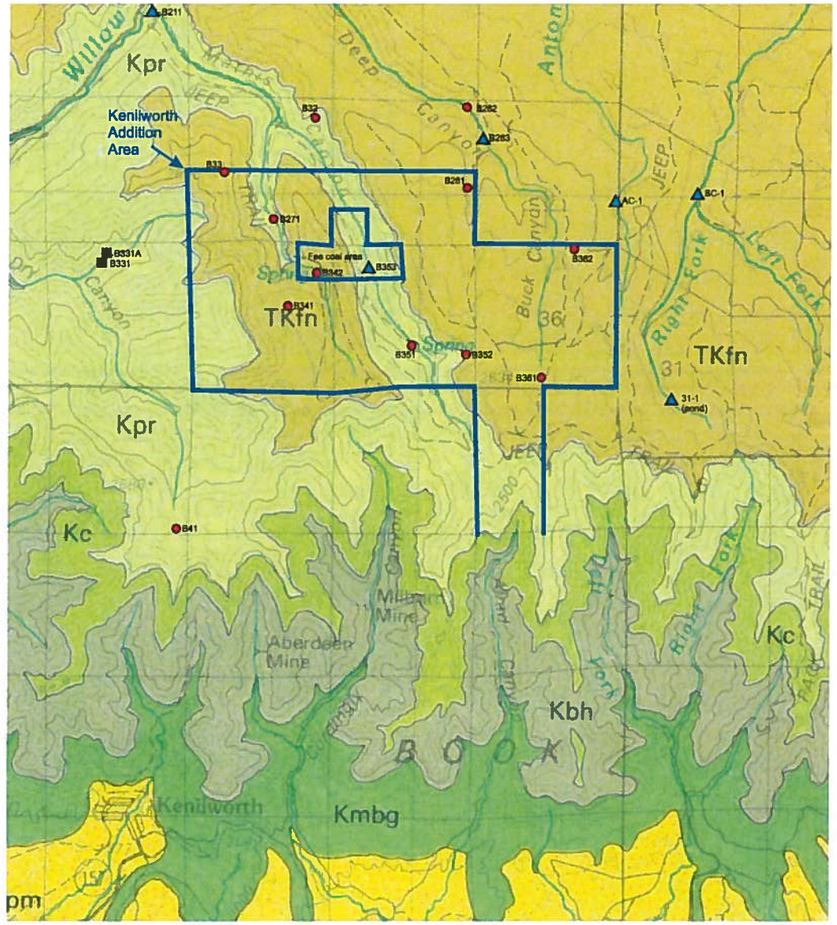
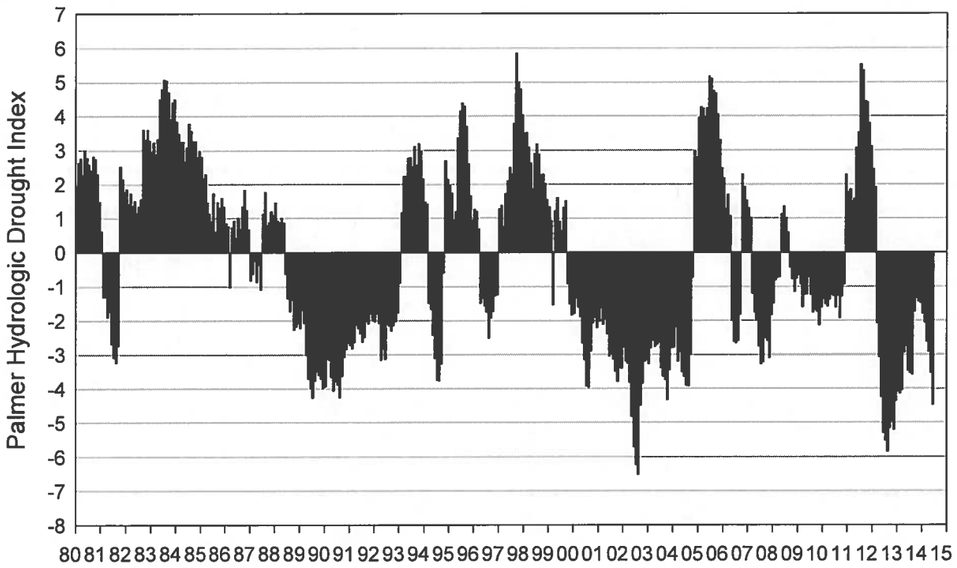
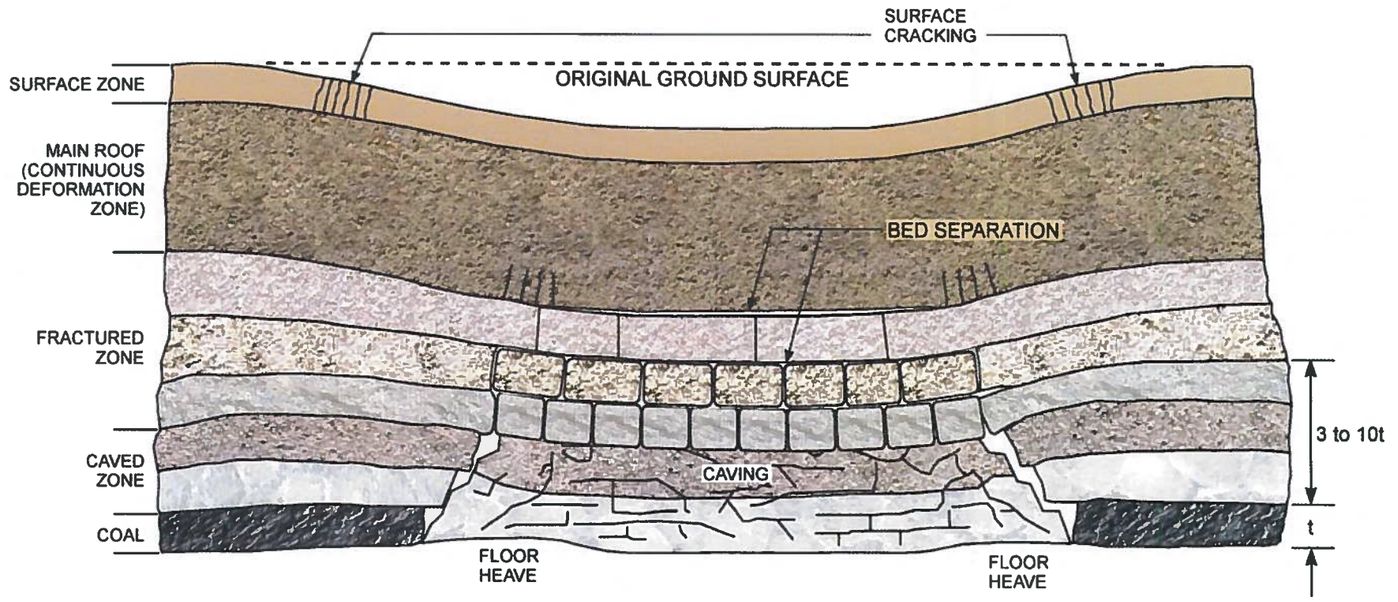


Figure 3 Geologic map of the Kenilworth Addition area.



-1 to -2 Mild Drought	1 to 2 Mild Wet Spell
-2 to -3 Moderate Drought	2 to 3 Moderate Wet Spell
-3 to -4 Severe Drought	3 to 4 Severe Wet Spell
-4 to -5 Extreme Drought	4 to 5 Extreme Wet Spell

Figure 4 Plot of the Palmer Hydrologic Drought Index for Utah Region 6.



(ADAPTED FROM SINGH AND KENDORSKI, 1981;
PENG AND CHIANG, 1984)

Figure 5 Subsidence disturbance zones (from MSHA, 2009).

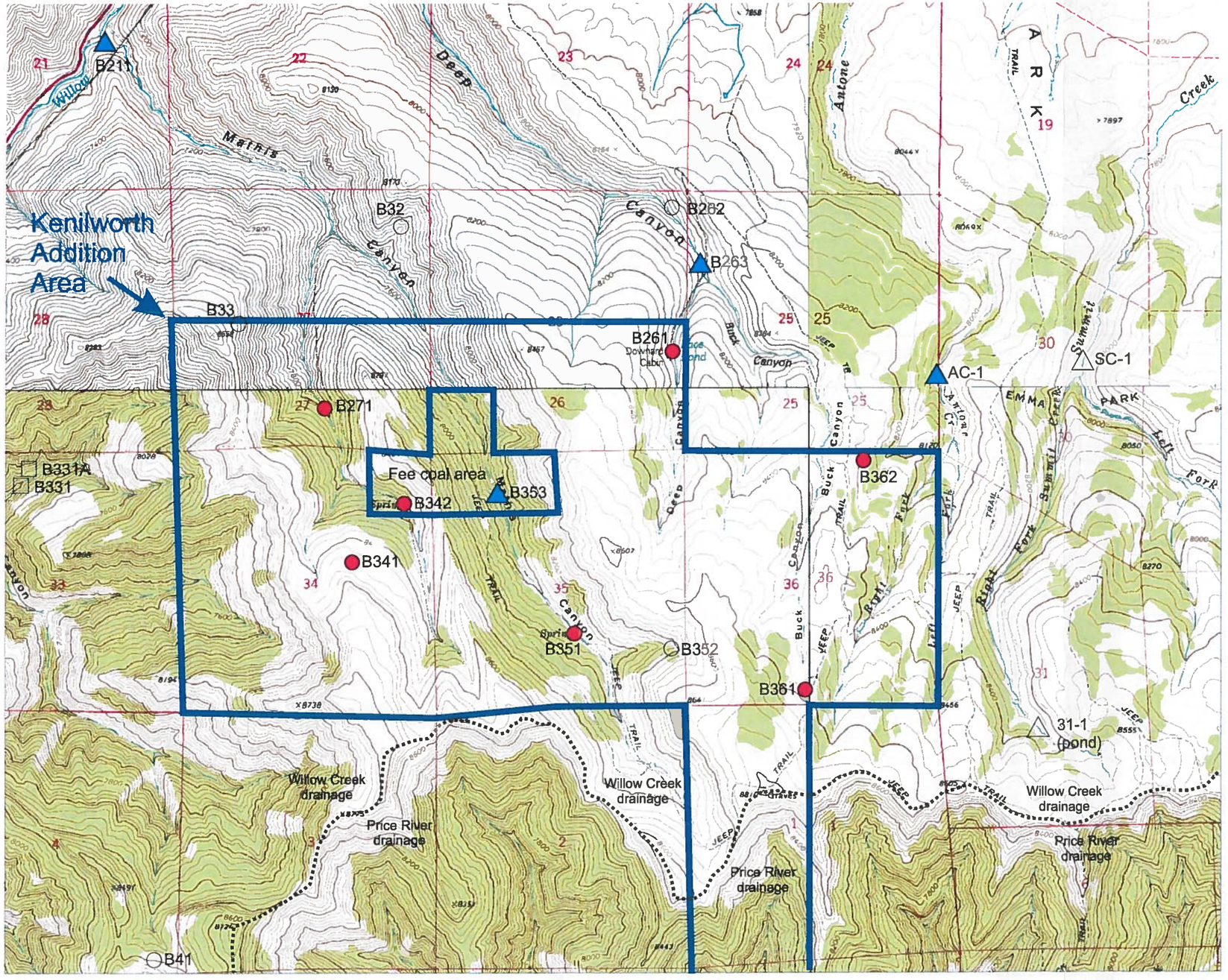


Figure 6 Proposed monitoring locations for the Kenilworth Addition area.

Table 1 Kenilworth Addition Area baseline monitoring site information.

Site	Description/comments	Geology	Drainage	Location	Use
Springs					
Flagstaff Limestone/North Horn Formation					
B261	Developed spring with stock tank	North Horn/Flagstaff	Deep Canyon	SE1/4, Sec. 26, T. 12 S. R. 10 E.	Wildlife, stockwatering
B262	Undeveloped spring	North Horn/Flagstaff	Deep Canyon	NW1/4, Sec. 25, T. 12 S. R. 10 E.	Wildlife, stockwatering
B271	Undeveloped spring	North Horn/Flagstaff	Right Fork, Mathis Canyon	SE1/4, Sec. 27, T. 12 S. R. 10 E.	Wildlife, stockwatering
B341	Developed spring with stock tank	North Horn/Flagstaff	Right Fork, Mathis Canyon	NE1/4, Sec. 34, T. 12 S. R. 10 E.	Wildlife, stockwatering
B342	Developed spring with stock tank	North Horn/Flagstaff	Right Fork, Mathis Canyon	NE1/4, Sec. 34, T. 12 S. R. 10 E.	Wildlife, stockwatering
B352	Undeveloped spring	North Horn/Flagstaff	Left Fork, Mathis Canyon	SE1/4, Sec. 35, T. 12 S. R. 10 E.	Wildlife, stockwatering
B361	Undeveloped seep above pond	North Horn/Flagstaff	Buck Canyon	SW1/4, Sec. 36, T. 12 S. R. 10 E.	Wildlife, stockwatering
B362	Undeveloped seep above pond	North Horn/Flagstaff	Buck Canyon	NE1/4, Sec. 36, T. 12 S. R. 10 E.	Wildlife, stockwatering
Price River Formation					
B41	Developed spring with stock tank	Price River	Right Fork, Dry Canyon	SW1/4, Sec. 4, T. 13 S. R. 10 E.	Wildlife, stockwatering
B351	Undeveloped spring	Price River	Left Fork, Mathis Canyon	SE1/4, Sec. 35, T. 12 S. R. 10 E.	Wildlife, stockwatering
Surface Water					
AC-1	Antone Creek	---	Willow Creek drainage	SE1/4, Sec. 25, T. 12 S. R. 10 E.	Wildlife, stockwatering
SC-1	Summit Creek	---	Willow Creek drainage	NE1/4, Sec. 30, T. 12 S. R. 11 E.	Wildlife, stockwatering
B353	Upper Mathis Canyon Creek	---	Willow Creek drainage	NW1/4, Sec. 35, T. 12 S. R. 10 E.	Wildlife, stockwatering
B211	Lower Mathis Canyon Creek	---	Willow Creek drainage	NE1/4, Sec. 21, T. 12 S. R. 10 E.	Wildlife, stockwatering
B263	Deep Canyon Creek	---	Willow Creek drainage	NW1/4, Sec. 25, T. 12 S. R. 10 E.	Wildlife, stockwatering
Wells					
B331	Well in Dry Canyon	Aberdeen Sandstone	Dry Canyon drainage	NW1/4, Sec. 33, T. 12 S. R. 10 E.	---
B331A	Well in Dry Canyon	Blackhawk Formation	Dry Canyon drainage	NW1/4, Sec. 33, T. 12 S. R. 10 E.	---

Table 2 Discharge and water quality data for the Kenilworth Addition area.

																Trace Inorganic Constituents															Nutrients					Other Properties						
Site	Date	Flow gpm	W.L. feet	T °C	pH S.U.	Cond. µS/cm	TDS mg/L	D.O. mg/l	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^- mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^- mg/L	Al (D) mg/l	As (D) mg/L	Ba (D) mg/l	B (D) mg/L	Cd (D) mg/L	Cu (D) mg/l	Fe (T) mg/L	Fe (D) mg/L	Hg (D) ug/L	Mb (D) mg/L	Mn (T) mg/L	Mn (D) mg/L	Pb (D) mg/L	Se (D) mg/L	Zn (D) mg/l	NO_3+NO_2 mg/L (N)	NO3 mg/L	NO_2 mg/L	NH3 mg/l	PO_4 mg/L	T Alk. mg/L	Hard. mg/L	S Sol. ml/l	TSS mg/L	O&G mg/L	Acid. mg/l
Springs																																								
B41	09/22/92	1.35		9.1	6.22	555	350		67	32	12	2	174	16	91	11	<0.006	<0.001		0.03	<0.005	0.005	0.14	<0.02		<0.05	0.01		<0.02	0.001	<0.01		0.98	<0.01	0.07		190	299				
B41	06/07/94	0.90		3.6	7.17	652	328		61	30	12	2	210	0	84	9	<0.006	<0.001		0.04	<0.005	0.005	0.1	<0.02		<0.01	0.01	<0.01		<0.001			1.07	<0.01	0.07		210	276			<1	
B41	08/31/94	0.45		10.2	8.56	469	338		72	34	12	2	212	0	97	10	<0.006	<0.001		0.02	<0.005	0.005	0.32	<0.02		<0.01	<0.01	<0.01	<0.02	<0.001	0.01		0.77	<0.01	<0.05		212	319			<2	
B41	05/09/95	2.24		0.6	8.18	717	420		77.1	39.2	17.2	1.7	199	<2	130	19	<0.03	<0.001		0.02	<0.003	0.005	0.03	<0.01		<0.01	<0.005	<0.005	<0.02	<0.01	<0.01		1.11	<0.01	0.85			354				
B41	06/22/95	13.46		5.7	7.5	665	340		73.2	35.9	13.1	1.8	235	<2	90	12	<0.03	<0.001		0.02	<0.003	0.005	0.09	0.03		<0.01	<0.005	<0.005	<0.02	<0.01	<0.01		0.91	<0.01	0.08			331			<2	
B41	08/30/95	0																																							
B41	10/23/95	0																																							
B41	05/31/96	0																																							
B41	10/02/96	0																																							
B41	06/05/97	1.35		8	7.34	525	390		74	35.9	13.5	1.6	229	<2	110	14							0.16	0.01			<0.005	<0.005										229	333				
B41	10/30/97	0.00																																							
B41	07/27/98	2.00		8	7.56	520	368		63	31	12	3	286	<5	75	12							1.1	<0.1			<0.1	<0.1										234	285		156		
B41	10/15/98	1.34		2.5	7.22	717	386		61	29	12	2	275	<5	67	10							<0.1	<0.1			<0.1	<0.1										225	272				
B41	05/19/99	1.00		9	7.48	472	356		62	29	12	2	268	<5	80	11							0.4	<0.1			<0.1	<0.1										219	274				
B41	10/13/99	1.50		6	7.67	375	373		65	31	15	2	274	<5	87	11							0.8	<0.1			<0.1	<0.1										225	290				
B41	10/18/00	1.35		4	7.54	518	381		62	31	14	2	265	<5	87	11	<1	<0.01	<1	<0.1	<0.01	<0.1	0.3	<0.1			<0.1	<0.1	<0.1	<0.01	<0.01			<0.03	<0.5	<0.05	217	282			<2	19
B41	05/31/01	1.80		4	7.58	527	344		62	30	12	1	271	<5	83	10							<0.1	<0.1			<0.1	<0.1										222	278				
B41	10/22/01	1.80		10	7.37	412	370		63	31	13	2	267	<5	87	11.1							3.3	<0.1			<0.05	<0.05										219	285				
B41	05/20/02	1.35		7	7.76	595	377		62	30	13	1	259	<5	87	11							<0.1	<0.1			<0.05	<0.05										212	278				
B41	08/26/02	0																																							
B41	10/23/02	0																																							
Average		**1.52**		**6.3**	**7.51**	**551**	**366**		**66**	**32**	**13**	**2**	**245**	**<5**	**90**	**12**																											
B261	06/07/94	0.8		8.8	7.39	630	290		81	26	8	1	300	0	6	3	<0.05	<0.001		0.02	<0.005	<0.01	0.07	<0.02		<0.01	0.22	0.19		<0.001			0.35	<1	0.06		300	309			<1	
B261	08/07/94	0																																							
B261	10/20/94	0																																							
B261	05/30/95	12.118		10	8.1	509	280		80.2	23.3	6.6	1.7	282	<2	20	4	0.03	<0.001		0.02	<0.003	<0.01	0.03	0.03		<0.01	0.006	0.01	<0.02	<0.002	<0.01		0.96	<0.01	<0.05			296			<2	
B261	06/27/95	13.464		10	7.9	456	310		78.6	22.5	7.8	1.6	301	<2	10	4	<0.03	<0.001		0.04	<0.003	<0.01	0.13	<0.01		<0.01	0.054	0.037	<0.02	<0.002	<0.01		0.09	<0.01	0.05			289			<2	
B261	08/17/95	0																																							
B261	10/30/95	0																																							
B-261	05/31/96	1.3464		17	9.35	255	190		43.8	10.7	3.4	16	169	< 2.	< 10.	4			0.11				1.42	0.16			0.229											169					
B-261	06/17/97	3.5904		15	8.22	597	310		90.7	27.2	7	2	332	< 2.	20	4							0.03	< .01			0.009											332					
B-261	10/29/97	0																																							
B-261	05/27/98	60		9	8.29	665	343		75	20	6	2	354	< 5.	12	4							0.1	< .1			< .1											290					
B-261	10/15/98	0																																							
B-261	05/18/99	1.1		15	7.48	573	296		70	23	7	2	350	< 5.	8	4							0.4	< .1			< .1											286					
B-261	10/13/99	0																																							
B-261	12/20/00	0																																							
B-261	05/24/01	0.763		8	8.14	496	325		77	23	6	2	348	< 5.	11	4							< .1	< .1			< .1											285					
B-261	10/22/01	0																																							
B-261	05/20/02	0																																							
B-261	08/26/02	0																																							
B-261	10/23/02	0																																							
B-261	05/24/06	0																																							
B-261	08/08/06	0																																							
B-261	10/03/06	0																																							
B-261	03/19/07	0																																							
B-261	06/05/07	0																																							
B-261	07/18/07	0																																							
B-261	10/11/07	0																																							
B-261	06/12/08	0																																							
B-261	09/03/08	0																																							

Site	Date	Flow gpm	W.L. feet	T °C	pH S.U.	Cond. µS/cm	TDS mg/L	D.O. mg/l	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^- mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^- mg/L	Al (D) mg/l	As (D) mg/L	Ba (D) mg/l	B (D) mg/L	Cd (D) mg/L	Cu (D) mg/l	Fe (T) mg/L	Fe (D) mg/L	Hg (D) ug/L	Mb (D) mg/L	Mn (T) mg/L	Mn (D) mg/L	Pb (D) mg/L	Se (D) mg/L	Zn (D) mg/l	NO_3+NO_2 mg/L (N)	NO3 mg/L	NO_2 mg/L	NH3 mg/l	PO_4 mg/L	T Alk. mg/L	Hard. mg/L	S Sol. ml/l	TSS mg/L	O&G mg/L	Acid. mg/l
B-261	11/03/08	0																																							
B-261	05/29/14	0																																							
Average		**3.01**		**11.6**	**8.11**	**523**	**293**		**74.5**	**22**	**6.48**	**3.5**	**304.5**	**<5**	**12.43**	**3.88**																										
B262	06/07/94	0.8		10.1	7.78	845	418		85	44	25	1	412	0	47	10	0.06	<0.001		0.04	<0.005	<0.01	1.14	0.03		<0.01	0.04	<0.01		<0.001		0.05	0.01	0.07		412	393			<1	
B262	08/07/94	4.0392		10.9	7.02	651	336		80	31	17	1	330	0	19	7	<0.05	<0.001		0.04	<0.005	<0.01	0.07	<0.02		<0.01	<0.01	<0.01	<0.02	<0.001	<0.01	0.09	<0.01	<0.05		330	327			<1	
B262	10/20/94	2.6928		10	7.6	645	320		77	31	16	2	332	0	12	7	<0.05	<0.001		0.03	<0.005	<0.01	<0.02	0.01		<0.01	<0.01	<0.01	<0.02	0.002	<0.01	0.16	<0.01	<0.05		332	320			15	
B262	06/27/95	31.416		7.5	7.3	576	340		69.2	33.5	23.5	1.2	347	<2	30	9	<0.03	<0.001		0.04	<0.003	<0.01	0.02	<0.01		<0.01	<0.005	<0.005	<0.02	<0.002	<0.01	0.06	<0.01	0.13			311			<2	
B262	08/17/95	8.0784		9.5	6.77	710	350		80.2	33	13.3	1	352	<2	30	4	<0.03	<0.01		0.03	<0.003	<0.01	0.51	<0.01		<0.01	0.007	0.017	<0.02	0.002	0.02	0.02	<0.01	<0.006			336			<2	
B262	10/30/95	4.0392		9	7.5	625	310		78.8	30.9	13	0.9	305	<2	35	5	<0.03	<0.001		0.02	<0.003	<0.01	0.16	<0.01		<0.01	0.012	0.009		<0.002	<0.01	0.03	<0.01	<0.05			324			5	
B262	05/31/96	8.53		8	7.8	491	360		79.7	34.2	18.5	1.3	350	<2	20	10			0.342				1.21	<0.01				<0.005								350	340				
B262	10/01/96	2.24		9	6.45	789	350		85.7	32.8	15.8	1.3	341	<2	20	9							<0.01	<0.01			<0.005	<0.005								341	349				
B262	06/17/97	17.95		9	8.48	746	360		82.6	36.6	19.4	1.3	342	<2	20	10							0.01	<0.01			<0.005	<0.005								342	357				
B262	10/29/97	4.04		7	8.03	832																																			
B262	07/27/98	10.00		8	7.46	754	399		80	36	17	<1	437	<5	20	12							<0.1	<0.1			<0.1	<0.1								358	348				
B262	10/15/98	5.80		9	7.02	702	431		82	35	18	1	443	<5	53	11							<0.1	<0.1			<0.1	<0.1								364	349			<2	
B262	05/18/99	2.00		13	7.65	670	418		75	40	21	1	444	<5	39	13							0.3	<0.1			<0.1	<0.1								364	352				
B262	10/13/99	0.00																																							
B262	10/18/00	0.00																																							
B262	05/24/01	20.20		9	7.77	669	396		70	36	19	<1	427	<5	30	8							<0.1	<0.1			<0.1	<0.1								350	323				
B262	10/22/01	0.00																																							
B262	05/20/02	0.00																																							
B262	08/26/02	0																																							
B262	10/23/02	0																																							
B262	05/29/14	<0.05		11.2	7.62	628	355		77.6	26.6	15.7	2.5	383	<5	17	7	<0.03	<0.01	0.214	0.02	<0.001	<0.01	0.19	<0.03	<0.2	<0.005	0.027	<0.002	<0.01	<0.02	<0.04										
Average		**6.09**		**9.35**	**7.48**	**689**	**367**		**78.8**	**34.3**	**18**	**1.3**	**374.6**	**<5**	**28**	**8.71**																										
B271	06/07/94	0.6		8.8	7.69	706																																			
B271	05/29/95	0.4488		7	8.4	615	340		79.4	28.3	13.2	1.1	308	<2	30	4	<0.03	<0.001		0.02	<0.003	<0.01	0.05	<0.01		<0.01	<0.005	<0.005	<0.02	0.002	<0.01	0.04	<0.01	<0.05			315			24	
B271	06/27/95	255.82		8.5	8.27	505	330		46.6	27.3	15.5	1	301	<2	30	5	<0.03	<0.001		0.03	<0.003	<0.01	<0.01	<0.01		<0.01	<0.005	<0.005	<0.02	<0.002	<0.01	<0.02	<0.01	<0.05			304			<2	
B271	08/17/95	0.8976		10	7.31	620	370		80.1	37.4	19.4	1.4	307	<2	22	10	0.05	<0.001		0.03	<0.003	<0.01	0.06	0.06		<0.01	0.019	0.006	<0.02	<0.002	<0.01	0.09	<0.01	<0.05			354			11	
B271	10/30/95	7.6296		3.5	7.94	535	350		85.9	32.7	16.6	1.9	333	<2	17	12	<0.03	0.001		0.03	<0.003	<0.01	0.19	<0.01		<0.01	0.017	0.013	<0.02	<0.001	<0.01	0.06	<0.01	<0.05				<0.4	<5	<2	
B271	05/31/96	3.14		10	8.7	391	330		77.3	30.4	12.1	1	306	<2	30	4			0.107				0.03	<0.01				0.006								306	318				
B271	10/01/96	0.90		7	7.08	741	360		85.5	34.7	16.3	1.3	333	<2	30	5							0.09	<0.01			<0.005	<0.005								333	356				
B271	06/17/97	162.02		9	8.49	566	330		81.9	31	14.3	1	332	<2	40	5							0.02	0.01			<0.005	<0.005								332	332				
B271	10/29/97	3.14		4	8.28	780	300		76	29	13	1	310	<10	29	5.7							0.14	0.02			0.03	0.014								310	310				
B271	05/27/98	448.80		4.5	8.7	734	385		79	25	12	<1	381	<5	33	7							0.3	<0.1			<0.1	<0.1								313	300				
B271	10/15/98	4.00		2.5	8.53	639	380		72	29	12	<1	368	<5	25	5							<0.1	<0.1			<0.1	<0.1								302	299				
B271	05/18/99	6.00		4.5	7.63	575	324		70	29	11	1	355	<5	31	5							<0.1	<0.1			<0.1	<0.1								291	294				
B271	10/13/99	0.90		5	7.77	385	327		74	31	14	<1	386	<5	27	5							1.7	<0.1			<0.1	<0.1								316	312				
B271	10/18/00	1.80		2	7.98	534	358		73	29	13	<1	366	<5	56	6	<1	<0.01	<1	<0.1	<0.01	<0.1	<0.1	<0.1			<0.1	<0.1	<0.1	<0.01	<0.01		<0.03	<0.5	<0.05	300	302			<2	27
B271	05/31/01	44.88		7	8.38	540	329		71	28	13	<1	342	<5	36	5							0.2	<0.1			<0.1	<0.1								280	293				
B271	10/22/01	4.04		7	8.24	430	359		73	31	13	<1	391	<5	31.6	6.2							3	<0.1			0.08	<0.05								320	310				
B271	05/20/02	0.50		12	7.65	512	376		69	31	13	<1	368	<5	29	6							1	<0.1			0.05	<0.05								302	300				
B271	08/26/02	0																																							
B271	10/23/02	0																																							
B271	06/23/14	0																																							
Average		**47.3**		**6.6**	**8.06**	**577**	**347**		**75**	**30**	**14**	**1**	**343**	**<5**	**31**	**6**																										
B341	06/07/94	0.8976		4.7	7.54	848	398		68	28	54	<1	334	12	66	4	<0.05	<0.001		0.05	<0.005	<0.01	0.02	<0.02		<0.01	<0.01	<0.01		0.005		0.23	<0.01	<0.05		346	285			<1	
B341	08/07/94	0.4488		8.2	7.81	810	422		75	30	63	<1	322		74	5	<0.05	<0.001		0.05	<0.005	<0.01	<0.02	<0.02		<0.01	<0.01	<0.01	<0.02	0.003	<0.01	0.13	<0.01	<0.05		322	311			<1	
B341	10/20/94	0.4488		3	8	748	406		69	28	60	<1	368		64	4	<0.05	<0.001		0.04	<0.005	<0.01	<0.02	<0.02		<0.01	<0.01	<0.01	<0.02	0.005	<0.01	0.18	<0.01	<0.05		368	287			23	
B341	05/29/95	2.244		7	7.5	650	350		90.1	28.1	12.9	0.7	303	<2	30	4	<0.03	<0.001		0.02	<0.003	<0.01	<0.01	<0.01		<0.01	<0.005	<0.005	<0.02	0.003	<0.01	0.12	<0.01	<0.05			341		30	14	
B341	06/27/95	49.368		4	7.26	650	390		102	28.8	14.4	0.7	352	<2	70	5	<0.03	<0.001		0.03	<0.003	<0.01	<0.01	<0.01		<0.01	<0.005	<0.005	<0.02	0.002	<0.01	0.07	<0.01	<0.05			373			<2	
B341	08/17/95	4.0392		9	7.42	740	370		86.4	32.6	26.8	0.8	337	<2	40	5	0.05	<0.001		0.03	<0.003	<0.01	0.74	0.09		<0.01	0.02	<0.005	<0.02	0.004	<0.01	0.09	<0.01	<0.05			350			9	
B341	10/30/95	0.8976		5	7.5	680	300		64.1	30.2	15.5	1.4	290	<2	30	10	0.06	0.001		0.03	<0.003	<0.01	0.63	0.08		<0.01	0.052	0.037	<0.02	<0.005	<0.01	0.03	<0.01	<0.05				<0.1	30	<2	
B341	05/31/96	0.04		6	8.01	517	410		73.3	29.3	52.8	0.9	353	<2	50	5			0.075				0.04	<0.01				<0.005								353	304				
B341	06/17/97	336.60		6.5	8.2	623	390		107	31.2	12.9	0.6	391	<2	40	6							0.01	<0.01			<0.005	<0.005								391	396				

Site	Date	Flow gpm	W.L. feet	T °C	pH S.U.	Cond. µS/cm	TDS mg/L	D.O. mg/l	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^- mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^- mg/L	Al (D) mg/l	As (D) mg/L	Ba (D) mg/l	B (D) mg/L	Cd (D) mg/L	Cu (D) mg/l	Fe (T) mg/L	Fe (D) mg/L	Hg (D) ug/L	Mb (D) mg/L	Mn (T) mg/L	Mn (D) mg/L	Pb (D) mg/L	Se (D) mg/L	Zn (D) mg/l	NO_3+NO_2 mg/L (N)	NO3 mg/L	NO_2 mg/L	NH3 mg/l	PO_4 mg/L	T Alk. mg/L	Hard. mg/L	S Sol. ml/l	TSS mg/L	O&G mg/L	Acid. mg/l
B341	10/29/97	1.80		4.5	8.25	1064	300		77	27	31	0.8	370	<10	46	5.1							0.12	<0.01			<0.005	<0.005									370	300				
B341	07/27/98	6.00		5	7.61	609	464		94	30	17	<1	454	<5	39	6							<0.1	<0.1			<0.1	<0.1									372	358				
B341	10/15/98	1.34		2.5	7.22	717	461		80	30	34	1	432	<5	42	5							<0.1	<0.1			<0.1	<0.1									354	323			<2	
B341	05/18/99	0.00																																								
B341	10/13/99	1.00		7	7.96	418	401		74	30	45	<1	418	<5	58	5							<0.1	<0.1			<0.1	<0.1									342	308				
B341	10/18/00	0.22		1	8.15	560	426		66	29	43	2	480	<5	57	6	<1	<0.01	<1	1	<0.01	<0.1	<0.1	7.7			0.2	<0.1	<0.1	<0.01	0.01			<0.03	<0.5	<0.05	394	284			<2	14
B341	05/24/01	60.14		6	7.57	617	383		77	27	14	<1	386	<5	35	4							<0.1	<0.1			<0.1	<0.1									316	303				
B341	10/22/01	1.80		8	7.62	451	401		75	29	39	<1	414	<5	53.6	5.3							<0.1	<0.1			<0.05	<0.05									340	307				
B341	05/20/02	0.27		8	8.04	680	429		69	29	41	<1	401	<5	56	5							<0.1	<0.1			<0.05	<0.05									329	292				
B341	08/26/02	0																																								
B341	10/23/02	0																																								
B341	06/23/14	0																																								
Average		**22.3**		**5.61**	**7.74**	**670**	**394**		**79.2**	**29.2**	**33.9**	**1**	**376.8**	**<5**	**50.04**	**5.26**																											
B342	06/07/94	2.244		7	7.53	750	352		80	31	14	<1	312	8	35	4	<0.05	<0.001		0.03	<0.005	<0.01	0.11	<0.02		<0.01	<0.01	<0.01		0.003			0.1	<0.01	<0.006		320	327			<1	
B342	08/07/94	0.8976		13.1	8.3	842	360		82	32	16	1	280	20	47	5	<0.05	<0.001		0.04	<0.005	<0.01	0.07	<0.02		<0.01	0.02	<0.01	<0.02	0.002	<0.01		0.08	<0.01	0.05		300	336			<1	
B342	05/29/95	0.4488		5.3	7.7	651	350		87.9	29.8	14.4	0.9	308	<2	30	4	<0.03	<0.001		0.02	<0.003	<0.01	0.39	0.01		<0.01	0.01	<0.005	<0.02	0.004	<0.01		0.07	<0.01	<0.05			342			<2	
B342	08/17/95	103.22		14	7.4	645	340		81.8	33.3	13.5	1.1	307	<2	30	4	<0.03	<0.001		0.03	<0.003	<0.01	0.05	0.05		<0.01	0.017	0.021	<0.02	<0.002	<0.01		0.09	<0.01	<0.05			341			<2	
B342	10/30/95	0.4488		5	7.56	638	300		68.1	33.1	9.6	1	269	<2	38	5	<0.03	<0.001		0.02	<0.003	<0.01	0.2	<0.01		<0.01	0.009	<0.005	<0.02	<0.001	<0.01		0.07	<0.01	<0.05				<1	<5	<2	
B342	05/31/96	4.94		7.5	8.47	441	350		84.5	30.5	13.8	0.8	307	<2	30	4			0.098				0.26	<0.01				0.006									307	337				
B342	06/17/97	8.98		8	8.06	663	360		98	29.6	12.2	0.7	355	<2	40	4							0.16	<0.01			<0.005	<0.005									355	367				
B342	10/29/97	3.14		5	7.82	809	190		70	24	12	0.6	330	<10	20	2.6							0.12	<0.01			0.021	<0.005									330	270				
B342	05/27/98	359.04		4.5	8.1	757	388		79	24	11	<1	385	<5	32	6							0.3	<0.1			<0.1	<0.1									316	296				
B342	10/15/98	0.00																																								
B342	05/18/99	6.00		4.5	7.84	607	355		77	27	12	<1	373	<5	36	4							<0.1	<0.1			<0.1	<0.1									306	303				
B342	10/13/99	2.24		5	7.76	360	354		83	31	16	<1	398	<5	36	5							1	<0.1			<0.1	<0.1									326	335				
B342	10/18/00	1.80		1	8.19	633	385		77	29	14	1	388	<5	36	5	<1	<0.01	<1	0.1	<0.01	<0.1	0.4	<0.1			<0.1	<0.1	<0.1	<0.01	<0.01			<0.03	<0.5	<0.05	318	312			<2	15
B342	05/24/01	49.37		5	7.49	526	367		72	27	13	<1	344	<5	33	4							<0.1	<0.1			<0.1	<0.1									310	291				
B342	10/22/01	4.04		9	8.22	436	381		85	30	14	<1	403	<5	37.1	5.4							0.3	<0.1			<0.05	<0.05									331	336				
B342	05/20/02	0.90		10	8.26	573	373		77	29	14	<1	375	<5	38	5							0.9	<0.1			<0.05	<0.05									307	312				
B342	08/26/02	0																																								
B342	10/23/02	0																																								
B342	06/23/14	0.25		19.4	8.4	704	414		81.1	31.7	17	4.2	396	<5	49	8							1.31	<0.03			0.106	<0.002										333				
Average		**28.8**		**7.71**	**7.94**	**627**	**351**		**80.2**	**29.5**	**13.5**	**1.3**	**346**	**14**	**35**	**4.69**																											
B351	06/07/94	0.4488		9	7.39	643	294		72	27	8	1	284	0	29	3	<0.05	<0.001		0.02	<0.005	<0.01	0.63	<0.02		<0.01	0.03	<0.01		<0.001			0.94	<0.01	0.06		284	291			<0.1	
B351	08/28/94	0																																								
B351	10/20/94	0																																								
B351	05/30/95	197.47		8	8.15	546	280		79.2	25.6	8	1.1	279	<2	10	3	<0.03	<0.001		0.02	<0.003	<0.01	0.08	0.03		<0.01	0.01	<0.005	<0.02	<0.002	<0.01		0.65	<0.01	<0.05			303			<2	
B351	06/27/95	22.44		7.7	7.4	420	280		71.9	20.6	5.8	1.1			30	4	<0.03	<0.001		0.02	<0.003	<0.01	0.69	<0.01		<0.01	0.022	<0.005	<0.02	<0.002	<0.01		0.97	<0.01	0.08			264				
B351	08/17/95	0.4488		12	6.24	626	310		82.7	32.8	90	0.9	307	<2	20	3	<0.03	<0.001		0.02	<0.003	<0.01	0.07	<0.01		<0.01	0.033	0.036	<0.02	<0.002	0.03		0.09	<0.01	<0.05			342			<2	
B351	10/30/95	12.118		6	8.13	580	370		82.6	30.6	38.7	0.8	342	<2	59	5	<0.03	<0.001		0.04	<0.003	<0.01	<0.01	<0.01		<0.01	<0.005	<0.005	<0.02	0.004	0.03		0.16	<0.01	<0.05			332			<2	
B351	05/31/96	3.59		10		393	320		76.1	31.2	9.6	0.7	299	<2	40	3			0.117				0.49	<0.01				0.012									299	318				
B351	05/30/97	0																																								
B351	06/17/97	22.4		7.1	8.12	549	270		80.1	24.8	5.2	0.7	280	<2	20	3							0.07	<0.01			<0.005	<0.005									280	302				
B351	10/29/97	0																																								
B351	05/27/98	65		12	8.28	596	318		71	17	4	<1	333	<5	13	4							0.1	<0.1			<0.1	<0.1									273	247				
B351	10/15/98	0																																								
B351	05/18/99	0																																								
B351	10/13/99	0																																								
B351	03/29/00	0																																								
B351	10/18/00	0																																								
B351	05/24/01	6.28		11	7.84	474	303		73	22	4	<1	330	<5	12	2							0.1	<0.1			<0.1	<0.1									270	273				
B351	10/22/01	0																																								
B351	04/11/02	1.85		3.4	8.05	319																																				
B351	05/20/02	0.00																																								
B351	06/28/02			9	7.4	510	387		82	33	11	< 1.	372	< 5.	66	5		< .01		0.17			< .1	< .1			< .05	< .05		< .01		0.34			< .1		305		< .1	2	< 5.	
B351	09/19/02	0.3		8	7.3	730	418		89	36	14	< 1.	360	< 5.	95	5							< .1	< .1			< .05	< .05				0.23		< .03			295					

Site	Date	Flow gpm	W.L. feet	T °C	pH S.U.	Cond. µS/cm	TDS mg/L	D.O. mg/l	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^- mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^- mg/L	Al (D) mg/l	As (D) mg/L	Ba (D) mg/l	B (D) mg/L	Cd (D) mg/L	Cu (D) mg/l	Fe (T) mg/L	Fe (D) mg/L	Hg (D) ug/L	Mb (D) mg/L	Mn (T) mg/L	Mn (D) mg/L	Pb (D) mg/L	Se (D) mg/L	Zn (D) mg/l	NO_3+NO_2 mg/L (N)	NO3 mg/L	NO_2 mg/L	NH3 mg/l	PO_4 mg/L	T Alk. mg/L	Hard. mg/L	S Sol. ml/l	TSS mg/L	O&G mg/L	Acid. mg/l
B351	11/19/02	0																																							
B351	03/29/03	0																																							
B351	06/05/03	2.5			8.7	490	354		77.7	31.6	10	1.3	339	< 5.	51	5							0.256	< .005			0.018	0.008									278					
B351	08/21/03	1		14	8.1	650	418		84.2	36.2	12.5	1	359	< 5.	77	6							0.31	< .005			0.035	0.025									294					
B351	10/06/03	0.01		13	7	700																																				
B351	06/03/04	3		15	8.46	610	378		77.4	26.7	11.2	1.1	402	< 5.	53.1	15.8							0.044	0.041			0.077	0.035														
B351	09/09/04			10	8.48	650	390		46.1	35	11.6	1.2	168	3.54	66.47	15.8							1.23	0.02			0.081	0.041														
B351	11/04/04	8		0.6	8.45	630	398		82.5	33.2	10.7	1.1	372	< 5.	53	5							1.59	0.49			0.068	0.056									305					
B351	06/29/05	200		9	8.49	560	323		79.2	30.2	7.68	0.6	337	< 5.	25	6		< .01		0.02			0.23	< .03			0.016	< .002				0.72		< .1			276		< .1			< 5.
B351	08/27/05			10	8.68	700	512		82.6	25.2	6.4	0.8	374	< 5.	20.17	< .5							0.45	< .01			0.03	0.04														
B351	11/07/05	6		4	8.6	590	373		75.3	21.7	10.4	1	389	< 5.	18.93	< .5		0.012		0.078			0.148	0.013			0.026	0.028		< .005							319					
B351	05/24/06	150		7.5	8.9	580	309		70.7	29.9	8.48	1	399	< 5.	26.34	< .5							0.37	0.02			0.037	< .005									327					
B351	08/08/06	12.5		20	8.26	585	358		72.2	29.9	9.3	1	350	< 10.	34	6							6.66	< .005			0.294	0.034									290					
B351	10/03/06	5		7.7	9.05	680	392		80.8	33.7	10.1	1.1	377	< 10.	37	4.7							2.623	0.021			0.131	0.025									309					
B351	06/05/07			10.5	8.14	663	351		77	32.9	15.1	1.1	361	< 10.	45	5.3							1.606	0.023			0.075	0.023									296					
B351	07/18/07	3		20	8.45	700	330		62.4	31.8	10.5	1.3	376	< 10.	50	5.4							0.557	0.017			0.061	0.034									308					
B351	10/11/07	0.5		13	8.08	398	304		55.8	27.1	8.98	4	288	< 10.	38	5.1							0.643	0.015			0.092	0.091									236					
B351	06/12/08	10		8.2	9.2	550	366		79	32	9.82	0.8	360	< 10.	36	4							0.163	< .01			0.013	0.012									295					
B351	09/03/08	5		8.8	8.75	600	397		82.5	32.2		1.3	372	< 10.	49	5.1							2.588	< .01			0.12	0.001									305					
B351	05/29/14	0.205		9.3	7.45	725	454		80.3	31.9	12.2	1.2	340	<5	96	5	<0.03	<0.01	0.120	<0.01	<0.001	<0.01	<0.05	<0.03	<0.2	<0.005	<0.002	<0.005	<0.01	<0.02	<0.004		0.66	<0.05	<0.1	<0.05	279	404	<0.1			14
Average		**18.951**		**9.78**	**8.12**	**582**	**356**		**75.9**	**29.3**	**13.5**	**1.1**	**339**	**1.77**	**41.8**	**5.37**																												
B352	06/07/94	0.1		11.9	7.9	800																																				
B352	08/28/94	0																																								
B352	10/20/94	0																																								
B352	05/30/95	23.79		8	7.9	549	280		69.1	26.5	16.8	0.2	277	<2	10	6	<0.03	<0.001		0.03	<0.003	<0.01	0.12	<0.01		<0.01	0.045	<0.005	<0.02	<0.002	<0.01		0.29	<0.01	<0.05			282			<2	
B352	06/27/95	0.90		8.5	7.28	542	340		72.4	30.9	18.9	1.4	306	<2	30	10	<0.03	<0.001		0.05	<0.003	<0.01	0.19	<0.01		<0.01	0.007	<0.005	<0.02	<0.002	<0.01		0.2	<0.01	<0.05			308			<2	
B352	08/17/95	0																																								
B352	10/30/95	0																																								
B352	05/31/96	0																																								
B352	10/01/96	0																																								
B352	05/30/97	0																																								
B352	06/17/97	2.69		10	8.26	537	340		82.9	30.6	21	1.3	310	<2	30	12							0.07	<0.01			0.006	0.009									310	333	<5			
B352	10/29/97	0																																								
B352	05/27/98	24.2		8	7.85	688	305		68	23	14	2	366	<5	19	10							1	<0.1			<0.1	<0.1									300	265				
B352	10/15/98	0																																								
B352	05/18/99	0																																								
B352	10/13/99	0																																								
B352	10/18/00	0																																								
B352	05/24/01	1.80		7	7.46	508	330		62	24	19	<1	363	<5	17	8							<0.1	<0.1			<0.1	<0.1									298	254				
B352	10/22/01	0.13		10	7.35	451	401		78	30	25	1	404	<5	25.6	13.5							0.1	<0.1			<0.05	<0.05									331	318				
B352	04/11/02	0.0987		6.6	7.56	657																																				
B352	05/20/02	0.00																																								
B352	06/28/02	0																																								
B352	09/19/02	0																																								
B352	11/19/02	0																																								
B352	06/05/03	0																																								
B352	08/21/03	0																																								
B352	10/01/03	0																																								
B352	06/03/04	0																																								
B352	09/09/04	0																																								
B352	11/04/04	0																																								
B352	06/29/05	2		9	8.28	570	352		83.7	29	17.7	1	401	< 5.	20	11		< .01		0.04			6.1	< .03			0.232	< .002				0.08		< .1			329		< .1			< 5.
B352	08/27/05	0																																								
B352	11/01/05	0																																								
B352	05/24/06	0		11	8.6	600																																				
B352	08/08/06	0																																								
B352	10/03/06	0																																								

Site	Date	Flow gpm	W.L. feet	T °C	pH S.U.	Cond. µS/cm	TDS mg/L	D.O. mg/l	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^- mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^- mg/L	Al (D) mg/l	As (D) mg/L	Ba (D) mg/l	B (D) mg/L	Cd (D) mg/L	Cu (D) mg/l	Fe (T) mg/L	Fe (D) mg/L	Hg (D) ug/L	Mb (D) mg/L	Mn (T) mg/L	Mn (D) mg/L	Pb (D) mg/L	Se (D) mg/L	Zn (D) mg/l	NO_3+NO_2 mg/L (N)	NO3 mg/L	NO_2 mg/L	NH3 mg/l	PO_4 mg/L	T Alk. mg/L	Hard. mg/L	S Sol. ml/l	TSS mg/L	O&G mg/L	Acid. mg/l
B352	06/05/07	0																																							
B352	07/18/07	0																																							
B352	10/11/07	0																																							
B352	06/12/08	0																																							
B352	09/03/08	0																																							
B352	05/29/14	0																																							
Average		**1.3263**		**9**	**7.84**	**590**	**335**		**73.7**	**27.7**	**18.9**	**1.1**	**347**	**<5**	**21.66**	**10.1**																											
B361	06/07/94	<0.2		17.7	7.59	726																																			
B361	08/07/94	0																																							
B361	10/20/94	0																																							
B361	05/30/95	3.59		10	8.3	311	160		51.7	9.5	2.4	6.9	173	<2	<10	2	<0.03	0.002		0.03	<0.003	<0.01	0.08	<0.01		0.024	0.007		<0.01	<0.002	<0.01		0.05	<0.01	<0.05			168			
B361	06/27/95	0																																							
B361	08/17/95	0																																							
B361	10/30/95	0																																							
B361	10/30/95	0																																							
B361	05/31/96	0																																							
B361	10/01/96	0																																							
B361	06/17/97	0.00																																							
B361	10/29/97	0																																							
B361	07/27/98	0																																							
B361	10/15/98	0																																							
B361	05/18/99	0																																							
B361	10/13/99	0																																							
B361	05/24/01	0																																							
B361	10/22/01	0																																							
B361	04/11/02	0																																							
B361	05/20/02	0.00																																							
B361	08/26/02	0																																							
B361	10/23/02	0																																							
Average		**0.17**		**13.9**	**7.95**	**519**	**160**		**51.7**	**9.50**	**2.40**	**6.90**	**173**	**<2**	**<10**	**2.0**																											
B362	06/07/94	0.5		16.4	7.25	575																																			
B362	10/20/94	0																																							
B362	06/27/95	3.14		6	7.2	479	300		76.1	21.5		1	275	<2	10	5	<0.03	<0.001		0.03	<0.003	<0.01	<0.01	<0.01		<0.1	<0.005	<0.005	<0.02	<0.002	<0.01		0.46	<0.01	<0.05			279		<2	
B362	08/17/95	0																																							
B362	10/30/95	0																																							
B362	05/31/96	0																																							
B362	10/01/96	0																																							
B362	06/17/97	0																																							
B362	10/29/97	0																																							
B362	07/27/98	0																																							
B362	10/15/98	0																																							
B362	05/18/99	0																																							
B362	10/13/99	0																																							
B362	10/18/00	0																																							
B362	05/24/01	1.57		9	8.55	442	269		60	15	7	2	284	<5	9	6							0.5	<0.1			<0.1	<0.1										238	212			
B362	10/22/01	0																																							
B362	05/20/02	0																																							
B362	05/20/02	0.00																																							
B362	08/26/02	0																																							
B362	10/23/02	0																																							
B362	05/24/06	0																																							
B362	09/26/06	0																																							
B362	10/03/06	0																																							
B362	03/19/07	0																																							
B362	06/05/07	0																																							
B362	07/18/07	0																																							

Site	Date	Flow gpm	W.L. feet	T °C	pH S.U.	Cond. µS/cm	TDS mg/L	D.O. mg/l	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^- mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^- mg/L	Al (D) mg/l	As (D) mg/L	Ba (D) mg/l	B (D) mg/L	Cd (D) mg/L	Cu (D) mg/l	Fe (T) mg/L	Fe (D) mg/L	Hg (D) ug/L	Mb (D) mg/L	Mn (T) mg/L	Mn (D) mg/L	Pb (D) mg/L	Se (D) mg/L	Zn (D) mg/l	NO_3+NO_2 mg/L (N)	NO3 mg/L	NO_2 mg/L	NH3 mg/l	PO_4 mg/L	T Alk. mg/L	Hard. mg/L	S Sol. ml/l	TSS mg/L	O&G mg/L	Acid. mg/l
B362	10/11/07	0																																							
B362	06/12/08	0																																							
B362	09/03/08	0																																							
B362	11/03/08	0																																							
B362	05/29/14	0																																							
Average		**0.17**		**10.5**	**7.67**	**498.7**	**285**		**68.1**	**18.3**	**7**	**1.5**	**280**	**<5**	**9.5**	**5.5**																										
Streams																																									
AC-1	06/20/05	75		20	8.46	450	288	7.9	94	32.2	8	1.4	397	< 5.	6.38	< .5							0.05	0.02			0.042	0.036														
AC-1	08/27/05	1.5		16	8	900	537		118	19.4	7.4	1.7	447	< 5.	2.47	15.9							0.98	0.05			0.04	0.18									367					
AC-1	11/07/05	2.5		4	8.85	380	284	8	61.6	15.2	8.06	3.7	263	3.234	9.47	21.5		< .005		< .05			0.301				0.068	0.034		< .005							228					
AC-1	05/24/06	30		18	8.45	490	249	9.2	71.7	19.4	7.41	1.5	374	< 5.	19.35	< .5		0.018		0.09			0.08	0.06			0.04	0.029		0.02				0.88	< .1		307	21		< .5	28	
AC-1	09/26/06	0																																							
AC-1	10/03/06	0																																							
AC-1	06/05/07	5		17.5	8.38	544	218	9	83.9	19	8.57	1.2	354	< 10.	12	10.5		< .02		0.03			0.445	0.014			0.05	0.025		< .02				< .05	0.08		290		< .2	< 5.	< 10.	
AC-1	07/18/07	1		18	7.75	657	322	9	86.2	22.1	9.76	2	386	< 10.	9	6.3		< .01		< .05			0.706	0.022			0.176	0.176		< .01				< .05	< .05		317		< .2	< 5.	< 10.	
AC-1	10/11/07	0																																							
AC-1	06/12/08	100		15	8.7	490	318	9	77.8	18.3	8.74	1	324	< 10.	10	4.2		< .01		< .05			0.129	< .01			0.018	0.005		< .01				< .05	< .05		268		< .2	< 5.	< 10.	
AC-1	09/03/08	3		12	8.68	528	333	9.9	85.8	18.9	8.07	1.5	347	< 10.	12	4.2		< .01		< .05			0.301	< .01			0.036	0.003		< .01				0.05	0.06		292		< .2	< 5.	< 10.	
AC-1	11/03/08	2		7.6	8.7	546	309	9.5	89.6	19.5	7.96	1.2	358	< 10.	11	4.3		< .01		< .05			0.493	0.026			0.059	0.033		< .01				0.07	< .05		294		0.2	< 5.	< 10.	
Average		**18.3**		**14.2**	**8.44**	**554**	**318**	**8.94**	**85.4**	**20.5**	**8.22**	**1.7**	**361**	**<10**	**10.19**	**7.54**																										
SC-1	06/16/04	0																																							
SC-1	09/01/04	0																																							
SC-1	11/19/04	0																																							
SC-1	06/20/05	1570.8		17.5	8.45	460	274	11	85.7	35.4	8.7	1.3	393	< 5.	4.12	<0.5							0.04	< .01			0.033	0.02									341					
SC-1	08/27/05	500		17	8.55	700	578	9.7	93	21.8	9.6	1.5	416	< 5.	14.82	<0.5							0.76	0.01			0.05	0.19														
SC-1	11/07/05	30		5	8.67	530	284	9.2	74.8	20.4	12.7	1.3	378	3.234	11.11	12.6		< .005		< .05			0.422	0.02			0.035	0.069		< .005							322					
SC-1	05/24/06	200		14	7.85	570	236	9.9	69.2	22.7	11.4	0.8	390	< 5.	17.7	<0.5		0.022		0.18			0.06	0.06			0.05	0.008		0.023				2.6	< .1		320	0.1		< .5	27.5	
SC-1	09/19/06	30		11	8.58	599	301	10.6	83.6	25.9	11.2	1.6	377	< 10.	16	5.3		< .02		0.04			0.596	0.018			0.071	0.044		< .02				< .05	0.09		309		< .2	< 5.	< 10.	
SC-1	10/03/06	35		11.5	8.7	570	314	10.2	75.5	25.5	11.3	1.5	340	< 10.	15	4.6		< .02		0.03			1.266	0.226			0.127	0.061		< .02				< .05	0.05		283		< .2	< 5.	< 10.	
SC-1	06/05/07	20		20	8.52	518	265	9.9	72.6	20.1	11.2	1.3	326	6.6	11	3.2		< .02		0.03			0.135	0.024			0.024	0.021		< .02				< .05	0.05		278		< .2	< 5.	< 10.	
SC-1	07/18/07	10		22	8.42	600	264	9.8	63.8	23.7	10.6	1.4	315	< 10.	16	3.7		< .01		< .05			0.457	0.027			0.053	0.014		< .01				< .05	0.05		265		< .2	< 5.	< 10.	
SC-1	10/11/07	5		5.1	7.94	409	328	11	77.3	25.2	10.4	1.5	368	< 10.	18	3.8		< .01		< .05			1.683	0.015			0.133	0.081		< .01				0.06	0.26		302		< .2	< 5.	< 10.	
SC-1	06/12/08	1122		13	8.6	480	290	10	67.5	20.3	9.8	1	307	< 10.	13	2.9		< .01		< .05			0.101	< .01			0.013	0.003		< .01				< .05	< .05		254		< .2	< 5.	< 10.	
SC-1	09/03/08	50		15	8.44	580	356	10.3	83.8	23.4	11.2	2.9	376	< 10.	17	4.4		< .01		< .05			0.602	0.188			0.06	0.019		< .01				0.07	0.05		308		< .2	< 5.	< 10.	
SC-1	11/03/08	60		0.8	8.8	475	330	13.1	75.5	23.4	11.4	1.5	330	< 10.	16	4.6		< .01		< .05			0.279	0.031			0.037	0.034		< .01				< .05	< .05		271		< .2	< 5.	< 10.	
Average		**242**		**13**	**8.46**	**541**	**318**	**10**	**77**	**24**	**11**	**1**	**360**	**<10**	**14**	**3.9**																										
B211	06/08/94			19.3	7.85	704	408	7.25	51	57	26	2	314	16	86	9	<0.5	<0.001		0.05	<0.005	<0.01	0.03	<0.02		<0.01	<0.01	<0.01		0.001				0.02	<0.01	0.06		330	361		2	<1	
B211	07/09/94	2.244		25.1	8.5	705		5.9																																
B211	08/28/94	0																																							
B211	09/23/94	0.8976		16.3	8.62	714	444	7	44	64	36	2	305	20	99	13	<0.05	0.001		0.05	<0.005	<0.01	0.08	<0.02		<0.01	<0.01	<0.01	<0.02	0.001	<0.01			0.06	<0.01	<0.05		325	372	<0.1	2	<1	
B211	10/30/94	3.1416		1.5	8.45	910		6.7																																
B211	03/19/95	20.196		7	8.52	768	450	9	49.5	52.9	28.1	1.2		<2	80	12	<0.03	<0.001		0.03	<0.003	<0.01	0.07	<0.01		<0.01	0.006	<0.005	<0.02	0.007	<0.01			0.01	<0.01	<0.05				<0.1	<5	<2	
B211	05/30/95	1122		8.6	8.63	568	280	9.2	58	39.6	16.9	1.2	272	<2	20	6	<0.03	<0.001		0.03	<0.003	<0.01	0.2	<0.01		<0.01	0.015	<0.005	<0.02	0.002	<0.01			0.05	<0.01	<0.05				<0.1	<5	<2	
B211	06/28/95	1122		14.3	8.6	652	310	8.4	55.7	44.6	42.9	1.7	296	<2	70	8	<0.03	<0.001		0.09	<0.003	<0.01	0.13	<0.01		<0.01	<0.005	0.006	<0.02	0.004	<0.01			0.05	<0.01	<0.05				<0.1	<5	<2	
B211	07/20/95	897.6		17.1	8.47	512		9																																
B211	08/17/95	314.16		11.4	7.64	700	370	9	60.1	53.2	20.2	1.5	302	10	59	7	<0.03	<0.001		0.04	<0.003	<0.01	0.07	0.02		<0.01	0.007	0.007	<0.02	0.003	<0.01			0.1	<0.01	<0.05				<0.1	<5	<2	
B211	09/19/95	212.28		10.2	7.85	675		9																																
B211	10/13/95			7.6	7.55	663		9.4																																
B211	10/22/95	119.83		6.4	8.41	664	420	9.2	63.8	60.9	20.1	1.5	322	17	67	9	<0.004	0.002		0.04	<0.003	<0.01	0.01	<0.01		<0.01	<0.005	<0.005	<0.02	0.007	<0.01			<0.02	<0.01	<0.05				<0.1	<5	3	
B211	11/28/95	25.133		1.5	7.69	772		10.9																																
B211	05/31/96	60.139		6.6	8.55	517	380	11.3	58.6	53	22.3	1.4	334	<2	60	9			0.083				0.08	0.03			<0.005	0.005									334	364	<0.1	<5		
B211	06/28/96	233.38		13	8.54	527	360	10.2	56.1	48.3	20.1	1.7	313	<2	60	9			0.094				2.99	0.21			0.071	0.012									313	339	<0.1	150	<2	
B211	10/16/96	3.1416		6.8	8.64	751	490	8.5	57.5	67	35.8	1.8	368	10	100	14							0.19	0.03			0.011	0.007									379	419		10		

Site	Date	Flow gpm	W.L. feet	T °C	pH S.U.	Cond. µS/cm	TDS mg/L	D.O. mg/l	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^- mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^- mg/L	Al (D) mg/l	As (D) mg/L	Ba (D) mg/L	B (D) mg/L	Cd (D) mg/L	Cu (D) mg/l	Fe (T) mg/L	Fe (D) mg/L	Hg (D) ug/L	Mb (D) mg/L	Mn (T) mg/L	Mn (D) mg/L	Pb (D) mg/L	Se (D) mg/L	Zn (D) mg/l	NO_3+NO_2 mg/L (N)	NO3 mg/L	NO_2 mg/L	NH3 mg/l	PO_4 mg/L	T Alk. mg/L	Hard. mg/L	S Sol. ml/l	TSS mg/L	O&G mg/L	Acid. mg/l
B211	04/30/97	511.63		6.3	9.42	586	300	9.3	53.1	38.2	17.1	1.5	262	17	50	4							0.29	0.01			0.012	0.008									279	290		26	<2	
B211	06/18/97	583.44		17	8.54	535	350	10.6	52.7	44.6	18.1	1.2	296	<2	50	8							0.06	<0.01			<0.005	<0.005									296	315		<5	4	
B211	10/30/97	413.34		5	8.45	720	360	9.1	56	47	20	1.1	330	<10	65	8.2							0.05	<0.01			0.007	<0.005									330	330		7	<5	
B211	05/27/98	1570.8		11.5	8.67	730	372		52	38	16	1	285	43	47	9							0.4	<0.1			<0.1	<0.1									305	286		53	<2	
B211	07/22/98	201.96		13	8.51	601	406	8.1	50	50	21	1	392	<5	61	12							<0.1	<0.1			<0.1	<0.1									321	331		8	<2	
B211	10/16/98	39.943		3	8.24	868	424		52	51	21	2	412	<5	49	9							<0.1	<0.1			<0.1	<0.1									337	430		5	<2	
B211	03/30/99			5	8.24	923	419	5.1	58	52	23	1	383	9	76	11							<0.1	<0.1			<0.1	<0.1									329	359		<5	<2	
B211	05/21/99	67.32		15	8.43	581		7.5																																	
B211	06/18/99	76.296		17	8.38	640	377	7.1	52	48	21	1	375	8	59	8							0.2	<0.1			<0.1	<0.1									320	328		11	<2	
B211	10/14/99	12.00		3	8.25	541	465	7.6	58	63	31	1	433	<5	88	12							<0.1	<0.1			<0.1	<0.1									372	404		<5	<2	
B211	08/22/00	8.98		10	8.28	818	427	9.3	45	58	30	2	397	<5	91	13							<0.1	<0.1			<0.1	<0.1									325	351		5	<2	
B211	09/25/00	20.20		9	8.31	838		8.1																																	
B211	10/18/00	20.20		6	8.35	811	421	8.8	58	54	23	1	450	<5	63	10	<1	<0.01	<1	0.1	<0.01	<0.1	<0.1	<0.1			<0.1	<0.1	<0.1	<0.01	<0.01			<0.03	<0.5	<0.05	369	367		<5	<2	
B211	02/22/01	0.00																																							
B211	03/22/01	12.12		3	8.25	719	395	8.3	55	47	20	1	397	<5	63	8							1.5	<0.1			<0.1	<0.1									331	331		74	<2	
B211	05/25/01	148.10		6	8.56	577	368		52	41	17	<1	378	<5	48	8							0.5	<0.1			<0.1	<0.1									314	299		53	<2	
B211	06/26/01	35.90		10	8.45	534	367	8.1	51	47	20	1	378	5	58	9.6							0.1	<0.1			<0.1	<0.1									319	321		39	<2	
B211	07/20/01	35.90		16	8.35	517		6.8																																	
B211	08/23/01	26.93		13	7.92	666	427	6.7	49	49	22	2	381	<5	60	11.2							<0.1	<0.1			<0.05	<0.05									317	324		<5	2	
B211	09/20/01	8.08		10	8.48	495		6.3																																	
B211	10/18/01	26.93		12	8.36	648	440	6.7	52	57	25	2	436	<5	65.6	11.4							0.2	<0.1			<0.05	<0.05									358	365		8	<2	
B211	11/21/01	14.81		4	8.31	840		8.4																																	
B211	03/21/02	0.00																																							
B211	05/20/02	5.83		22	8.23	660	449	7.7	49	59	29	2	405	<5	87	13							0.1	<0.1			<0.05	<0.05									339	365		20	2	
B211	08/26/02	0																																							
B211	10/23/02	0.8976		9	8.38	820	467	8.2	56	65	33	1	437	5	98	13							< .1	< .1			< .05	< .05									366	408		11	< 2.	
average		**199**		**10**	**8.36**	**679**	**398**	**8**	**54**	**52**	**24**	**1**	**358**	**15**	**67**	**10**																										
B263	07/09/94	2.6928		21.1	8.27	548		5.8																																	
B263	08/07/94	0																																							
B263	09/23/94	0																																							
B263	10/20/94	3.5904		1	8.44	513		6																																	
B263	06/27/95	260.3		15.6	8.3	468	310	6.9	75.9	25.9	14.4	1.8	286	<2	50	9	0.12	0.001		0.04	<0.003	<0.01	0.83	0.09		<0.01	0.047	0.029	<0.02	<0.001	<0.01		0.03	<0.01	0.05			<0.1	38	<2	
B263	07/21/95	116.69		18.3	8.35	470		8.3																																	
B263	08/17/95	26.928		22.5	7.52	592	330	7	77.2	30.5	15.4	2.6	296	10	11	9	0.68	0.001		0.03	0.009	<0.01	3.86	0.53		<0.01	0.122	0.093	<0.02	<0.001	<0.01		0.08	<0.01	<0.05			0.1	140	<2	
B263	09/19/95	20.196		14	7.75	605		8.5																																	
B263	10/13/95	0																																							
B263	10/30/95	0.033		4	8.19	626		10																																	
B263	05/31/96	60.1		11.1	8.47	401	290	8.1	71.9	26.5	12.3	1.8	290	<2	10	7			0.285				1.97	<0.01			0.085	0.006									290	289	<0.1	72		
B263	06/17/97	448.8		12	8.42	469	290	10.2	71.3	27.1	12.7	2.5	314	<2	20	9							0.22	0.01			0.028	0.016									314	290		<5	<2	
B263	10/29/97	143.6		3.5	8.31	916	270		75	27	14	1.6	320	<10	13	9.9							0.13	<0.01			0.18	0.008									320	300		15	<5	
B263	07/27/98	1.0		13	8.03	705	362		74	29	12	1	392	<5	13	10							0.1	<0.1			<0.1	<0.1									321	304				
B263	10/15/98	8.5		8.9	7.95	538	400		78	32	15	2	393	<5	12	10							0.1	<0.1			<0.1	<0.1									322	327		8	<2	
B263	05/18/99	30		14.5	8.23	553	295		63	23	11	2	318	6	12	8							<0.1	<0.1			<0.1	<0.1									271	252		7	<2	
B263	10/13/99	0.3		7	8.37	405	311		67	30	16	3	352	7	13	9							0.3	<0.1			<0.1	<0.1									300	291		25	<2	
B263	10/18/00	2.69		4	8.15	616	367	8.6	74	28	14	2	384	<5	12	9	<1.	<0.01	<1.	0.1	<0.01	<0.1	<0.1	<0.1			<0.1	<0.1	<0.1	<0.01	<0.01	0.08		<0.03	<0.5	<0.05	315	300		<5	<2	11
B263	05/24/01	125		15	8.5	531	310	7.2	71	23	10	1	335	<5	10	6							0.6	<0.1			<0.1	<0.1									275	272		37	<2	
B263	10/22/01	1.80		8	7.91	440	357		80	30	14	2	411	<5	10.6	11							<0.1	<0.1			<0.05	<0.05									337	323		<5	<2	
B263	05/20/02	0																																							
B263	08/26/02	0																																							
B263	10/23/02	0																																							
B263	06/20/05	448.8		20	8.64	470	300	8	83.4	40.3	12.1	2.1	402	< 5.	14.41	< .5							0.1	< .01			0.027	0.015														
B263	08/27/05	3		15	8.69	700	619		82.2	27	10.6	4.5	435	< 5.	4.53	< .5							0.81	< .01			0.1	0.19									357					
B263	11/07/05	6		4	8.93	530	373	8.4	72.8	23.2	17.1	3.3	351	7.752	14.82	15.9		0.007		0.061			0.264	0.013			0.149	0.121		< .005							313					
B263	05/24/06	80		13	8.55	550	243	9.2	79.2	24.8	12.4	1.9	487	< 5.	13.99	< .5		0.018		0.06			0.25	0.24			0.043	0.05		0.019			5		< .1		400		12		< .5	26.1
B263	08/08/06	0																																							
B263	10/03/06	0																																							
B263	03/19/07	20		5.6	7.84	371	269	11.1	45.6	12.4	10.3	3.8	223	< 10.	8.7	5.3		< .02		< .01			3.726	0.134			0.087	< .005		< .02			0.48		0.1		183		0.4		< 5.	< 10.

Site	Date	Flow gpm	W.L. feet	T °C	pH S.U.	Cond. µS/cm	TDS mg/L	D.O. mg/l	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^- mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^- mg/L	Al (D) mg/l	As (D) mg/L	Ba (D) mg/l	B (D) mg/L	Cd (D) mg/L	Cu (D) mg/l	Fe (T) mg/L	Fe (D) mg/L	Hg (D) ug/L	Mb (D) mg/L	Mn (T) mg/L	Mn (D) mg/L	Pb (D) mg/L	Se (D) mg/L	Zn (D) mg/l	NO_3+NO_2 mg/L (N)	NO3 mg/L	NO_2 mg/L	NH3 mg/l	PO_4 mg/L	T Alk. mg/L	Hard. mg/L	S Sol. ml/l	TSS mg/L	O&G mg/L	Acid. mg/l
B263	06/05/07	2		17.7	8.52	564	313	8.2	58.5	27.4	19.5	4.1	355	< 10.	11	5.3		< .02		0.05			2.454	0.035			0.687	0.045		< .02			< .05		0.09		297		< .2		< 5.	< 10.
B263	07/18/07	0																																							
B263	10/11/07	0																																							
B263	06/12/08	150		9.2	8.5	470	307	12.4	75.2	19.6	9	1.7	311	9.6	8	3.3		< .01		< .05			0.236	0.017			0.034	0.023		< .01			0.06		< .05		271		< .2		11.7	< 10.
B263	09/03/08	0																																							
B263	11/03/08	0																																							
B263	05/29/14	0.034		16.8	7.84	633	336		68.6	29.4	14.2	2	362	<5	13	7	<0.03	<0.01	0.275	0.03	<0.001	<0.01	1.26	<0.03	<0.2	<0.005	0.189	0.008	<0.01	<0.02	<0.004										
Average		**53.0**		**11.8**	**8.27**	**547**	**333**		**72.2**	**26.8**	**13.3**	**2.3**	**351**	**8.07**	**13.75**	**8.45**																										
B353	07/09/94	3.5904		20.6	8.34	501		7																																
B353	08/28/94	4.0392		13.5	9	508	248		62	33	11	2	250	0	31	5	<0.05	0.001		0.03	<0.005	<0.01	0.29	0.02		<0.01	0.02	<0.01	<0.02				<0.02	<0.01	<0.05		250	290			2	
B353	09/23/94	4.488		9.3	8.51	573	296	7.4	66	34	11	2	275	0	29	4	<0.05	0.002		0.02	<0.005	<0.01	0.08	<0.02		<0.01	<0.01	0.01	<0.02	<0.01			<0.02	<0.01	<0.05		275	304	<0.1	<2	2	
B353	05/30/95	197.47		6.1	8.5	566	230	9.8	75.9	27.6	8.1	1.1	275	<2	10	4	<0.03	<0.001		0.02	<0.003	<0.01	0.16	0.03		<0.01	0.015	0.006	<0.02				0.4	<0.01	<0.05				<0.4	<5	<2	
B353	06/27/95	201.96		9.6	8.3	468	280	9	70.2	25.9	8.9	0.9	281	<2	40	4	<0.03	<0.001		0.02	<0.003	<0.01	0.22	<0.01		<0.01	0.018	0.009	<0.02	<0.001	<0.01		0.21	<0.01	<0.05				<0.1	18	<2	
B353	07/21/95	224.4		11.1	8.3	488		10.7																						<0.001	<0.01										
B353	08/17/95	58.344		11.6	7.53	575	300	8.4	73.6	34	9.6	1.1	281	<2	26	3	<0.03	<0.001		0.02	<0.003	<0.01	0.43	<0.01		<0.01	0.02	0.008	<0.02				0.06	<0.01	<0.05				0.05	24	<2	
B353	09/19/95	40.392		10.2	8.02	555		8.6																						<0.002	<0.01										
B353	10/13/95	18.85		6.2	8.47	574																																			
B353	10/30/95	21.991		4.8	8.48	549		9.9																																
B353	11/28/95	12.118		0	5.57	650		10.8																																
B353	03/27/96	0																																							
B353	05/31/96	9.87		10.1	9.41	354	270	8.2	60.1	30	9	1	253	<2	30	3			0.103				0.09	0.01			<0.005	0.005										253	274	<0.1	<5		
B353	10/02/96	0.00																																							
B353	04/30/97	0																																							
B353	06/17/97	130		6.1	7.6	523	290	12	72.1	31.5	8.8	0.9	308	<2	30	5							0.21	<0.01			0.011	<0.005										308	310		8	<2	
B353	10/29/97	0.45		4	8.26	666	310		70	29	9	1	360	<10	32	3.6							0.06	<0.01			<0.005	<0.005										360	290		<1	<5	
B353	03/23/98	0																																							
B353	05/27/98	673		10.5	8.47	641	330		71	24	8	<1	373	<5	22	5							0.4	<0.1			<0.1	<0.1										306	276		28	<2	
B353	10/15/98	21.5		6	8.01	490	363		69	32	9	1	344	<5	33	5							0.3	<0.1			<0.1	<0.1										82	304		15	<2	
B353	03/30/99	0																																							
B353	05/18/99	15		11	8.07	491	293		61	25	7	1	309	<5	29	3							0.1	<0.1			<0.1	<0.1										253	255		7	<2	
B353	10/13/99	2		6	8.12	371	314		70	30	12	<1	356	<5	30	4							<0.1	<0.1			<0.1	<0.1										291	298		13	<2	
B353	03/29/00	0																																							
B353	10/18/00	8.98		7	8.31	597	318	8.6	62	32	11	1	339	<5	30	5		<0.01	<1.	0.1	<0.01	<0.1	<0.1	<0.1			<0.1	<0.1	<0.1	<0.01	<0.01	<0.03		<0.03	<0.5	<0.05		278	287		9	<2	
B353	05/24/01	125.7		12	8.31	540	296	7.4	58	29	8	<1	333	<5	25	4							0.2	<0.1			<0.1	<0.1										273	264		15	<2	
B353	10/22/01	14.8		7	8.33	385	348		64	34	10	1	350	<5	32.2	4.9							<0.1	<0.1			<0.05	<0.05										287	300		5	<2	
B353	05/20/02	1.35		14	7.94	517	347		62	32	11	<1	336	<5	39	5							<0.1	<0.1			<0.05	<0.05										275	287		13	<2	
B353	08/26/02	0																																							
B353	10/23/02	1.3464		7	8.1	745	357		69	36	11	< 1.	365	< 5.	49	5							< .1	< .1			< .05	< .05										300	321		< 5.	< 2.	
B353	05/29/14	1.40		13.6	8.14	633	375	7.65	76.9	35.1	10.3	2.4	384	<5	38	6	<0.03	<0.01	0.121	0.01	<0.001	0.03	0.64	<0.03	<0.2	<0.005	0.103	0.003	<0.01	<0.02	0.026		0.14	<0.05	<0.1	<0.05	315	379	0.2	86	<5	<5
Average		**57.9**		**9.05**	**8.17**	**540**	**309**	**8.96**	**67.4**	**30.8**	**9.59**	**1.3**	**320.7**	**0**	**30.84**	**4.36**																										

Stock Watering Ponds

31-1	11/03/08	0																																							
31-1	09/03/08	0																																							
31-1	06/12/08	0																																							
31-1	10/11/07	0																																							
31-1	07/18/07	0																																							
31-1	06/05/07	0																																							
31-1	03/19/07	0																																							
31-1	10/12/06	0																																							
31-1	08/08/06																																								
31-1	05/24/06	0																																							
31-1	11/01/05	0																																							
31-1	08/27/05	0																																							
31-1	06/20/05	0																																							
31-1	12/22/80	---		2	8.3	198	200		54	13.2	5.9	12	185	31.2	7	4		0.002	0.018	0.005	<0.001	0.01	1.6	0.06	<0.0002		1.05	0.005	<0.001	<0.001	0.007				<0.01	0.08	204			26.2	<0.1	
Average		**0**		**2**	**8.3**	**198**	**200**		**54**	**13.2**	**5.9**	**12**	**185**	**31.2**	**7**	**4**																												

Site	Date	Flow gpm	W.L. feet	T °C	pH S.U.	Cond. µS/cm	TDS mg/L	D.O. mg/l	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^{-} mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^{-} mg/L	Al (D) mg/l	As (D) mg/L	Ba (D) mg/l	B (D) mg/L	Cd (D) mg/L	Cu (D) mg/l	Fe (T) mg/L	Fe (D) mg/L	Hg (D) ug/L	Mb (D) mg/L	Mn (T) mg/L	Mn (D) mg/L	Pb (D) mg/L	Se (D) mg/L	Zn (D) mg/l	NO_3+NO_2 mg/L (N)	NO3 mg/L	NO_2 mg/L	NH3 mg/l	PO_4 mg/L	T Alk. mg/L	Hard. mg/L	S Sol. ml/l	TSS mg/L	O&G mg/L	Acid. mg/l
32-1	12/22/80	---		2	7.3	262	265		44	30	9	15	317	<0.01	<3.0	10		<0.001	0.040	0.015	<0.001	0.02	0.36	0.06	<0.0001		0.135	0.12	<0.001	<0.001	0.015				0.2	0.08	260				15	6
36-1	12/22/80	---		2	8.0	205	220		54	13.2	29	11	185	31	<3.0	4		0.002	0.022	0.016	<0.001	0.01	0.49	0.06	<0.0002		0.475	0.195	<0.001	<0.001	0.007				<0.01	0.13	214				24.2	<0.1

Wells

B331	07/30/96	6274.3
B331	07/08/97	6290.5
B331	10/31/97	6288.2
B331	05/28/98	6292.8
B331	07/22/98	6292.8
B331	10/19/98	6290.5
B331	03/31/99	6313.6
B331	07/23/99	6318.2
B331	10/14/99	6372.2
B331	07/21/00	6369.6
B331	10/19/00	6368.6
B331	05/30/01	6367.4
B331	07/24/01	6367
B331	10/17/01	6366.7
B331	05/28/02	6366.2
B331	07/29/02	6365.8
B331	09/27/02	6365.8
B331	10/31/02	6365.8
B331A	07/30/96	6871.2
B331A	07/08/97	6810.3
B331A	10/31/97	6812
B331A	05/28/98	6812.2
B331A	07/22/98	6811.5
B331A	10/19/98	6808.9
B331A	03/31/99	6812.1
B331A	07/23/99	6811.2
B331A	10/14/99	6809.1
B331A	07/21/00	6808.4
B331A	10/19/00	6808.2
B331A	05/30/01	6808.2
B331A	07/24/01	6808
B331A	10/17/01	6808
B331A	05/28/02	6807.8
B331A	07/29/02	6807.6
B331A	09/27/02	6809.8
B331A	10/31/02	6807.8

In-Mine Groundwater

Aberdeen Mine groundwater sample										
	7/2001	3644	76	69	807	36	884	<0.1	1283	95
Pinacle Mine groundwater sample										
	7/2001	3279	67	74	409	35	862	<0.1	549	81

Table 3 Isotopic compositions and radiocarbon ages of groundwaters, surface waters, and in-mine groundwaters.

Sampling Site	Date	Data Source	$\delta^{18}O$ ‰	$\delta^{2}H$ (‰)	$\delta^{34}S$ ‰	$\delta^{13}C$ ‰	^{3}H (TU)	^{14}C (pmc)	radiocarbon age
Springs									
North Horn Formation									
B341	15-Oct-98	Willow Creek Mine MRP	-15.33	-116.07	-16.6	-9.6	16	82.66	modern
B262	15-Oct-98	Willow Creek Mine MRP	-15.04	-114.2	+4.0	-15.2	15.7	98.92	modern
Price River Formation									
B41	15-Oct-98	Willow Creek Mine MRP	-14.87	-114.92	+11.2	-12.1	19.6	101.2	modern
B41	19-May-99	Willow Creek Mine MRP	-16.25	-121.09		-10.6	8.17	55.85	modern
Surface Water									
B353	15-Oct-98	Willow Creek Mine MRP	-14.75	-113.9					
B211	01-Oct-97	Willow Creek Mine MRP	-14.40	-110.16					
B211	16-Oct-98	Willow Creek Mine MRP	-14.57	-113.82					
B263	15-Oct-98	Willow Creek Mine MRP	-14.65	-112.91					
Underground in-mine water									
Aberdeen Mine	July 2001	Tower Mine MRP				-13.1	0.18	9.01	15,000 years
Pinacle Mine	July 2001	Tower Mine MRP				-10.1	0.28	10.79	13,000 years

Table 4 Proposed hydrologic monitoring protocols.

Discharge measurements

Protocol	Applies to	Parameter	Frequency
A	Streams	Discharge	2nd, 3rd, and 4th quarters when reasonably accessible
B	Springs	Discharge	2nd, 3rd, and 4th quarters when reasonably accessible

Water quality measurements

Protocol	Applies to	Parameters	Table	Frequency
1	Streams	Beginning at least six (6) months prior to the beginning of underground mining operations in the Kenilworth Addition area, field and operational laboratory water quality measurements for two (2) years, followed by field water quality measurements only. In the event that mining-related water-quality impacts at a monitoring site are detected, laboratory water quality measurements to resume.	6	2nd, 3rd, and 4th quarters when reasonably accessible
2	Springs	Beginning at least six (6) months prior to the beginning of underground mining operations in the Kenilworth Addition area, field and operational laboratory water quality measurements for two (2) years, followed by field water quality measurements only. In the event that mining-related water quality impacts at a monitoring site are detected, laboratory water quality measurements to resume.	7	2nd, 3rd, and 4th quarters when reasonably accessible

Table 5 Proposed hydrologic monitoring locations.

Site	Protocols	Comments
Streams		
AC-1	A, 1	Antone Creek below Kenilworth Addition area
B211	A, 1	Mathis Canyon Creek below Kenilworth Addition area
B263	A, 1	Deep Canyon Creek below Kenilworth Addition area
B353	A, 1	Mathis Canyon Creek within Kenilworth Addition area
Springs		
B261	B, 2	North Horn/Flagstaff spring in Deep Canyon
B271	B, 2	North Horn/Flagstaff spring in Right Fork Mathis Canyon
B341	B, 2	North Horn/Flagstaff spring in Right Fork Mathis Canyon
B342	B, 2	North Horn/Flagstaff spring in Right Fork Mathis Canyon
B362	B, 2	North Horn/Flagstaff spring in Buck Canyon
B351	B, 2	Price River spring in Left Fork Mathis Canyon

Table 6 Streams operational water-quality monitoring parameters.

FIELD MEASUREMENTS	REPORTED AS
pH	pH units
Specific Conductivity	µS/cm @ 25°C
Dissolved Oxygen	mg/L
Temperature	°C
LABORATORY MEASUREMENTS	
Total Dissolved Solids	mg/L
Total Suspended Solids	mg/L:
Bicarbonate	mg/L
Carbonate	mg/L
Calcium (dissolved)	mg/L
Chloride	mg/L
Iron (total)	mg/L
Iron (dissolved)	mg/L
Magnesium (dissolved)	mg/L
Manganese (total)	mg/L
Manganese (dissolved)	mg/L
Potassium (dissolved)	mg/L
Sodium (dissolved)	mg/L
Sulfate	mg/L
Oil and grease	mg/L
Cations	meq/l
Anions	meq/l
Cation/Anion Balance	%

Table 7 Springs operational water-quality monitoring parameters.

FIELD MEASUREMENTS	REPORTED AS
pH	pH units
Specific Conductivity	µS/cm @ 25°C
Temperature	°C
LABORATORY MEASUREMENTS	
Total Dissolved Solids	mg/L
Carbonate	mg/L
Bicarbonate	mg/L
Calcium (dissolved)	mg/L
Chloride	mg/L
Iron (total)	mg/L
Iron (dissolved)	mg/L
Magnesium (dissolved)	mg/L
Manganese (total)	mg/L
Manganese (dissolved)	mg/L
Potassium (dissolved)	mg/L
Sodium (dissolved)	mg/L
Sulfate	mg/L
Cations	meq/L
Anions	meq/L
Cation/Anion Balance	%

Centennial Project
Permit # 007/019
Permit Plate Renumbering

New Plate Number	Name / Description	Original Plate Number
Chapter 1		
Plate 1-1	Centennial Project - General Location Map	Plate #1
Plate 1-2	Centennial Project - Current Leases	Plate #4
Plate 1-3	Centennial Project - Current Leases / Permit Area	Figure 1-2
Plate 1-4	Centennial Disturbed Areas Map	Figure 1-2A
Plate 1-5	Surface Area Boundary - Deadman Canyon	Plate #5
Plate 1-6	GVH Locations Map	Figure 1-1
Chapter 2		
Plate 2-1	Regional Soils Map	Plate #18
Plate 2-2	Soil Survey Map - Deadman Canyon	Plate #18
Plate 2-3	Topsoil Storage Piles - Deadman Canyon	Plate #37
Chapter 3		
Plate 3-1	Regional Vegetation Map	Plate #19
Plate 3-2	Vegetation Survey Map - Deadman Canyon	Plate #19
Plate 3-3	Revegetation Map - Deadman Canyon	Plate #20
Plate 3-4A	Wildlife Distribution Map - Raptor Survey (CONFIDENTIAL)	Plate #34A
Plate 3-4B	Wildlife Distribution Map - Mule Deer	Plate #34B
Plate 3-4C	Wildlife Distribution Map - Elk	Plate #34C
Plate 3-4D	Wildlife Distribution Map - Sage Grouse	Plate #34D
Chapter 4		
Plate 4-1	Regional Land Use Map	Figure 4-1

Centennial Project
Permit # 007/019
Permit Plate Renumbering

New Plate Number	Name / Description	Original Plate Number
Chapter 5		
Plate 5-1	Centennial Project - Regional Surface Ownership Map	Plate #2
Plate 5-2	Centennial Project - Regional Mineral Ownership Map	Plate #3
Plate 5-3	Lower Sunnyside Seam Production Areas	Plate #26
Plate 5-4	Centennial Seam Production Areas	Plate #27
Plate 5-5	Gilson Seam Production Areas	Plate #28
Plate 5-6	Aberdeen Seam Proposed Mine Plan	Plate #29
Plate 5-7	As-Constructed Surface Facilities Map - Deadman Canyon	Plate #6
Plate 5-8	Cross Section References - Deadman Canyon	Plate #14
Plate #5-9 (Sheet 1 of 19)	Section Profiles - Deadman Canyon	Plate #15 (Sheet 1 of 19)
Plate #5-9 (Sheet 2 of 19)	Section Profiles - Deadman Canyon	Plate #15 (Sheet 2 of 19)
Plate #5-9 (Sheet 3 of 19)	Section Profiles - Deadman Canyon	Plate #15 (Sheet 3 of 19)
Plate #5-9 (Sheet 4 of 19)	Section Profiles - Deadman Canyon	Plate #15 (Sheet 4 of 19)
Plate #5-9 (Sheet 5 of 19)	Section Profiles - Deadman Canyon	Plate #15 (Sheet 5 of 19)
Plate #5-9 (Sheet 6 of 19)	Section Profiles - Deadman Canyon	Plate #15 (Sheet 6 of 19)
Plate #5-9 (Sheet 7 of 19)	Section Profiles - Deadman Canyon	Plate #15 (Sheet 7 of 19)
Plate #5-9 (Sheet 8 of 19)	Section Profiles - Deadman Canyon	Plate #15 (Sheet 8 of 19)
Plate #5-9 (Sheet 9 of 19)	Section Profiles - Deadman Canyon	Plate #15 (Sheet 9 of 19)
Plate #5-9)Sheet 10 of 19)	Section Profiles - Deadman Canyon	Plate #15)Sheet 10 of 19)
Plate #5-9 (Sheet 11 of 19)	Section Profiles - Deadman Canyon	Plate #15 (Sheet 11 of 19)
Plate #5-9 (Sheet 12 of 19)	Section Profiles - Deadman Canyon	Plate #15 (Sheet 12 of 19)
Plate #5-9 (Sheet 13 of 19)	Section Profiles - Deadman Canyon	Plate #15 (Sheet 13 of 19)
Plate #5-9 (Sheet 14 of 19)	Section Profiles - Deadman Canyon	Plate #15 (Sheet 14 of 19)
Plate #5-9 (Sheet 15 of 19)	Section Profiles - Deadman Canyon	Plate #15 (Sheet 15 of 19)
Plate #5-9 (Sheet 16 of 19)	Section Profiles - Deadman Canyon	Plate #15 (Sheet 16 of 19)
Plate #5-9 (Sheet 17 of 19)	Section Profiles - Deadman Canyon	Plate #15 (Sheet 17 of 19)
Plate #5-9 (Sheet 18 of 19)	Section Profiles - Deadman Canyon	Plate #15 (Sheet 18 of 19)
Plate #5-9 (Sheet 19 of 19)	Section Profiles - Deadman Canyon	Plate #15 (Sheet 19 of 19)
Plate 5-10	Typical Road Cross Sections	Plate #35
Plate 5-11	Centennial Project - Subsidence Monitoring Stations	Plate #25

Centennial Project
Permit # 007/019
Permit Plate Renumbering

New Plate Number	Name / Description	Original Plate Number
Chapter 6		
Plate 6-1	Regional Surface Geology Map	Plate #21
Plate 6-2	Geologic Cross Section References and Drill Hole References	Plate #22
Plate 6-3	Cross Section A-A'	Plate #23
Plate 6-4	Cross Section B-B'	Plate #24
Plate 6-5	Kenilworth Lease Geologic Cross Section	Plate #22A
Chapter 7		
Plate 7-1	Watershed and Culvert Sizing and Revegetation Reference Areas	Plate #9
Plate 7-2	Support Facilities - Surface Area Drainage	Plate #8
Plate 7-3	Regional Surface and Ground Water Rights Map	Figure 5
Plate 7-4	Sediment Pond 'B' - As Constructed	Plate #11
Plate 7-5	Sediment Pond 'C' - As Constructed	Plate #12
Plate 7-6	Sediment Pond 'E' - As Constructed	Plate #13
Plate 7-7	Seep / Spring Survey Map	Figure 7-2
Plate 7-8	Ground and Surface Water Monitoring Locations	Figure 6
Plate 7-9	Reclamation Watershed Map	Plate #17A
Plate 7-10	Post Mining Hydrology - Final Reclamation Plan - Deadman Canyon Phase 1	Plate #16
Plate 7-11	Post Mining Hydrology - Final Reclamation Plan - Deadman Canyon Phase 2	Plate #17

Centennial Project
Permit # 007/019
Permit Drawings Renumbered / Modified
February 22, 2016

Original Plate Number	Plate Name	New Plate Number	Modification (other than renumbered)
1	Centennial Project - General Location Map	Plate 1-1	Reduce to 11x17; Add background topo
1A	Centennial Project - Coal Leases and Acquisitions	Omitted	Incorporated into Plate 1-2and 1-3
2	Centennial Project - Surface Ownership Map	Plate 5-1	Reduce to 11x17; Add background topo
3	Centennial Project - Mineral Ownership Map	Plate 5-2	Reduce to 11x17; Add background topo
4	Centennial Project - Leases	Plate 1-2	Reduce to 11x17; Add background topo
5	Surface Area Boundary - Deadman Canyon	Plate 1-5	Reduce to 11x17; Utilize 2006 aerial survey contours
6	As-Constructed Surface Facilities - Deadman Canyon	Plate 5-7	Utilize 2006 aerial survey contours
6A	Left-Fork Fan Area - As-Constructed	--	No Change
7	As Proposed Surface Facilities - Deadman Canyon	Omitted	Plate 5-7 shows as-constructed facilities
8	Support Facilities - Surface Area Drainage	Plate 7-2	Utilize 2006 aerial survey contours
9	Watershed and Culvert Sizing and Revegetation Reference Areas	Plate 7-1	
10	Proposed Sediment Pond 'E-PM' - Post Mining	Omitted	Plate 7-6 provides the as-constructed information
11	Catch Basin 'B' - As-Constructed	Plate 7-4	Reduce to 11x17; Add cell volumes
12	Sediment Pond 'C' - As-Constructed	Plate 7-5	Reduce to 11x17
13	Sediment Pond 'E' - Proposed Aberdeen Surface	Plate 7-6	Reduce to 11x17; Provide As-Constructed Sediment Pond 'E' replacement
14	Cut and Fill Cross Section Reference - Deadman Canyon	Plate 5-8	Reduce to 11x17; Utilize 2006 aerial survey contours
15 (Sheet 1 of 19)	Cut and Fill Cross - Deadman Canyon	5-9 (Sheet 1 of 19)	Reduce to 11x17
15 (Sheet 2 of 19)	Cut and Fill Cross - Deadman Canyon	5-9 (Sheet 2 of 19)	Reduce to 11x17
15 (Sheet 3 of 19)	Cut and Fill Cross - Deadman Canyon	5-9 (Sheet 3 of 19)	Reduce to 11x17
15 (Sheet 4 of 19)	Cut and Fill Cross - Deadman Canyon	5-9 (Sheet 4 of 19)	Reduce to 11x17
15 (Sheet 5 of 19)	Cut and Fill Cross - Deadman Canyon	5-9 (Sheet 5 of 19)	Reduce to 11x17
15 (Sheet 6 of 19)	Cut and Fill Cross - Deadman Canyon	5-9 (Sheet 6 of 19)	Reduce to 11x17
15 (Sheet 7 of 19)	Cut and Fill Cross - Deadman Canyon	5-9 (Sheet 7 of 19)	Reduce to 11x17
15 (Sheet 8 of 19)	Cut and Fill Cross - Deadman Canyon	5-9 (Sheet 8 of 19)	Reduce to 11x17
15 (Sheet 9 of 19)	Cut and Fill Cross - Deadman Canyon	5-9 (Sheet 9 of 19)	Reduce to 11x17
15 (Sheet 10 of 19)	Cut and Fill Cross - Deadman Canyon	5-9 (Sheet 10 of 19)	Reduce to 11x17
15 (Sheet 11 of 19)	Cut and Fill Cross - Deadman Canyon	5-9 (Sheet 11 of 19)	Reduce to 11x17
15 (Sheet 12 of 19)	Cut and Fill Cross - Deadman Canyon	5-9 (Sheet 12 of 19)	Reduce to 11x17
15 (Sheet 13 of 19)	Cut and Fill Cross - Deadman Canyon	5-9 (Sheet 13 of 19)	Reduce to 11x17
15 (Sheet 14 of 19)	Cut and Fill Cross - Deadman Canyon	5-9 (Sheet 14 of 19)	Reduce to 11x17

Centennial Project
Permit # 007/019
Permit Drawings Renumbered / Modified
February 22, 2016

Original Plate Number	Plate Name	New Plate Number	Modification (other than renumbered)
15 (Sheet 15 of 19)	Cut and Fill Cross - Deadman Canyon	5-9 (Sheet 15 of 19)	Reduce to 11x17
15 (Sheet 16 of 19)	Cut and Fill Cross - Deadman Canyon	5-9 (Sheet 16 of 19)	Reduce to 11x17
15 (Sheet 17 of 19)	Cut and Fill Cross - Deadman Canyon	5-9 (Sheet 17 of 19)	Reduce to 11x17
15 (Sheet 18 of 19)	Cut and Fill Cross - Deadman Canyon	5-9 (Sheet 18 of 19)	Reduce to 11x17
15 (Sheet 19 of 19)	Cut and Fill Cross - Deadman Canyon	5-9 (Sheet 19 of 19)	Reduce to 11x17
16	Post Mining Hydrology - Final Reclamation - Deadman Canyon - Phase 1	Plate 7-10	Reduce to 11x17; Utilize 2006 aerial survey contours
17	Final Mining Hydrology - Final Reclamation - Deadman Canyon - Phase 2	Plate 7-11	Reduce to 11x17; Utilize 2006 aerial survey contours
17A	Reclamation Watershed Map	Plate 7-9	Reduce to 11x17; Add background topo
18	Regional Soil Survey Map	Plate 2-1	
18	Soil Survey Map - Deadman Canyon	Plate 2-2	Reduce to 11x17; Utilize 2006 aerial survey contours
19	Regional Vegetation Survey Map	Plate 3-1	
19	Vegetation Survey Map - Deadman Canyon	Plate 3-2	Reduce to 11x17; Utilize 2006 aerial survey contours
19A	Vegetation Map - Mt. Nebo	Omitted	Incorporated into Plate 3-1
20	Revegetation Map - Deadman Canyon	Plate 3-3	Reduce to 11x17; Utilize 2006 aerial survey contours
21	Surface Geology of the Andalex Resources Mine Plan Area	Plate 6-1	
22	Centennial Project - Geologic Cross Section Reference and Drill Hole Locations Map	Plate 6-2	Reduce to 11x17; Add background topo
22A	Kenilworth Lease Geologic Cross Section	Plate 6-5	
23	Centennial Project - Cross Section A-A'	Plate 6-3	
24	Centennial Project - Cross Section B-B'	Plate 6-4	
25	Centennial Project - Subsidence Monitoring Stations Map	Plate 5-11	Reduce to 11x17; Add background topo
26	Lower Sunnyside Seam Production Areas	Plate 5-3	Reduce to 11x17; Add background topo
27	Centennial Seam Production Areas	Plate 5-4	Reduce to 11x17; Add background topo
28	Gilson Seam Production Areas	Plate 5-5	Reduce to 11x17; Add background topo
29	Proposed Mine Plan - Aberdeen Seam	Plate 5-6	Reduce to 11x17; Add background topo
30	Proposed Mine Plan - Gilson Seam	Previously Omitted	
31	Proposed Mine Plan - Centennial Seam	Omitted	Mine is sealed and closed with no proposed mining activities in the Centennial Seam
32	Pinnacle Mine - Current Mine Plan (Mine is closed and sealed)	Previously Omitted	
33	Apex Mine - Current Mine Plan (Mine is closed and sealed)	Previously Omitted	

Centennial Project
Permit # 007/019
Permit Drawings Renumbered / Modified
February 22, 2016

Original Plate Number	Plate Name	New Plate Number	Modification (other than renumbered)
34A	Centennial Project - Wildlife Distribution Map (Raptors) - Confidential Binder	Plate 3-4A	
34B	Centennial Project - Wildlife Distribution Map (Mule Deer)	Plate 3-4B	Reduce to 11x17
34C	Centennial Project - Wildlife Distribution Map (Elk)	Plate 3-4C	Reduce to 11x17
34D	Centennial Project - Wildlife Distribution Map (Sage Grouse)	Plate 3-4D	Reduce to 11x17
35	Typical Road Cross Sections	Plate 5-10	Reduce to 11x17
36	Topsoil Storage Pile 'G'	Omitted	Data moved to Plate 2-3
37	Topsoil Piles - Deadman Canyon	Plate 2-3	Reduce to 11x17
38		Previously Omitted	
39		Previously Omitted	
40	Centennial Seam Isopachs (Mine is closed and sealed)	Previously Omitted	
41	Proposed Mine Plan - Centennial Seam	Previously Omitted	
Figure 4	Water Quality Data	Omitted	Data provided elsewhere in MRP
Figure 5	Surface and Ground Water Rights	Plate 7-3	Reduce to 11x17; Add background topo
Figure 6	Ground and Surface Water Monitoring	Omitted	Data incorporated into Plate 7-8
Figure 1-2	Centennial Leases / Permit Area	Plate 1-3	
Figure 1-2A	Centennial Disturbed Area	Plate 1-4	
Figure 4-1	Regional Land Use Map	Plate 4-1	Reduce to 11x17
Figure IV-II	Ground and Surface Water Monitoring Locations	Omitted	Data incorporated into Plate 7-8
Figure 7-1	Water Monitoring Locations Map	Plate 7-8	Reduce to 11x17; Add background topo
Figure 7-2	Seep / Spring Survey Map	Plate 7-7	Reduce to 11x17; Add background topo
Figure 1-1	GVH Locations Map	Plate 1-6	

FORMERLY PLATE 1

CENTENNIAL PROJECT
GENERAL LOCATION MAP
PLATE 1-1

DATE: FEB. 22, 2016
REVISION NUMBER: 2

R. 9 E.
R. 10 E.
R. 10 E.
R. 11 E.

T. 12 S.
T. 13 S.

UNLEASED

PERMIT AREA

SURFACE PERMIT ONLY
(NO MINERALS)

OSO GAS WELL PAD
AND PIPELINE
(±11.92 ACRES -
NOT IN PERMIT AREA)

T. 12 S.
T. 13 S.

SURFACE PERMIT ONLY
(NO MINERALS)

SURFACE FACILITIES
(DEADMAN CANYON)

ANCILLARY ROAD
RIGHT-OF-WAY

HELPER CITY

KENILWORTH

COUNTY ROAD 299

T. 13 S.
T. 14 S.

R. 9 E.
R. 10 E.

PRICE CITY

R. 10 E.
R. 11 E.

COUNTY
AIRPORT

T. 13 S.
T. 14 S.

1/2 0 1 2 MILES
SCALE: 1" = 1 MILE

I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

UTAH REGISTERED
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David W. Hibbs
PROFESSIONAL ENGINEER

NOTES

1. SEE PLATE 1-2 FOR LEASE AND RIGHTS-OF-WAY DETAILS.

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TOWER DIVISION
PRICE, UTAH

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FORMERLY PLATE 4

CENTENNIAL PROJECT
CURRENT LEASES
PLATE 1-2

DATE: FEB. 22, 2016
REVISION NUMBER: 2

R. 10 E.
R. 11 E.

MATHIS FEE
(UNLEASED)

FEDERAL LEASE
UTU-81893

MATHIS FEE

FEDERAL
LEASE
UTU-66060

FEDERAL LEASE
UTU-69600

ZION
FEE

SURFACE PERMIT ONLY
(NO MINERALS)

SURFACE PERMIT ONLY
(NO MINERALS)

OSO GAS WELL PAD
AND PIPELINE
(±11.92 ACRES -
NOT IN PERMIT AREA)

SURFACE
FACILITIES
(DEADMAN
CANYON)

T. 12 S.
T. 13 S.

T. 12 S.
T. 13 S.

1250 0 2500 5000 FEET

SCALE: 1" = 2,500 FEET

I CERTIFY THIS MAP TO BE TRUE AND CORRECT
TO THE BEST OF MY KNOWLEDGE.

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David W. Hibbs
PROFESSIONAL ENGINEER

LEGEND

- PERMIT BOUNDARY
- SURFACE PERMIT BOUNDARY
- LEASE BOUNDARY
- 1 FEDERAL LEASE UTU-010581
- 2 FEDERAL LEASE UTSL-27304
- 3 BLM R.O.W. UTU-64158
- 4 BLM R.O.W. UTU-062045
- 5 CAVE PRIVATE EASEMENT
- 6 FEDERAL LEASE UTSL-63058

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FORMERLY FIGURE 1-2

CENTENNIAL PROJECT / CURRENT LEASES / PERMIT AREA

PLATE 1-3

DATE: FEB. 22, 2016

REVISION NUMBER: 2

1250 0 2500 5000 FEET

NEW COAL LEASE BOUNDARY

UNLEASED AREA

MATHIS FEE LEASE
(640 Acres)

UTU-81893
(1760.00 Acres)

UTU-79975
(Surface Only -
167.53 Acres)

UTU-66060
(Surface Only -
285.68 Acres)

UTU-66060
(161.41 Acres)

OSO GAS WELL PAD
AND PIPELINE
(±11.92 ACRES -
NOT IN PERMIT AREA)

PREVIOUS PERMIT
BOUNDARY (C/007/019)

NEW COAL LEASE BOUNDARY

UTU-010581
(Surface Only -
40.00 Acres)

UTU-69600
(497.18 Acres)

ZION FEE
LEASE
(205.98 Acres)

UTU-010581
(40.00 Acres)

UTSL-27304
(Surface Only -
40.00 Acres)

NEW COAL LEASE BOUNDARY

UTSL-27304
(155.96 Acres)

BLM ROW UTU-64158
(Left Fork Fan
and Access Road)
(1.45 Acres)

SL-63058
(40.00 Acres)

BLM ROW U-62045
(10 Acres)

CAVE PRIVATE
EASEMENT
(1.5 Acres)

T 12 S
T 13 S

R 10 E
R 11 E

PERMIT AREA TABULATION

FEDERAL COAL LEASES (MINERALS):	2,654.55 ACRES
FEE COAL LEASES:	845.98 ACRES
BLM SURFACE R.O.W.:	11.45 ACRES
PRIVATE EASEMENT:	1.50 ACRES
FEDERAL COAL LEASES (SURFACE ONLY):	533.21 ACRES
PERMIT AREA SUBTOTAL:	4,046.69 ACRES
LESS OSO GASWELL AREA	(11.92) ACRES
TOTAL PERMIT AREA:	4,034.77 ACRES

I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

UTAH REGISTERED PROFESSIONAL ENGINEER
#6449561
David W. Hibbs

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PRICE, UTAH

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FORMERLY FIG. 1-2A

CENTENNIAL PROJECT
DISTURBED AREAS MAP

PLATE 1-4

DATE: FEB. 22, 2016
REVISION NUMBER: 2

1250 0 2500 5000 FEET

R 10 E
R 11 E

T 12 S
T 13 S

UNLEASED AREA

NEW COAL LEASE BOUNDARY

GOB GAS
VENT HOLE PADS
(15 EACH)

SURFACE PERMIT ONLY
(NO MINERALS)

NEW COAL LEASE BOUNDARY

OSO GAS WELL
PAD AND PIPELINE
(11.92± ACRES -
NOT IN PERMIT AREA)

PREVIOUS PERMIT BOUNDARY
(C/007/019)

NEW COAL LEASE BOUNDARY

SURFACE PERMIT ONLY
(NO MINERALS)

LEFT FORK
VENTILATION FAN
AND ACCESS ROAD

MINESITE SURFACE
FACILITY AREA

N

I CERTIFY THIS MAP TO BE TRUE AND CORRECT
TO THE BEST OF MY KNOWLEDGE.

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PROFESSIONAL ENGINEER

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Sections 7 and 18, T12S, R11E

150 0 300 600 FEET

FORMERLY PLATE 5

CENTENNIAL PROJECT
SURFACE AREA BOUNDARY
DEADMAN CANYON

PLATE 1-5

DATE: FEB. 22, 2016
REVISION NUMBER: 2

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Federal Lease SL-27304(M)

BLM Right-of-Way #UTU-062045

Private Property Easement

Federal Lease SL-27304(M)

Zion Fee

Federal Lease UTU-010581

Federal Lease UTU-010581

Federal Lease UTSL-63058

Federal Lease UTSL-27304

Section 18

Section 7

Federal Lease UTU-010581

LEGEND

- Disturbed Surface Boundary
- Lease Boundary
- Undisturbed Surface Drainage (Diversion Ditch)
- Permit Boundary
- Permit Boundary - Surface Only

34.94 ACRES DISTURBED

AERIAL SURVEY BY OLYMPUS AERIAL SURVEY, SLC, UTAH 2006. CONTOUR INTERVAL 10'.

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TOWER DIVISION
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FORMERLY FIG. 1-1

CENTENNIAL PROJECT
GVH LOCATIONS MAP

PLATE 1-6

DATE: FEB. 22, 2016
REVISION NUMBER: 2

500 0 1000 2000 FEET

GVH 16A
GVH 15A
GVH 14A
GVH 13A
GVH 12A
GVH 11A

GVH 17 (PAD ONLY)
GVH 16 (PAD ONLY)
GVH 15 (PAD ONLY)
GVH 14
GVH 13
GVH 12
GVH 11
GVH 10 (ELIMINATED)

SURFACE ONLY - NO MINERALS

REMONUMENTED SECTION CORNER (BLM)

OSO COMPRESSOR STATION

GVH 9
GVH 8A
GVH 8
GVH 7
GVH 7A
GVH 6
GVH 5A
GVH 5 (RECLAIMED)

Aspen/Grass Reference Area

Sagebrush/Grass Reference Area

GVH 4
GVH 3
GVH 1 (RECLAIMED)

1.13 ACRES (125' RADIUS AROUND GVH HOLE)

SURFACE ONLY - NO MINERALS

OSO GAS WELL PAD AND PIPELINE (11.92 ACRES - NOT IN PERMIT AREA)

I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

UTAH REGISTERED PROFESSIONAL ENGINEER
#6449561
David W. Hibbs

LEGEND

- CURRENT GVH LOCATIONS
- PROPOSED GVH LOCATIONS (Primary)
- PROPOSED GVH LOCATIONS (Alternate)
- OSO PIPELINE CORRIDOR (APPROXIMATE LOCATION)
- EXISTING ROADS
- NEWLY CONSTRUCTED ROADS
- SURFACE OWNERSHIP BOUNDARY
- ANDALEX PERMIT BOUNDARY
- VEGETATION REFERENCE AREAS

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SURFACE PERMIT ONLY
(NO MINERALS)

OSO GAS WELL PAD
AND PIPELINE
(±11.92 ACRES -
NOT IN PERMIT AREA)

SURFACE PERMIT ONLY
(NO MINERALS)

SURFACE
FACILITIES

1500' 0 3000' 6000'

SOURCE OF SOIL INFORMATION:
"SOIL SURVEY OF CARBON COUNTY AREA, UTAH" AS PUBLISHED BY THE UNITED STATES DEPARTMENT OF AGRICULTURE'S SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE UNITED STATES DEPARTMENT OF THE INTERIOR, THE BUREAU OF LAND MANAGEMENT, AND THE UTAH AGRICULTURAL EXPERIMENT STATION

FORMERLY PLATE 18

CENTENNIAL PROJECT
REGIONAL SOILS MAP

PLATE 2-1

DATE: FEB. 22, 2016
REVISION NUMBER: 2

I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

UTAH REGISTERED
#6449561
David W. Hibbs
PROFESSIONAL ENGINEER

SOIL TYPES

2	BADLAND	35	GERST–BADLAND–STORMITT COMPLEX	75	PERMA FAMILY – 15 TO 40 PERCENT SLOPES	101	SENCHERT LOAM – 30 TO 50 PERCENT SLOPES
7	BEJE–TRAG COMPLEX	36	GERST–STRYCH–BADLAND COMPLEX – 3% TO 50% SLOPES	76	PERMA FAMILY – DATINO COMPLEX	104	SENCHERT FAMILY – 3 TO 15 PERCENT SLOPES
11	CABBA FAMILY – 40 TO 70 PERCENT SLOPES	37	GERST–STRYCH–BADLAND COMPLEX – 50% TO 70% SLOPES	85	RABBITEX SILT LOAM – 15 TO 50 PERCENT SLOPES	105	SENCHERT FAMILY–SENCHERT COMPLEX
13	CABBA FAMILY – GUBEN–ROCK OUTCROP COMPLEX	47	GUBEN–ROCK OUTCROP COMPLEX	86	RABBITEX–DONEY FAMILY – MIDFORK FAMILY COMPLEX	107	SUPERT–WINETTI COMPLEX
20	COMODORE–DATINO VARIANT COMPLEX	62	MIDFORK FAMILY – COMMODORE COMPLEX	88	RABBITEX FAMILY – DATINO VARIANT COMPLEX	113	STRYCH VERY STONY LOAM – 3 TO 15 PERCENT SLOPES
21	CROYDON LOAM – 8 TO 30 PERCENT SLOPES	63	MIDFORK FAMILY – PODO ASSOCIATION	95	ROCK OUTCROP	114	STRYCH VERY STONY LOAM – DRY – 3 TO 30 PERCENT SLOPES
25	DONEY FAMILY – 3 TO 15 PERCENT SLOPES	71	PATHEAD EXTREMELY BOULDERY FINE SANDY LOAM – 40 TO 70 PERCENT SLOPES	96	ROCK OUTCROP–RUBBLELAND–TRAVESSILLA COMPLEX	117	TRAG–BEJE–SENCHERT COMPLEX
26	DONEY FAMILY – 50 TO 70 PERCENT SLOPES			97	ROTTULEE FAMILY – TRAG COMPLEX	121	TRAVESILLA–ROCK OUTCROP–GERST COMPLEX
27	DONEY FAMILY – PODO COMPLEX	72	PATHEAD–CURECANTI FAMILY ASSOCIATION	100	SENCHERT LOAM – 3 TO 15 PERCENT SLOPES	124	UINTA FAMILY–PODO ASSOCIATION

ANDALEX RESOURCES, INC.
TOWER DIVISION
PRICE, UTAH

G:\Current Drawings\MRP Maps\Tower Mine\Permit Plates Renumbered\Plate 2-1 - Regional Soils Map R1.dwg, Soils Map, 2/22/2016 8:27:25 AM, 1:1

Sections 7 and 18, T12S, R11E

150 0 300 600 FEET

FORMERLY PLATE 18

CENTENNIAL PROJECT
SOIL SURVEY MAP
DEADMAN CANYON

PLATE 2-2

DATE FEB. 22, 2016
REVISION NUMBER 2

I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

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#6449561
David W. Hibbs

Federal Lease SL-27304(M)

BLM Right-of-Way #UTU-062045

Private Property Easement

Federal Lease UTSL-63058

Federal Lease UTSL-27304

Section 18

Section 7

Federal Lease UTU-010581

Zion Fee

Federal Lease UTU-010581

Federal Lease UTU-010581

B2E Mountain Loam

D2E Upland Stoney Loam

DM Mine Dump

D3E Upland Stoney Loam

LIMIT OF DETAILED SURVEY DONE BY U.S. DEPT OF AGRICULTURE S.C.S.

Da Ba Bd RO DM

D DS SW SP SC P

KEYED NOTES

Ba	Brycan bouldary load, 8 to 20% slopes
Bd	Brycan soil, disturbed
Da	Datino very stoney loam, 15 to 35% slopes
RO	Rock outcrop, 50 to 100% slopes
DS	Soil Description and Sample Site
SW SP SC	Soil Sample Site
P	Soil Sample Pit

LEGEND

- Disturbed Surface Boundary
- Lease Boundary
- Undisturbed Surface Drainage (Diversion Ditch)
- Permit Boundary
- Permit Boundary - Surface Only
- Soil Type Boundary

AERIAL SURVEY BY OLYMPUS AERIAL SURVEY, SLC, UTAH 2006. CONTOUR INTERVAL 10'.

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TOWER DIVISION
PRICE, UTAH

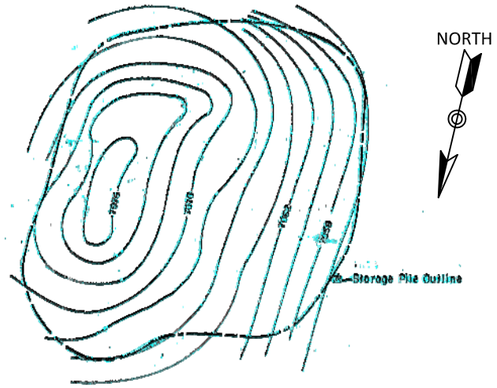
G:\Current Drawings\MRP Maps\Tower Mine\Permit Plates Renumbered\Plate 2-2 - Soil Suvey Map - Deadman Canyon R1.dwg, Plate 2-2, 2/22/2016 8:28:43 AM, 1:1

FORMERLY PLATE 37

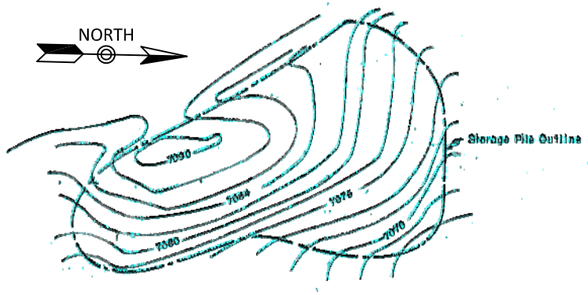
CENTENNIAL PROJECT
TOP SOIL STORAGE PILES
DEADMAN CANYON

PLATE 2-3

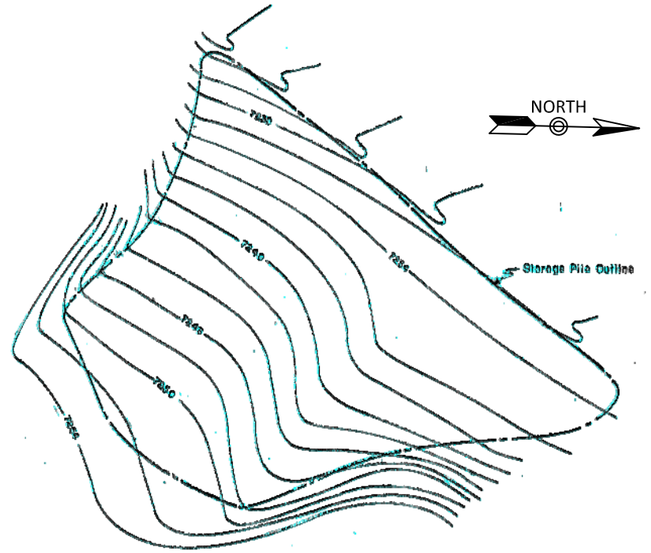
DATE: FEB. 22, 2016
REVISION NUMBER: 2



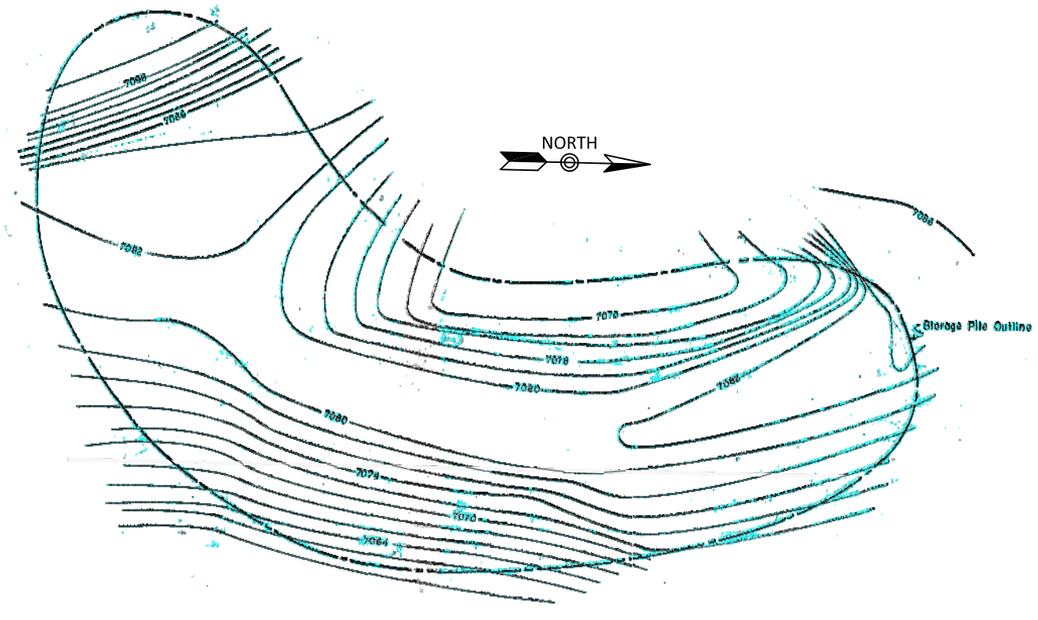
TOPSOIL PILE 'A'
35,731.58 CUBIC FEET
SCALE: 1" = 40'-0"
CONTONTOUR INTERVAL: 2'-0"



TOPSOIL PILE 'C'
20,586 CUBIC FEET
SCALE: 1" = 40'-0"
CONTOUR INTERVAL: 2'-0"

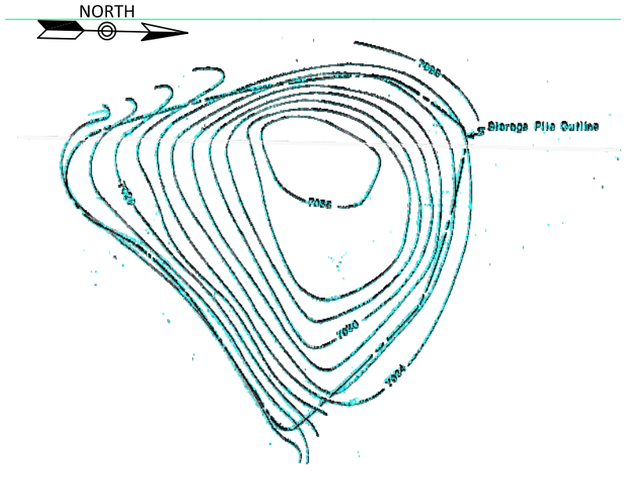


TOPSOIL PILE 'F'
60,289 CUBIC FEET
SCALE: 1" = 40'-0"
CONTOUR INTERVAL: 2'-0"



TOPSOIL PILE 'G'
181,656 CUBIC FEET
SCALE: 1" = 40'-0"
CONTOUR INTERVAL: 2'-0"

NOTE:
SEE PLATE 5-7 FOR TOPSOIL PILE LOCATIONS.



TOPSOIL PILE 'J'
73,681 CUBIC FEET
SCALE: 1" = 40'-0"
CONTOUR INTERVAL: 2'-0"

I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

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David W. Hibbs

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G:\Current Drawings\MRP Maps\Tower Mine\Permit Plates Renumbered\Plate 2-3 - Top Soil Storage Piles.dwg, Plate 2-3, 2/22/2016 11:34:23 AM, 1:1

FORMERLY PLATE 19

CENTENNIAL PROJECT
REGIONAL VEGETATION MAP

PLATE 3-1

DATE: FEB. 22, 2016
REVISION NUMBER: 2

R. 10 E.
R. 11 E.

T. 12 S.
T. 13 S.

TYPICAL SURFACE PERMIT ONLY (NO MINERALS)

OSO GAS WELL PAD AND PIPELINE (±11.92 ACRES - NOT IN PERMIT AREA)

SURFACE FACILITIES

VEGETATION TYPE BOUNDARY

PERMIT LINE

PERMIT LINE (SURFACE ONLY)

PJ	PINYON–JUNIPER
DE	DECIDUOUS
OB	OAKBRUSH
CO	CONIFER
GS	GRASSLAND – SAGEBRUSH
MB	MIXED BRUSH

N

1250 0 2500 5000 FEET

SCALE: 1" = 2,500 FEET

KENILWORTH

ANDALEX RESOURCES, INC.
TOWER DIVISION
PRICE, UTAH

UTAH REGISTERED PROFESSIONAL ENGINEER
#6449561
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G:\Current Drawings\MRP Maps\Tower Mine\Permit Plates Renumbered\Plate 3-1 - Regional Vegetation Map.dwg, Vegetation Map, 2/22/2016 8:42:21 AM, 1:1

FORMERLY PLATE 19

CENTENNIAL PROJECT
VEGETATION SURVEY MAP
DEADMAN CANYON
PLATE 3-2

DATE: FEB. 22, 2016
REVISION NUMBER: 2

Sections 7 and 18, T12S, R11E

150 0 300 600 FEET

NOTE:
SEE PLATE 7-1 FOR REVEGETATION REFERENCE AREAS.

I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

UTAH REGISTERED PROFESSIONAL ENGINEER
#6449561
David W. Hibbs

Federal Lease SL-27304(M)

BLM Right-of-Way #UTU-062045

Private Property Easement

Federal Lease UTSL-27304

Federal Lease UTSL-63058

Section 18

Section 7

Federal Lease SL-27304(M)

LIMIT OF DETAILED SURVEY DONE BY U.S. DEPT OF AGRICULTURE S.C.S.

B2E Mountain Loam (Summer Precip.)

D2E Upland Stoney Loam (Pinyon-Juniper)

B2E Mountain Loam (Summer Precip.)

DM Mine Dump

DM

D3E Upland Stoney Loam (Oak)

DM

Zion Fee

Federal Lease UTU-010581

Federal Lease UTU-010581

Federal Lease UTU-010581

Da

Bd

Ba

RO

KEY

Ba	Mountain Stoney Loam (Oak)
Bd	No range site
Da	Upland Stoney Loam (Pinyon-Juniper)
RO	No range site
•24	Sample Site
⊢⊣	100' Transect

LINE LEGEND

- Disturbed Surface Boundary
- Lease Boundary
- Undisturbed Surface Drainage (Diversion Ditch)
- Permit Boundary
- Permit Boundary - Surface Only
- Soil Type Boundary

AERIAL SURVEY BY OLYMPUS AERIAL SURVEY, SLC, UTAH 2006. CONTOUR INTERVAL 10'.

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TOWER DIVISION
PRICE, UTAH

G:\Current Drawings\MRP Maps\Tower Mine\Permit Plates Renumbered\Plate 3-2 - Vegetation Survey Map - Deadman Canyon.dwg, Plate 3-2, 2/22/2016 8:46:04 AM, 1:1

FORMERLY PLATE 20

CENTENNIAL PROJECT
REVEGETATION MAP
DEADMAN CANYON

PLATE 3-3

DATE: FEB. 22, 2016
REVISION NUMBER: 2

Sections 7 and 18, T12S, R11E

150 0 300 600 FEET

NOTE:
SEE PLATE 7-1 FOR REVEGETATION REFERENCE AREAS.

I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

UTAH REGISTERED PROFESSIONAL ENGINEER
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David W. Hibbs

Federal Lease SL-27304(M)

BLM Right-of-Way #UTU-062045

Private Property Easement

Federal Lease UTSL-27304

Federal Lease UTSL-63058

Section 18

Section 7

Federal Lease SL-27304(M)

Zion Fee

Federal Lease UTU-010581

Federal Lease UTU-010581

Federal Lease UTU-010581

KEY

- Shrubs (2.15 acres)
- Drainage Area Seed Mix (15.02 acres)
- Steep Slope Area Seed Mix (17.03 acres)

Chapter 4 of the MRP indicates seed mixtures and distribution quantities.

NOTES:
1. The current approved seed mixtures will be used in all areas, including transplant areas (shrub clumps).

LINE LEGEND

- Disturbed Surface Boundary
- Lease Boundary
- Undisturbed Surface Drainage (Diversion Ditch)
- Permit Boundary
- Permit Boundary - Surface Only
- Seed Mix Boundary
- Reclaimed Contour (20' Intervals)
- Undisturbed Contour (20' Intervals)

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TOWER DIVISION
PRICE, UTAH

G:\Current Drawings\MRP Maps\Tower Mine\Permit Plates Renumbered\Plate 3-3 - Revegetation Map - Deadman Canyon.dwg, Plate 3-3, 2/22/2016 8:48:38 AM, 1:1

R. 10 E.
R. 11 E.

T. 12 S.
T. 13 S.

TYPICAL SURFACE PERMIT ONLY (NO MINERALS)

OSO GAS WELL PAD AND PIPELINE (±11.92 ACRES - NOT IN PERMIT AREA)

NEW COAL LEASE BOUNDARY

SURFACE PERMIT ONLY (NO MINERALS)

KENILWORTH

LEGEND

- DENOTES DEER SUMMER RANGE
- DENOTES DEER WINTER RANGE
- DENOTES DEER YEAR-LONG RANGE
- DENOTES OTHER DEER RANGE

MAP INFORMATION OBTAINED FROM THE UTAH DIVISION OF WILDLIFE RESOURCES CONSERVATION DATA CENTER.

FORMERLY PLATE 34B

CENTENNIAL PROJECT
WILDLIFE DISTRIBUTION
MULE DEER RANGE

PLATE 3-4B

DATE: FEB. 22, 2016
REVISION NUMBER: 2

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UTAH REGISTERED #6449561 David W. Hibbs PROFESSIONAL ENGINEER

1500' 0 3000' 6000'

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TOWER DIVISION
PRICE, UTAH

G:\Current Drawings\MRP Maps\Tower Mine\Permit Plates Renumbered\Plate 3-4B - Wildlife Distribution - Deer.dwg, Deer Range, 2/22/2016 8:52:33 AM, 1:1

LEGEND

DENOTES ELK SUMMER RANGE

DENOTES ELK WINTER RANGE

MAP INFORMATION OBTAINED FROM THE UTAH DIVISION OF WILDLIFE RESOURCES CONSERVATION DATA CENTER.

FORMERLY PLATE 34C

CENTENNIAL PROJECT
WILDLIFE DISTRIBUTION
ELK RANGE

PLATE 3-4C

DATE: FEB. 22, 2016

REVISION NUMBER: 2

R. 10 E.
R. 11 E.

T. 12 S.
T. 13 S.

TYPICAL SURFACE PERMIT ONLY (NO MINERALS)

OSO GAS WELL PAD AND PIPELINE (±11.92 ACRES - NOT IN PERMIT AREA)

NEW COAL LEASE BOUNDARY

SURFACE PERMIT ONLY (NO MINERALS)

I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

UTAH REGISTERED
#6449561
David W. Hibbs
PROFESSIONAL ENGINEER

T. 12 S.
T. 13 S.

R. 10 E.
R. 11 E.

KENILWORTH

1500' 0 3000' 6000'

N

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PRICE, UTAH

G:\Current Drawings\MRP Maps\Tower Mine\Permit Plates Renumbered\Plate 3-4C - Wildlife Distribution - Elk.dwg, Elk Range, 2/22/2016 8:54:55 AM, 1:1

LEGEND

DENOTES SAGE GROUSE RANGE

MAP INFORMATION OBTAINED FROM THE UTAH DIVISION OF WILDLIFE RESOURCES CONSERVATION DATA CENTER.

FORMERLY PLATE 34D

CENTENNIAL PROJECT
WILDLIFE DISTRIBUTION
SAGE GROUSE RANGE

PLATE 3-4D

DATE: FEB. 22, 2016
REVISION NUMBER: 2

R. 10 E.
R. 11 E.

NEW COAL LEASE BOUNDARY

TYPICAL SURFACE PERMIT ONLY (NO MINERALS)

OSO GAS WELL PAD AND PIPELINE (±11.92 ACRES - NOT IN PERMIT AREA)

T. 12 S.
T. 13 S.

NEW COAL LEASE BOUNDARY

SURFACE PERMIT ONLY (NO MINERALS)

KENILWORTH

I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

UTAH REGISTERED PROFESSIONAL ENGINEER
#6449561
David W. Hibbs

T. 12 S.
T. 13 S.

R. 10 E.
R. 11 E.

1500' 0 3000' 6000'

N

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TOWER DIVISION
PRICE, UTAH

G:\Current Drawings\MRP Maps\Tower Mine\Permit Plates Renumbered\Plate 3-4D - Wildlife Distribution - Sage Grouse.dwg, Sage Grouse Range, 2/22/2016 8:58:08 AM, 1:1

FORMERLY FIGURE 4-1

CENTENNIAL PROJECT
REGIONAL LAND USE MAP

PLATE 4-1

DATE: FEB. 22, 2016
REVISION NUMBER: 2

1500' 0 3000' 6000'

KYUNE II GRAZING ALLOTMENT

PACE POND

DOWNARD CABIN

WILLOW CREEK GRAZING ALLOTMENT

TYPICAL SURFACE PERMIT ONLY (NO MINERALS)

OSO GAS WELL PAD AND PIPELINE (±11.92 ACRES - NOT IN PERMIT AREA)

T. 12 S.
T. 13 S.

R. 10 E.
R. 11 E.

MILBURN MINE

ARRONCO MINE

ABERDEEN MINE

KENILWORTH MINE

ROCK TUNNEL/ KENILWORTH MINE

ROCK TUNNEL/ KENILWORTH MINE

WOOD HILL GRAZING ALLOTMENT

COAL CREEK GRAZING ALLOTMENT

SURFACE FACILITIES

DEADMAN GRAZING ALLOTMENT

CORNER GRAZING ALLOTMENT

I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE

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David W. Hibbs
PROFESSIONAL ENGINEER

LEGEND

- BLM LANDS - WILDLIFE HABITAT, GRAZING, AND INCIDENTAL RECREATION - MINING & COALBED METHANE EXTRACTION PERMITTED AREAS ONLY
- INCORPORATED AREA - RESIDENTIAL, COMMERCIAL, INDUSTRIAL
- GRAZING ALLOTMENTS - PER NAME
- EXISTING FACILITIES / STRUCTURES

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PRICE, UTAH

G:\Current Drawings\MRP Maps\Tower Mine\Permit Plates Renumbered\Plate 4-1 - Regional Land Use.dwg, Land Use Map, 2/22/2016 9:00:55 AM, 1:1

FORMERLY PLATE 2

CENTENNIAL PROJECT
REGIONAL SURFACE OWNERSHIP MAP

PLATE 5-1

DATE: FEB. 22, 2016
REVISION NUMBER: 2

I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

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USA
Dennis Bottino
Mary Frandsen Trust
Blackhawk Coal Co.
Mathis Land Inc.
John Critchlow et al
R. 10 E.
R. 11 E.
Jay Critchlow et al
R.D. Campbell
Shimmin Investments
Scott W. Mathis
Scott and Donna Mathis
Mathis Canyon Inc.
Scott Mathis
Jerry Carlson Properties
T. 12 S.
T. 13 S.
Dave Cave et al
SURFACE PERMIT ONLY (NO MINERALS)
OSO GAS WELL PAD AND PIPELINE (±11.92 ACRES - NOT IN PERMIT AREA)
Blackhawk Coal Company
Deseret Title Corp.
Robert Nelson
AMCA
Canyon Fuel
Cave et al
State of Utah
KENILWORTH

LEGEND
- PROPERTY LINES
- PERMIT LINE
- PERMIT LINE (SURFACE ONLY)

1250 0 2500 5000 FEET
SCALE: 1" = 2,500 FEET

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TOWER DIVISION
PRICE, UTAH

G:\Centennial Project\Mine Plan\Figures\Plate Figures\Plate 5-1 Surface Ownership Map_Surface Ownership_2016.mxd 2/22/2016 9:32:37 AM 1:1

FORMERLY PLATE 35

CENTENNIAL PROJECT
TYPICAL ROAD
CROSS SECTIONS

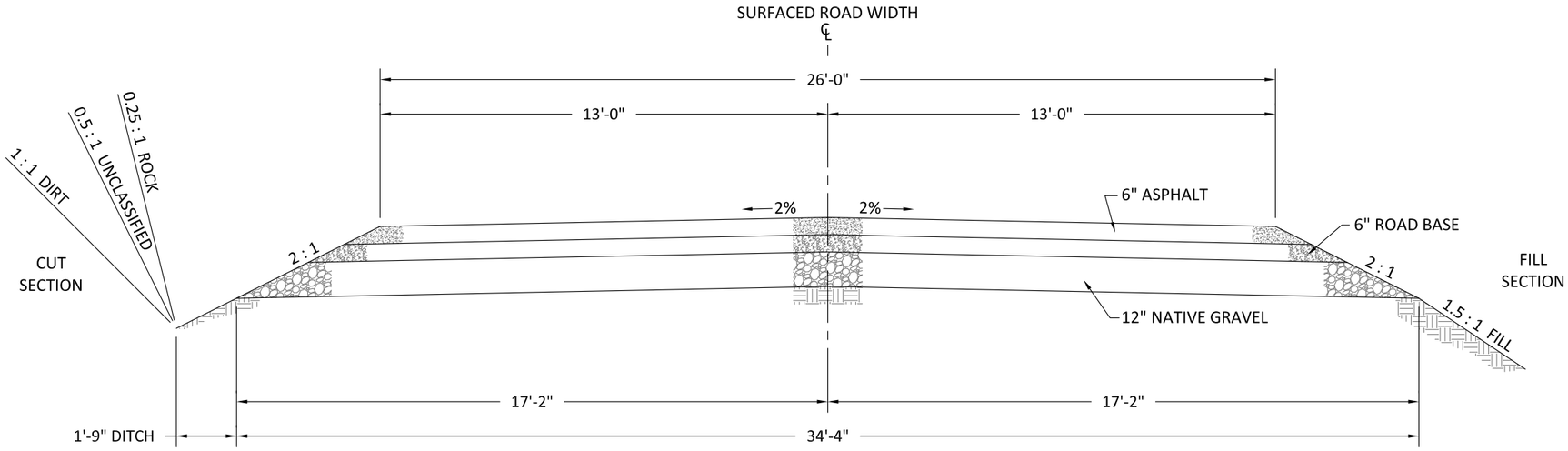
PLATE 5-10

DATE: FEB. 22, 2016
REVISION NUMBER: 2

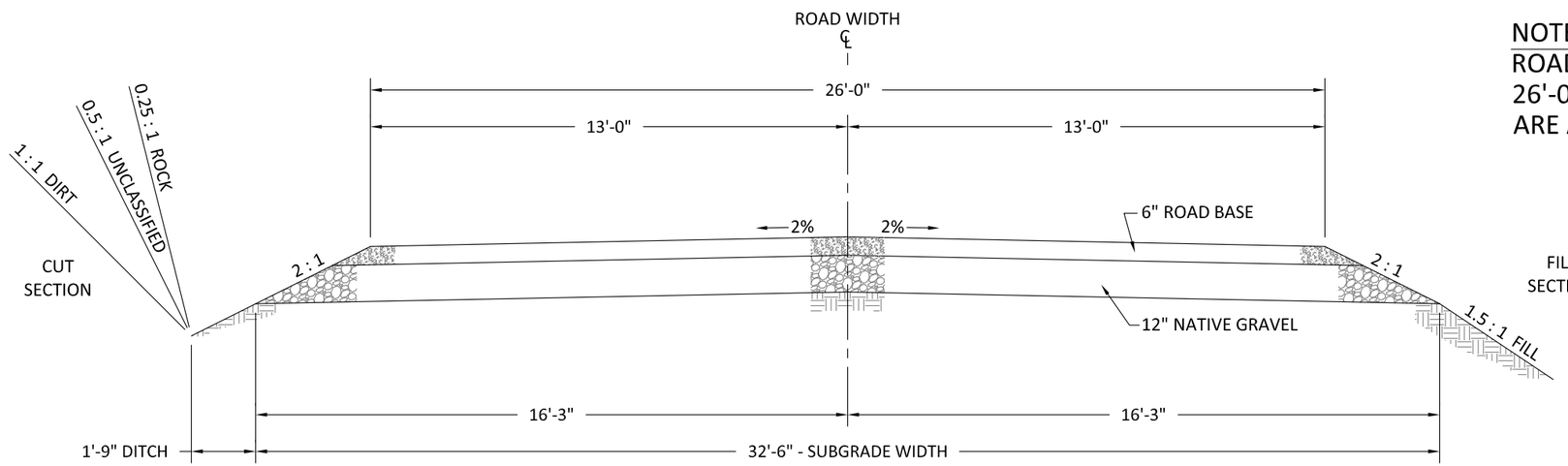
2 0 4 8 FEET

SCALE: 1/4" = 1'-0"

TYPICAL CROSS SECTION FOR PAVED AREAS



TYPICAL CROSS SECTION FOR UNPAVED AREAS



NOTE:
ROAD WIDTHS MAY VARY FROM 12'-0" TO 26'-0". TYPICAL SLOPES AND SURFACING ARE AS SHOWN.

I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

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G:\Current Drawings\MRP Maps\Tower Mine\Permit Plates Renumbered\Plate 5-10 - Road Cross Sections.dwg, Plate 5-10, 2/22/2016 10:46:48 AM, 1:1

FORMERLY PLATE 25

CENTENNIAL PROJECT
SUBSIDENCE MONITORING STATIONS

PLATE 5-11

DATE: FEB. 22, 2016
REVISION NUMBER: 2

1250 0 2500 5000 FEET
SCALE: 1" = 2,500 FEET

R. 10 E.
R. 11 E.

T. 12 S.
T. 13 S.

TYPICAL SURFACE PERMIT ONLY (NO MINERALS)

OSO GAS WELL PAD AND PIPELINE (±11.92 ACRES - NOT IN PERMIT AREA)

LIMIT OF SUBSIDENCE (20 DEGREE)

SURFACE FACILITIES

TYPICAL EPHEMERAL DRAINAGE CHANNEL

Rebar on ridge

Blue Flame No. 1 Mine

Outcrop

KENILWORTH

LEGEND

- SUBSIDENCE MONITORING STATION
- PERMIT LINE
- PERMIT LINE (SURFACE ONLY)

I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

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G:\Current Drawings\MRP Maps\Tower Mine\Permit Plates Renumbered\Plate 5-11 - Subsidence Monitoring R3.dwg, Subsidence Monitoring, 2/22/2016 10:47:53 AM, 1:1

FORMERLY PLATE 3

CENTENNIAL PROJECT
REGIONAL MINERAL OWNERSHIP MAP

PLATE 5-2

DATE: FEB. 22, 2016
REVISION NUMBER: 2

1250 0 2500 5000 FEET
SCALE: 1" = 2,500 FEET

N

I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

UTAH REGISTERED PROFESSIONAL ENGINEER
#6449561
David W. Hibbs

USA-BLM
Carbon County
State of Utah
Carbon County Sublease
Carbon County
Edwards
Blackhawk Coal Company
KENILWORTH
State of Utah
Carbon County
Whitmore Fee Lease
Andalex Fee
Sunedco Fee Lease

R. 10 E.
R. 11 E.

T. 12 S.
T. 13 S.
Fee Coal

MATHIS FEE (UNLEASED)
FEDERAL LEASE UTU-81893
MATHIS FEE
FEDERAL LEASE UTU-66060
AEP Fee Coal
FEDERAL LEASE UTU-69600
ZION FEE
SURFACE FACILITIES

SURFACE PERMIT ONLY (NO MINERALS)

OSO GAS WELL PAD AND PIPELINE (±11.92 ACRES - NOT IN PERMIT AREA)

SURFACE PERMIT ONLY (NO MINERALS)

LEGEND

- PERMIT BOUNDARY
- SURFACE PERMIT BOUNDARY
- LEASE BOUNDARY
- ① FEDERAL LEASE UTU-010581
- ② FEDERAL LEASE UTSL-27304
- ③ FEDERAL LEASE UTSL-63058

ANDALEX RESOURCES, INC.
TOWER DIVISION
PRICE, UTAH

G:\Current Drawings\Maps\Mine Tower Maps\Permit Plates Renumbered\Plate 5-2 Mineral Ownership.dgn Mineral Ownership 2/22/2016 09:09:39 AM 1:1

FORMERLY PLATE 26

CENTENNIAL PROJECT
LOWER SUNNYSIDE SEAM
PRODUCTION AREAS

PLATE 5-3

DATE: FEB. 22, 2016
REVISION NUMBER: 2

1250 0 2500 5000 FEET

SCALE: 1" = 2,500 FEET

I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

UTAH REGISTERED PROFESSIONAL ENGINEER
#6449561
David W. Hibbs

R. 10 E.
R. 11 E.

T. 12 S.
T. 13 S.

TYPICAL SURFACE PERMIT ONLY (NO MINERALS)

OSO GAS WELL PAD AND PIPELINE (±11.92 ACRES - NOT IN PERMIT AREA)

DH-6
DH P.G&E
DH-5
MC-191
77-3-CP
DH-2
89-1-APEX
DH-7 NACC
77-2-CP
DH-2A
77-1-CP
DH-1
MC-193
77-5-CP
77-4-CP
77-6-CP
77-7-CP
SURFACE FACILITIES

APEX MINE
LOWER SUNNYSIDE SEAM

NOTE:
THE APEX MINE IS NOW INACTIVE, CLOSED AND SEALED.

LEGEND
PERMIT LINE
PERMIT LINE (SURFACE ONLY)

ANDALEX RESOURCES, INC.
TOWER DIVISION
PRICE, UTAH

KENILWORTH

G:\Current Drawings\WRP Maps\Tower Mine\Permit Plates Renumbered\Plate 5-3 - Lower Sunnyside Production.dwg, Lower Sunnyside Seam, 2/22/2016 9:06:04 AM, 1:1

FORMERLY PLATE 27

CENTENNIAL PROJECT
CENTENNIAL SEAM PRODUCTION AREAS

PLATE 5-4

DATE: FEB. 22, 2016
REVISION NUMBER: 2

1250 0 2500 5000 FEET

SCALE: 1" = 2,500 FEET

I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

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#6449561
David W. Hibbs

R. 10 E.
R. 11 E.

T. 12 S.
T. 13 S.

NEW COAL LEASE BOUNDARY

UNLEASED AREA

NEW COAL LEASE BOUNDARY

2000' COVER

SURFACE PERMIT ONLY (NO MINERALS)

OSO GAS WELL PAD AND PIPELINE (11.92± ACRES – NOT IN PERMIT AREA)

2000' COVER

6.0
6.5
7.0
7.5

Centennial Seam Isopachs

Pinnacle Mine Centennial Seam

3rd West

1st West

Main West

North Split

Rock Tunnels From Gilson Seam to Centennial Seam

NEW COAL LEASE BOUNDARY

SURFACE PERMIT ONLY (NO MINERALS)

Outcrop

T. 12 S.
T. 13 S.

R. 10 E.
R. 11 E.

NOTE:
The Pinnacle Mine is now inactive, closed and sealed.

LEGEND
PERMIT LINE
PERMIT LINE (SURFACE ONLY)

ANDALEX RESOURCES, INC.
TOWER DIVISION
PRICE, UTAH

KENILWORTH

G:\Current Drawings\MRP Maps\Tower Mine\Permit Plates Renumbered\Plate 5-4 - Centennial Seam Isopachs.dwg, Plate 5-4, 2/22/2016 9:08:58 AM, 1:1

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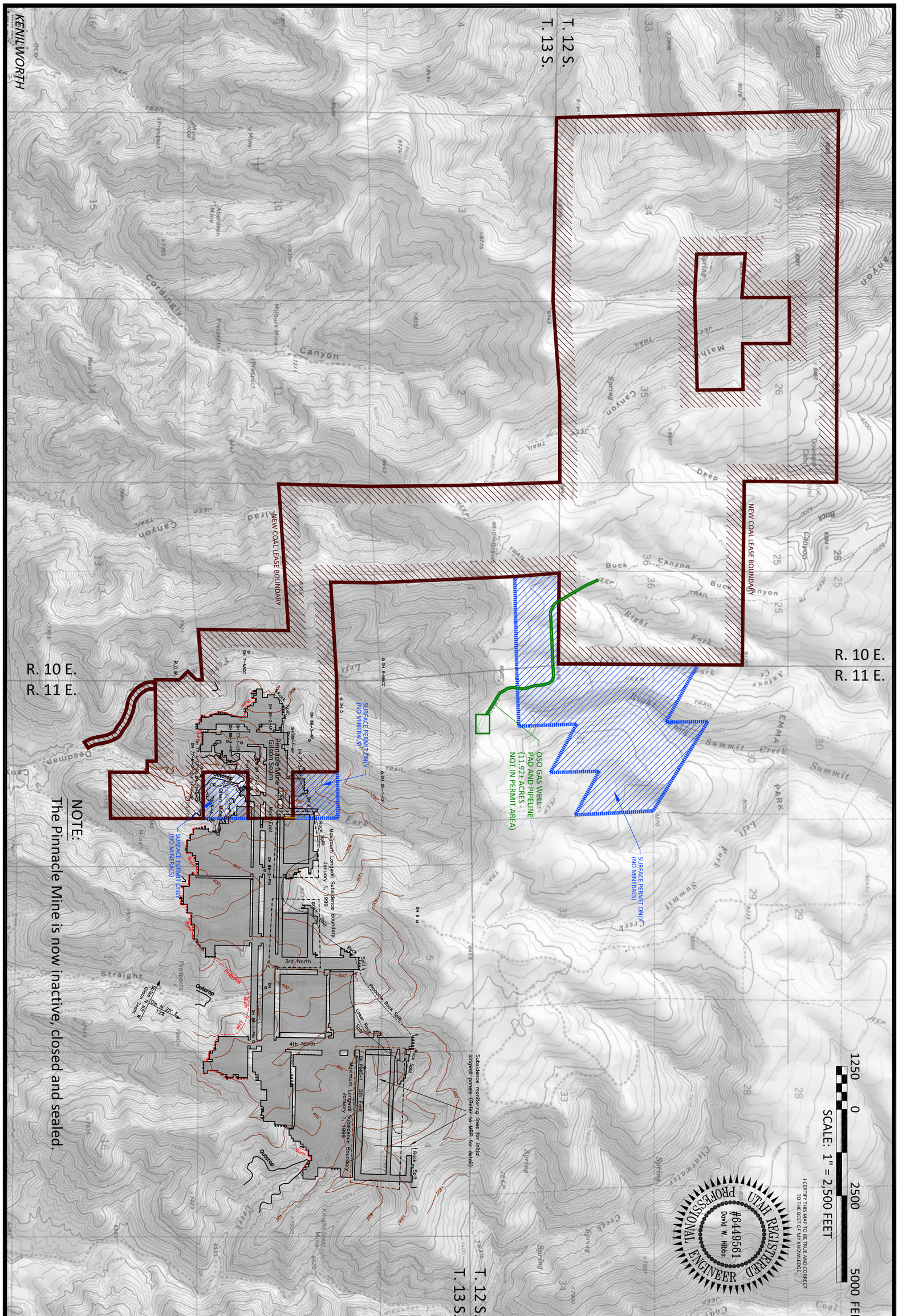

NOTE:
The Pinnacle Mine is now inactive, closed and sealed.

ANDALEX RESOURCES, INC.
TOWER DIVISION
PRICE, UTAH

LEGEND
PERMIT LINE
PERMIT LINE (SURFACE ONLY)

CENTENNIAL PROJECT
GILSON SEAM PRODUCTION AREAS

DATE: FEB. 22, 2016
REVISION NUMBER: 2

PLATE 5-5

FORMERLY PLATE 28

FORMERLY PLATE 29

CENTENNIAL PROJECT
ABERDEEN SEAM
PROPOSED MINE PLAN

PLATE 5-6

DATE: FEB. 22, 2016

REVISION NUMBER: 2

1250 0 2500 5000 FEET

SCALE: 1" = 2,500 FEET

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#6449561
David W. Hibbs

R. 10 E.
R. 11 E.

T. 12 S.
T. 13 S.

PROPOSED WORKINGS - DEPENDENT UPON LEASE ACQUISITION AND CONDITIONS

NEW COAL LEASE BOUNDARY

UNLEASED AREA

NEW COAL LEASE BOUNDARY

NEW COAL LEASE BOUNDARY

SURFACE PERMIT ONLY (NO MINERALS)

SURFACE PERMIT ONLY (NO MINERALS)

SURFACE PERMIT ONLY (NO MINERALS)

EXISTING WORKINGS

USO GAS WELL PAD AND PIPELINE (11.92 ACRES NOT IN PERMIT AREA)

NOTE:
ADDITIONAL LEASES SHALL BE ACQUIRED PRIOR TO MINING IN ANY CURRENTLY UNLEASED AREAS.

Note:
The Aberdeen Mine in currently inactive, closed and sealed.

LEGEND
PERMIT LINE
PERMIT LINE (SURFACE ONLY)

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G:\Current Drawings\MRP Maps\Tower Mine\Permit Plates Renumbered\Plate 5-6 - Aberdeen Seam Mine Plan.dwg, Layout1, 2/22/2016 9:14:36 AM, 1:1

Sections 7 and 18, T12S, R11E

150 0 300 600 FEET

FORMERLY PLATE 14

CENTENNIAL PROJECT
CROSS SECTION REFERENCES
DEADMAN CANYON

PLATE 5-8

DATE: FEB. 22, 2016
REVISION NUMBER: 2

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Federal Lease SL-27304(M)

BLM Right-of-Way #UTU-062045

Private Property Easement

Zion Fee

Federal Lease UTU-010581

Federal Lease UTSL-63058

Federal Lease UTSL-27304

Section 18

Section 7

Federal Lease SL-27304(M)

Federal Lease UTU-010581

Federal Lease UTU-010581

0+00 1+00 2+00 3+00 4+00 5+00 6+00 7+00 8+00 9+00 10+00 11+00 12+00 13+00 14+00 15+00 16+00 17+00 18+00 19+00 20+00 21+00 22+00 23+00 24+00 25+00 26+00 27+00 28+00 29+00 30+00 31+00 32+00 33+00 34+00 35+00 36+00 37+00 38+00 39+00 40+00 41+00 42+00 43+00 44+00 45+00 46+00 47+00

LEGEND

- Disturbed Surface Boundary
- Lease Boundary
- Permit Boundary
- Permit Boundary - Surface Only

AERIAL SURVEY BY OLYMPUS AERIAL SURVEY, SLC, UTAH 2006. CONTOUR INTERVAL 10'.

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TOWER DIVISION
PRICE, UTAH

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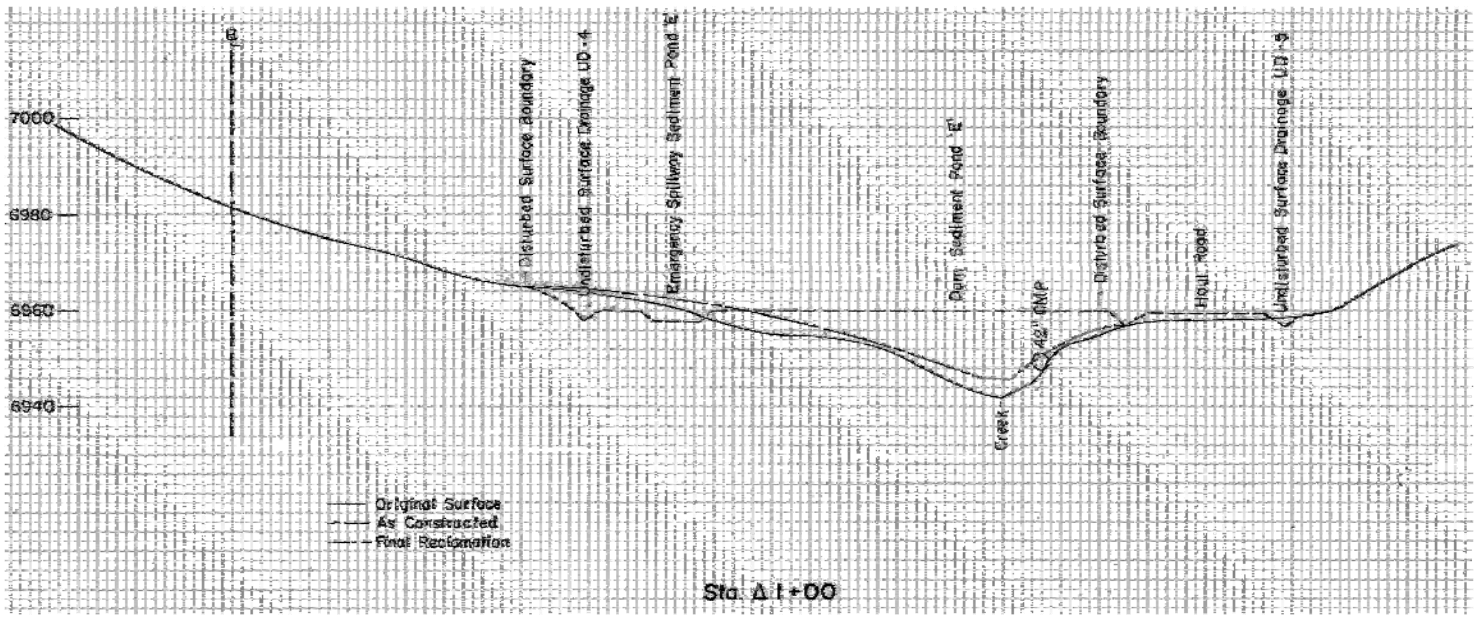

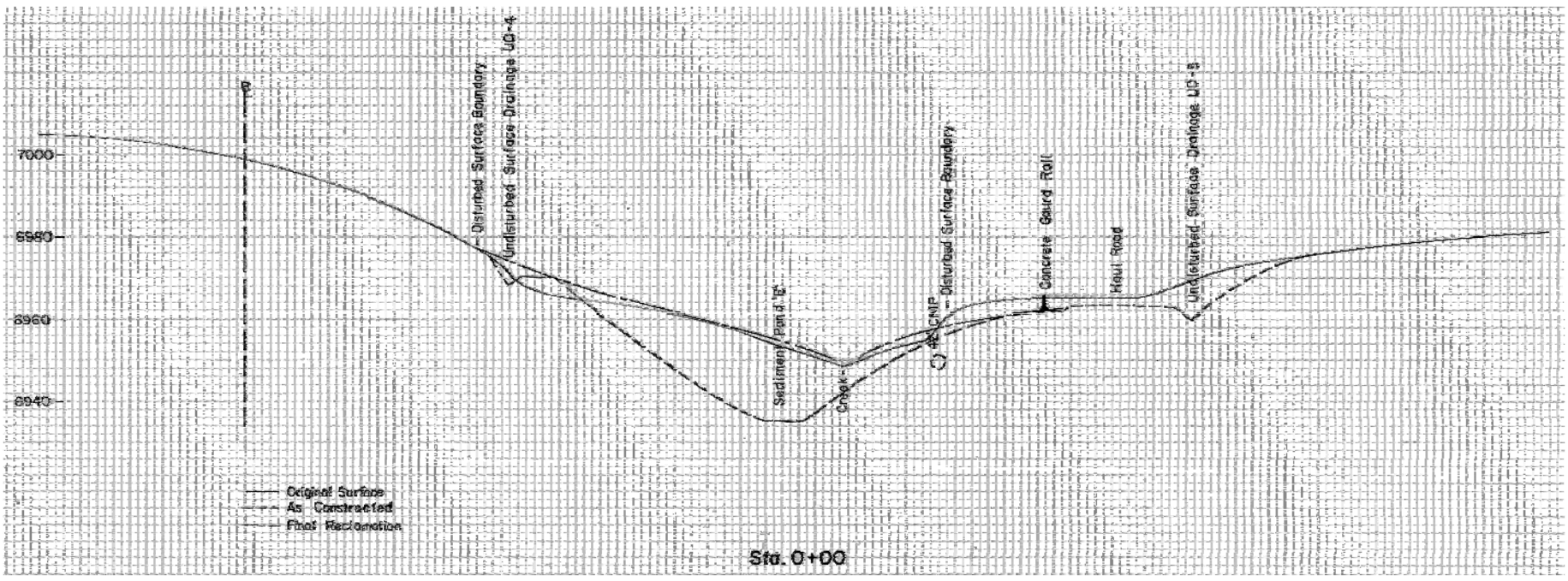

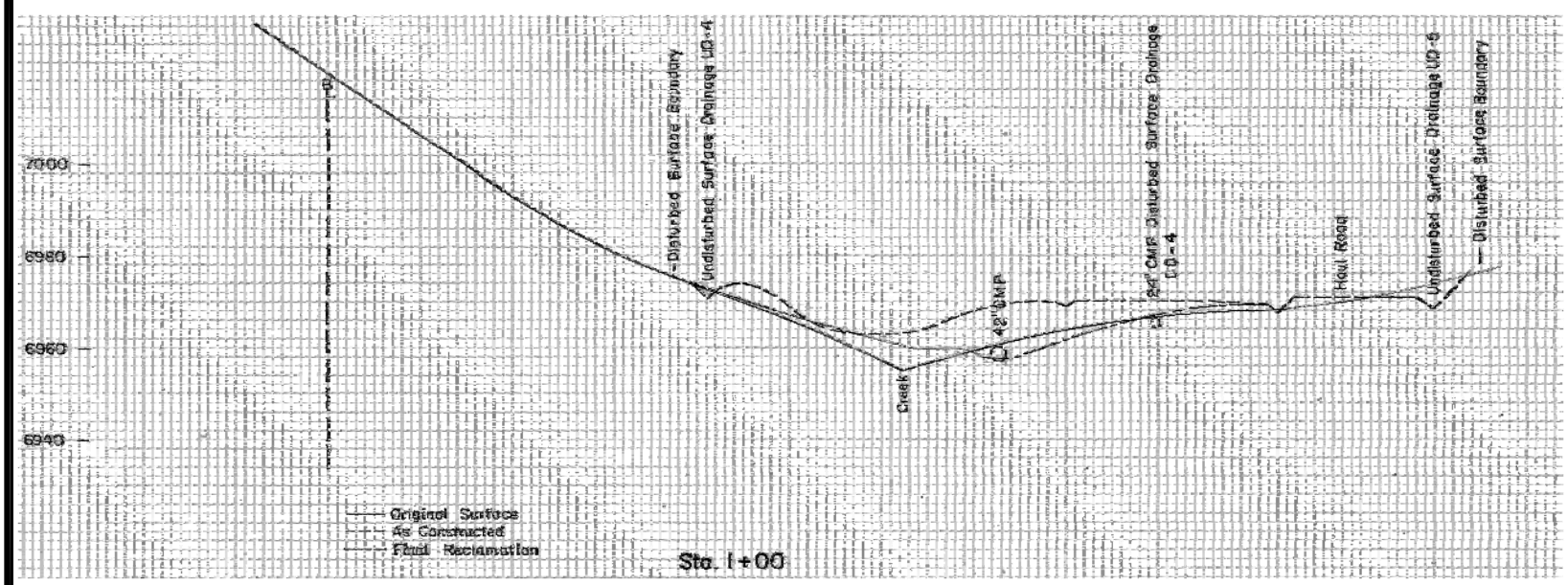

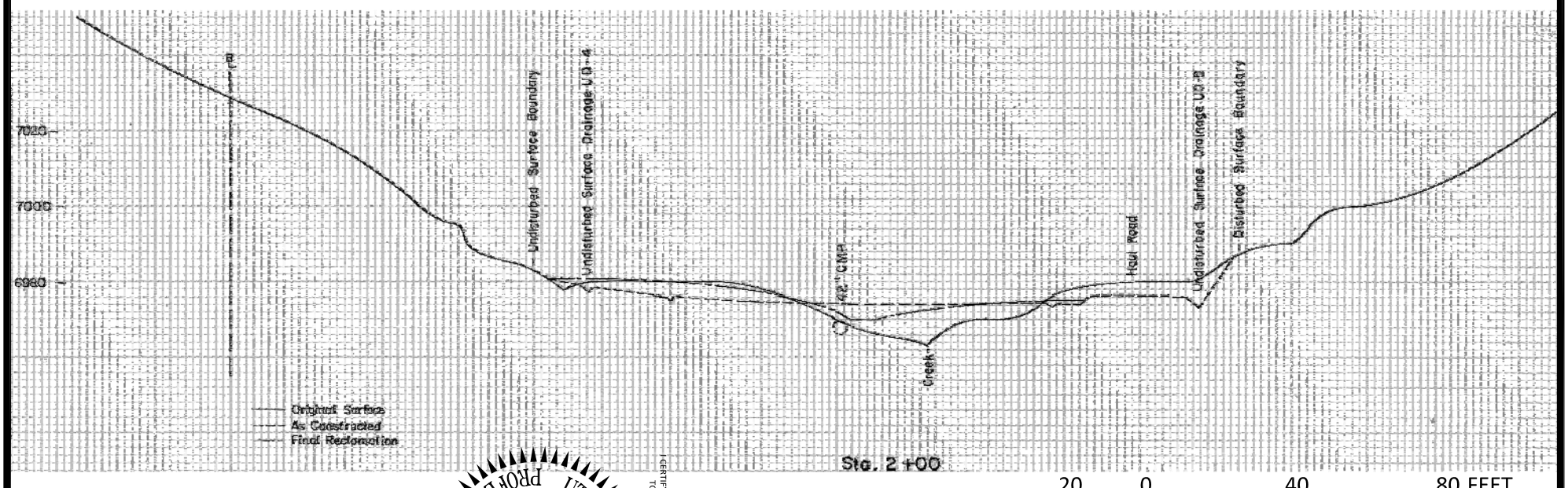

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CENTENNIAL PROJECT
SECTION PROFILES
DEADMAN CANYON

DATE FEB. 22, 2016
REVISION NUMBER 2

PLATE 5-9 SHEET 1 of 19

FORMERLY PLATE 15
SHEET 1 of 19

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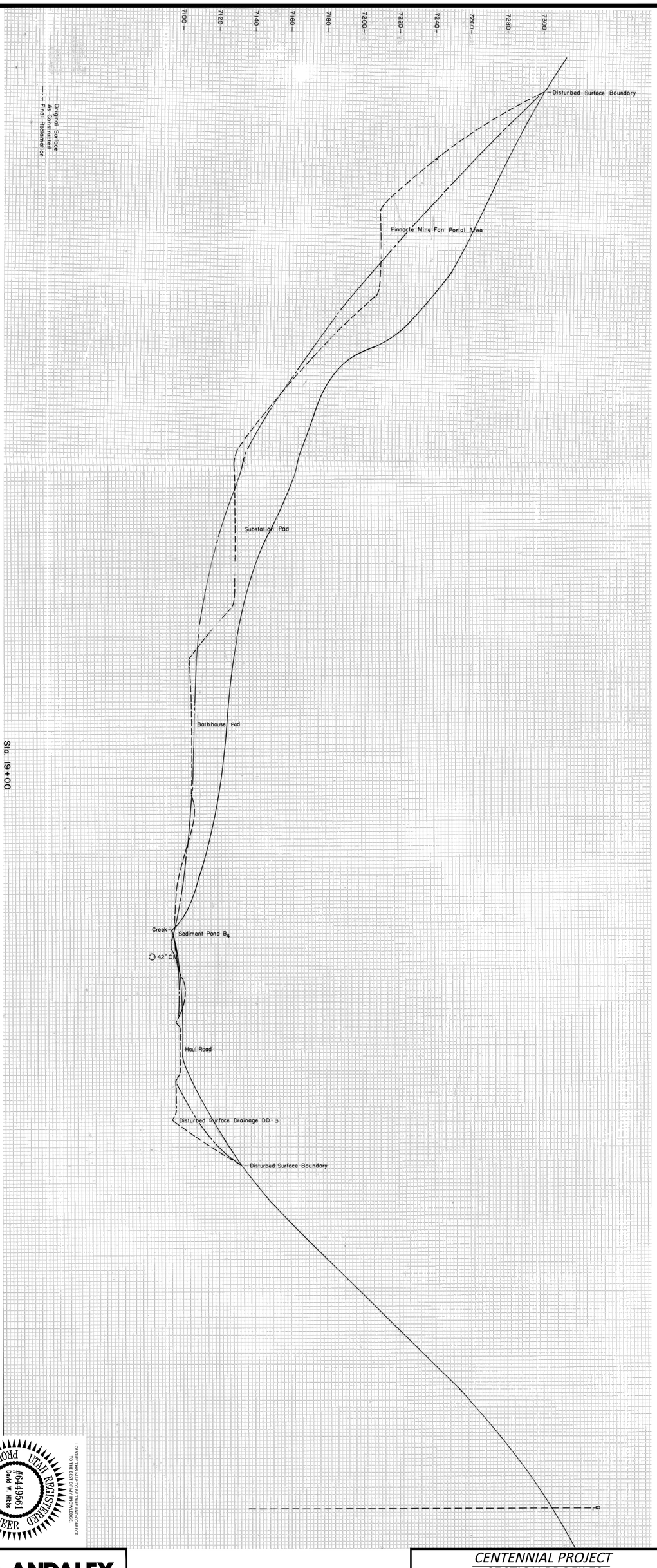

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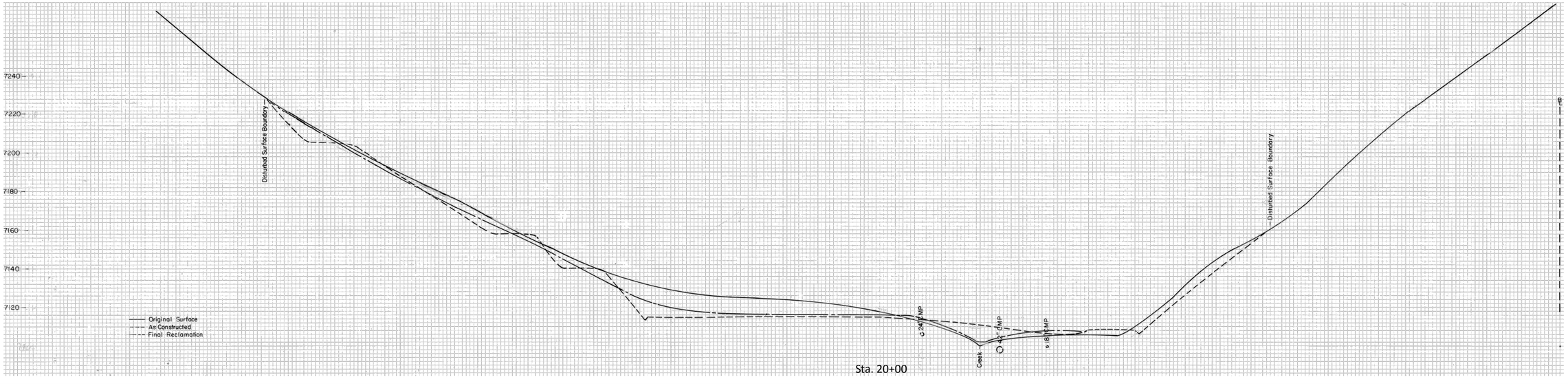
20 0 40 80 FEET

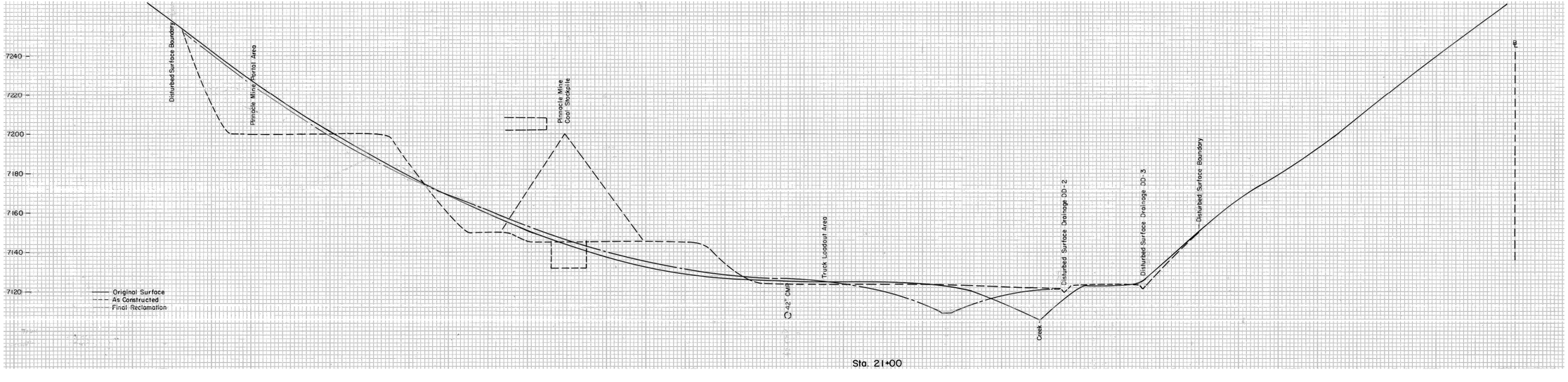
CENTENNIAL PROJECT
SECTION PROFILES
DEADMAN CANYON

DATE FEB. 22, 2016
REVISION NUMBER 2

PLATE 5-9 *SHEET 10 of 19*

FORMERLY PLATE 15
SHEET 10 of 19





FORMERLY PLATE 15
SHEET 11 of 19

80 FEET
40
0
20

CENTENNIAL PROJECT
SECTION PROFILES
DEADMAN CANYON

PLATE 5-9 SHEET 11 of 19

DATE FEB. 22, 2016
SCALE AS SHOWN 2

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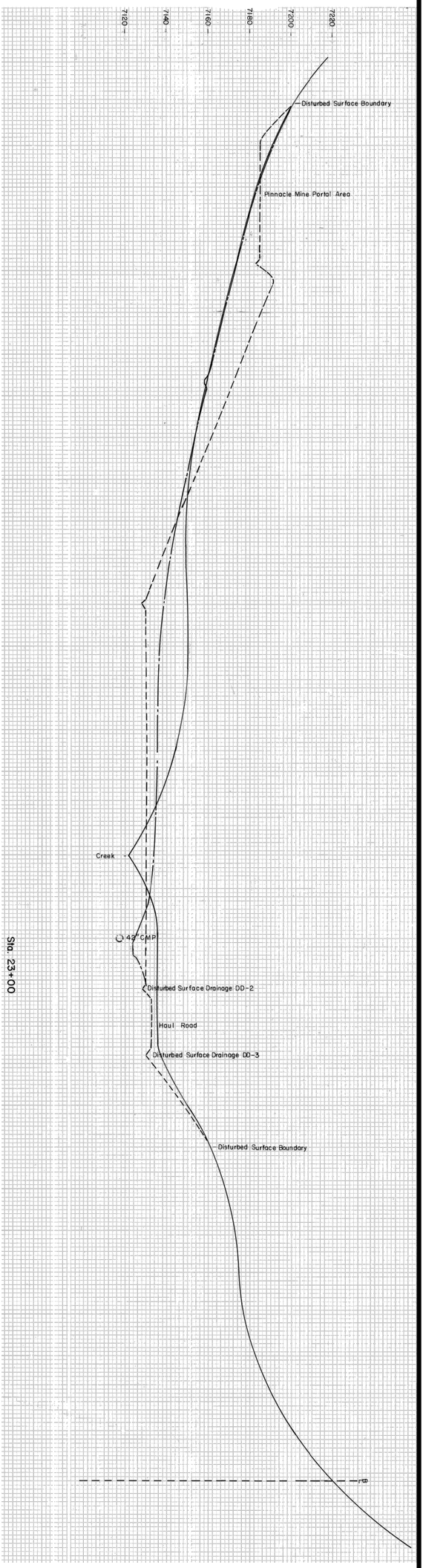

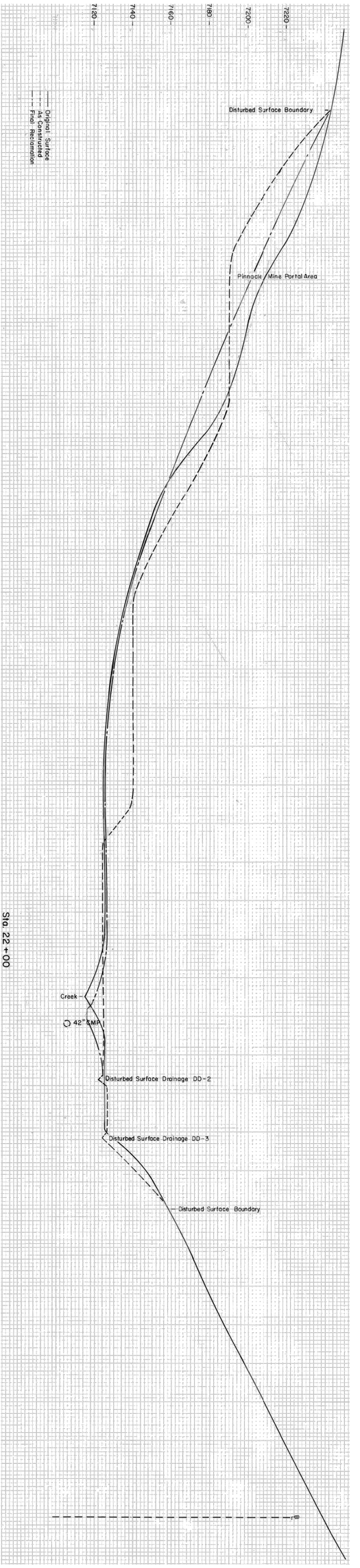

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TOWER DIVISION
PRICE, UTAH

CENTENNIAL PROJECT
SECTION PROFILES
DEADMAN CANYON

DATE: FEB. 22, 2016
REVISION NUMBER: 2

PLATE 5-9 *SHEET 12 of 19*

FORMERLY PLATE 15
SHEET 12 of 19

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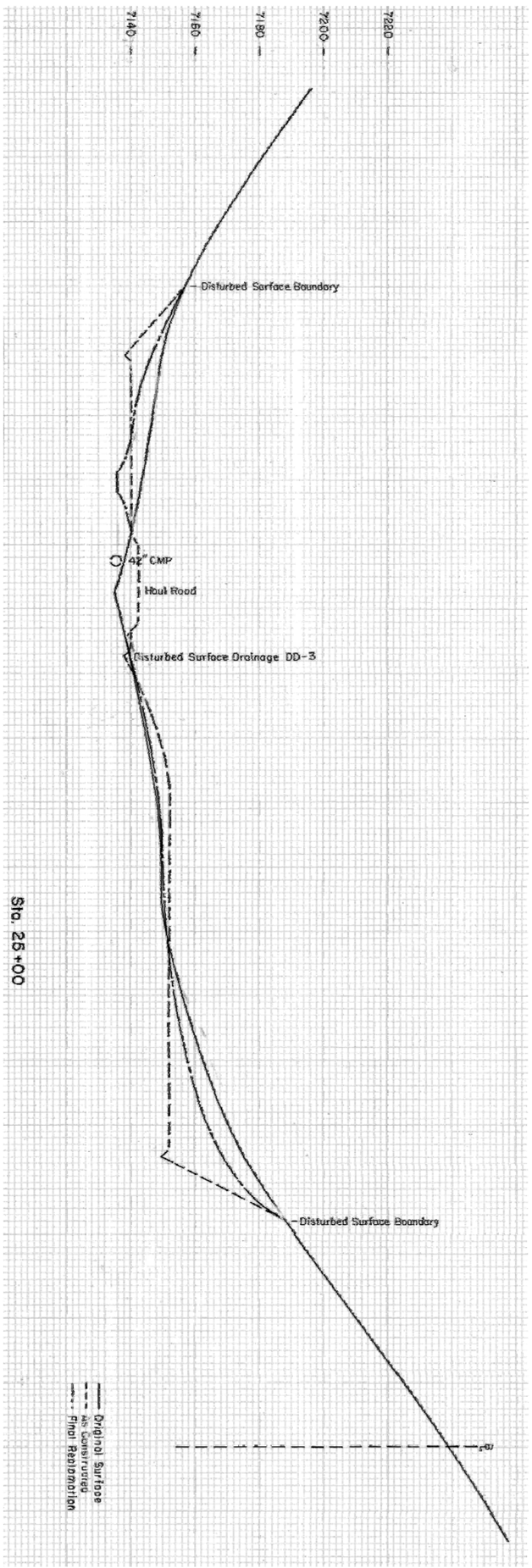

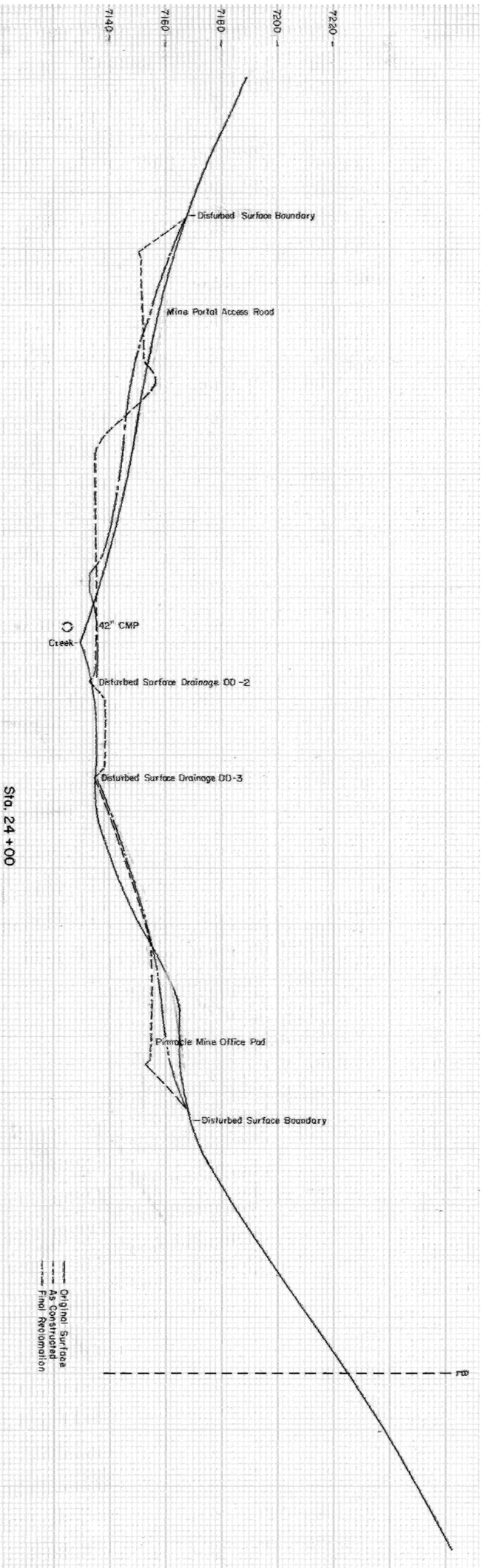

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TOWER DIVISION
PRICE, UTAH

CENTENNIAL PROJECT
SECTION PROFILES
DEADMAN CANYON

DATE FEB. 22, 2016
REVISION NUMBER 2

PLATE 5-9 SHEET 13 of 19

FORMERLY PLATE 15
SHEET 13 of 19

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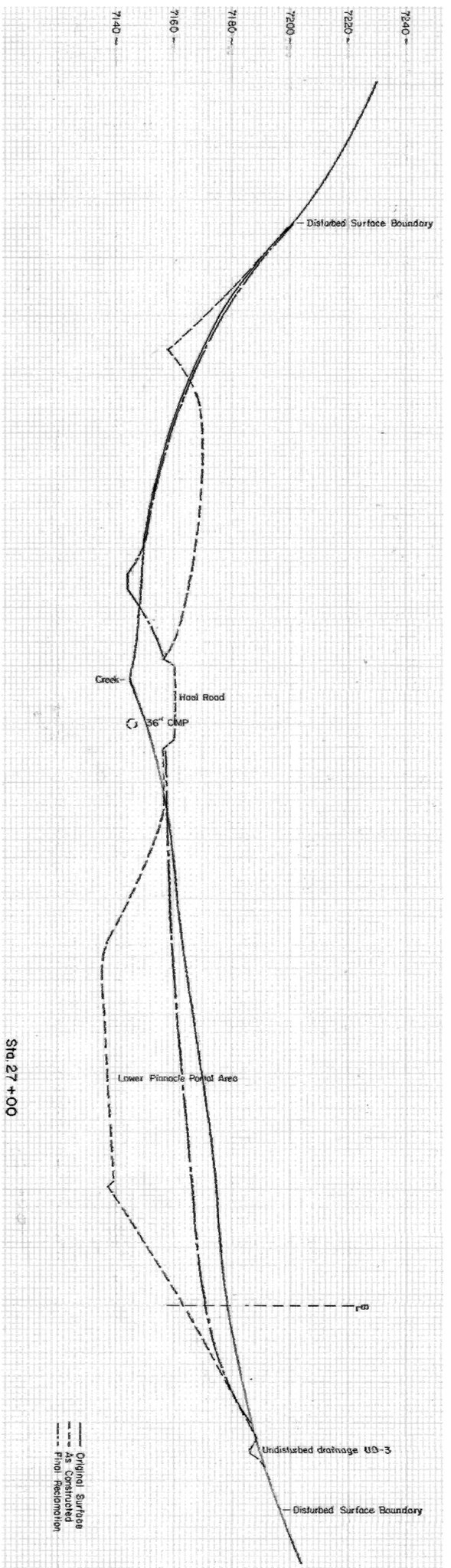

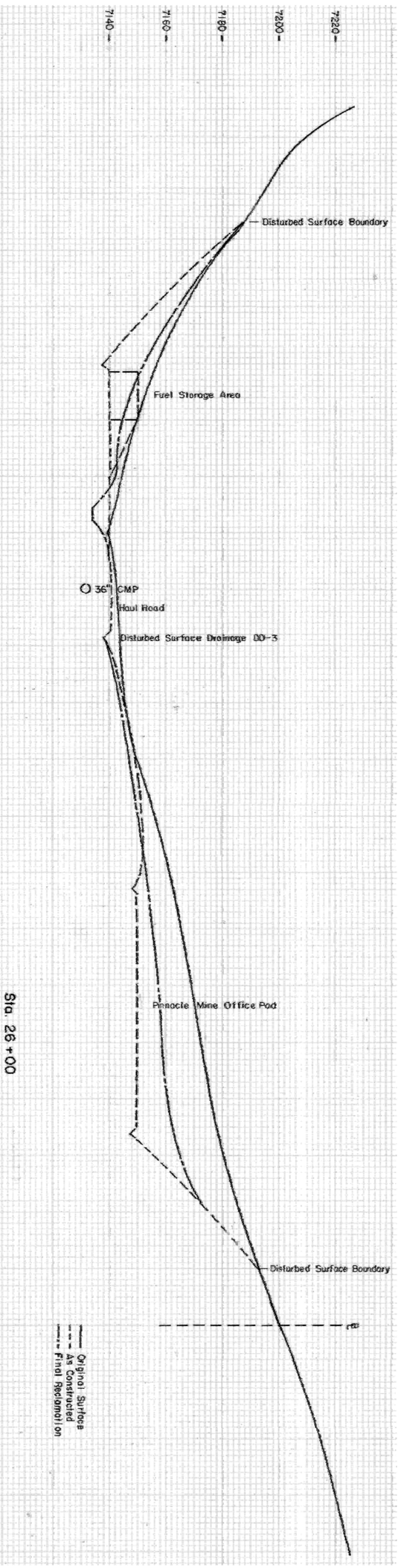

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TOWER DIVISION
PRICE, UTAH

CENTENNIAL PROJECT
SECTION PROFILES
DEADMAN CANYON

DATE FEB. 22, 2016
REVISION NUMBER 2

PLATE 5-9 SHEET 14 of 19

FORMERLY PLATE 15
SHEET 14 of 19

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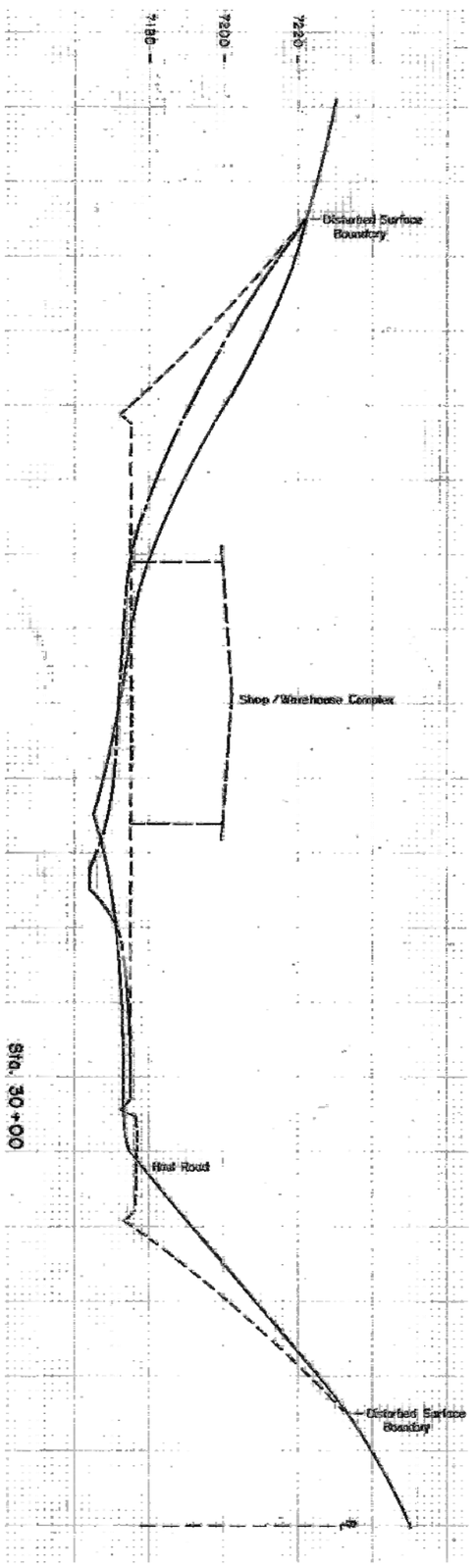

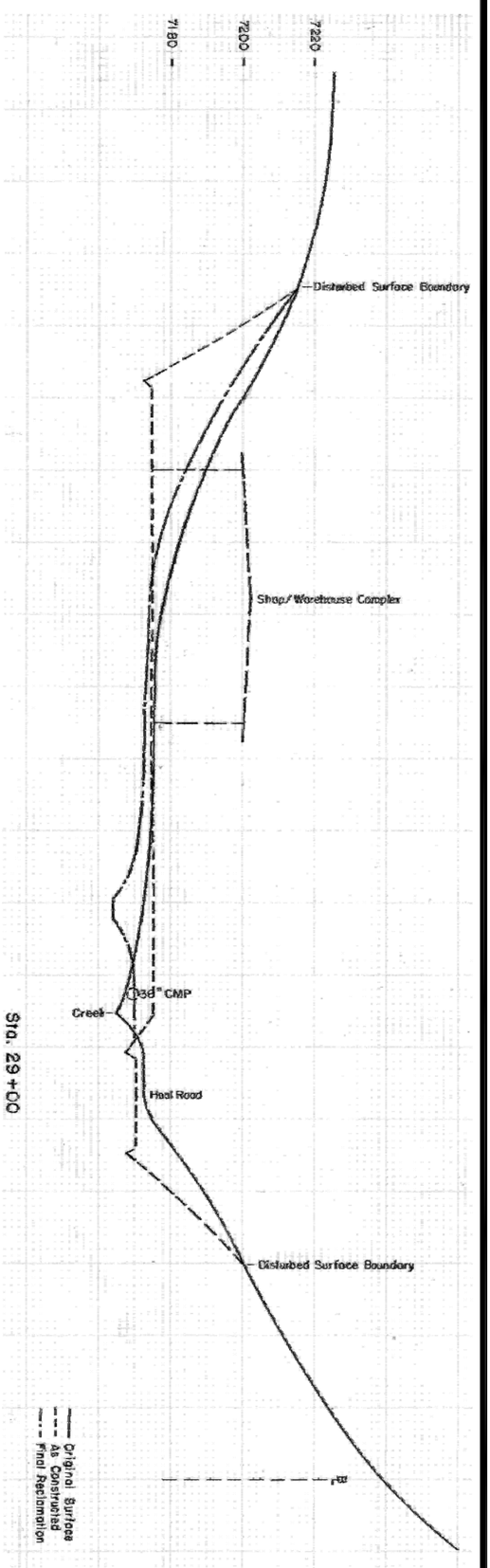

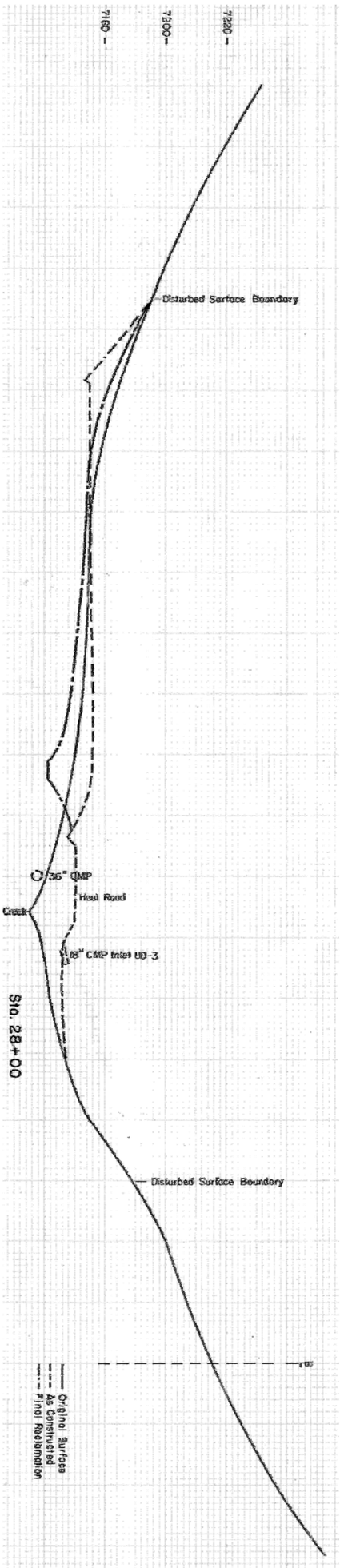

20 0 40 80 FEET

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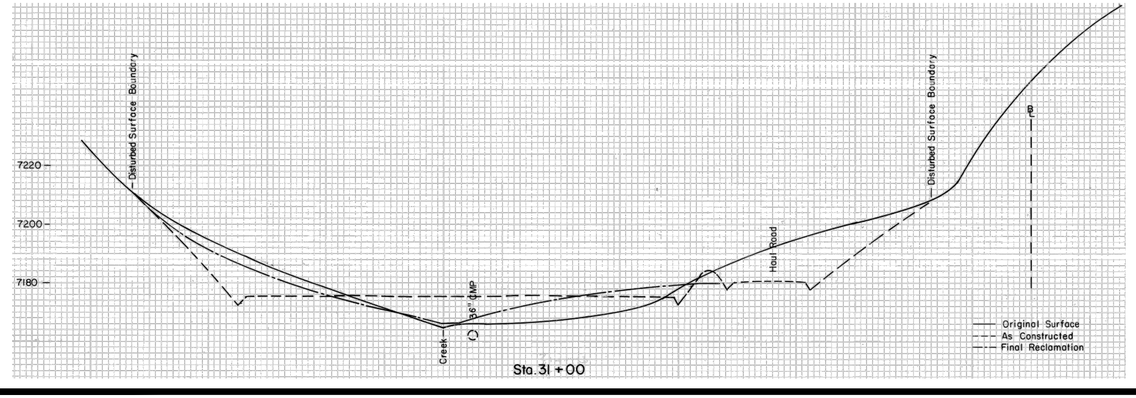
CENTENNIAL PROJECT
SECTION PROFILES
DEADMAN CANYON

DATE FEB. 22, 2016
REVISION NUMBER 2

PLATE 5-9 SHEET 15 of 19

FORMERLY PLATE 15
SHEET 15 of 19



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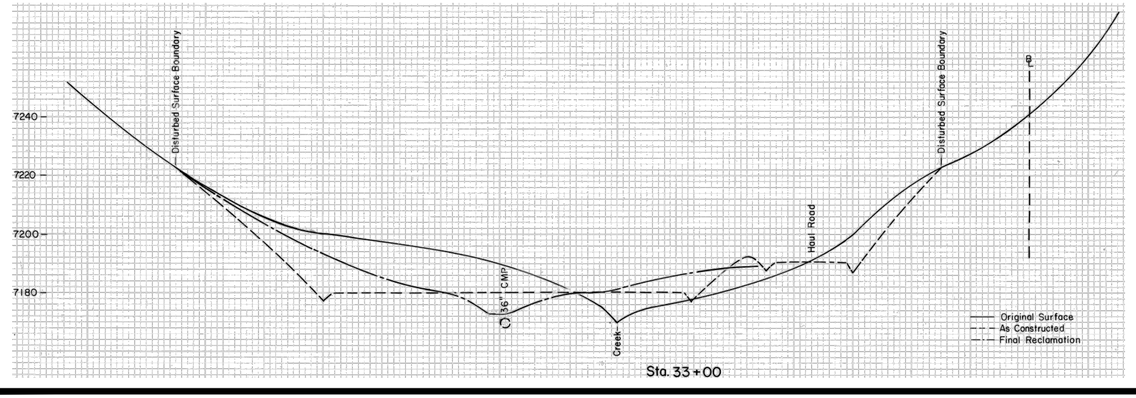

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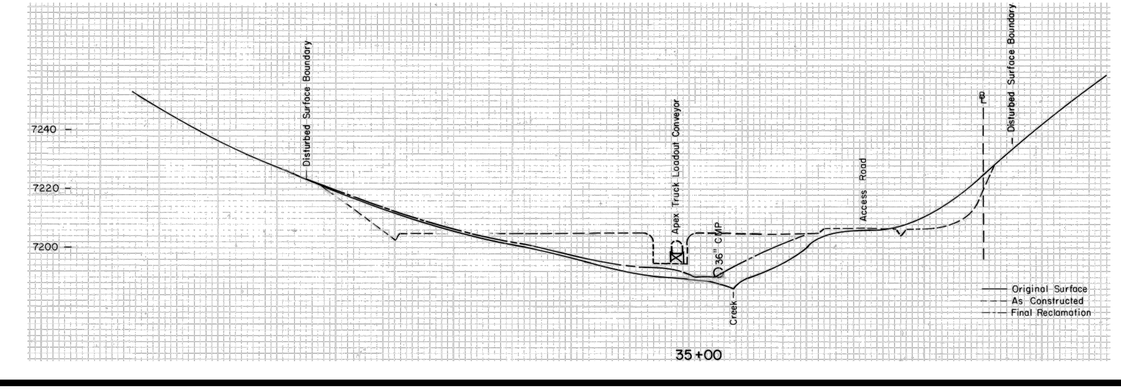

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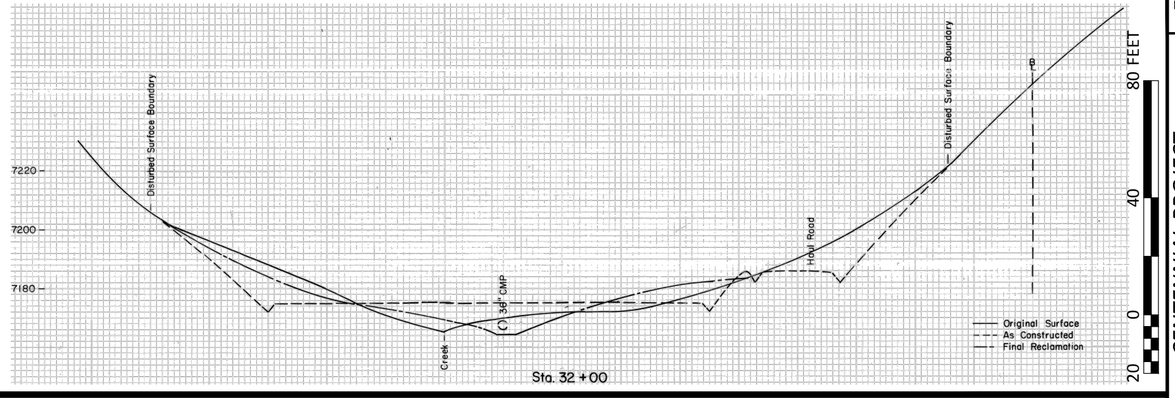

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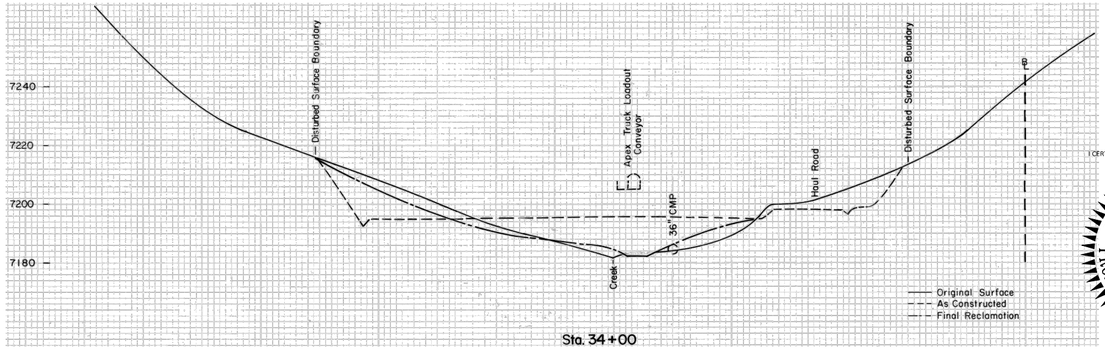

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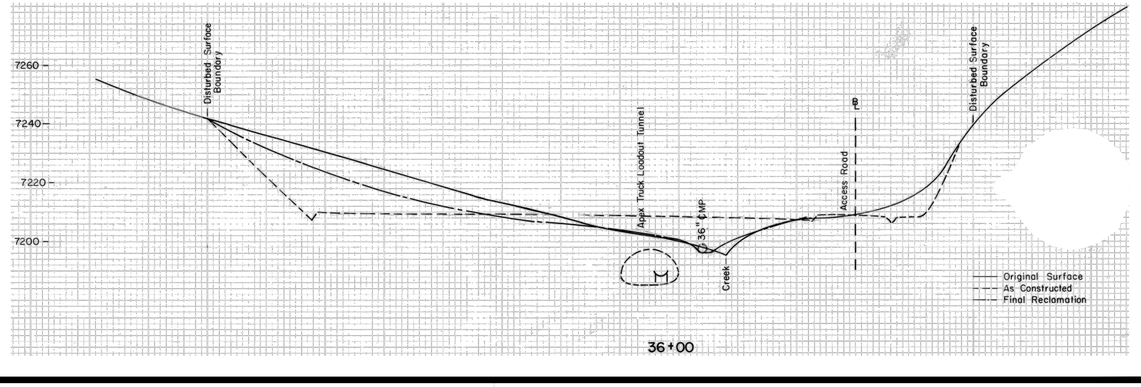

36 + 00

FORMERLY PLATE 15
SHEET 16 of 19

CENTENNIAL PROJECT
SECTION PROFILES
DEADMAN CANYON

SHEET 16 of 19

PLATE 5-9

DATE FEB. 22, 2016
REVISION NUMBER 2

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UTAH REGISTERED
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ANDALEX RESOURCES, INC.
TOWER DIVISION
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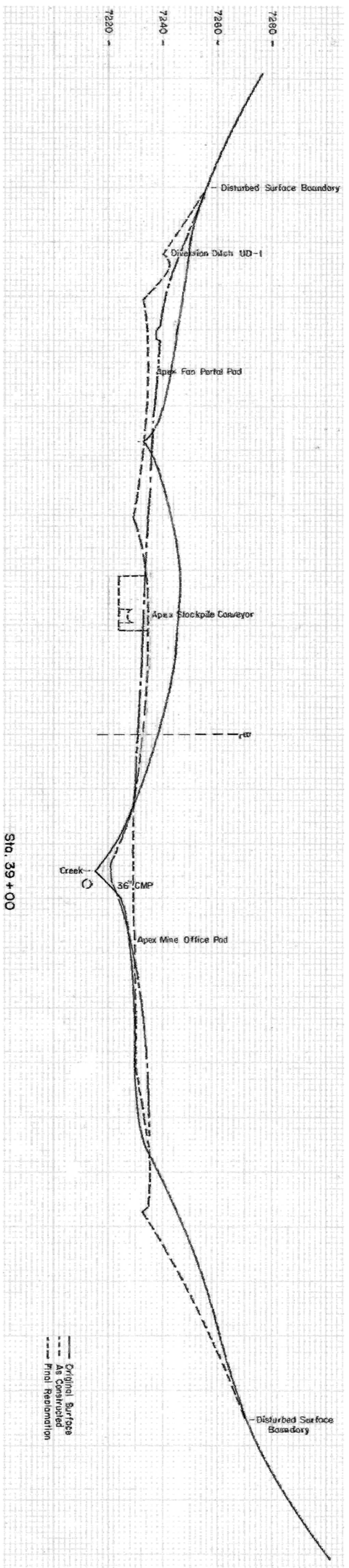

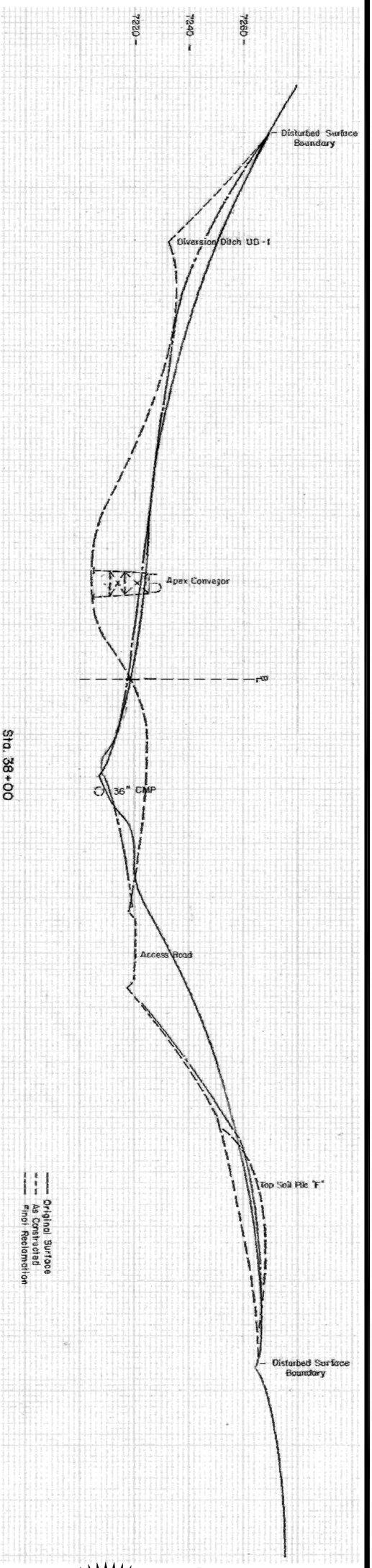

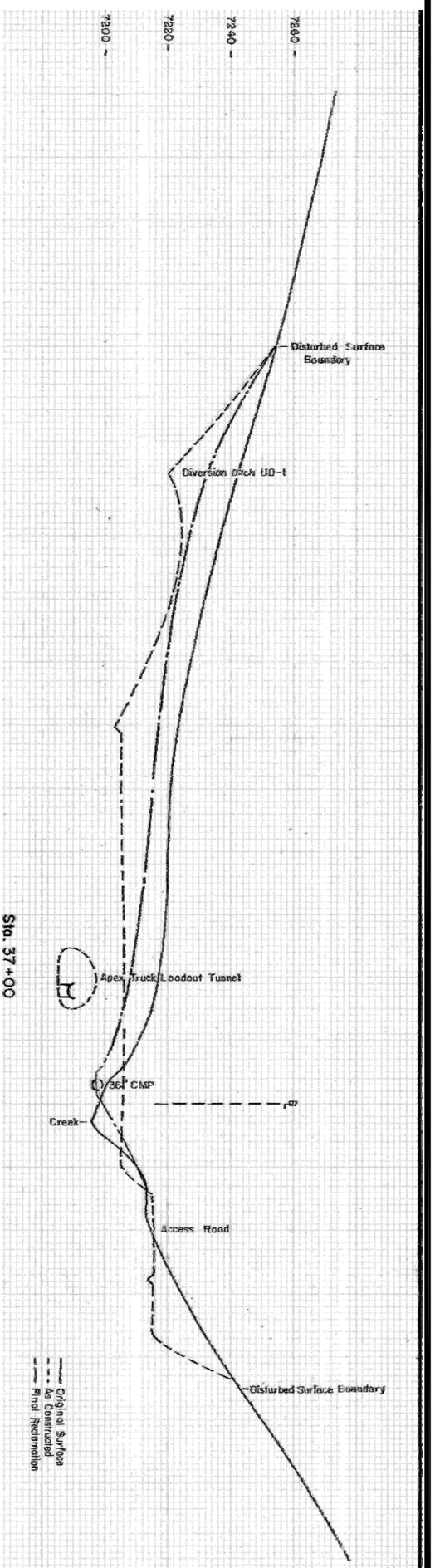

20 0 40 80 FEET

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UTAH REGISTERED
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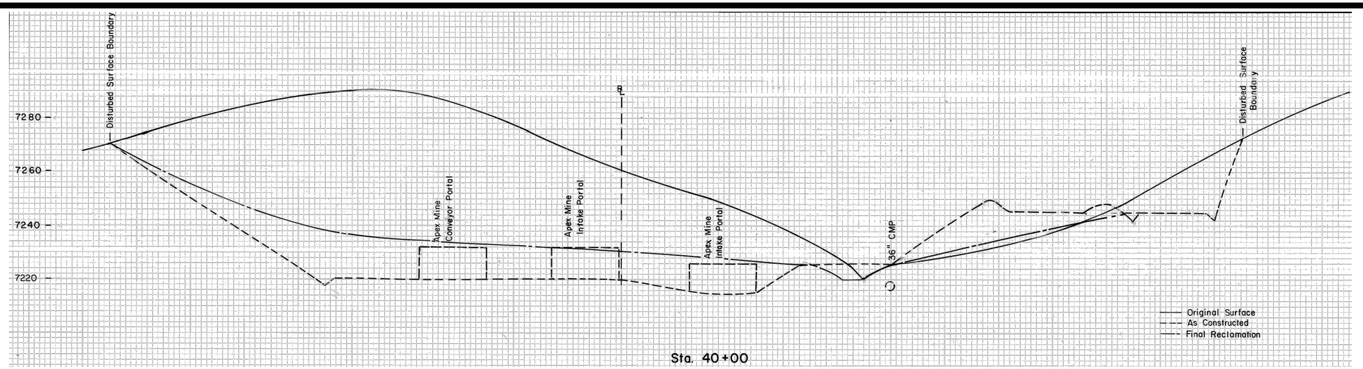
CENTENNIAL PROJECT
SECTION PROFILES
DEADMAN CANYON

DATE FEB. 22, 2016
REVISION NUMBER 2

PLATE 5-9 SHEET 17 of 19

FORMERLY PLATE 15
SHEET 17 of 19



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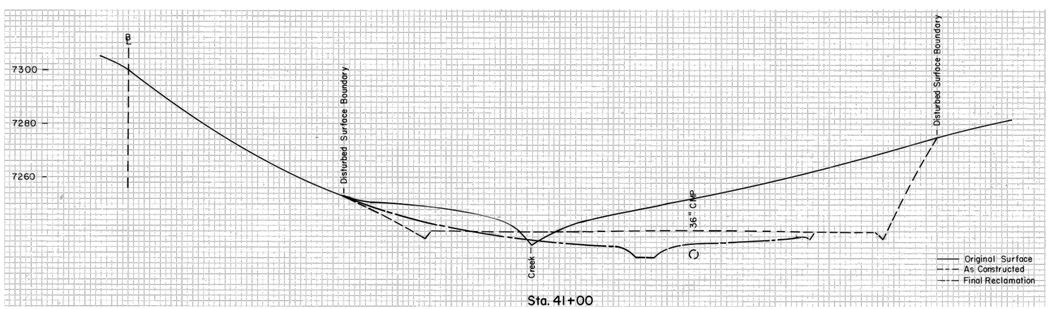

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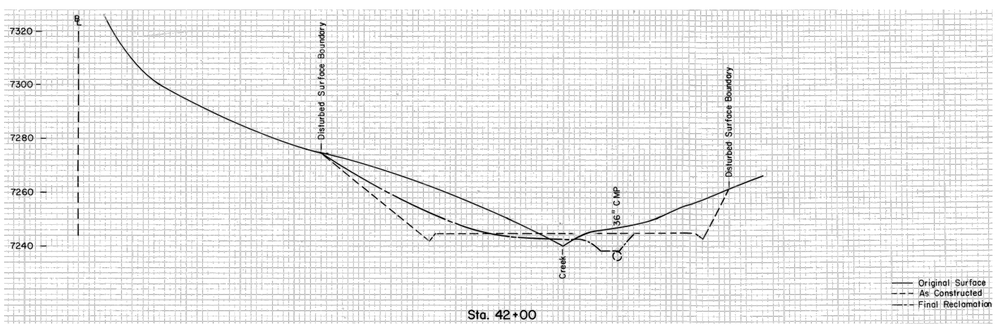

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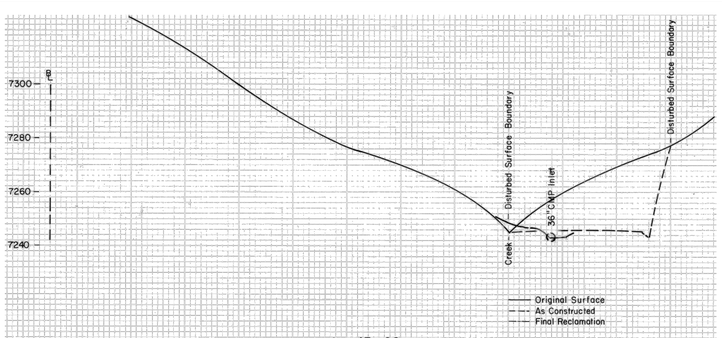

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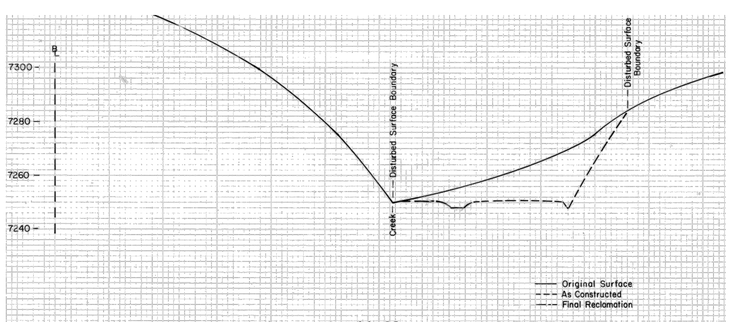

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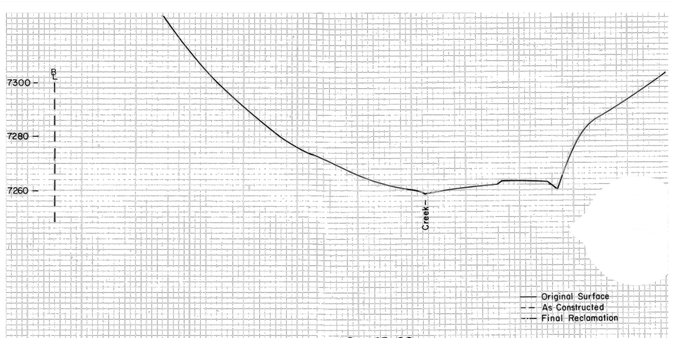

Sta. 45+00

20 0 40 80 FEET

FORMERLY PLATE 15
SHEET 18 of 19

CENTENNIAL PROJECT
SECTION PROFILES
DEADMAN CANYON

PLATE 5-9 SHEET 18 of 19

DATE FEB. 22, 2016
REVISION NUMBER 2

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UTAH REGISTERED #6449561 David W. Hibbs PROFESSIONAL ENGINEER

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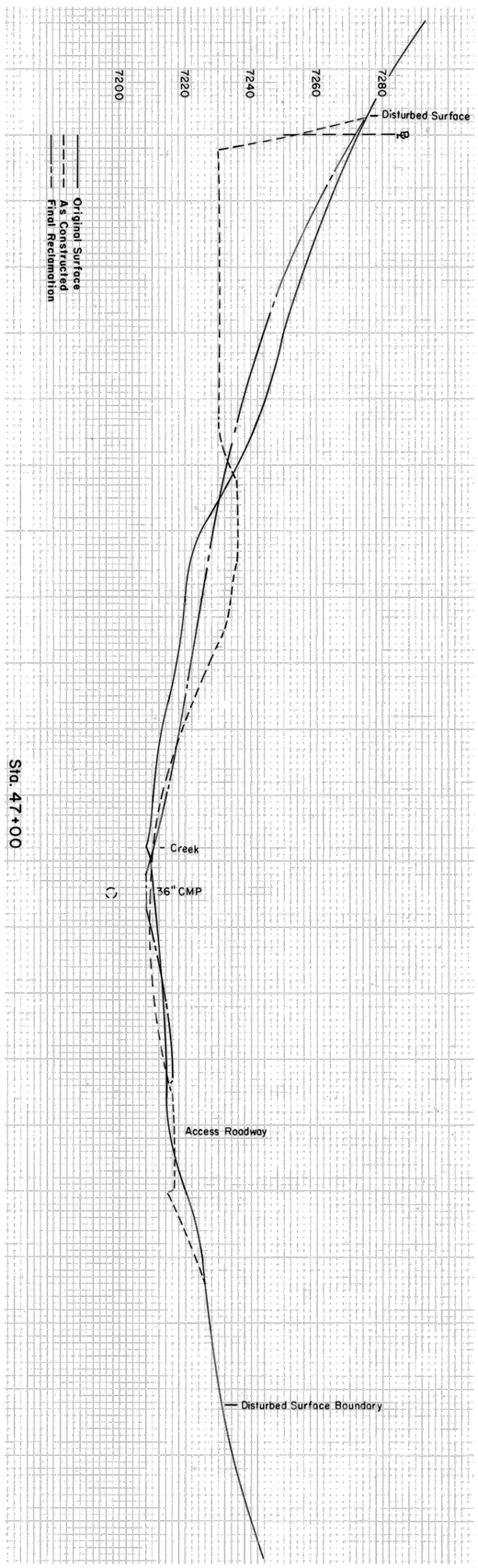
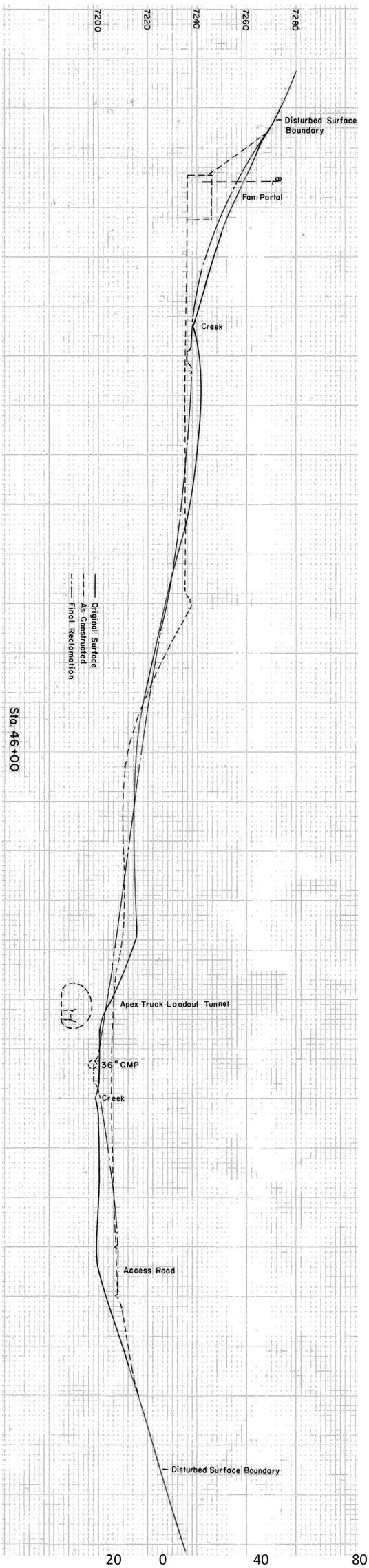




I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

UTAH REGISTERED PROFESSIONAL ENGINEER
#6449561
David W. Hibbs

ANDALEX RESOURCES, INC.
TOWER DIVISION
PRICE, UTAH

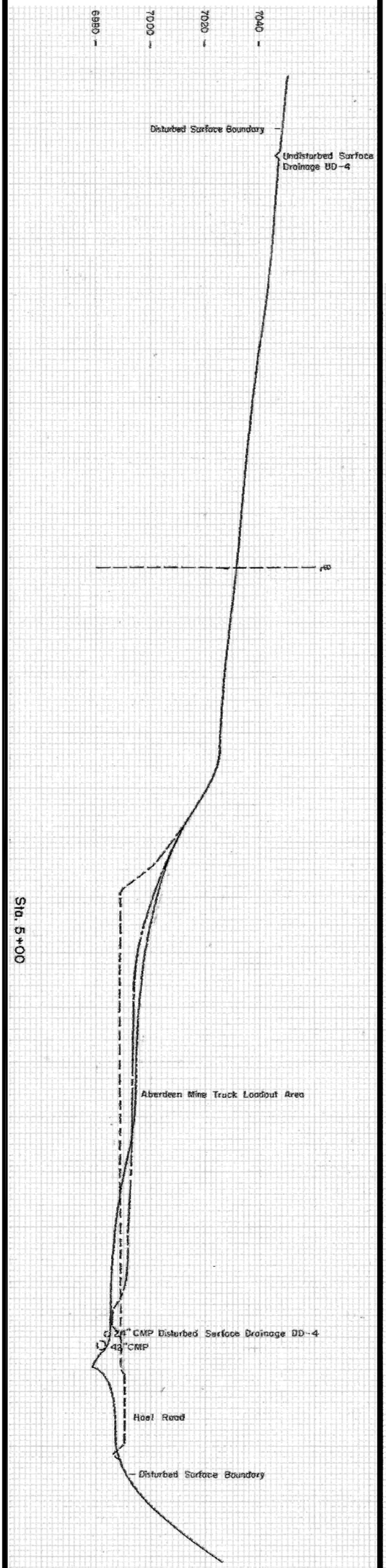
CENTENNIAL PROJECT
SECTION PROFILES
DEADMAN CANYON

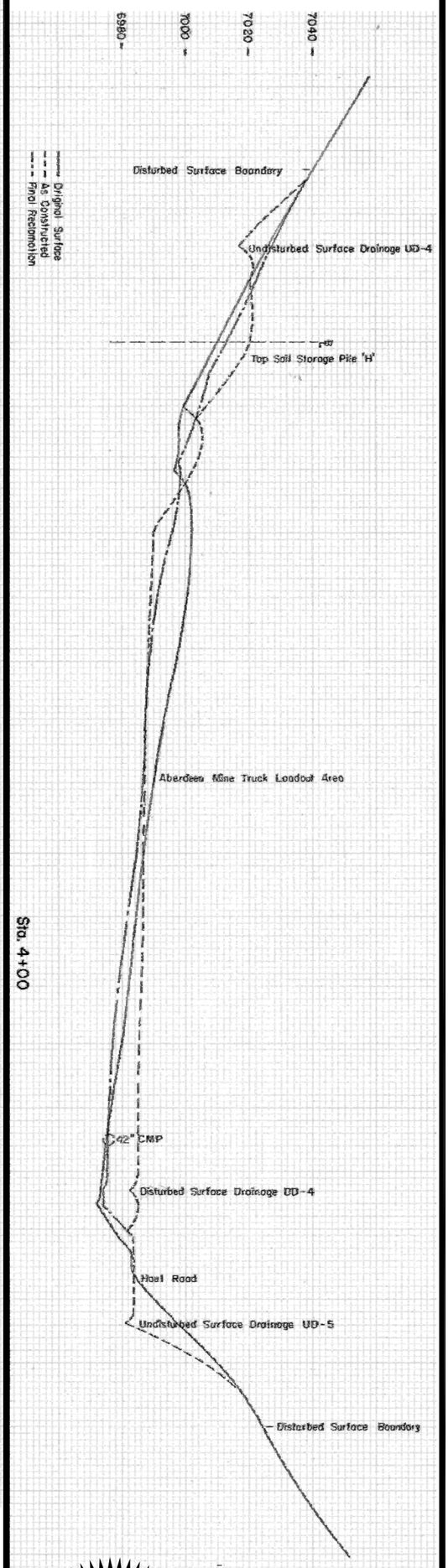
DATE FEB. 22, 2016
REVISION NUMBER 2

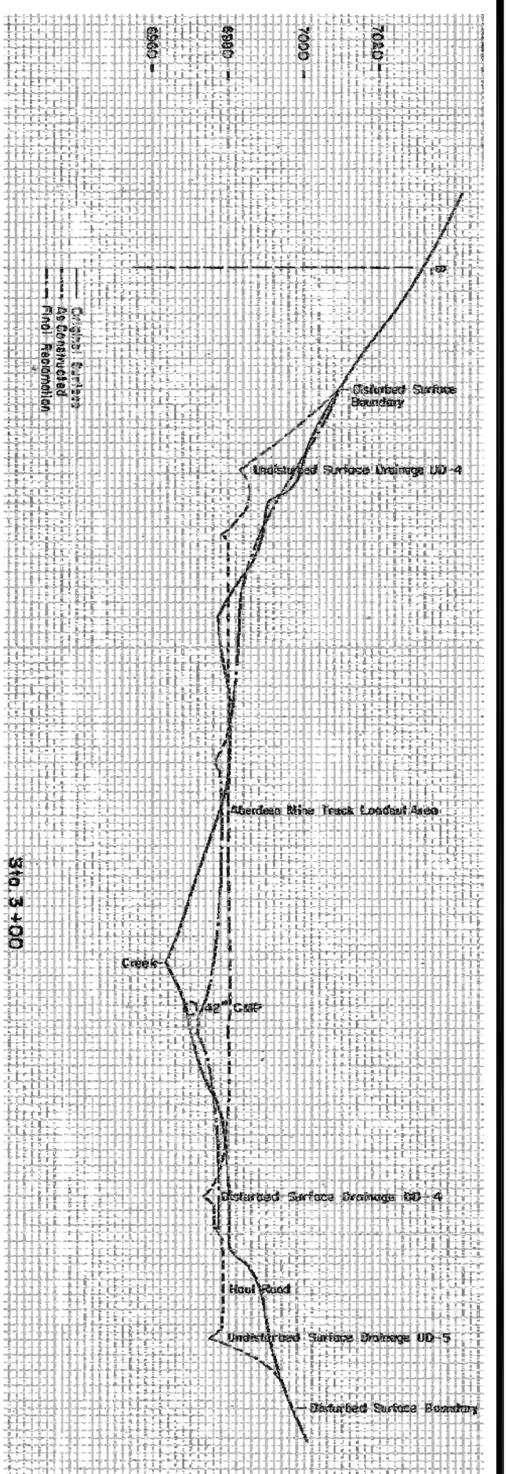
PLATE 5-9 SHEET 19 of 19

FORMERLY PLATE 15
SHEET 19 of 19

G:\Current Drawings\MRP Maps\Tower Mine\Permit Plates Renumbered\Plate 5-9 - Sheet 2.dwg, Plate 5-9 Sheet 2, 2/22/2016 9:31:55 AM, 1:1







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I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

UTAH REGISTERED PROFESSIONAL ENGINEER #6449591 David W. Hibbs

ANDALEX RESOURCES, INC.
TOWER DIVISION
PRICE, UTAH

CENTENNIAL PROJECT
SECTION PROFILES
DEADMAN CANYON

DATE FEB. 22, 2016
REVISION NUMBER 2

PLATE 5-9 SHEET 2 of 19

FORMERLY PLATE 15
SHEETS 1 and 2 of 19

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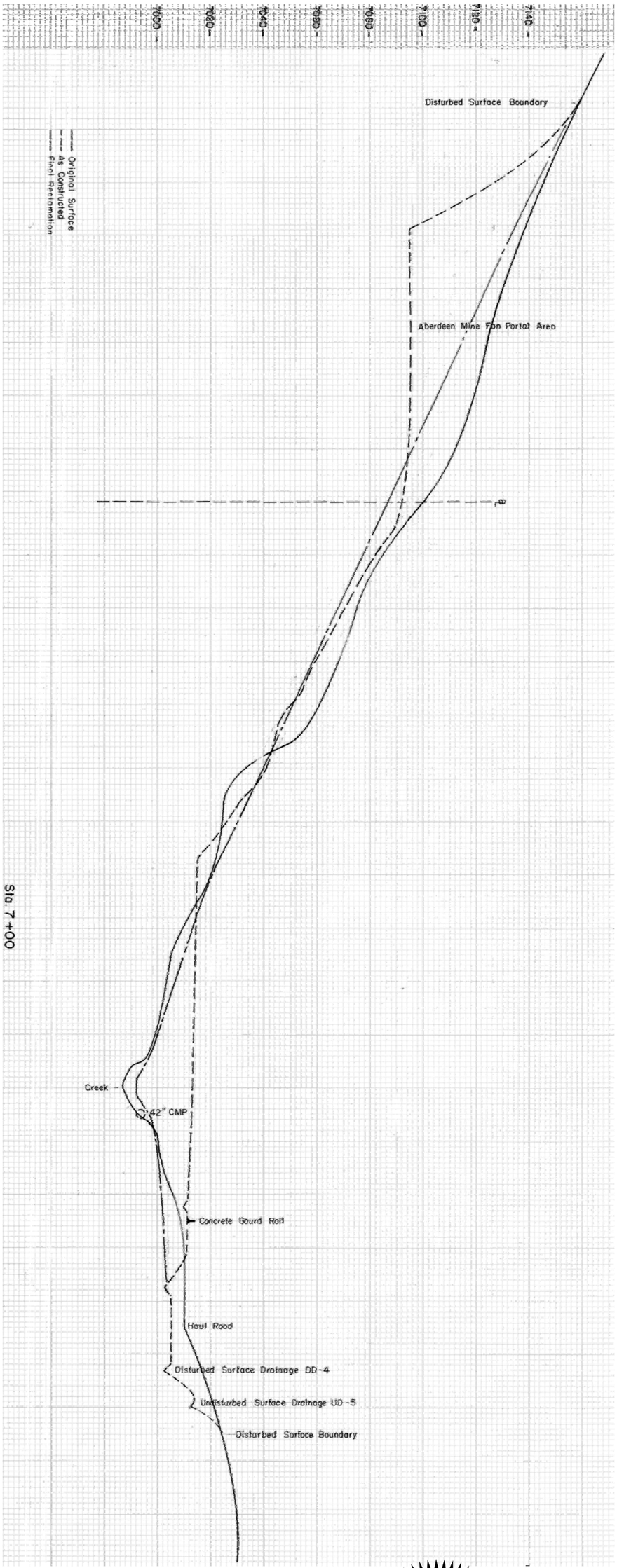

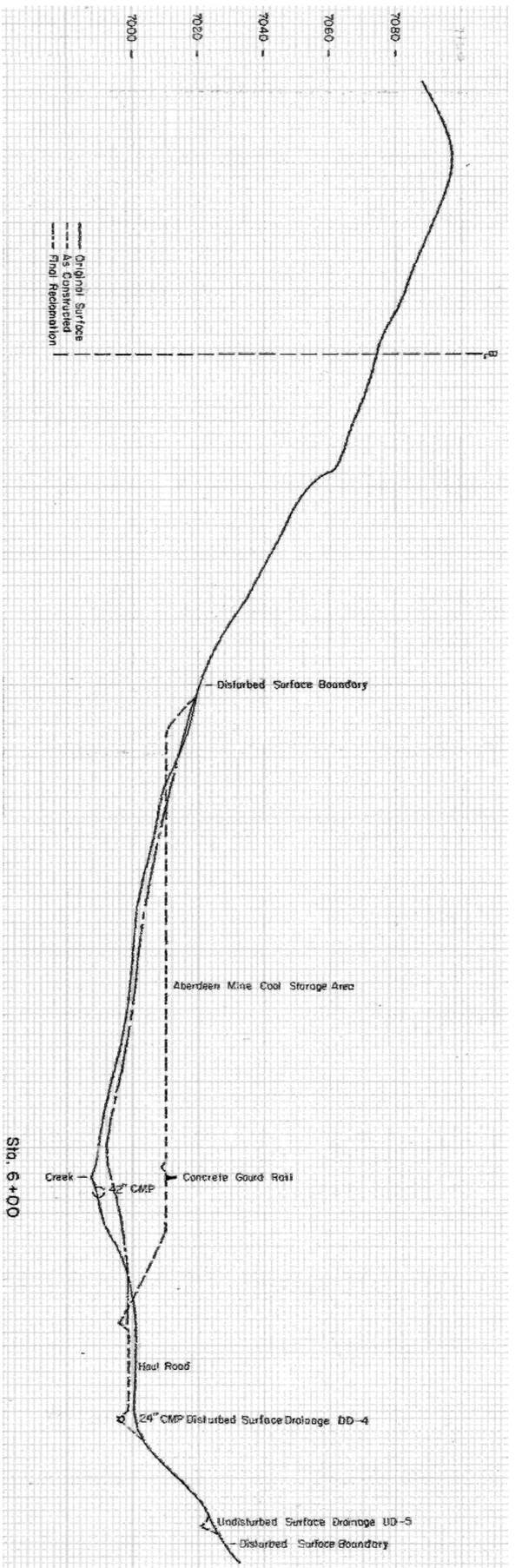

20 0 40 80 FEET

I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

UTAH REGISTERED PROFESSIONAL ENGINEER
#6449591
David W. Hibbs

ANDALEX RESOURCES, INC.
TOWER DIVISION
PRICE, UTAH

CENTENNIAL PROJECT
SECTION PROFILES
DEADMAN CANYON

DATE FEB. 22, 2016
REVISION NUMBER 2

PLATE 5-9 SHEET 3 of 19

FORMERLY PLATE 15
SHEET 3 of 19

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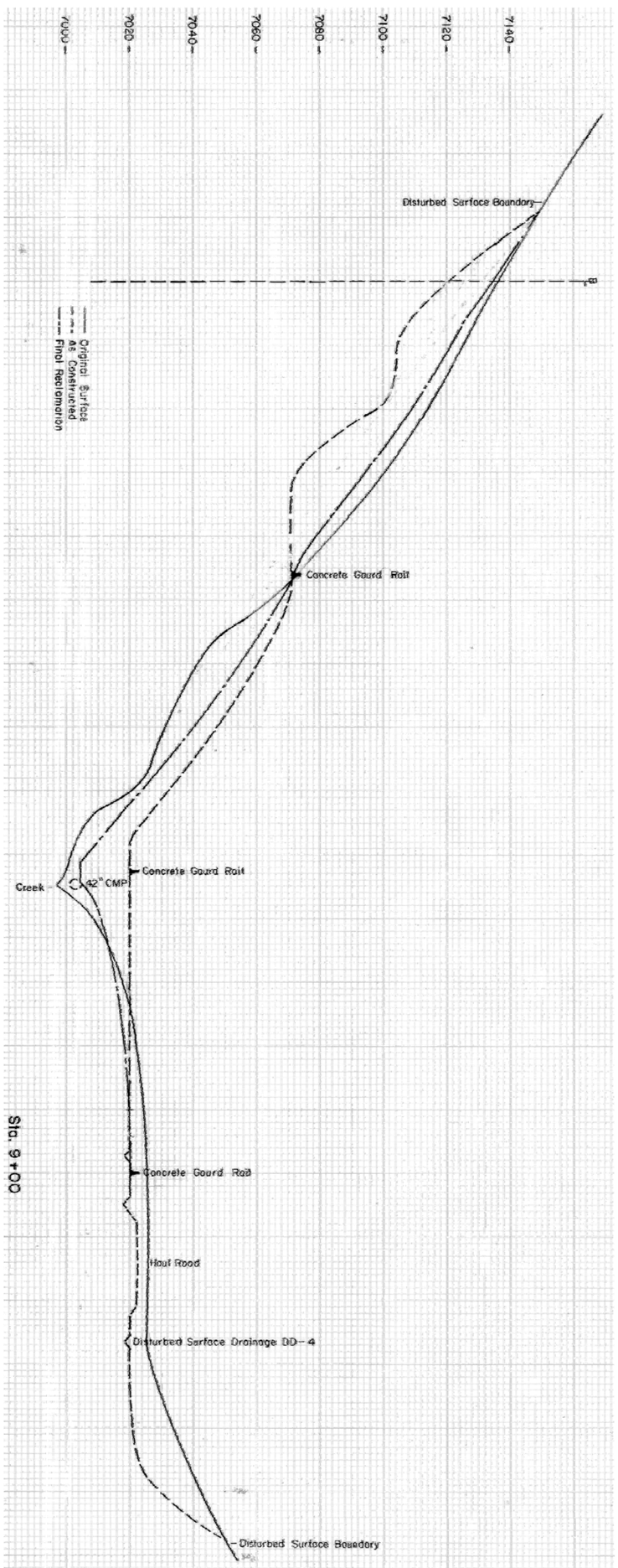

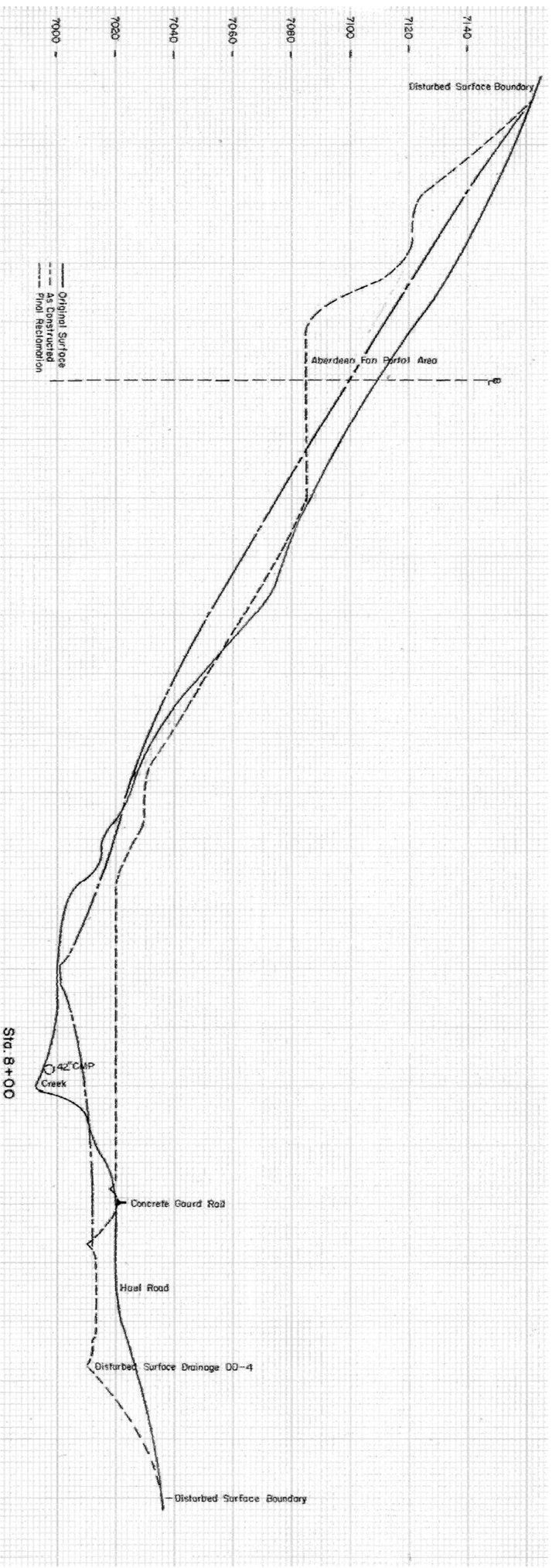

20 0 40 80 FEET

I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

UTAH REGISTERED PROFESSIONAL ENGINEER
#6449561
David W. Hibbs

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TOWER DIVISION
PRICE, UTAH

CENTENNIAL PROJECT
SECTION PROFILES
DEADMAN CANYON

DATE FEB. 22, 2016
REVISION NUMBER 2

PLATE 5-9 SHEET 4 of 19

FORMERLY PLATE 15
SHEET 4 of 19

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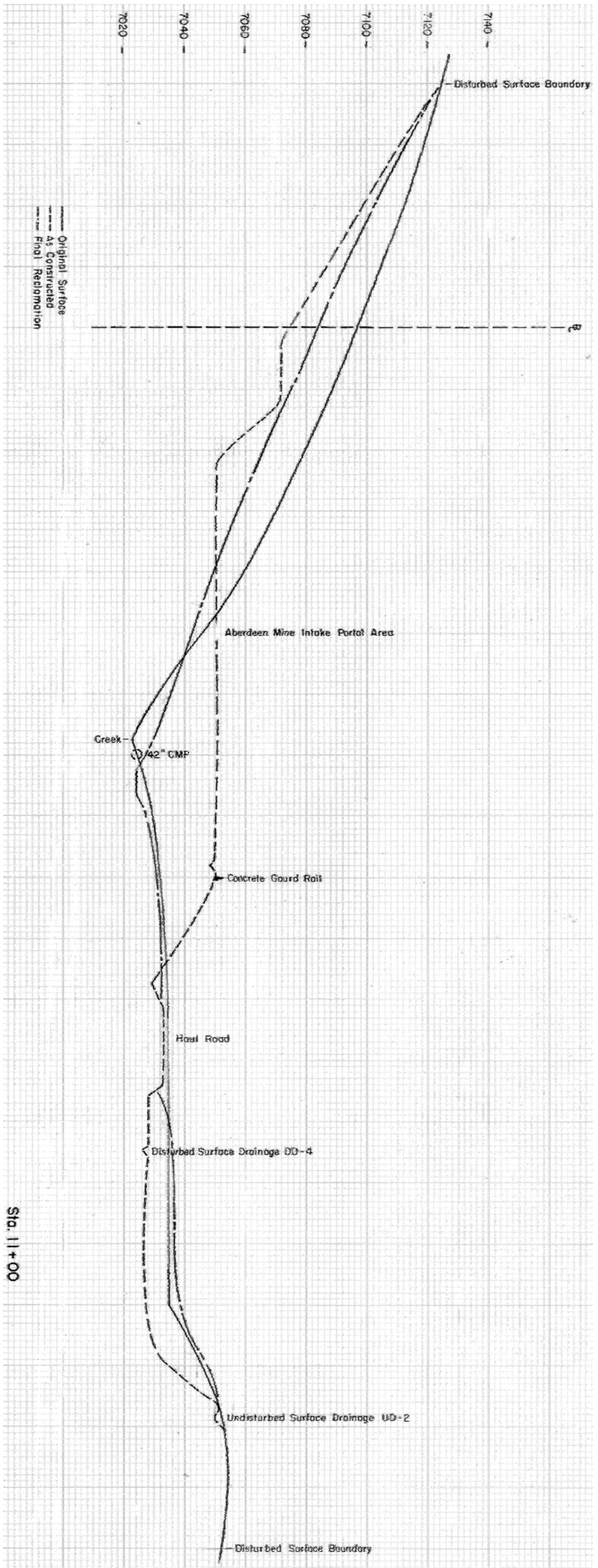
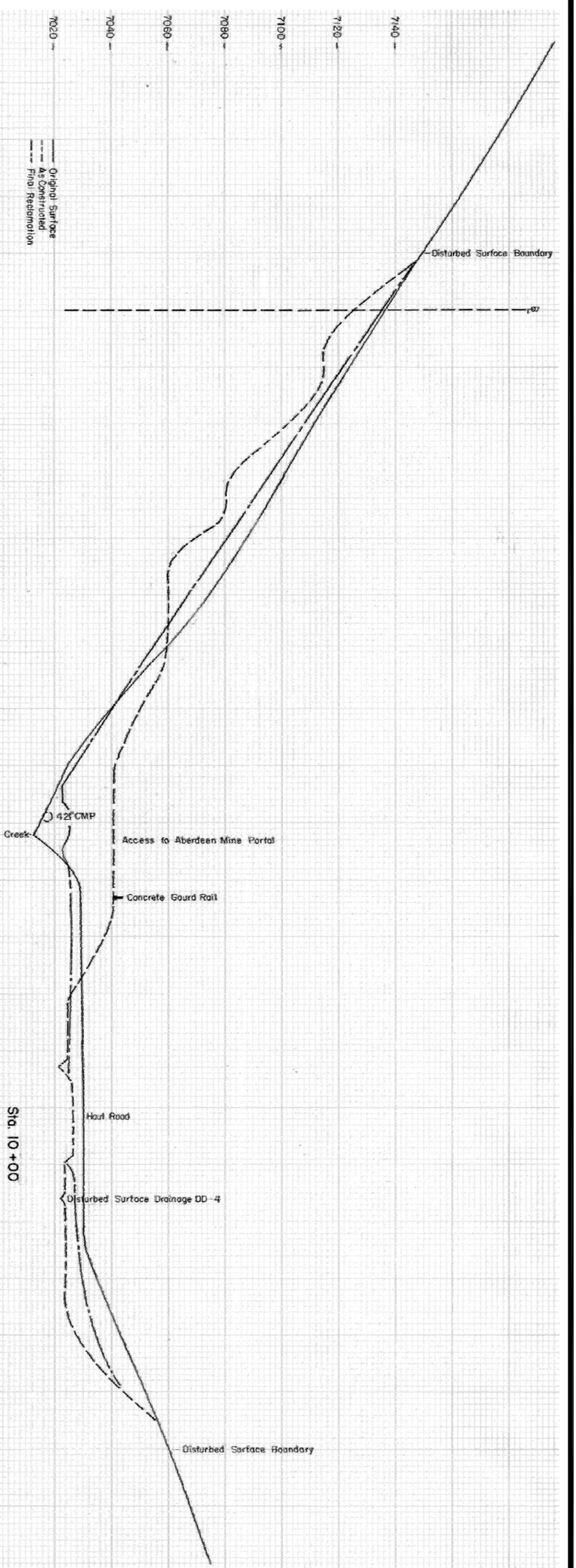




20 0 40 80 FEET

ANDALEX RESOURCES, INC.
TOWER DIVISION
PRICE, UTAH

I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

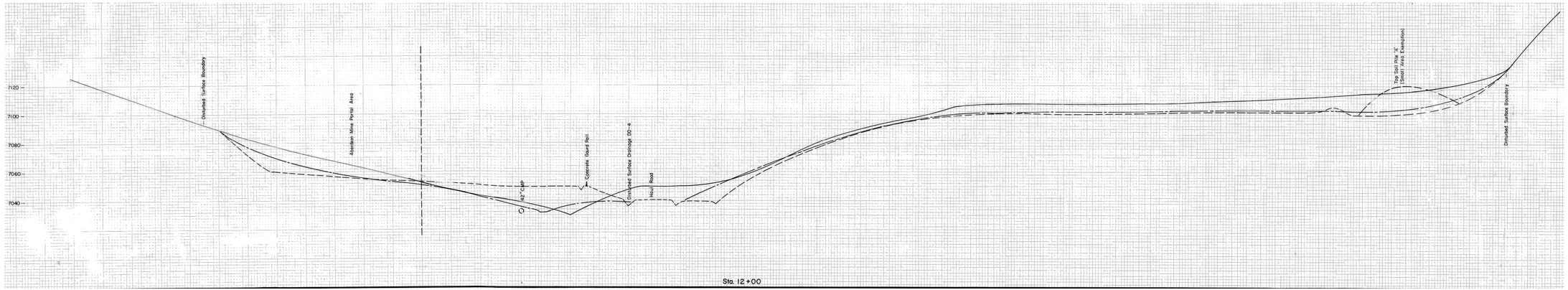
UTAH REGISTERED PROFESSIONAL ENGINEER
#6449561
David W. Hibbs

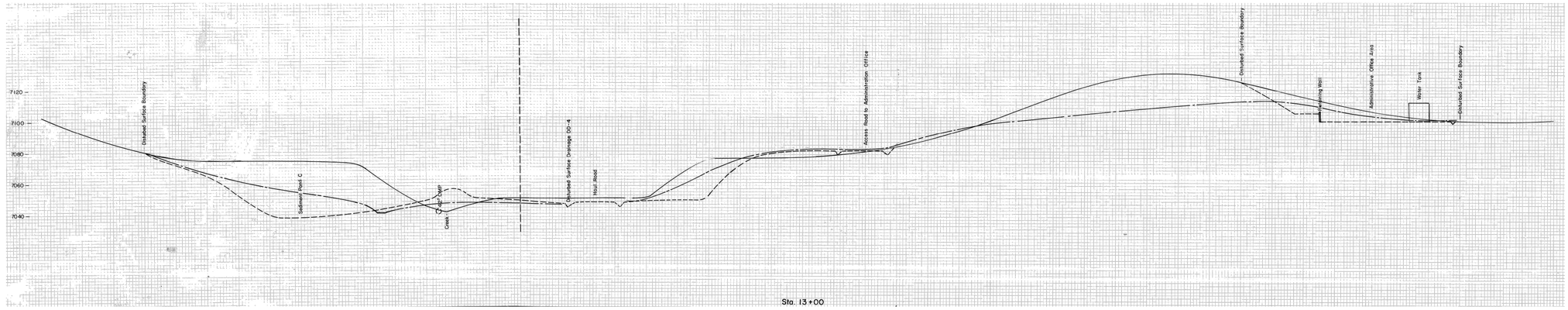
CENTENNIAL PROJECT
SECTION PROFILES
DEADMAN CANYON

DATE FEB. 22, 2016
REVISION NUMBER 2

PLATE 5-9 SHEET 5 of 19

FORMERLY PLATE 15
SHEET 5 of 19





20 0 40 80 FEET

FORMERLY PLATE 15
SHEET 6 of 19

CENTENNIAL PROJECT
SECTION PROFILES
DEADMAN CANYON

DATE FEB. 27, 2015
DRAWING NO. 2

PLATE 5-9 SHEET 6 of 19

I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

UTAH REGISTERED PROFESSIONAL ENGINEER
#6449561
David W. Hibbs

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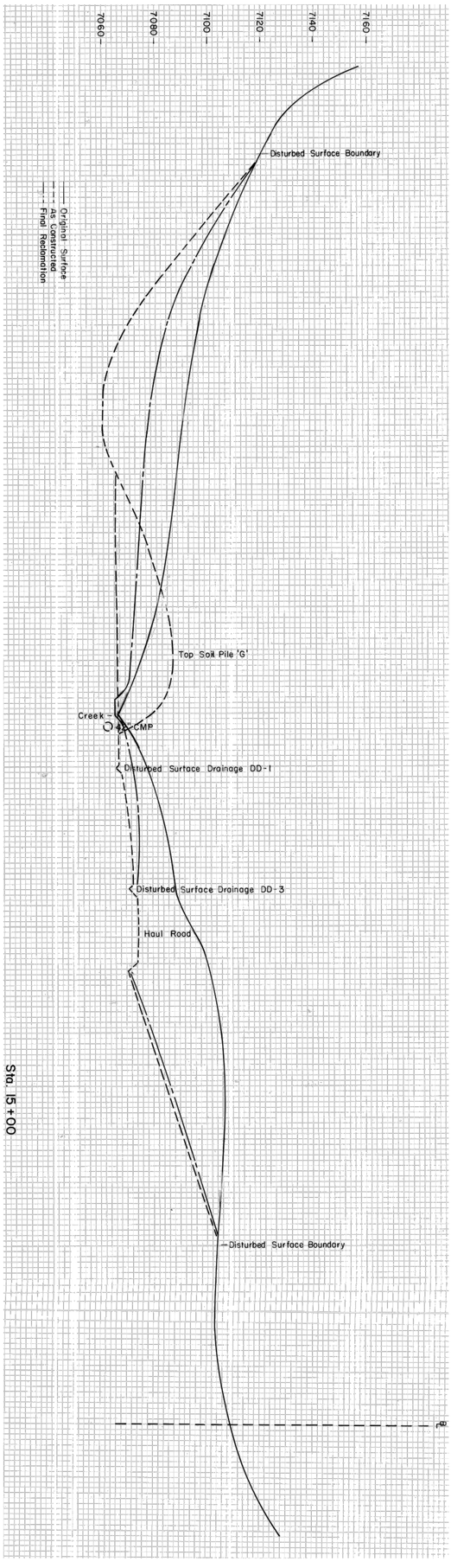
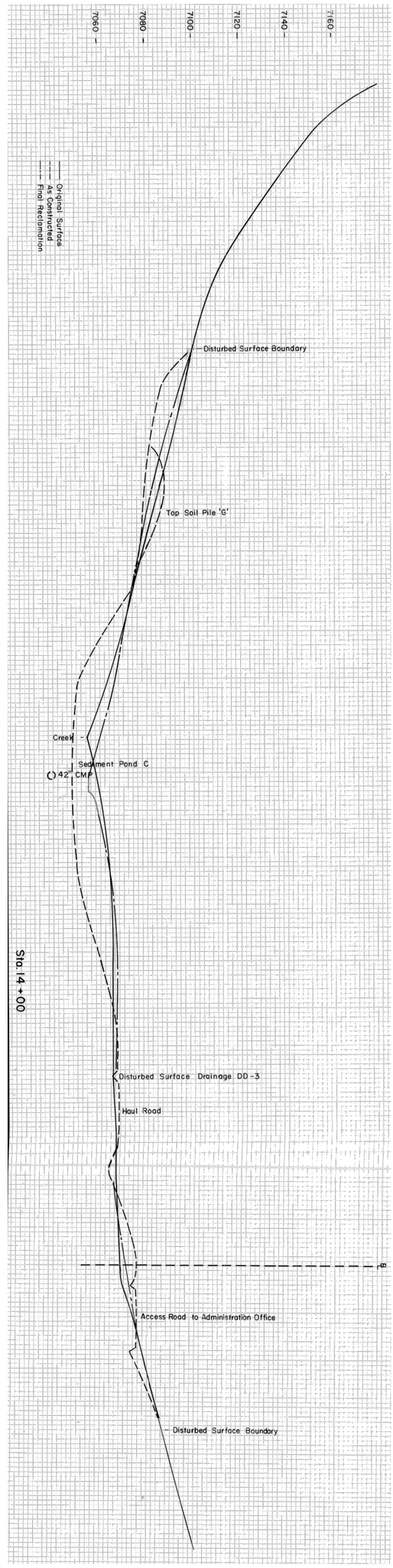
TOWER DIVISION
PRICE, UTAH

C:\Users\Documents\2014 Annual Mine Permit Plates\Revised Plate 5-9 Sheet 6.dgn 2/26/2015 8:49:55 AM





20 0 40 80 FEET

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PROFESSIONAL ENGINEER
#6449561
David W. Hibbs
UTAH REGISTERED

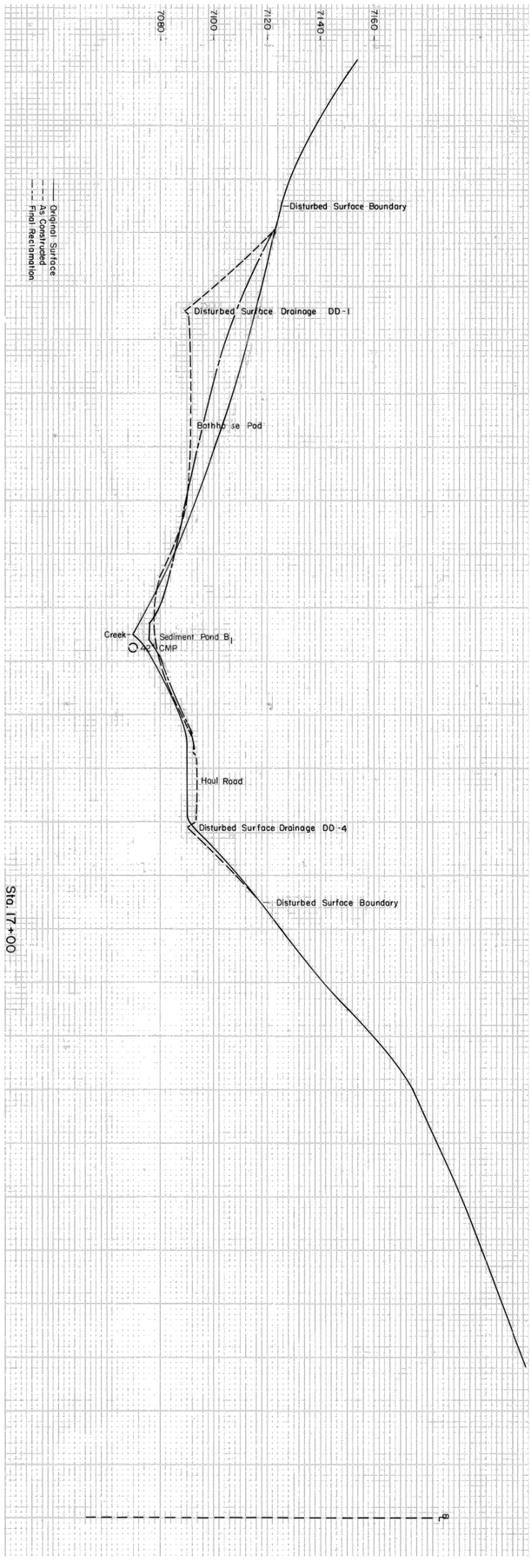
ANDALEX RESOURCES, INC.
TOWER DIVISION
PRICE, UTAH

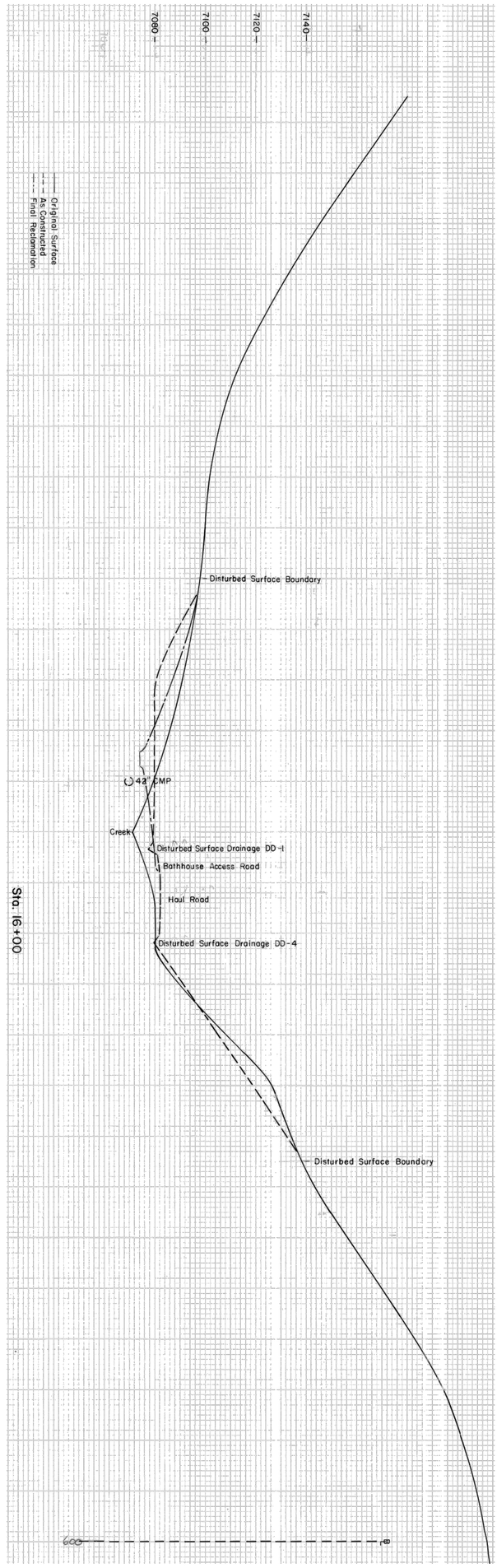
CENTENNIAL PROJECT
SECTION PROFILES
DEADMAN CANYON

DATE FEB. 22, 2016
REVISION NUMBER 2

PLATE 5-9 *SHEET 7 of 19*

FORMERLY PLATE 15
SHEET 7 of 19





20 0 40 80 FEET

ANDALEX RESOURCES, INC.
TOWER DIVISION
PRICE, UTAH

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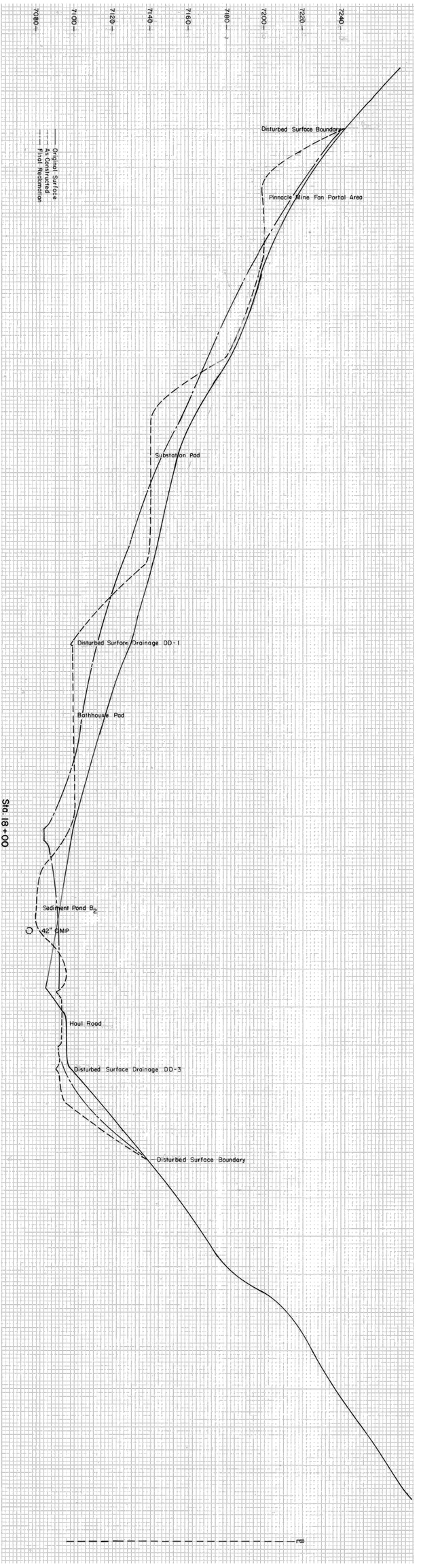
UTAH REGISTERED PROFESSIONAL ENGINEER #6449561 David W. Hibbs

CENTENNIAL PROJECT
SECTION PROFILES
DEADMAN CANYON

DATE FEB. 22, 2016
REVISION NUMBER 2

PLATE 5-9 *SHEET 8 of 19*

FORMERLY PLATE 15
SHEET 8 of 19



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ANDALEX RESOURCES, INC.
TOWER DIVISION
PRICE, UTAH

PROFESSIONAL ENGINEER
UTAH REGISTERED
#6449561
David W. Hibbs

I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

CENTENNIAL PROJECT
SECTION PROFILES
DEADMAN CANYON

DATE FEB. 22, 2016
REVISION NUMBER 2

PLATE 5-9 *SHEET 9 of 19*

FORMERLY PLATE 15
SHEET 9 of 19

FORMERLY PLATE 21

CENTENNIAL PROJECT
REGIONAL SURFACE GEOLOGY MAP

PLATE 6-1

DATE: FEB. 22, 2016
REVISION NUMBER: 2

1500 0 3000 6000 FEET
SCALE: 1" = 3,000 FEET

R. 10 E.
R. 11 E.

T. 12 S.
T. 13 S.

SURFACE PERMIT ONLY
(NO MINERALS)

OSO GAS WELL PAD
AND PIPELINE
(±11.92 ACRES -
NOT IN PERMIT AREA)

SURFACE PERMIT ONLY
(NO MINERALS)

SURFACE
FACILITIES

KENILWORTH

Kpr
Kc
TKfn
Kbh
Kmbg
QTpm

LEGEND

TKfn	FLAGSTAFF LIMESTONE (PALEOCENE) AND NORTH HORN FORMATION (PALEOCENE AND UPPER CRETACEOUS)
Kpr	PRICE RIVER FORMATION (UPPER CRETACEOUS)
Kc	CASTLE GATE SANDSTONE (UPPER CRETACEOUS)
Kbh	BLACKHAWK FORMATION (UPPER CRETACEOUS)
Kmbg	MAIN BODY OF THE BLUE GATE MEMBER
QTpm	PEDIMENT MANTLE (HOLOCENE TO MIOCENE?)

NOTE:
MAP DATA TRACED FROM THE "GEOLOGIC MAP OF THE PRICE 30' X 60' QUADRANGLE, CARBON, DUCHESNE, UINTAH, AND WASATCH COUNTIES, UTAH" BY MALCOLM P. WEISS, IRVING J. WITKIND, AND WILLIAM B. CASHION, 1990.

LEGEND
PERMIT LINE
PERMIT LINE (SURFACE ONLY)

I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

UTAH REGISTERED
#6449561
David W. Hibbs
PROFESSIONAL ENGINEER

ANDALEX RESOURCES, INC.
TOWER DIVISION
PRICE, UTAH

G:\Current Drawings\MRP Maps\Tower Mine\Permit Plates Renumbered\Plate 6-1 - Surface Geology.dwg, Surface Geology, 2/22/2016 10:50:14 AM, 1:1

FORMERLY PLATE 22

CENTENNIAL PROJECT
GEOLOGIC CROSS SECTION AND DRILL HOLE REFERENCES

PLATE 6-2

DATE: FEB. 22, 2016
REVISION NUMBER: 2

1250 0 2500 5000 FEET
SCALE: 1" = 2,500 FEET

R. 10 E.
R. 11 E.

MC-102
MC-98
MC-192
MC-165
MC-150
MC-133

NOTE:
SEE PLATE 6-5 FOR KENILWORTH LEASE GEOLOGIC CROSS SECTION DETAILS.

TYPICAL SURFACE PERMIT ONLY (NO MINERALS)

T. 12 S.
T. 13 S.

OSO GAS WELL PAD AND PIPELINE
(±11.92 ACRES - NOT IN PERMIT AREA)

A'
B'
A
B

DH-6
DH PG&E
DH-5
DH-1
MC-191
77-3-CP
DH-2
89-1-APEX
DH-7 NACC
77-2-CP
DH-2A
77-1-CP
MC-193
77-4-CP
77-5-CP
77-6-CP
77-7-CP
SURFACE FACILITIES

NOTE:
SEE PLATES 6-3 AND 6-4 FOR GEOLOGIC CROSS SECTION DETAILS.

I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

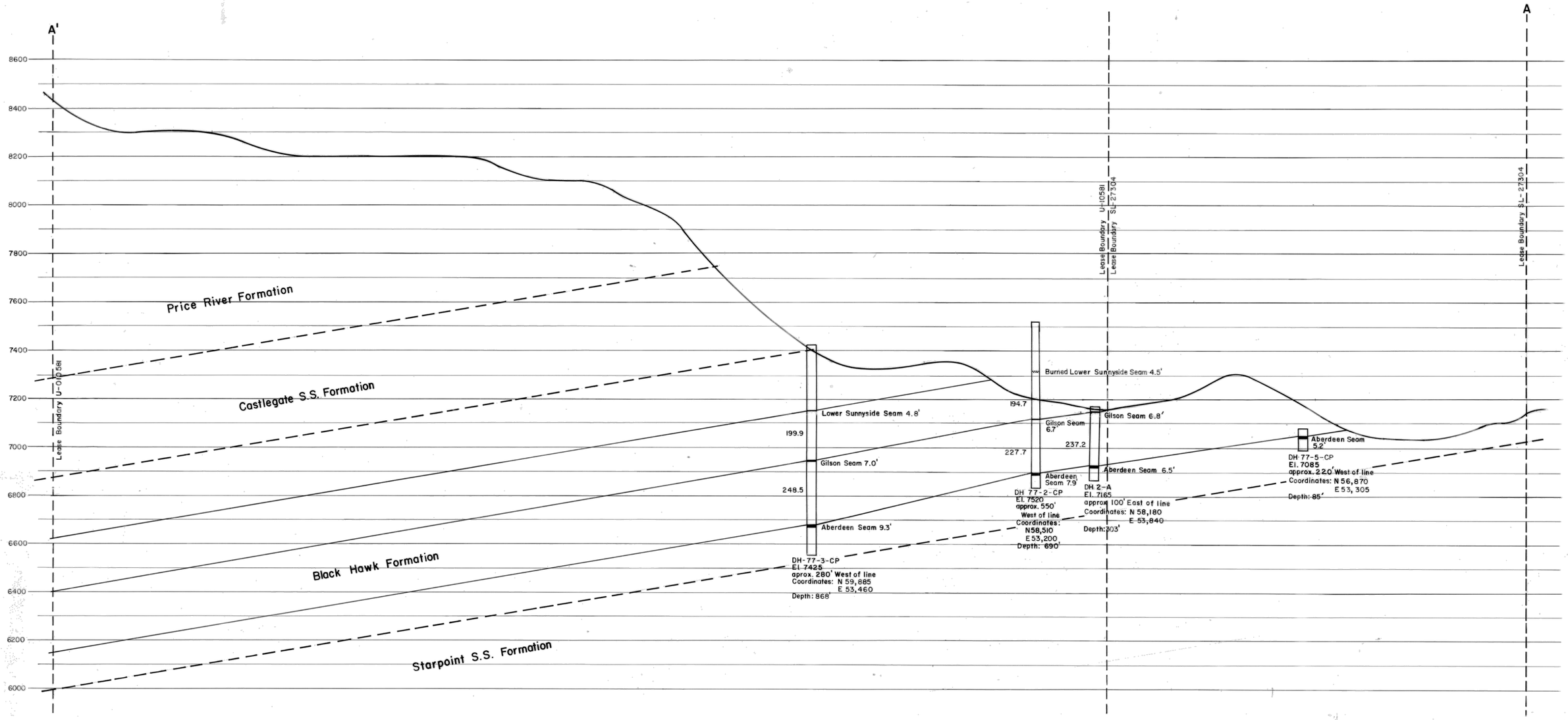
UTAH REGISTERED
#6449561
David W. Hibbs
PROFESSIONAL ENGINEER

LEGEND
SECTION LINES
PERMIT LINE
PERMIT LINE (SURFACE ONLY)

ANDALEX RESOURCES, INC.
TOWER DIVISION
PRICE, UTAH

KENILWORTH

G:\Current Drawings\MRP Maps\Tower Mine\Permit Plates Renumbered\Plate 6-2 - Geo Cross Section Ref.dwg, Drill Holes, 2/22/2016 10:52:32 AM, 1:1



I, the undersigned do hereby attest to the accuracy of the above map.

Michael W. Glasson — 12-11-86
Michael W. Glasson — Date
Senior Geologist
AMCA Coal Leasing, Inc

I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE
UTAH REGISTERED #6449561 David W. Hibbs PROFESSIONAL ENGINEER

Andalex Resources, Inc.
P.O. Box 910
East Carbon, Utah

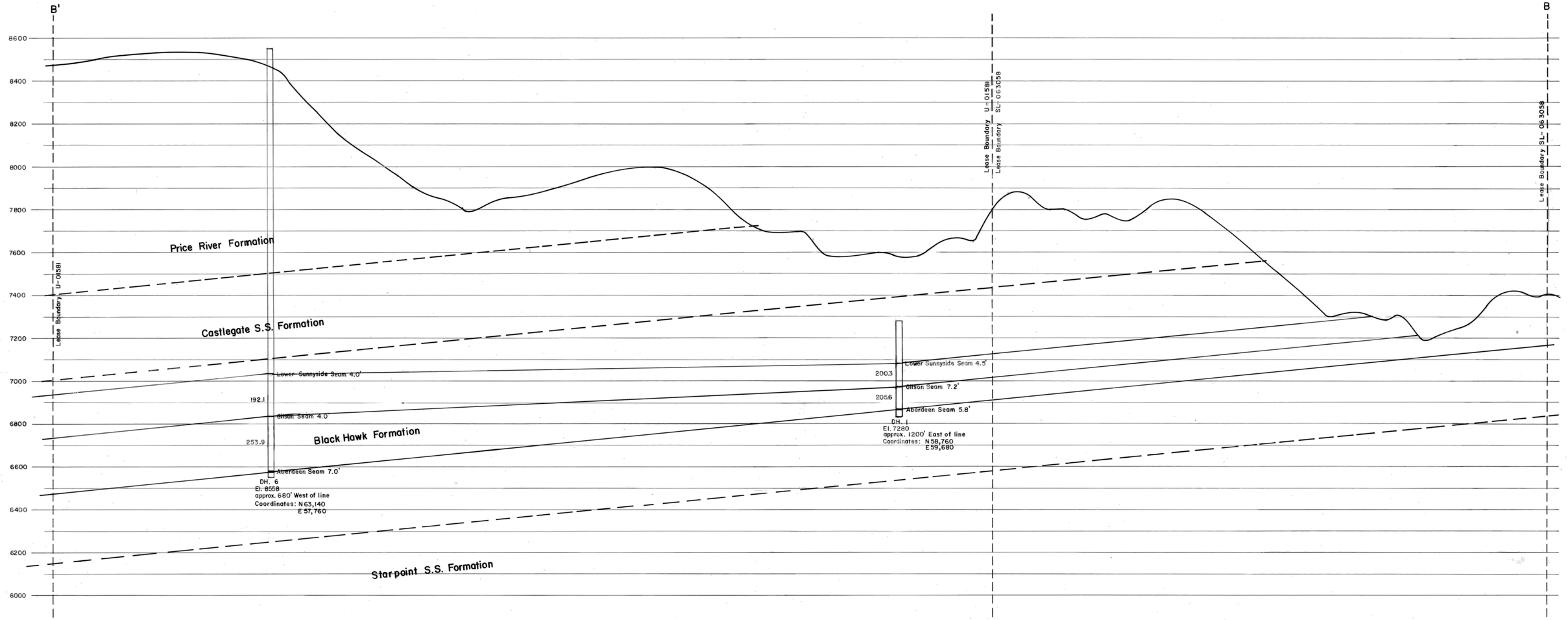
Cross Section A-A'

DRAWN BY J.C.B.
APPROVED
DATE 6-28-81
SCALE Vertical: 1"=200'0"
Horizontal: 1"=300'0"

NO.	DATE	REVISIONS	BY
1	12-10-86	General	JCB
2	2-22-16	Update Plate Number	PJJ

Centennial Project

Plate 6-3
Formerly Plate 23



I, the undersigned do hereby attest to the accuracy of the above map.

Michael W. Glasson 12-11-86
Michael W. Glasson Date
Senior Geologist
AMCA Coal Leasing, Inc.

Centennial Project

I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.
UTAH REGISTERED #6449561 David W. Hibbs PROFESSIONAL ENGINEER

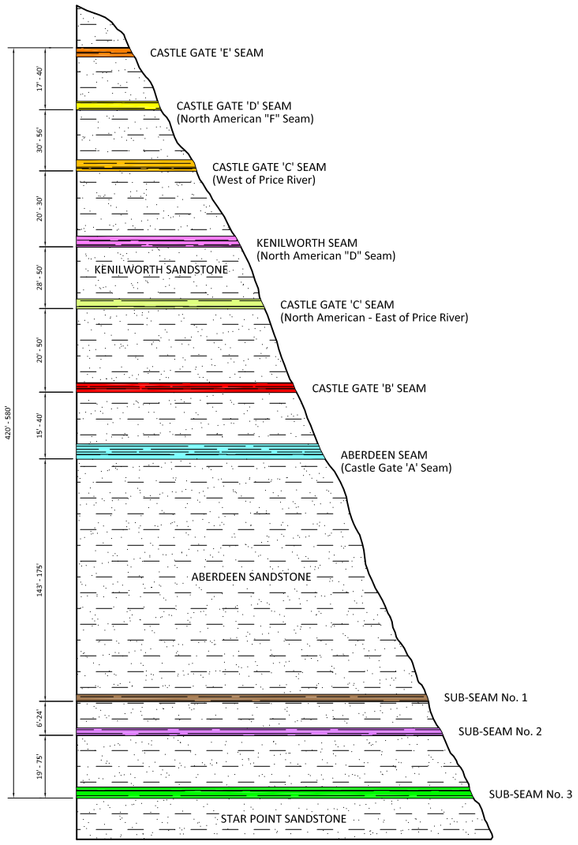
Plate 6-4
Formerly Plate 24

Andalex Resources, Inc.
P.O. Box 910
East Carbon, Utah

Cross Section B-B'

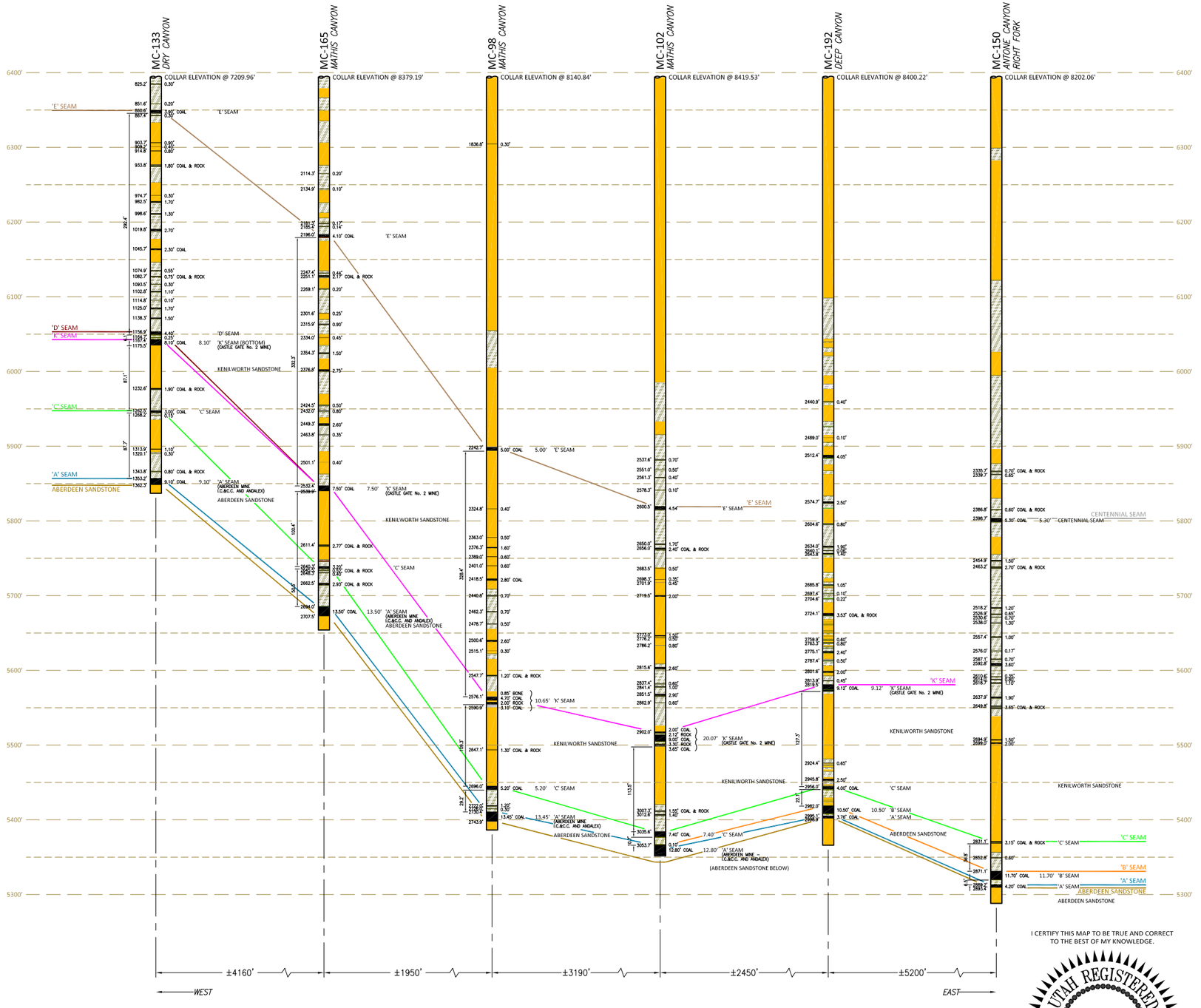
DRAWN BY J.C.B.
APPROVED
DATE 6-30-81
SCALE Vertical: 1"=200'0"
Horizontal: 1"=300'0"

NO.	DATE	REVISIONS	BY
1	12-10-86	General	JCB
2	2-22-16	Update Plate Number	PJJ



TYPICAL STRATIGRAPHIC SECTION

SCALE: NONE



KENILWORTH GEOLOGIC SECTION

SCALE: 1" = 150'

LEGEND

DH-05 — DRILL HOLE NAME

SANDSTONE

BONE/DIRTY COAL

COAL

VOID/MINE WORKINGS

UNDESCRIBED/
NON-SANDSTONE STRATA

MUD/SILT/SHALE

1.80' — SEAM THICKNESS

624.9' — DEPTH TO TOP OF STRATA

'K' SEAM — SEAM NAME

(CASTLE GATE No. 2 MINE) — IN-SEAM MINE NAME

SEAM CORRELATION LINE (COLOR BY SEAM)

DRILL HOLE SHORTENED

5500' — 100' INDEX ELEVATION LINE

50' INTERMEDIATE ELEVATION LINE

FORMERLY PLATE 22A

CENTENNIAL PROJECT
KENILWORTH LEASE
GEOLOGIC CROSS SECTION

PLATE 6-5

DATE: FEB. 22, 2016

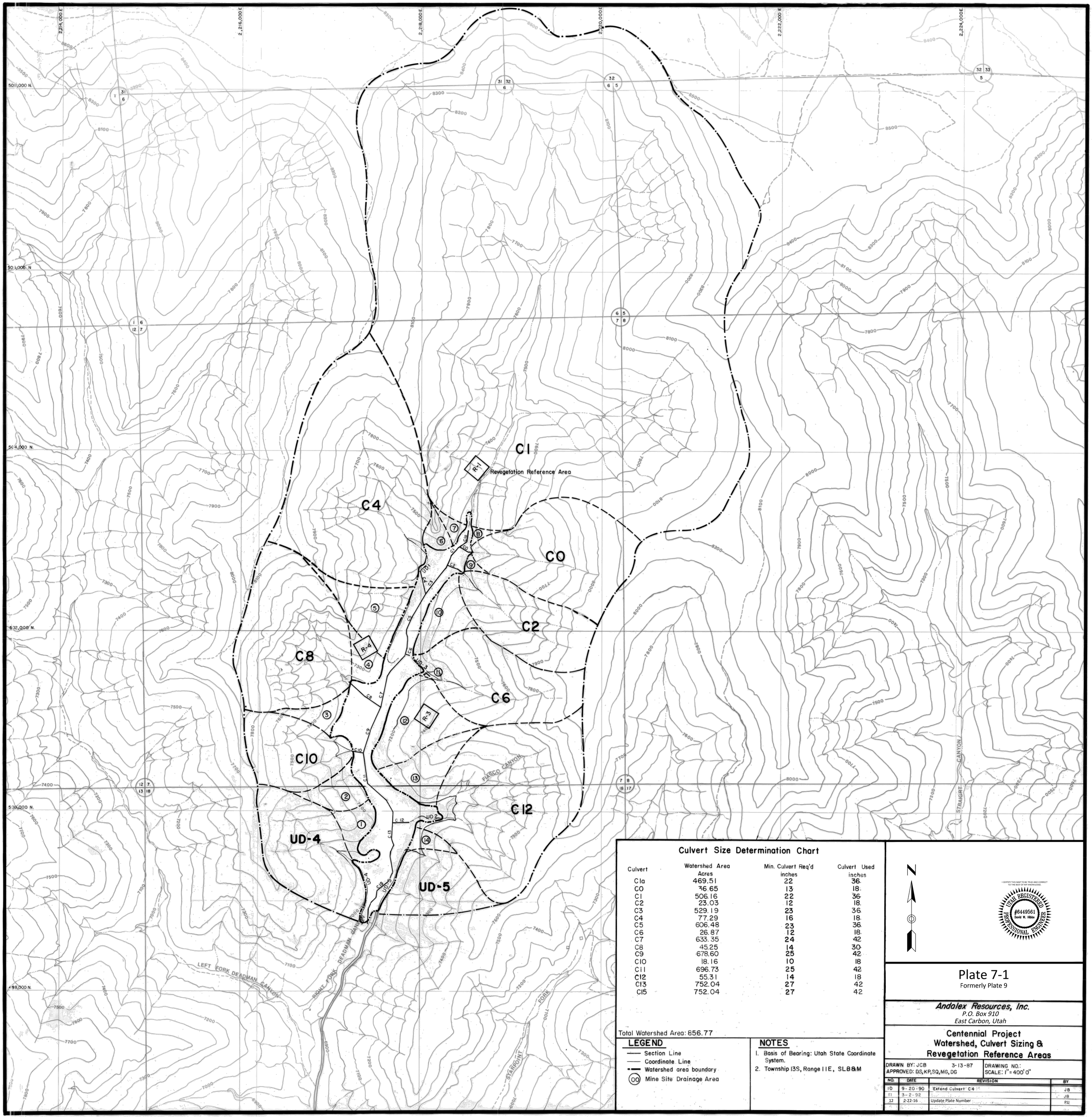
REVISION NUMBER: 2

I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

UTAH REGISTERED PROFESSIONAL ENGINEER
#6449561
David W. Hibbs

ANDALEX RESOURCES, INC.
TOWER DIVISION
PRICE, UTAH

G:\Current Drawings\MRP Maps\Tower Mine\Permit Plates Renumbered\Plate 6-5 - Kenilworth Geologic Section.dwg, Model, 2/22/2016 11:02:11 AM, 1:150



Culvert Size Determination Chart

Culvert	Watershed Area Acres	Min. Culvert Req'd inches	Culvert Used inches
C1a	469.51	22	36
CO	36.65	13	18
C1	506.16	22	36
C2	23.03	12	18
C3	529.19	23	36
C4	77.29	16	18
C5	606.48	23	36
C6	26.87	12	18
C7	633.35	24	42
C8	45.25	14	30
C9	678.60	25	42
C10	18.16	10	18
C11	696.73	25	42
C12	55.31	14	18
C13	752.04	27	42
C15	752.04	27	42

Total Watershed Area: 856.77

LEGEND

- Section Line
- Coordinate Line
- Watershed area boundary
- (00) Mine Site Drainage Area

NOTES

1. Basis of Bearing: Utah State Coordinate System.
2. Township 13S, Range 11E, SLB&M

I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

UTAH REGISTERED PROFESSIONAL ENGINEER #6449561 David W. Hibbs

Plate 7-1

Formerly Plate 9

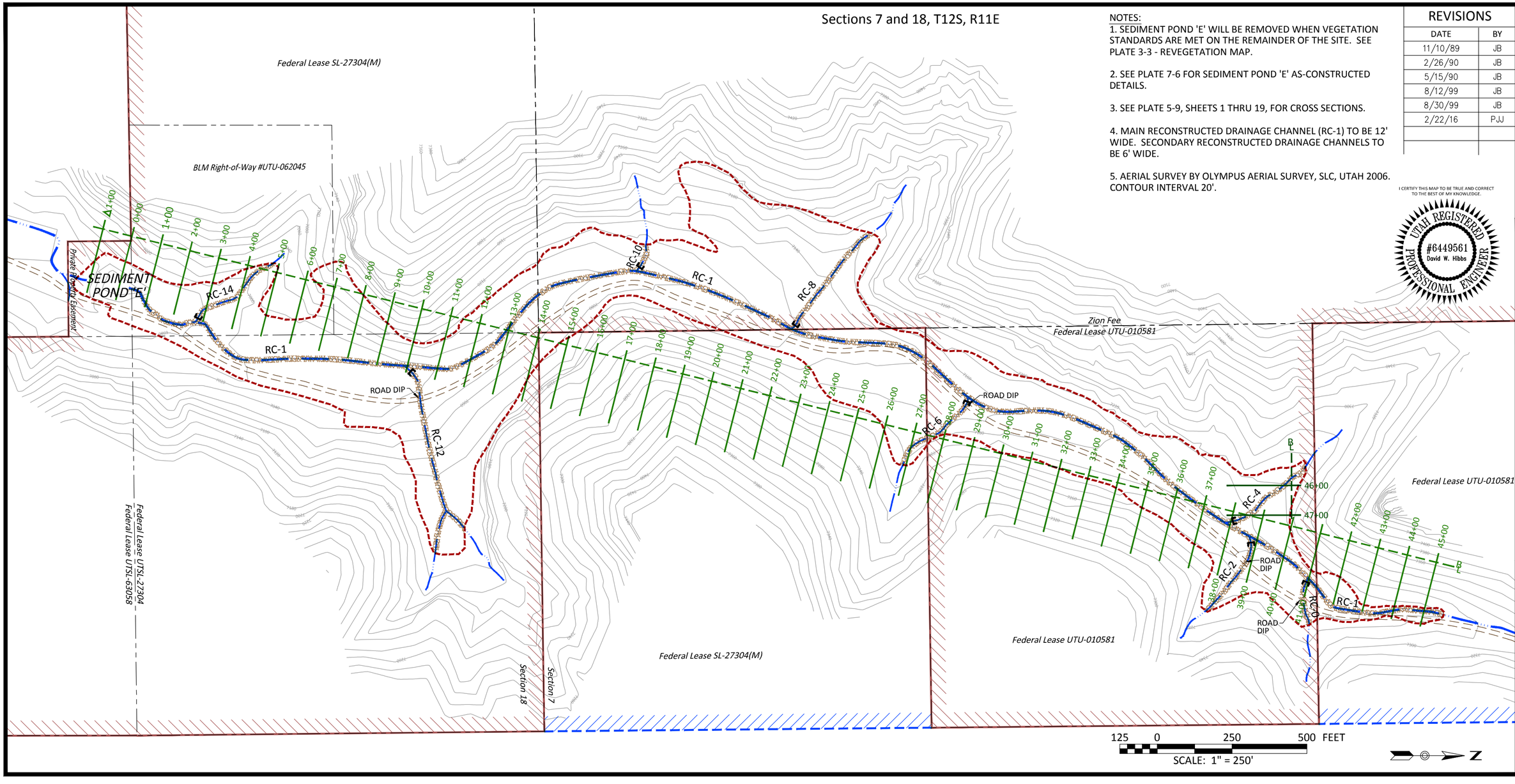
Andalex Resources, Inc.
P.O. Box 910
East Carbon, Utah

Centennial Project
Watershed, Culvert Sizing & Revegetation Reference Areas

DRAWN BY: JCB 3-13-87
APPROVED: DS, KP, SQ, MG, DG

DRAWING NO.:
SCALE: 1" = 400' 0"

NO.	DATE	REVISION	BY
10	9-20-90	Extend Culvert C4	JB
11	3-2-92		JB
12	2-22-16	Update Plate Number	PJJ



NOTES:

1. SEDIMENT POND 'E' WILL BE REMOVED WHEN VEGETATION STANDARDS ARE MET ON THE REMAINDER OF THE SITE. SEE PLATE 3-3 - REVEGETATION MAP.

2. SEE PLATE 7-6 FOR SEDIMENT POND 'E' AS-CONSTRUCTED DETAILS.

3. SEE PLATE 5-9, SHEETS 1 THRU 19, FOR CROSS SECTIONS.

4. MAIN RECONSTRUCTED DRAINAGE CHANNEL (RC-1) TO BE 12' WIDE. SECONDARY RECONSTRUCTED DRAINAGE CHANNELS TO BE 6' WIDE.

5. AERIAL SURVEY BY OLYMPUS AERIAL SURVEY, SLC, UTAH 2006. CONTOUR INTERVAL 20'.

REVISIONS

DATE	BY
11/10/89	JB
2/26/90	JB
5/15/90	JB
8/12/99	JB
8/30/99	JB
2/22/16	PJJ

I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

UTAH REGISTERED PROFESSIONAL ENGINEER #6449561 David W. Hibbs

FORMERLY PLATE 16

CENTENNIAL PROJECT
POST MINING HYDROLOGY
FINAL RECLAMATION PLAN
DEADMAN CANYON - PHASE 1

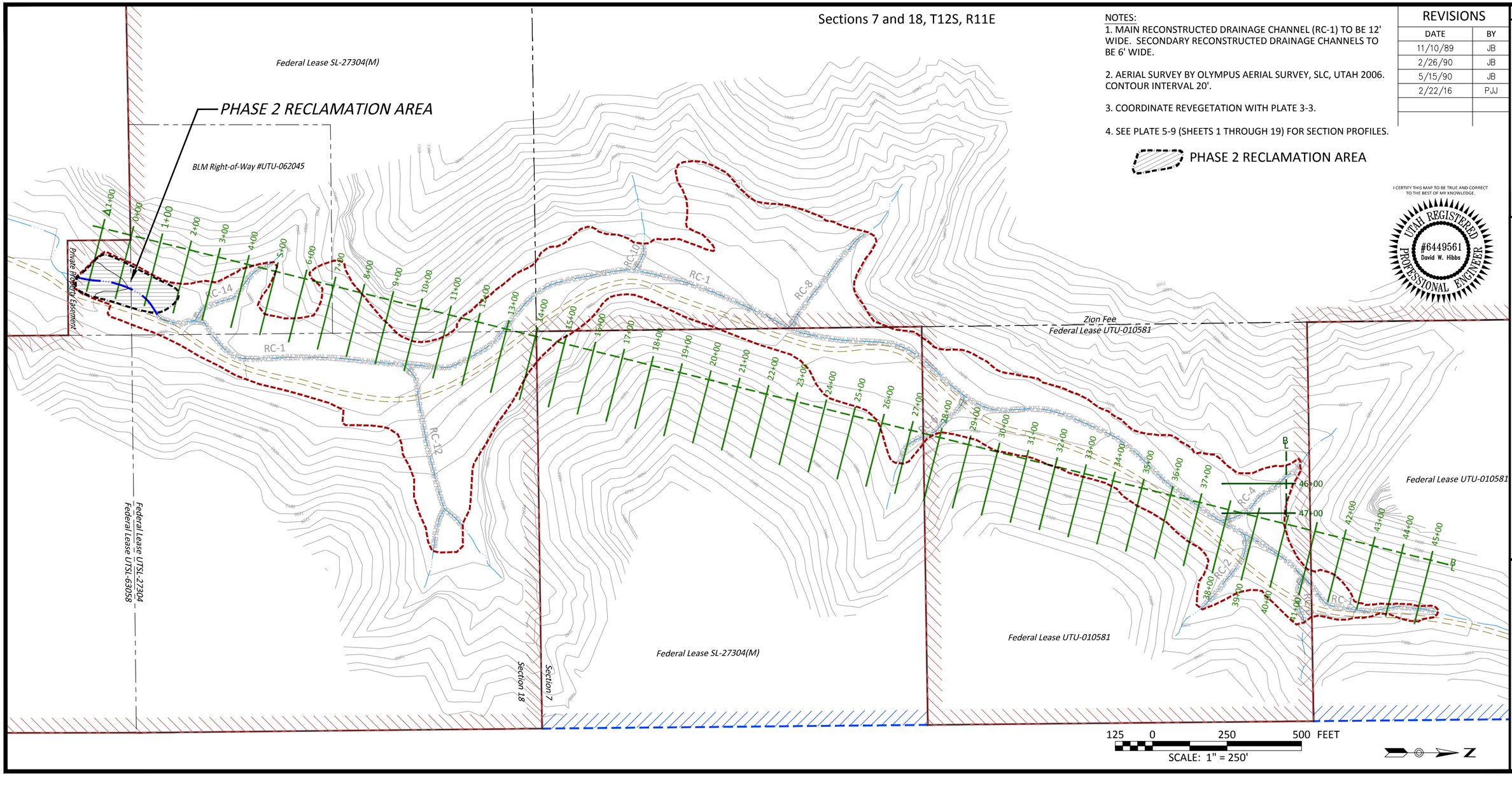
PLATE 7-10

MISC. DATE 7/88
REVISION NUMBER 6

LEGEND

- Loose Rock Check Dam
- Cross Section Reference
- Disturbed Surface Boundary
- Lease Boundary
- Permit Boundary
- Permit Boundary - Surface Only
- Reconstructed Drainage

ANDALEX RESOURCES, INC.
TOWER DIVISION
PRICE, UTAH



NOTES:

1. MAIN RECONSTRUCTED DRAINAGE CHANNEL (RC-1) TO BE 12' WIDE. SECONDARY RECONSTRUCTED DRAINAGE CHANNELS TO BE 6' WIDE.

2. AERIAL SURVEY BY OLYMPUS AERIAL SURVEY, SLC, UTAH 2006. CONTOUR INTERVAL 20'.

3. COORDINATE REVEGETATION WITH PLATE 3-3.

4. SEE PLATE 5-9 (SHEETS 1 THROUGH 19) FOR SECTION PROFILES.

PHASE 2 RECLAMATION AREA

REVISIONS	
DATE	BY
11/10/89	JB
2/26/90	JB
5/15/90	JB
2/22/16	PJJ

I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

UTAH REGISTERED PROFESSIONAL ENGINEER #6449561 David W. Hibbs

LEGEND

- Disturbed Surface Boundary
- Lease Boundary
- Permit Boundary
- Permit Boundary - Surface Only
- Reconstructed Drainage
- Loose Rock Check Dam
- Cross Section Reference

FORMERLY PLATE 17

CENTENNIAL PROJECT
POST MINING HYDROLOGY
FINAL RECLAMATION PLAN
DEADMAN CANYON - PHASE 2

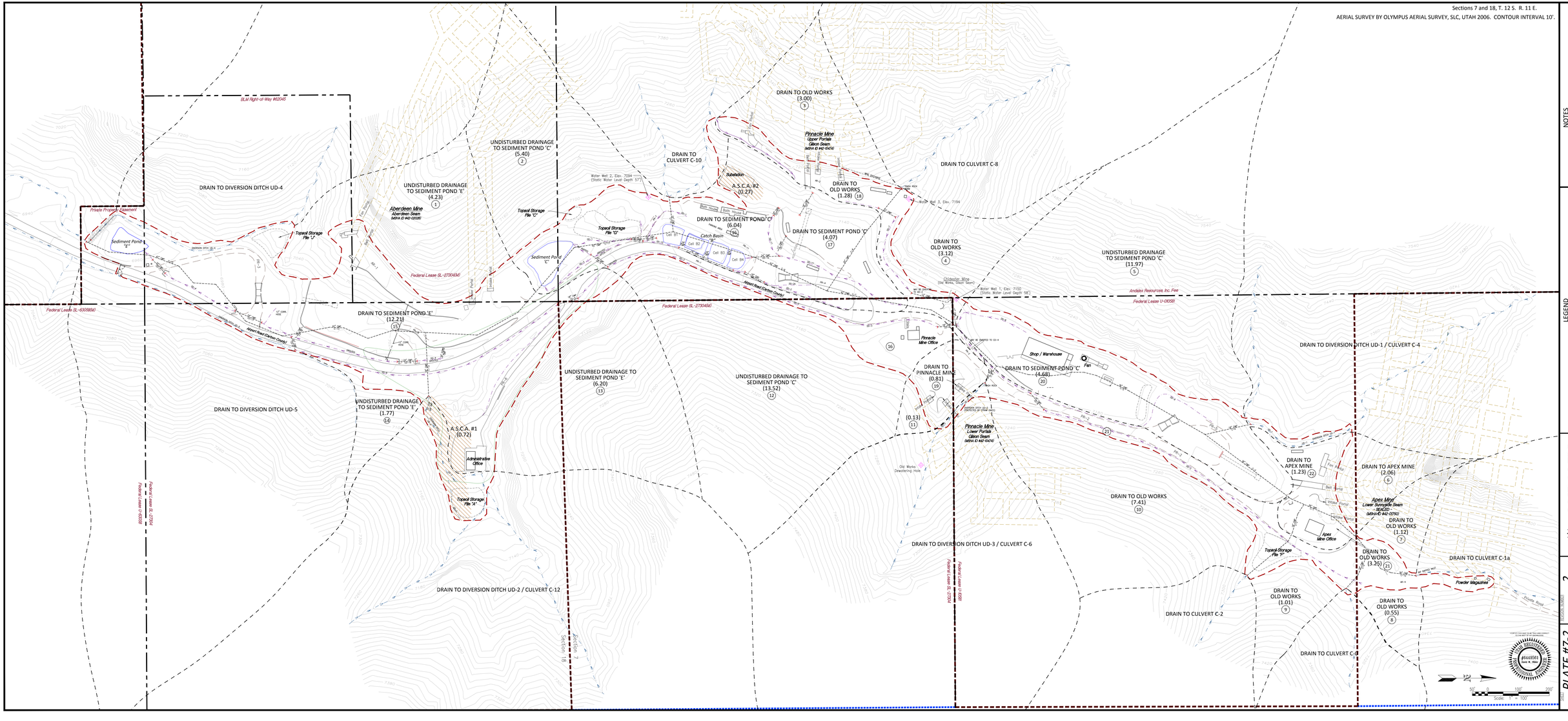
PLATE 7-11

MINE ID# 7/88
REVISION NUMBER 4

ANDALEX RESOURCES, INC.
TOWER DIVISION
PRICE, UTAH

Sections 7 and 18, T. 12 S. R. 11 E.

AERIAL SURVEY BY OLYMPUS AERIAL SURVEY, SLC, UTAH 2006. CONTOUR INTERVAL 10'.


BLM Right-of-Way #62045
Private Property Easement
Federal Lease SL-065968U
Federal Lease SL-27304U
Federal Lease SL-027304
Federal Lease U-0825
Andalex Resources, Inc. Fee
Mount Nebo (Carbon County)
Sediment Pond 'E'
Sediment Pond 'C'
Topsoil Storage File 'J'
Topsoil Storage File 'C'
Topsoil Storage File 'G'
Topsoil Storage File 'A'
Topsoil Storage File 'F'
Aberdeen Mine
Aberdeen Seam
(MSHA ID #42-02038)
Pinnacle Mine
Upper Portals
Gilson Seam
(MSHA ID #42-02474)
Pinnacle Mine
Lower Portals
Gilson Seam
(MSHA ID #42-02474)
Apex Mine
Lower Sunnyside Seam
- BANDED -
(MSHA ID #42-02092)
Subsidence Area
Subsidence Area
Subsidence Area

FORMERLY FIGURE 5

CENTENNIAL PROJECT REGIONAL SURFACE AND GROUND WATER RIGHTS

PLATE 7-3

DATE: FEB. 22, 2016

REVISION NUMBER: 2

1500' 0 3000' 6000'

R. 10 E. R. 11 E.

T. 12 S.
T. 13 S.

91-3375
91-2529
91-3597
91-564
91-3595
91-3593
91-3598
91-3592
91-3661
91-3662
91-1855
91-1856
91-4645
91-1650
91-4644
91-4643
91-3624
91-1857
91-1248
91-1247
91-1249
91-1224
91-1255
91-1223
91-1254
91-1222
91-1253
91-848
91-1226
91-882
91-854
91-1250
91-1252
91-1251
91-3725
91-1230
91-1229
91-1228
91-1227
91-1231
91-1567
91-1232
91-1236
91-1237
91-1233
91-1234
91-859
91-887
91-857
91-886
91-856
91-884
91-1235
91-858
91-885
91-3663
91-860
91-888
91-861
91-889
91-1204
91-1202
91-1203
91-1206
91-1187
91-4800
91-351
91-855
91-883
91-4803
91-4805
91-845
91-846
91-847
91-4379
91-4655
91-4720
91-4173
a11509
a11509
a11509
a11509
91-4719
91-2572

OSO GAS WELL PAD AND PIPELINE (±11.92 ACRES - NOT IN PERMIT AREA)

SURFACE PERMIT ONLY (NO MINERALS)

SURFACE PERMIT ONLY (NO MINERALS)

SURFACE FACILITIES

I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

UTAH REGISTERED #6449561 David W. Hibbs PROFESSIONAL ENGINEER

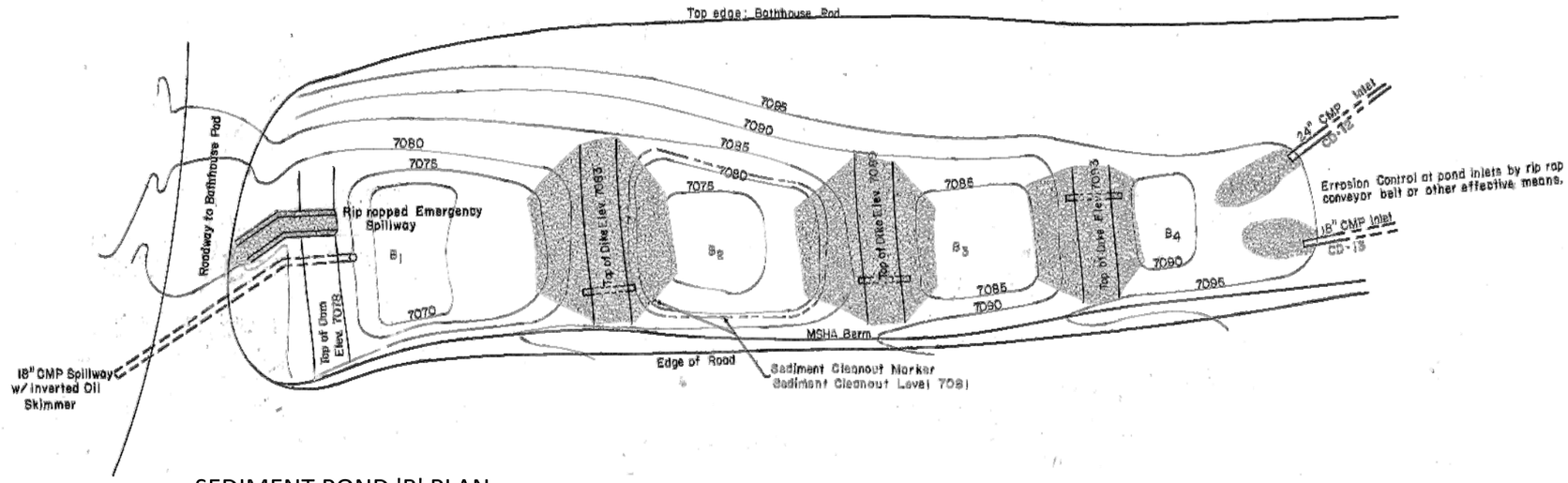
LEGEND

- UNDERGROUND WATER RIGHT
- STOCKWATER RESERVOIR WATER RIGHT
- SPRING WATER RIGHT
- POINT-TO-POINT WATER RIGHT

WATER RIGHTS INFORMATION OBTAINED FROM THE UTAH DIVISION OF WATER RIGHTS ON-LINE MAPS AND FILES.

ANDALEX RESOURCES, INC.
TOWER DIVISION
PRICE, UTAH

G:\Current Drawings\MRP Maps\Tower Mine\Permit Plates Renumbered\Plate 7-3 - Regional Water Rights Map.dwg, Plate 7-3 Water Rights Map, 2/22/2016 11:12:51 AM, 1:1

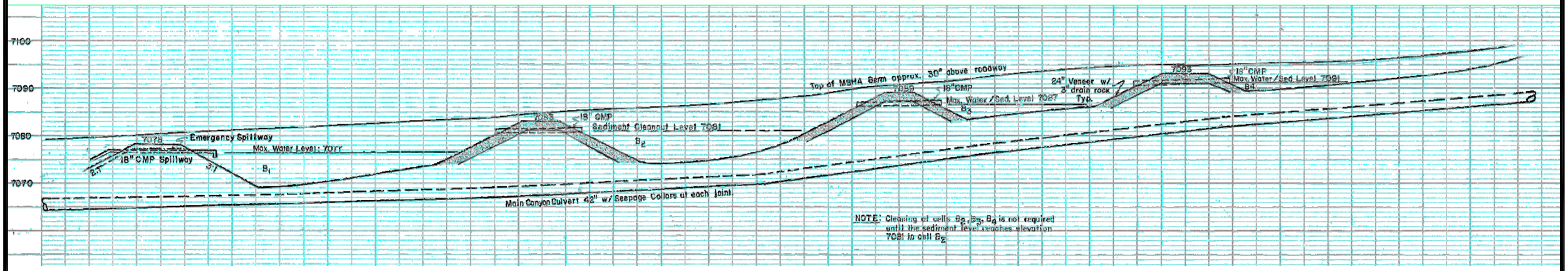


SEDIMENT POND 'B' PLAN

SCALE: 1" = 40'-0"

NORTH

NOTE:
(1) All Cross sections & profiles surveyed by Bruce T.S. Ware, registered land surveyor for the State of Utah.



SEDIMENT POND 'B' PROFILE

SCALE: 1" = 20'-0"

CELL B1

POND BOTTOM:	7069.0'
PRINCIPLE SPILLWAY:	7077.0'
EMERGENCY SPILLWAY:	7077.5'
TOP OF DAM:	7078.0'
MAX. WATER LEVEL:	7077.0'

POND VOLUME

PRINCIPLE SPILLWAY:	0.25 ACRE FEET
EMERGENCY SPILLWAY:	0.28 ACRE FEET

CELL B2

POND BOTTOM:	7074.0'
SPILLWAY:	7081.0'
TOP OF DAM:	7083.0'
MAX. WATER/SEDIMENT LEVEL:	7081.0'

POND VOLUME

CAPACITY:	0.18 ACRE FEET

CELL B3

POND BOTTOM:	7083.0'
SPILLWAY:	7087.0'
TOP OF DAM:	7089.0'
MAX. WATER/SEDIMENT LEVEL:	7087.0'

POND VOLUME

CAPACITY:	0.07 ACRE FEET

CELL B4

POND BOTTOM:	7089.0'
SPILLWAY:	7091.0'
TOP OF DAM:	7093.0'
MAX. WATER/SEDIMENT LEVEL:	7091.0'

POND VOLUME

CAPACITY:	0.02 ACRE FEET

I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

UTAH REGISTERED PROFESSIONAL ENGINEER #6449561 David W. Hibbs

ANDALEX RESOURCES, INC.
TOWER DIVISION
PRICE, UTAH

DRAWN BY: JCB

3	MRP/AB
5	11/4/99
4	9-13-93
7	2-22-2016

FORMERLY PLATE 11

CENTENNIAL PROJECT
SEDIMENT POND 'B'
AS-CONSTRUCTED

PLATE 7-4

DATE: FEB. 22, 2016
REVISION NUMBER: 7

G:\Current Drawings\MRP Maps\Tower Mine\Permit Plates Renumbered\Plate 7-4 - Catch Basin B - As Constructed.dwg, Plate 7-4, 2/22/2016 11:15:36 AM, 1:1

DRAWN BY: JCB 12-10-86

APPROVED MWG

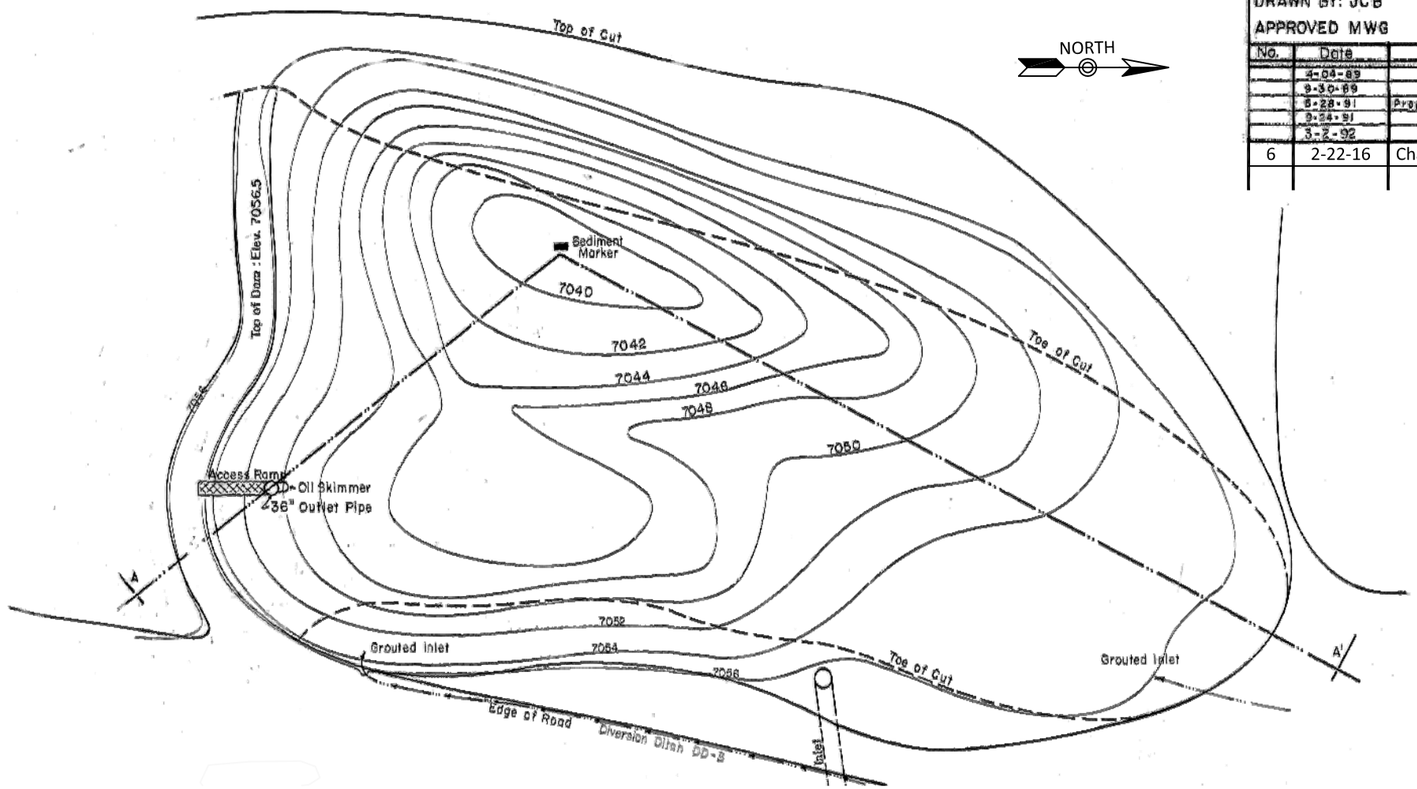
No.	Date	Revisions	By
	4-04-89		JB
	9-30-89		JB
	5-28-91	Proposed Emergency Spillway	JB
	9-24-91		JB
	3-2-92		JB
6	2-22-16	Change Plate Size and Plate Number	PJJ

FORMERLY PLATE 12

CENTENNIAL PROJECT
SEDIMENT POND 'C'
AS-CONSTRUCTED

PLATE 7-5

DATE FEB. 22, 2016
REVISION NUMBER 6



SEDIMENT POND 'C' PLAN

SCALE: 1" = 40'-0"

SEDIMENT POND 'C'

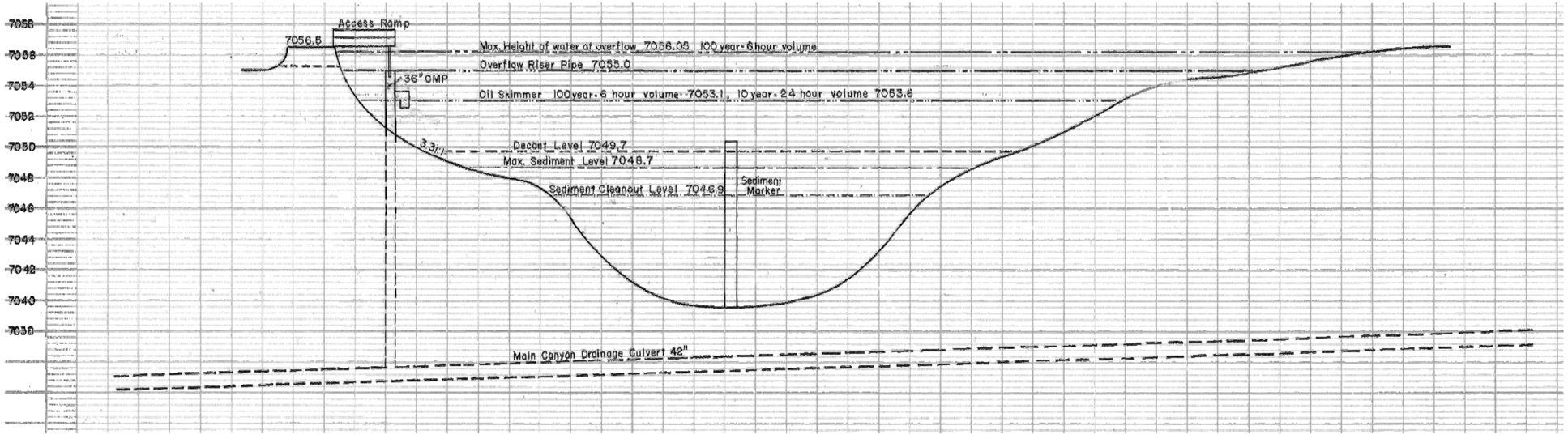
POND BOTTOM:.....7039.5'
OIL SKIMMER:.....7053.1'
OVERFLOW RISER PIPE:.....7055.0'
TOP OF DAM:.....7056.5'

MAX. WATER LEVEL:.....7056.05'

POND VOLUME

OIL SKIMMER:.....3.1 ACRE FEET
OVERFLOW RISER PIPE:.....4.3 ACRE FEET
MAX. HEIGHT OF WATER:.....5.0 ACRE FEET

NOTE:
(1) All Cross sections & profiles surveyed by Bruce T.S. Ware, registered land surveyor for the State of Utah.



SEDIMENT POND 'C' PLAN - CROSS SECTION A-A'

HORIZONTAL SCALE: 1" = 40'-0" VERTICAL SCALE: 1" = 8'-0"

I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

UTAH REGISTERED PROFESSIONAL ENGINEER
#6449561
David W. Hibbs

ANDALEX RESOURCES, INC.
TOWER DIVISION
PRICE, UTAH

G:\Current Drawings\MRP Maps\Tower Mine\Permit Plates Renumbered\Plate 7-5 - Catch Basin C - As Constructed.dwg, Plate 7-5, 2/22/2016 11:19:25 AM, 1:1

FORMERLY PLATE 13

CENTENNIAL PROJECT
SEDIMENT POND 'E'
AS-CONSTRUCTED

PLATE 7-6

DATE FEB. 22, 2016
REVISION NUMBER 2

LEGEND

Disturbed Area Boundary:
2' Contour Lines: 6972
10' Contour Lines: 6970
Drainage:
Spot Elevations: X 61.1
Top of Cut:
Riprap:

SEDIMENT POND 'E'

POND VOLUME
Principle Spillway . . . . . 2.57 ac.ft.
Emergency Spillway . . . . . 3.13 ac.ft.

SEDIMENT LEVEL
Maximum Sediment Level, ... ,6949.3'
Clean Out Level, ... ,6947.8'

PRINCIPLE ELEVATIONS
Pond Bottom, ... ,6934.5'
Decant Inlet, ... ,6949.3'
Principle Spillway, ... ,6957.6'
Emergency Spillway . . . . . ,6958.6'
Top of Dam, ... ,6961.0'

I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

UTAH REGISTERED PROFESSIONAL ENGINEER
#6449561
David W. Hibbs

EMERGENCY SPILLWAY
GROUTED RIPRAP
ELEV. 6958.6'
TOTAL VOLUME: 3.13 AC.FT.

TOP OF CUT

TYPICAL DISTURBED
AREA BOUNDARY

LOOSE ROCK
CHECK DAM

X SEDIMENT CLEANOUT - 6947.8'

DECANT INLET
ELEV. 6949.3'
(MAX. SED. LEVEL)

DECANT VALVE

PRINCIPLE SPILLWAY
30" CMP
6957.6' ELEV.
POND VOLUME
2.57 AC.FT.

CONCRETE
BARRIER

42" CMP

NAIL
N=498861.94
E=2217486.30
ELEV. 6963.0'

HAUL ROAD

POND INLET
24" CMP

MINE ACCESS ROAD

NORTH

SEDIMENT POND 'E' - AS-CONSTRUCTED PLAN

SCALE: 1" = 30'-0"

ANDALEX RESOURCES, INC.
TOWER DIVISION
PRICE, UTAH

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FORMERLY FIGURE 7-2

CENTENNIAL PROJECT
SEEP / SPRING SURVEY MAP

PLATE 7-7

DATE: FEB. 22, 2016
REVISION NUMBER: 3

1500' 0 3000' 6000'

R. 10 E.
R. 11 E.

T. 12 S.
T. 13 S.

B21
B262
B263
B32
SC-S1
B33
B261
B271
B321
B331A
B331
B342
B353
B362
B341
B351
B352
36-1
B361
31-1
32-1
B51
B41
B71
B121
S25-1
B161
S18-1

SURFACE PERMIT ONLY
(NO MINERALS)

OSO GAS WELL PAD
AND PIPELINE
(±11.92 ACRES -
NOT IN PERMIT AREA)

SURFACE PERMIT ONLY
(NO MINERALS)

SURFACE
FACILITIES

I CERTIFY THIS MAP TO BE TRUE AND CORRECT
TO THE BEST OF MY KNOWLEDGE.

UTAH REGISTERED
#6449561
David W. Hibbs
PROFESSIONAL ENGINEER

- SPRING MONITORING STATION
- MONITORING WELL STATION
- STREAM MONITORING STATION
- STOCK WATERING POND

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TOWER DIVISION
PRICE, UTAH

G:\Current Drawings\MRP Maps\Tower Mine\Permit Plates Renumbered\Plate 7-7 - Seep and Spring Survey Map.dwg, Seep and Springs Map, 2/22/2016 11:22:42 AM, 1:1

FORMERLY FIGURE 7-1

CENTENNIAL PROJECT OPERATIONAL WATER MONITORING LOCATIONS

PLATE 7-8

DATE: FEB. 22, 2016
REVISION NUMBER: 3

1750' 0 3500' 7000'

R. 10 E. R. 11 E.

T. 12 S.
T. 13 S.

B211 B32 B262 B263 B33 UG103 BN301 B261 AC-1 SC-1 B271 B321 B331A B342 B353 B362 B331 B-2 UG102 B341 B311 B351 B352 B361 UG101 B-3 31-1 B51 B41 B71 B121 7-1 12-1 Well #1 002 001 003 004 UPDES UTG 040029 8-1 25-1 S-25-1 17-1 17-2 18-3 18-4 S18-1 18-2 B161

SURFACE PERMIT ONLY (NO MINERALS)

OSO GAS WELL PAD AND PIPELINE (±11.92 ACRES - NOT IN PERMIT AREA)

SURFACE FACILITIES

I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

UTAH REGISTERED #6449561 David W. Hibbs PROFESSIONAL ENGINEER

LEGEND

FORMER TOWER WATER MONITORING SITES

- SPRING MONITORING STATION
- STREAM MONITORING STATION

CURRENT TOWER WATER MONITORING STATIONS

- WELL MONITORING STATION
- SPRING MONITORING STATION
- UNDERGROUND WATER MONITORING STATION
- STOCK POND MONITORING STATION
- STREAM MONITORING STATION

FORMER RAG MONITORING STATIONS

- WELL MONITORING STATION
- SPRING MONITORING STATION
- STREAM MONITORING STATION

ANDALEX RESOURCES, INC.
TOWER DIVISION
PRICE, UTAH

G:\Current Drawings\MRP Maps\Tower Mine\Permit Plates Renumbered\Plate 7-8 Water Monitoring Locations.dwg, Water Monitoring Locations, 2/22/2016 11:24:30 AM, 1:1

T. 12 S.
T. 13 S.

RC1
RC4
RC0
RC8
RC2
RC6
RC10
RC12
RC14

WATERSHED AREA BOUNDARY

RECLAIMED AREA BOUNDARY

RIGHT FORK DEADMAN CANYON

DEADMAN CANYON LEFT FORK

R. 10 E.
R. 11 E.

I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

UTAH REGISTERED PROFESSIONAL ENGINEER
#6449561
David W. Hibbs

400' 0 800' 1,600'

SCALE: 1" = 800'

ANDALEX RESOURCES, INC.
TOWER DIVISION
PRICE, UTAH

DIRECTION OF DRAINAGE
WATERSHED AREA BOUNDARY
RECLAIMED AREA BOUNDARY
EPHEMERAL DRAINAGE CHANNEL

CENTENNIAL PROJECT
RECLAMATION
WATERSHED MAP

DATE FEB. 22, 2016
REVISION NUMBER 2

PLATE 7-9

FORMERLY PLATE 17A

G:\Current Drawings\MRP Maps\Tower Mine\Permit Plates Renumbered\Plate 7-9 - Redamation Watershed Map.dwg, Plate 7-9, 2/22/2016 11:25:56 AM, 1:1