

PACIFICORP

PROPOSED COTTONWOOD FAN PORTAL AREA
COTTONWOOD CANYON

300 BIOLOGY (R645-301-300)

TABLE OF CONTENTS

<u>REGULATION</u>		<u>Page</u>
R645-301-310	Introduction	1
R645-301-320	Environmental Description	2
R645-301-330	Operation Plan	3
R645-301-340	Reclamation Plan	4
R645-301-350	Performance Standards	5
R645-301-353.120	Revegetation	7

APPENDICES

Appendix A	Raptor Survey Results - 1996 (includes map Cottonwood Fan Portal Midterm Review Raptor Nest Location (KS1691C))
Appendix B	U.S.F.W.S. Letter (dated March 10, 1997)
Appendix C	Cottonwood Canyon Impact Zone Survey, Joseph M. Jarvis, 1981
Appendix D	Fish and Wildlife Resources Information (reference from MRP pages 2-159 thru 2-174)
Appendix E	Vegetation Information for the Cottonwood Portal Area, Jerry R. Baker, 1982
Appendix F	Seed Mixture
Appendix G	Revegetation of the Soil Piles and Disturbed Slope Implemented in 1981
Appendix H	1994 and 1995 Proposed Cottonwood Fan Portal Vegetation Monitoring Reports
Appendix I	2002 Cottonwood Canyon Vegetation Monitoring Data: includes quantitative data for the 1998 reclamation [final]

Disturbed areas and soil piles of the proposed Cottonwood portal area total about five acres. Elevation is approximately 7,200 feet with a west and southwest exposure. On the steeper portion of the disturbed area, slope varies from 35-40°. The native plant community is dominated by Utah juniper and pinyon pine. However, both Douglas fir and White fir also occur. Common grasses are Salina Wildrye, Western Wheatgrass and Indian Ricegrass. Total aerial plant cover is about 40 percent. Soils are probably moderately alkaline and saline. Surface soil texture is a silt loam. Topsoil is shallow and rocky.

Revegetation of the proposed Cottonwood Fan Portal soil piles and disturbed slope was implemented in 1981 (refer to Appendix G). Quantitative and qualitative data were taken at the revegetated slopes as well as at the reference area. Based on the criteria outlined in the MRP, the slopes appear to be successful (refer to Appendix H). Cover and productivity sampling of the reclaimed slopes were conducted in accordance to R645-301-356 of DOGM's regulations. Dr. Patrick Collins, of Mt. Nebo Scientific Inc., used an 80% statistical confidence interval for establishing sample adequacy and group comparison tests. This is sufficient for base monitoring within the ten year responsibility period of the area. DOGM regulation R645-301-356.112 requires a statistical confidence interval of 90%. Based on the agreement between Dr. Collins and Ms. White of this discrepancy, the 1997 annual report of the reclaimed slope and reference area will reflect their decision. **Dr. Collins 2002 vegetation survey is included in Appendix I.**

Density sampling was established using point quarter distance method (refer to pg. 226 of the 1994 annual report and pg. 270 of the 1995 annual report). Table 9 in each of these reports show little to no significant difference of cover between revegetated slopes and reference areas; significantly more productivity between the revegetated slopes and reference areas; and significantly more woody species densities between the revegetated slopes and reference areas. Based on the findings of Dr. Collins, revegetation of the Cottonwood Fan Portal site has been successful. Therefore, the proposed species and methods are expected to be appropriate for final reclamation.

COTTONWOOD/WILBERG MINE
C/015/019

R645-301-300 BIOLOGY

APPENDIX I

2002 Cottonwood Canyon Vegetation Monitoring Data
(includes quantitative data for the 1998 reclamation [final])

COTTONWOOD CANYON AREA



ENERGY WEST MINING COMPANY
QUALITATIVE SAMPLING DATA SHEET AND
QUANTTTATIVE/QUALITATIVE NOTES
2002

SITE NAME: Soil Piles

AREA: Cottonwood Fan Portal Area

DATE: September 2-6, 2002

WORKERS: P. Collins, D. Collins

SLOPE: 35 deg.

EXPOSURE: Variable

ANIMAL USE/DISTURBANCE:

EROSION: Negligible

COVER: (Cover not sampled this year)

DOMINANT PLANT SPECIES OBSERVED:

Artemisia tridentata
Chrysothamnus nauseosus

Aster chilensis
Aster foliaceus
Penstemon palmeri

Elymus cinereus
Elymus lanceolatus
Elymus smithii
Elymus salinus
Elymus junceus

NOTES:

- 1) Recorded only qualitative data this year.
- 2) Sites looked excellent with good diversity.
- 3) Much of north pile has been removed. The remaining area has been reseeded (see photograph).

ENERGY WEST MINING COMPANY
QUALITATIVE SAMPLING DATA SHEET AND
QUANTITATIVE/QUALITATIVE NOTES
2002

SITE NAME: Reclaimed Slope (old, '81)

AREA: Cottonwood Fan Portal Area

DATE: September 2-6, 2002

WORKERS: P. Collins, D. Collins

SLOPE: 35-41 deg.

EXPOSURE: W

ANIMAL USE/DISTURBANCE: Slight to moderate

EROSION: Minor erosion near roadside

COVER: (see quantitative data)

DOMINANT PLANT SPECIES OBSERVED:

Artemisia tridentata

Atriplex canescens

Atriplex confertifolia

Ceratoides lanata

Chrysothamnus nauseosus

Chrysothamnus viscidifolius

Ephedra viridis

Gutierrezia sarathrae

Aster foliaceus

Agropyron cristatum

Bromus carinatus

Elymus lanceolatus

Elymus salinus

Elymus smithii

Elymus junceus

Elymus cinereus

Poa pratensis

NOTES:

- 1) Slope is in excellent condition.
- 2) Qualitative sampling only this year.

ENERGY WEST MINING COMPANY
QUALITATIVE SAMPLING DATA SHEET AND
QUANTITATIVE/QUALITATIVE NOTES
2002

SITE NAME: Reference Area

AREA: Cottonwood Fan Portal Area

DATE: September 2-6, 2002

WORKERS: P. Collins, D. Collins

SLOPE: 33 deg.

EXPOSURE: W

ANIMAL USE/DISTURBANCE: Slight to moderate

EROSION: Slight, natural patterns.

COVER: (see quantitative data)

DOMINANT PLANT SPECIES OBSERVED:

Amalanchier utahensis

Atriplex confertifolia

Chrysothamnus nauseosus

Eriogonum corymbosum

Ephedra viridis

Juniperus osteosperma

Pinus edulis

Stanleya pinnata

Machaeranthera canescens

Elymus salinus

Stipa hymenoides

NOTES:

- 1) This Reference Area still in good shape, but destructive results of a large storm event a few years ago.
- 2) Qualitative data only were taken this year.

ENERGY WEST MINING COMPANY
QUALITATIVE SAMPLING DATA SHEET AND
QUANTITATIVE/QUALITATIVE NOTES
2002

SITE NAME: CFP Tube Conveyor Area (1996 Seeding)

AREA: Trail Mtn. Mine/Cottonwood Fan Portal Area

DATE: September 2-6, 2002

WORKERS: P. Collins, D. Collins

SLOPE: 28 deg.

EXPOSURE: W, N, S.

ANIMAL USE/DISTURBANCE: None

EROSION: Negligible. Rocks in area seem to be greatly enhancing erosion control.

COVER: (no quantitative data taken this year)

DOMINANT PLANT SPECIES OBSERVED:

Atriplex canescens
Atriplex confertifolia
Artemisia tridentata
Chrysothamnus nauseosus

Aster foliaceus
Cirsium sp.
Linum lewisii
Penstemon palmeri

Elymus spicatus
Elymus lanceolatus
Elymus cinereus
Elymus smithii

- NOTES:
- 1) We sampled qualitative data this year.
 - 2) This year in this area we saw no yellow sweetclover.
 - 3) In 1997 the area was dominated by yellow sweetclover, whereas in 1998 we didn't see much of it. There was a lot again in 1999 and 2000. In 2001 there were many more desirable species and very little sweetclover. In 2002 we saw no yellow sweetclover and the fourwing saltbush looked much larger and mature. More shrubs were also present.
 - 4) Even though it was not seeded that long ago, the site was in excellent condition.

ENERGY WEST MINING COMPANY
QUALITATIVE SAMPLING DATA SHEET AND
QUANTITATIVE/QUALITATIVE NOTES
2002

SITE NAME: Belt Portal ('96)

AREA: Cottonwood Fan Portal Area

DATE: September 2-6, 2002

WORKERS: P. Collins, D. Collins

SLOPE: Variable

EROSION: Negligible

EXPOSURE: SSW

ANIMAL USE/DISTURBANCE: Slight

COVER: (no quantitative data recorded)

DOMINANT PLANT SPECIES OBSERVED:

Artemisia tridentata

Chrysothamnus nauseosus

Rosa woodsii

Elymus cinereus

Elymus lanceolatus

Elymus salinus

- NOTES: 1) Qualitative sampling done in 2002.
- 2) Site looked very good.
- 3) Most of the area was dominated by Gt. Basin Wildrye.
- 4) Large boulders greatly enhanced erosion control.

ENERGY WEST MINING COMPANY
QUALITATIVE SAMPLING DATA SHEET AND
QUANTITATIVE/QUALITATIVE NOTES
2002

SITE NAME: Portal Diesel ('96)

AREA: Cottonwood Fan Portal Area

DATE: September 2-6, 2002

WORKERS: P. Collins, D. Collins

SLOPE: 43 deg.

EXPOSURE: SW

ANIMAL USE/DISTURBANCE: Slight

EROSION: Negligible

COVER: (no quantitative data recorded this year)

DOMINANT PLANT SPECIES OBSERVED:

Chrysothamnus nauseosus

Astragalus cicer

Aster foliaceus

Elymus cinereus

Elymus smithii

Elymus lanceolatus

Elymus spicatus

Stipa hymenoides

NOTES:

- 1) In 2002, soil material from the topsoil pile was used to reclaim the 2 sediment ponds historical used at the CFP area. The area was then re-seeded in late summer or early fall 2002.
- 2) Cover seemed higher this year.
- 3) Site looked very good.
- 4) Site was dominated by grasses with some forbs and shrubs.

ENERGY WEST MINING COMPANY
QUALITATIVE SAMPLING DATA SHEET AND
QUANTITATIVE/QUALITATIVE NOTES
2002

SITE NAME: Reclaimed Slope (Final) '98

AREA: Cottonwood Fan Portal Area

DATE: September 2-6, 2002

WORKERS: P. Collins, D. Collins

SLOPE: variable

EXPOSURE: SW

ANIMAL USE/DISTURBANCE: Slight

EROSION: Negligible

COVER: (see quantitative data)

DOMINANT PLANT SPECIES OBSERVED:

Aster chilensis

Aster glaucodes

Linum lewisii

Melilotus officinalis

Malcomia africana

Penstemon palmeri

Salsola pestifer

Agropyron cristatum

Elymus lanceolatus

Elymus junceus

Elymus cinereus

Elymus smithii

Elymus spicatus

- NOTES:
- 1) Generally, the site looked good.
 - 2) Road areas were rocky.
 - 3) There were patches where diversity was high; other areas diversity was low.
 - 5) We sampled quantitatively for cover (n=20) and woody species density (n=20).
 - 6) There were areas that had lots of small sagebrush seedlings.
 - 7) This was the 4th year of drought over the general area. This may have influenced the sampling results.

Woody Species Density

RECLAIMED SLOPE '98	No/Ac
<i>Artemisia tridentata</i>	206.64
<i>Atriplex canescens</i>	533.83
<i>Chrysothamnus nauseosus</i>	602.71
<i>Gutierrezia sarothrae</i>	34.44
Total	1377.63

ENERGY WEST

Reclaimed Slope '98 (Final)

Cottonwood Fan Portal Area

Slope: Variable

Exposure: S W

Sample Date: 2 - 6 Sept 02

	1.00	2.00	3.00	4.00	5.00	6.00	7.00
SHRUBS							
<i>Artemisia tridentata</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Atriplex canescens</i>	0.00	0.00	0.00	0.00	5.00	0.00	10.00
<i>Chrysothamnus nauseosus</i>	0.00	2.00	10.00	0.00	0.00	0.00	0.00

FORBS

<i>Artemisia drucunculus</i>	0.00	0.00	0.00	0.00	0.00	0.00	5.00
<i>Aster chilensis</i>	0.00	0.00	2.00	5.00	5.00	0.00	5.00
<i>Linum lewisii</i>	0.00	0.00	0.00	0.00	5.00	0.00	0.00
<i>Melilotus officinalis</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Penstemon palmeri</i>	0.00	0.00	0.00	0.00	0.00	10.00	5.00

GRASSES

<i>Agropyron cristatum</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Bromus carinatus</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Elymus cinereus</i>	0.00	0.00	0.00	0.00	0.00	0.00	5.00
<i>Elymus junceus</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Elymus lanceolatus</i>	0.00	0.00	0.00	0.00	5.00	0.00	0.00
<i>Elymus smithii</i>	0.00	0.00	0.00	0.00	5.00	0.00	0.00
<i>Elymus spicatus</i>	0.00	0.00	0.00	0.00	5.00	0.00	5.00
<i>Elymus trachycaulus</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Stipa hymenoides</i>	25.00	3.00	3.00	5.00	0.00	10.00	0.00

COVER

Total Living Cover	25.00	5.00	15.00	10.00	30.00	20.00	35.00
Litter	5.00	1.00	5.00	5.00	5.00	10.00	5.00
Bareground	20.00	70.00	10.00	55.00	40.00	50.00	35.00
Rock	50.00	24.00	70.00	30.00	25.00	20.00	25.00

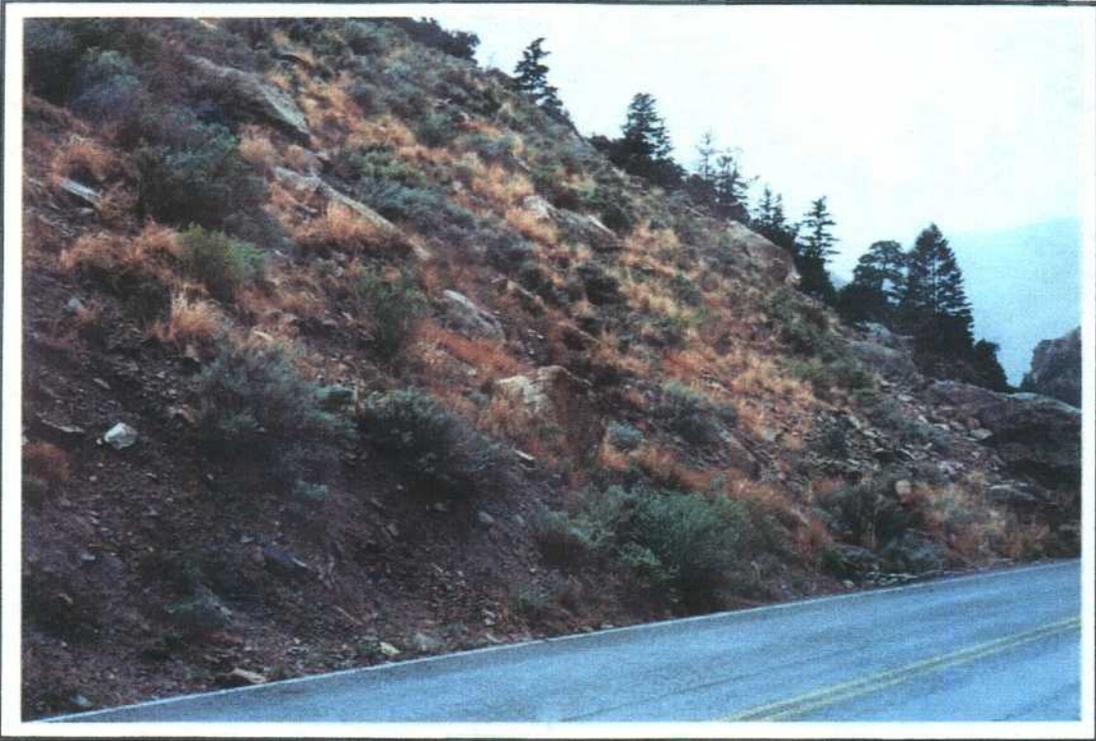
% COMPOSITION

Shrubs	0.00	40.00	66.67	0.00	16.67	0.00	28.57
Forbs	0.00	0.00	13.33	50.00	33.33	50.00	42.86
Grasses	100.00	60.00	20.00	50.00	50.00	50.00	28.57

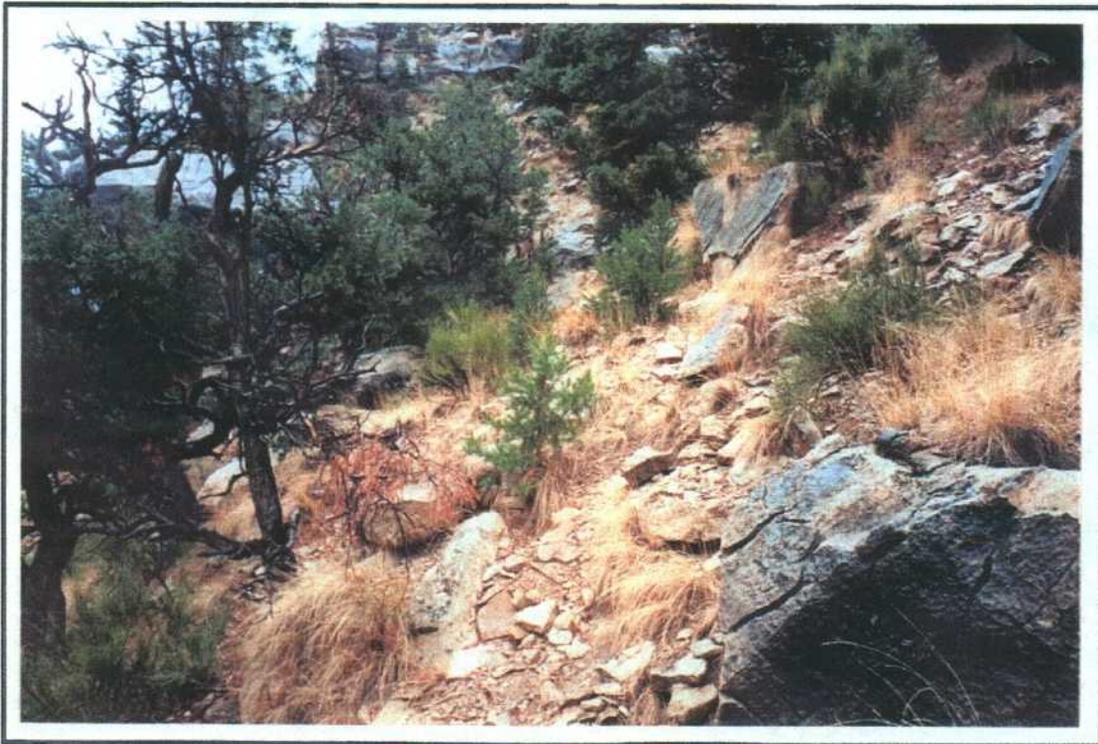
	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00
1.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	10.00	5.00	1.00	0.00	0.00
0.00	0.00	0.00	3.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.00	0.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	7.00	0.00	0.00	0.00	0.00	3.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00
0.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15.00	0.00	0.00	0.00	0.00	15.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	30.00
0.00	2.00	2.00	0.00	0.00	0.00	0.00	5.00	0.00	25.00	0.00
10.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	20.00	5.00	30.00	0.00	0.00
0.00	8.00	0.00	0.00	0.00	0.00	0.00	10.00	0.00	0.00	0.00
5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	20.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00
40.00	20.00	30.00	30.00	5.00	15.00	35.00	25.00	35.00	25.00	40.00
10.00	5.00	5.00	5.00	5.00	5.00	5.00	10.00	15.00	5.00	5.00
25.00	45.00	35.00	35.00	15.00	50.00	35.00	40.00	25.00	15.00	40.00
25.00	30.00	30.00	30.00	75.00	30.00	25.00	25.00	25.00	55.00	15.00
2.50	10.00	10.00	40.00	40.00	0.00	28.57	20.00	2.86	0.00	0.00
22.50	40.00	23.33	0.00	0.00	0.00	0.00	0.00	11.43	0.00	25.00
75.00	50.00	66.67	60.00	60.00	100.00	71.43	80.00	85.71	100.00	75.00

ENERGY WEST
 Reclaimed Slope '98 (Final)
 Cottonwood Fan Portal Area
 Slope: Variable
 Exposure: S W
 Sample Date: 2 - 6 Sept 02

18.00	19.00	20.00	Mean	SDev	Freq	
<hr/>						SHRUBS
0.00	0.00	0.00	0.15	0.48	10.00	<i>Artemisia tridentata</i>
3.00	5.00	0.00	1.95	3.23	35.00	<i>Atriplex canescens</i>
0.00	0.00	2.00	0.95	2.27	25.00	<i>Chrysothamnus nauseosus</i>
<hr/>						FORBS
0.00	0.00	0.00	0.25	1.09	5.00	<i>Artemisia drucunculus</i>
0.00	0.00	3.00	1.85	2.26	45.00	<i>Aster chilensis</i>
2.00	0.00	0.00	0.35	1.15	10.00	<i>Linum lewisii</i>
0.00	0.00	0.00	0.75	2.38	10.00	<i>Melilotus officinalis</i>
0.00	0.00	0.00	1.05	2.54	20.00	<i>Penstemon palmeri</i>
<hr/>						GRASSES
0.00	0.00	0.00	0.75	3.27	5.00	<i>Agropyron cristatum</i>
0.00	0.00	0.00	0.75	3.27	5.00	<i>Bromus carinatus</i>
20.00	10.00	30.00	4.75	9.68	25.00	<i>Elymus cinereus</i>
0.00	0.00	0.00	1.60	5.49	15.00	<i>Elymus junceus</i>
0.00	0.00	0.00	1.00	2.55	15.00	<i>Elymus lanceolatus</i>
5.00	5.00	5.00	3.75	7.56	35.00	<i>Elymus smithii</i>
5.00	10.00	0.00	2.15	3.51	30.00	<i>Elymus spicatus</i>
0.00	0.00	0.00	0.25	1.09	5.00	<i>Elymus trachycaulus</i>
0.00	0.00	0.00	3.45	6.85	35.00	<i>Stipa hymenoides</i>
<hr/>						COVER
35.00	30.00	40.00	25.75	10.99		Total Living Cover
10.00	10.00	10.00	6.80	3.17		Litter
25.00	20.00	25.00	33.75	14.99		Bareground
30.00	40.00	25.00	33.70	15.83		Rock
<hr/>						% COMPOSITION
8.57	16.67	5.00	14.80	17.55		Shrubs
5.71	0.00	7.50	16.25	17.80		Forbs
85.71	83.33	87.50	68.95	22.18		Grasses



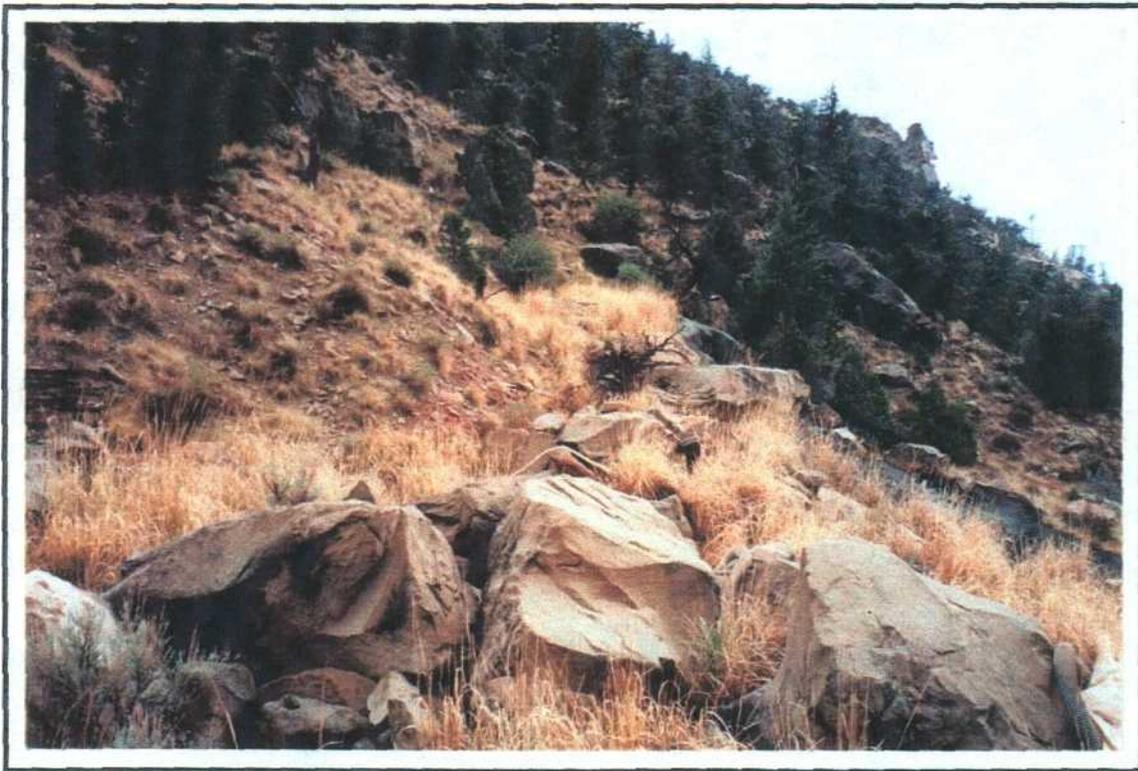
Cottonwood Canyon - Fan Portal Reclaimed Slope 1981



Cottonwood Canyon - Fan Portal Reference Area



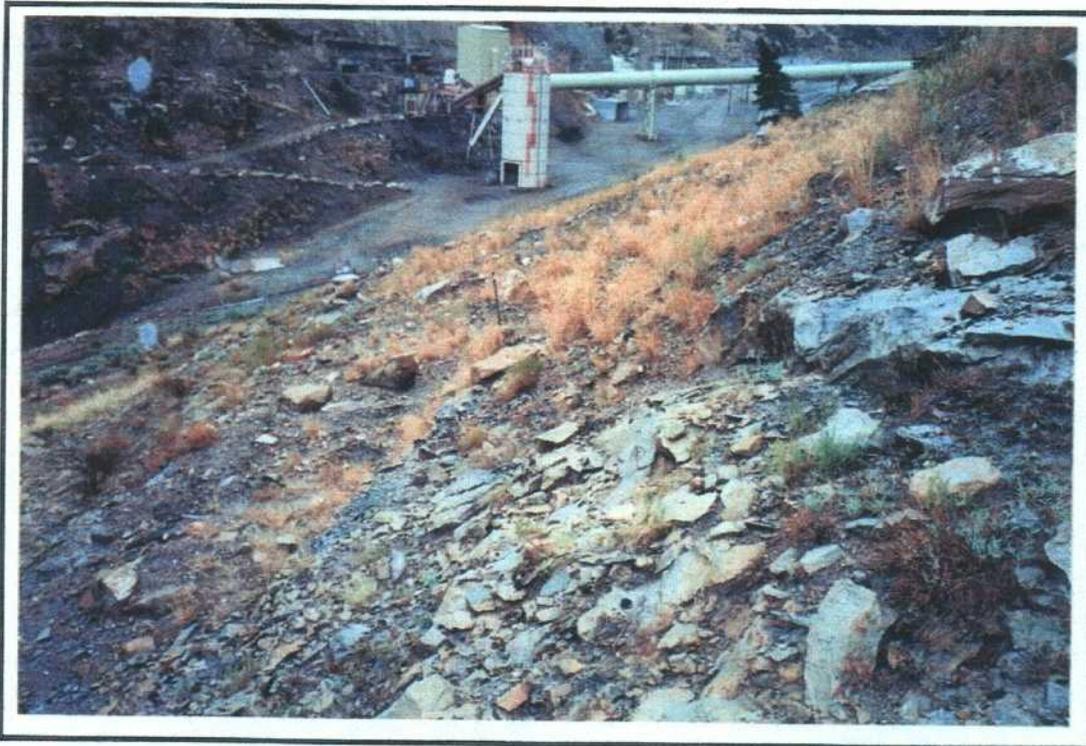
Cottonwood Canyon - Tube Conveyor



Cottonwood Canyon - Belt Portal 1996



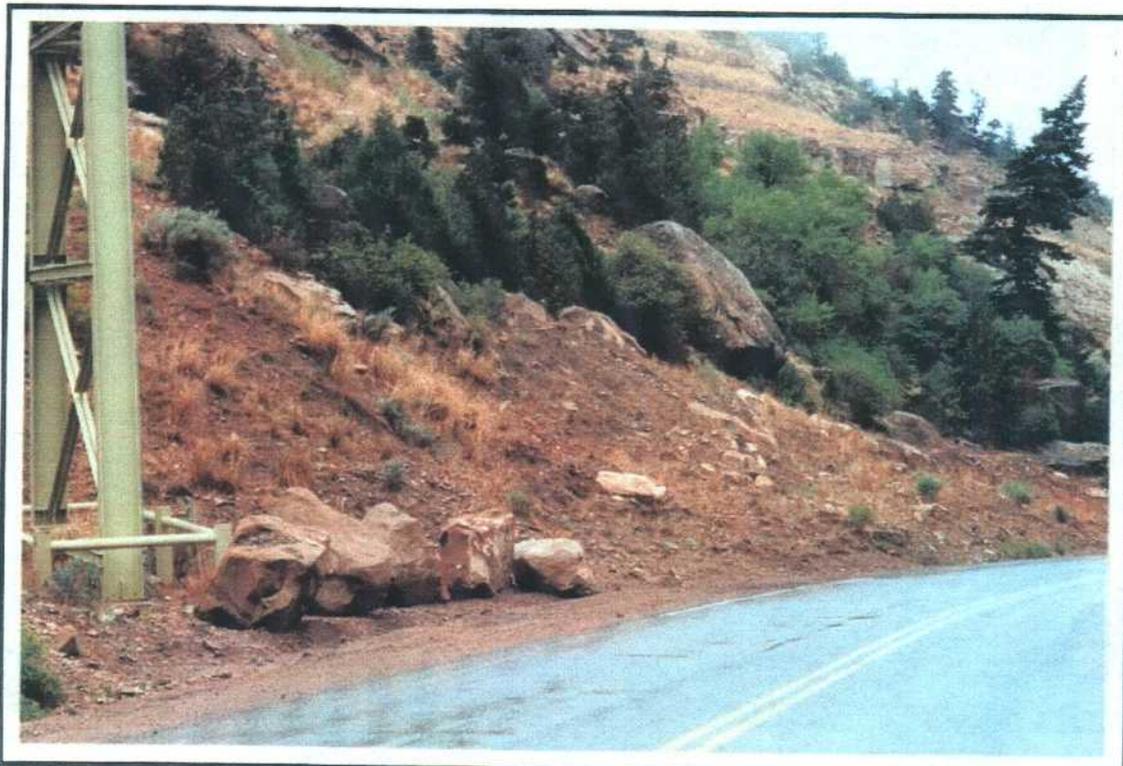
Cottonwood Canyon - Portal (Diesel) 1996



Cottonwood Canyon - Reclaimed Slope 1998 (Final)



Cottonwood Canyon - Soil Pile (Removed) North



Cottonwood Canyon - Soil Pile (Not Removed) South

LIST OF MAPS

CM-10501-CP Hydrologic Map
Map 3 (5-3-1) Cottonwood Fan Portal (Hansen, Allen & Luce)

LIST OF APPENDICES

R645-301-700 Appendix A Hydrologic Analysis of Disturbed Area Runoff Control Culverts, Sediment Ponds, and Small Area Exemptions at the Cottonwood Mine Portal Site and Hydrologic Analysis of Undisturbed and Disturbed Area Runoff Control Ditches, Culverts, and Sediment Basins at the Cottonwood /Wilberg Mine Cottonwood Canyon Fan Portal Site (Hansen, Allen & Luce 1989)

Appendix B Sediment Basin Removal Justification - RUSLE sediment loss modeling

760. RECLAMATION

761. GENERAL REQUIREMENTS

Before abandoning the Cottonwood Fan Portal area or seeking bond release, PacifiCorp will ensure that all temporary structures are removed and reclaimed. Temporary structures utilized at the Fan Portal site include two sediment basins (reclaimed July, 2002), silt fence structures, gabions and undisturbed diversion ditches excluding #UD-3 and #DD-4 which will be retained. The use of a sediment modeling program (RUSLE ver. 1.06) was used to justify the removal of the two sediment basins. This information is detailed in Appendix B of this chapter.

762. ROADS

The "Old Johnson Road" will be utilized to access reclamation activities associated with the Cottonwood Fan Portal. Reclamation of the road will commence immediately after it is no longer needed for reclamation operations (refer to R645-301-400 for details concerning reclamation of the access road). Silt fencing will be placed according to need along the road outslope, base of backfill, to insure sediment control.

762.100

Cut and fill slopes will be reshaped to be compatible with the postmining land use and to complement the drainage pattern of the surrounding area. Ditches DD-4 and UD-3 will be retained in their current configurations to prevent undisturbed/disturbed runoff from affecting the steep slope reclamation project. Additional response to the status of ditch DD-4 is included as an attachment at the end of the section. These ditches will be allowed to reclaim naturally. No maintenance will be conducted.

763. SILTATION STRUCTURES

During the reclamation process and until vegetation success is achieved, all temporary structures will be retained and maintained. In addition to the operational siltation structures (refer to Plate 5-5 - Surface Facilities Map Phase I Reclamation [sediment basins, ditches, silt fence structures]) silt fence structures will be installed during reclamation above the upper sediment basin (reclaimed July, 2002) and along the base of the major slope area which is on the main fill embankment terrace. This terrace provides drainage (Ditch DD-4) to the existing south sediment basin. In no case will the structures be removed sooner than two years after the last augmented seeding. When the siltation structures are removed, the land on which the siltation structure is located will be regraded and revegetated in accordance with the reclamation plan. Refer to Plate 5-5A Drawing # KS1742D Cottonwood Fan Portal Surface Facilities Map Phase II Reclamation for the final basin site configurations including filling of the sediment basins.

After the sediment basins have been filled, silt fence will be used to control sediment until vegetation is well established.

SEDIMENT CONTROL

Sediment control measures (silt fences) will be installed during Phase II reclamation after removal of the basins. Silt fence will be installed at the lowest point of disturbance at each of the basins.

TOPSOIL AND SUBSOIL PILE SEDIMENT CONTROL

After removal of the topsoil pile and subsoil pile to the extent required, contouring and reseeded will be completed according to the MRP, reclamation plan. Silt fence will be installed at the base of each pile to control sediment until vegetation can be established, when vegetation meets standards as required by the Division the silt fencing will be removed.

**PacifiCorp
Cottonwood Fan Portal**

Justification to Remove Sediment Basins

Appendix B

Sediment Loss Modeling for Justification to Remove Sediment Basins

Sediment loss was calculated, using the Revised Universal Soil Loss Equation (RUSLE) ver. 1.06, to determine if reclamation practices would cause or contribute to the degradation of downstream water quality. RUSLE is a set of mathematical equations that estimates soil loss and sediment yield resulting from rill and interrill erosion. This empirically derived value was used to compare modeled sediment loss from a disturbed area to a typical undisturbed area with similar aspect, elevation, and slope. The equation uses the factors as follows:

$$A=RKLSCP$$

Where:

- A = Average annual soil loss in tons per acre per year
- R = Rainfall/runoff erosivity
- K = Soil erodibility
- LS = Hillslope length and steepness
- C = Cover management
- P = Support practice

Sediment loss for the Cottonwood Fan Portal Area was determined by calculating the sediment loss from a detailed area of the proposed mine site reclamation. Drawing KS-1881D shows this area and where each calculation was made. Slope profiles were placed on runoff plains within the reclaimed area. The areas were divided according to the direction of runoff. Each profile was identified by cross-section. For instance, cross-section 52+00 passes through the area where the slope profile was calculated, therefore, the slope profile was named 52+00.

Data for the undisturbed area was collected from a previously modeled undisturbed area of the Des Bee Dove Mine. The slope profile calculations are similar in aspect, slope, elevation, vegetative and rock cover, soil characteristics and temperature. Refer to the Des Bee Dove permit, Appendix XIV, Phase I Reclamation Plan for slope profiles. Input data for this area is included on the disk provided.

The area selected to calculate sediment loss is considered representative for the entire disturbed drainage area. In other words, the average loss is determined from the reclaimed areas and then multiplied by an acreage factor. The RUSLE program is found in this appendix on the 3.5" floppy disk labeled RUSLE, Cottonwood Fan Portal Area, Input Parameters for Soil Loss Calculations. A review of the files will present all values used to determine sediment loss on the disturbed areas. The RUSLE equation factors mentioned above are discussed below. Table 1 summarizes sediment loss calculations used in RUSLE.

The R-factor is the expression of the erosivity of rainfall and runoff. Rainfall data can be found in the City database within RUSLE. Editing of the City database was conducted in order to gain historical meteorological data similar to the conditions found at the Des Bee Dove mine site (i.e.

temperature, precipitation, elevation, exposure, etc.). Sixteen (1976-1992) years of precipitation and temperature data from the town of Hiawatha, Utah was added to the data base in order to conduct this modeling exercise. The estimated R-value for this area calculated to be 10 for both disturbed and undisturbed areas.

The K-factor is an expression of the inherent erodibility of the soil or surface material at the Cottonwood Fan Portal Area. Redistributed soil material used for reclamation was originally derived from native sandstone and shale parent materials. Chemical analysis of these materials were conducted in 1997 to estimate the chemical characteristics of the facility benches. The data (average of % sand, silt, clay, and rock cover of all sampling conducted on the benches) from these samples was used to calculate the K-factor for the disturbed areas of the mine (refer to **R645-301-200: Soils** to review this data). The K-factor estimated for the reclaimed disturbed areas of the Cottonwood Fan Portal Area is 0.307. The K-factor result for the undisturbed area is 0.21.

Topography was taken into account when calculating the LS-factor. This factor takes the hillslope length (L) and gradient (S) as contributing to erosion. If either one of these factors increase, total soil loss per unit area will also increase. Various lengths and gradients were used in each profile and are shown on Drawing KS-1881D in this appendix.

The cover-factor (C) was determined for the soil in a reclaimed state. This site was reclaimed in 1998 and some vegetation has established. Vegetation data from the 2002 vegetation survey (refer to R645-301-300: Biology, Appendix I) conducted by Mt. Nebo Scientific was used to determine this factor. The maximum roughness, however, was used in this calculation since deep pocking was utilized over the entire reclamation site. Other ground cover entries were also used such as rock fragments and vegetative residue (i.e. straw or wood fiber mulch). These entries were conservatively used since no data has been established.

The support practice (P) factor is important when calculating for the disturbed area. It allows credit for creating closed outlet terraces or sediment basins (i.e. pocking) spaced evenly along the hillslope profile.

Listed below in Table 1 are the values used to calculate sediment loss from the reclaimed portions of the Cottonwood Fan Portal Area.

The table indicates sediment contributions from the disturbed areas of the Cottonwood Fan Portal Area. Table 1 shows that the average sediment loss from the reclaimed area is estimated at 0.20 tons/acre/year or based on approximately 5 acres of disturbance, 1.0 tons/year. It is assumed the remainder of the reclaimed disturbed area will be similar to the study area.

Table 1: Soil loss calculations of the Cottonwood Fan Portal Area reclaimed area utilizing RUSLE.

Location*	50+00	52+00	54+00
R	10	10	10
K	0.322	0.326	0.289
LS	19.48	21.36	23.52
C	0.0404	0.0393	0.0385
P	0.077	0.077	0.077
SDR	0.008	0.008	0.008
A	0.1951	0.2107	0.2015
SY	0.0203	0.0219	0.0209

* Refer to Drawing KS-1881D in this Appendix for the location of each hillslope profile.

It can be seen in Table 1 that the support practices greatly reduce sediment loss (sediment yield) from the site. Credits were allowed for pocking mulching, and tackifying the reclaimed surface to reduce runoff and loss of sediment. Although straw bales and sediment fences were installed as part of the sediment pond removal, their effect is ignored in the calculations using the RUSLE.

Table 2 shows the modeling results of the undisturbed area at the Des Bee Dove Mine. Sediment loss (A) is notable less than that of the disturbed, however, the sediment yield is similar.

Table 2: Soil loss calculations of the Des Bee Dove Mine undisturbed area utilizing RUSLE.

Location**	DBD A1-1U	DBD A1-2U	DBD A1-3U	DBD A2-1U	DBD A2-2U	DBD A2-3U
R	10	10	10	10	10	10
K	0.2	0.2	0.2	0.2	0.2	0.2
LS	14.5	16.2	14.3	13.3	7.71	16.3
C	0.0017	0.0017	0.0017.0	0.0017	0.0017	0.0017
P	1.0	1.0	1.0	1.0	1.0	1.0
SDR	1.0	1.0	1.0	1.0	1.0	1.0
A	0.0493	0.0551	0.0486	0.0452	0.0262	0.0554
SY	0.0493	0.0551	0.0486	0.0452	0.0262	0.0554

** Refer to Drawing CS-1854D in Appendix XIV in Des Bee Dove MRP for the location of each hillslope profile.

The results illustrated in Table 2 show similar annual sediment yields per acre in the disturbed area as compared to the undisturbed. This is due directly to the deep gouging and mulching techniques that were used during final reclamation. As shown by the values in the “P” (support practices) and “SDR” (sediment delivery ratio), much of the sediment that is detached as a result of rill and interrill erosion processes is trapped within the pocks or stabilized by mulching practices. The sediment yield from the disturbed area is near zero (0). Sediment contributions from the disturbed areas is expected to be negligible