SUMMIT COAL COMPANY

1987 ANNUAL REPORT

BOYER MINE

File ACT/043/008 #6

BLACKHAWK ENGINEERING, CO.

Rt. 1, Box 146-H5 - Helper, Utah 84526 - Telephone (801) 637-2422

RECEIVED
MAR 31 1988
DIVISION OF OIL
GAS & MINING
PRICE, UTAH

March 31, 1988

Mr. Lowell P. Braxton
Administrator
Utah Division of Oil, Gas & Mining
355 West North Temple
3 Triad Center, Suite 350
Salt Lake City, Utah 84180-1203

Re: Annual Report
Summit Coal Company
Boyer Mine
ACT/043/008
Summit County, Utah

Dear Mr. Braxton:

Enclosed is the 1987 Annual Report for the Summit Coal Company Boyer Mine Operation.

If you have any questions, or need any further information, please let me know.

Respectfully,

Dan W. Guy

Dan W. Guy

cc: Mr. Jack Blonquist
File

SUMMIT COAL COMPANY

1987 ANNUAL REPORT

BOYER MINE

[Revised January 1988]

COAL MINING AND RECLAMATION OPERATIONS FOR 1987
(Authority UMC 784)

(Must be submitted to the Division by March 31, 1988)

State of Utah
Department of Natural Resources
Division of Oil, Gas and Mining
3 Triad Center, Suite 350
355 West North Temple
Salt Lake City, UT 84180-1203
(801) 538-5340

Operator: Summit Coal Co.

Mine Name: Boyer Mine

Mailing Address: P.O. Box 646 Coalville Utah 84017

Company Representative: Jack Blonquist

Permit Number: ACT/043/008

Date of Most Recent Permanent Program Permit: May 15, 1987

Quantity of Coal Mined (tonnage) 1987: 34,044.975 Tons

Attach Updated Mine Sequence Map.

All monitoring activities during the report period must be submitted with this report (including, but not limited to):

A. Summarized Water Monitoring Data

B. Precipitation or Other Climatological Data

C. Subsidence Monitoring Report

D. Vegetation Data (test plots) or Revegetation Success Monitoring (includes interim and final)

E. Permit Stipulation Status

jr
1426R/1

1987

WATER MONITORING DATA

GROUND WATER

CHEMTECH
CHEMICAL AND BACTERIOLOGICAL ANALYSES

367 SOUTH COMMERCE LOOP
OREM, UTAH 84057
(801) 226-8822

2875 MAIN
SUITE #101
SALT LAKE CITY, UTAH 84115
(801) 483-1162

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DIVISION OF

CERTIFICATE OF ANALYSIS

SAMPLE IDENTIFICATION
CLIENT: Earthfax Engineering
7324 So. 1300 E.
Midvale, UT 84047
LAB NO: U024780
DATE SAMPLED: 1-29-88
TIME SAMPLED:
SAMPLED BY: JDG
LOCATION: Boyer Mine
New Well
COMMENTS: Metals - Dissolved

PARAMETER	LEVEL
Alkalinity as $CaCO_3$, mg/l	334
Ammonia as NH_3-N, mg/l	3.96
Arsenic as As, mg/l	0.011
Barium as Ba, mg/l	0.118
Bicarbonate as HCO_3, mg/l	407
Boron as B, mg/l	0.15
Cadmium as Cd, mg/l	<.01
Calcium as Ca, mg/l	48.2
Carbonate as CO_3, mg/l	0
Chloride as Cl, mg/l	227
Chromium as Cr (Hex), mg/l	<.01
Chromium as Cr (Tot), mg/l	<.01
Aluminum as Al, mg/l	<.1
Molybdenum as Mo, mg/l	<.01
Sulfide as S, mg/l	<.1

PARAMETER	LEVEL
Conductivity, umhos/cm	1,450
Copper as Cu, mg/l	<.01
Fluoride as F, mg/l	1.72
Hardness as $CaCO_3$, mg/l	200
Hydroxide as OH, mg/l	0
Iron as Fe (Diss), mg/l	<.01
Iron as Fe (Tot), mg/l	0.055
Lead as Pb, mg/l	<.01
Magnesium as Mg, mg/l	15.5
Manganese as Mn, mg/l	0.038
Mercury as Hg, mg/l	<.0002
Nickel as Ni, mg/l	0.020
Nitrate as NO_3-N, mg/l	<.01
Nitrite as NO_2-N, mg/l	<.005
Phosphate as PO_4-P, mg/l	<.01
Potassium as K, mg/l	4.9
Selenium as Se, mg/l	<.002
Silica as SiO_2 (Diss), mg/l	7.78
Silver as Ag, mg/l	<.01
Sodium as Na, mg/l	273
Sulfate as SO_4, mg/l	149
Total Dissolved Solids, mg/l	905
Turbidity, NTU	0.17
Zinc as Zn, mg/l	0.075
pH Units	7.76

Rex Henderson

CHEMTECH

CHEMICAL AND BACTERIOLOGICAL ANALYSES

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CERTIFICATE OF ANALYSIS

SAMPLE IDENTIFICATION
CLIENT: Earthfax Engineering, Inc
7324 So. 1300 E.
Midvale, UT 84047
LAB NO: U023366
DATE SAMPLED: 11-30-87
TIME SAMPLED:
SAMPLED BY: RBW
LOCATION: Boyer Mine
New Well
COMMENTS: Metals Dissolved

PARAMETER	LEVEL
Alkalinity as $CaCO_3$, mg/l	312
Ammonia as NH_3-N, mg/l	1.15
Arsenic as As, mg/l	0.012
Barium as Ba, mg/l	0.052
Bicarbonate as HCO_3, mg/l	380
Boron as B, mg/l	0.21
Cadmium as Cd, mg/l	<.01
Calcium as Ca, mg/l	46.4
Carbonate as CO_3, mg/l	0
Chloride as Cl, mg/l	205
Chromium as Cr (Hex), mg/l	<.01
Chromium as Cr (Tot), mg/l	<.01
Sulfide as S, mg/l	<.1
Aluminum as Al, mg/l	<.1
Molybdenum as Mo, mg/l	<.01

PARAMETER	LEVEL
Conductivity, umhos/cm	1,440
Copper as Cu, mg/l	<.01
Fluoride as F, mg/l	0.88
Hardness as $CaCO_3$, mg/l	180
Hydroxide as OH, mg/l	0
Iron as Fe (Diss), mg/l	<.01
Iron as Fe (Tot), mg/l	0.095
Lead as Pb, mg/l	0.032
Magnesium as Mg, mg/l	15.2
Manganese as Mn, mg/l	0.020
Mercury as Hg, mg/l	<.0002
Nickel as Ni, mg/l	<.01
Nitrate as NO_3-N, mg/l	<.01
Nitrite as NO_2-N, mg/l	0.011
Phosphate as PO_4-P, mg/l	<.01
Potassium as K, mg/l	5.3
Selenium as Se, mg/l	0.0022
Silica as SiO_2 (Diss), mg/l	14.8
Silver as Ag, mg/l	<.01
Sodium as Na, mg/l	266
Sulfate as SO_4, mg/l	86
Total Dissolved Solids, mg/l	900
Turbidity, NTU	1.5
Zinc as Zn, mg/l	0.26
pH Units	7.94

Rex Henderson

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CHEMICAL AND BACTERIOLOGICAL ANALYSES

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CERTIFICATE OF ANALYSIS

SAMPLE IDENTIFICATION
CLIENT: Earthfax Engineering
7324 So. 1300 E.
Midvale, UT 84047
LAB NO: U021555
DATE SAMPLED: 9-29-87
TIME SAMPLED:
SAMPLED BY: DNG
LOCATION: Boyer Mine
New Well
COMMENTS:

PARAMETER	LEVEL
Alkalinity as $CaCO_3$, mg/l	334
Aluminum as Al, mg/l	<.1
Ammonia as NH_3-N, mg/l	2.38
Arsenic as As, mg/l	<.01
Barium as Ba, mg/l	0.018
Bicarbonate as HCO_3, mg/l	407
Boron as B, mg/l	0.18
Cadmium as Cd, mg/l	<.01
Calcium as Ca, mg/l	27.8
Carbonate as CO_3, mg/l	0
Chloride as Cl, mg/l	157
Chromium as Cr (Hex), mg/l	<.01
Chromium as Cr (Tot), mg/l	<.01
Molybdenum as Mo, mg/l	<.01
Sulfide as S, mg/l	<.1
Conductivity, umhos/cm	1020
Copper as Cu, mg/l	<.01
Fluoride as F, mg/l	0.98
Hardness as $CaCO_3$, mg/l	65
Hydroxide as OH, mg/l	0
Iron as Fe (Diss), mg/l	<.01
Iron as Fe (Tot), mg/l	0.060
Lead as Pb, mg/l	<.01
Magnesium as Mg, mg/l	7.1
Manganese as Mn, mg/l	0.062
Mercury as Hg, mg/l	<.0002
Nickel as Ni, mg/l	<.01
Nitrate as NO_3-N, mg/l	0.050
Nitrite as NO_2-N, mg/l	0.0078
Phosphate as PO_4-P, mg/l	0.022
Potassium as K, mg/l	4.2
Selenium as Se, mg/l	<.002
Silica as SiO_2 (Diss), mg/l	7.4
Silver as Ag, mg/l	<.01
Sodium as Na, mg/l	230
Sulfate as SO_4, mg/l	67
Total Dissolved Solids, mg/l	767
Turbidity, NTU	2.4
Zinc as Zn, mg/l	<.01
pH Units	7.97

Rex Henderson

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CHEMICAL AND BACTERIOLOGICAL ANALYSES

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SAMPLE IDENTIFICATION

CLIENT: Earthfax Engineering, Inc
7324 So. 1300 E.
Midvale, UT 84047

LAB NO: U021025

DATE SAMPLED: 9-10-87

TIME SAMPLED:

SAMPLED BY:

LOCATION: Morby Well

COMMENTS:

PARAMETER	LEVEL
Alkalinity as $CaCO_3$, mg/l	328
Aluminum as Al, mg/l	<.1
Ammonia as NH_3-N, mg/l	1.71
Arsenic as As, mg/l	<.01
Barium as Ba, mg/l	0.045
Bicarbonate as HCO_3, mg/l	401
Boron as B, mg/l	0.110
Cadmium as Cd, mg/l	<.01
Calcium as Ca, mg/l	101
Carbonate as CO_3, mg/l	0
Chloride as Cl, mg/l	274
Chromium as Cr (Hex), mg/l	<.01
Chromium as Cr (Tot), mg/l	<.01
Molybdenum as Mo, mg/l	<.01
Sulfide as S, mg/l	<.1

PARAMETER	LEVEL
Conductivity, umhos/cm	2,020
Copper as Cu, mg/l	<.01
Fluoride as F, mg/l	1.03
Hardness as $CaCO_3$, mg/l	532
Hydroxide as OH, mg/l	0
Iron as Fe (Diss), mg/l	0.18
Iron as Fe (Tot), mg/l	1.67
Lead as Pb, mg/l	<.01
Magnesium as Mg, mg/l	56.8
Manganese as Mn, mg/l	0.158
Mercury as Hg, mg/l	<.0002
Nickel as Ni, mg/l	<.01
Nitrate as NO_3-N, mg/l	0.498
Nitrite as NO_2-N, mg/l	0.048
Phosphate as PO_4-P, mg/l	<.01
Potassium as K, mg/l	6.8
Selenium as Se, mg/l	<.002
Silver as Ag, mg/l	<.01
Sodium as Na, mg/l	270
Sulfate as SO_4, mg/l	260
Total Dissolved Solids, mg/l	1,380
Turbidity, NTU	27
Zinc as Zn, mg/l	1.04
pH Units	7.32

Rex Henderson

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CHEMICAL AND BACTERIOLOGICAL ANALYSES

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SAMPLE IDENTIFICATION

CLIENT: Earthfax Engineering, Inc
7324 So. 1300 E.
Midvale, UT 84047

LAB NO: U021026

DATE SAMPLED: 9-10-87

TIME SAMPLED:

SAMPLED BY:

LOCATION: Boyer Well

COMMENTS:

PARAMETER	LEVEL
Alkalinity as $CaCO_3$, mg/l	274
Aluminum as Al, mg/l	<.1
Ammonia as NH_3-N, mg/l	0.48
Arsenic as As, mg/l	<.01
Barium as Ba, mg/l	0.060
Bicarbonate as HCO_3, mg/l	334
Boron as B, mg/l	0.127
Cadmium as Cd, mg/l	<.01
Calcium as Ca, mg/l	17.2
Carbonate as CO_3, mg/l	0
Chloride as Cl, mg/l	31.2
Chromium as Cr (Hex), mg/l	<.01
Chromium as Cr (Tot), mg/l	<.01
Molybdenum as Mo, mg/l	<.01
Sulfide as S, mg/l	<.1
Conductivity, umhos/cm	579
Copper as Cu, mg/l	0.025
Fluoride as F, mg/l	0.52
Hardness as $CaCO_3$, mg/l	91
Hydroxide as OH, mg/l	0
Iron as Fe (Diss), mg/l	<.01
Iron as Fe (Tot), mg/l	0.27
Lead as Pb, mg/l	<.01
Magnesium as Mg, mg/l	9.1
Manganese as Mn, mg/l	0.038
Mercury as Hg, mg/l	<.0002
Nickel as Ni, mg/l	<.01
Nitrate as NO_3-N, mg/l	1.838
Nitrite as NO_2-N, mg/l	<.005
Phosphate as PO_4-P, mg/l	<.01
Potassium as K, mg/l	3.1
Selenium as Se, mg/l	<.002
Silver as Ag, mg/l	<.01
Sodium as Na, mg/l	103
Sulfate as SO_4, mg/l	21
Total Dissolved Solids, mg/l	380
Turbidity, NTU	0.75
Zinc as Zn, mg/l	0.27
pH Units	7.70

Rex Henderson

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CHEMICAL AND BACTERIOLOGICAL ANALYSES

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FEB 18 1988
DIVISION OF
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TO: Earthfax Engineering
7324 So. 1300 E. Suite 100
Midvale, UT 84047

SAMPLE ID: Lab #U020147 - New Well @ Dover Mine, 7-31-87

sample date 7/2/87

CERTIFICATE OF ANALYSIS

PARAMETER	LEVEL
Chromium as Cr, mg/l	<.01
Copper as Cu, mg/l	<.01
Iron as Fe, mg/l	0.28
Lead as Pb, mg/l	0.010
Magnesium as Mg, mg/l	3.5
Manganese as Mn, mg/l	0.025
Mercury (Inorganic) as Hg, mg/l	<.0002
Molybdenum as Mo, mg/l	<.01
Nickel as Ni, mg/l	0.020
Sodium as Na, mg/l	216
Zinc as Zn, mg/l	0.16
Ammonia as NH_3-N, mg/l	1.18
Nitrate as NO_3-N, mg/l	<.01
Nitrite as NO_2-N, mg/l	<.005
Phosphate as PO_4-P, mg/l	<.01
pH Units	8.29

Rex Henderson

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CHEMICAL AND BACTERIOLOGICAL ANALYSES

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DIVISION OF
OIL, GAS & MINING

TO: Earthfax Engineering
7224 So. 1300 E. Suite 100
Midvale, UT 84047

SAMPLE ID: Lab #U020147 - New Well @ Boyer Mine, 7-31-87

CERTIFICATE OF ANALYSIS

PARAMETER	LEVEL
TDS, mg/l	625
Total Hardness as $CaCO_3$, mg/l	34.1
Boron as B, mg/l	0.157
Bicarbonate as HCO_3, mg/l	417
Carbonate as CO_3, mg/l	2.1
Chloride as Cl, mg/l	115
Fluoride as F, mg/l	2.74
Selenium as Se, mg/l	<.002
Sulfate as SO_4, mg/l	38.0
Sulfide as S, mg/l	<.1
Aluminum as Al, mg/l	<.1
Arsenic as As, mg/l	<.01
Barium as Ba, mg/l	0.030
Calcium as Ca, mg/l	16.6
Cadmium as Cd, mg/l	<.01

Rex Henderson

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CHEMICAL AND BACTERIOLOGICAL ANALYSES

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FEB 18 1988
DIVISION OF
OIL, GAS & MINING

CERTIFICATE OF ANALYSIS

SAMPLE IDENTIFICATION

CLIENT: Earthfax Engineering
7324 So. 1300 E.
Midvale, UT 84047

LAB NO: U019194

DATE SAMPLED: 6-6-87

TIME SAMPLED:

SAMPLED BY:

LOCATION: Old Well

COMMENTS:

PARAMETER	LEVEL
Alkalinity as $CaCO_3$, mg/l	387
Aluminum as Al, mg/l	<.1
Ammonia as NH_3-N, mg/l	0.42
Arsenic as As, mg/l	0.022
Barium as Ba, mg/l	0.082
Bicarbonate as HCO_3, mg/l	472
Boron as B, mg/l	0.58
Cadmium as Cd, mg/l	<.01
Calcium as Ca, mg/l	288
Carbonate as CO_3, mg/l	0
Chloride as Cl, mg/l	470
Chromium as Cr (Hex), mg/l	<.01
Chromium as Cr (Tot), mg/l	<.01
Molybdenum as Mo, mg/l	<.01
Conductivity, umhos/cm	3,440
Copper as Cu, mg/l	<.01
Fluoride as F, mg/l	0.74
Hardness as $CaCO_3$, mg/l	1,460
Hydroxide as OH, mg/l	0
Iron as Fe, mg/l	8.70
Lead as Pb, mg/l	0.055
Magnesium as Mg, mg/l	205
Manganese as Mn, mg/l	0.12
Mercury as Hg, mg/l	<.0002
Nickel as Ni, mg/l	<.01
Nitrate as NO_3-N, mg/l	0.10
Nitrite as NO_2-N, mg/l	0.009
Phosphate as PO_4-P, mg/l	<.01
Potassium as K, mg/l	13.2
Selenium as Se, mg/l	0.0020
Silica as SiO_2 (Diss), mg/l	5.7
Silver as Ag, mg/l	<.01
Sodium as Na, mg/l	284
Sulfate as SO_4, mg/l	1,110
Total Dissolved Solids, mg/l	2,680
Turbidity, NTU	74
Zinc as Zn, mg/l	0.75
pH Units	7.79

Rex Henderson

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CHEMICAL AND BACTERIOLOGICAL ANALYSES

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CERTIFICATE OF ANALYSIS

SAMPLE IDENTIFICATION
CLIENT: Earthfax Engineering
7324 So. 1300 E.
Midvale, UT 84047
LAB NO: U019193
DATE SAMPLED: 6-6-87
TIME SAMPLED:
SAMPLED BY:
LOCATION: New Well

COMMENTS:

PARAMETER	LEVEL
Alkalinity as $CaCO_3$, mg/l	365
Aluminum as Al, mg/l	<.1
Ammonia as NH_3-N, mg/l	0.63
Arsenic as As, mg/l	<.01
Barium as Ba, mg/l	0.020
Bicarbonate as HCO_3, mg/l	445
Boron as B, mg/l	0.28
Cadmium as Cd, mg/l	<.01
Calcium as Ca, mg/l	36.1
Carbonate as CO_3, mg/l	0
Chloride as Cl, mg/l	86.6
Chromium as Cr (Hex), mg/l	<.01
Chromium as Cr (Tot), mg/l	<.01
Molybdenum as Mo, mg/l	<.01
Conductivity, umhos/cm	932
Copper as Cu, mg/l	<.01
Fluoride as F, mg/l	2.76
Hardness as $CaCO_3$, mg/l	92
Hydroxide as OH, mg/l	0
Iron as Fe, mg/l	0.075
Lead as Pb, mg/l	0.022
Magnesium as Mg, mg/l	2.1
Manganese as Mn, mg/l	<.01
Mercury as Hg, mg/l	<.0002
Nickel as Ni, mg/l	<.01
Nitrate as NO_3-N, mg/l	0.020
Nitrite as NO_2-N, mg/l	0.009
Phosphate as PO_4-P, mg/l	0.024
Potassium as K, mg/l	3.7
Selenium as Se, mg/l	<.002
Silica as SiO_2 (Diss), mg/l	6.9
Silver as Ag, mg/l	<.01
Sodium as Na, mg/l	195
Sulfate as SO_4, mg/l	27
Total Dissolved Solids, mg/l	587
Turbidity, NTU	4.3
Zinc as Zn, mg/l	0.043
pH Units	8.17

Rex Henderson

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CHEMICAL AND BACTERIOLOGICAL ANALYSES

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CERTIFICATE OF ANALYSIS

SAMPLE IDENTIFICATION

CLIENT: Earthfax Engineering
7324 So. 1300 E.
Midvale, UT 84047

LAB NO: U019192
DATE SAMPLED: 6-6-87
TIME SAMPLED:
SAMPLED BY:
LOCATION: Morby Well

COMMENTS: Dissolved Metals

PARAMETER	LEVEL
Alkalinity as $CaCO_3$, mg/l	349
Aluminum as Al, mg/l	<.1
Ammonia as NH_3-N, mg/l	0.86
Arsenic as As, mg/l	0.018
Barium as Ba, mg/l	0.055
Bicarbonate as HCO_3, mg/l	425
Boron as B, mg/l	0.27
Cadmium as Cd, mg/l	<.01
Calcium as Ca, mg/l	128
Carbonate as CO_3, mg/l	0
Chloride as Cl, mg/l	264
Chromium as Cr (Hex), mg/l	<.01
Chromium as Cr (Tot), mg/l	<.01
Molybdenum as Mo, mg/l	<.01
Conductivity, umhos/cm	2,050
Copper as Cu, mg/l	<.01
Fluoride as F, mg/l	0.86
Hardness as $CaCO_3$, mg/l	598
Hydroxide as OH, mg/l	0
Iron as Fe, mg/l	0.27
Lead as Pb, mg/l	0.035
Magnesium as Mg, mg/l	60.2
Manganese as Mn, mg/l	0.092
Mercury as Hg, mg/l	<.0002
Nickel as Ni, mg/l	<.01
Nitrate as NO_3-N, mg/l	0.075
Nitrite as NO_2-N, mg/l	0.011
Phosphate as PO_4-P, mg/l	<.01
Potassium as K, mg/l	9.3
Selenium as Se, mg/l	0.0023
Silica as SiO_2 (Diss), mg/l	6.0
Silver as Ag, mg/l	<.01
Sodium as Na, mg/l	220
Sulfate as SO_4, mg/l	417
Total Dissolved Solids, mg/l	1,310
Turbidity, NTU	1.7
Zinc as Zn, mg/l	1.22
pH Units	7.72

Raw water (≈ 1 liter)
Metals (500 ml w/ HNO_3)
Nutrients (500 ml w/ H_2SO_4)
Field pH, EC, temp

Rex Henderson

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CHEMICAL AND BACTERIOLOGICAL ANALYSES

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(801) 486-5563

FEB 18 1988

CERTIFICATE OF ANALYSIS

SAMPLE IDENTIFICATION
CLIENT: Earthfax Engineering
7324 So. 1300 E. #100
Midvale, UT 84047
LAB NO: U018048
DATE SAMPLED: 4-2-87
TIME SAMPLED:
SAMPLED BY: DNG/RBG
LOCATION: Boyer Mine
New Well
COMMENTS: Metals Dissolved

PARAMETER	LEVEL
Alkalinity as $CaCO_3$, mg/l	361
Aluminum as Al, mg/l	<.01
Ammonia as NH_3-N, mg/l	0.68
Arsenic as As, mg/l	<.01
Barium as Ba, mg/l	0.065
Bicarbonate as HCO_3, mg/l	426
Boron as B, mg/l	0.28
Cadmium as Cd, mg/l	<.01
Calcium as Ca, mg/l	22.7
Carbonate as CO_3, mg/l	6.5
Chloride as Cl, mg/l	84.6
Chromium as Cr (Hex), mg/l	<.01
Chromium as Cr (Tot), mg/l	<.01
Molybdenum as Mo, mg/l	<.01
Oil & Grease, mg/l	1.09
Sulfide as S, mg/l	<.1
Conductivity, umhos/cm	920
Copper as Cu, mg/l	0.015
Fluoride as F, mg/l	3.35
Hardness as $CaCO_3$, mg/l	70
Hydroxide as OH, mg/l	0
Iron as Fe (Diss), mg/l	<.01
Iron as Fe (Tot), mg/l	0.02
Lead as Pb, mg/l	<.01
Magnesium as Mg, mg/l	3.2
Manganese as Mn, mg/l	0.032
Mercury as Hg, mg/l	<.0002
Nickel as Ni, mg/l	<.01
Nitrate as NO_3-N, mg/l	0.010
Nitrite as NO_2-N, mg/l	0.026
Phosphate as PO_4-P, mg/l	0.070
Potassium as K, mg/l	3.4
Selenium as Se, mg/l	<.002
Silica as SiO_2 (Diss), mg/l	6.9
Silver as Ag, mg/l	0.022
Sodium as Na, mg/l	180
Sulfate as SO_4, mg/l	10.6
Total Dissolved Solids, mg/l	525
Turbidity, NTU	1.3
Zinc as Zn, mg/l	0.060
pH Units	8.29
TSS, mg/l	58
Settleable Solids, mg/l	<.1

Rex Henderson

CHEMTECH

CHEMICAL AND BACTERIOLOGICAL ANALYSES

367 SOUTH COMMERCE LOOP
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(801) 226-8822

2875 MAIN
SUITE # 01
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(801) 483-1163

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CERTIFICATE OF ANALYSIS

SAMPLE IDENTIFICATION

CLIENT: Earthfax Engineering
7324 So. 1300 E. #100
Midvale, UT 84047

LAB NO: U016940
DATE SAMPLED: 1-29-87
TIME SAMPLED:
SAMPLED BY: DNG
LOCATION: Boyer Mine
Old Well
COMMENTS: Metals Dissolved

PARAMETER	LEVEL
Alkalinity as $CaCO_3$, mg/l	332
Aluminum as Al, mg/l	0.12
Ammonia as NH_3-N, mg/l	0.54
Arsenic as As, mg/l	0.018
Barium as Ba, mg/l	0.080
Bicarbonate as HCO_3, mg/l	405
Boron as B, mg/l	0.43
Cadmium as Cd, mg/l	<.01
Calcium as Ca, mg/l	148
Carbonate as CO_3, mg/l	0
Chloride as Cl, mg/l	97.8
Chromium as Cr (Hex), mg/l	<.01
Chromium as Cr (Tot), mg/l	<.01
Molybdenum as Mo, mg/l	<.01
Conductivity, umhos/cm	3,500
Copper as Cu, mg/l	0.025
Fluoride as F, mg/l	0.64
Hardness as $CaCO_3$, mg/l	1,450
Hydroxide as OH, mg/l	0
Iron as Fe (Diss), mg/l	0.33
Iron as Fe (Tot), mg/l	14.1
Lead as Pb, mg/l	0.030
Magnesium as Mg, mg/l	173
Manganese as Mn, mg/l	0.16
Mercury as Hg, mg/l	<.0002
Nickel as Ni, mg/l	0.020
Nitrate as NO_3-N, mg/l	1.09
Nitrite as NO_2-N, mg/l	0.032
Phosphate as PO_4-P, mg/l	<.01
Potassium as K, mg/l	12.9
Selenium as Se, mg/l	0.0025
Silica as SiO_2 (Diss), mg/l	6.0
Silver as Ag, mg/l	0.010
Sodium as Na, mg/l	302
Sulfate as SO_4, mg/l	1,230
Total Dissolved Solids, mg/l	2,810
Turbidity, NTU	--
Zinc as Zn, mg/l	1.02
pH Units	7.63
Sulfide as S, mg/l	<.1

Rex Henderson

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CERTIFICATE OF ANALYSIS

SAMPLE IDENTIFICATION

CLIENT: Earthfax Engineering, Inc.
7324 So. 1300 E. Suite 100
Midvale, UT 84047

LAB NO.: U015765

DATE SAMPLED: 11-8-86

TIME SAMPLED:

SAMPLED BY: CSW

LOCATION: Bover Mine - Coalville UT
Morbey Well

COMMENTS: Metals Dissolved

PARAMETER	LEVEL
Alkalinity as $CaCO_3$, mg/l	143
Ammonia as NH_3-N, mg/l	<.1
Arsenic as As, mg/l	<.01
Barium as Ba, mg/l	0.035
Bicarbonate as HCO_3, mg/l	174
Boron as B, mg/l	0.32
Cadmium as Cd, mg/l	<.01
Calcium as Ca, mg/l	102
Carbonate as CO_3, mg/l	0
Aluminum as Al, mg/l	<.1
Molybdenum as Mo, mg/l	<.01
Sulfide as S, mg/l	<.1

PARAMETER	LEVEL
Chloride as Cl, mg/l	220
Chromium as Cr (Hex.), mg/l	<.01
Chromium as Cr (Total), mg/l	<.01
Conductivity, umhos/cm	1,820
Copper as Cu, mg/l	0.017
Fluoride as F, mg/l	0.53
Hardness as $CaCO_3$, mg/l	750
Hydroxide as OH, mg/l	0
Iron as Fe (Dissolved), mg/l	0.020
Iron as Fe (Total), mg/l	0.15
Lead as Pb, mg/l	0.047
Magnesium as Mg, mg/l	82
Manganese as Mn, mg/l	0.020
Mercury as Hg, mg/l	<.0002
Nickel as Ni, mg/l	0.020
Nitrate as NO_3-N, mg/l	3.84
Nitrite as NO_2-N, mg/l	0.011
Phosphate as PO_4-P, mg/l	<.01
Potassium as K, mg/l	5.9
Selenium as Se, mg/l	<.002
Silica as SiO_2 (Dissolved), mg/l	--
Silver as Ag, mg/l	<.01
Sodium as Na, mg/l	123
Sulfate as SO_4, mg/l	400
Total Dissolved Solids, mg/l	1,280
Turbidity, NTU	--
Zinc as Zn, mg/l	0.53
pH Units	7.63

CHEMTECH

CATION-ANION BALANCE

Sample No.: 15765

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Cations	mg/l	Eq/l
Ca	102.0000	5.0898
Mg	82.0000	6.7478
Mn	0.0200	0.0007
Na	123.0000	5.3505
K	5.9000	0.1509
Fe	0.0200	0.0011
Pb	0.0470	0.0005
Zn	0.5300	0.0162
Al	0.0000	0.0000
NH3-	0.0000	0.0000
	Total	17.3574

Anions	mg/l	Eq/l
HCO3	174.0000	2.8519
CO3	0.0000	0.0000
Cl	220.0000	6.2062
SO4	400.0000	8.3320
NO3	3.8400	0.0619
NO2	0.0110	0.0002
[illegible]	0.0000	0.0000
F	0.5300	0.0279
	Total	17.4801

% Difference	-0.705
Calculated TDS	1023
Laboratory TDS	1280
% Difference	-22.334
Laboratory hardness	750
Calculated hardness	593

MICAL AND BACTERIOLOGICAL ANALYSES

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CERTIFICATE OF ANALYSIS

SAMPLE IDENTIFICATION

CLIENT: Earthfax Engineers, Inc.
7324 S. 1300 E.
Midvale, UT 84047

LAB NO.: U015415

DATE SAMPLED: 10-21-86

TIME SAMPLED: 1530

SAMPLED BY: CSW

LOCATION: Boyer Mine - Old Well
Coalville, UT

COMMENTS: Metals - Dissolved Only

PARAMETER	LEVEL
Alkalinity as $CaCO_3$, mg/l	344
Ammonia as NH_3-N, mg/l	1.12
Arsenic as As, mg/l	0.018
Barium as Ba, mg/l	0.062
Bicarbonate as HCO_3, mg/l	420
Boron as B, mg/l	0.209
Cadmium as Cd, mg/l	0.017
Calcium as Ca, mg/l	225
Carbonate as CO_3, mg/l	0
Sulfide as S, mg/l	<.1
Aluminum as Al, mg/l	<.1
Molybdenum as Mo, mg/l	<.01

PARAMETER	LEVEL
Chloride as Cl, mg/l	466
Chromium as Cr (Hex.), mg/l	--
Chromium as Cr (Total), mg/l	<.01
Conductivity, umhos/cm	4590
Copper as Cu, mg/l	<.01
Fluoride as F, mg/l	0.91
Hardness as $CaCO_3$, mg/l	1500
Hydroxide as OH, mg/l	0
Iron as Fe (Dissolved), mg/l	1.44
Iron as Fe (Total), mg/l	--
Lead as Pb, mg/l	0.10
Magnesium as Mg, mg/l	175
Manganese as Mn, mg/l	0.078
Mercury as Hg, mg/l	<.0002
Nickel as Ni, mg/l	0.030
Nitrate as NO_3-N, mg/l	0.096
Nitrite as NO_2-N, mg/l	0.0097
Phosphate as PO_4-P, mg/l ...(ortho)	<.01
Potassium as K, mg/l	13.4
Selenium as Se, mg/l	0.0038
Silica as SiO_2 (Dissolved), mg/l	--
Silver as Ag, mg/l	<.01
Sodium as Na, mg/l	320
Sulfate as SO_4, mg/l	1040
Total Dissolved Solids, mg/l	2870
Turbidity, NTU	--
Zinc as Zn, mg/l	0.36
pH Units	7.44

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CATION-ANION BALANCE

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Sample No.: 15415

Cations	mg/l	Eq/l
Ca	225.0000	11.2275
Mg	175.0000	14.4008
Na	320.0000	13.9200
K	13.4000	0.3426
Fe	1.4400	0.0774
Pb	0.1000	0.0010
Zn	0.3600	0.0110
Al	0.0000	0.0000
NH3-	1.1200	0.0800
	Total	40.0602

Anions	mg/l	Eq/l
HCO3	420.0000	6.8838
CO3	0.0000	0.0000
Cl	466.0000	13.1459
SO4	1040.0000	21.6632
NO3	0.0960	0.0015
NO2	0.0097	0.0002
PO4	0.0000	0.0000
F	0.9100	0.0479
	Total	41.7425

% Difference	-4.113
Calculated TDS	2447

EMICAL AND BACTERIOLOGICAL ANALYSE

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SAMPLE IDENTIFICATION

CLIENT: Earthfax Engineers, Inc.
7324 S. 1300 E.
Midvale, UT 84047

LAB NO.: U015322

DATE SAMPLED: 10-17-86

TIME SAMPLED:

SAMPLED BY: CSW

LOCATION: Boyer Mine Well #1 (Boyer Well)
Coalville, UT

COMMENTS: Metals - Dissolved Only

PARAMETER	LEVEL
Alkalinity as $CaCO_3$, mg/l	205
Ammonia as NH_3-N, mg/l	1.46
Arsenic as As, mg/l	<.01
Barium as Ba, mg/l	<.01
Bicarbonate as HCO_3, mg/l	250
Boron as B, mg/l	0.133
Cadmium as Cd, mg/l	0.017
Calcium as Ca, mg/l	5.62
Carbonate as CO_3, mg/l	29.6
Sulfide as S, mg/l	<.1
Aluminum as Al, mg/l	<.1
Molybdenum as Mo, mg/l	<.01

PARAMETER	LEVEL
Chloride as Cl, mg/l	23
Chromium as Cr (Hex.), mg/l	--
Chromium as Cr (Total), mg/l	<.01
Conductivity, umhos/cm	582
Copper as Cu, mg/l	<.01
Fluoride as F, mg/l	0.64
Hardness as $CaCO_3$, mg/l	38.9
Hydroxide as OH, mg/l	0
Iron as Fe (Dissolved), mg/l	0.025
Iron as Fe (Total), mg/l	--
Lead as Pb, mg/l	<.01
Magnesium as Mg, mg/l	3.6
Manganese as Mn, mg/l	<.01
Mercury as Hg, mg/l	<.0002
Nickel as Ni, mg/l	0.030
Nitrate as NO_3-N, mg/l	0.764
Nitrite as NO_2-N, mg/l	0.0087
Phosphate as PO_4-P, mg/l ....(ortho)	<.01
Potassium as K, mg/l	3.7
Selenium as Se, mg/l	<.002
Silica as SiO_2 (Dissolved), mg/l	--
Silver as Ag, mg/l	<.01
Sodium as Na, mg/l	126
Sulfate as SO_4, mg/l	30.2
Total Dissolved Solids, mg/l	369
Turbidity, NTU	--
Zinc as Zn, mg/l	<.01
pH Units	8.37

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CATION-ANION BALANCE

Sample No.: 15322

Cations	mg/l	Eq/l
Ca	5.6200	0.2804
Mg	3.6000	0.2962
Na	126.0000	5.4810
K	3.7000	0.0946
Fe	0.0250	0.0013
Pb	0.0000	0.0000
Zn	0.0000	0.0000
Al	0.0000	0.0000
NH3-	1.4600	0.1043
	Total	6.2579

Anions	mg/l	Eq/l
HCO3	250.0000	4.0975
CO3	29.6000	0.9866
Cl	23.0000	0.6488
SO4	30.2000	0.6291
NO3	0.7640	0.0123
NO2	0.0087	0.0002
P	0.0000	0.0000
F	0.6400	0.0337
	Total	6.4082

% Difference	-2.373
Calculated TDS	346

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ANALYTICAL REPORT FOR:

EARTHFAX ENGINEERING, INC.
R. GAINER
7324 SOUTH 1300 EAST # 100
MIDVALE, UTAH 84047

Invoice # 18905
Date 09/26/86
Customer #

WATER SAMPLES - CERTIFIED ANALYSES

ANALYSES	BOYER WELL	MORBY WELL
Setl. Solids mg/l	< .5	< .5
Tot. Dis. Solids mg/l	245	1385
Tot. Sus. Solids mg/l	90	12
Tot. Hardness mg/l	60	816
Boron mg/l	< .05	< .05
Bicarbonate mg/l	314	468
Carbonate mg/l	0	0
Chloride mg/l	20.6	67.9
Fluoride mg/l	.80	.33
Potassium mg/l	5	6
Selenium mg/l	.009	.008
Sulfate mg/l	38.3	591.6
Sulfide mg/l	< .01	< .01
Aluminum mg/l	< .05	< .05
Arsenic mg/l	.001	.001
Barium mg/l	.11	.22
Cadmium mg/l	.002	.002
Calcium mg/l	14	210
Chromium mg/l	< .005	< .005
Copper mg/l	.074	.037
Iron mg/l	.07	.21
Lead mg/l	.014	.010
Magnesium mg/l	5	87
Manganese mg/l	.015	.030
Mercury mg/l	< .0001	< .0001
Molybdenum mg/l	< .05	< .05
Nickel mg/l	.014	.019
Sodium mg/l	108	128
Zinc mg/l	.082	.592
Ammonia mg/l	.14	.11
Nitrate mg/l	.10	3.40
Nitrite mg/l	< .01	< .01
Phosphate mg/l	.03	.04
Oil & Grease mg/l	< 5	< 5
pH	7.74	7.11

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ANALYTICAL REPORT FOR:

EARTHFAX ENGINEERING INC.
R. WHITE
7324 SOUTH 1300 EAST # 100
MURRAY, UTAH 84047

Invoice # 18132
Date 05/28/86
Customer #

WATER SAMPLE - CERTIFIED ANALYSES

ANALYSES	OLD WELL
Tot. Dis. Solids mg/l	2580
Tot. Hardness mg/l	1440
Boron mg/l	.52
Bicarbonate mg/l	351
Carbonate mg/l	0
Chloride mg/l	472.8
Fluoride mg/l	.32
Potassium mg/l	12
Selenium mg/l	.012
Sulfate mg/l	1160.0
Sulfide mg/l	< .01
Aluminum mg/l	< .05
Arsenic mg/l	.008
Barium mg/l	.02
Cadmium mg/l	.010
Calcium mg/l	355
Chromium mg/l	.036
Copper mg/l	.011
Iron mg/l	4.50
Lead mg/l	.065
Magnesium mg/l	185
Manganese mg/l	.130
Mercury mg/l	.0002
Molybdenum mg.l	< .05
Nickel mg/l	.029
Sodium mg/l	427
Zinc mg/l	.480
Ammonia mg/l	1.65
Nitrate mg/l	1.47
Nitrite mg/l	.03
Phosphate mg/l	< .01

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ANALYTICAL REPORT FOR:

EARTHFAX ENGINEERING, INC. R. GAINER	Invoice # 17905
6542 SOUTH 670 WEST	Date 12/13/85
MURRAY, UTAH 84123	Customer # C-30

WATER SAMPLES-CERTIFIED ANALYSES

Sample #	OLD WELL
Tot. Dis. Solids mg/l	2730
Tot. Hardness mg/l	2867
Boron mg/l	.41
Bicarbonate mg/l	429
Carbonate mg/l	0
Chloride mg/l	494.4
Fluoride mg/l	.21
Potassium mg/l	12
Selenium mg/l	.012
Sulfate mg/l	1248.4
Sulfide mg/l	< .01
Aluminum mg/l	< .05
Arsenic mg/l	.005
Barium mg/l	< .01
Cadmium mg/l	.004
Calcium mg/l	365
Chromium mg/l	.021
Copper mg/l	.011
Iron mg/l	2.61
Lead mg/l	.082
Magnesium mg/l	239
Manganese mg/l	.065
Mercury mg/l	.0003
Molybdenum mg/l	< .05
Nickel mg/l	.025
Sodium mg/l	370
Zinc mg/l	1.350
Ammonia mg/l	1.44
Nitrate mg/l	.05
Nitrite mg/l	< .01
Phosphate mg/l	.06

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ANALYTICAL REPORT FOR:

EARTHFAX ENGINEERING, INC. R. GAINER	Invoice # 17905
6542 SOUTH 670 WEST	Date 12/13/85
MURRAY, UTAH 84123	Customer # C-30

WATER SAMPLES-CERTIFIED ANALYSES

Sample #	OLD WELL
Tot. Dis. Solids mg/l	~~5760~~
Tot. Hardness mg/l	2867
Boron mg/l	.41
Bicarbonate mg/l	602
Carbonate mg/l	0
Chloride mg/l	980.50
Fluoride mg/l	.21
Potassium mg/l	12
Selenium mg/l	.012
Sulfate mg/l	115.0
Sulfide mg/l	< .002
Aluminum mg/l	< .05
Arsenic mg/l	.005
Barium mg/l	< .01
Cadmium mg/l	.004
Calcium mg/l	60
Chromium mg/l	.021
Copper mg/l	.011
Iron mg/l	2.61

error

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WATER SAMPLES-CERTIFIED ANALYSES

Sample #	OLD WELL
Lead mg/l	.082
Magnesium mg/l	239
Manganese mg/l	.065
Mercury mg/l	.0003
Molybdenum mg/l	< .05
Nickel mg/l	.025
Sodium mg/l	370
Zinc mg/l	1.350
Ammonia mg/l	1.44
Nitrate mg/l	.05
Nitrite mg/l	< .01
Phosphate mg/l	.06

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ANALYTICAL REPORT FOR:

EARTHFAX ENGINEERING, INC.
R. GAINER
7324 SOUTH 1300 EAST # 100
MURRAY, UTAH 84047

Invoice # 17846
Date 11/13/85
Customer #

WATER SAMPLES - CERTIFIED ANALYSES

ANALYSES	BOYER WELL	MORBY WELL
Tot. Dis. Solids mg/l	395	1005
Tot. Hardness mg/l	20	640
Boron mg/l	< .05	< .05
Bicarbonate mg/l	259	856
Carbonate mg/l	0	0
Chloride mg/l	7.6	39.2
Fluoride mg/l	.70	.78
Potassium mg/l	5	8
Selenium mg/l	.004	.006
Sulfate mg/l	32.3	418.0
Sulfide mg/l	< .01	< .01
Aluminum mg/l	< .05	< .05
Arsenic mg/l	.012	.006
Barium mg/l	.04	.04
Cadmium mg/l	< .001	.002
Calcium mg/l	8	91
Chromium mg/l	< .005	< .005
Copper mg/l	.024	.002
Iron mg/l	.57	< .03
Lead mg/l	.014	.029
Magnesium mg/l	4	47
Manganese mg/l	.032	.040
Mercury mg/l	< .0001	.0001
Molybdenum mg/l	< .05	< .05
Nickel mg/l	.024	.008
Sodium mg/l	115	195
Zinc mg/l	.147	.003
Ammonia mg/l	.52	.16
Nitrate mg/l	< .01	.31
Nitrite mg/l	< .01	< .01
Phosphate mg/l	.06	.04

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#5 invoice
sep

10/12/05

Mosby well

T = 13°C EC = 1300 µmhos/cm

pH = 7.43

Boyer well

EC = 430 µmhos/cm

T = 10° C pH = 7.28

BOYER MINE
SEEP AND SPRING INVENTORY
OCT 24-25, 1985

SP-1
pH = 7.5
EC = 650 μmhos
T = 10°C
Q = 4 gpm

SP-2
Seep

SP-3
Dry

SP-4
Dry

SP-5
Dry

SP-6
Dry

SP-7
Dry

SP-8
Dry

SP-9
pH = 8.6
EC = 440 μmhos
T = 12°C
Q = ½ gpm

SP-10
Seep

SP-11
pH = 7.3
EC = 700 μmhos/cm
T = 7°C
Q = 5 gpm

SP-12
pH = 7.2
T = 7°C
EC = 675 μmhos/cm
Q = 1 gpm

SP-13
pH = 7.8
T = 8°C
EC = 790 μmhos/cm
Q = ½ gpm

SP-14
pH = 7.9
T = 9°C
EC = 790 μmhos/cm
Q = 2 gpm

SP-15
pH = 7.1
T = 5°C
EC = 750 μmhos/cm
Q = 8 gpm (overflow)

SP-16
pH = 7.2
T = 10°C
EC = 1080 μmhos/cm
Q = 1 gpm

SP-17
pH = 7.9
T = 6°C
EC = 400 μmhos/cm
Q = 1½ gpm

SP-18
Dry

SP-19
pH = 8.0
T = 13°C
EC = 250 μmhos/cm
Q = 1 gpm

BOYER MINE SEEP & SPRING SURVEY (CONTINUED)
OCT 24-25, 1985

SP-20
pH = 8.4
T = 10°C
EC = 250 µmhos/cm
Q = 10 gpm

SP-21 (old oxbow)
20'×20'×0.5' (water)
Not flowing

SP-22
Dry

SP-23
Dry

SP-24
Dry

SP-25
Dry

SP-26
Dry

SP-27
Dry

SP-28
Dry

SP-29
pH = 7.3
T = 7°C
EC = 700 µmhos/cm
Q = 3 gpm

SP-30
Seep

SP-31
pH = 8.5
T = 15°C
EC = 690 µmhos/cm
Q = ¼ gpm

SP-32
Seep

SP-33
pH = 7.4
T = 8°C
EC = 725 µmhos/cm
Q = 1 gpm

August 3, 1985

CHEMICAL & MINERALOGICAL SERVICES • 445 WEST 2700 SOUTH • SALT LAKE CITY, UTAH 84115 • (801) 485-0711

ANALYTICAL REPORT FOR:

EARTHFAX ENGINEERING, INC.
R. GAINER
7324 SOUTH 1300 EAST # 100
MURRAY, UTAH 84047

Invoice # 17589
Date 09/18/85
Customer #

ANALYSES	BOYER WELL	MORBY WELL
Tot. Dis. Solids mg/l	380	1030
Tot. Hardness mg/l	25	924
Boron mg/l	.08	.07
Bicarbonate mg/l	287	791
Carbonate mg/l	0	0
Chloride mg/l	15.4	57.1
Fluoride mg/l	.50	.40
Potassium mg/l	3	4
Selenium mg/l	.006	.013
Sulfate mg/l	42.0	321.3
Sulfide mg/l	< .01	.03
uminum mg/l	< .05	< .05
Arsenic mg/l	.012	.008
Barium mg/l	.05	.12
Cadmium mg/l	.002	.002
Calcium mg/l	7	130
Chromium mg/l	< .005	.006
Copper mg/l	.064	.011
Iron mg/l	.79	.19
Lead mg/l	.013	.025
Magnesium mg/l	4	50
Manganese mg/l	.014	.034
Mercury mg/l	< .0001	< .05
Molybdenum mg/l	< .05	< .05
Nickel mg/l	.006	.015
Sodium mg/l	120	125
Zinc mg/l	.072	.315
Ammonia mg/l	.21	.28
Nitrate mg/l	.09	.30
Nitrite mg/l	.01	.02
Phosphate mg/l	.07	.05

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Your Consulting Chemist

SURFACE WATER

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CERTIFICATE OF ANALYSIS

SAMPLE IDENTIFICATION

CLIENT: Earthfax Engineering
7324 So. 1300 E.
Midvale, UT 84047

LAB NO: U019191

DATE SAMPLED: 6-6-87

TIME SAMPLED:

SAMPLED BY:

LOCATION: SS-4

COMMENTS: Dissolved Metals

PARAMETER	LEVEL
Alkalinity as $CaCO_3$, mg/l	308
Aluminum as Al, mg/l	0.12
Ammonia as NH_3-N, mg/l	<.1
Arsenic as As, mg/l	<.01
Barium as Ba, mg/l	0.045
Bicarbonate as HCO_3, mg/l	376
Boron as B, mg/l	0.25
Cadmium as Cd, mg/l	<.01
Calcium as Ca, mg/l	78.5
Carbonate as CO_3, mg/l	0
Chloride as Cl, mg/l	95.6
Chromium as Cr (Hex), mg/l	<.01
Chromium as Cr (Tot), mg/l	<.01
TSS, mg/l	82
Settleable Solids, mg/l	0.1
Oil & Grease, mg/l	<.5
Conductivity, umhos/cm	933
Copper as Cu, mg/l	<.01
Fluoride as F, mg/l	0.63
Hardness as $CaCO_3$, mg/l	355
Hydroxide as OH, mg/l	0
Iron as Fe, mg/l	0.085
Lead as Pb, mg/l	0.020
Magnesium as Mg, mg/l	31.1
Manganese as Mn, mg/l	<.01
Mercury as Hg, mg/l	<.0002
Nickel as Ni, mg/l	<.01
Nitrate as NO_3-N, mg/l	0.031
Nitrite as NO_2-N, mg/l	<.005
Phosphate as PO_4-P, mg/l	0.12
Potassium as K, mg/l	2.4
Selenium as Se, mg/l	<.002
Silica as SiO_2 (Diss), mg/l	17.8
Silver as Ag, mg/l	<.01
Sodium as Na, mg/l	80
Sulfate as SO_4, mg/l	50
Total Dissolved Solids, mg/l	496
Turbidity, NTU	16
Zinc as Zn, mg/l	0.075
pH Units	7.90
Molybdenum as Mo, mg/l	<.01

Rex Henderson

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CERTIFICATE OF ANALYSIS

SAMPLE IDENTIFICATION
CLIENT: Earthfax Engineering
7324 So. 1300 E. #100
Midvale, UT 84047
LAB NO: U018045
DATE SAMPLED: 4-2-87
TIME SAMPLED:
SAMPLED BY: DNG/RBG
LOCATION: Boyer Mine
SS-4
COMMENTS: Metals Dissolved

PARAMETER	LEVEL
Alkalinity as $CaCO_3$, mg/l	291
Aluminum as Al, mg/l	0.18
Ammonia as NH_3-N, mg/l	<.1
Arsenic as As, mg/l	<.01
Barium as Ba, mg/l	0.058
Bicarbonate as HCO_3, mg/l	355
Boron as B, mg/l	0.41
Cadmium as Cd, mg/l	<.01
Calcium as Ca, mg/l	110
Carbonate as CO_3, mg/l	0
Chloride as Cl, mg/l	98.0
Chromium as Cr (Hex), mg/l	<.01
Chromium as Cr (Tot), mg/l	<.01
Molybdenum as Mo, mg/l	<.01
Oil & Grease, mg/l	0.57
Sulfide as S, mg/l	<.1
Conductivity, umhos/cm	974
Copper as Cu, mg/l	0.015
Fluoride as F, mg/l	0.58
Hardness as $CaCO_3$, mg/l	378
Hydroxide as OH, mg/l	0
Iron as Fe (Diss), mg/l	0.080
Iron as Fe (Tot), mg/l	0.085
Lead as Pb, mg/l	<.01
Magnesium as Mg, mg/l	29.3
Manganese as Mn, mg/l	<.01
Mercury as Hg, mg/l	<.0002
Nickel as Ni, mg/l	<.01
Nitrate as NO_3-N, mg/l	<.01
Nitrite as NO_2-N, mg/l	<.005
Phosphate as PO_4-P, mg/l	0.12
Potassium as K, mg/l	2.2
Selenium as Se, mg/l	<.002
Silica as SiO_2 (Diss), mg/l	15.4
Silver as Ag, mg/l	<.01
Sodium as Na, mg/l	53.2
Sulfate as SO_4, mg/l	98.3
Total Dissolved Solids, mg/l	589
Turbidity, NTU	5.9
Zinc as Zn, mg/l	0.030
pH Units	7.46
TSS, mg/l	266
Settleable Solids, mg/l	0.2

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SAMPLE IDENTIFICATION
CLIENT: Earthfax Engineering
7324 So. 1300 E. #100
Midvale, UT 84047
LAB NO: U018046
DATE SAMPLED: 4-2-87
TIME SAMPLED:
SAMPLED BY: DNG/RBG
LOCATION: Boyer Mine
SS-5
COMMENTS: Metals Dissolved

PARAMETER	LEVEL
Alkalinity as $CaCO_3$, mg/l	181
Aluminum as Al, mg/l	0.22
Ammonia as NH_3-N, mg/l	<.1
Arsenic as As, mg/l	0.011
Barium as Ba, mg/l	0.048
Bicarbonate as HCO_3, mg/l	220
Boron as B, mg/l	0.30
Cadmium as Cd, mg/l	<.01
Calcium as Ca, mg/l	64.2
Carbonate as CO_3, mg/l	0
Chloride as Cl, mg/l	53.1
Chromium as Cr (Hex), mg/l	<.01
Chromium as Cr (Tot), mg/l	<.01
Molybdenum as Mo, mg/l	<.01
Oil & Grease, mg/l	0.60
Sulfide as S, mg/l	<.1
Conductivity, umhos/cm	530
Copper as Cu, mg/l	0.015
Fluoride as F, mg/l	0.36
Hardness as $CaCO_3$, mg/l	232
Hydroxide as OH, mg/l	0
Iron as Fe (Diss), mg/l	0.02
Iron as Fe (Tot), mg/l	0.118
Lead as Pb, mg/l	<.01
Magnesium as Mg, mg/l	20.1
Manganese as Mn, mg/l	0.070
Mercury as Hg, mg/l	<.0002
Nickel as Ni, mg/l	<.01
Nitrate as NO_3-N, mg/l	0.12
Nitrite as NO_2-N, mg/l	0.017
Phosphate as PO_4-P, mg/l	0.12
Potassium as K, mg/l	2.8
Selenium as Se, mg/l	<.002
Silica as SiO_2 (Diss), mg/l	8.5
Silver as Ag, mg/l	<.01
Sodium as Na, mg/l	24.8
Sulfate as SO_4, mg/l	47.8
Total Dissolved Solids, mg/l	363
Turbidity, NTU	18.4
Zinc as Zn, mg/l	0.035
pH Units	7.94
TSS, mg/l	418
Settleable Solids, mg/l	0.3

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CLIENT: Earthfax Engineering
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Midvale, UT 84047

LAB NO: U018047

DATE SAMPLED: 4-2-87

TIME SAMPLED:

SAMPLED BY: DNG/RBG

LOCATION: Boyer Mine
SS-6

COMMENTS: Metals Dissolved

PARAMETER	LEVEL
Alkalinity as $CaCO_3$, mg/l	180
Aluminum as Al, mg/l	0.19
Ammonia as NH_3-N, mg/l	<.1
Arsenic as As, mg/l	0.018
Barium as Ba, mg/l	0.080
Bicarbonate as HCO_3, mg/l	220
Boron as B, mg/l	0.34
Cadmium as Cd, mg/l	<.01
Calcium as Ca, mg/l	73.4
Carbonate as CO_3, mg/l	0
Chloride as Cl, mg/l	55.1
Chromium as Cr (Hex), mg/l	<.01
Chromium as Cr (Tot), mg/l	<.01
Molybdenum as Mo, mg/l	<.01
Oil & Grease, mg/l	<1
Sulfide as S, mg/l	<.1
Conductivity, umhos/cm	535
Copper as Cu, mg/l	0.015
Fluoride as F, mg/l	0.26
Hardness as $CaCO_3$, mg/l	244
Hydroxide as OH, mg/l	0
Iron as Fe (Diss), mg/l	0.042
Iron as Fe (Tot), mg/l	0.080
Lead as Pb, mg/l	<.01
Magnesium as Mg, mg/l	21.3
Manganese as Mn, mg/l	0.060
Mercury as Hg, mg/l	<.0002
Nickel as Ni, mg/l	<.01
Nitrate as NO_3-N, mg/l	0.095
Nitrite as NO_2-N, mg/l	0.018
Phosphate as PO_4-P, mg/l	0.11
Potassium as K, mg/l	3.0
Selenium as Se, mg/l	0.0029
Silica as SiO_2 (Diss), mg/l	8.9
Silver as Ag, mg/l	<.01
Sodium as Na, mg/l	26.5
Sulfate as SO_4, mg/l	47.4
Total Dissolved Solids, mg/l	356
Turbidity, NTU	25.8
Zinc as Zn, mg/l	0.032
pH Units	7.98
TSS, mg/l	398
Settleable Solids, mg/l	0.2

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SAMPLE IDENTIFICATION

CLIENT: Earthfax Engineering, Inc.
7324 So. 1300 E. Suite 100
Midvale, UT 84047

LAB NO.: U016570

DATE SAMPLED: 1-2-87

TIME SAMPLED:

SAMPLED BY: DNG/CW

LOCATION: Boyer Mine
SS-5

COMMENTS:

PARAMETER	LEVEL
Alkalinity as $CaCO_3$, mg/l	276
Ammonia as NH_3-N, mg/l	<.1
Arsenic as As, mg/l	<.01
Barium as Ba, mg/l	0.14
Bicarbonate as HCO_3, mg/l	308
Boron as B, mg/l	0.078
Cadmium as Cd, mg/l	<.01
Calcium as Ca, mg/l	75.6
Carbonate as CO_3, mg/l	13.6
Aluminum as Al, mg/l	<.01
Molybdenum as Mo, mg/l	<.01
Sulfide as S, mg/l	<.1

PARAMETER	LEVEL
Chloride as Cl, mg/l	42
Chromium as Cr (Hex.), mg/l	<.01
Chromium as Cr (Total), mg/l	<.01
Conductivity, umhos/cm	641
Copper as Cu, mg/l	0.025
Fluoride as F, mg/l	0.15
Hardness as $CaCO_3$, mg/l	299
Hydroxide as OH, mg/l	0
Iron as Fe (Dissolved), mg/l	0.018
Iron as Fe (Total), mg/l	0.23
Lead as Pb, mg/l	0.036
Magnesium as Mg, mg/l	32.9
Manganese as Mn, mg/l	<.01
Mercury as Hg, mg/l	<.0002
Nickel as Ni, mg/l	<.01
Nitrate as NO_3-N, mg/l	0.25
Nitrite as NO_2-N, mg/l	0.016
Phosphate as PO_4-P, mg/l (ortho)	<.01
Potassium as K, mg/l	2.3
Selenium as Se, mg/l	<.002
Silica as SiO_2 (Dissolved), mg/l	5.7
Silver as Ag, mg/l	<.01
Sodium as Na, mg/l	21.9
Sulfate as SO_4, mg/l	31.5
Total Dissolved Solids, mg/l	370
Turbidity, NTU	--
Zinc as Zn, mg/l	0.075
pH Units	8.57
TSS, mg/l	22
Settleable Solids, mg/l	<.1
Oil & Grease, mg/l	<.5

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CATION-ANION BALANCE

Sample No.: 16570

Cations	mg/l	Eq/l
Ca	75.6000	3.7724
Mg	32.9000	2.7073
Mn	0.0000	0.0000
Na	21.9000	0.9526
K	2.3000	0.0588
Fe	0.0180	0.0010
Pb	0.0000	0.0000
Zn	0.0750	0.0023
Al	0.0000	0.0000
NH3-	0.0000	0.0000
	Total	7.4945

Anions	mg/l	Eq/l
HCO3	308.0000	5.0481
CO3	13.6000	0.4533
Cl	42.0000	1.1848
SO4	31.5000	0.6561
NO3	0.2500	0.0040
NO2	0.0160	0.0003
PO4	0.0000	0.0000
F	0.1500	0.0079
	Total	7.3546

% Difference	1.884
Calculated TDS	372
Laboratory TDS	370
% Difference	0.443
Laboratory hardness	299
Calculated hardness	324

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CHEMICAL AND BACTERIOLOGICAL ANALYSES

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SAMPLE IDENTIFICATION

CLIENT: Earthfax Engineering, Inc.
7324 So. 1300 E. Suite 100
Midvale, UT 84047

LAB NO.: U016571

DATE SAMPLED: 1-2-87

TIME SAMPLED:

SAMPLED BY: DNG/CW

LOCATION: Boyer Mine
SS-6

COMMENTS:

PARAMETER	LEVEL
Alkalinity as $CaCO_3$, mg/l	279
Ammonia as NH_3-N, mg/l	<.1
Arsenic as As, mg/l	<.01
Barium as Ba, mg/l	0.14
Bicarbonate as HCO_3, mg/l	321
Boron as B, mg/l	0.072
Cadmium as Cd, mg/l	<.01
Calcium as Ca, mg/l	75.3
Carbonate as CO_3, mg/l	9.4
Aluminum as Al, mg/l	<.01
Molybdenum as Mo, mg/l	<.01
Sulfide as S, mg/l	<.1

PARAMETER	LEVEL
Chloride as Cl, mg/l	46
Chromium as Cr (Hex.), mg/l	<.01
Chromium as Cr (Total), mg/l	<.01
Conductivity, umhos/cm	659
Copper as Cu, mg/l	0.025
Fluoride as F, mg/l	<.1
Hardness as $CaCO_3$, mg/l	304
Hydroxide as OH, mg/l	0
Iron as Fe (Dissolved), mg/l	0.013
Iron as Fe (Total), mg/l	0.30
Lead as Pb, mg/l	0.038
Magnesium as Mg, mg/l	32.8
Manganese as Mn, mg/l	<.01
Mercury as Hg, mg/l	<.0002
Nickel as Ni, mg/l	<.01
Nitrate as NO_3-N, mg/l	0.25
Nitrite as NO_2-N, mg/l	<.005
Phosphate as PO_4-P, mg/l	<.01
Potassium as K, mg/l	2.3
Selenium as Se, mg/l	<.002
Silica as SiO_2 (Dissolved), mg/l	5.9
Silver as Ag, mg/l	<.01
Sodium as Na, mg/l	21.8
Sulfate as SO_4, mg/l	32.8
Total Dissolved Solids, mg/l	381
Turbidity, NTU	--
Zinc as Zn, mg/l	0.17
pH Units	8.46
TSS, mg/l	14
Settleable Solids, mg/l	<.1
Oil & Grease, mg/l	<.5

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CATION-ANION BALANCE

Sample No.: 16571

Cations	mg/l	Eq/l
Ca	75.3000	3.7575
Mg	32.6000	2.6991
Mn	0.0000	0.0000
Na	21.8000	0.9483
K	2.3000	0.0588
Fe	0.0130	0.0007
Pb	0.0380	0.0004
Zn	0.1700	0.0052
Al	0.0000	0.0000
NH3-	0.0000	0.0000
	Total	7.4700

ions	mg/l	Eq/l
HCO3	321.0000	5.2612
CO3	9.4000	0.3133
Cl	46.0000	1.2977
SO4	32.8000	0.6832
NO3	0.2500	0.0040
NO2	0.0000	0.0000
PO4	0.0000	0.0000
F	0.0000	0.0000
	Total	7.5594

% Difference	-1.190
Calculated TDS	378
Laboratory TDS	381
% Difference	-0.662
Laboratory hardness	304
Calculated hardness	323

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SAMPLE IDENTIFICATION

CLIENT: Earthfax Engineering, Inc.
7324 S. 1300 E.
Midvale, UT 84047

LAB NO.: U015035

DATE SAMPLED: 9-27-86

TIME SAMPLED:

SAMPLED BY: RBG

LOCATION: SS-5

COMMENTS:

PARAMETER	LEVEL
Alkalinity as $CaCO_3$, mg/l	171
Ammonia as NH_3-N, mg/l	0.26
Arsenic as As, mg/l	<.01
Barium as Ba, mg/l	<.01
Bicarbonate as HCO_3, mg/l	209
Boron as B, mg/l	<.01
Cadmium as Cd, mg/l	<.01
Calcium as Ca, mg/l	56.7
Carbonate as CO_3, mg/l	9.3
Aluminum as Al, mg/l	<.1
Molybdenum as Mo, mg/l	<.01
TSS, mg/l	10.5
Settleable Solids, ml/l	<.1

PARAMETER	LEVEL
Chloride as Cl, mg/l	46.1
Chromium as Cr (Hex.), mg/l	--
Chromium as Cr (Total), mg/l	<.01
Conductivity, umhos/cm	617
Copper as Cu, mg/l	0.015
Fluoride as F, mg/l	0.21
Hardness as $CaCO_3$, mg/l	279
Hydroxide as OH, mg/l	0
Iron as Fe (Dissolved), mg/l	--
Iron as Fe (Total), mg/l	0.16
Lead as Pb, mg/l	0.060
Magnesium as Mg, mg/l	26.0
Manganese as Mn, mg/l	0.012
Mercury as Hg, mg/l	<.000
Nickel as Ni, mg/l	<.01
Nitrate as NO_3-N, mg/l	<.01
Nitrite as NO_2-N, mg/l	0.014
Phosphate as PO_4-P, mg/l	<.01
Potassium as K, mg/l	3.9
Selenium as Se, mg/l	<.002
Silica as SiO_2 (Dissolved), mg/l	--
Silver as Ag, mg/l	<.01
Sodium as Na, mg/l	6.82
Sulfate as SO_4, mg/l	27.9
Total Dissolved Solids, mg/l	394
Turbidity, NTU	--
Zinc as Zn, mg/l	0.055
pH Units	8.36
Oil & Grease, mg/l	<.5

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CLIENT: Earthfax Engineering, Inc.
7324 S. 1300 E.
Midvale, UT 84047
LAB NO.: U015036
DATE SAMPLED: 9-27-86
TIME SAMPLED:
SAMPLED BY: RBG
LOCATION: SS-6
COMMENTS:

PARAMETER	LEVEL
Alkalinity as $CaCO_3$, mg/l	170
Ammonia as NH_3-N, mg/l	0.15
Arsenic as As, mg/l	<.01
Barium as Ba, mg/l	<.01
Bicarbonate as HCO_3, mg/l	207
Boron as B, mg/l	<.01
Cadmium as Cd, mg/l	<.01
Calcium as Ca, mg/l	57.2
Carbonate as CO_3, mg/l	9.7
Aluminum as Al, mg/l	<.1
Molybdenum as Mo, mg/l	<.01
TSS, mg/l	11.5
Settleable Solids, ml/l	<.1

PARAMETER	LEVEL
Chloride as Cl, mg/l	43.9
Chromium as Cr (Hex.), mg/l	--
Chromium as Cr (Total), mg/l	<.01
Conductivity, umhos/cm	596
Copper as Cu, mg/l	<.01
Fluoride as F, mg/l	0.12
Hardness as $CaCO_3$, mg/l	273
Hydroxide as OH, mg/l	0
Iron as Fe (Dissolved), mg/l	--
Iron as Fe (Total), mg/l	0.34
Lead as Pb, mg/l	0.095
Magnesium as Mg, mg/l	26.0
Manganese as Mn, mg/l	0.012
Mercury as Hg, mg/l	<.0002
Nickel as Ni, mg/l	<.01
Nitrate as NO_3-N, mg/l	<.01
Nitrite as NO_2-N, mg/l	0.012
Phosphate as PO_4-P, mg/l	<.01
Potassium as K, mg/l	3.8
Selenium as Se, mg/l	<.002
Silica as SiO_2 (Dissolved), mg/l	--
Silver as Ag, mg/l	<.01
Sodium as Na, mg/l	6.76
Sulfate as SO_4, mg/l	25.4
Total Dissolved Solids, mg/l	381
Turbidity, NTU	--
Zinc as Zn, mg/l	0.023
pH Units	8.39
Oil & Grease, mg/l	<.5

CHEMTECH

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ANALYTICAL REPORT FOR:

EARTHFAX ENGINEERING, INC.
R. GAINER
7324 SOUTH 1300 EAST # 100
MIDVALE, UTAH 84047

Invoice # 18906
Date 09/26/86
Customer #

WATER SAMPLES - CERTIFIED ANALYSES

ANALYSES	SS-5	SS-6
Setl. Solids mg/l	< .5	< .5
Tot. Dis. Solids mg/l	470	320
Tot. Sus. Solids mg/l	56	48
Tot. Hardness mg/l	206	204
Boron mg/l	< .05	< .05
Bicarbonate mg/l	262	253
Carbonate mg/l	0	2
Chloride mg/l	15.4	14.8
Fluoride mg/l	.18	.17
Potassium mg/l	2	2
Selenium mg/l	.009	.008
lfate mg/l	64.0	70.0
lfide mg/l	< .01	< .01
Aluminum mg/l	< .05	< .05
Arsenic mg/l	.004	.009
Barium mg/l	.12	.11
Cadmium mg/l	.002	.002
Calcium mg/l	52	57
Chromium mg/l	< .005	< .005
Copper mg/l	.015	.011
Iron mg/l	.07	.07
Lead mg/l	.014	.014
Magnesium mg/l	13	14
Manganese mg/l	.015	.015
Mercury mg/l	< .0001	< .0001
Molybdenum mg/l	< .05	< .05
Nickel mg/l	.005	.009
Sodium mg/l	8	9
Zinc mg/l	.007	.001
Ammonia mg/l	.13	.13
Nitrate mg/l	.17	.19
Nitrite mg/l	< .01	< .01
Phosphate mg/l	< .01	< .01
l & Grease mg/l	< 5	< 5
pH	8.21	8.43
EC	591	487

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ANALYTICAL REPORT FOR:

EARTHFAX ENGINEERING, INC.
R. GAINER
7324 SOUTH 1300 EAST # 100
MIDVALE, UTAH 84047

Invoice # 18010
Date 03/28/86
Customer #

WATER SAMPLES - CERTIFIED ANALYSES

ANALYSES	SS-4	SS-4A	SS-5	SS-6
Setl. Solids ml/l	< .5	< .5	< .5	< .5
Tot. Dis. Solids mg/l	600	600	390	405
Tot. Sus. Solids mg/l	276	124	104	150
Tot. Hardness mg/l	274	248	244	254
Boron mg/l	< .05	< .05	< .05	< .05
Bicarbonate mg/l	307	278	220	266
Carbonate mg/l	0	0	0	0
Chloride mg/l	38.6	44.0	67.2	65.8
Fluoride mg/l	.43	.50	.27	.26
Potassium mg/l	5	6	5	4
Selenium mg/l	.008	.009	.012	.012
Sulfate mg/l	51.3	96.1	57.6	63.6
Sulfide mg/l	< .01	< .01	.02	< .01
Aluminum mg/l	.05	< .05	< .05	< .05
Arsenic mg/l	< .001	< .001	.005	.009
Barium mg/l	.13	.17	.17	.15
Cadmium mg/l	.002	.002	.003	.002
Calcium mg/l	75	81	84	77
Chromium mg/l	< .005	< .005	< .005	< .005
Copper mg/l	.015	.018	.013	.010
Iron mg/l	.06	.10	.04	.07
Lead mg/l	.018	.051	.015	.015
Magnesium mg/l	19	20	30	28
Manganese mg/l	.021	.025	.035	.048
Mercury mg/l	.0001	< .0001	< .0001	.0001
Molybdenum mg/l	< .05	< .05	< .05	< .05
Nickel mg/l	.005	.009	.009	.011
Sodium mg/l	35	36	30	25
Zinc mg/l	.005	.082	.022	.044
Ammonia mg/l	.05	.25	.25	.95
Nitrate mg/l	4.21	3.41	3.65	1.74
Nitrite mg/l	< .01	< .01	< .01	< .01
Phosphate mg/l	< .01	< .01	< .01	< .01
Oil & Grease mg/l	< 5	< 5	< 5	< 5

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Samp 11/25/85

CMS

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ANALYTICAL REPORT FOR:

EARTHFAX ENGINEERING, INC.
R. GAINER
7324 SOUTH 1300 EAST # 100
MURRAY, UTAH 84047

Invoice # 17904
Date 12/13/85
Customer # C-30

WATER SAMPLES-CERTIFIED ANALYSES

Sample #	SS-5	SS-6
Set. Solids mg/l	< .5	< .5
Tot. Dis. Solids mg/l	400	450
Tot. Sus. Solids mg/l	13	11
Tot. Hardness mg/l	305	298
Boron mg/l	< .05	< .05
Bicarbonate mg/l	240	245
Carbonate mg/l	0	0
Chloride mg/l	37.7	38.8
Fluoride mg/l	.29	.15
Potassium mg/l	2	2
Selenium mg/l	.004	.004
Sulfate mg/l	36.1	42.8
Sulfide mg/l	< .01	< .01
Aluminum mg/l	.26	.81
Arsenic mg/l	.018	.010
Barium mg/l	.14	.15
Cadmium mg/l	.003	.006
Calcium mg/l	47	49
Chromium mg/l	< .005	.005
Copper mg/l	.006	.007
Iron mg/l	.24	.46
Lead mg/l	.031	.041
Magnesium mg/l	25	25
Manganese mg/l	.039	.043
Mercury mg/l	.0007	.0004
Molybdenum mg/l	< .05	< .05
Nickel mg/l	.005	.005
Sodium mg/l	12	13
Zinc mg/l	.002	.012
Ammonia mg/l	.24	.22
Nitrate mg/l	.04	.04
Nitrite mg/l	< .01	< .01
Phosphate mg/l	.36	.14
Oil & Grease mg/l	< 5	< 5

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F. Broadhurst
Your Consulting Chemist

#6 - October
Invoice

SS-1	10/30/85	No flow
SS-2	10/30/85	No flow
SS-3	10/30/85	No flow
SS-4	10/30/85	No flow

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ANALYTICAL REPORT FOR:

EARTHFAX ENGINEERING INC.
R. GAINER
7324 SOUTH 1300 EAST # 100
MURRAY, UTAH 84047

Invoice # 17632
Date 09/18/85
Customer #

ANALYSES	SS-5	SS-6
Setl. Solids mg/l	< .5	< .5
Tot. Dis. Solids mg/l	310	315
Tot. Sus. Solids mg/l	2	1
Tot. Hardness mg/l	232	221
Boron mg/l	< .05	< .05
Bicarbonate mg/l	222	240
Carbonate mg/l	0	0
Chloride mg/l	28.2	28.9
Fluoride mg/l	.1	.1
Potassium mg/l	3	2
Selenium mg/l	.002	.001
Sulfate mg/l	11.2	12.0
Sulfide mg/l	< .01	< .01
Aluminum mg/l	< .05	< .05
Arsenic mg/l	.025	.020
Barium mg/l	.11	.11
Cadmium mg/l	.002	.001
Calcium mg/l	41	39
Chromuim mg/l	< .005	< .005
Copper mg/l	.006	.008
Iron mg/l	< .03	< .03
Lead mg/l	.023	.023
Magnesium mg/l	19	19
Manganese mg/l	.001	.001
Mercury mg/l	< .0001	< .0001
Molybdenum mg/l	< .05	< .05
Nickel mg/l	.010	.010
Sodium mg/l	15	15
Zinc mg/l	.006	.008
Ammonia mg/l	.10	.06
Nitrate mg/l	.23	.18
Nitrite mg/l	.03	.01
Phosphate mg/l	.28	.08
Oil and Grease mg/l	< 5	< 5

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C-30
7/30/85

SS-6 → Stage at 8:30 am = 0.09 ft
Deepened stilling well.
Stage at 10:35 am = 0.77 ft. Add 0.68 ft to all previous stage readings.

8/3/85

Sampled private wells. Both owners only at site on weekends. Mrs. Boyer indicated that she knows of no active wells in the Chalk Creek alluvium downstream from the mine.

Boyer Well (sampled 13:30)
T = 12 °C
EC = 460 μmhos/cm
pH = 7.30

Allowed to flow ≈ 10 min prior to sampling. No access port in well to allow water level measurement

C-30
3 Aug 1985

Morby Well
T = 10 °C
EC = 1400 μmhos/cm
pH = 6.95

Well ≈ 230 ft deep

1987

PRECIPITATION DATA

Intermittent Stream - SS-4

Note ** Water flowing to upper fence then seep into ground

1 gpm flow (visual)

Rain gage

1" water Emptied

20' of H_2O on Pore Stilling Well

Ephemeral Streams

No Noticeable flow on staff gage

No Water air bottles

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ANALYTICAL REPORT FOR:

EARTHFAX ENGINEERING, INC.
R. WHITE
7324 SOUTH 1300 EAST # 100
MIDVALE, UTAH 84047

Invoice # 17380
Date 07/16/85
Customer # C-30

WATER SAMPLES - CERTIFIED ANALYSES

ANALYSES	SS-4	SS-5	SS-6
Setl. Solids mg/l	< .5	< .5	< .5
Tot. Dis. Solids mg/l	560	295	305
Tot. Sus. Solids mg/l	18	25	40
Tot. Hardness mg/l	338	234	241
Boron mg/l	< .05	< .05	< .05
Bicarbonate mg/l	249	248	239
Carbonate mg/l	0	0	0
Chloride mg/l	74.0	26.0	27.0
Fluoride mg/l	.39	.11	.11
Potassium mg/l	2	2	2
Selenium mg/l	.016	.002	.001
Sulfate mg/l	104.0	15.0	15.0
Sulfide mg/l	.03	.03	.03
Aluminum mg/l	< .05	< .05	< .05
Arsenic mg/l	.002	.002	.002
Barium mg/l	.09	.09	.09
Cadmium mg/l	.001	< .001	< .001
Calcium mg/l	100	65	65
Chromium mg/l	.008	< .005	< .005
Copper mg/l	.007	.001	.003
Iron mg/l	.22	.25	.34
Lead mg/l	.019	< .010	< .010
Magnesium mg/l	24	16	16
Manganese mg/l	.008	.012	.012
Mercury mg/l	.0003	.0004	.0005
Molybdenum mg/l	< .05	< .05	< .05
Nickel mg/l	.022	.012	.011
Sodium mg/l	50	11	14
Zinc mg/l	< .001	.013	.004
Ammonia mg/l	.05	.06	.05
Nitrate mg/l	< .01	< .01	< .01
Nitrite mg/l	< .01	< .01	< .01
Phosphate mg/l	.22	.09	.08
Oil & Grease mg/l	< 5	< 5	< 5

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Boyer Mine Monthly Field Trip
29 JUL 1985

SS-1 → No sample, no flow mark on crest stage gage (1:40pm)

SS-2 → Same as above (1:45pm).

Rain gage → chart changed at 2:00pm. Raining at time of chart change, started approx. 1:45pm, Pen knocked off chart. No rainfall recorded during previous month. Rain in bucket emptied at chart change.

SS-3 → No sample. Flow depth = 0.20ft (insufficient depth to permit sampling). Cleaned gage stick and replaced. (2:10pm)

SS-4 → No flow. Changed chart. No sample could be collected (no flow). Still raining slightly 2:40pm

C-30
7/29/85

SS-5 streamflow measurement
29 Jul 1985
Beginning time: 3:30 pm
Meter — Price AA
Thunderstorms in area but not raining at SS-5 at beginning

Width (ft)	Depth (ft)	Revs.	t (s)	V (ft/s)	Q (cfs)
3	1.05	10	43	0.53	1.67
3	0.55	30	46	1.44	2.38
3	0.60	40	40	2.20	3.96
3	0.65	40	44	2.00	3.90
3	0.80	60	47	2.80	6.72
3	0.70	50	44	2.50	5.25
3	0.70	40	44	2.00	4.20
3	0.65	15	45	0.75	1.46
3	0.55	30	46	1.44	2.38
3	0.30	5	57	0.21	0.19

TOTAL= 32.11 cfs

Ending time: 3:50 pm
Clear water, no rain

Irrigation canal overflow approx. 300 ft downstream from SS-5 — ≈ 10 gpm (est.)

C-30
7/29/85

SS-6
Stage = 0.08 ft (4:35 pm)
Tried to lower stilling well but could not.
Will return tomorrow to lower.
Flow measurement (29 Jul 198[illegible])
Beginning time: 5:30 pm

Width (ft)	Depth (ft)	Revs.	t (s)	V (ft/s)	Q (cfs)
3	0.45	10	42	0.54	0.73
3	0.50	25	40	1.38	2.07
3	0.70	40	48	1.84	3.86
3	0.70	25	45	1.23	2.58
3	0.70	40	50	1.76	3.70
3	0.75	40	45	1.96	4.41
3	0.90	40	44	2.00	5.40
3	0.75	40	47	1.88	4.23
3	0.80	40	43	2.05	4.92
3	0.50	40	52	1.70	2.55

TOTAL= 34.45 cfs

Ending time: 6:00 pm
No rain, clear water

11:36 am SS-5 Upstream 6-28-85

Sta	Width	Depth	Clicks/Sec	V (ft/s)	Q (ft³/sec)
0+02	4	.3	6/44	.318	.38
0+06	4	.4	30/44	1.51	2.42
0+10	4	.8	70/44	3.50	11.20
0+14	4	.8	60/46	2.86	9.15
0+18	4	.9	80/46	3.80	13.68
0+22	4	1.0	70/44	3.50	14.00
0+26	4	.9	70/44	3.50	12.60
0+30	4	1.0	50/50	2.20	8.80
0+34	4	.5	30/48	1.38	2.76

(end @ 36

Total Q = 79.59

SS-6 Dock 6-28-85

Sta	Width	Depth	Clicks/Sec	V (ft/s)	Q (ft³/sec)
0+02	4	.8	20/60	.797	26.29
0+06	4	.9	80/45	3.72	13.39
0+10	4	1.0	60/42	3.13	12.52
0+14	4	.9	50/53	2.08	7.49
0+18	4	.9	60/41	3.21	11.56
0+22	4	.8	50/45	2.44	7.81
0+26	4	.5	50/45	2.44	4.88
0+30	4	.6	50/46	2.39	5.74
0+34	4	1.0	90/58	1.52	6.08

Total Q = 95.76

Stage 24 inches
Time 10:45 am

3 Jun 1985

Sample from SS-4 (INTERM.)

Time = 20:45

Cloudy. Air temp = 14°C

Grab sample

T = 8.5°C

EC = 640 μmhos/cm @ 8.5°C

pH = 7.05

DO = 6.0 ppm

Q = 1.5 gpm (volumetric)

Gauge height = 0.33 ft (above inflow pipe invert)

3 Jun 1985

Flow measurement at SS-5 (Chalk Creek upper).

Beginning time = 19:30

Cloudy. Air temp = 15°C

Meter → Price-type AA

Width (ft)	Depth (ft)	0.6d (ft)	Revs/ sec	Vel. (ft/s)	Q (ft³/s)
4	1.3	0.78	80/47	3.72	19.34
4	1.2	0.72	100/41	5.32	25.54
4	1.5	0.9	80/46	3.80	22.80
4	1.5	0.9	100/44	4.96	29.76
4	1.3	0.78	80/43	4.07	21.16
4	1.2	0.72	100/48	4.55	21.84
4	1.2	0.72	80/45	3.89	18.67
4	1.0	0.6	50/40	2.74	10.96
3	0.7	0.42	10/40	.565	1.19
				Total Q	171.26

Composite of six samples (depth-integrated) at 5' intervals:

T = 8°C

EC = 360 μmhos/cm @ 8°C

DO = 8.2 ppm (sample = middle)

pH = 7.36

3 Jun 1985

Flow measurement at SS-6 (Chalk Creek - down)

Beginning time = 1800

Partly cloudy, Air temp. = 18°C

Gage height (above bottom of inflow pipe) = 0.71 ft

Meter → Price-type AA

Width (ft)	Depth (ft)	0.6 d (ft)	Revs./ secs.	V (ft/s)	Q (ft³/s)
4	1.5	0.9	60/40	3.28	19.68
4	1.0	0.6	60/40	3.28	13.12
4	1.1	0.66	100/46	4.75	20.90
4	1.3	0.78	80/40	4.37	22.72
4	1.3	0.78	80/49	3.57	18.56
4	1.4	0.84	80/42	4.16	23.30
4	1.2	0.72	100/44	4.96	23.81
4	1.3	0.78	100/46	4.75	24.70
4	1.3	0.78	80/45	3.89	20.23
				Total Q	187.02 cfs

Depth-integrated samples collected at 5' intervals across stream & composited.

T = 8°C

EC = 400 μmhos/cm @ 13.5°C

pH = 7.30

DO = 8.5 ppm (sampled at middle)

UTAH
DEPARTMENT OF HEALTH

Norman H. Bangerter
Governor

Suzanne Dandoy, M.D., M.P.H.
Executive Director

BAQ-0999-1

August 19, 1987

Mr. Dan Guy
Blackhawk Engineering
Route 1, Box 146-H5
Helper, Utah 84526

Dear Mr. Guy:

Re: Approval Order for Boyer Coal Mine
Summit County, CDS B

The above-referenced project has been evaluated and found to be consistent with the requirements of the Utah Air Conservation Regulations (UACR) and the Utah Air Conservation Act. A 30-day public comment period was held and all comments received were evaluated. The conditions of this approval order reflect any changes to the proposed conditions which resulted from the evaluation of the comments received. This air quality approval order authorizes the project with the following conditions:

1. Summit Coal Company shall operate the underground coal mine according to the information submitted in the notice of intent dated December 26, 1986, and the additional information dated March 27, 1987.

2. The approved installations shall consist of the following equipment located at the site:

A. Continuous miner.
B. Stacking tube.
C. Crusher/screen unit.
D. Conveyors.
E. Storage piles.
F. Frontend loaders.
G. Haul trucks.
H. Other associated equipment.

3. Visible emissions from any point or fugitive emission source associated with the installation or control facilities shall not exceed 20% opacity. Opacity observations of emissions from stationary sources

shall be conducted in accordance with 40 CFR 60, Appendix A, Method 9. Opacity observations of intermittent sources shall use procedures similar to Method 9, but the requirement for observations to be made at 15-second intervals over a 6-minute period shall not apply. The opacity of any single reading shall not exceed 20% for intermittent sources.

4. All unpaved haul roads and other operational areas in use shall be water sprayed to minimize fugitive dust as conditions warrant in order to ensure that the opacity is maintained at 20% or less.

5. All installations and facilities authorized by this approval order shall be adequately and properly maintained.

6. The Executive Secretary shall be notified upon start-up of the installation, as an initial compliance inspection is required.

7. The moisture content of the coal shall be maintained at a minimum of 8% throughout the process. Moisture content shall be determined by ASTM Method D3302-82 commercial method. Testing shall be performed if directed by the Executive Secretary.

8. Coal production shall not exceed 192,000 tons per year without prior approval in accordance with Section 3.1, UACR. Records of production shall be kept for all periods when the plant is in operation. Records of production shall be made available to the Executive Secretary upon request, and shall include a period of two years ending with the date of the request. Production shall be determined by weigh scale records.

Any future modifications to the equipment approved by this order must also be approved in accordance with Section 3.1.1, UACR.

"Allowable emissions" as defined in Section 1.12, UACR, for this source (the entire plant) are currently calculated at 8.60 tons/yr for particulate. These calculations are for the purposes of determining the applicability of PSD and nonattainment area major source requirements of the UACR. They are not to be used for purposes of determining compliance.

The fee for issuing this approval order is $709.12. The amount (see enclosure for breakdown of costs) is payable to the Utah Department of Health, sent to the Executive Secretary, Utah Air Conservation Committee, 288 North 1460 West, P.O. Box 16690, Salt Lake City, Utah 84116-0690 and is due within 30 days after receipt of this approval order. Please return payment in the enclosed self-addressed envelope.

Sincerely,

F. Burnell Cordner

F. Burnell Cordner
Executive Secretary
Utah Air Conservation Committee

FBC/DK/sh
cc: EPA Region VIII (John Dale)
Summit County Health Department

1987

SUBSIDENCE MONITORING REPORT

Subsidence Monitoring

No subsidence monitoring was performed in 1987, since no second mining was done in the area to the west where monitoring is scheduled. Monuments will be placed and monitored as required in Chapter 3 of the M.R.P.

1987

VEGETATION DATA

APPENDIX 9-1

REFERENCE AREA DETERMINATION AND FINDINGS

SCOPE

A reference area, approximately 200 ' X 300' (1.37 acres) in size was selected September 30th 1986, for the Transitional Mountain Shrub vegetation type which is representative of the disturbed area associated with Summit Coal. The reference area was selected on the basis of similarity of species, composition, cover, productivity, geology, soils, slope and aspect of the vegetation types within the disturbed area defined at that time. This was done in conjunction with Mr. Lynn Kunzler of the Utah Division of Oil, Gas & Mining. The purpose of the reference area is to provide the following information:

1. To approximate and describe the condition of the land prior to mining.
2. To identify and describe important wildlife habitat in the mine plan area and the development of corresponding mitigation plans.
3. Identify and provide protection for any threatened and/or endangered species.
4. To aid in the prediction of revegetation potential for the site.
5. To establish the standards which must be utilized to measure the success of revegetation for the purpose of bond release. Standards must be set up for each vegetation type which has been or will be disturbed at the mine. Measurements must be taken to describe species composition, cover, density, (of woody plants) and production.

(Appendix 9-1)

METHODOLOGY

A reconnaissance-type survey was conducted within the vegetation type that was disturbed, then correlated to a reference area in undisturbed areas. A shrub and tree density survey was conducted during an initial sample period in October 1986. Additional species composition information and a re-evaluation of range site condition and vegetation cover by species will be surveyed in conjunction with quantitative sampling and total cover in July 1987. In addition, Summit Coal Co. will re-evaluate the range condition of the reference area every 5 years, during the field season prior to submitting an application for permit renewal. Specific efforts were made to locate and identify species proposed or listed as threatened or endangered, noxious weeds and selenium indicators.

Shrub and Tree Density: (as defined: the number of plants per unit area.)

Due to the size of the reference area (1.37 acres) and the very low density of shrubs and trees, an exact count was made by species; therefore, no statistical tests were necessary for sample adequacy.

On October 7, 1986, a three person crew from the consulting firm of E.I.S. conducted a 100% inventory of the reference. After the reference area had been staked and identified on the ground utilizing orange florescent flagging for perimeters and 4' metal stakes on each corner and signed as a "Vegetation Reference Area", each member of the survey party contoured the area on a 10 foot spacing. Each shrub and/or tree was spotted with orange florescent paint, identified and counted. The paint spot on the foliage reduced the chance of duplication and minimized the risk of missing individual plants Results:

Common Name	Scientific Name	Total #	#/Acre
	Shrubs		
Birchleaf Mt. Mahogany	Cercocarpus montanus	322	235
Rabbit Brush	Chrysothamnus nauseosus var. albicaulus	492	359
*Gambel Oak	Quercus gambel	286	208
Big Sage	Artemisia tridentata spp. vaseyana	185	135
Bitter Brush	Purshia tridentata	55	40
Service berry	Amelanchier utahensis	67	49
Snowberry	Symphoricarpos oreophilus	32	23
Woods Rose	Rosa woodsii	20	15
	Trees		
Utah Juniper	Juniperus osteosperma	59	43
Choke cherry	Prunus virginiana	2	1.5
**Oregon grape	Mahonia repens		est. 200
		Total	1,308.5

*The oak brush was concentrated on the northeastern aspect adjacent to a small drainage on what appeared to be a cooler and more moist area.

**Oregon grape is in evidence at approximately 15% to 20%, none of which approached the 1' height.

Cover: As defined: The percent of ground covered by a species or life form [cover by species may and often does add up to more than 100% and is used to establish plant diversity. Total cover differs in that it cannot equal more than 100%, including cover by rock, litter, crytogams and bare ground]

Cover, will be re-evaluated during July of 1987. The methodology proposed to be used is the "Point Method". This method employs a M^2 frame with a rod (pin) that drops through the vegetation. Hits are recorded accordingly to what the pin intersects first (i.e., vegetation, litter, rock, bare ground). Transects of 50 points are counted as one sample unit. The location of the frame along the transect will be regularly place. The location and orientation of the transect within the study site will be randomly placed.

Minimum sample size = 15

Maximum sample size = 50

Cover data will be obtained at 50 points spaced at 1 meter intervals along a transect at each randomly selected sample point. A linear point-frequency fram (Mueller-Dombois and Ellenberg 1974) will be used to accurately measure vertical hits on vegetation, litter, rock and bare ground. Crown or shoot cover will be measured by counting only the first interception of the pin with a plant part. Overhead canopy cover will be determined by recording the plant species hit when the vertical line of the pin will be protected upward above the frame. Where crowns overlap in layered vegetation, the uppermost layer will be considered the primary vegetation hit and subsequent hits on lower vegetation will be recorded separately.

This technique provides frequency information for vegetative, litter, rock and bare ground components of total cover along a given

transect. Frequency of individual plant species encountered along each transect will also be determined to provide relative distribution information.

Sample Adequacy Determination

Utah Division of Oil, Gas & Mining guidelines (1982) dictate the following sampling adequacy requirements for estimates of cover, shrub density and tree density:

Reference Areas	Grass & Herbs	90%/d=.1	A statement of productivity (preferebly a letter from the SCS). RA should be in fair range condition or better.
	Shrub & Forest Lands	80%/d=.1	

The following formula will be used to demonstrate sample adequacy:

$$\frac{t^2 s^2}{(d\bar{x})^2}$$

t = the t value for a 2-tailed test,

(t = 1.645 for 90% confidence, t = 1.282 for 80% confidence)

s = the sample standard deviation,

d = the desired change in the mean,

x = the sample mean of the parameter in question

The balance of the data will be supplied to the Utah Division of Oil, Gas & MIning in August of 1987. The data and proposed methodologies have been supplied by Melvin A Coonrod, MF Silviculture of the Consulting firm of Environmental Industrial Supply, Elmo, Utah.

(Add to Appendix 9-1)

APPENDIX 9-2

REFERENCE AREA DETERMINATION

METHODOLOGIES

Quantitative sampling of vegetation involved point samples along 50 M transects. A random numbers table was used to determine the number of paces between transect lines. The direction of each transect was randomly selected by a hand-held compass. Compass headings that fell within the plot boundary and did not bisect other transects were used. Ten point samples were taken every 5 meters along each transect using a modified point frame. Recordings included plant species and vigor, litter, rock and bare ground.

A single tail t-test was used to determine the number of samples needed to satisfy a 90% confidence limit.

SPECIES LIST

Symbol	Scientific Name	Common Name
Grasses		
BRAN	Bromus anomalus	nodding brome
ORHYH	Oryzopsis hymenoides	Indian ricegrass
POA	Poa sp.	bluegrass
ELYMU	Elymus sp.	Rye grass
AGSP[3]	Agropyron spicatum	bluebunch grass
POPR	Poa pratensis	Kentucky bluegrass
AGROP	Agropyron sp.	Wheatgrass
Forbs		
OPUNT	Opuntia sp.	Prickly pear cactus
BERE	Berberis repens	oregon grape
WYAM	Wyethia amplericaulis	Mulesear dock
CABU[2]	Capsella bursa	Shepherd's purse
PEPA[3]	Penstemon palmeri	Palmer penstemon
SAKA	Salsola kali	Russian thistle
CIAR	Cirsium arvense	Canada thistle
BRASS[2]	Brassica sp.	Mustard
CRYPT	Cryptantha sp.	Cryptantha
ASTRA	Astragalus sp.	Milkvetch
EUOC	Euthamia occidentalis	Western goldenrod
Shrubs		
ARAB[3]	Artemesia absinthium	Common sagewort
GUMI	Gutierrezia microcephala	broom snakeweed
CHNA[2]	Chrysothamnus nauseosus	Rubber rabbitbrush
ARFR[4]	Artemesia frigida	Fringed sage
CEMO[2]	Cercocarpus montanus	birchleaf Mt. Mahogany
AMUT	Amelanchier utahensis	Utah serviceberry
ARTR	Artemesia tridentata	Big Sagebrush
PUTR[2]	Purshia tridentata	Antelope bitterbrush
SYOR[2]	Symphoricarpus oreophilus	Snowberry

Species list [cont.]

Symbol	Scientific Name	Common Name
Trees		
JUOS	Juniperus osteosperma	Utah juniper
QUGA	Quercus gambelii	Gambles oak

% COVER

	Points	Percent
Total	4000	
Veg. Cover	462	11.6%
Bare Ground	2210	55.3%
Litter	1127	28.2%
Rock	201	5.0%

t-Test

t for a 1 tail at 90% confidence & $\propto$df = 1.282

s^2 [variance] = 2.19

n [sample size] = 400

$\bar{x}$ [sample mean] = 1.2

n should be less than or equal to 400

$$n = \frac{[s^2]\,[t^2]}{[10\%\ \text{mean}]^2} = \frac{[2.19]\,[1.282]^2}{[1.2 \times .10]^2} = 257.1$$

PERCENT COVER BY SPECIES

	Symbol	Plants	% Cover
Grasses:	BRAN	27	5
	ORHYH	61	13
	POA	1	.2
	ELYMU	16	3
	AGSP[3]	2	.4
	POPR	5	1
	AGROP	32	6
		144	28.6
Forbs:	OPUNT	2	.4
	BERE	12	2.5
	WYAM	1	.2
	CABU[2]	5	1
	PEPA[3]	2	.4
	SAKA	1	.2
	CIAR	2	.4
	BRASS[2]	0	0
	CRYPT	4	.8
	ASTRA	1	.2
	EUOC[4]	0	0
		30	6.1
Shrubs:	ARAB[3]	5	1
	GUMI	29	6.2
	CHNA[2]	4	.8
	ARFR[4]	3	.6
	CEMO[2]	57	12.3

	Symbol	Plants	% Cover
Shrubs:	AMUT	36	7.8
	ARTR	85	18.4
	PUTR[2]	9	2
	SYOR[2]	15	3.2
		224	53.1
Trees:	JUOS	11	2.3
	QUGA	34	7.3
		45	9.6

1000

Company Name _____ Date 8/12/87

Location Summit Site Reference area Time 0730

Magnetic Heading 320° NW Transect # (1)

Species vigor and/or % cover. Lots of Deer Sign - Prominant travel PATH and Several Scat Piles.

L		L		L		B		R		BRAN	X	L		L		R		L	
CABU²	X	L		L		ORHY	X	L		L		L		CABU²	X	B		R	
L		R		R		ORHY	/	B		CHNA²	X	B		B		B		B	
B		B		B		B		B		B		B		B		B		CABU²	X
B		B		B		B		L		B		B		B		B		B	
B		B		L		L		B		B		R		BRAN	/	POPA	X	B	
CABU²	/	PEPA⁶	X	R		B		B		B		B		B		B		B	
B		B		CABU²	/	B		B		R		B		B		R		B	
B		I		R		R		R		R		R		R		R		R	
BRAN	/	L		BRAN	/	L		BRAN	/	BRAN	/	L		B		L		B	
ORHY†	/	L		L		B		L		L		L		B		L		B	
L		L		L		L		L		L		L		L		L		L	
B		B		B		R		R		AGRO	/	B		B		R		FEST⁴	X
B		A		B		B		B		B		B		B		B		R	
B		B		B		R		R		B		B		B		B		B	
B		B		B		B		B		B		B		B		B		B	
L		CENS²	X	P		L		L		L		L		L		L		L	
T		B		B		B		B		B		B		L		L		B	
L		L		L		L		L		L		B		B		L		L	
ORHY†	/	B		L		B		B		BRAN	/	L		L		L		L	

Comments & Observations * RARE IN this flat area. Usually consists of pebble size stones, As differentiated from larger rocks.

* — Means dried/dead VIGOR

Tumble weed (Russian Thistle) Purple Thistle (not identified) Evening Primrose

Mustard

Several in Fringed Sage

RF

Vegetation Field Notes

Space - 1

Company Name _____ Date 8/12/97

Location Summit Site Pit area Time 0820

Magnetic Heading 20° NE Transect # 2

Species vigor and/or % cover.

B	B	B	ORHYH	[illegible]	B	B	B	B	B
ARTR	ARTR	CEMO2	ARTR	B	B	B	B	B	B
B	B	B	B	B	AMUT	B	B	B	B
L	B	B	B	B	B	B	B	B	B
B	L	L	GUMI	B	GUMI	B	B	B	PR
CEMO2	ORHYH	B	B	B	B	B	B	B	B
AMUT	L	B	B	B	B	L	L	B	B
AMUT	ORHYH	L	B	B	L	L	B	L	B
L	L	L	L	B	B	B	B	B	L
B	B	B	B	B	B	B	B	B	B
B	B	B	B	B	B	CEMO2	L	B	B
B	B	B	B	B	L	L	L	B	L
B	CEMO2	unk Horse Tail	B	B	B	B	B	B	B
B	B	B	B	B	B	B	B	B	ORHYH
B	B	B	B	B	B	B	B	B	B
B	B	B	B	L	B	B	B	B	B
L	L	L	B	L	L	CEMO2	CEMO2	CEMO2	L
L	L	B	B	B	B	L	L	L	B
B	B	B	L	B	L	L	L	B	L
B	B	L	B	B	B	L	B	L	B

Comments & Observations Dam Travel Path

Real Steep area, soft dirt, East exposure

Company Name _____ Date [illegible]

Location [illegible] Site [illegible] Time [illegible]

Magnetic Heading 60° NE Transect # [illegible]

Species vigor and/or % cover.

ELYMU	ELYMU	ELYMU	ELYMU	B	B	B	B	B	B
B	B	B	B	B	B	B	B	B	B
B	B	B	B	B	B	B	B	B	B
B	B	B	B	B	B	L	B	B	B
CEMO²	CEMO²	B	B	B	ORHYH	B	CEMO²	B	B
? Horsltail	B	B	B	B	B	L	B	L	B
B	B	ORHYH	B	B	ARAB³	B	B	B	B
L	L	B	L	L	CEMO²	L	CEMO²	L	CEMO²
B	B	B	B	B	B	B	B	B	B
B	B	L	L	B	B	B	B	B	[illegible]
B	B	B	B	B	B	B	B	B	B
B	B	B	B	B	B	B	B	B	B
B	B	B	B	B	B	B	B	B	B
B	B	B	B	B	B	B	R	B	B
B	B	B	B	B	B	B	B	B	B
B	B	B	B	B	B	B	B	B	B
CEMO²	B	B	L	B	B	B	B	B	B
B	B	B	R	L	L	B	L	R	L
ARTR	ARTR	R	R	B	B	B	B	B	R
AGSP	CEMO²	CEMO²	L	L	L	R	CEMO²	L	B

Comments & Observations [illegible]

[illegible]

Company Name _____ Date 8/12/87

Location [illegible] Site [illegible] Time 0910

Magnetic Heading 0° N Transect # (4)

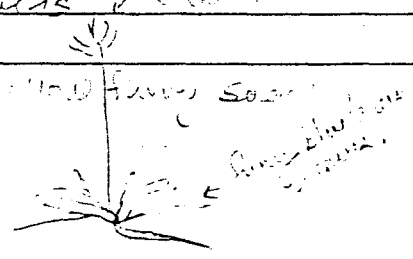
Species vigor and/or % cover.

L	B	L	L	B	L	L	L	L	L
B	L	L	L	L	B	L	L	L	L
B	B	B	B	L	L	L	L	B	L
B	B	ELYMU X	B	L	L	ELYMU /	B	L	B
B	L	L	B	B	B	L	B	B	B
B	B	B	B	B	B	B	B	B	B
B	B	B	B	B	B	B	B	B	B
B	ORHYH /	B	B	L	B	B	B	B	B
ARAB3 X	B	B	B	B	L	L	ORHYH /	ORHYA /	B
ARAB3 /	B	B	B	B	B	B	B	B	B
L	ORHYH /	ORHYH /	L	B	B	ORHYA /	L	L	L
ASTRA /	B	B	B	B	B	B	B	B	B
B	L	L	B	B	B	B	B	B	B
B	B	B	GUMI /	B	B	B	B	B	B
B	B	B	B	B	B	B	B	B	B
B	B	B	B	B	B	B	B	B	B
B	B	B	ORHYH /	B	B	B	B	B	B
B	B	B	B	B	B	B	B	B	B
CEMO2 /	B	B	L	L	L	L	L	B	B
L	L	ARAB2 /	L	B	L	L	B	B	B

Comments & Observations [illegible]

Couple Scat, Deer trails [illegible]

growth on [illegible] Sand



…pany Name ______________________ Date 8/12/87

…tion Summit Site Ref. Area Time 0940

…etic Heading 70° NE Transect # (5)

…es …or and/or % cover.

B	AMUT	B	ORHYH	B	B	B	ORHYH	B
L	B	B	B	B	B	B	B	B
B	B	B	B	B	L	B	B	R
[illegible]	[illegible]	B	L	B	L	L	ORHYH	L
L	L	L	AMUT	L	B	AMUT	L	L
ARTR	ARTR	ARTR	AMUT	AMUT	ARTR	AMUT	AMUT	ARTR
L	L	L	B	B	L	L	ARTR	L
L	AMUT	AMUT	L	AMUT	GUMI	L	AGROP	B
B	L	B	B	L	GUMI	L	L	Xa
B	L	B	B	L	ARTR	ORHY	ARTR	B
L	B	ARTR 69	L	L	AG	L	L	B
B	R	L	B	B	GUMI	B	GUMI	B
L	ARTR	GUMI	GUMI	B	B	L	ARTR	L
L	GUMI	L	B	B	B	QUGA	B	L
L	L	AMUT	L	JU	QUGA	L	AMUT	ARTR
GUMI	B	B	L	QUGA	L	L	L	L
AG	B	AG	B	B	L	L	B	L
ARTR	ARTR	ARTR	L	L	L	L	L	L
L	L	L	B	B	B	B	B	L
B	L	L	L	B	B	B	B	L

…Observations Numerous [illegible]

[illegible] ORHY : Indian Rice[illegible] QUGA = Gambel Oak

[illegible] GUMI [illegible] Ju = Juniper

Vegetation Field Notes

Company Name _____ Date 8/12/87

Location Summit Site Ref area Time 10:00

Magnetic Heading 140° SE Transect # 6

Species vigor and/or % cover.

JUOS	/	JUOS	5/	L		L		ARTR	/	ARTR	/	ARTR	5/	L		L		L	
POPR	/	POPR	/	POPR	4/	L		L		B		L		L		POPR	/	POPR	6/
L		L		L		L		L		L		L		L		L		L	
B		L		ARTR	/	L		L		B		B		B		L		B	
B		B		B		XA		L		B		B		B		B		B	
B		B		R		B		R		B		R		B		B		R	
ARTR	/	L		L		L		L		B		B		R		B		L	
ARTR	/	ARTR	/	ARTR	/	ARTR	/	B		B		B		B		B		B	
L		L		B		ORHYH	/	B		ORHYH	/	ORHYH	/	B		B		B	
B		B		B		B		B		B		B		B		ORHYH	/	B	
B		B		L		XA		B		B		B		B		B		B	
B		B		B		B		B		B		B		QUGA	/	R		R	
B		L		R		L		L		ARTR	/	ARTR	/	L		B		B	
L		L		L		WYAM	/	L		L		B		B		L		L	
L		L		L		L		L		AG	6/	B		B		R		L	
ARTR	/	B		B		B		B		B		GUMI	/	B		B		B	
B		B		B		POPR	/	B		ARTR	/	R		B		R		R	
B		B		B		R		B		B		B		L		R		B	
PUTR	2/	B		B		B		B		B		B		B		B		B	
B		B		B		B		B		B		B		B		B		B	

Comments & Observations dropped 3 point antler found, deer seat, paths yearling buck skeleton found.

POPR: Poa pratensis Wy: Mule ear PUTR: bitterbrush

Vegetation Field Notes

Company Name _____ Date 8/12/97

Location Summit Site Ref. Corner Time 1020

Magnetic Heading 300° NW Transect # (7)

Species vigor and/or % cover.

B	L	L	L	R	B	B	B	L	L
B	L	L	B	B	L	L	L	B	L
L	L	L	SYOR	L	L	L	L	SYOR	L
L	L	L	L	L	SYOR	L	L	L	L
L	L	L	L	L	L	L	L	L	L
L	L	L	L	L	L	L	L	L	C
L	L	B	L	L	L	L	R	L	B
L	B	B	B	L	L	L	B	B	L
L	L	L	B	B	B	L	L	B	B
!	L	B	L	B	B	L	B	B	L
L	B	L	B	B	B	B	B	B	B
L	L	L	L	L	L	L	L	L	L
L	L	L	L	L	L	L	L	B	L
B	B	B	B	B	h	ARTR	L	B	B
B	B	B	B	B	B	B	B	B	B
B	B	ARTR	B	B	ARTR	L	L	L	B
B	B	B	B	B	B	B	R	B	B
B	B	B	B	B	L	L	L	B	B
L	B	B	B	L	L	B	B	AMUT	B
L	ARTR	ARTR	AMUT	B	ARTR	ARTR	B	B	L

Comments & Observations Deer bird, scat, paths

SYOR - Strawberry

Vegetation Field Notes

Company Name _____ Date 8/12/87

Location Summit Site Raf Area Time 10:40

Magnetic Heading 270° E Transect # 3

Species vigor and/or % cover.

L		B		R		L		L		B		B		B		L		L	
L		L		QUGA	/	L		L		B		CEMO2	/	CEMO2	/	L		L	
L		QUGA	/	L		L		GUMI	/	L		L		GUMI	/	L		L	
SYOR2	/	SYOR2	/	L		AGPYR	/	B		L		L		L		B		L	
CEMO2	/	CEMO2	/	CEMO2	/	CEMO2	/	L		Elks. L		Elks. L		Elks. L		R		L	
ARTR	/	ARTR	/	ARTR	/	ARTR	/	L		B		B		CEMO2	/	L		L	
B		B		B		B		B		R		R		CEMO2	/	B		GUMI	/
B		B		B		B		B		L		ORHYH	/	R		L		B	
GUMI1	/	L		B		L		B		B		B		B		B		ORHYH	/
L		L		B		L		B		L		L		L		L		B	
L		AMUT	/	AMUT	/	L		L		AMUT	/	AMUT	/	AMUT	/	L		L	
L		L		L		L		L		L		L		L		ARTR		L	
L		ARTR	/	B		L		L		B		L		L	over scat	L		B	
B		B		B		L		B		L		L		L		B		R	
ARTR	/	L		L		L		L		B		B		L		B		B	
L		B		L		L		L		SYOR2	/	SYOR2	/	L		SYOR2	/	B	
L		L		L		L		L		L		Z		L		L		L	
BRAN	X	BRAN	X	L		L		R		L		L		BRAN	/	BRAN	/	L	
B		B		L		L		L		L		L		L		L		L	
L		SYOR2	/	SYOR2	/	L		B		ARTR	/	ARTR	/	L		L		L	

Comments & Observations Large Deer (Elk?) scat, Young doe skull & bones
Dead yearling buck.

CEBS = Birch Mohag.

Vegetation Field Notes

Company Name _____ Date 8/12/87

Location Summit Site Ref. Area Time 11:00

agnetic Heading 200° SW Transect # 9

Species vigor and/or % cover.

B		L		L		L		B		B		B		L		R		B	
B		B		B		B		B		CEMO2	/	R		CEMO2	/	L		B	
CEMO2	/	L		CEMO2	/	L		L		B		B		B		B		B	
B		L		ARTR	14 /	L		B		R		L		B		B		B	
L		L		B		L		L		L		ARTR	/	JUOS	/	L		B	
ELYMU	/	L		SYOR2	/	L		L		L		JUOS	/	L		JUOS	/	L	
B		B		B		B		B		B		B		B		B		B	
B		B		B		B		B		B		B		B		B		B	
L		R		B		B		B		B		AGRO	/	B		AGRO	/	L	
B		B		B		B		B		B		B		B		B		B	
SYOR2	/	ARTR	/	ARTR	/	L		B		B		B		B		B		B	
B		B		B		B		B		B		B		B		B		B	
B		B		B		B		B		B		B		B		B		B	
B		B		B		B		B		B		B		B		B		B	
B		B		B		B		B		B		B		B		B		B	
BR	/	BRAN	/	BRAN	/	R		L		BRAN	/	R		L		BLAN	/	L	
B		B		L		L		L		L		L		B		L		B	
B		R		B		R		B		B		L		R		R		B	
B		B		B		L		B		B		B		B		B		B	
L		B		L		B		B		B		B		L		B		B	

omments & Observations Dear S[illegible] + paths

Vegetation Field Notes

Company Name _____ Date 8/12/87

Location Summit Site Rel. Area Time 11:15

Magnetic Heading 260° SW Transect # (10)

Species vigor and/or % cover.

L	ORHY	ORHY	B	R	B	B	B	B	B	R
B	B	B	B	B	B	B	B	B	B	B
B	B	B	L	B	B	B	R	B	B	B
B	L	B	B	L	B	L	L	B	L	
L	JUS	L	L	L	L	L	L	L	L	
L	L	L	BRAN	L	L	BRAN	L	L	B	
L	L	L	L	R	L	L	R	L	L	
B	B	B	B	B	B	B	B	B	B	
B	L	L	B	B	B	B	B	B	B	
R	B	B	B	B	B	B	B	R	B	
L	B	B	R	B	B	B	B	B	B	
L	L	L	R	ORHY	R	L	L	L	L	
B	B	L	B	B	L	L	B	B	B	
L	B	B	B	B	R	L	L	B	[illegible]	
L	L	L	B	SCAT L	L	L	L	L	GUMT	
GUMT	B	B	B	R	B	L	L	B	B	
L	L	L	GUMT	B	B	L	L	B	R	
L	L	L	L	L	L	L	L	L	L	
L	B	B	B	B	B	B	ARTR	L	L	
L	L	L	L	L	L	L	L	L	L	

Comments & Observations Scat

Tom burned

= prickly pear

Vegetation Field Notes

Company Name _____ Date 8/12/87

Location Summit Site Key Area Time 1145

Magnetic Heading 20° NE Transect # (11)

Species vigor and/or % cover.

L		AGRO		L		GUMI		B		L		L		L		L		TA					
L		L		B		B		L		B		L		L		B		L					
GUMI		B		B		L		B		L		L		L		L		R					
B		R		GUMI		L		L		L		L		L		L		B					
L		L		B		L		B		L		B		B		CIAR		B					
L		L		L		L		L		L		L		L		L		L					
L		QUGA		L		R		L		L		L		L		QUGA		L					
QUGA		L		L		L		L		L		QUGA		L		L		L					
QUGA		QUGA		QUGA		L		L		L		L		L		QUGA		L					
QUGA		QUGA		L		L		QUGA		QUGA		QUGA		L		L		L					
R		R		L		R		L		L		L		R		R		L					
R		R		QUGA		R		R		QUGA		QUGA		QUGA		R		R					
R		QUGA		ALTR		QUGA		R		B		B		B		R		R					
L		L		L		ELYMU		ELYMU		ELYMU		ELYMU		ELYMU		ELYMU		ELYMU					
SYOR		L		R		B		R		R		L		L		BRTA		L					
L		C		L		L		L		L		C		L		L		L					
QUGA		L		L		L		L		L		ARTR		L		L		B					
QUGA		QUGA		QUGA		L		L		L		L		L		CIAR		L					
L		QUGA		L		L		L		L		L		L		L							
QUGA		L		L		QUGA		L		L		L		L		QUGA		QUGA					

Comments & Observations Dead Deer Skeleton - Not an old doe, Scat

Company Name _____ Date 8/12/87

Location Summit Site Raf Area Time 1200

Magnetic Heading 60° NE Transect # 12

Species vigor and/or % cover.

R		L		B		B		B		L		B		B		B		B	
B		ARTR	/	ARTR	/	ARTR	/	ARTR	/	L		ARTR	17 /	L		B		L	
B		L		B		B		B		B		B		B		B		B	
AGROP	/	B		B		B		B		L		GUMI	/	AGROP	/	L		L	
B		B		B		B		B		B		B		B		B		B	
AGROP	/	AG ROP	/	B		CEMO2	/	B		B		ORHYH	/	L		L		L	
AMUT	/	AMUT	/	B		B		B		B		B		B		B		AG	/
ORHYH	/	ORHYH	/	B		L		B		ORHYH	/	B		B		B		B	
L		CEMO2	/	B		ORHYH	/	B		B		B		B		B		B	
B		B		B		B		L		ARTR	/	ARTR	/	R		L		L	
ORHYH	/	ORHYH	/	B		B		B		GUMI	X	B		B		B		B	
L		B		B		L		B		B		B		B		B		B	
B		B		B		B		B		ORHYH	/	B		B		B		B	
B		B		B		B		B		ORHYH	/	L		GUMI	X	B		B	
B		B		B		B		B		B		B		B		B		B	
B		B		B		B		B		B		L		B		B		B	
B		R		B		B		B		L		L		L		B		ORHYH	/
B		B		ARAB3	X	R		L		B		B		ARAB3	/	R		B	
ARTR	/	L		B		B		B		B		B		B		B		B	
L		B		B		L		B		B		B		B		B		B	

Comments & Observations Yearling Buck skeleton. (5th dead deer so far!)

Company Name _____ Date 8/12/87

Location Summit Site Ref Area Time 1220

Magnetic Heading 180° S Transect # 13

Species vigor and/or % cover.

B	B	B	B	B	B	B	B	B	B
B	B	B	B	B	B	B	B	B	B
B	B	B	B	B	B	B	B	B	B
B	B	B	B	B	B	B	B	B	B
B	B	B	B	B	B	B	B	B	B
B	L	B	PUTR /	B	B	B	B	B	B
L	SYOR /	B	L	B	B	L	B	B	L
L	L	L	L	B	B	B	B	B	L
L	L	L	B	B	B	B	B	B	B
B	B	L	R	L	L	L	L	CRYPT /	B
L	L	AGROP /	L	R	L	B	B	B	L
B	B	L	B	B	L	B	B	R	B
B	B	R	R	R	B	B	B	R	B
B	R	B	B	B	B	B	B	B	B
B	R	B	B	B	B	L	L	R	L
L	L	L	CEMO /	L	L	L	L	L	L
L	L	L	R	L	L	L	L	R	L
L	R	L	L	L	L	L	L	L	L
L	L	R	R	L	L	L	R	L	R
R	L	AMUT /	R	L	L	L	R	R	L

Comments & Observations Dead doe fawn ≈ 1 yr age bones still intact w/ [illegible]

Vegetation Field Notes

Company Name _____ Date 8/12/87

Location SUMMIT Site Ref. Area Time 12:30

Magnetic Heading 230° SE Transect # (14)

Species vigor and/or % cover.

B	B	ARAB	B	B	R	B	B	B	B
B	B	B	B	ORHY	E	B	B	B	R
PUTR	B	PUTR	PUTR	L	R	B	B	B	R
R	B	B	B	R	L	L	L	B	L
R	B	R	B	B	R	L	R	L	L
B	B	R	R	E	R	R	R	R	R
PUTR	R	B	L	L	R	R	B	R	PUTR
R	B	R	L	L	B	B	CHRY	L	R
B	B	B	B	ORHY	R	B	B	R	B
B	B	B	B	B	B	B	B	B	B
B	B	B	B	B	B	B	B	B	B
B	B	B	B	B	B	B	B	B	B
B	B	AMUT	SYOR	B	XA	L	B	L	PUTR
B	BERE	R	BERE	B	B	B	B	B	R
L	L	B	L	B	B	L	L	B	B
BERE	L	B	L	B	L	L	L	B	BERE
B	R	B	L	L	B	B	B	B	B
B	B	B	B	B	B	B	B	B	B
B	B	R	R	B	B	BERE	B	B	B
B	B	B	R	L	AG	L	L	L	R

Comments & Observations _____

Vegetation Field Notes

Company Name _____ Date 8/12/82

Location SUMMIT Site Prof. Area Time 1255

agnetic Heading 330° NW. Transect # (15)

Species vigor and/or % cover.

B	R	B	B	R	B	Ag /	B	AGROP /	R
B	AG /	B	R	CEMO2 /	R	B	R	B	R
B	AG /	L	L	L	L	ORHY /	B	L	R
AMUT /	L	R	R	B	AGROP /	L	CEMO2 /	L	L
B	AGROP /	R	B	R	AGROP /	B	B	B	R
AGROP /	B	R	B	L	L	R	B	B	R
B	AG /	R	L	B	R	B	B	B	B
B	B	CEMO2 /	B	B	L	L	B	B	L
L	L	AMUT /	L	L	L	L	L	AMUT /	B
B	B	B	B	B	R	B	B	R	B
B	B	B	B	B	B	B	B	B	B
B	B	B	B	B	B	B	B	B	B
L	B	B	B	B	B	B	B	B	B
L	B	B /	B	B	B	B	L	B	B
B	CEMO2 /	MO /	B	B	B	B	B	B	B
B	B	B	B	B	B	B	B	B	ARAE? /
B	B	B	B	B	L	L	L	L	B
B	B	B	B	B	B	B	B	B	B
B	B	B	B	B	B	B	B	B	B
B	B	B	B	B	I	L	R	R	B

Comments & Observations _____

Vegetation Field Notes

Company Name _____ Date 8/12/15

Location Summit Site Ref. Area Time 1310

agnetic Heading 190° SW Transect # (16)

Species vigor and/or % cover: 4-5

B	B	CHNA 2	B	B	L	L	B	L	B		
B	B	B	ORHY	B	B	B	B	B	ORHY		
L	B	B	L	B	B	B	B	B	B		
L	ARTR	ARTR	L	B	B	B	B	B	B		
B	B	B	B	AGROP	B	B	B	ORHY	F.		
L	L	L	B	L	B	B	B	B	B		
B	B	B	B	B	CEMO 2	ELYMU	B	L	B		
B	B	B	B	B	B	B	B	B	B		
B	B	B	B	B	AGROP	AGROP	L	B	B		
B	L	B	ORHY	ORHY	B	B	B	B	B		
B	B	B	B	B	ARTR 2	B	ORHY	B	CEMO 2		
B	B	B	B	B	AGROP	L	CEMO 2	B	B		
B	B	L	B	B	B	B	B	B	B		
B	GUNT	B	B	L	B	B	B	B	B		
B	B	B	B	B	B	B	B	B	B		
B	B	B	B	B	B	B	B	B	B		
B	B	L	B	B	B	B	L	B	B		
L	L	AMUS 4	L	L	L	L	JU	L	L		
L	L	L	L	L	L	L	L	L	L		
B	B	B	L	B	L	L	L	Horse tail	L		

Comments & Observations LARGE Deer Tracks

Vegetation Field Notes

Company Name _____ Date 8/12/87

Location Summit Site Ref. Area Time 1330

Magnetic Heading _____ Transect # 17

Species vigor and/or % cover.

B		B		B		B		B		B		B		ORHY4	/	B		B					
B		B		B		B		B		B		B		B		B		B					
B		B		B		B		B		B		B		B		B		B					
B		B		B		B		B		B		B		B		B		B					
L		B		B		B		L		L		B		B		B		B					
B		B		B		B		B		B		B		B		B		B					
B		B		B		B		B		B		B		B		B		B					
B		B		B		B		B		B		B		L		B		B					
L		B		B		B		L		L		L		L		B		L					
B		B		B		B		L		B		L		L		L		L					
B		L		L		B		L		L		L		L		L		B					
L		Ju	/	L		L		L		L		L		L		L		L					
L		L		L		L		L		AMUT	/	B		L		L		L					
L		L		L		L		L		L		L		L		L		L					
L		L		L		L		L		L		L		L		L		L	/	OPUNT			
L		L		L		JUOS	/	L		L		L		L		L		L					
L		L		L		L		L		L		ARTR	/	L		L		L					
B		B		B		B		B		B		B		L		B		L					
B		OP	/	B		B		B		B		ARTR	/	L		L		L					
L		L		L		L		L		L		L		L		L		L					

Comments & Observations Deer Scat! & dead deer both yearling bucks found 2' apart

Vegetation Field Notes

Company Name _____ Date 8/12/17

Location Summit Site Ref. Site Time 1340

Magnetic Heading 120 SE Transect # (18)

Species vigor and/or % cover.

L	L	L	B	B	B	B	B	B	B
AMUT /	L	L	L	B	B	B	B	B	B
B	B	B	B	B	B	L	B	B	B
B	B	L	B	ARAB3 /	B	B	B	B	B
L	L	L	L	B	B	B	B	B	B
B	B	B	B	B	B	B	B	B	B
CEMO /	CEMO /	B	CEMO /	CEMO /	B	B	B	B	B
B	B	B	B	B	B	B	B	B	B
B	B	B	B	B	B	B	B	B	B
B	L	L	B	B	B	B	B	B	B
B	B	B	ORHY /	B	L	L	B	B	B
ORHY /	CEMO2 /	B	B	B	B	B	B	B	ORHY /
B	B	B	B	B	B	B	B	B	B
B	B	B	B	B	B	B	B	B	B
L	L	L	B	L	B	L	L	HIAB3 /	B
B	B	L	B	L	L	B	B	B	L
B	B	B	B	B	B	B	B	B	B
RR	L	B	B	B	B	B	B	B	B
ORHY /	AELE /	B	CEMO /	L	ARTR /	L	L	L	CEMO /
L	L	L	L	L	ORHY /	ORHY /	L	L	L

Comments & Observations chopped forked Horn

Vegetation Field Notes

Company Name _____ Date 8/12/87

Location Summit Site Ref area Time 13:50

agnetic Heading 190° SW Transect # 19

Species vigor and/or % cover.

B	B	B	B	B	B	B	B	B	B
B	B	B	B	B	B	B	B	B	B
B	B	B	B	B	B	B	B	B	B
B	B	B	B	B	B	B	B	B	B
B	B	B	B	B	B	B	B	B	B
L	ORHYH /	R	L	L	CEMO2 /	CEMO2 /	CEMO2 /	L	L
B	B	B	B	B	B	L	B	L	B
B	B	B	B	B	B	B	B	B	B
XA	XA	L	L	B	L	L	L	B	B
R	R	R	L	B	CEMO2 /	B	B	R	R
B	B	B	B	B	R	PUTR /	L	B	B
B	CEMO2 /	CEMO2 /	B	B	B	B	B	B	B
B	B	B	B	B	B	B	R	B	B
B	R	B	B	B	B	B	B	B	R
B	B	R	B	B	R	B	B	B	B
B	B	B	B	B	B	B	B	B	B
B	L	R	L	B	B	B	L	L	B
L	R	L	L	B	L	L	L	ORHYH /	B
B	B	ORHYH /	B	R	B	B	B	B	B
B	R	B	B	B	L	B	B	B	B

omments & Observations _____

Company Name _____ Date 8/12/87

Location Summit Site Ref area Time 1400

Magnetic Heading 160 SE Transect # 20

Species vigor and/or % cover.

B	B	B	B	R	B	B	ARTR 3	L	B
B	L	L	L	B	L	R	L	L	B
L	L	L	CHNA 2	L	B	B	R	L	L
L	L	L	CRYPT	L	L	R	B	B	B
ARAB 3	B	B	B	B	B	B	B	B	B
B	B	B	B	B	B	B	B	B	B
B	B	B	B	B	B	B	B	B	B
R	L	B	R	L	B	B	B	B	B
AMUT	B	B	AMUT	B	B	B	B	B	[illegible]
B	B	B	B	B	B	B	B	B	B
ORHY	B	B	XA	B	R	GUMI	BERE	B	B
L	ORHY	CEMO 2	L	BERE	L	BERE	L	AMUT	L
ARTR	BERE	B	ARTR	L	BERE	L	L	L	L
B	B	B	B	B	B	B	B	B	B
L	L	L	L	L	L	L	B	B	L
L	JUSS	L	L	L	L	L	BRAN	L	L
ARAB 3	L	L	R	L	L	R	L	L	L
XA	L	R	B	BERE	L	BERE	L	L	L
L	L	L	L	B	CRYPT	L	L	L	R
B	POPR	B	B	L	B	B	B	B	L

Comments & Observations Dead deer yearling buck

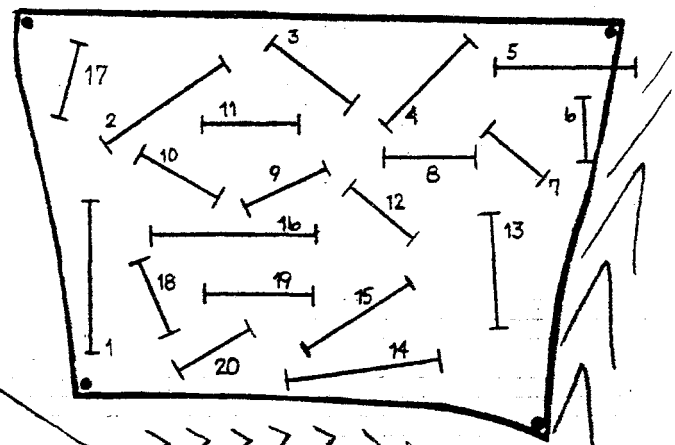
Found another 2 dead fawns on way back to [illegible]

Broad leaf Xanth = Cryptosperma

BY D. GOI DATE 9/10/87 SUBJECT ..... SHEET NO. ..... OF.....

CHKD. BY ..... DATE .... JOB NO. .....

SUMMIT COAL CO.
BOYER MINE
REFERENCE AREA TRANSECTS
SCALE: 1"=100' (Ref. Area Only)



TO COALVILLE

U-133

OFFICE

N

1987

PERMIT/ STIPULATION STATUS

STATE OF UTAH
NATURAL RESOURCES
Oil, Gas & Mining

Norman H. Bangerter, Governor
Dee C. Hansen, Executive Director
Dianne R. Nielson, Ph.D., Division Director

355 W. North Temple · 3 Triad Center · Suite 350 · Salt Lake City, UT 84180-1203 · 801-538-5340

May 15, 1987

Mr. Richard Blonquist
Summit Coal Company
P. O. Box 752
Coalville, Utah 84017

Dear Mr. Blonquist:

Re: State Permit and Decision Document, Boyer Mine, ACT/043/008, Folder No. 3, Summit County, Utah

Enclosed is the five-year permanent program mining permit for the Boyer Mine. Two originals are included. Please read the special conditions in Attachment A, then sign both copies and return one to the Division.

Also enclosed is the state's Decision Document, including the Findings, Technical Analysis, and the Cumulative Hydrologic Impact Assessment.

Since there are a substantial number of stipulations, please read them carefully and note when responses are due. If you have questions about any of the stipulations please contact Susan Linner.

Thank you for your cooperation during the permitting process.

Best regards,

Dianne R. Nielson

Dianne R. Nielson
Director

SCL:jvb
cc: R. Hagen
L. Braxton
B. Team
0028R-52

an equal opportunity employer

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Division of Wildlife Resources, April 6, 1987
Summit County Health Dept., October 14, 1986

PERMIT

1177R

FINDINGS

Summit Coal Company
Boyer Mine
PRO/043/008
Summit County, Utah

May 15, 1987

1. The Mining and Reclamation Plan (MRP) is accurate and complete and all requirements of the Surface Mining Control and Reclamation Act (the "Act"), and the approved Utah State Program have been complied with (UMC 786.19[a]).

2. The applicant proposes acceptable practices for the reclamation of disturbed lands (MRP, Section 3.6). These practices have been shown to be effective in the short-term; there are no long-term reclamation records utilizing native species in the western United States. Never the less, the regulatory authority has determined that reclamation, as required by the Act, can be feasibly accomplished under the MRP (see Technical Analysis [TA], Section UMC 817.111-.117)(UMC 786.19[b]).

3. The assessment of the probable cumulative impacts of all anticipated coal mining in the general area on the hydrologic balance has been made by the regulatory authority. The mining operation proposed under the application has been designed to prevent damage to the hydrologic balance in the permit area and in the associated off-site areas (UMC 786.19[c]). (See Cumulative Hydrologic Impact Analysis (CHIA) Section, attached to this Findings Document.)

4. The proposed permit area is (UMC 786.19[d]):

   A. Not included within an area designated unsuitable for underground coal mining operations (MRP, Section 2.5, pp. 2-6, 2-7).

   B. Not within an area under study for designated lands unsuitable for underground coal mining operations (MRP, Section 2.5, p.2-6).

   C. Not on any lands subject to the prohibitions or limitations of 30 CFR 761.11(a) (national parks, etc.), 761.11(f) (public buildings, etc.) and 761.11(g) (cemeteries) (MRP, sections 1.2, 2.5).

   D. Within 100 feet of the outside right-of-way line of a public road. The Division gave notice and opportunity for a public hearing as required by UMC 786.12(d). No requests for a hearing were received within the comment period. Therefore, the Division has determined that the interests of the public will be protected and hereby gives the applicant a variance to the prohibition of UMC 761.12(d).

E. Not within 300 feet of any occupied dwelling. The applicant has provided Plate 2-1, showing the location of all buildings within 1000 feet of the permit area. This map shows no occupied dwellings to be within 300 feet of current or proposed surface facilities. The Division has confirmed this with a pace survey.

5. The issuance of a permit is in compliance with the National Historic Preservation Act and implementing regulations (36 CFP 800) (UMC 786.19[e]). See letter from SHPO dated September 15, 1986 attached to TA.

6. The applicant has the legal right to enter and begin underground activities in the permit area through two fee leases (MRP, Section 2.4, Appendix 2-3) (UMC 786.19[f]).

7. The applicant has shown that prior violations of applicable law and regulations have been corrected (MRP, section 2-3; see attached memo from Joe Helfrich, DOGM Compliance Coordinator) (UMC 786.19[i]).

8. Summit Coal Company is not considered delinquent at this time in payment of fees for the Abandoned Mine Reclamation Fund for its exploration operation (Personal communication, John Sender, OSM Fee Compliance Specialist, May 11, 1987) (UMC 786.19[h]).

9. The applicant does not control and has not controlled exploration operations with a demonstrated pattern of willful violations of the Act of such nature, duration and with such resulting irreparable damage to the environment as to indicate an intent not to comply with the provisions of the Act (See attached memo from Joe Helfrich) (UMC 786.19[i]). The applicant has not been permitted for underground mining operations to date.

10. Underground coal mining and reclamation operations to be performed under the permit will not be inconsistent with other such operations anticipated to be performed in areas adjacent to the proposed permit area (UMC 786.19[j]). Summit Minerals Inc. has filed an application with the Division to reopen the old Blackhawk Mine. Leases to be mined would be south of the applicant's proposed workings. At the present time, Summit Coal Company does not propose to mine leases beneath Blackhawk Mine surface facilities.

11. A detailed analysis of the proposed bond had been made. The Division has determined that $100,900.00 is adequate to cover the costs which would be incurred by the state if it was required to contract for final reclamation at the minesite. The applicant has posted a collateral bond in the form of property whose value has been appraised to be greater than or equal to the required bond amount.

12. No lands designated as prime farmlands or alluvial valley floors occur on the permit area (MRP, Sections 7.3, 8.4, Appendix 9-2) (UMC 786.19[l]).

13. The proposed postmining land use of the permit area has been found to comply with local land use plans and to be compatible with long range land use objectives (see TA section UMC 817.133). No conditions have been placed on the proposed postmining land use by the surface landowner (UMC 786.19[m]).

14. The regulatory authority has made all specific approvals required by the Act, and the approved Sate Program (UMC 786.19[n]).

15. The proposed operation will not affect the continued existence of any threatened or endangered species or result in the destruction or adverse modification of their critical habitats (MRP Section 10.3.3, also see TA Section UMC 817.97). The Utah Division of Wildlife Resources has concurred with the Fish and Wildlife Plan.

16. All procedures for public participation required by the Act, and the approved Utah State Program have been complied with (UMC 786.23(a)[2]).

Prior to the permit taking effect, the applicant must sign the permit, indicating its compliance with the special stipulations in the permit.

Susan C. Linner
Permit Supervisor

Dianne R. Nielson
for Associate Director, Mining
Division of Oil, Gas and Mining

James P Bruchs
Administrator,
Mineral Resource Development
and Reclamation Program

Dianne R. Nielson
Director
Division of Oil Gas and Mining

Glenn J Bachman
Assistant Attorney General
Approved as to Form

1180R

Stipulation Document

Summit Coal Company
Boyer Mine
PRO/043/008
Summit County, Utah

May 15, 1987

Stipulation UMC 800-(1)-JRH

1. Within 90 days from the date of permit approval and concurrent with the submittal of information required in other stipulations contained within this document, the permittee shall provide to the Division, any revisions or modifications to the calculations and estimate for reclamation of the mine facilities.

Stipulations UMC 817.42-(1-3)-RS

1. The permittee shall submit revised designs for the catch basin proposed to treat drainage from the coal waste disposal area such that the final design must incorporate valid hydrologic assumptions and criteria and insure compliance with subsection (a)(3) of UMC 817.42. Designs must be submitted within 30 days of permit issuance and be approved by the Division prior to any further initiation of mining activity in the powder and cap magazine and coal waste disposal area.

2. The permittee shall within 30 days of permit issuance, submit revised appropriate sections and plates in the MRP to reflect a commitment to retain straw bale (or equivalent) treatment structures at the outlet of culvert C-6. Additionally, the permittee must commit, within 30 days of permit issuance, to sample all discharges from these structures and incorporate the analysis schedule proposed in Table 5-1 for all samples. A commitment to submit results of the analysis to the Division within 30 days of receipt must also be made.

3. Prior to beginning any underground coal mining activities under this permit in the affected drainage area, the applicant must construct the sedimentation system as proposed in the MRP.

Stipulation UMC 817.43-(1)-RPS

1. Within 60 days of permit issuance, the permittee shall submit a revised complete and technically adequate design plan for all diversions which incorporates correct hydrologic assumptions and meets the requirements of UMC 817.43.

Stipulation UMC 817.44-(1)-RPS

1. The permittee must submit complete and technically adequate designs for UD-1 that demonstrate compliance with subsections (b)(2) and (d) of this rule within 120 days of permit issuance.

Stipulations UMC 817.46-(1-6)-RPS

1. Within 30 days of permit issuance, the permittee shall submit to the Division a commitment to maintain a minimum detention time of 24 hours in the sedimentation pond for all 10-yr, 24-hr and lesser precipitation events.

2. Within 30 days of permit issuance, the permittee shall submit detailed information regarding the sediment pond clean out. This information should include elevation of 60% volume, elevation of maximum sediment storage volume, location of sediment marker in pond, and a commitment to clearly mark the referenced elevations on the stake.

3. Within 30 days of permit issuance, the permittee shall provide correct assumptions and peak flow values for design flows used for the design of the sedimentation pond.

4. Within 30 days of permit issuance, the permittee shall submit plans to the Division for the emergency spillway for the sedimentation pond. These plans should incorporate the 25-yr, 24-hr design event, a spillway lining of adequately sized riprap, a filter blanket design, and an adequately sized energy dissipator.

5. Within 30 days of permit issuance, the permittee shall submit to the Division a commitment to inspect the sedimentation pond during construction and submit certified as-built drawings of the structure. These must be conducted by a registered professional engineer.

6. Within 30 days of permit issuance, the permittee shall provide a correct Plate depicting the location of sampling station SS-7.

Stipulations UMC 817.46-(1-2)-JRH

1. Within 30 days from the date of the permit approval, the permittee shall provioe a compliance plan for the reconstruction and modification of the sediment pond facilities. The compliance plan shall include the design specifications for the modification or reconstruction of the structure to meet the design and performance standards

of Subchapter K of the rules; a reconstruction schedule which shows anticipated dates for beginning and completing interim steps and final reconstruction; provisions for monitoring the structure during and after modification or reconstruction to ensure that the performance standards of Subchapter K of the rules are met; and, a showing that the risk or harm to the environment or to public health or safety is minimized during the period of modification or reconstruction.

2. Within 90 days from the date of the permit approval, the permittee shall provide to the Division, a design for the proposed catch basin which is in compliance with the performance standards of Subchapter K of the regulations.

Stipulation UMC 817.47-(1)-RS

1. Within 30 days of permit issuance, the permittee shall submit adequate designs for the energy dissipator for the primary spillway. These designs must be based upon the expected velocity for the discharge from a 10-yr, 24-hr precipitation event.

Stipulations UMC 817.48-(1-2)-JSL

1. Within 90 days of permit approval the permittee will provide the Acid-Base potential (ABP) data for the pad materials. If the ABP from the pad is found to be less than or equal to -5 Tons $CaCO_3$/1000 Tons Material, the permittee must submit to the Division within 90 days of permit approval a plan to abate the potential contamination of groundwater.

2. Within 90 days of permit approval the permittee must provide an acid- or toxic-forming material (ATFM) waste disposal plan that will effectively reduce pyrite oxidation. The permittee may amend the ATFM with $CaCO_3$ at the required amounts or seal the material from any aerobic atmospheric conditions.

Stipulation UMC 817.49-(1)-RPS

1. Within 30 days of permit issuance, the permittee shall submit to the Division a commitment to conduct the inspection required by subsection (h) of UMC 817.49 and to submit the results of that inspection to the Division within 30 days following completion of construction of the proposed sedimentation pond.

Stipulation UMC 817.56-(1)-RS

1. Within 30 days of permit issuance, the permittee shall commit to renovating the permanent diversion labeled as UD-1 prior to final abandonment of the site. The commitment should include intent to ensure the capacity and stability criteria of the proposed design are adequately met and all necessary structural features are in good repair, functional and constructed as per the approved design.

Stipulation UMC 817.71-(1)-JRH

1. Within 90 days from the date of permit approval, the permittee shall provide to the Division, a plan for the location and disposal of excess spoil, mine development waste, sediment pond waste and other coal waste related materials anticipated on the site. The plan shall include a determination as to the total estimated amount of waste materials to be taken from the mine during the expected life of the operations so as to correctly size the facility; determination as to the nature, extent and treatment of acid- and toxic-forming materials which may have been utilized in the construction of the portal and mine facilities pads; analysis of the foundation and liner materials used to construct the waste facility; determination of the location of the waste facilities such that they are not constructed within surface drainages and will not potentially contaminate surface and groundwater; and plans for the amount and type of materials used to cover the waste material, topsoil requirements and revegetation requirements for the waste disposal facility.

Stipulation UMC 817.95-(1)-SCL

1. The permittee is not authorized to construct new facilities or make modifications to existing facilities, if such activities would become a source of air pollution or increase air pollution, until an Air Quality Approval Order is received.

Stipulation UMC 817.106-(1)-JSL

1. The permittee must commit to regrade, stabilize and revegetate according to performance standards UMC 817.111 through 817.116 all rills and gullies greater than nine inches deep.

Stipulations UMC 817.121-.126-(1-3)-DD

1. Within 30 days of permit approval the permittee shall include and commit to the following additions to the subsidence control plan to minimize impacts to surface lands from subsidence:

   A. To protect the Highway 133 and utilities the surface permit boundary will be maintained no less than 60 feet from the center line of highway 133. Along this southern boundary, due to the uncertainty of the angle of draw and in the interest of prudence, the permittee will utilize an angle of draw of 25 degrees (from the vertical) to determine the underground limit of second mining (pillar recovery). Before any secondary mining begins and then each year following the permittee shall submit a certified mine map of his underground workings to verify compliance.

   B. Until the permittee can otherwise justify stable pillar design for partial extraction, partial extraction may be conducted beyond the second mining limit as follows:

      Development mining assuming 18' roof spans and not more than the following extraction may be conducted.

Depth	Maximum Extraction	Centers
150' to 300'	51%	60' X 60'
400' to 600'	45%	70' X 70'
600' to 800'	40%	80' X 80'
800' to 1000'	36%	90' X 90'

Barrier pillars of a minimum of 150' width should be maintained for protection of main entries.

   C. Due to the hazards and damage to the surface caused by plug caving, the applicant shall not pull any pillars under a minimum overburden depth of 150'.

   D. Prior to initiating second mining and in the interest of protecting the highway and power line, the permittee shall be required to install monuments between the line projected by a 65 degree angle of draw from the limit of second mining to the surface and 30 feet from the center line of the highway. The line of monuments shall be spaced at 0.1d and be maintained 1.4d ahead of second mining (where d is the overburden depth). Both horizontal and vertical measurements shall be taken. A certified survey of the monuments shall be provided to the Division prior to second mining and then thereafter annually until subsidence is complete.

E. Pillar extraction should be as uniform, complete, and rapid as safety allows to minimize fracturing of strata.

2. The permittee shall within 30 days of permit approval, commit to restoring areas impacted by subsidence-caused surface cracks or other subsidence features such as escarpments (not to include naturally occuring escarpments which are not a result of mining) which are of a size or nature that could, in the Division's determination, either injure or harm grazing livestock or wildlife. Restoration shall include recontouring of the affected land surface including measures to prevent rilling, and revegetation in accordance with the approved permanent revegetation plan in the MRP. Restoration shall be undertaken after annual subsidence survey data indicate that the surface has stabilized, but in all cases restoration and revegetation shall be completed prior to bond release.

3. The permittee shall distribute a notice by mail at least 6 months in advance of mining beneath a property to all owners of property that could be affected by subsidence. The notification shall contain, as a minimum:

(a) Identification of specific areas in which mining will take place;

(b) Dates of underground operations that could cause subsidence and affect specific structures; and

(c) Measures to be taken to prevent or control adverse surface effects.

Stipulation UMC 817.150-.156-(1)-JRH

1. Within 30 days from the date of permit approval the permittee shall be required to incorporate into the text of the mining and reclamation plan, specific plans regarding the operation of the haul roads. This would include a commitment that the west haul road shall not be utilized for loaded coal trucks leaving the site. Due to the steep gradient of the road as it leaves the site and enters onto the county road, loaded vehicles could pose a safety hazard during poor road conditions and in the event of equipment (brake) failure. The permittee should also include other appropriate measures to be taken such as the installation of one way signs or other such signs directing the traffic on the road for proper use.

Stipulation UMC 817.180-(1)-JRH

1. Within 30 days from the date of permit approval, the permittee shall provide to the Division, a complete plan for the coal handling and storage facilities proposed to be utilized at the mine site. The plan shall include, but not be limited to the following: capacities for the raw and clean coal stockpiles, materials handling flow sheet, waste handling and materials rehandling requirements, temporary and permanent storage locations and capacities for coal and coal-related waste materials.

1187R

STATE OF UTAH
NATURAL RESOURCES
Oil, Gas & Mining

Norman H. Bangerter, Governor
Dee C. Hansen, Executive Director
Dianne R. Nielson, Ph.D., Division Director

355 W. North Temple • 3 Triad Center • Suite 350 • Salt Lake City, UT 84180-1203 • 801-538-5340

March 9, 1988

Mr. Jack Blonquist
Summit Coal Company
P.O. Box 646
Coalville, UT 84017

Re: Stipulation Response, Waste Rock Disposal Area (December 15, 1987), Summit Coal Company, Boyer Mine, ACT/043/008, File #2, Summit County, Utah

Dear Mr. Jack Blonquist:

Please find enclosed the Division's review of the above-referenced submittal. Due to the size of the proposed facility, the submittal will be processed as a permit revision. This action requires publication of public notice and a 60-day comment period. Additionally, it has been decided to process the proposed final disposal area submittal without review of the temporary facility proposal. Essentially, the submittals are identical except for acreage differences. The same baseline information required by the final area will be required for the temporary area. Also, the permit process timeframe will be approximately identical for the final disposal proposal. Therefore, the most expeditious and beneficial permitting action will be for the final waste disposal area.

It is recognized by the Division that many of the concerns noted in this review are contingent upon the results of the overburden/groundwater investigation that is expected to be funded by the SOAP program. Final receipt of this grant has not yet been obtained by our office. We expect to have an answer on fund availability by late March. The study would be initiated (well drilling) by mid- to late April, with final approval feasible by June of this year. If SOAP funds are not available for this project, Summit Coal Company would be required to gather and submit this information.

Due to the uncertainty of the SOAP funding availability, the deadline for response to this review will be May 1, 1988. Our office will notify you when a decision has been made on the SOAP grant. If you have any questions on this matter, feel free to call me or Sue Linner of my staff.

Sincerely,

L. P. Braxton
Administrator
Mineral Resource Development
and Reclamation Program

jr
Enclosure
cc: B-team
6000R/20:21

March 8, 1988

TO: File

FROM: Rick P. Summers, Reclamation Hydrologist RPS

RE: Stipulation Response, Waste Rock Disposal Area (December 15, 1987), Summit Coal Company, Boyer Mine, ACT/043/008, File #2, Summit County, Utah

Summary:

The application is not approvable as submitted. The following concerns will need to be addressed prior to approval. It should be recognized that a portion of the following concerns may be addressed utilizing funding from the Small Operator's Assistance Program (SOAP). The eligibility of the site for this funding is uncertain at this time. Therefore, the timeframe for applicant response should reflect an adequate period for this decision. If SOAP funding is not available for the required information, the applicant will be required to collect and submit the information.

UMC 783.15 Ground Water Information

1. The application does not contain a description of the ground water resources at the immediate waste rock disposal area. The existing application contains information of a general nature, but is not adequate for permitting this site. The application must contain information required by UMC 783.15(a)(1-3) and UMC 783.15(b).

UMC 784.13 Reclamation Plan: General Requirements

1. (b)(1) The applicant should revise the current Mining and Reclamation Plan (MRP) reclamation timetable to include removal of the waste area sedimentation pond and monitoring of the drainage entering the pond during the reclamation period.

UMC 784.14 Reclamation Plan: Protection of the Hydrologic Balance

1. (b)(1) The drainage plan for the site should include designs and calculations for a typical diversion to be installed at the site at the locations identified on Plate 3-4.

2. (b)(1) The application should include designs for a culvert to be placed at the upper end of the access road. It appears this culvert is necessary for the diversion crossing the access road from the east and discharging into the sediment pond.

3. (b)(3) The application must contain a description of the water monitoring plan (points, parameters, analysis methods, frequency and reporting) for the operation and reclamation phases of the operation. The existing MRP (plates and narrative) should be revised to reflect these additional monitoring plans. If SOAP funding is not available for the collection of baseline data, the applicant will be required to collect and submit this information.

4. (c) The application does not contain a revised determination of the probable hydrologic consequences of the proposed waste disposal facility on the hydrologic regime of the area.

UMC 784.22 Diversions

1. The peak flow values presented in Table 3.3.1 are in error.

2. The diversion designs presented are incomplete. The application must depict control of the drainage from the entire site for the entire life of the facility. Diversions should be planned to control the drainage from the area identified as Phase 5 to the sediment pond.

3. Designs for channel stability measures or a justification demonstrating that no measures are necessary should be included.

4. Designs demonstrating the 0.3 ft. freeboard requirement were not submitted.

5. The proposed size of the diversions was not included in the application.

6. Plans to retain the diversions until bond release and subsequent reclamation commitments of the diversion and pond structures were not submitted.

UMC 784.23 Operation Plan: Maps and Plans

1. Plate 3-4 should be corrected to depict the location of the diversions and the culvert dicussed previously in this review.

2. The existing MRP monitoring map should be updated to depict the proposed water monitoring points. These should include groundwater sampling wells, sediment pond outfall, and points to be sampled during the reclamation period to demonstrate compliance with UMC 817.46(u).

UMC 817.46 Hydrologic Balance: Sedimentation Ponds

1. The applicant's use of a 60% reduction in the sediment volume is unacceptable. Subsection (b)(2) requires the use of 0.1 AF/ac for a storage volume and Subsection (h) requires removal of sediment from the pond when the volume reaches 60% of that design volume.

2. The assumption that only one-fifth of the area will be disturbed at any one time is not acceptable. Conversations with Division biologists indicate that the period to establish a vegetation cover equivalent to the undisturbed area (CN of 70) for this area can be on the order of three (3) years.

3. The required design event for the design of the sediment pond may be revised by the State Department of Health. The potential for acid or toxic drainage discharging to the pond during operational phases may require a larger safety factor for containment of the runoff. Comments on the application from the Department of Health have not been received by the Division. They will be forwarded to the applicant upon our receipt.

4. Plans should be submitted demonstrating the safe passage of the design peak flow from the emergency spillway to the county road drainage system. At a minimum, a 25 yr. - 24 hr. event should be used for these designs. The designs should include diversion size and stability calculations.

5. The spillway designs do not meet the requirements of Subsection (j) of this regulation. A one-foot minimum embankment height is required with the spillway flowing at design depth.

6. An NPDES permit will be required for the proposed sedimentation pond. The sampling discussed on page 6 should commit to sampling the discharge per that permit.

7. Plans should be submitted to immediately establish a vegetative cover on the sediment pond embankments and surrounding disturbed area.

UMC 817.48 Hydrologic Balance: Acid- and Toxic-Forming Materials

1. The application should address measures to divert all surface drainage from each phase of disturbance. Diversions should be located upgradient from each lift of waste placement. These diversions should be designed for the 10 yr -24 hr event.

2. The application should state that all materials will be buried or treated within the first thirty (30) days following first exposure at the site.

UMC 817.49 Hydrologic Balance: Permanent and Temporary Impoundments

1. Subsection (c) requires that excavated sideslopes not exceed 2:1. The application proposes 1:1 slopes. This should be corrected.

UMC 817.53 Hydrologic Balance: Transfer of Wells

1. The applicant should describe plans for the wells upon reclamation. Intent to transfer or well plugging plans should be included.

jr
6000R/15:18

February 19, 1988

TO: File

FROM: Randy Harden, Reclamation Engineer

RE: Proposed Waste Disposal Facility, Summit Coal Company, Boyer Mine, ACT/043/008, Folder #2, Summit County, Utah

SUMMARY

The proposed facility is not considered to be sufficiently adequate for approval. The following review discusses concerns regarding the construction, operation, and reclamation of the waste disposal site.

UMC 784.19 Underground Development Waste - JRH

Some of the information required in order to determine the proposal is not considered to be complete. With regard to this section of the regulations, the operator must still address the following:

1. The character of the bedrock and any adverse geological conditions in the disposal area.

2. A survey identifying all springs, seepage and ground water flow observed or anticipated during wet periods in the area of the disposal site.

3. A survey of the potential effects of subsidence of the subsurface strata due to past and future mining operations.

The proposed drawings and text provided do not include sufficient descriptions or detail to describe the geotechnical investigation, design, construction, operation, maintenance and removal of the site and facilities. As an example, the plans do not indicate how haul roads will be routed in order to negotiate the hillside and the configuation of the waste disposal piles. Without

routing and scheduling of these roads, it appears to be difficult to construct the waste disposal area in accordance with the proposed plan.

The operator has not provided foundation soils information with the proposal. Topsoil and subsoil depths should be determined prior to construction in order to determine the mass balance and the quantities available for reclamation.

The operator has proposed that a 12" layer of clay be installed in conjunction with the pad excavation. Until such time as the infiltration and soils characteristics are determined for the design of the facilities, it is unknown as to whether or not this clay layer will be required. It would appear, however, that the Division would not want to see such a clay layer installed as part of the foundation for the waste material. The layer would only serve to concentrate any ground-water flow along the clay boundary and through the waste material. In looking at how the waste facilities are currently layed out, this would allow the water to pass along the clay layer and collect soluble contaminants in the waste material, and then discharge them at or near the surface at the toe of the slope of the waste pile.

UMC 817.46 Hydrologic Balance - Sediment Ponds - JRH

The operator has proposed an incised pond with inslopes of 1:1. In accordance with part (m) of this section, no slopes shall be designed to be steeper than 2h:1v. The operator must redesign this structure in order to be considered in compliance with the requirements of this section.

UMC 817.103 Backfilling and Grading: Covering Coal and Acid- and Toxic-forming Materials - JRH

The operator has not collected sufficient information for the design of the waste disposal facility to demonstrate prevention of surface or ground-water contamination. Sufficient soils, groundwater and climatic information must be provided to demonstrate that the design will protect against the upward migration of salts, exposure by erosion, formation of acid or toxic seeps; and will provide adequate depth for plant growth, or other conditions and requirements to prevent water contamination.

jr
cc: S. Linner
R. Summers
1384R/21:22

February 12, 1988

TO: File

FROM: James Leatherwood

Re: Coal Waste Disposal, December 18, 1987 Submittal, Summit Coal Company, Boyer Mine, ACT/043/008, Folder No. 2, Summit County, Utah

Abstract

The above mentioned submittal has been reviewed and found not to be technically adequate. Topsoil removal, protection, and redistribution and waste disposal issues are discussed below.

UMC 817.22 - .25 Soil Management - JSL

Topsoil Removal

The plan does not adequately meet UMC 817.22. All topsoil materials must be removed in a separate layer from the area to be disturbed. All subsoil materials are to be removed and segregated separately. The depth of topsoil removal must be specified in the plan. The soil survey for the proposed area indicates that a Bezzant Gravelly loam and a small amount of Moweba Gravelly loam exist. The topsoil depth of the soil is approximately seven inches. It is advisable to commit to removing a minimum of seven inches of topsoil material.

Topsoil Storage

The plan does not adequately meet UMC 817.23. All stockpiled topsoil must be selectively placed on a stable surface in the permit area and be protected from wind and water erosion, unnecessary compaction and contaminants. The topsoil cannot be stockpiled in a berm due to the high potential for water erosion and contamination form eroded acid-or toxic-forming materials.

The removed topsoil must be stockpiled at a site that will not be disturbed and will be protected from contaminants. The stockpile should not be a mix of topsoil and subsoil. The topsoil and subsoil should be stockpiled separately. The plan must address the specific measures that will be used to insure protection. These measures should include plans, cross-sections volumes, designs and maps of the following:

1) Location
2) Drainage diversions
3) Stockpile dimensions (include max and min slopes)
4) Biological stabilization (include rate and seed mix)
5) Compaction mitigation.

The use of the upper subsoils for a berm is adequate if another incised berm/drainage will be implemented around the perimeter of the waste backfill. The runoff from the waste material should not come into contact with any growth medium. The runoff will most likely contain toxic levels of boron. If this will not be implemented then I recommend a double berm in which the upper two feet of subsoils is removed first as an outside berm, then the remaining subsoils to removed and placed as the inside disturbance area berm.

Soil Redistribution

The plan does not adequately meet UMC 817.24. The submittal did not segregate the topsoil from the subsoil so no topsoil redistribution plan was established. A general soil redistribution plan was discussed. However, topsoil must be removed and stored separately form all subsoil. A redistribution plan is required. The plan should include:

1) Subsoil scarification prior to topsoil redistribution (include depth of scarification)
2) Expected depth of topsoil redistribution.
3) Topsoil compaction mitigation (Division recommends incorporating alfalfa at a rate of 1 ton per acre tilled in the upper acre slice).
4) Length of time between topsoil redistribution and seeding and mulching (if seeding will not occur for longer than one month some type of soil stabilization plans are needed.
5) The site should be left in a rough condition.
6) Redistribution should be carried out when the soil is dry.

The final total depth of soil redistribution is dependent upon the acceptance from the operator to the Divisions change in the backfilling and treatment of the acid- or toxic forming material. If the applicant advocates for the use of a 12 inch clay layer then the proposed four feet of soil redistribution will be adequate. If the no clay cap is placed on the waste then a total of five feet of material must be redistributed.

Topsoil Testing and Amendments

Prior to any site disturbance, the topsoil and subsoil must be sampled and analyzed for the following: Texture, $CaCO_3$ %, pH, available phosphorus, electrical conductivity saturation percentage and potassium. The rate of sampling should be one sample every acre with a minimum total of three samples. The depth should be a composite of the upper seven inch soil depth and a composite of the soil between seven inches and 48 inches.

After redistribution (ie. final reclamation) the soil materials should be evaluated for fertilizer and other amendments as necessary.

UMC 817.103 Backfilling and Grading: Covering Acid- And Toxic-Forming Materials - JSL

Due to the hydrologic problems associated with encapsulating acid-forming materials, the floor of the backfill site should not be lined with clay but should be lined with the required amount of $CaCO_3$ equivalent. Based on the data submitted, sampled October 29, 1987, the required amount of $CaCO_3$ equivalent would be between 23.13 to 25.94 tons of $CaCO_3$/1000 tons of proposed backfill waste material. Thus the floor will be lined with $CaCO_3$ equivalent and the waste material would be backfilled on top of the $CaCO_3$ equivalent material.

The Division also recommends that the clay ~~liner~~ not be placed on top of the waste if the applicant would redistribute a total of five feet of soil materials. Five feet of material is required to insure that the vegetative root growth does not come into significant contact with the waste material. Again, the boron is highly toxic and would cause substantial vegetative damage if the vegetation is impacted by the waste materials.

cc. R. Harden
S. Linner
✓R. Summers

0534R69-71

BLACKHAWK ENGINEERING, CO.

Rt. 1, Box 146-H5 - Helper, Utah 84526 - Telephone (801) 637-2422

December 15, 1987

Mr. Lowell P. Braxton, Administrator
Utah Division of Oil, Gas & Mining
355 West North Temple
#3 Triad Center Suite 350
Salt Lake City, Utah 84180-1203

RE: Response to Stipulations
Boyer Mine Permit
ACT/043/008, #2
Summit County, Utah

Dear Mr. Braxton:

Please find enclosed 8 copies of the Summit Coal Company response to the remaining concerns on the PAP Stipulations.

The following is a summary of the stipulation responses:

[1] UMC 817.48-[2]-JSL

A new Appendix 3 "Waste Disposal Area" is herein submitted. This Appendix will show a proposed disposal site within the permit area, and should replace the existing Appendix 3 showing the Summit County Landfill as a coal waste disposal site. Also enclosed are updated Plate 2-1, and new Plates 3-4 and 3-4a for the disposal site. A preliminary report on the waste material is also included with Appendix 3. The final report should be done this week and will be forwarded upon receipt;

[2] UMC 800-[1]-JRH

The submittal of the waste disposal plan is a proposal. The final determination of bonding costs will be made upon review and approval of this design. The bond will be updated at that time. In the interim, Mr. Hardin indicated the existing bond would be considered adequate.

It is my understanding that all other stipulations have been adequately addressed at this time.

If you have any questions, or need any further information, please let me know.

Respectfully,

Dan W. Guy

cc: Jack Blonquist
File

STATE OF UTAH
NATURAL RESOURCES
Oil, Gas & Mining

Norman H. Bangerter, Governor
Dee C. Hansen, Executive Director
Dianne R. Nielson, Ph.D., Division Director

355 W. North Temple • 3 Triad Center • Suite 350 • Salt Lake City, UT 84180-1203 • 801-538-5340

November 12, 1987

Mr. Jack Blonquist, Mine Manager
Summit Coal Company
P.O. Box 752
Coalville, Utah 84017

RE: Response to Stipulations, Summit Coal Company, Boyer Mine, ACT/043/008, Folder #2, Summit County, Utah

Dear Mr. Blonquist:

Please find enclosed technical memos (3) concerning your submittal of September 21, 1987, relative to permit stipulations for the Boyer Mine. The comments should be addressed and a response submitted to this office by December 15, 1987.

Please feel free to contact the author(s) of the memos or myself if you have any questions.

Sincerely,

Rick Summers
Reclamation Hydrologist

jr
Enclosure
cc: B team

an equal opportunity employer

October 2, 1987

TO: Memo to File

FROM: James S. Leatherwood, Reclamation Soils Specialist

RE: Permit Stipulation UMC 817.48-(2)-JSL, Response Review, September 21, 1987 Submittal, Summit Coal Company, Boyer Mine, ACT/043/008, Folder No. 2, Summit County, Utah

Stipulation UMC 817.48-(2)-JSL

The above stated submittal has been reviewed and found to be deficient. The requirements of UMC 817.48 and corresponding UMC 817.103 have not been adequately addressed. The operator has obtained approval from Summit County Health to dispose of their acid- or toxic-forming material in the Three Mile Canyon landfill.

However, based on the following review, I do not recommend disposing any acid- or toxic-forming material at the Three Mile Canyon Landfill. A temporary storage plan should be initiated immediately. A meeting between the operator, their consultants and the Division is advised.

I have briefly reviewed the Three Mile Canyon landfill technical standards against the underground coal mining activities performance standards. The review of the landfill consisted of an examination of the September 21, 1987 submittal and the Department of Health, Division of Solid and Hazardous Waste file.

The September 21, 1987 submittal included a report entitled "Supplemental Soil, Bedrock and Groundwater Studies" by Dames and Moore, Job No. 14367-003-06, 1/3/86. As the title of the report infers, the submittal is a supplement to a 8/27/85 study by Dames and Moore. The submitted supplemental report did not contain detailed earthwork, surface hydrology, geology, or groundwater studies. An attachment to the September 21, 1987, submittal indicates that present technical problems exist between state Health and the Three Mile Landfill.

Further examination of the Three Mile landfill consisted of reviewing State Health files. The State Health file contained the 8/27/85 Dames and Moore Report - Proposal previously mentioned in this memo.

The file also contained a inadequate sampling and analysis plan, a 6/17/86 Report and a 1/16/87 report titled "Drilling, Field Testing and Installation for An Up Gradient Observation Well." It was evident that there exists extreme localized variations in groundwater levels in the immediate landfill site. A handwriten review of the Three Mile Canyon landfill in the State Health file outlined various groundwater study problems. The following concerns are outlined from the review for your information:

1. Flow directions and gradients for groundwater in the landfill area have not been established.
   - only one well penetrates the deep water table,
   - no pezometric contour maps have been submitted.
2. The ability of the well system to monitor groundwater has not been demonstrated,
   - which wells are up gradient and downgradient
   - why is well No. 4 screened deeper than well No. 3,
   - how will background be established and how will analytical data be compared
   - well No. 1 is downslope of the landfill
3. The report states that Rockport Reservoir is locally recharging the aquifers, yet no data has been presented to support this conclusion
   - water level data for surrounding wells did not include the water level of the reservoir
4. The relationship between perched groundwater and deep groundwater has not been established
   - What is the water perched on?
   - No pezometric maps were submitted to illustrate the flow directions
   - groundwater stabilized below the soil/bedrock interface in boring No. 6
5. The report identifies 2 aquifers based on analytical data
   - the data submitted on page 10 is apparently erroneous
   - no sampling plan or QA/QC was submitted,
   - What additional analysis was conducted?
6. Miscellaneous
   - explain the 20 head difference between wells No. 3 and 4
   - what is the justification for projecting a decrease in jointing with depth..

Other problems were also evident. Lab analysis December 2, 1985, by Ford Labs indicate that Arsenic exceeded drinking water standards and Boron and chromium exceeded the maximum containment level in borehole #4. The iron content was also very high in

borehole No. 4. Borehole No. 3 lead concentrations also exceeded the maximum containment level for the sampling time period. Well No. 4 exceeded cadmium drinking water levels in a March 17, 1987, analysis. Due to the complexity of the physical-chemical nature of this site, it would be extremely difficult to model out how an acid producing waste would symbiotically react in this system.

September 23, 1985, correspondence from the Bureau of Reclamation contained concerns about the potential waste degradation due to the location of the landfill to the Rockport Reservoir. They also questioned the high fluctuation of the water table data in Well No. 1 and 2 on August 7, 1985 and August 12, 1985. Well No. 1 and 2 were 6 and 13.5 feet on August 7, 1985, respectively, while on August 12, 1985, Well No. 1 was 13.5 feet and Well no. 2 was 7.9 feet.

The August 2, 1987, Dames and Moore Report for the pH of Well No. 3 and 4 is also questionable. These two wells are adjacent to each other, yet well No. 3 had a pH of 6.4 while well No. 4 had a pH of 9.6.

Dale Parker, Executive Secretary of Utah Solid and Hazardous Waste Committee in a September 20, 1985, correspondence stated that they are opposed to siting the facility at the location due to the threat to water quality at the Rockport Reservoir.

Based on this information, I recommend that the Summit Coal Company do not dispose or place any acid- or toxic-forming materials at the Three Mile Canyon landfill. Due to the complexity and time constraints involved, I recommend that the Division work with Summit Coal Company in developing a temporary storage site to adequately contain the acid- or toxic-forming material. A meeting between the operator, their consultants and the Division's should be administered as soon as possible.

Additional Comments

As outlined in the Division previous review, page 3-67 referencing the waste analysis does not adequately verify a non-acid or toxic-forming material.

jvb
cc: L. Braxton
R. Harden
D. Darby
S. Linner
R. Summers
0534R-55

November 3, 1987

TO: FILE

FROM: Randy Harden, Reclamation Engineer

RE: Response to Permit Stipulations (received 9/24/97, Summit Coal Company, Boyer Mine, ACT/043/008, Summit County, Utah, Folder #2

The information provided in the stipulation response dated October 24, 1987 regarding stipulation UMC 817.71-1-JRH has been amended by the Division based on a request by the operator for an extension of time to facilitate design of a waste disposal site for the Boyer Mine. The Division has granted to Summit Coal Company, an extension of time to November 30, 1987 to meet the requirements of the above referenced stipulation.

As a result of the extension of time, Stipulation UMC 800-1-JRH shall also be extended in conjunction with the design of the waste disposal facilities. Final determination of the reclamation costs and bonding amount cannot be determined until sufficient designs are submitted to and approved by the Division. In the interim, the existing bond between the Division and Summit Coal Company shall be considered adequate.

cc: S. Linner
R. Summers

October 22, 1987

TO: Technical File

FROM: Rick P. Summers, Reclamation Hydrologist RPS

RE: Response to Permit Stipulations (received 9-24-87), Summit Coal Company, Boyer Mine, ACT/043/008, Summit County, Utah

Summary:

Except for stipulation UMC 817.44 - (1) - RS, the submittal is complete at this time. That stipulation will be reviewed in December of 1987 and comments forwarded to the applicant at that time. The remainder of the stipulations have been addressed adequately and can be deleted from the permit.

Body:

Comments on the 9-24-87 submittal follow the original requests made in the DOGM letter of 7-27-87. New comments are indicated by indentation and an asterisk (*).

Stipulation UMC 817.42-1-RPS

1. The permittee shall within 30 days of permit issuance, submit revised appropriate sections and plates in the MRP to reflect a commitment to retain straw bale (or equivalent) treatment structures at the outlet of culvert C-6. Additionally, the permittee must commit, within 30 days of permit issuance, to sample all discharges from these structures and incorporate the analysis schedule proposed in Table 5-1 for all samples. A commitment to submit results of the analysis to the Division within 30 days of receipt must also be made.

Comment:

The applicant has proposed a catch basin as an alternative to the straw bales proposed in the original MRP. The Division approves the use of the catch basin, but will require straw bales or equivalent for the discharge from this basin until it can be demonstrated (through monitoring) that the catch basin as a sole treatment structure is adequate to maintain effluent limitations.

Narrative should be added to the permit reflecting this commitment. The applicant has committed to sampling the discharges from the catch basin for the operational parameters in the original MRP (Table 5-1 of Volume 2).

*The applicant has committed to the above on pps. 7-4d and has updated plate 7-1. This stipulation has been addressed.

Stipulation UMC 817.43-(1)-RPS

1. Within 60 days of permit issuance, the permittee shall submit a revised complete and technically adequate design plan for all diversions which incorporates correct hydrologic assumptions and meets the requirements of UMC 817.43.

Comment:

The applicant has revised Tables 7-1 and 7-2 to incorporate values calculated by the Division during the technical analysis stage of permit approval. The applicant must submit revised maps depicting the correct watersheds referenced for each structure. The Technical Analysis was written with the assumption the notation "M.D." related to riprap size means "median diameter" and not "maximum diameter". This should be stated on all applicable tables with a footnote.

*The applicant has submitted a corrected plate depicting the watersheds (plate 7-1). Notation has been added where appropriate in the permit to clarify the use of M.D. as mean diameter. This stipulation has been addressed.

Stipulation UMC 817.44-(1)-RPS

1. The permittee must submit complete and technically adequate designs for UD-1 that demonstrate compliance with subsections (b)(2) and (d) of this rule within 120 days of permit issuance.

Comment:

This response has not been reviewed at this time in order to allow operator to use resources to develop plans required to upgrade operational aspects of the current minesite. The review of these designs will be performed in December of 1987 and comments will be forwarded to the operator at that time.

Stipulations UMC 817.46-(2, 3, 5)-RPS

2. Within 30 days of permit issuance, the permittee shall submit detailed information regarding the sediment pond clean out. This information should include elevation of 60% volume, elevation of maximum sediment storage volume, location of sediment marker in pond, and a commitment to clearly mark the referenced elevations on the stake.

Comment:

The applicant has submitted correct elevations for the sediment clean out elevation (60 %), the maximum sediment elevation, committed to installation of indicator stake, and committed to clean out at 60 % elevation. However, the application states that the sediment volume was based upon PSIAC and USLE methods when it appears 0.1 AF/Ac was used. The narrative should be corrected to clarify the plan. The applicant needs to address the proposed plan for sediment pond clean out. This information must include: proposed disposal site for sediments removed, a proposal to insure that water draining from sediments removed (i.e. if dewater of the sediment is necessary prior to loading) reports a sediment treatment structure, a commitment to monitor the sediment pond dewatering process (if dewatering is needed) with samples at the start, mid-point, and at end of dewatering, and the method to be used to insure original (or greater) pond volume is restored.

*The applicant has provided the necessary information on p. 7-6, section 7.2.4.3. of the submittal. This stipulation has been adequately addressed.

Comment:

The applicant should submit stage-discharge curve demonstrating the primary spillway is capable of passing the design flow. The assumptions used in the preparation of the curve should also be included and referenced to applicable Plates as needed.

*The applicant has submitted a stage-discharge curve for the sediment pond. Technical analysis of the curve is attached to this memo.

5. Within 30 days of permit issuance, the permitted shall submit to the Division a commitment to inspect the sedimentation pond during construction and submit certified as-built drawings of the structure. These must be conducted by a registered professional engineer.

Comment:

The applicant states this information is found in Appendix 7-C. This section contains a certification statement, however a certified drawing (nor commitment) of the structure has not been submitted.

*The applicant has committed to submitting this information to the Division within 30 days of completion of the construction of the sediment pond. The pond is currently constructed, however the sediment volume is approaching the level required for cleaning. The Division feels that an as-built certified drawing of the pond following the sediment removal would be more useful and applicable to the rules for this situation. The applicant is currently studying alternatives for a waste disposal area. When an area is approved, the applicant will clean the pond. Therefore, drawings of the as-built nature of the pond are not required at this time. The commitment to supply these drawings satisfies the stipulation.

Stipulation UMC 817.47-(1)-RS

1. Within 30 days of permit issuance, the permittee shall submit adequate designs for the energy dissipator for the primary spillway. These designs must be based upon the expected velocity for the discharge from a 10-yr, 24-hr precipitation event.

Comment:

Designs for the energy dissapator were found to be deficient. The following deficiencies are noted:

1. Plate 7-2 depicts a concrete stilling basin and Figure 7-1a proposes a loose rock check dam. The proposal is vague as to the proposed location and type of structure. Cross-section A-A' depicts approximately 20 ft. from the outlet of the primary spillway and the roadside diversion. If the loose rock dam is to be placed to allow for the 15 ft. rock apron, the 30 in. dam will be located less than 5 ft. from the outlet. Is adequate space available onsite for this design? The backwater effect from the dam could cause the spillway to function under outlet flow conditions.

2. The proposal should include information (including calculations and assumptions) for the expected outlet velocity from the primary spillway flowing at maximum capacity. The energy dissipator should be designed using the worst case velocity (i.e. emergency spillway at design flow or primary spillway at maximum capacity).

3. The proposal uses a 30.0 % (3.33 : 1) slope for the calculation of the expected velocity from the emergency spillway. Plate 7-2 depicts the maximum slope as 67.7 % (1 1/2 : 1) and the slope entering the dissipator as 43 % (2.33 : 1). The proposal needs clarification.

4. The proposal should include the proposed size of riprap to be used for the rock apron (including determination information).

5. The proposal should include specific dimensions for the entire structure. These should include: 1) length, width and depth of basin, 2) width of loose rock check dam.

*The applicant has not addressed all of the above items. However, technical analysis of the proposed structure was performed and found to be adequate. It should be noted that the site configuration required the use of several assumptions for the design analysis. Due to the limited space available for the dissapator, standard design practices were impractical. The technical analysis indicated that the structure will perform satisfactory, however adjustment of the design will be required if inspection of the structure indicates improper functioning during flow events. This stipulation has been addressed adequately.

Stipulation UMC 817.49-(1)-RPS

1. Within 30 days of permit issuance, the permittee shall submit to the Division a commitment to conduct the inspection required by subsection (h) of UMC 817.49 and to submit the results of that inspection to the Division within 30 days following completion of construction of the proposed sedimentation pond.

Comment:

The applicant has submitted a commitment to conduct the inspections required under UMC 817.46, however the inspection required by UMC 817.49 (h) has not been submitted (nor committed).

*The applicant has committed to the above. This stipulation has been addressed.

Stipulation UMC 817.56-(1)-RS

1. Within 30 days of permit issuance, the permittee shall commit to renovating the permanent diversion labeled as UD-1 prior to final abandonment of the site. The commitment should include intent to ensure the capacity and stability criteria of the proposed design are adequately met and all necessary structural features are in good repair, functional and constructed as per the approved design.

Comment:

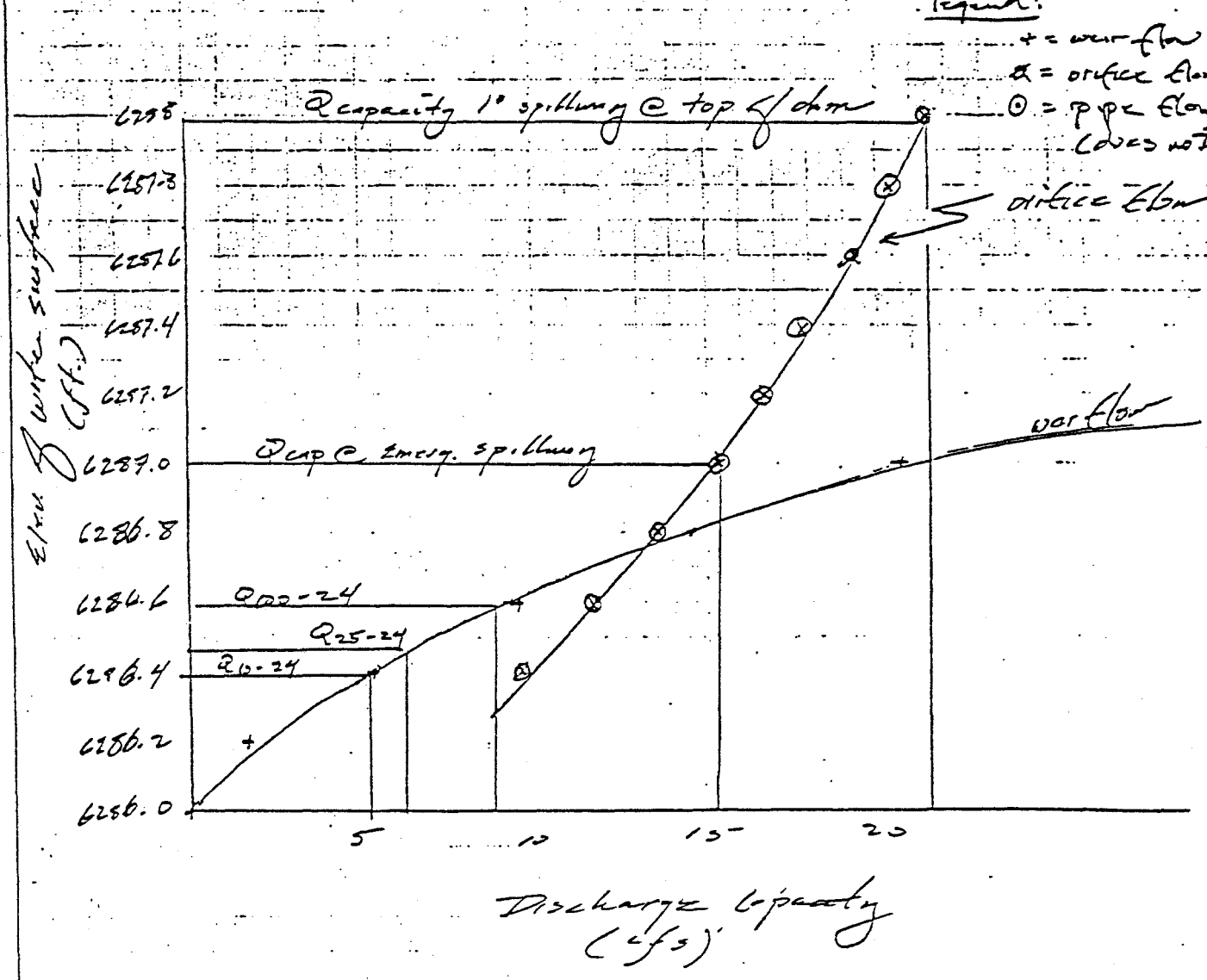
The applicant has not committed to renovation of the diversion prior to site abandonment (i.e. following sedimentation pond removal, the applicant must insure the diversion constructed during phase 1 of reclamation is still functional as per approved design). A single paragraph describing the commitment to renovate the diversion to approved design specifications and repair of any diversion degradation which occurred prior to meeting the requirements of UMC 817.46 (u) will be sufficient for this stipulation.

*The applicant has committed to the above items on page 7-4a(1) of section 7.4.2.1. This stipulation has been addressed.

rps
6000R

Boyce, RPS, 4/19/87

II Stage-Discharge Curve:



conclusions:

1) approve. 1° spillway alone is overdesigned

2) no need to review emergency spillway. 1° spillway will handle in excess of 100yr-24

energy dissipator: figure 7.25, 1° spillway max @ elev. of emerg. crest = 15.1 cfs
assume TW < centerline of pipe (implicit in stage-Q 0.60 rule).
use Fig 7.25 L_{apron} = 10 minimum, can use 8'
p. 7-6d-2 propose 20' approve
W_{apron} = Dia + L_e = 2' + 8' = 10' approve
D_{50} = 0.5'; d_{max} = 1.5 D_{50} = 1.5(0.5) = 0.75'

I. Results

Elev.	Head (above 1°)	Q_{weir} (cfs)	$Q_{Orifice}$	Q_{TOT}
6286	0	0	0	0
6286.2	0.2	1.84	6.76	28.8
6286.4	0.4	5.23	9.57	29.16
6286.6	0.6	9.64	11.72	29.51
6286.8	0.8	14.88	13.53	29.86
6287.0	1.0	20.86	15.13	30.21
6287.2	1.2	-	16.57	-
6287.4	1.4	34.76	17.90	30.89
6287.6	1.6	-	19.13	-
6287.8	1.8	-	20.29	-
6288.0	2.0	59.59	21.37	31.88

* note: no need to check emergency spillway rising 1' with peak 100yr-24hr event (5.77 cfs)

1° elevation = 6286'
emergency elev. = 6287'
Top elev. = 6288

Project: Stage-Discharge Curve, Boyer Mine

Date: 4/18/87

Reviewed: R. Hummers, Reclamation Hydrologist

I. Inputs & Assumptions

Input	DOGM	Boyer	comm
Ht. Riser	8 ft.	not submitted	
Dia. Riser	2 ft.		
Co inlet	0.6		
Total head (top of riser to outlet)	9.0 ft	6286' - 6277'	
Length Barrel	78'		scaled from A-A', Plate
Total length of system	86'		
Dia. Barrel	2 ft.		
n-value	0.024		
K_b	0.5		
K_c	1.0		
K_f	3.63		

$K_F = 1846 n^2 L / D^{4/3}$

BLACKHAWK ENGINEERING, CO.

Rt. 1, Box 146-H5 - Helper, Utah 84526 - Telephone (801) 637-2422

October 23, 1987

Mr. Lowell P. Braxton
Administrator
Utah Division of Oil, Gas & Mining
355 West North Temple
3 Triad Center, Suite 350
S.L.C., Ut. 84180-1203

Attn: Sue Linner

Re: Mine Permit Stipulations
UMC. 817.95-1-SCL & 817.71-1-JRH
Summit Coal Company
Boyer Mine
ACT/043/008
Summit County, Utah

Dear Mr. Braxton:

Summit Coal Co. is herein submitting a fomal request for an extension of time to Nov. 30. 1987 to meet the requirements of the above referenced stipulations.

The request is based on the need to re-evaluate the Summit County Landfill for a proposed disposal site (by your staff), a probable design of a new disposal site within the permit area, and to obtain results of additional sampling on the mine waste. These items were all discussed at the on-site meeting with your staff on October 13, 1987. It was suggested at that time that I submit for an extension on the stipulations. I have postponed requesting the extension until now, in hope that the latest sampling results and the results of the additional review of the landfill by your staff would be available. Neither of these results are yet available, and I thought it best to submit for an extension of time adequate to allow us to reach a reasonable solution to this problem.

Thank you for your cooperation in this matter. If you have any questions, or need any further information, please let me know.

Respectfully,

Dan W. Guy

CC: Mr. Jack Blonquist
File

BLACKHAWK ENGINEERING, CO.

Rt. 1, Box 146-H5 - Helper, Utah 84526 - Telephone (801) 637-2422

September 21, 1987

RECEIVED

SEP 24 1987

DIVISION OF OIL
GAS & MINING

Mr. Lowell P. Braxton
Administrator
Utah Division of Oil, Gas & Mining
355 West North Temple
#3 Triad Center Suite 350
Salt Lake City, Utah 84180-1203

RE: Mine Permit Stipulations
Summit Coal Company
Boyer Mine
ACT/043/008, #3
Summit County, Utah

Dear Mr. Braxton:

Enclosed are 7 copies of the Summit Coal Company response to the Division's July 27, 1987 Stipulation Response Review. All outstanding comments have been addressed with this submittal, or with the July 23 submittal.

All pages and maps are numbered, and should replace, or be added to appropriate locations in the plan.

I would like to point out that I had an opportunity to meet with Rick Summers, Randy Hardin, James Leatherwood and Lynn Kunzler on 9/16/87 while they were in Price, concerning these stipulations. This meeting helped to clarify a number of questions, and will likely save a great deal of time and paperwork in the future. I appreciate the opportunity to meet with your staff in this manner, and I especially appreciate the assistance and cooperation from Mr. Summers in helping to solve some difficult hydrologic problems. Please express my thanks to your staff for their time and cooperation.

If you have any questions, or need any further information, please let me know.

Respectfully,

Dan W. Guy

Dan W. Guy

cc: Mr. Jack Blonquist
File

BLACKHAWK ENGINEERING, CO.

Rt. 1, Box 146-H5 - Helper, Utah 84526 - Telephone (801) 637-2422

July 23, 1987

Mr. Lowell P. Braxton,
Administrator
Utah Division of Oil, Gas & Mining
355 West North Temple
#3 Triad Center Suite 350
Salt Lake City, Utah 84180-1203

RE: Mine Permit Stipulations
Summit Coal Company
Boyer Mine
ACT/043/008, #3
Summit County, Utah

Dear Mr. Braxton:

Enclosed are 7 copies of follow-up information for the Boyer Mine Permit Stipulations. The following specific items are addressed with this submittal:

1. Bureau of Air Quality - Notice of Intent to Approve Boyer Coal Mine [Add to Appendix 3-2];

2. Department of Health Approval for Summit County Landfill, including landfill design criteria [Add to Appendix 3-2];

3. Resubmitted Appendix 7-C, "Stability Analysis of the Boyer Mine Sedimentation Pond", using actual laboratory data in place of assumed data previously submitted. [This entire Appendix should replace the existing Appendix 7-C in the plan].

If you have any questions, or need any further information, please let me know.

Respectfully,

Dan W. Guy

Dan. W. Guy

cc: Mr. Jack Blonquist
File

BLACKHAWK ENGINEERING, CO.

Rt. 1, Box 146-H5 - Helper, Utah 84526 - Telephone (801) 637-2422

June 20, 1987

Mr. Lowell P. Braxton,
Administrator
Utah Division of Oil, Gas and Mining
355 West North Temple
3 Triad Center, Suite 350
Salt Lake City, Utah 84180-1203

Re: Mine Permit Stipulations
Summit Coal Company
Boyer Mine
ACT/043/008, #3
Summit County, Utah

Dear Mr. Braxton:

Enclosed are 7 copies of the Summit Coal Co. response to the Division Stipulation Document of May 15, 1987. All stipulations are addressed in this submittal to facilitate their early review and approval.

Portions of this submittal have been previously submitted in connection with N.O.V. 87-15-2-3; however, for consistency, I am resubmitting the information as responses to the stipulations.

The pages and maps are numbered, and should replace those with corresponding numbers in the M.R.P. Appendices should be added to the plan in the designated sections.

If you have any questions, or need any further information, please let me know.

Respectfully,

Dan W. Guy

Dan W. Guy

cc: Mr. Jack Blonquist
File

1987

MODIFICATIONS / AMENDMENTS

December 14, 1987

Mr. Lowell P. Braxton
Administrator
Utah Division of Oil, Gas & Mining
355 West North Temple
#3 Triad Center Suite 350
Salt Lake City, Utah 84180-1203

RE: Temporary Waste Disposal Area
Summit Coal Company
Boyer Mine
ACT/043/008
Summit County, Utah

Dear Mr. Braxton:

Summit Coal Company is herein submitting an application for approval of a temporary coal waste disposal site for the Boyer Mine.

The proposed site is approximately 3000' from the Boyer Mine and is located within the permit area. The proposed disturbance for the temporary site is 0.72 acres, which is less than 15% of the present disturbed area for the mine. This site was examined by your staff during a 10/13/87 visit.

Even though this disposal site is termed as temporary, it is projected to become a part of a larger permanent waste disposal site. The proposal for the permanent site is being submitted concurrently with this application.

This request for approval of a temporary disposal site is being submitted for 3 main reasons:

[1] The mine site is presently filled to capacity with mining waste, and the company is in desparate need of a place to dispose of this material;

[2] DOGM has denied Summit Coal Company approval to dispose of this material in the Summit County Landfill, and has required the company to dispose of the material within a permitted area;

[3] The time frame for establishment of a permitted waste disposal area within the permit area is 6 - 9 months; the mine is presently out of room for on-site storage of this material and must move it before it encounters another low coal or waste generating area within the mine.

It should be noted that this material has been tested, and found to be neither acid nor toxic forming as previously thought.

It is our hope this proposal will meet with your approval.. Any further information, please give me a call.

Respectfully,

Dan W. Guy

cc: Jack Blonquist
File

Appendix 3-3

Temporary Waste Disposal Area

12/15/87

General Description

Site Selection

Disturbance

Access Road

Preparation

Topsoil Protection

Hydrologic Controls

Future Monitoring of Wells

Operation

Phase I

Lifts, etc.

Removal if Not Approved Within 1 Year

Reclamation

Seed Mix

Plates 2-1 Location

3-4 Plan Profiles

3-4a Sediment Pond

Temporary Coal Waste Disposal Area

General Description:

The Boyer Mine is located in T2N, R6E, in Summit County, Utah, and is operated by Summit Coal Company. The mine site is extremely small, consisting of a total of 153.04 acres of permit area and only 7.0 acres of disturbed area for surface facilities and storage. During the course of mining, areas have been encountered where rock splits and/or roof/floor material must be removed with the coal. This coal is diluted with rock to the point it is not saleable, but cannot be stored underground [per M.S.H.A. regulations], and thus becomes waste. The waste material in the past is presently stored in open piles on the mine site; however, due to the limited size of the site, further storage is not possible.

Summit Coal Company applied for approval to take this material to the Summit County Landfill, and although it was approved by Summit County, the request was denied by DOGM.

Site Selection:

An alternative disposal site was selected within the permit area, with the assistance of the DOGM technical staff. This site is located on the north side of the highway approximately 3000' west of the

mine. The proposed site is on a small ridge area, with a natural drainage on either side. The undisturbed runoff can easily be diverted around the disposal area, and with the proposed plan, disturbed runoff can be diverted into a sedimentation pond below the disturbance. This temporary site was selected because it is part of a proposal for a larger, permanent disposal site.

Disturbance:

The proposed total disturbance for the temporary disposal site is 0.72 acres, consisting of 0.48 acres of storage area, and the balance for the pond and road.

Access Road:

The proposed access road into the site will be approximately 200' long. This will be a Class II road, and will be constructed as shown on the attached Plate 3-4. The road grade will be 10%, and the road will have a finished surface width of 12' with a berm and side ditch on the downhill side, draining into a catch basin.

Preparation:

The area will be prepared as follows:

[1] The access road and catch basin will be constructed first. Any topsoil removed during road construction will be

stored in the berm along the road;

[2] The sediment pond will then be constructed. The pond will be incised, with a 4' berm around the low side for added protection. Any soil removed from the pond area will be stored in the berm around the edge of the pond;

[3] The storage area will then be prepared by removing at least 5' of soil from the pad using a dozer. This material will be pushed to the perimeter, forming a large berm around the disposal area as shown on Plate 3-4. All soil and removed vegetation will be stored in this berm for replacement upon reclamation.

[4] At least 12" of non-porous clay material will be placed over the pad area prior to disposal.

Topsoil Protection:

All topsoil will be stored in berms along the road, pond and disposal site. The material will not be compacted. All soil storage will be seeded using the approved temporary seed mix. Other protective measures such as straw bales, silt fences or diversions will be employed as necessary to prevent erosion of the piles until vegetation is established.

Hydrologic Controls:

Undisturbed runoff will be diverted around the disposal site by the natural drainages on either side, and the slope away from the ridge. The berm will further ensure the separation of undisturbed and disturbed area runoff.

Disturbed area runoff will be directed to the sedimentation pond [storage area] and to a catch basin [road area]. The disturbed area draining to the pond will be 0.48 acres, and the road area draining through the catch basin will be 0.24 acres. The drainage calculations for the various areas are summarized on Table 3.3.1, and the sediment pond specifications are shown on Table 3.3.2 and Plate 3-4a.

The pond is adequately sized to contain the runoff from a 100 year-24 hour precipitation event on the storage area; therefore, no discharge is expected from the pond. In the event a discharge should occur, it would be sampled in accordance with the approved plan for the sedimentation pond at the mine site.

It is proposed to install 3 ground water monitoring wells in conjunction with the larger, permanent disposal site. The schedule for installation has not yet been determined, however, it should be in early 1988. These wells will serve to monitor possible ground water affects of the temporary disposal as well as the permanent site.

Operation:

The temporary disposal site will allow for storage of approximately 3000 tons of waste material. The material will be hauled to the site by truck and dumped in piles or rows around the perimeter. A dozer or loader will compact the material in lifts not to exceed 24 inches to a total height as shown on Plate 3-4. Approximately 1100 ton of material is presently stored at the mine; therefore, the temporary site should be more than adequate to contain additional material generated during the 6 - 9 months required for approval of the permanent site. If the permanent disposal plan is not approved within one year of the approval of the temporary site, the waste material will be removed and taken to a site approved by the Division, and the area will be reclaimed.

Reclamation:

Once the waste disposal site is filled to capacity or is no longer needed, the area will be permanently reclaimed. The waste material will be graded to a final configuration as shown on Plate 3-4, and covered with a minimum of 4' of the soil material stored in the berm. A small berm [18" high] will be left around the perimeter to direct drainage to the pond. The area will then be seeded with the permanent mix. The pond and road will remain in place until revegetation standards are met on the reclaimed pad area. At that time, the small berm, pond, and road will be removed and reseeded. The areas will be recontoured to the configuration shown on Plate 3-4 [Final Reclamation].

Table 3.3.1

Temporary Waste Disposal Area Drainage

Drainage	Temp. Storage Pad	Access Road
Area [ac.]	0.48	0.72
Runoff CN	90	90
Slope [%]	16.67	10.00
Hydraulic Length [ft.]	200	-
T.O.C. [hrs.]	0.025	0.025
Precipitation [10-24][in.]	1.89	1.89
Precipitation [100-24][in.]	2.85	2.85
*Q [10-24] [cfs]	0.12	0.14
*Q [100-24] [cfs]	0.15	0.23

* Rationale Method; C = 1

Table 3.3.2

Temporary Waste Disposal Area

Sediment Pond Specifications

Pond Size 40'w x 80'l x 5' deep	= 11,840 ft^3
*Pond Slopes	= 1 : 1 inside
Pond Volume at Overflow	= 0.271 ac. ft.
Runoff to Pond [10-24]	= 0.04 ac. ft.
Runoff to Pond [100-24]	= 0.07 ac. ft.
Direct precip to pond [10-24]	= 0.002 ac. ft.
Direct precip to pond [100-24]	= 0.004 ac. ft.
Sediment Storage [0.1 ac. ft./acre x 60%]	= 0.029 ac. ft.
Required Pond Volume [10-24]	= 0.071 ac. ft.
Required Pond Volume [100-24]	= 0.103 ac. ft.

Conclusion: Pond Volume is adequate to contain the runoff from a 10 year-24 hour event and a 100 year-24 hour event, assuming the sediment level is not allowed to exceed the 60% cleanout depth.

* 1:1 slopes are used since pond is incised.

UPDATED MINE MAP