State of Utah
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

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August 28, 1992

TO: Pamela Grubaugh-Littig, Permit Supervisor

FROM: Thomas Munson, Senior Reclamation Hydrologist TM

RE: Permit Conditions, Five Year Renewal, Pacificorp Electric Operations, Des-Bee-Dove Mine, ACT/015/017, Folder #2, Emery Country, Utah

1. Condition R645-301-728(1) TM

Required Action

The proposed sediment monitoring program is acceptable. The isolation of the plots, capturing all the runoff, drying the sediment samples and comparing the data with precipitation data is an accepted method of collecting worthwhile data on sediment yields for different plot treatments. The operator must submit a conceptual drawing showing dimensions and apparatus to be used in the second phase plot design in Appendix XVII.

Response

The Des-Bee-Dove Haul Road Reclamation Study Runoff and Sediment Yield Monitoring Program and a drawing of the proposed Test Plot Sediment Collection System are found in Appendix XVI. This condition is satisfied.

2&3. Conditions R645-301-731 & R645-301-731.121 (1) TM

Required Action

The BTCA plan, using a typical cross-section of the contour ditch design is found on Drawing CM-10393-DS, Sheet 3 of 5, BTCA Appendix XVII, Volume 7, and the calculations found in Appendix XVII are considered acceptable. This condition will be considered satisfied once the conceptual drawing and the revised Appendix XVII are submitted.

Response

The Des-Bee-Dove Haul Road Reclamation Study Runoff and Sediment Yield Monitoring Program and a Drawing of the proposed Test Plot Sediment Collection System are included in Appendix XVI instead of Appendix XVII as requested. This condition is satisfied.

4. Condition R645-301-742.220(1) TM

Required Action

The January 30, 1992 submittal included page 3-54 which adequately addressed the sediment removal procedure for the pond, including descriptions related to testing of the removed material. The addition to Appendix VII discussed the expected velocities of 24.9 fps over the grouted riprap spillway. The spillway, as designed, will experience supercritical flows at the outlet and, as such, appropriate energy dissipation will be required to dissipate that energy. The grouted riprap spillway would be considered nonerosive and is approved based on the in place inspection program and the commitment to maintain the grout in good repair. The operator will be required to submit an energy dissipation design for the outlet of the spillway capable of withstanding the supercritical velocities.

Response

The operator states that any potential discharge from the pond will flow from the spillway onto natural bedrock. This is considered adequate for energy dissipation and erosion protection at the outlet. This condition is satisfied.

5. Condition R645-301-742.300(1) (TM)

Required Action

The operator has not supplied any calculations for the ditches and culverts draining any areas north and west of drainage area #4. All ditches and culverts will be sized and calculations will be included in the PAP for the mine site. Plate 3-8 must show all hydrologic structures numbered corresponding to calculations in the text.

Response

Drawing CM-10421-DS, Sheet 1 of 2, Packet 3-8, Volume 3 has been revised to reflect all the drainage areas, culverts, and ditches. Appendix XII gives all the data inputs for the hydrologic calculations associated with any structures. The structures in place were designed using the 10 yr/6 hr storm event. Any structures which have been identified as having erosive velocities have been demonstrated as stable using standard riprap calculations, identifying bedrock, riprap, natural cobble, and boulders where appropriate. This condition is satisfied.

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DBCON2

APPENDIX XVI

SUMMARY

1. JULY 25, 1990 LETTER TO MR. DAVID SMALDONE FROM MS. PAMELA GRUBAUGH-LITTIG

2. JULY 12, 1990 MEMO FROM TOM MUNSON TO MS. PAMELA GRUBAUGH-LITTIG

3. TEST PLOTS - OUTLINE

4. JULY 31, 1990 LETTER TO MS. PAMELA GRUBAUGH-LITTIG FROM VAL PAYNE (WITH AERIAL PHOTOS)

5. HAUL ROAD RECLAMATION STUDY

6. DES BEE DOVE EROSION TASK FORCE AGENDA

7. NOVEMBER 13, 1991 MEMO TO TASK FORCE MEMBERS FROM GUY DAVIS

8. DES BEE DOVE HAUL ROAD RECLAMATION STUDY RUNOFF AND SEDIMENT YIELD MONITORING PROGRAM (WITH DRAWING)

DES BEE DOVE HAUL ROAD
RECLAMATION STUDY

INTRODUCTION

The focus of the Reclamation Study is primarily the Mancos shale. Therefore; the following information, regarding the first three phases of the study, addresses only the portion of the haul road which impacted the Mancos shale. Specifically, the major fill slope located between Stations 131+00 and 142+00.

PHASE I LITERATURE REVIEW/INFORMATION SEARCH

Because the primary issues are reclaimability and erosion of Mancos shale, the literature review focused on these issues. It should be noted that the gathering of information is a continuing process. The major literature sources are listed herein. These references provide useful information as well as valuable additional references for continuing research.

Bureau of Land Management, 1985; Gully erosion, Technical Note 366, US Dept. of Interior, 181 pages.

Bureau of Land Management, 1979; Reclaimability analysis of the Emery coal field, Emery County Utah, EMRIA Report No. US Dept of Interior, 413 pages.

Heede, Burchard H., 1976; Gully development and control: the status of our knowledge, USDA For. Serv. Res. Pap. RM-169, 42 p. Rocky Mt. For. and Range Exp. Sta., Fort Collins, Colo.

Williams, R.D. and Schuman, G.E. (Editors). 1987. Reclaiming mine soils and overburden in the western United States, analytic parameters and procedures. Soil Conservation Society of America, Akeny, Iowa.

As stated previously, only the major reference sources are listed here. Other references are cited within the text.

PHASE II SITE CHARACTERIZATION

Climate

The Des Bee Dove haul road is located near the base of the eastern slope of the Wasatch Plateau in western Emery County, Utah. At higher elevations of the plateau, 10,000 feet, annual precipitation averages more than 15 inches, primarily as winter snowfall. This precipitation depletes the moisture from the westerly airflow thus making the downslope flow significantly dryer.

Data from the PacifiCorp East Mountain weather station, 1.5 miles northwest of the haul road site, at an elevation of 9,000 feet, indicates a mean annual precipitation of approximately 14.5 inches. The mean annual precipitation at the Hunter Power Plant, 10 miles southeast of the haul road site at an elevation of 5,800 feet, is 7.5 inches. The mean annual precipitation at the haul road site, elevation 7,000 feet, is estimated to be approximately 11 or 12 inches.

A comparison of the seasonal distribution of annual precipitation at East Mountain (water years 1980-81 thru 1988-89) and Hunter Plant (water years 1975-76 thru 1988-89) indicates the following (see pages 4 and 5):

LOCATION	SEASON	PRECIP. (IN)	% AN.PR.
East Mountain	Summer (Apr-Oct)	62.13	47.6
	Winter (Oct-Apr)	68.46	52.4
Hunter Plant	Summer	55.94	53.4
	Winter	48.77	46.6

The seasonal distribution of annual precipitation at the haul road site is expected to be similar to that of Hunter Plant. Most of the precipitation is received in the "summer" season primarily in the form of thunder storms in July and August.

Estimated annual temperatures at the haul road site were also extrapolated from the East Mountain and Hunter Plant average annual temperature data (water years 1985-86 thru 1988-89, pages 6 thru 9).

YEAR	AV. ANN. TEMP. (°F)	HIGH AV. TEMP. (°F)	LOW AV. TEMP. (°F)	HOTTEST MONTH	COLDEST MONTH
East Mountain					
85-86	40.2	62.7	25.1	Aug	Nov
86-87	40.1	60.3	19.5	Jul	Jan
87-88	38.6	62.6	15.3	Jul	Dec
88-89	38.9	61.8	20.1	Jul	Jan
Hunter Plant					
85-86	49.4	70.8	26.9	Aug	Dec
86-87	47.5	71.9	21.5	Jul	Jan

87-88	49.3	75.7	17.0	Jul	Jan
88-89	50.0	76.5	16.3	Jul	Jan

The average annual temperature at the haul road site is expected to be approximately 43° F. The high average temperature is expected to be approximately 66° F, occurring in July. The low average temperature is expected to be approximately 20° F, occurring in January.

The slope aspect at the haul road site is generally southwestern.

Soils

The soils at the haul road site are classified by the Soil Conservation Service as Rockland (SCS Soil Survey, Carbon-Emery Area, Utah 1970). Discussion of this soil type is included on pages 10 thru 12.

Additional soil chemical information is included on page 13. These soil analyses were performed in conjunction with the existing vegetation test plots.

Vegetation

Vegetation cover at the haul road site is very sparse (estimated at less than 25% overall) and is dominated by <u>Halogeton glomeratus</u>.

Slope Stability

Soils engineering and physical properties are discussed in the stability analysis performed by Chen Northern, Inc. This information is found on pages 14 thru 20.

Slope erosion has been monitored since 1986. This information is presented on pages 21 thru 24.

TABLE 1: EAST MOUNTAIN PRECIPITATION

Elevation - 9,005 Feet

Water Year	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	TOTAL
80-81	1.28	0.39	0.05	0.29	0.52	2.77	0.64	0.87	0.11	0.57	0.85	2.55	10.90
81-82	1.93	0.53	0.97	3.22	0.14	1.67	0.00	0.45	0.09	1.86	1.10	2.61	14.57
82-83	0.38	2.90	1.39	1.30	1.81	1.98	0.92	0.71	0.61	1.27	4.83	1.62	19.71
83-84	0.76	2.43	2.42	0.27	0.65	1.22	0.50	0.22	1.18	1.90	2.33	0.64	14.53
84-85	3.27	0.97	1.67	0.49	0.59	1.77	1.35	1.73	0.28	2.47	0.12	2.31	17.02
85-86	1.15	2.38	0.87	0.30	2.10	1.43	1.05	0.38	0.53	0.87	2.24	1.63	14.92
86-87	1.57	0.39	0.16	1.37	1.37	1.65	1.16	1.77	0.58	2.49	1.16	0.06	13.73
87-88	2.77	1.91	1.29	1.42	0.00	0.99	2.08	1.03	0.81	0.45	0.96	0.91	14.61
88-89	0.61	0.43	1.56	1.00	0.68	1.03	0.26	0.47	0.43	1.19	2.44	0.49	10.59
89-90	0.28	0.39	0.16	0.74	2.08								

TABLE 2 : HUNTER PLANT PRECIPITATION

Elevation - 5,800 Feet

Water Year	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	TOTAL
75-76	0.13	0.25	0.19	0.02	0.40	0.00	0.89	0.84	0.03	0.31	0.08	0.70	3.84
76-77	0.00	0.02	0.00	0.37	0.07	0.00	0.03	1.28	0.07	1.35	0.41	0.50	4.10
77-78	0.01	0.18	0.00	1.28	1.05	1.74	0.34	1.21	0.00	0.69	1.14	0.14	7.78
78-79	0.03	2.22	0.22	1.43	0.53	2.43	0.24	0.47	0.00	0.00	0.79	0.00	8.36
79-80	0.00	0.00	0.41	1.70	1.70	0.67	0.75	1.11	0.00	0.02	0.51	2.06	8.93
80-81	0.66	0.06	0.02	0.00	0.07	1.48	0.16	0.45	0.14	0.20	0.70	2.43	6.37
81-82	0.58	0.27	0.45	0.94	0.45	0.54	0.00	0.02	0.00	0.15	1.06	1.23	5.69
82-83	0.20	1.25	0.45	0.54	0.41	0.84	0.37	0.51	0.00	2.18	1.58	0.88	9.21
83-84	0.53	0.66	1.07	0.03	0.35	0.34	0.34	0.05	1.09	1.80	1.89	2.35	10.50
84-85	1.6	0.06	1.24	0.20	0.95	1.01	0.67	0.64	0.26	1.50	0.03	0.86	9.11
85-86	0.92	1.40	0.42	0.10	0.97	0.40	0.31	0.00	0.31	0.55	1.01	0.57	7.05
86-87	0.92	0.08	0.10	0.32	0.45	0.90	0.12	1.38	1.25	1.65	1.27	0.11	8.55
87-88	1.91	1.02	0.66	0.55	0.00	0.66	1.64	0.59	0.20	0.69	0.44	0.78	9.14
88-89	0.69	0.04	0.48	1.23	0.02	0.23	0.00	0.37	0.14	1.01	1.70	0.35	6.26
89-90	0.20	0.00	0.03	0.31									

Table 3: TEMPERATURES IN EMERY COUNTY, UTAH (1986 WATER YEAR)

	Hunter Plant		Huntington Plant		Electric Lake		East Mountain	
Month	Average Temp. (°F)	Departure From Normal	Average Temp. (°F)	Departure From Normal	Average Temp. (°F)	Departure From Normal	Average Temp. (°F)	Departure From Normal
1985								
Oct.	49.6	+1.2	49.6	+0.2	37.3	-0.2	41.5	+5.1
Nov.	34.7	-0.5	33.1	-2.9	24.4	-1.3	25.1	-2.1
Dec.	26.9	+0.2	27.6	+-.2	14.7	-1.1	26.7	+4.0
1986								
Jan.	30.3	+6.2	30.1	+6.5	18.6	+4.0	28.8	+5.1
Feb.	36.3	+7.9	34.0	+3.8	19.9	+0.6	27.3	+3.1
Mar.	45.3	+9.5	43.6	+5.9	30.4	+9.6	35.8	+7.6
Apr.	47.6	+3.0	45.1	0.0	29.5	+0.8	36.0	+2.0
May	55.5	+3.4	54.8	-0.1	39.0	0.0	34.9	-5.6
June	69.1	+7.7	69.1	+3.3	54.1	+5.5	59.1	+5.0
July	70.2	-1.8	69.1	-2.6	54.5	-1.2	59.3	-2.6
Aug.	70.8	+4.4	70.6	+1.2	57.6	+3.8	62.7	+0.9
Sept	56.8	-1.9	56.5	-3.9	43.1	-4.4	45.7	-4.8
TOTALS	49.4	+3.3	48.6	+1.0	35.3	+1.4	40.2	+1.9

Table 4: TEMPERATURES IN EMERY COUNTY, UTAH (1987 WATER YEAR)

	Hunter Plant		Huntington Plant		Electric Lake		East Mountain	
Month	Average Temp. (°F)	Departure From Normal	Average Temp. (°F)	Departure From Normal	Average Temp. (°F)	Departure From Normal	Average Temp. (°F)	Departure From Normal
1986								
Oct.	30.6	-0.1	47.0	-2.4	36.5	-1.0	37.6	+1.2
Nov.	37.2	+2.0	37.8	+1.8	28.7	+3.0	36.4	+9.2
Dec.	28.9	+2.2	29.3	+1.9	17.1	+1.3	19.6	-3.1
1987								
Jan.	21.5	-2.6	24.4	+0.8	9.8	-4.8	19.5	-3.2
Feb.	31.4	+3.0	31.9	+1.7	13.0	-6.3	22.8	-0.9
Mar.	36.3	+0.5	34.6	-3.1	18.1	-2.7	26.0	+1.8
Apr.	50.8	+6.2	50.2	+5.1	34.2	+5.5	41.3	+13.1
May	56.5	+4.4	55.2	+0.3	42.6	+3.6	45.9	+5.4
June	69.1	+7.7	67.6	+1.8	50.6	+2.0	59.4	+5.3
July	71.9	+3.5	68.0	-3.7	N/A	---	60.3	-1.6
Aug.	71.1	+4.7	68.8	-0.6	55.0	+1.2	57.3	-4.5
Sept	65.1	+6.4	63.0	+2.6	49.6	+2.1	54.7	+4.2
TOTALS	47.5	+3.2	48.2	+0.6	32.3	-1.6	40.1	+1.3

TABLE 5: TEMPERATURES IN EMERY COUNTY, UTAH (1988 WATER YEAR)

Month	Hunter Plant		Huntington Plant		Electric Lake		East Mountain	
	Average Temp.*	Departure From Normal	Average Temp.*	Departure From Normal	Average Temp.*	Departure From Normal	Average Temp.*	Departure From Normal
1987								
Oct.	55.1	+6.7	53.9	+4.5	41.4	+3.9	42.0	+4.8
Nov.	38.5	+3.3	35.8	-0.2	24.6	-1.1	25.8	-2.4
Dec.	25.0	-1.7	24.4	-3.0	11.2	-4.6	15.3	-6.1
1988								
Jan.	17.0	-7.1	20.5	-3.1	10.4	-4.2	17.7	-3.7
Feb.	31.4	+3.0	30.9	+0.7	16.3	-3.0	24.7	+0.7
Mar.	38.4	+2.6	36.2	-1.5	17.4	-3.4	25.9	-1.8
Apr.	49.1	+4.5	47.3	+2.2	32.8	+4.1	38.0	+2.6
May	57.0	+4.9	55.8	+0.9	40.2	+1.2	46.1	+4.2
June	71.0	+9.6	68.2	+2.4	53.1	+4.5	58.5	+3.2
July	75.7	+7.3	74.2	+2.5	58.4	+2.7	62.6	+0.9
Aug.	72.2	+5.8	70.1	+0.7	54.5	+0.7	60.0	-1.0
Sept	61.6	+2.9	60.8	+0.4	45.6	-1.9	47.0	-3.6
TOTALS	49.3	+3.5	48.2	+0.5	33.8	-0.1	38.6	-0.2

* Temperatures reported in degrees Fahrenheit.

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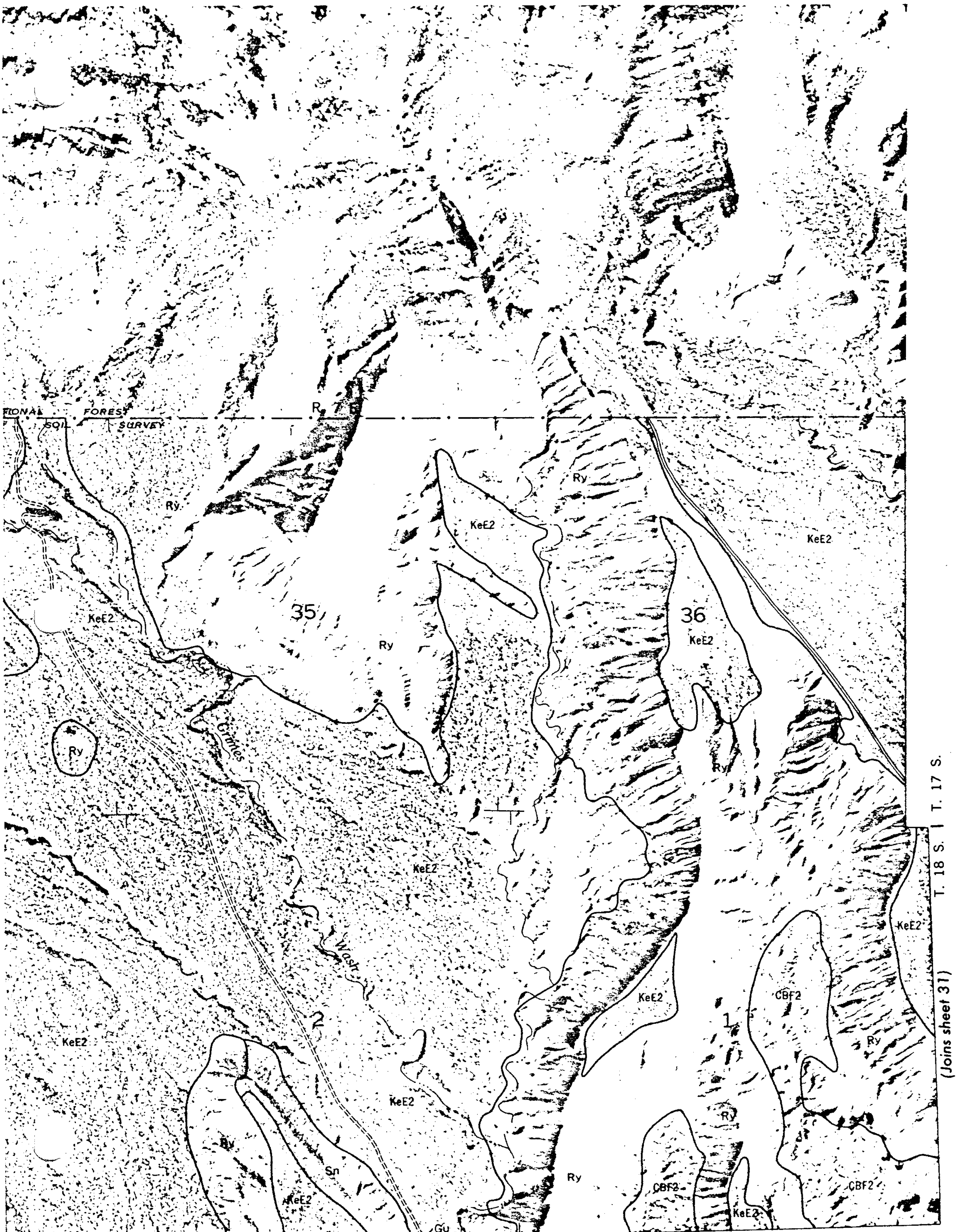
TABLE 6 : TEMPERATURES IN EMERY COUNTY, UTAH (1989 Water Year)

Month	Hunter Plant		Huntington Plant		Electric Lake		East Mountain	
	Average Temp.*	Departure From Normal	Average Temp.*	Departure From Normal	Average Temp.*	Departure From Normal	Average Temp.*	Departure From Normal
1988								
October	57.4	+9.0	56.3	+6.9	45.3	+7.8	43.8	+5.9
November	38.4	+3.2	37.7	+1.7	23.6	-2.1	23.5	-4.2
December	26.8	+0.1	25.1	-2.3	10.9	-4.9	21.1	-0.3
1989								
January	16.3	-7.8	18.8	-4.8	10.3	-4.3	20.1	-2.1
February	27.0	-1.4	24.5	-5.7	12.7	-6.6	20.2	-3.5
March	45.3	+9.5	41.5	+3.8	28.9	+8.1	34.0	+5.7
April	54.1	+9.5	50.8	+5.7	35.6	+6.9	42.1	+6.0
May	58.9	+6.8	55.6	+0.7	43.0	+4.0	46.8	+4.4
June	66.4	+5.0	64.0	-1.8	42.2	-6.4	50.3	-4.5
July	76.5	+8.1	73.4	+1.7	57.9	+2.2	61.8	+0.1
August	69.7	+3.3	66.6	-2.8	50.5	-3.3	53.8	-6.4
September	62.8	+4.1	60.7	+0.3	45.2	-2.3	48.8	-1.6
TOTALS	50.0	+4.1	47.9	+0.3	33.8	-0.1	38.9	0.0

* Temperatures reported in degrees Fahrenheit.


NATIONAL FOREST
SOIL SURVEY
R. 7 E.
Ry
KeE2
35
36
Ry
KeE2
Ry
Grimes
Wash
2
1
KeE2
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Sn
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(Joins sheet 31)

spersed with areas of the Ravola soil (fig. 13). Both soils are on flood plains and alluvial fans.

Included in mapping were small areas of Billings silty clay loam.

Runoff is rapid from the Bunderson soil, and most areas contain gullies 5 to 20 feet deep and 500 to 1,300 feet apart. Head cutting is common, and it is forming shallow gullies. In places windblown hummocks less than 2 feet high occur. Typically, these are on the east and north sides of greasewood and other plants.

The soils in this mapping unit are suited to the production of range forage. Controlling gully erosion and regulating the amount and season of range use are needed. Clearing the brush and reseeding grasses are not feasible, because of the small amount of rainfall. (Both soils are in Capability unit VIIe–D, nonirrigated; Ravola soil is in Desert Loam Bottom range site)

Riverwash (Rv) consists of streambeds or riverbeds, including oxbow-loops and other channels. These areas are exposed at low water and subject to shifting during periods of high water because of deposition and erosion. The deposited materials are extremely variable, ranging from boulders in the upper part of streams to silt and clay in the lower, more nearly level areas. Most areas are channeled and have little or no cover of vegetation. (Capability unit VIIIw–4, nonirrigated; not rated for other uses)

Rock land (Ry) is a miscellaneous land type having a surface 50 to 70 percent covered by stones, boulders, and outcrops of shale and sandstone. Most of this land type is moderately eroded, but many areas are severely eroded. Soil characteristics are almost obscured by the stones and boulders. The slopes are very steep to perpendicular, but typically they are between 50 and 80 percent.

Included in mapping were gently sloping, deep fine sandy loams. Intermingled with the sandstone outcrops were inclusions of shallow fine sandy loams. Also included on some of the north-facing slopes in the mountains along the west side of the survey area were small areas of an unidentified soil.

This land type has almost no value for farming, although some areas have a sparse cover of grass, sagebrush, pinon, and juniper. This vegetation grows on all exposures, but it is dominant on north and west exposures. Small areas are accessible to livestock and wildlife, but most of the land type is too steep and rocky for grazing. (Capability unit VIIIs–3, nonirrigated; not rated for other uses)

Figure 13.—An area of Ravola-Bunderson complex, 1 to 3 percent slopes, eroded. The nearly bare, light-colored slickspots are the Bunderson soil.

Saltair Series

Soils of the Saltair series are deep, poorly drained, very strongly saline, moderately fine textured, and nearly level to gently sloping. They occupy moderate to large areas on alluvial fans, on flood plains, and in narrow alluvial valleys. These soils have formed in alluvium derived from marine shale and sandstone. The vegetation is greasewood, saltgrass, and kochia, but bare surfaces are common. Elevations range from 4,000 to 6,500 feet. The annual rainfall is 6 to 11 inches, and the mean annual soil temperature is 47° to 54° F. The frost-free season is 110 to 160 days.

In a typical profile, the surface layer is light brownish-gray, strongly calcareous, very strongly saline silty clay loam about 7 inches thick. The underlying material is light brownish-gray and light-gray heavy silt loam that is very strongly saline in the upper part. Platy crusts of salt on the surface, underlain by layers of soft, granular material, are common. The content of salt is 2 percent or more within 20 inches of the surface.

This soil is used for range, but the quality of the forage is poor.

Representative profile of Saltair silty clay loam in a pasture, 1,200 feet north and 500 feet west of the SE. corner of section 13, T. 17 S., R. 9 E. in Emery County, Utah:

A11sa—0 to ½ inch, grayish-brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) when moist; weak, thin, platy structure breaking to moderate, fine, granular structure; soft, firm, very sticky and plastic; plentiful large roots; many medium and fine vesicular pores; strongly calcareous; strongly alkaline (pH 8.9); thin salt crust; clear, smooth boundary.

A12sa—½ inch to 7 inches, light brownish-gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) when moist; many, fine, distinct, yellowish-brown (10YR 5/6) mottles; weak to moderate, fine, angular blocky structure; very hard, very firm, very sticky and very plastic; plentiful medium and fine roots; common medium and fine pores; strongly calcareous; moderately alkaline (pH 8.3); very strongly saline; efflorescent salt on many ped surfaces and in pores; clear, smooth boundary.

C1gsa—7 to 14 inches, light brownish-gray (2.5Y 6/2) heavy silt loam, grayish brown (2.5Y 5/2) when moist; common, fine, distinct, yellowish-brown (10YR 5/4) mottles and common, fine, faint, gray (N 5/0) mottles; weak, fine, angular blocky structure; very hard, very firm, very sticky and very plastic; few fine roots; common medium pores; strongly calcareous; very strongly saline; efflorescent salt on many ped surfaces and in pores; strongly alkaline (8.5); gradual, wavy boundary.

CAPABILITY UNIT VIIIw-4 (NONIRRIGATED)

This capability unit consists of the land type Riverwash, which is gravelly and cobbly. Areas of this land type are subject to damaging overflows and do not support the growth of plants. Their main use is for wildlife habitat.

CAPABILITY UNIT VIIIw-8 (NONIRRIGATED)

This capability unit consists of deep, poorly drained, very strongly saline, fine textured and moderately fine textured soils that generally have a crust of salt ½ to 1 inch thick on the surface. These soils are in the Cache, Libbings, and Saltair series.

Because of their high content of salt, these soils have no known farm use. Plants cannot grow on them. Experience indicates that reclaiming these soils for use as salt meadow pasture is economically not feasible.

CAPABILITY UNIT VIIIs-3 (NONIRRIGATED)

This capability unit consists only of bare, steep ledges of Rock land on which plants do not grow. The only use is for wildlife habitat, water supply, and esthetic purposes.

CAPABILITY UNIT VIIIs-7 (NONIRRIGATED)

This capability unit consists of rough, broken, and nearly bare areas of Badland and of a Bunderson soil. These areas have little potential for the production of plants and are sources of silt carried by runoff.

Small areas are used for a limited amount of grazing. The areas are used mainly, however, as a habitat for wildlife, for water supply, and for esthetic purposes.

Estimated yields

Table 1 gives the estimated average acre yields of the principal crops and pasture grown on irrigated soils under two levels of management. These yields are estimated on the basis of records obtained from farmers for the specific soils, on field observations of soil scientists, and on data compiled by economists of the Colorado River Storage Project. If no information was available for a particular soil, the estimates were made on the basis of yields on a similar soil. Only soils that are suitable for the crops and pasture specified are listed in table 1. In a given year, yields may be considerably higher or lower than the estimated average.

Under both levels of management, yields are based on a generalized crop rotation consisting of 5 years of a legume, 2 years of row crops, and 2 years of small grain. This rotation or a variation of it is used in most of the survey area. The kinds of row crops to be grown depend on the expected supply of irrigation water. Oats or barley normally are grown as a nurse crop to new seedings of alfalfa.

The yields in columns A are those that can be expected under average, or common, management. Under common management, phosphorus fertilizer is applied sparingly or not at all; nitrogen is seldom used. Most of the available animal manure is spread. Sugar beets generally are fertilized with phosphorus and nitrogen.

Under common management, water-control structures generally are inadequate, and water is applied without enough regard to proper length of run or to the timely needs of crops. Pastures are not clipped, rotation grazing is not practiced, and no commercial fertilizer is applied. In some instances droppings are scattered, but generally they are not.

The yields in columns B are those expected over a period of years under a moderately high level of management. This management provides that phosphorus fertilizer is applied when new seedings of alfalfa are being established and again after 2 or 3 years. Nitrogen fertilizer is used on row crops after the first year out of alfalfa and occasionally on small grains, unless animal manure is available. All available animal manure is spread. Tillage is reduced to essential, timely operations to avoid traffic pans or compacting the soil. In addition, operators use control structures for handling irrigation water, use proper lengths of runs that are adapted to soil conditions, and apply water in the quantity that satisfies crop requirements.

Under a moderately high level of management, irrigated pastures generally contain about 50 percent alfalfa and 50 percent grass. Regardless of the amount of alfalfa, fewer animals die of bloat when rotation grazing is used than when it is not used. Alfalfa is allowed to mature to the hay stage before animals graze it, and then animals are concentrated so that all the forage is consumed within a few days.

Pastures that are rotated, and in which alfalfa is the primary source of forage, should be grazed about 6 days and then rested for 28 to 40 days to allow for the regrowth of plants. The length of the regrowth period is about the same as the interval between hay cuttings. Six paddocks, or grazing units, generally are well suited to rotation grazing. This is the minimum number of paddocks that can be used if irrigation water is applied about every 14 days. This number allows for an irrigation immediately after grazing is finished and again 6 to 7 days before the next grazing so that the soil is dry when grazed.

At the stocking rate of 20 cows per acre, 6 days are needed to harvest efficiently the forage in a 5-acre pasture. Pastures grazed at this rate seldom need to be mowed for weed control oftener than every other year. Droppings are spread each year.

From 40 to 50 pounds of available nitrogen fertilizer are applied before growth starts each spring. Phosphorus fertilizer is applied every 2 or 3 years.

The length and warmth of the growing season at Green River allows farmers to have a greater variety of crops and larger yields than are feasible in the other parts of the survey area. For this reason, the soils at Green River are designated "extended season" phases to separate them from their counterparts in Castle Valley. For example, at Green River three full crops of alfalfa are obtained, and corn matures and is harvested for grain. In Castle Valley, on the other hand, alfalfa produces only two full crops and part of a third, and corn does not mature for grain. The frost-free period in Green River is 140 to 160 days, and the average temperature in summer is 76° F. In Castle Valley, the frost-free season is 110 to 130 days, and the average temperature in summer is 66° F.

The amount of soluble salts or alkali in the soil determines the kinds of crops that can be grown, and it affects crop yields.

FGL
FRUIT GROWERS LABORATORY, INC.

May 19 ,1989

LAB NO:15913 03

RE: LANDSCAPE SOIL ANALYSIS

RECEIVED
SEP 15 1989
DIVISION OF
OIL, GAS & MINING

Nature-Gro Corp.
P.O. Box 4135
Pacoima, CA 91381

Location: Utah P & E, below road
Description: Preplant Landscape
Date Sampled: 05/04/89
Sampled by: Nature-Gro
Date Received: 04/27/89
Depth: 0-6"

TEST RESULTS

Test Description	Your Analysis		Optimum Range	Comment
Moisture	1.00	%	1/2 Satn. %	Too Dry
Saturation	32.00	%	--	Loam
Nitrate-Nitrogen	6.00	PPM	10 - 40	Low
Phosphorus	2.00	PPM	13 - 40	Very Low
Exch. Potassium	270.00	PPM	81 - 300	Ample
Limestone	7.30	%	0	See Below*
pH	7.90		5.8 - 8.2	OK
Soil Salinity	20.70		0.3 - 2.0	Excessive
Gypsum Requirement	4.00	T/AF	0	Apply
Lime Requirement	0.00	T/AF	0	OK
Sulfate-Sulfur	95.80	meq/l	< 20	Excessive
Chloride	39.00	meq/l	<3	Excessive
Boron	0.50	PPM	0.02 - 1.0	OK
Calcium	49.30	meq/l	>2.0	Ample
Magnesium	16.30	meq/l	>1.5	Ample
Sodium	175.80	meq/l	See SAR/ESP	--
SAR	30.70		<7	Too High
ESP	30.30		<10	Too High
Zinc	2.40	PPM	> 0.7	Ample
Manganese	1.60	PPM	>1.4	Ample
Iron	16.90	PPM	>8	Ample
Copper	0.80	PPM	>0.2	Ample

Soil pH & Limestone levels are important to consider when making plant selections. Soils having pH levels above 7.0 should not be used for plants that require acid soil conditions. Soils containing free limestone should not be used for plants that require acid soil conditions or are sensitive to limestone.

FGL, Inc.

Darrell H. Nelson

13

MAIN OFFICE – & LABORATORY 853 CORPORATION STREET – P.O. BOX 272 SANTA PAULA, CALIFORNIA 93060-0272
BRANCH OFFICE – & LABORATORY 2500 STAGECOACH ROAD STOCKTON, CALIFORNIA 95205 (209) 942-0181 (209) 942-0423

Chen Northern, Inc.

[illegible] S
[illegible] Utah 84[illegible]5
[illegible] 3661
[illegible] 3963 Facsimile

August 29, 1990

APPENDIX III

Des-Bee-Dove Mine
Sedimentation Pond & Road
Stability Analysis

Johansen & Tuttle
90 South 100 East
Castledale, Utah 84513

Attention: Mr. Craig Johansen

Subject: Debris Basin Dike and
Road Fill Slope Stability Analysis
Project No. 5-462-90

Gentlemen:

At your request, we have performed a slope stability analysis for the two embankments referenced above. This letter presents the results of our analysis for these embankments which are located near Orangeville, Utah. The analysis was conducted for the purpose of estimating the factor of safety against slope failure for these embankments.

Site Conditions

A representative of our firm has not been at the site to review site conditions and consequently we have relied upon the information provided by your firm in order to understand site conditions. It is our understanding that the cross-sectional data for the both the dike and the road fill as provided by your firm represent typical cross-sections of the slopes to be analyzed. The cross section as analyzed for the Road Fill and the Debris Basin are shown on Figures 1 and 4, respectively. We further understand that there is no anticipated phreatic surface in the embankment of either project and that the foundation soils for both projects are essentially the same as the embankment material.

We understand that field density testing indicates that the soil at the road embankment has an in situ dry density which varies from 112.5 to 122.2 pounds per cubic foot and that the moisture content varies from 9.8 to 11.2 percent of the dry density. Similarly, the soil within the Debris Basin Dike has an in situ dry density which varies from 102.7 to 115 pounds per cubic foot with a moisture content in the range 11.6 to 19.9 percent. Soil samples representative of the embankment and foundation soils, at each of the embankment sites, were delivered to our laboratory.

Laboratory Testing

The samples delivered to our laboratory were observed and visually classified. Pertinent laboratory testing was conducted on each sample to determine the engineering and physical properties of the soils in general accordance with ASTM or other approved procedures.

Tests Conducted:	To Determine:
Grain-size Distribution Figures 2 and 5	Size and distribution of soil particles; that is, clay, silt, sand, and gravel.
Atterberg Limits Figure 2	A method of describing the affect of varying water content on the consistency of fine-grained soils.
Moisture-density Relationship Figures 2 and 5	The optimum moisture content for compacting soil and the maximum dry unit weight (density) for a given compactive effort.
Direct Shear Figure 3 and 6	General soil strength properties.

Results of the laboratory tests are summarized on the enclosed figures as indicated above. Based on the laboratory test results soil samples were classified in accordance with ASTM D-2487 which is based on the Unified Soil Classification System.

Soil Conditions

Road Fill

The embankment and foundation soils contained in the road fill consist of a clay with moderate plasticity. This clay is primarily fine-grained but contains chunks of claystone which accounts for the gradation as shown on Figure 2. The moisture density relationship indicates that the soil has a maximum dry density of 124 pounds per cubic foot and an optimum moisture content of 10.5 percent.

Based on the field density tests soil samples were reconstructed to a dry unit weight of 115 pounds per cubic foot at a moisture content of 10 percent for direct shear testing. Due to the lack of a phreatic surface through the embankment the direct shear testing was completed at the moisture density indicated above. Direct shear test results indicated a friction angle of 36 degrees and a cohesion intercept of 1,500 pounds per square foot. The direct shear results seem somewhat high for anticipated field conditions. As a result, for use in the slope stability analysis, the friction angle has been reduced to 30 degrees and the cohesion to 1,200 pounds per square foot. It should be noted that if a phreatic surface were to be established within the road fill that this could lead to a substantial softening of the soils as measured during this testing.

Debris Basin

The soil contained in the embankment and foundation of the Debris Basin Dike consists of silty sand with gravel. This soil is broadly graded and has low to no plasticity. The moisture density relationship indicates a maximum density of 125 pounds per cubic foot and a moisture content of 9.5 percent.

Based on results of the field density tests, samples were reconstructed for direct shear testing at a dry unit weight of 105 pounds per cubic foot and moisture content of 15 percent. Prior to the initiation of the direct shear testing these samples were allowed to saturate. Direct shear testing indicated a friction angle of 32 degrees with no cohesion. Due to the significant amounts of coarse rock removed from the soil in order the prepare samples which could be tested in the direct shear testing apparatus, it is felt that a slight increase in the test results for this sample would be appropriate for use in stability analysis. Soil strengths used in the stability analysis are a friction angle of 34 degrees and a cohesion intercept of zero.

Stability Analysis

A computer model of Bishop's Simplified Method was used to perform the actual stability calculations. The computer model used was Stabl5M, which was developed at Purdue University for the Federal Highway Administration.

The Bishop's Simplified Method of Analysis is a limiting equilibrium method which relates, through the use of a factor of safety, the available shearing strength and the shear stresses which develop within the soil mass. This relationship provides a limiting value of which the forces acting to cause failure are in balance with those acting to resist failure. The limiting value of the factor of safety is 1.0 at which the shearing stresses are equal to the maximum shearing strength and failure of a particular potential failure mass is eminent.

Analyzing the stability of a particular potential failure mass using the Bishop's method requires that the mass be divided into several slices. The analysis to determine slope stability then considers all the forces acting on each individual slice or body. In the Bishop's method the forces which act on each slice are resolved vertically. This yields an equation of equilibrium in which the unknowns are the normal and tangential forces acting on the failure surface and the difference between the vertical side forces. The tangential force on the failure surface is the shearing force acting to cause failure of the body. The normal force is used in the Mohr-Coulomb strength criteria of the soil.

In order to reduce the number of unknowns, Bishop applied the limit equilibrium condition that the shearing stress equals the available strength, divided by the factor of safety. Ultimately it is the factor of safety that is being solved for. In the Simplified Bishop's Method it is assumed that the difference in the vertical side forces is small enough to be neglected. Comparison of this method with more rigorous methods shows that this assumption results in a slightly lower or more conservative factor of safety. In general, however, the results of this method are very close to the more rigorous methods and the Bishop's Simplified Method is considered to be appropriate for use in slope stability analysis.

Both embankments were analyzed under static conditions. In addition the Debris Basin was also analyzed under earthquake conditions. For the conditions of this study, it is felt that the pseudo static method of analysis is appropriate for use in the dynamic analysis.

The pseudo static method of analysis assumes a constant horizonal acceleration of a given value. The site of the debris basin is located within Zone 2-B of the Uniform Building Code Seismic Zone Map of the United States. It is estimated that at the site there is a 90 percent probability that the site will experience a maximum horizonal acceleration of 0.10g in the next 50 years and 0.2g during the next 250 years. It has been estimated that for use in seismic Zone 2, that a pseudo static coefficient or constant acceleration of 0.10g is appropriate. This value is used under earthquake conditions in this study.

Analysis Results

	Factor Safety	Required Safety Factor
Road Fill	1.72	1.3
Debris Basin, Down Stream	1.65	1.5
Debris Basin, Down Stream with Earthquake	1.28	1.2
Debris Basin, Up Stream	2.20	1.5
Debris Basin, Up Stream with Earthquake	1.63	1.2

Conclusions

Based on the assumptions used in this analysis, as previously discussed, it is our opinion that the slopes under consideration have factors of safety against failure in excess of those which have been set as a required minimum. As such, we feel that these slopes should be considered stable.

It should be noted, however, that a change in field conditions could significantly alter the results of this analysis. One of the most common causes of slope failures is the presence of unaccounted for seepage water which can cause softening of cohesive soils and, in all types of slopes, result in pore pressures which reduce slope stability. As with all embankments, monitoring of field conditions is important to determine that field conditions do not change. Where field conditions do change, stability of slopes needs to be reconsidered.

Limitations

This analysis has been completed in accordance with general accepted soil engineering practices in this area. The results of this analysis and the conclusions contained in this letter are based upon the data provided from the client and the assumptions regarding field densities and phreatic surface. If actual conditions appear to be different from those described herein this office should be advised at once so that reevaluation and recommendations may be made.

CHEN-NORTHERN, INC.

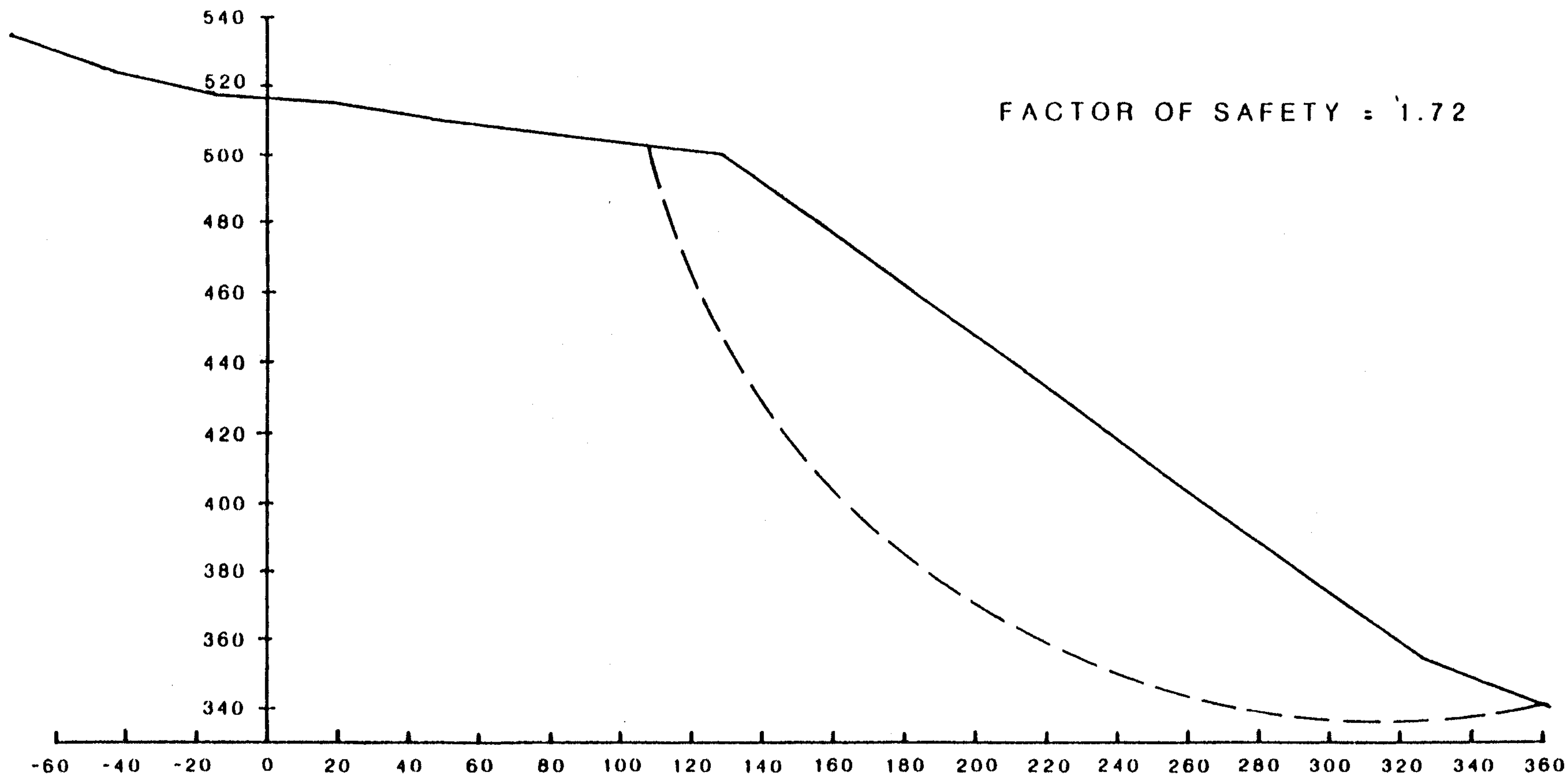
David K. Marble

David K. Marble, P.E.

Rev. by WVJ, P.E.

DKM:ew

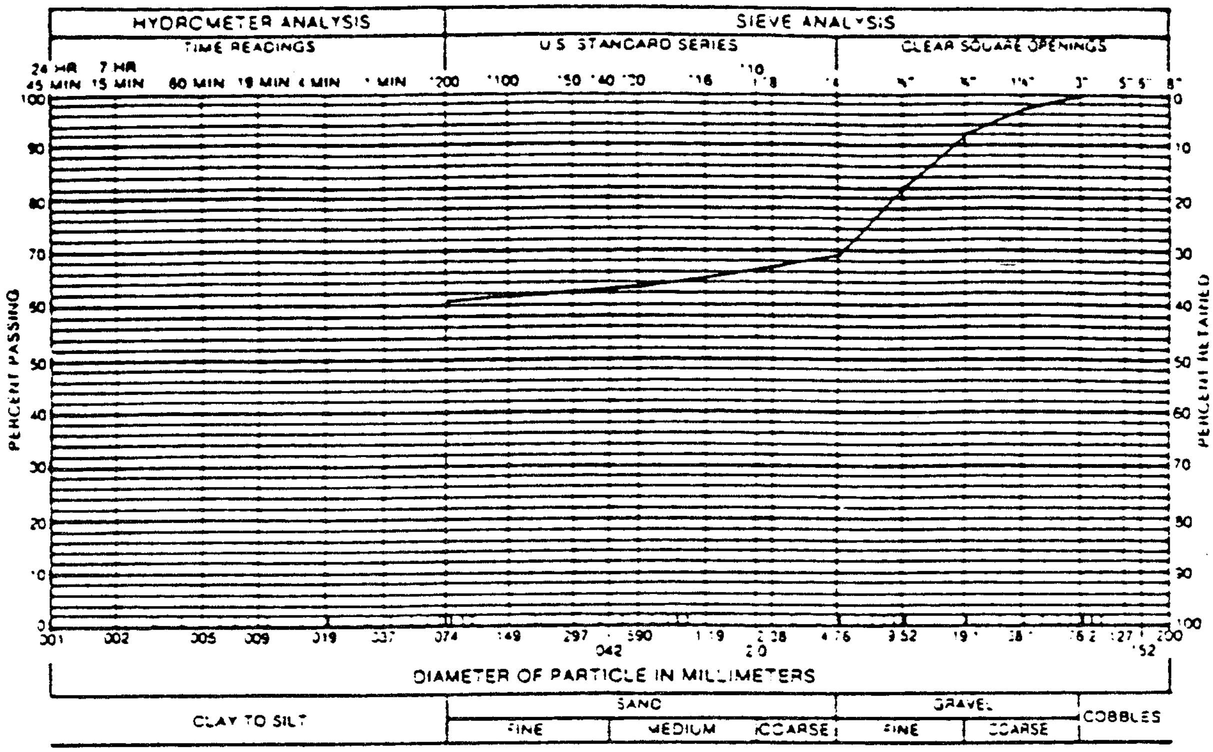
Enclosures-6



— — — CRITICAL FAILURE SURFACE

#546290	Chen Northern, Inc.	ROAD FILL EMBANKMENT	Figure 1

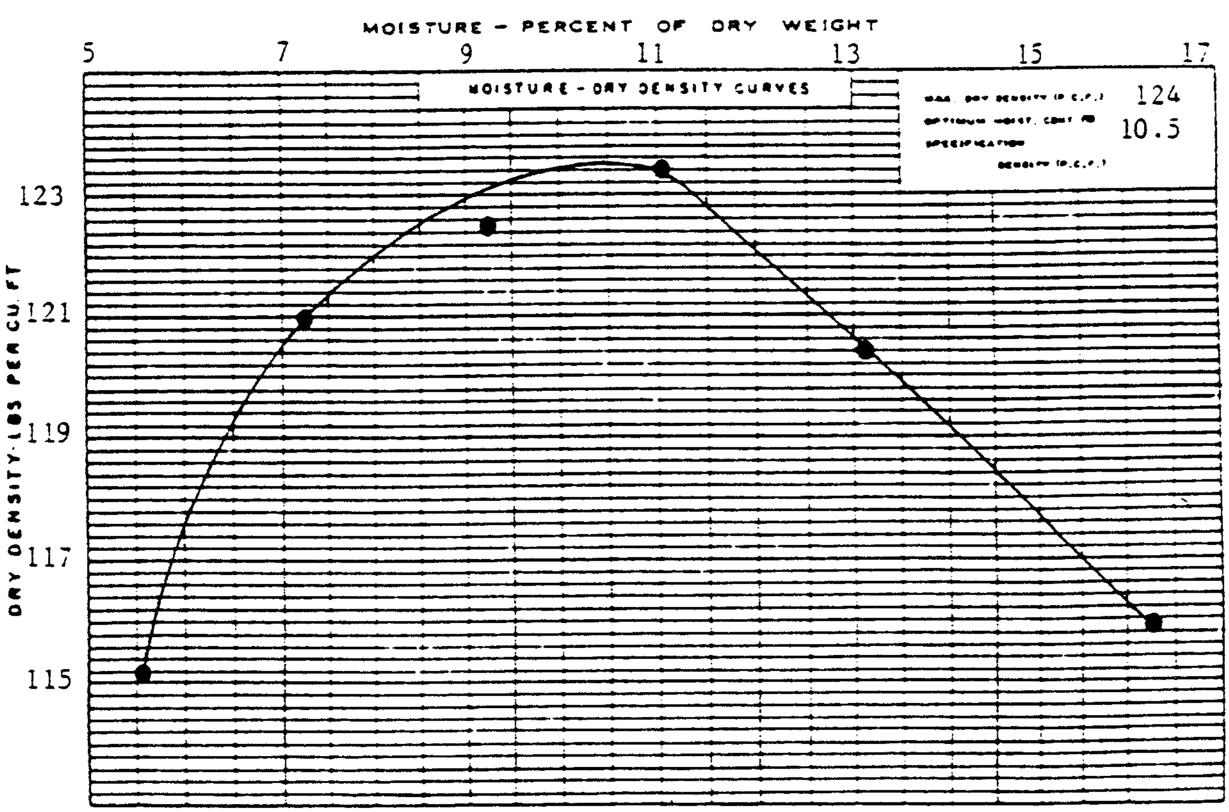
Chen Northern, Inc.



GRADATION TEST RESULTS

GRAVEL 32 % SAND 7 % SILT AND CLAY 61 %

LIQUID LIMIT 31 % PLASTICITY INDEX 15 %



COMPACTION TEST RESULTS

COMPACTION TEST PROCEDURE

SAMPLE OF (CL) Lean Clay

Job #5-462-90 FROM Road Fill DEPTH Fig. 2

Chen Northern, Inc.

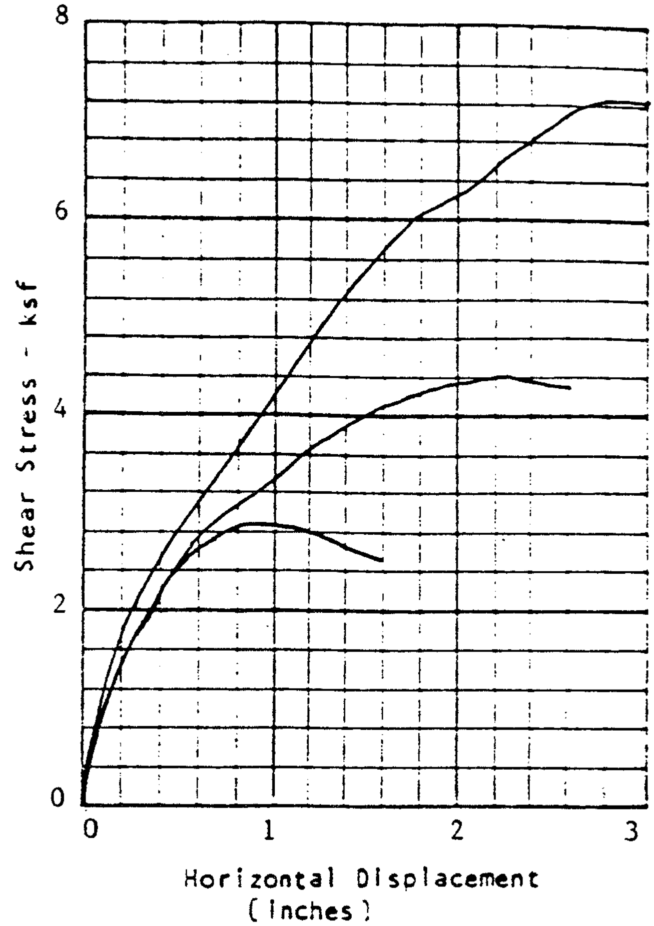
TEST NUMBER	1	2	3	4
LOCATION	ROAD-FILL	ROAD-FILL	ROAD-FILL	
HEIGHT-INCH	1"	1"	1"	
DIAMETER-INCH	2.4"	2.4"	2.4"	
WATER CONTENT - %	10	10	10	
DRY DENSITY - pcf	115	115	115	
CONSOL. LOAD - ksf	2	2	8	
NORMAL LOAD - ksf	2	4	8	
SHEAR STRESS - ksf	2.81	4.48	7.20	

TYPE OF SPECIMEN Remolded

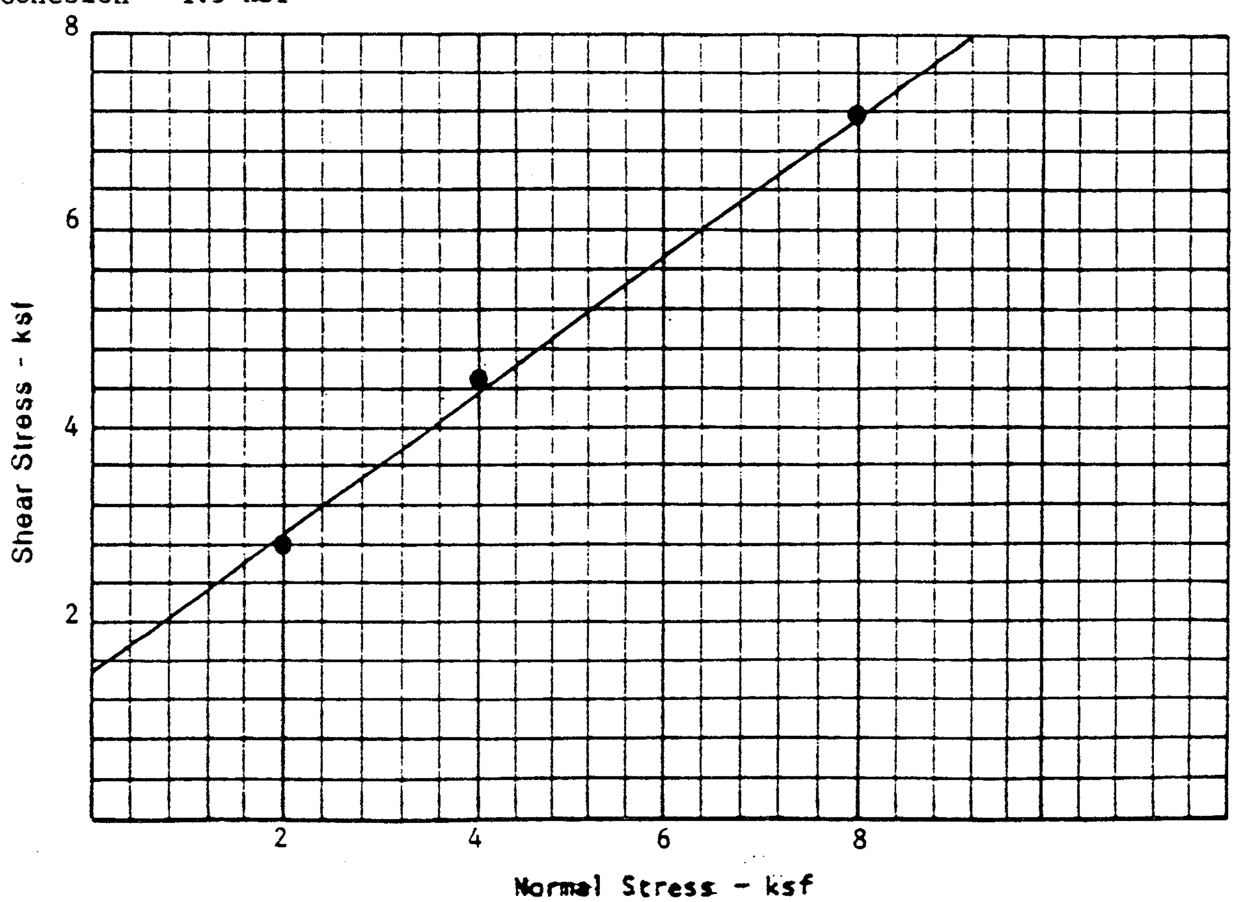
SOIL DESCRIPTION (CL) Lean Clay

TYPE OF TEST Unsaturated

Shear Rate 0.12 MM/MIN



Friction Angle = 36°
Cohesion = 1.5 ksf



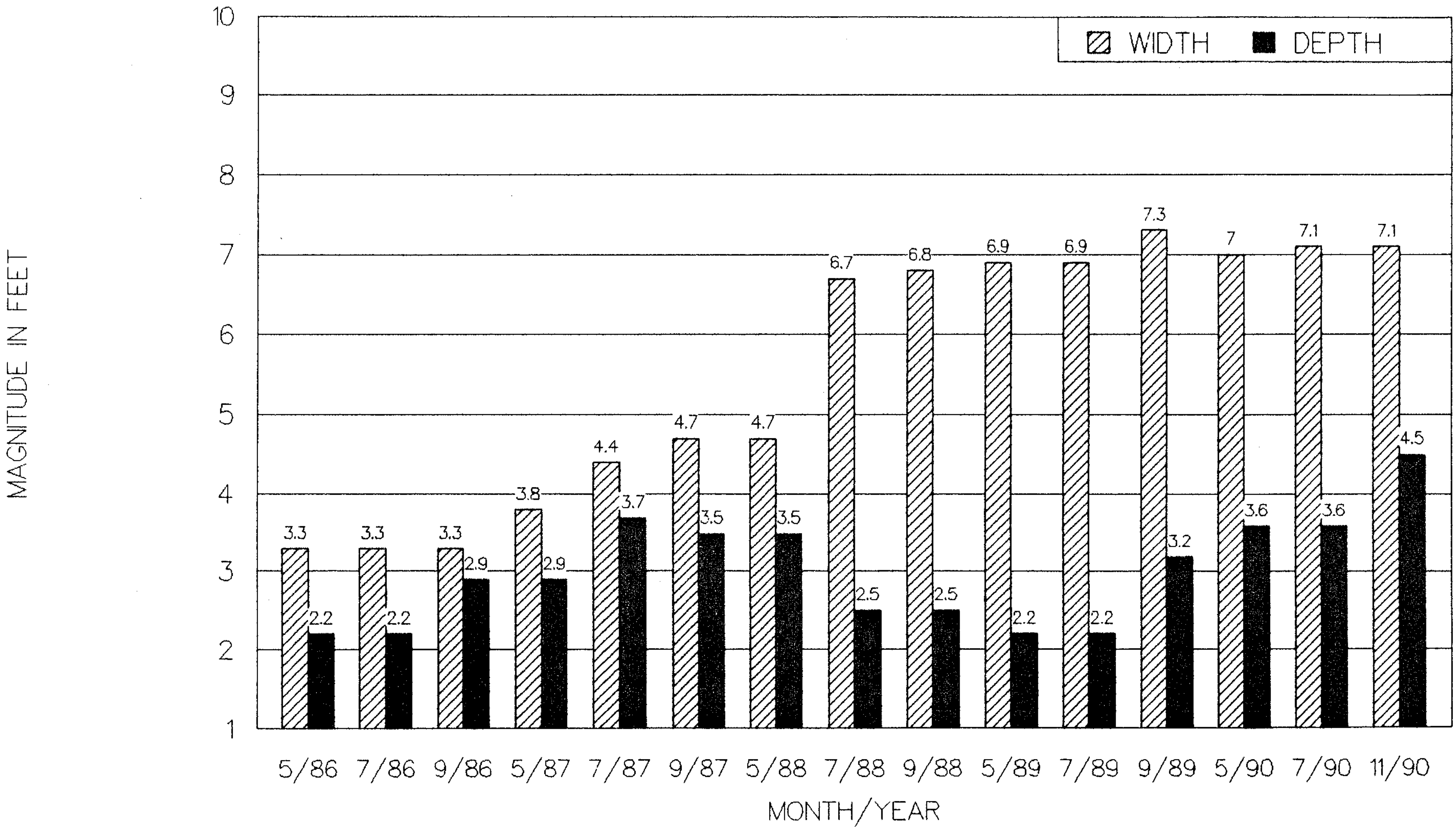
Job #5-462-90

DIRECT SHEAR TEST RESULTS

Fig. 3

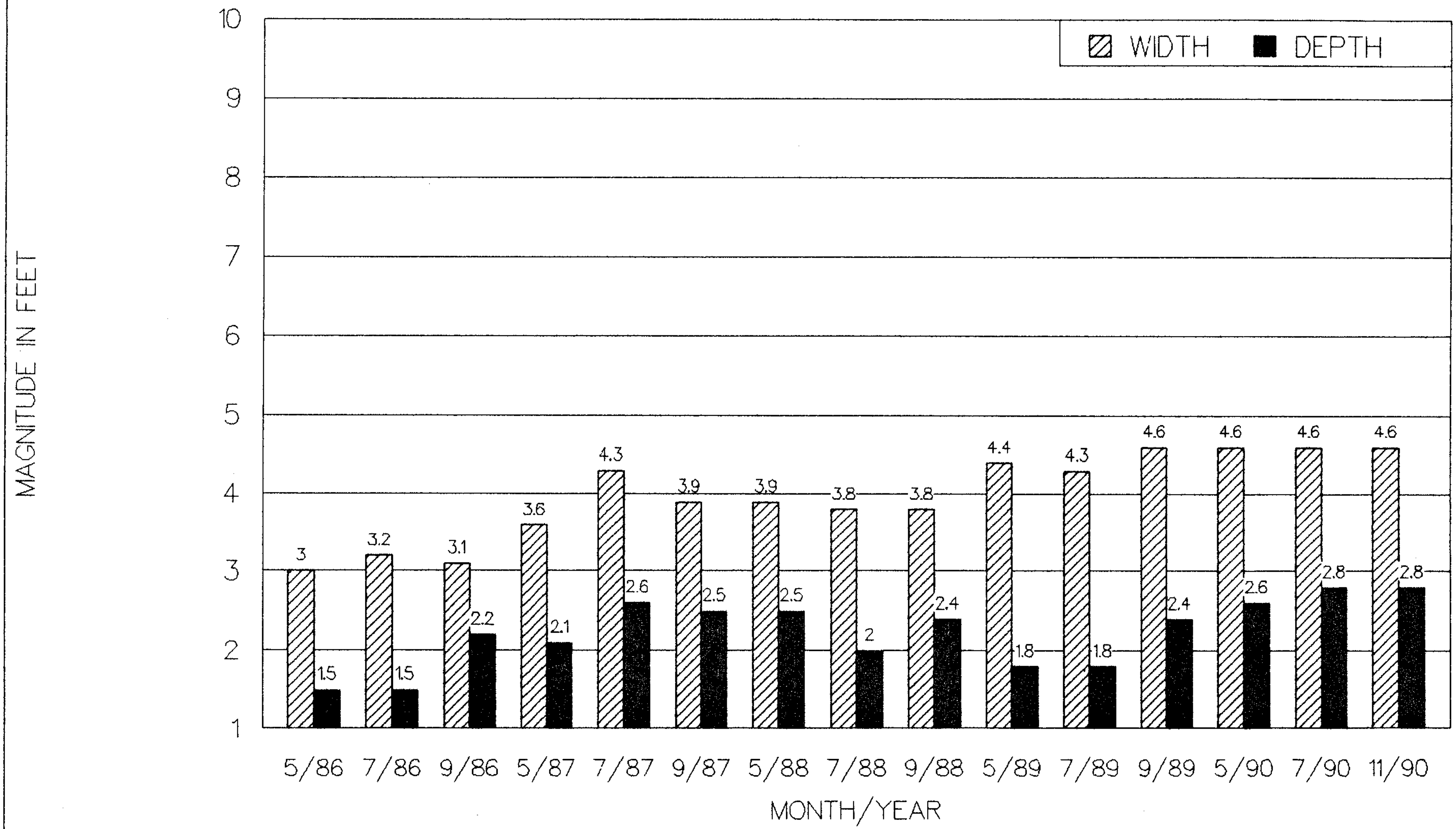
DES-BEE-DOVE HAUL ROAD EROSION
1986 THRU 1990

SITE 1



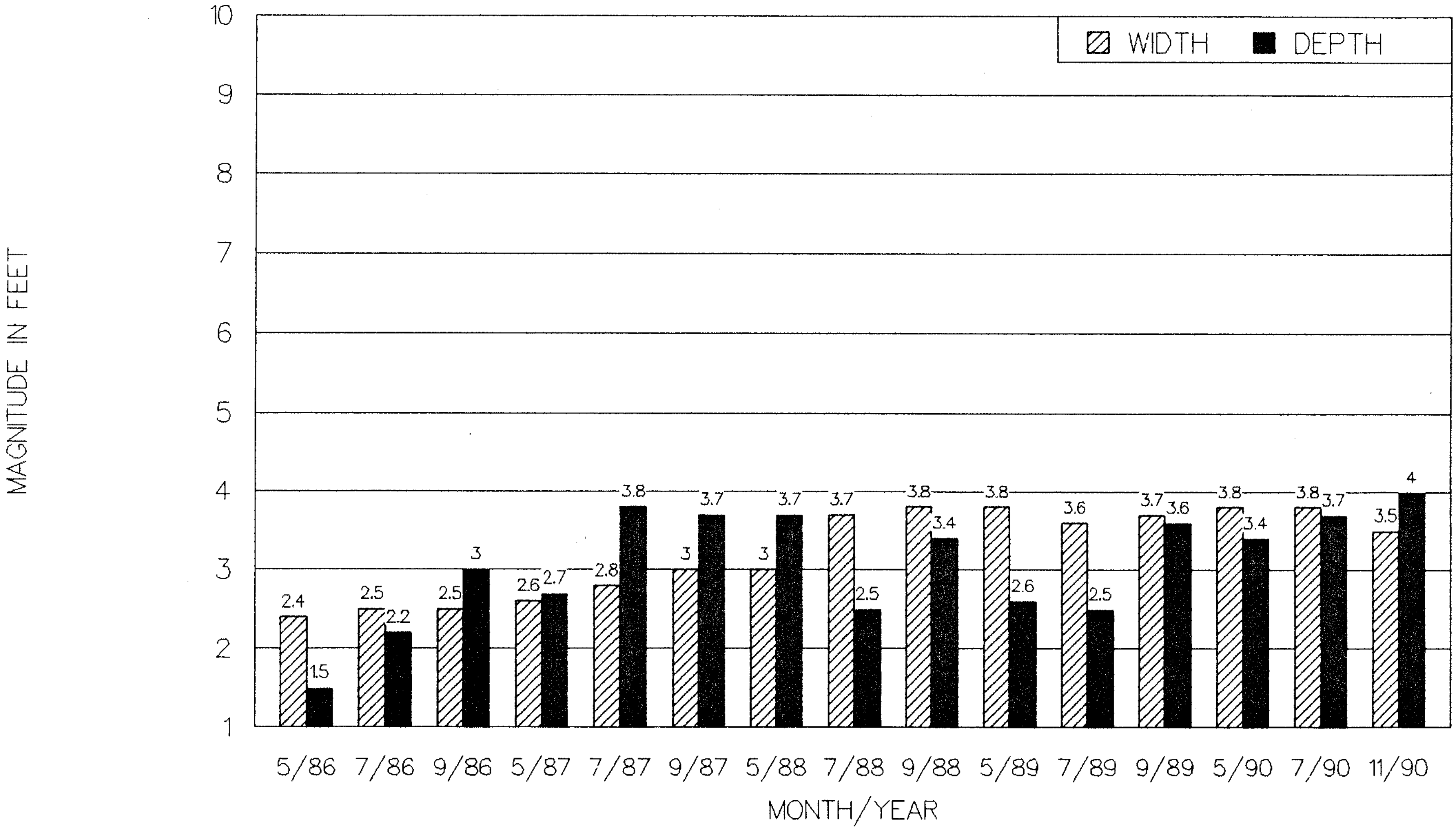
DES-BEE-DOVE HAUL ROAD EROSION
1986 THRU 1990

SITE 2



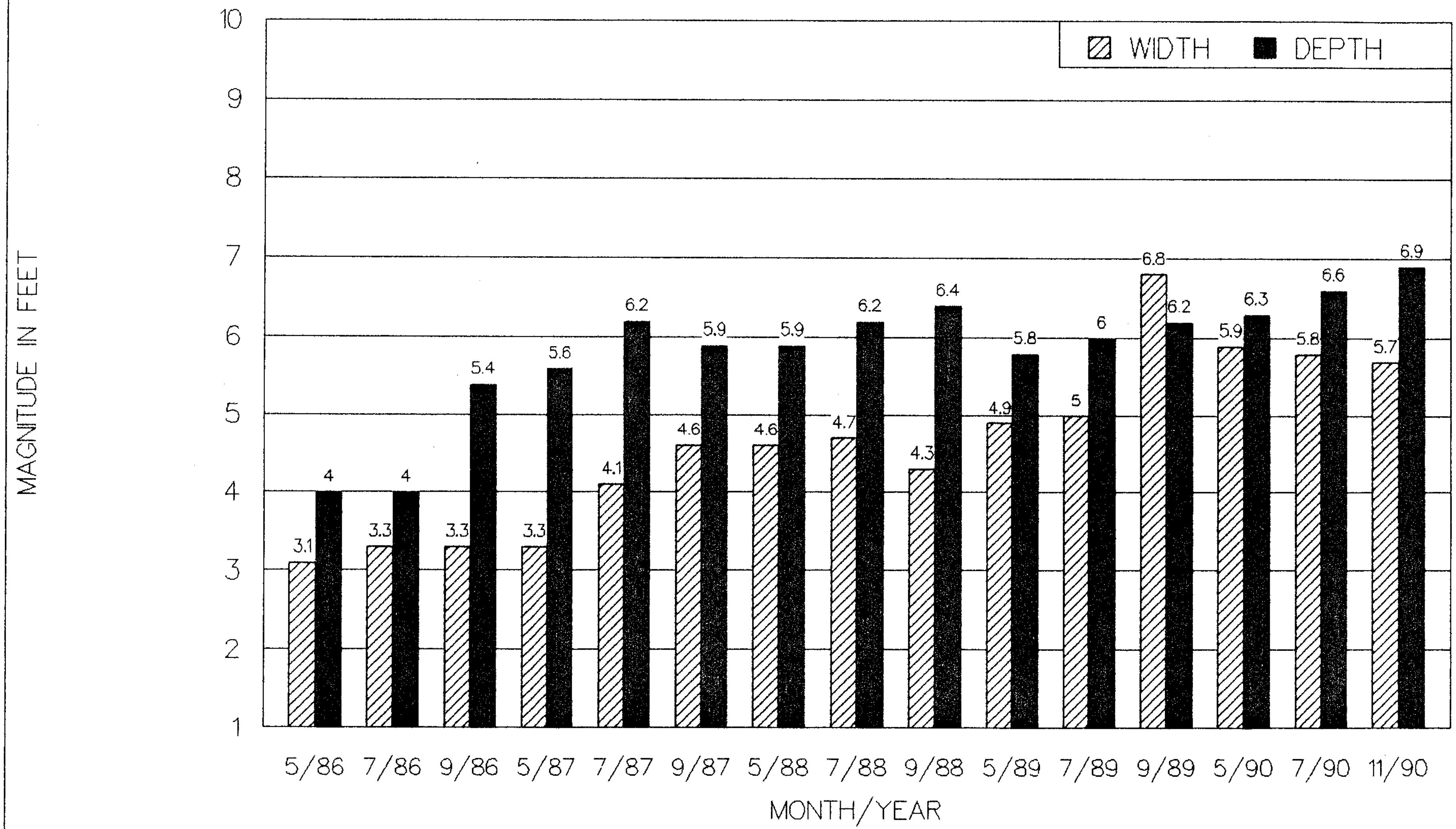
DES-BEE-DOVE HAUL ROAD EROSION
1986 THRU 1990

SITE 3



DES–BEE–DOVE HAUL ROAD EROSION
1986 THRU 1990

SITE 4



PHASE III DESIGN DEVELOPMENT

The primary objective of the reclamation study is to determine the reclaimability potential of the disturbed Mancos shale and to assess the effectiveness of the reclamation methodologies outlined in the Des Bee Dove Permit Application Package.

A secondary objective is the stabilization of erosion rills and gullies.

Effective reclamation will preferably include revegetation. Establishment of a vegetative cover will help to reduce and control erosion.

Existing site characteristics create marginal conditions for revegetation. These characteristics include; climatic factors (lack of precipitation and southwestern exposure, lack of topsoil, existing soil characteristics (low essential elements, high salinity, high sulfur and chloride, poor texture).

Similar characteristics existed at the Emery Coal Field (BLM EMRIA Report No. 16). Measures to address these factors included admixing of better soil materials or power plant fly ash with the existing soil. Proper admixing may dilute high soil elements and supplement low ones.

In addition to dilution, admixing with fly ash or other materials of less density than the Mancos, results in improved physical characteristics including increased pore volume, moisture availability and air capacity.

Admixtures proposed for the haul road test plots (See Map Cm-10602-DS Sheet 1 of 3) include better quality soil and coal spoil materials. Fly ash is not proposed because the elements which it would add to the Mancos (i.e. copper, zinc, calcium) are present in adequate concentrations. It is felt that the other admixtures are more suitable for improving the physical characteristics of the Mancos.

The potential for coal spoil materials to support vegetation has been observed at various abandoned mine refuse piles. Therefore, it appears that this material is a viable admixture.

Observations of natural conditions indicate that a mixture of soil and Mancos also supports vegetation.

The following procedures are proposed for admixing of materials at the haul road test plot site (refer to page 28):

1* Sample and analyze natural mancos/shale sites which support vegetation.

2* Sample and analyze coal spoil sites which support vegetation.

3* Sample and analyze coal waste material at the Cottonwood Waste Rock Site.

4* Sample and analyze the soil (Mancos) at the haul road site.

*Analyses will include the following parameters:

Texture (% sand, silt clay)
SAR (meq/l)
pH (standard units)
Ec (mmhos/cm)
Saturation Percentage (%)
Organic Carbon (%)
Total N (%)
Available Phosphorus (mg/Kg)
Available Potassium (mg/Kg)
Water Extractable Boron (mg/Kg)
Water Extractable Selenium (mg/Kg)
Acid-Base Potential
Available Water (%)
    1/3 and 15 atmospheres
Soluble Ca, Mg and Na (meq/l)

5 Apply admixtures/or amendments to approximate conditions at natural vegetated mancos sites.

6 Incorporate adequate quantities of admixtures or amendments into top 12 to 18 inches of the mancos soil at the test plot sites to simulate soil conditions at natural vegetated mancos sites.

7 Sample and analyze test plot sites (per parameter list) to determine similarity with natural areas.

Following incorporation of admixtures and amendments at the test plots, contour ditches will be constructed across the entire test plot area. The ditches will be installed at 11 foot intervals from the top of the slope to the bottom. The ditches will completely retain the runoff at the test plot resulting from a 10 yr/6 hr storm event (see pages 31 and 32).

Following construction of the contour ditches the following seed mixture will be hand broadcast on the entire test plot. The seed will be covered by hand raking.

Agropyron dasystachyum	thickspike wheatgrass	3
A. smithii	western wheatgrass	4
Oryzopsis hymenoides	Indian ricegrass	3
Elymus cinereus	basin wildrye	4
Sporobolus airoides	alkali sakatoon	.25
Melilotus officinalis	yellow sweetclover	2

Linum lewisii	Lewis Flax	1
Sphaeralcea grossularifolia	globemallow	.5
Atriplex canescens	fourwing saltbush	2
A. corrugata	mat saltbush	2
A. confertifolia	shadscale	1
Ceratoides lanata	winterfat	2
Kochia prostrata	prostrata kochia	.5
	Total (PLS/Acre)	25.25

Following seeding, the various mulch treatments will be applied as indicated on page 28.

A standard 4 wire field fence will be installed to protect the test plots from disturbance by livestock.

A rip-rap lined ditch and dirt berm will be installed along the crest of the slope above the test plot area. The ditch is sized to adequately carry runoff from a 10 yr/6 hr storm event (see pages 33 thru 38).

The test plots will be monitored as described in the Des Bee Dove Permit Application Package.

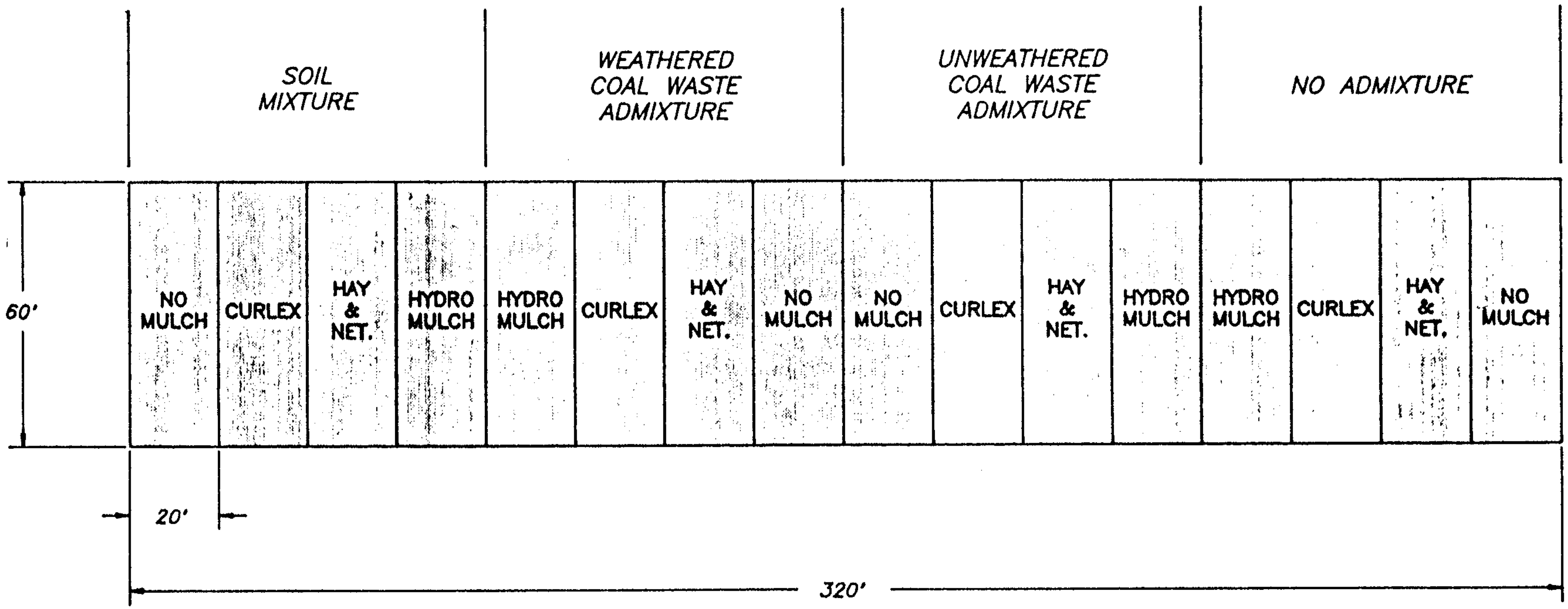
The present erosion monitoring program will continue at the four(4) established sites (see Map CM-10602-DS sheet 1 of 3). The current monitoring data seems to indicate gully development toward equalibrium at several sites similar to that discussed in BLM Technical Note 366. Data will be obtained from areas where naturally stable channels exist on slopes similar to the haul road slope. The geometric configuration of these natural channels will be determined and a comparison made between them and the erosion channels on the haul road slope.

The feasibility of constructing a simulated natural channel at the sites of haul road erosion will be determined. Construction of such a channel may include the various gully control structures as discussed in USFS Research Paper RM-169, pages 12 thru 31. If feasible, construction of the down slope channel would include attempts to establish vegetation as a means of channel stabilization.

Technical information will continue to be collected as well as site specific monitoring data. All information will be used to evaluate the effectiveness of reclamation measures installed and to identify possible alternatives, if necessary, for final reclamation of the haul road.

Additionally, as stated in the Des Bee Dove PAP, vegetation test plots will be established at several additional fill slope sites along the haul road. These sites will provide information on the suitability of the fill material for final reclamation of the haul road in soils other than the mancos.

DES–BEE–DOVE HAUL ROAD
RECLAMATION TEST PLOTS



CAD FILE NAME/DISK#: HAULRD KL7

PACIFICORP ELECTRIC OPERATIONS
FUEL RESOURCES DEPARTMENT
P.O. BOX 26128 SALT LAKE CITY, UTAH 84126–0128

DES–BEE–DOVE
HAUL ROAD RECLAMATION STUDY
VEGETATION TEST PLOTS

DRAWN BY:	K. LARSEN	CS1284A	
SCALE:	1" =40'	DRAWING #:	
DATE:	MARCH 5, 1991	SHEET 1 OF 1	REV. ___

DES BEE DOVE HAUL ROAD

HYDROLOGICAL ANALYSIS

Rainfall depth for a 10 yr/6 hr storm event was determined from US Dept. of Commerce, NOAA Atlas 2, 1973.

The rainfall-runoff relation for the test plot slope was determined as discussed in SCS National Engineering Handbook, 1972, Section 4, Hydrology, Chapter 10.

The peak runoff values for the riprapped crest ditch were calculated by use of the "Storm Hydrograph Program" by Richard H. Hawkins and Kim A. Marshall, September 1979, Utah State University Foundation. The drainage area was determined based on final reclamation topography of the haul road from Station 121+00 to 142+00.

The design of the crest ditch is based on Manning's equation for open channels. The design channel is a trapezoid shape with 1:2 side slopes and a 2 feet bottom width. The value for Manning's N for the rip-rap channel lining was taken from A Compliance Manual, Methods for Meeting OSM Requirements, by Skelly and Loy, 1979, page 7-16.

The channel capacity was determined as outline in Utah State DOT Manual of Instructions, Part 4 - Road Drainage, 1984, pages 3-22 and 3-32.

The rip-rap ditch lining design was based on the procedure in Applied Hydrology and Sedimentology for Disturbed Areas, by B.J. Barfield, R.C. Warner and C.T. Haan, Oklahoma Technical Press, 1981.

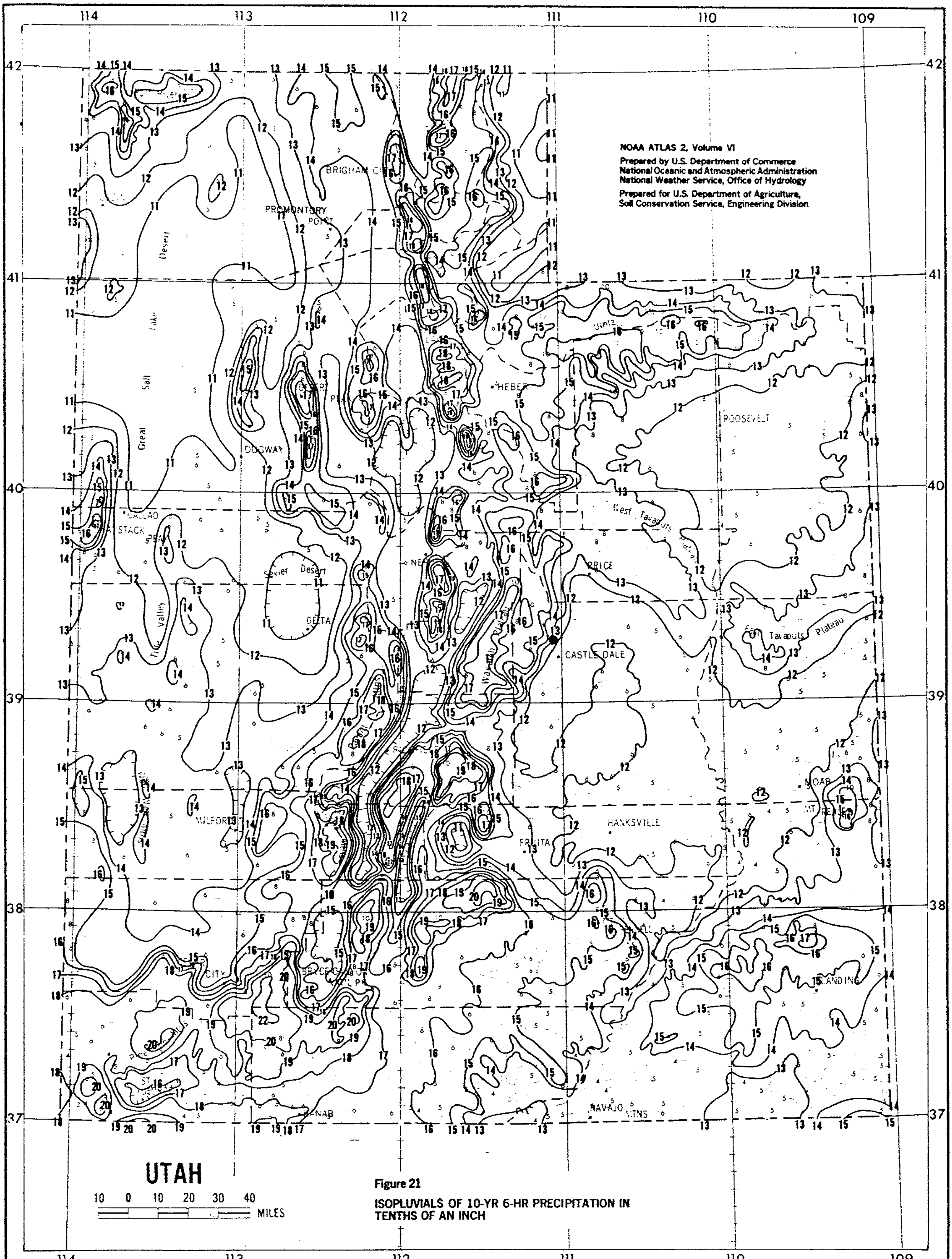


Figure 21

ISOPLUVIALS OF 10-YR 6-HR PRECIPITATION IN TENTHS OF AN INCH

DES BEE DOVE HAUL ROAD
STORM RUNOFF VALUES FOR 10 YEAR, 6 HOUR EVENT

RAINFALL DEPTH 1.3 INCHES

DISTRIBUTION: SOIL CONSERVATION SERVICE TYPE II

CN: 98

RAINFALL-RUNOFF RELATION, TEST PLOT SLOPE

$$Q = \frac{(P - 0.2\ S)^2}{P + 0.8\ S}$$

WHERE: $P = 1.3''$

$$S = \frac{1000}{CN} - 10 = .204$$

$$Q = \frac{(1.3 - 0.2\ (.204))^2}{1.3 + 0.8\ (.204)}$$

$Q = 1.09\ IN/FT^2$

TEST PLOT AREA = 320' X 60' = 19,200 FT^2

TOTAL RUNOFF = 1744 CU.FT.

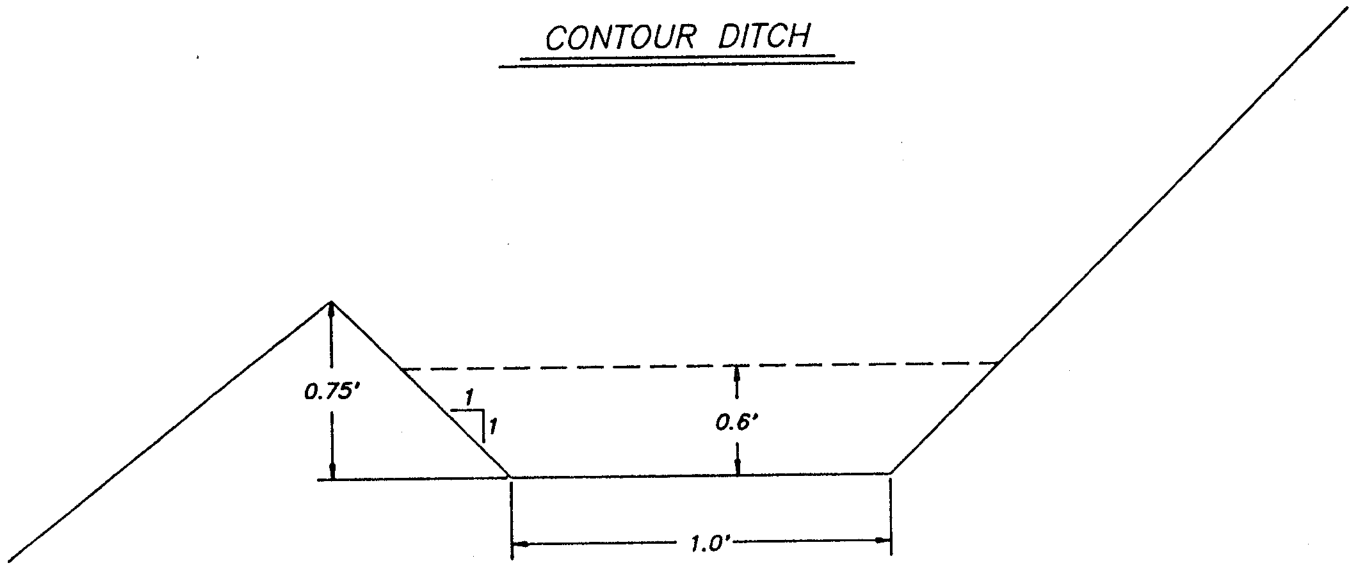
CONTOUR DITCHES CAPACITY = 1 CU.FT./ 1 FT. LENGTH

CAPACITY OF EACH DITCH = 320 CU.FT.

LENGTH OF SLOPE = 60 FT.

SPACING OF DITCHES = 11 FT.

CONTOUR DITCH



CAPACITY = 1 FT^3 PER LINEAR FT

CAD FILE NAME/DISK#: HAULRD KL7

PACIFICORP ELECTRIC OPERATIONS
FUEL RESOURCES DEPARTMENT
P.O. BOX 26128 SALT LAKE CITY, UTAH 84126-0128

DES-BEE-DOVE
HAUL ROAD RECLAMATION STUDY
CONTOUR DITCH - TYP. CROSS SECTION

DRAWN BY: K. LARSEN	CS1286A	
SCALE: NONE	DRAWING #:	
DATE: MARCH 5, 1991	SHEET 1 OF 1	REV.

TABLE

STORM RUNOFF DETERMINATION
FOR
DBD HAUL ROAD
CREST DITCH

INPUT SUMMARY:

DISTRIBUTION = SCS TYPE II
RAINFALL DEPTH = 1.3 INCHES
STORM DURATION = 6 HOURS
RUNOFF AREA = .02 SQ. MILES
RUNOFF CURVE NO. = 98
TIME OF CONCENTRATION = .03 HRS.

HYDROGRAPH ORDINATES:

TIME (HR)	PPT (IN)	CUM. FLOW (IN)	DEL. FLOW (IN)	FLOW RATE (IN/HR)	FLOW RATE (CFS)
0.00	0.00	0.0000	0.0000	0.0000	0.00
0.00	0.00	0.0000	0.0000	0.0000	0.00
0.01	0.00	0.0000	0.0000	0.0000	0.00
0.01	0.00	0.0000	0.0000	0.0000	0.00
0.02	0.00	0.0000	0.0000	0.0000	0.00
0.02	0.00	0.0000	0.0000	0.0000	0.00
2.98	0.84	0.6347	0.0048	1.1955	15.43
2.99	0.84	0.6395	0.0048	1.1961	15.44
2.99	0.85	0.6443	0.0048	1.1966	15.44
3.00	0.85	0.6491	0.0048	1.1972	15.45
3.00	0.86	0.6539	0.0016	1.1977	15.46
3.00	0.86	0.6555	0.0016	1.1744	15.16
3.01	0.86	0.6571	0.0016	1.1271	14.55
3.01	0.86	0.6587	0.0016	1.0558	13.63
3.02	0.86	0.6603	0.0016	0.9605	12.40
3.02	0.87	0.6619	0.0016	0.8412	10.86
6.04	1.30	1.0836	0.0000	0.0036	0.05
6.04	1.30	1.0836	0.0000	0.0015	0.02
6.05	1.30	1.0836	0.0000	0.0003	0.00
6.05	1.30	1.0836	0.0000	0.0000	0.00
6.06	1.30	1.0836	0.0000	0.0000	0.00
6.06	1.30	1.0836	0.0000	0.0000	0.00
6.06	0.00	0.0000	0.0000	0.0000	0.00

OUTPUT SUMMARY:

TOTAL RUNOFF DEPTH = 1.084 IN.
INITIAL ABSTRACTION = .041 IN.
PEAK FLOW = 15.503 CFS
TIME TO PEAK = 2.998 HOURS
RUNOFF VOLUME CHECK = 1.086 IN.

CREST DITCH CAPACITY CALCULATIONS

$$K' = \frac{Qn}{b^{8/3}\, s^{1/2}}$$

WHERE:

Q = 15.503 CFS
n = 0.0395 (Manning's n for rip-rap)
s = 0.08
b = 2'

K' = 0.302

FROM CHART (PAGE 36) - CAPACITY OF TRAPEZOIDAL CHANNEL

$$\frac{d}{b} = .34$$

d = b(d/b)

d = .68 ft.

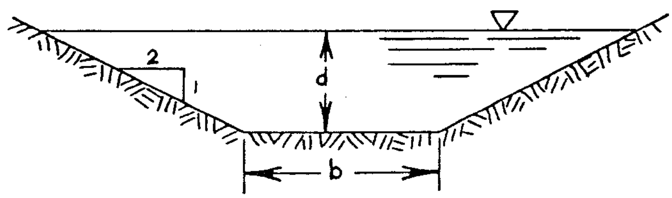
THEREFORE; CREST DITCH WILL CARRY THE PEAK RUNOFF OF 15.503 CFS WITH APPROXIMATELY 0.3' FREEBOARD.

A filter layer will be placed beneath the rip-rap channel lining materials. The filter will consist of 2 inch minus road base material and will be placed in a layer equal in thickness to the D_{50} size of the ditch.

VALUES OF $b^{8/3}$

b	$b^{8/3}$	b	$b^{8/3}$
1	1.00	21	3360
2	6.35	22	3800
3	18.7	23	4280
4	40.3	24	4790
5	73.1	25	5340
6	119	26	5930
7	179	27	6560
8	256	28	7230
9	350	29	7940
10	464	30	8690
11	598	31	9840
12	755	32	10320
13	934	33	11200
14	1140	34	12130
15	1370	35	13110
16	1630	36	14160
17	1910	37	15176
18	2230	38	16320
19	7940	39	17466
20	2950	40	18732

Table 3-22: TRAPEZOIDAL CHANNEL
2:1 SIDE SLOPES

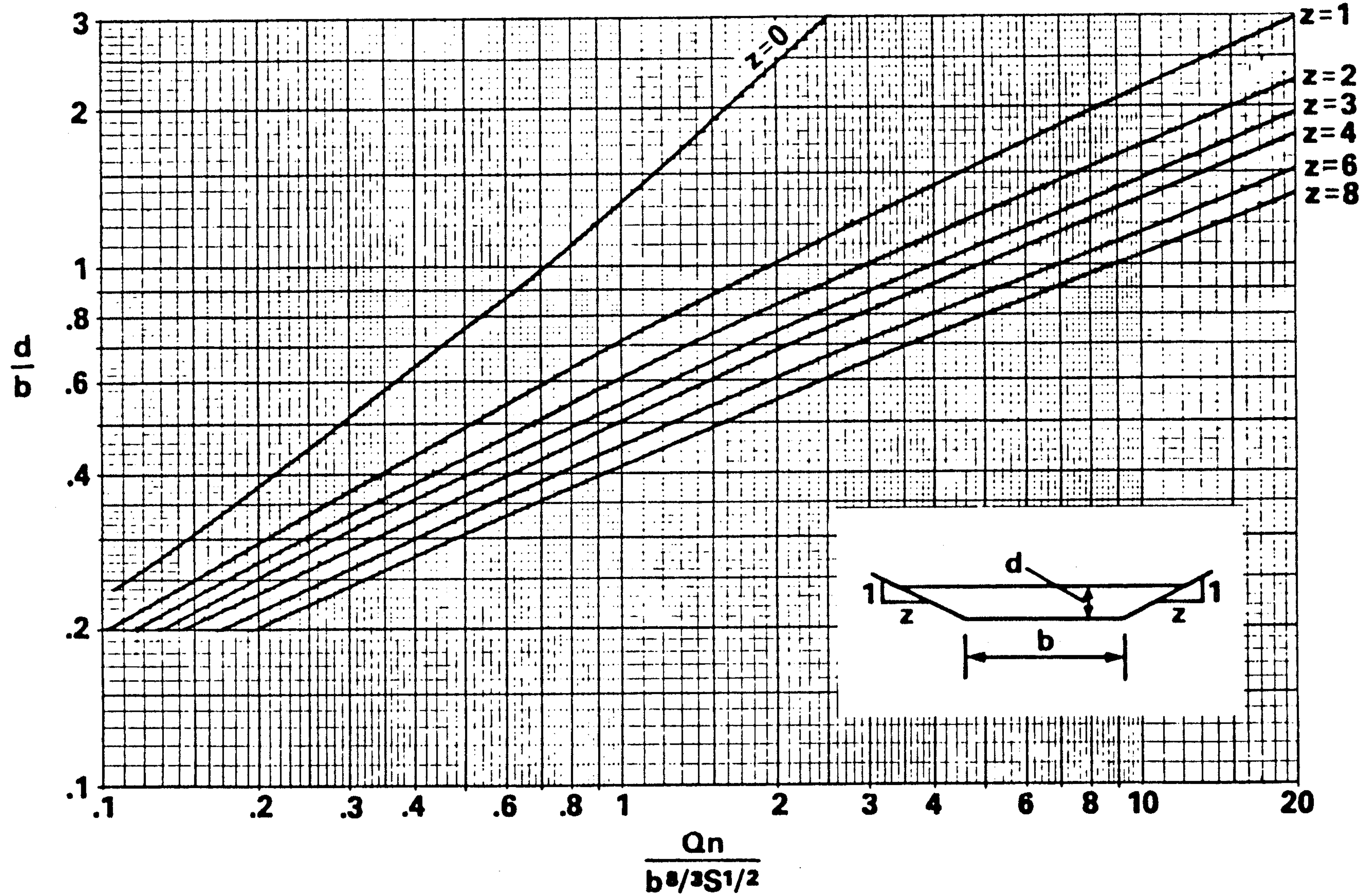


1. Calculate $K' = \dfrac{Qn}{b^{8/3}s^{1/2}}$
2. Enter the table below at K′ and find the corresponding value of d/b.
3. Calculate d = b(d/b).

Values of K′ as a function of the ratio d/b.

d/b	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.20	.116	.127	.139	.150	.163	.176	.189	.203	.217	.232
0.30	.248	.264	.281	.298	.316	.334	.353	.372	.392	.413
0.40	.434	.456	.478	.501	.525	.549	.574	.599	.625	.652
0.50	.679	.707	.736	.765	.795	.826	.857	.889	.922	.956
0.60	.990	1.02	1.06	1.10	1.13	1.17	1.21	1.25	1.29	1.33
0.70	1.37	1.41	1.46	1.50	1.54	1.59	1.63	1.68	1.73	1.78
0.80	1.83	1.88	1.93	1.98	2.03	2.08	2.14	2.19	2.25	2.31
0.90	2.36	2.42	2.48	2.54	2.60	2.66	2.73	2.79	2.85	2.92
1.00	2.99	3.05	3.12	3.19	3.26	3.33	3.40	3.48	3.55	3.62
1.10	3.70	3.78	3.85	3.93	4.01	4.09	4.17	4.25	4.34	4.42
1.20	4.51	4.59	4.68	4.77	4.86	4.95	5.04	5.13	5.22	5.32
1.30	5.41	5.51	5.61	5.71	5.81	5.91	6.01	6.11	6.21	6.32
1.40	6.42	6.53	6.64	6.75	6.86	6.97	7.09	7.20	7.31	7.43
1.50	7.54	7.66	7.78	7.90	8.02	8.15	8.27	8.40	8.52	8.65
1.60	8.78	8.91	9.04	9.17	9.30	9.44	9.57	9.71	9.85	9.99
1.70	10.1	10.3	10.4	10.6	10.7	10.8	11.0	11.1	11.3	11.4
1.80	11.6	11.7	11.9	12.1	12.2	12.4	12.5	12.7	12.9	13.0
1.90	13.2	13.4	13.5	13.7	13.9	14.0	14.2	14.4	14.6	14.7
2.00	14.9	15.1	15.3	15.5	15.6	15.8	16.0	16.2	16.4	16.6
2.10	16.8	17.0	17.2	17.4	17.6	17.8	18.0	18.2	18.4	18.6

Capacity of Trapezoidal Channel



R I P R A P   S I Z I N G   F O R
T R A P A Z O I D A L   D I T C H E S

ENTER LISTED PARAMETERS
1. FLOW RATE (CFS) 15.503
2. CHANNEL SLOPE .08
3. BOTTOM WIDTH (FT) 2
4. SIDE SLOPE .5
5. PHI ANGLE 42
6. SPECIFIC GRAVITY OF RIPRAP 2.65

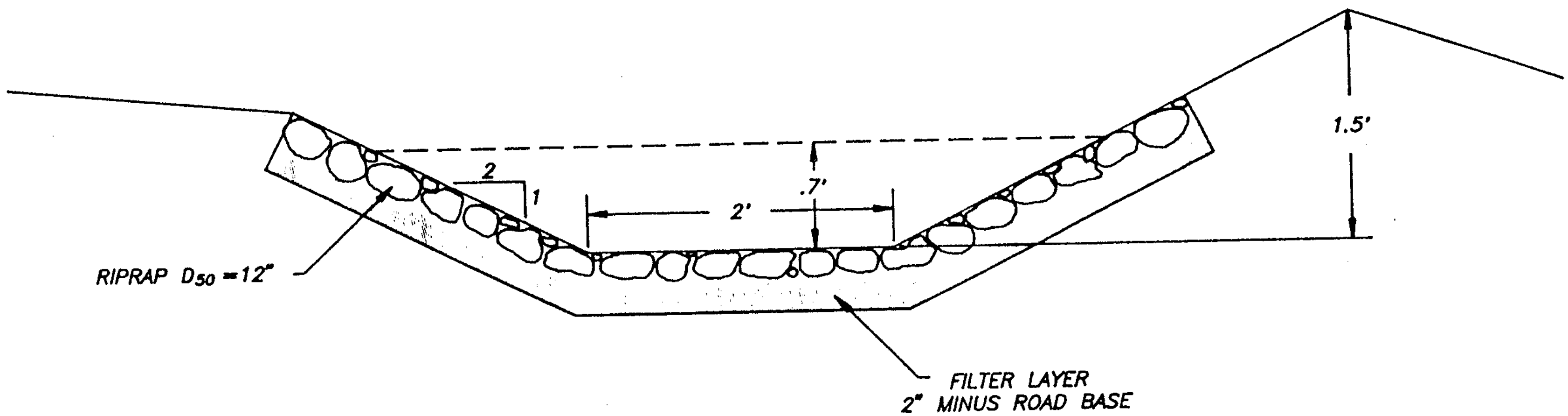
DESIRED SAFETY FACTOR FOR CHANNEL BOTTOM 1.0
DESIRED SAFETY FACTOR FOR CHANNEL BANKS 1.04

VELOCITY	DEPTH	D50	S.F. BTM	S.F. BANK
6.427	.707	.9985	1.232	1.04

RUN COMPLETE

Ok

CREST DITCH & BERM



CAD FILE NAME/DISK#: HAULRD KL7

PACIFICORP ELECTRIC OPERATIONS
FUEL RESOURCES DEPARTMENT
P.O. BOX 26128 SALT LAKE CITY, UTAH 84126-0128

DES-BEE-DOVE
HAUL ROAD RECLAMATION STUDY
CREST DITCH & BERM

DRAWN BY: K. LARSEN	CS1285A
SCALE: NONE	DRAWING #:
DATE: MARCH 5, 1991	SHEET 1 OF 1 — REV. __

DES BEE DOVE EROSION TASK FORCE

AGENDA

DATE: November 12th and 13th, 1991 (1 1/2 Days)

LOCATION: PacifiCorp Training Center
1/4 Mile South of Huntington Airport

OBJECTIVE: **TO RECEIVE WRITTEN CONSENSUS RECOMMENDATIONS FROM THE TASK FORCE. PACIFICORP MANAGEMENT WILL DEVELOP A PLAN TO SUBMIT TO DOGM FOR APPROVAL AND IMPLEMENTATION**

PART I: TRAINING CENTER - NOVEMBER 12th - 9:00 - 11:30 AM

Overview of Problem and Objective - Guy Davis

Slide Presentation of Site History - Guy Davis

Study Results:

Erosion Studies - Val Payne and Guy Davis

Vegetation/Erosion Study - DOGM

Reclamation Study Overview - Val Payne

Test Plots - Val Payne and DOGM

Application to Interim Problem Solution - Guy Davis

BREAK: LUNCH AND TRAVEL TO MINE SITE 11:30 AM - 1:00 PM
(Lunch Provided by PacifiCorp)

PART II: FIELD SITE 1:00 - 3:00 PM

Problem Analysis -

Tentative Solutions -

PART III: **TRAINING CENTER 3:30 - 5:00 PM**

Consensus Recommendations -

Written Recommendations -

Final Statement -

PART IV: **TRAINING CENTER - NOVEMBER 13TH - 9:00 - 11:30 AM**

Time allocated if consensus and written recommendations are not met on November 12th timeframe.

PACIFICORP
ELECTRIC OPERATIONS

ONE UTAH CENTER

201 SOUTH MAIN • SUITE 2100 • SALT LAKE CITY, UTAH 84140-0021 • (801) 220-2000

DATE: November 7, 1991

TO: TASK FORCE MEMBER

FROM: Guy Davis - PacifiCorp *Guy*

SUBJECT: **DES BEE DOVE EROSION TASK FORCE**

Thank you for accepting this Task Force position. To help familiarize you with the area that the Task Force will be looking at, a brief history of what has occurred and future activities will be helpful.

A haul road was completed for the Des Bee Dove Mine in the Spring of 1983 which connected Highway 57 with the Danish Bench county road. The roadway was constructed for coal haulage from the mine to the Hunter Plant without going through the residential area of Orangeville.

Construction required the disturbance of the mancos shale to a large dugway which created cutslope and fillslope areas. This geologic formation (mancos shale) is very erodible with very limited revegetation capability.

Erosion in the fillslope areas has occurred in many locations. The larger erosion which is now present is the combination of 8 1/2 years of minor erosion and large > 10 yr/24 hr precipitation events. The first large event to this road area is recorded on 8-12-81 and caused erosion throughout the mine area particularly in this mancos location. Other violations were issued to the operator in following years concerning the erosion issue with abatement requirements met. The main abatement requirements were the establishment of the belt conveyor along the road guardrail, cut off ditches, installation of strawbale/silt fence filters on the pond access road and monitoring 4 locations at the crest of the main erosion site on May, July and September for width and depth measurements. Monitoring of the erosion sites are continuing. Seeding of the area was done in the fall of 1986 by the operator.

In the fall of 1989 a test plot area was located, on which a newly developed tackifier, soil additive and sulfur were applied along with seeding, in an attempt to reduce erosion and increase vegetation. The plots are still being monitored and conclusions are still pending.

In the recent past, another violation has been issued to PacifiCorp for not controlling erosion on the location. Part of the abatement of this violation is to establish interim erosion control on the mancos area. Berming and waterbarring of the pad area just above the largest erosion area is being done at this time. This action will capture the runoff from the pad for containment of a 10 yr/24 hr event. Plans for runoff control of another smaller area has been submitted to the Division of Oil, Gas and Mining.

FUTURE PLOTS

Future test plots are planned adjacent to the 1989 test plot area to help determine final reclamation methods. These plots will test several soil additives including sulfuric acid. Results of these plots may aid in interim soil stabilization. Feasibility of the study and other amendments to the study are in the process. Additional information and discussion of the proposed plots will be presented in the November 12th meeting.

If there are any questions, please call me at 653-2312.

Des Bee Dove Meeting 11/12/91

Name	Agency
Bill Malencik	DOGM
Henry Sauer	DOGM
George S. Cook	Soil Con. Service
Leland D. Hasser	Soil Cons. Service
Susan White	DOGM
Ken Wyatt	DOGM
Val Payne	PacifiCorp
Dale Grange	Energy West
Dennis Worwood	Extension Service - USU
Jess Kelley	DOGM
Guy Davis	PacifiCorp

PACIFICORP

ONE UTAH CENTER
201 SOUTH MAIN • SUITE 2100 • SALT LAKE CITY, UTAH 84140-0021 • (801) 220-2000

DATE: November 13, 1991

TO: Task Force Member

FROM: Guy Davis

SUBJECT: CONSENSUS RECOMMENDATIONS FROM NOVEMBER 12, 1991 MEETING AND FIELD VISIT

I am enclosing the notes which were taken at the afternoon session of the task force during our 11-12-91 meeting. These notes are what I understand to be the group consensus recommendations. If there are any comments to the stated recommendations, please call me at 653-2312.

CONSENSUS RECOMMENDATIONS:

1. Interim erosion has been minimized at the site by the recent berm and waterbar installation. The operator will continue to monitor the 4 erosion study locations at the crest of the slope area in May, July and September. In addition, photos of the slope will be taken annually at the bottom of the area during the fall of the year.

2. Test plots on the pad's recently disturbed berm and waterbars will be initiated in the fall of '92. Plots will be monitored annually by visual observation and photos. Soil testing will be done at the commencement and end of the plot schedule. Vegetative monitoring for density, cover and diversity will be done during the 3rd growing season. Vegetative productivity will be monitored at the end of the test plot schedule. Proposed treatments to the plots will be discussed and agreed upon by the operator and DOGM.

3. Future test plots on the outslope area will be considered after reviewing results of the '92 test plots on the pad area.

4. The disturbed pad area will be seeded in the fall of '91 with 30 pounds/acre of Annual ryegrass for further interim erosion control. No mulch or fertilizer will be applied.

5. Transplants for the '92 test plots will be discussed by the operator and DOGM. Probable planting in spring of '93.

6. **Native seed planting is a proposed plot treatment. If this treatment is agreed upon, the seed collecting must start in the summer of '92.**

DES-BEE-DOVE HAULROAD RECLAMATION STUDY
RUNOFF AND SEDIMENT YIELD MONITORING PROGRAM

The runoff and sediment yield monitoring program will consist of two phases. During the first phase, the development of the 1992 test plots (see map CM-10602-D5), staff gages will be installed in the trough areas within each type of application. Visual inspections will be made after precipitation events to document the effectiveness of the different types of applications. The second phase of the project will involve applying the applications based on the contoured ditched area to the proposed sloped test plot area. A total sediment collection will be installed to analyze the sediment yield from each type of application. Each type of application will be separated by a barrier of wood or metal to isolate each area. Runoff and sediment yield will be diverted to a collection system designed to accommodate a 10 year/24 hour precipitation event. Each collection system will consist of a container sized for a precipitation event of less than one inch and an overflow contained sized for a 10y/24h event. The following formulas will be utilized to determine the necessary volume once the size of the test plots has been determined.

Total Runoff Volume Calculation:

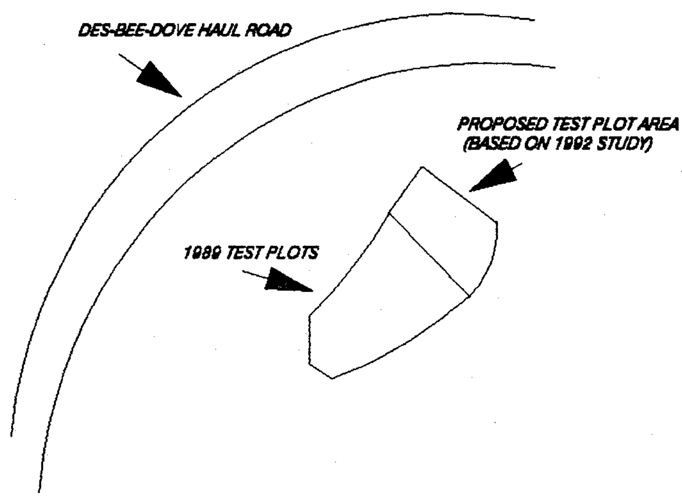
Area = dependent on the number of applications
Curve Number = 89, Range, Poor, Soil Group D
Precipitation Event = 10y/24h, 2.0 inches

$S = (1000/CN) - 10$
$Q = (P - 0.2S)^2 /P + 0.8S$

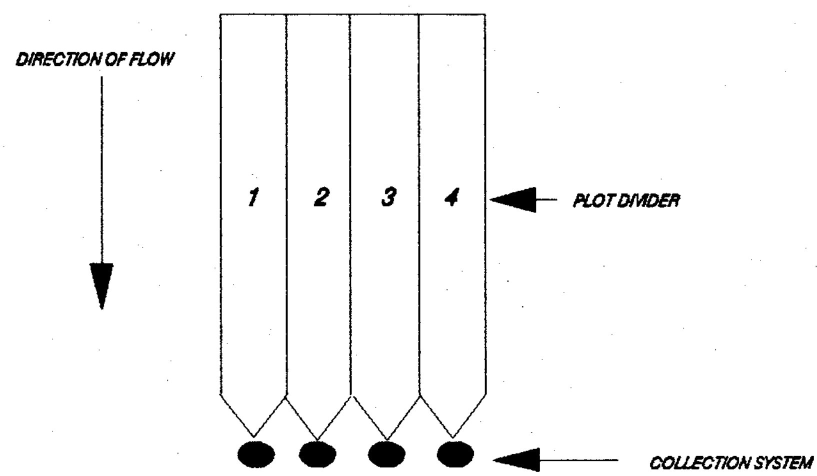
S = Infiltration Depth
CN = Curve Number
Q = Runoff in inches, ft^2

Precipitation will be monitored utilizing a recording rain gage and compared to the sediment yield from each type of application. Sediment yield from the test plots will be determined from dried weighing of samples. Since each application will be similar in nature, i.e. type of soil, slope, length, and area, direct comparisons of the sediment yield from each type of application can then be made along with comparisons to the precipitation events.

DES-BEE-DOVE HAULROAD RECLAMATION STUDY
RUNOFF AND SEDIMENT YIELD MONITORING PROGRAM
PROPOSED TEST PLOTS



CONCEPTUAL TEST PLOT CONFIGURATION



Sediment Collection System

Test plot dimensions will be based on the number of applications selected from the 1992 test plot study. By modifying designs used by Jackson[1], each test plot will be approximately 10 feet wide and approximately 100 feet long (the length will be dependent on the final site construction). Each plot will be divided-bordered by installing either boards or corrugated metal along the existing slope, approximately 1.5:1. A total sediment collection system will be designed to collect all the sediment and precipitation from a 10 year/24 hour event. Sediment and precipitation will be funneled to the collection system which will consist of two containers. The first container will be sized for precipitation events of 1.0 inch or less, the second for a 10 year/24 hour event. If a significant amount of sediment is collected in the first container, the total amount of sediment will be determined and compared to the amount of precipitation. If the storm event exceeds the first container, the overflow will collected in the second container and the amount of sediment will be determined calculating the total sediment solids in the runoff water.

[1] William L. Jackson, Karla Knoop, Joseph J. Szalona and Shirley Hudson, "A Runoff and Soil-loss Monitoring Technique Using Paried Plots," Technical Note 368, USDI Bureau of Land Management, Denver, CO, August, 1985

The grouted rip-rap spillway, depicted in Drawing No. 5, is considered to meet the requirements of R645(R614)-301-742.223.1 for non-erodible construction. The following calculations of flows in the narrowest (8' bottom width) portion of the spillway result in a velocity of 24.9 fps.

TRAPEZOIDAL CHANNEL ANALYSIS & DESIGN[1]
OPEN CHANNEL - UNIFORM FLOW

Worksheet Name: DBD Pond Spillway
Comment: LOWER SECTION

Solve for Depth
Given Input Data:

Bottom Width	8.00 ft
Left Side Slope	1.50:1 (H:V)
Right Side Slope	1.50:1 (H:V)
Manning's n	0.025
Channel Slope	0.1500 ft/ft
Discharge	372.00 cfs

Computed Results:

Depth	1.47 ft
Velocity	24.90 fps
Flow Area	14.94 sq ft
Flow Top Width	12.40 ft
Wetted Perimeter	13.28 ft
Critical Depth	3.29 ft
Critical Slope	0.0079 ft/ft
Froude Number	4.00 (flow is Supercritical)

[1]Open Channel Flow Module, Version 3.21 (c) 1990
Haestad Methods, Inc. *37 Brookside Rd* Waterbury, CT 06708

The lack of documentation regarding maximum allowable velocities for grouted rip-rap channels limits the ability to assess the stability of the spillway based strictly on calculations. However, the spillway is examined at least quarterly, during the regular

sediment pond inspections. Any damaged areas observed during the inspections, or at other occasions, will be repaired. Any potential discharge from the pond will flow from the spillway onto natural bedrock. This will adequately serve as energy dissipation and erosion protection at the discharge point.

RECEIVED
APR 28 1992
DIVISION OF
OIL GAS & MINING

APPENDIX XII

ADDITION 4/24/92

CULVERT SIZING

DITCH SIZING

REFERENCE DRAWING

CM-10421-DS, SHEET 1 OF 2

VOLUME 3, PACKET 3-8

DES BEE DOVE DRAINAGE AREA SUMMARY

DBD DA-2

1. See Table DBD DA-2
   (OSM Storm, Version 6.21)

2. Curve Number - 85 (Chart A)

3. Storm Design - 10 yr/6 hr (R645-301-743.300)

4. Peak Discharge - 5.12 cfs

DBD DA-3

1. See Table DBD DA-3
   (OSM Storm, Version 6.21)

2. Curve Number - 98 (Chart A)

3. Storm Design - 10 yr/6 hr (R645-301-743.300)

4. Peak Discharge - .60 cfs

DBD DA-4

1. See Table DBD DA-4
   (OSM Storm, Version 6.21)

2. Curve Number - 98 (Chart A)

3. Storm Design - 10 yr/6 hr (R645-301-743.300)

4. Peak Discharge - .42 cfs

DBD DA-5

1. See Table DBD DA-5
   (OSM Storm, Version 6.21)

2. Curve Number - 90 (Chart A)

3. Storm Design - 10 yr/6 hr (R645-301-743.300)

4. Peak Discharge - 1.3 cfs

DBD DA-6

1. See Table DBD DA-6
(OSM Storm, Version 6.21)

2. Curve Number - 85 (Chart A)

3. Storm Design - 10 yr/6 hr (R645-301-743.300)

4. Peak Discharge - 2.99 cfs

DBD DA-7

1. See Table DBD DA-7
(OSM Storm, Version 6.21)

2. Curve Number - 90 (Chart A)

3. Storm Design - 10 yr/6 hr (R645-301-743.300)

4. Peak Discharge - .77 cfs

DBD DA-8

1. See Table DBD DA-8
(OSM Storm, Version 6.21)

2. Curve Number - 85 (Chart A)

3. Storm Design - 10 yr/6 hr (R645-301-743.300)

4. Peak Discharge - 7.81 cfs

DBD DA-9

1. See Table DBD DA-9
(OSM Storm, Version 6.21)

2. Curve Number - 85 (Chart A)

3. Storm Design - 10 yr/6 hr (R645-301-743.300)

4. Peak Discharge - .25 cfs

DBD DA-10

1. See Table DBD DA-10
   (OSM Storm, Version 6.21)

2. Curve Number - 85 (Chart A)

3. Storm Design - 10 yr/6 hr (R645-301-743.300)

4. Peak Discharge - .17 cfs

DBD DA-11

1. See Table DBD DA-11
   (OSM Storm, Version 6.21)

2. Curve Number - 85 (Chart A)

3. Storm Design - 10 yr/6 hr (R645-301-743.300)

4. Peak Discharge - .21 cfs

DBD DA-12

1. See Table DBD DA-12
   (OSM Storm, Version 6.21)

2. Curve Number - 85 (Chart A)

3. Storm Design - 10 yr/6 hr (R645-301-743.300)

4. Peak Discharge - .38 cfs

Table 9.1.--Runoff curve numbers for hydrologic soil-cover complexes

(Antecedent moisture condition II, and I_a = 0.2 S)

Land use	Cover: Treatment or practice	Cover: Hydrologic condition	Hydrologic soil group A	B	C	D
Fallow	Straight row	----	77	86	91	94
Row crops	"	Poor	72	81	88	91
	"	Good	67	78	85	89
	Contoured	Poor	70	79	84	88
	"	Good	65	75	82	86
	"and terraced	Poor	66	74	80	82
	" " "	Good	62	71	78	81
Small grain	Straight row	Poor	65	76	84	88
		Good	63	75	83	87
	Contoured	Poor	63	74	82	85
		Good	61	73	81	84
	"and terraced	Poor	61	72	79	82
		Good	59	70	78	81
Close-seeded legumes 1/ or rotation meadow	Straight row	Poor	66	77	85	89
	" "	Good	58	72	81	85
	Contoured	Poor	64	75	83	85
	"	Good	55	69	78	83
	"and terraced	Poor	63	73	80	83
	"and terraced	Good	51	67	76	80
Pasture or range		Poor	68	79	86	89
		Fair	49	69	79	84
		Good	39	61	74	80
	Contoured	Poor	47	67	81	88
	"	Fair	25	59	75	83
	"	Good	6	35	70	79
Meadow		Good	30	58	71	78
Woods		Poor	45	66	77	83
		Fair	36	60	73	79
		Good	25	55	70	77
Farmsteads		----	59	74	82	86
Roads (dirt) 2/		----	72	82	87	89
(hard surface) 2/		---	74	84	90	92

1/ Close-drilled or broadcast.
2/ Including right-of-way.

FROM "NEH" SECTION 4

Project Title = DBD DA-2
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

--- Watershed data for watershed # 1
Curve number = 85.0
Area = 18.2 acres
Hydraulic length = 1450.00 Feet
Elevation change = 900.0 feet
Concentration time = 0.05 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

--- Total Area = 18.2 acres

--- Storm data
Total precipitation = 1.3 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 5.12 cfs
Discharge volume = 0.50 acre ft

time (hr.)	rainfall (in.)	hydrograph (cfs)		time (hr.)	rainfall (in.)	hydrograph (cfs)
0.00	0.000	0.000	*	0.10	0.008	0.000
0.20	0.008	0.000	*	0.30	0.008	0.000
0.40	0.008	0.000	*	0.50	0.008	0.000
0.60	0.012	0.000	*	0.70	0.012	0.000
0.80	0.012	0.000	*	0.90	0.012	0.000
1.00	0.012	0.000	*	1.10	0.014	0.000
1.20	0.014	0.000	*	1.30	0.014	0.000
1.40	0.014	0.000	*	1.50	0.014	0.000
1.60	0.025	0.000	*	1.70	0.025	0.000
1.80	0.025	0.000	*	1.90	0.025	0.000
2.00	0.025	0.000	*	2.10	0.097	0.123
2.20	0.097	1.259	*	2.30	0.097	2.656
2.40	0.097	3.966	*	2.50	0.097	5.115
2.60	0.026	2.352	*	2.70	0.026	1.873
2.80	0.026	1.739	*	2.90	0.026	1.802
3.00	0.026	1.863	*	3.10	0.021	1.611
3.20	0.021	1.591	*	3.30	0.021	1.608
3.40	0.021	1.643	*	3.50	0.021	1.677
3.60	0.014	1.281	*	3.70	0.014	1.216
3.80	0.014	1.204	*	3.90	0.014	1.219
4.00	0.014	1.234	*	4.10	0.013	1.139
4.20	0.013	1.129	*	4.30	0.013	1.133
4.40	0.013	1.144	*	4.50	0.013	1.155
4.60	0.010	0.995	*	4.70	0.010	0.969
4.80	0.010	0.965	*	4.90	0.010	0.972
5.00	0.010	0.978	*	5.10	0.009	0.906
5.20	0.009	0.896	*	5.30	0.009	0.897
5.40	0.009	0.902	*	5.50	0.009	0.907
5.60	0.010	0.993	*	5.70	0.010	1.014
5.80	0.010	1.026	*	5.90	0.010	1.032
6.00	0.010	1.038	*	6.10	0.000	0.215

Project Title = DBD DA-3
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

--- Watershed data for watershed # 1
Curve number = 98.0
Area = 0.7 acres
Hydraulic length = 290.00 Feet
Elevation change = 10.0 feet.
Concentration time = 0.04 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

--- Total Area = 0.7 acres

--- Storm data
Total precipitation = 1.3 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.60 cfs
Discharge volume = 0.06 acre ft

time (hr.)	rainfall (in.)	hydrograph (cfs)		time (hr.)	rainfall (in.)	hydrograph (cfs)
0.00	0.000	0.000	*	0.10	0.008	0.000
0.20	0.008	0.000	*	0.30	0.008	0.000
0.40	0.008	0.000	*	0.50	0.008	0.000
0.60	0.012	0.004	*	0.70	0.012	0.012
0.80	0.012	0.019	*	0.90	0.012	0.025
1.00	0.012	0.031	*	1.10	0.014	0.038
1.20	0.014	0.044	*	1.30	0.014	0.048
1.40	0.014	0.052	*	1.50	0.014	0.055
1.60	0.025	0.096	*	1.70	0.025	0.110
1.80	0.025	0.118	*	1.90	0.025	0.123
2.00	0.025	0.127	*	2.10	0.097	0.452
2.20	0.097	0.540	*	2.30	0.097	0.575
2.40	0.097	0.589	*	2.50	0.097	0.598
2.60	0.026	0.247	*	2.70	0.026	0.178
2.80	0.026	0.163	*	2.90	0.026	0.163
3.00	0.026	0.164	*	3.10	0.021	0.138
3.20	0.021	0.133	*	3.30	0.021	0.132
3.40	0.021	0.132	*	3.50	0.021	0.132
3.60	0.014	0.099	*	3.70	0.014	0.092
3.80	0.014	0.091	*	3.90	0.014	0.091
4.00	0.014	0.091	*	4.10	0.013	0.083
4.20	0.013	0.082	*	4.30	0.013	0.081
4.40	0.013	0.081	*	4.50	0.013	0.081
4.60	0.010	0.069	*	4.70	0.010	0.067
4.80	0.010	0.066	*	4.90	0.010	0.067
5.00	0.010	0.067	*	5.10	0.009	0.061
5.20	0.009	0.060	*	5.30	0.009	0.060
5.40	0.009	0.060	*	5.50	0.009	0.060
5.60	0.010	0.065	*	5.70	0.010	0.066
5.80	0.010	0.067	*	5.90	0.010	0.067
6.00	0.010	0.067	*	6.10	0.000	0.013

Project Title = DBD DA-4
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

--- Watershed data for watershed # 1
Curve number = 98.0
Area = 0.6 acres
Hydraulic length = 230.00 Feet
Elevation change = 10.0 feet.
Concentration time = 0.03 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

--- Total Area = 0.6 acres

--- Storm data
Total precipitation = 1.3 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.42 cfs
Discharge volume = 0.05 acre ft

time (hr.)	rainfall (in.)	hydrograph (cfs)		time (hr.)	rainfall (in.)	hydrograph (cfs)
0.00	0.000	0.000	*	0.10	0.008	0.000
0.20	0.008	0.000	*	0.30	0.008	0.000
0.40	0.008	0.000	*	0.50	0.008	0.000
0.60	0.012	0.003	*	0.70	0.012	0.009
0.80	0.012	0.014	*	0.90	0.012	0.018
1.00	0.012	0.022	*	1.10	0.014	0.027
1.20	0.014	0.031	*	1.30	0.014	0.034
1.40	0.014	0.036	*	1.50	0.014	0.038
1.60	0.025	0.068	*	1.70	0.025	0.078
1.80	0.025	0.082	*	1.90	0.025	0.086
2.00	0.025	0.089	*	2.10	0.097	0.325
2.20	0.097	0.388	*	2.30	0.097	0.402
2.40	0.097	0.411	*	2.50	0.097	0.418
2.60	0.026	0.162	*	2.70	0.026	0.114
2.80	0.026	0.114	*	2.90	0.026	0.114
3.00	0.026	0.114	*	3.10	0.021	0.095
3.20	0.021	0.092	*	3.30	0.021	0.092
3.40	0.021	0.092	*	3.50	0.021	0.092
3.60	0.014	0.068	*	3.70	0.014	0.063
3.80	0.014	0.063	*	3.90	0.014	0.063
4.00	0.014	0.064	*	4.10	0.013	0.058
4.20	0.013	0.057	*	4.30	0.013	0.057
4.40	0.013	0.057	*	4.50	0.013	0.057
4.60	0.010	0.048	*	4.70	0.010	0.046
4.80	0.010	0.046	*	4.90	0.010	0.046
5.00	0.010	0.046	*	5.10	0.009	0.043
5.20	0.009	0.042	*	5.30	0.009	0.042
5.40	0.009	0.042	*	5.50	0.009	0.042
5.60	0.010	0.046	*	5.70	0.010	0.047
5.80	0.010	0.047	*	5.90	0.010	0.047
6.00	0.010	0.047	*	6.10	0.000	0.007

APPENDIX XII

ADDED 4/24/92

TABLE DBD DA-5

Project Title = DBD DA-5
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

--- Watershed data for watershed # 1
Curve number = 90.0
Area = 2.7 acres
Hydraulic length = 700.00 Feet
Elevation change = 75.0 feet.
Concentration time = 0.06 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

--- Total Area = 2.7 acres

--- Storm data
Total precipitation = 1.3 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 1.30 cfs
Discharge volume = 0.12 acre ft

time (hr.)	rainfall (in.)	hydrograph (cfs)		time (hr.)	rainfall (in.)	hydrograph (cfs)
0.00	0.000	0.000	*	0.10	0.008	0.000
0.20	0.008	0.000	*	0.30	0.008	0.000
0.40	0.008	0.000	*	0.50	0.008	0.000
0.60	0.012	0.000	*	0.70	0.012	0.000
0.80	0.012	0.000	*	0.90	0.012	0.000
1.00	0.012	0.000	*	1.10	0.014	0.000
1.20	0.014	0.000	*	1.30	0.014	0.000
1.40	0.014	0.000	*	1.50	0.014	0.000
1.60	0.025	0.000	*	1.70	0.025	0.000
1.80	0.025	0.011	*	1.90	0.025	0.034
2.00	0.025	0.059	*	2.10	0.097	0.385
2.20	0.097	0.675	*	2.30	0.097	0.928
2.40	0.097	1.130	*	2.50	0.097	1.297
2.60	0.026	0.584	*	2.70	0.026	0.453
2.80	0.026	0.399	*	2.90	0.026	0.408
3.00	0.026	0.416	*	3.10	0.021	0.356
3.20	0.021	0.348	*	3.30	0.021	0.348
3.40	0.021	0.352	*	3.50	0.021	0.356
3.60	0.014	0.272	*	3.70	0.014	0.257
3.80	0.014	0.251	*	3.90	0.014	0.253
4.00	0.014	0.255	*	4.10	0.013	0.235
4.20	0.013	0.232	*	4.30	0.013	0.231
4.40	0.013	0.233	*	4.50	0.013	0.234
4.60	0.010	0.201	*	4.70	0.010	0.195
4.80	0.010	0.194	*	4.90	0.010	0.194
5.00	0.010	0.195	*	5.10	0.009	0.181
5.20	0.009	0.178	*	5.30	0.009	0.177
5.40	0.009	0.178	*	5.50	0.009	0.179
5.60	0.010	0.195	*	5.70	0.010	0.199
5.80	0.010	0.201	*	5.90	0.010	0.201
6.00	0.010	0.202	*	6.10	0.000	0.044

APPENDIX XII

ADDED 4/24/92

Project Title = DBD DA-6
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

--- Watershed data for watershed # 1
Curve number = 85.0
Area = 10.5 acres
Hydraulic length = 1410.00 Feet
Elevation change = 610.0 feet.
Concentration time = 0.06 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

--- Total Area = 10.5 acres

--- Storm data
Total precipitation = 1.3 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 2.99 cfs
Discharge volume = 0.29 acre ft

time (hr.)	rainfall (in.)	hydrograph (cfs)		time (hr.)	rainfall (in.)	hydrograph (cfs)
0.00	0.000	0.000	*	0.10	0.008	0.000
0.20	0.008	0.000	*	0.30	0.008	0.000
0.40	0.008	0.000	*	0.50	0.008	0.000
0.60	0.012	0.000	*	0.70	0.012	0.000
0.80	0.012	0.000	*	0.90	0.012	0.000
1.00	0.012	0.000	*	1.10	0.014	0.000
1.20	0.014	0.000	*	1.30	0.014	0.000
1.40	0.014	0.000	*	1.50	0.014	0.000
1.60	0.025	0.000	*	1.70	0.025	0.000
1.80	0.025	0.000	*	1.90	0.025	0.000
2.00	0.025	0.000	*	2.10	0.097	0.071
2.20	0.097	0.730	*	2.30	0.097	1.542
2.40	0.097	2.315	*	2.50	0.097	2.994
2.60	0.026	1.402	*	2.70	0.026	1.130
2.80	0.026	1.022	*	2.90	0.026	1.060
3.00	0.026	1.096	*	3.10	0.021	0.950
3.20	0.021	0.939	*	3.30	0.021	0.946
3.40	0.021	0.966	*	3.50	0.021	0.986
3.60	0.014	0.757	*	3.70	0.014	0.719
3.80	0.014	0.708	*	3.90	0.014	0.717
4.00	0.014	0.726	*	4.10	0.013	0.671
4.20	0.013	0.666	*	4.30	0.013	0.667
4.40	0.013	0.673	*	4.50	0.013	0.680
4.60	0.010	0.587	*	4.70	0.010	0.572
4.80	0.010	0.568	*	4.90	0.010	0.572
5.00	0.010	0.576	*	5.10	0.009	0.534
5.20	0.009	0.528	*	5.30	0.009	0.528
5.40	0.009	0.531	*	5.50	0.009	0.534
5.60	0.010	0.583	*	5.70	0.010	0.596
5.80	0.010	0.604	*	5.90	0.010	0.607
6.00	0.010	0.611	*	6.10	0.000	0.134

APPENDIX XII

ADDED 4/24/92

Project Title = DBD DA-7
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

--- Watershed data for watershed # 1
Curve number = 90.0
Area = 1.6 acres
Hydraulic length = 760.00 Feet
Elevation change = 115.0 feet.
Concentration time = 0.05 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

--- Total Area = 1.6 acres

--- Storm data
Total precipitation = 1.3 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.77 cfs
Discharge volume = 0.07 acre ft

time (hr.)	rainfall (in.)	hydrograph (cfs)		time (hr.)	rainfall (in.)	hydrograph (cfs)
0.00	0.000	0.000	*	0.10	0.008	0.000
0.20	0.008	0.000	*	0.30	0.008	0.000
0.40	0.008	0.000	*	0.50	0.008	0.000
0.60	0.012	0.000	*	0.70	0.012	0.000
0.80	0.012	0.000	*	0.90	0.012	0.000
1.00	0.012	0.000	*	1.10	0.014	0.000
1.20	0.014	0.000	*	1.30	0.014	0.000
1.40	0.014	0.000	*	1.50	0.014	0.000
1.60	0.025	0.000	*	1.70	0.025	0.000
1.80	0.025	0.007	*	1.90	0.025	0.021
2.00	0.025	0.035	*	2.10	0.097	0.230
2.20	0.097	0.403	*	2.30	0.097	0.552
2.40	0.097	0.672	*	2.50	0.097	0.771
2.60	0.026	0.343	*	2.70	0.026	0.264
2.80	0.026	0.237	*	2.90	0.026	0.242
3.00	0.026	0.247	*	3.10	0.021	0.211
3.20	0.021	0.206	*	3.30	0.021	0.206
3.40	0.021	0.209	*	3.50	0.021	0.211
3.60	0.014	0.161	*	3.70	0.014	0.152
3.80	0.014	0.149	*	3.90	0.014	0.150
4.00	0.014	0.151	*	4.10	0.013	0.139
4.20	0.013	0.137	*	4.30	0.013	0.137
4.40	0.013	0.138	*	4.50	0.013	0.139
4.60	0.010	0.119	*	4.70	0.010	0.116
4.80	0.010	0.115	*	4.90	0.010	0.115
5.00	0.010	0.116	*	5.10	0.009	0.107
5.20	0.009	0.106	*	5.30	0.009	0.105
5.40	0.009	0.106	*	5.50	0.009	0.106
5.60	0.010	0.116	*	5.70	0.010	0.118
5.80	0.010	0.119	*	5.90	0.010	0.119
6.00	0.010	0.120	*	6.10	0.000	0.025

APPENDIX XII

ADDED 4/24/92

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Project Title          = DBD DA-8
WATERSHED HYDROGRAPH
     Inflow into structure #  1
     Structure type:          Null


--- Watershed data for watershed # 1
    Curve number               =     85.0
    Area                       =     26.9 acres
    Hydraulic length           = 2000.00 Feet
    Elevation change           =   1100.0 feet.
    Concentration time         =     0.07 hours
    Concentration time type = SCS Upland Curves
    Unit hydrograph type       = Disturbed

--- Total Area            =     26.9 acres

--- Storm data
    Total precipitation  =      1.3 inches
    Storm type           = SCS 6 hour design storm
    Peak Discharge       =     7.81 cfs
    Discharge volume     =     0.74 acre ft
```

time (hr.)	rainfall (in.)	hydrograph (cfs)		time (hr.)	rainfall (in.)	hydrograph (cfs)
0.00	0.000	0.000	*	0.10	0.008	0.000
0.20	0.008	0.000	*	0.30	0.008	0.000
0.40	0.008	0.000	*	0.50	0.008	0.000
0.60	0.012	0.000	*	0.70	0.012	0.000
0.80	0.012	0.000	*	0.90	0.012	0.000
1.00	0.012	0.000	*	1.10	0.014	0.000
1.20	0.014	0.000	*	1.30	0.014	0.000
1.40	0.014	0.000	*	1.50	0.014	0.000
1.60	0.025	0.000	*	1.70	0.025	0.000
1.80	0.025	0.000	*	1.90	0.025	0.000
2.00	0.025	0.000	*	2.10	0.097	0.184
2.20	0.097	1.878	*	2.30	0.097	3.974
2.40	0.097	6.002	*	2.50	0.097	7.808
2.60	0.026	3.769	*	2.70	0.026	3.109
2.80	0.026	2.745	*	2.90	0.026	2.795
3.00	0.026	2.890	*	3.10	0.021	2.518
3.20	0.021	2.491	*	3.30	0.021	2.501
3.40	0.021	2.550	*	3.50	0.021	2.603
3.60	0.014	2.016	*	3.70	0.014	1.919
3.80	0.014	1.877	*	3.90	0.014	1.894
4.00	0.014	1.916	*	4.10	0.013	1.776
4.20	0.013	1.762	*	4.30	0.013	1.763
4.40	0.013	1.778	*	4.50	0.013	1.795
4.60	0.010	1.556	*	4.70	0.010	1.518
4.80	0.010	1.502	*	4.90	0.010	1.510
5.00	0.010	1.520	*	5.10	0.009	1.414
5.20	0.009	1.399	*	5.30	0.009	1.395
5.40	0.009	1.402	*	5.50	0.009	1.410
5.60	0.010	1.538	*	5.70	0.010	1.571
5.80	0.010	1.593	*	5.90	0.010	1.604
6.00	0.010	1.613	*	6.10	0.000	0.386

APPENDIX XII

ADDED 4/24/92

Project Title = DBD DA-9
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

-- Watershed data for watershed # 1
Curve number = 85.0
Area = 1.3 acres
Hydraulic length = 300.00 Feet
Elevation change = 135.0 feet.
Concentration time = 0.01 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 1.3 acres

-- Storm data
Total precipitation = 1.3 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.25 cfs
Discharge volume = 0.04 acre ft

time (hr.)	rainfall (in.)	hydrograph (cfs)		time (hr.)	rainfall (in.)	hydrograph (cfs)
0.00	0.000	0.000	*	0.10	0.008	0.000
0.20	0.008	0.000	*	0.30	0.008	0.000
0.40	0.008	0.000	*	0.50	0.008	0.000
0.60	0.012	0.000	*	0.70	0.012	0.000
0.80	0.012	0.000	*	0.90	0.012	0.000
1.00	0.012	0.000	*	1.10	0.014	0.000
1.20	0.014	0.000	*	1.30	0.014	0.000
1.40	0.014	0.000	*	1.50	0.014	0.000
1.60	0.025	0.000	*	1.70	0.025	0.000
1.80	0.025	0.000	*	1.90	0.025	0.000
2.00	0.025	0.000	*	2.10	0.097	0.006
2.20	0.097	0.065	*	2.30	0.097	0.135
2.40	0.097	0.198	*	2.50	0.097	0.252
2.60	0.026	0.106	*	2.70	0.026	0.081
2.80	0.026	0.084	*	2.90	0.026	0.087
3.00	0.026	0.090	*	3.10	0.021	0.077
3.20	0.021	0.076	*	3.30	0.021	0.077
3.40	0.021	0.079	*	3.50	0.021	0.081
3.60	0.014	0.060	*	3.70	0.014	0.057
3.80	0.014	0.058	*	3.90	0.014	0.059
4.00	0.014	0.059	*	4.10	0.013	0.054
4.20	0.013	0.054	*	4.30	0.013	0.055
4.40	0.013	0.055	*	4.50	0.013	0.056
4.60	0.010	0.047	*	4.70	0.010	0.046
4.80	0.010	0.046	*	4.90	0.010	0.047
5.00	0.010	0.047	*	5.10	0.009	0.043
5.20	0.009	0.043	*	5.30	0.009	0.043
5.40	0.009	0.043	*	5.50	0.009	0.044
5.60	0.010	0.048	*	5.70	0.010	0.049
5.80	0.010	0.049	*	5.90	0.010	0.050
6.00	0.010	0.050	*	6.10	0.000	0.008

Project Title = DBD DA-10
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

--- Watershed data for watershed # 1
Curve number = 85.0
Area = 0.9 acres
Hydraulic length = 210.00 Feet
Elevation change = 50.0 feet.
Concentration time = 0.01 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

--- Total Area = 0.9 acres

--- Storm data
Total precipitation = 1.3 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.17 cfs
Discharge volume = 0.02 acre ft

time (hr.)	rainfall (in.)	hydrograph (cfs)		time (hr.)	rainfall (in.)	hydrograph (cfs)
0.00	0.000	0.000	*	0.10	0.008	0.000
0.20	0.008	0.000	*	0.30	0.008	0.000
0.40	0.008	0.000	*	0.50	0.008	0.000
0.60	0.012	0.000	*	0.70	0.012	0.000
0.80	0.012	0.000	*	0.90	0.012	0.000
1.00	0.012	0.000	*	1.10	0.014	0.000
1.20	0.014	0.000	*	1.30	0.014	0.000
1.40	0.014	0.000	*	1.50	0.014	0.000
1.60	0.025	0.000	*	1.70	0.025	0.000
1.80	0.025	0.000	*	1.90	0.025	0.000
2.00	0.025	0.000	*	2.10	0.097	0.004
2.20	0.097	0.043	*	2.30	0.097	0.090
2.40	0.097	0.132	*	2.50	0.097	0.168
2.60	0.026	0.070	*	2.70	0.026	0.054
2.80	0.026	0.056	*	2.90	0.026	0.058
3.00	0.026	0.060	*	3.10	0.021	0.051
3.20	0.021	0.050	*	3.30	0.021	0.052
3.40	0.021	0.053	*	3.50	0.021	0.054
3.60	0.014	0.040	*	3.70	0.014	0.038
3.80	0.014	0.039	*	3.90	0.014	0.039
4.00	0.014	0.040	*	4.10	0.013	0.036
4.20	0.013	0.036	*	4.30	0.013	0.036
4.40	0.013	0.037	*	4.50	0.013	0.037
4.60	0.010	0.031	*	4.70	0.010	0.031
4.80	0.010	0.031	*	4.90	0.010	0.031
5.00	0.010	0.031	*	5.10	0.009	0.029
5.20	0.009	0.029	*	5.30	0.009	0.029
5.40	0.009	0.029	*	5.50	0.009	0.029
5.60	0.010	0.032	*	5.70	0.010	0.033
5.80	0.010	0.033	*	5.90	0.010	0.033
6.00	0.010	0.033	*	6.10	0.000	0.005

APPENDIX XII

ADDED 4/24/92

```
Project Title          = DBD DA-11
WATERSHED HYDROGRAPH
     Inflow into structure #  1
     Structure type:          Null


--- Watershed data for watershed # 1
    Curve number              =    85.0
    Area                      =     1.0 acres
    Hydraulic length          =  375.00 Feet
    Elevation change          =   140.0 feet.
    Concentration time        =    0.02 hours
    Concentration time type   = SCS Upland Curves
    Unit hydrograph type      = Disturbed

--- Total Area            =      1.0 acres

--- Storm data
    Total precipitation   =      1.3 inches
    Storm type            = SCS 6 hour design storm
    Peak Discharge        =      0.21 cfs
    Discharge volume      =      0.03 acre ft
```

time (hr.)	rainfall (in.)	hydrograph (cfs)		time (hr.)	rainfall (in.)	hydrograph (cfs)
0.00	0.000	0.000	*	0.10	0.008	0.000
0.20	0.008	0.000	*	0.30	0.008	0.000
0.40	0.008	0.000	*	0.50	0.008	0.000
0.60	0.012	0.000	*	0.70	0.012	0.000
0.80	0.012	0.000	*	0.90	0.012	0.000
1.00	0.012	0.000	*	1.10	0.014	0.000
1.20	0.014	0.000	*	1.30	0.014	0.000
1.40	0.014	0.000	*	1.50	0.014	0.000
1.60	0.025	0.000	*	1.70	0.025	0.000
1.80	0.025	0.000	*	1.90	0.025	0.000
2.00	0.025	0.000	*	2.10	0.097	0.005
2.20	0.097	0.052	*	2.30	0.097	0.110
2.40	0.097	0.161	*	2.50	0.097	0.205
2.60	0.026	0.087	*	2.70	0.026	0.066
2.80	0.026	0.068	*	2.90	0.026	0.071
3.00	0.026	0.073	*	3.10	0.021	0.063
3.20	0.021	0.062	*	3.30	0.021	0.063
3.40	0.021	0.064	*	3.50	0.021	0.066
3.60	0.014	0.049	*	3.70	0.014	0.047
3.80	0.014	0.047	*	3.90	0.014	0.048
4.00	0.014	0.048	*	4.10	0.013	0.044
4.20	0.013	0.044	*	4.30	0.013	0.044
4.40	0.013	0.045	*	4.50	0.013	0.045
4.60	0.010	0.039	*	4.70	0.010	0.038
4.80	0.010	0.038	*	4.90	0.010	0.038
5.00	0.010	0.038	*	5.10	0.009	0.035
5.20	0.009	0.035	*	5.30	0.009	0.035
5.40	0.009	0.035	*	5.50	0.009	0.036
5.60	0.010	0.039	*	5.70	0.010	0.040
5.80	0.010	0.040	*	5.90	0.010	0.040
6.00	0.010	0.041	*	6.10	0.000	0.006

APPENDIX XII

ADDED 4/24/92

Project Title = DBD DA-12
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

--- Watershed data for watershed # 1
Curve number = 85.0
Area = 1.9 acres
Hydraulic length = 410.00 Feet
Elevation change = 225.0 feet.
Concentration time = 0.02 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

--- Total Area = 1.9 acres

--- Storm data
Total precipitation = 1.3 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.38 cfs
Discharge volume = 0.05 acre ft

time (hr.)	rainfall (in.)	hydrograph (cfs)		time (hr.)	rainfall (in.)	hydrograph (cfs)
0.00	0.000	0.000	*	0.10	0.008	0.000
0.20	0.008	0.000	*	0.30	0.008	0.000
0.40	0.008	0.000	*	0.50	0.008	0.000
0.60	0.012	0.000	*	0.70	0.012	0.000
0.80	0.012	0.000	*	0.90	0.012	0.000
1.00	0.012	0.000	*	1.10	0.014	0.000
1.20	0.014	0.000	*	1.30	0.014	0.000
1.40	0.014	0.000	*	1.50	0.014	0.000
1.60	0.025	0.000	*	1.70	0.025	0.000
1.80	0.025	0.000	*	1.90	0.025	0.000
2.00	0.025	0.000	*	2.10	0.097	0.010
2.20	0.097	0.098	*	2.30	0.097	0.206
2.40	0.097	0.302	*	2.50	0.097	0.384
2.60	0.026	0.162	*	2.70	0.026	0.123
2.80	0.026	0.128	*	2.90	0.026	0.133
3.00	0.026	0.137	*	3.10	0.021	0.117
3.20	0.021	0.116	*	3.30	0.021	0.118
3.40	0.021	0.121	*	3.50	0.021	0.123
3.60	0.014	0.092	*	3.70	0.014	0.087
3.80	0.014	0.088	*	3.90	0.014	0.090
4.00	0.014	0.091	*	4.10	0.013	0.083
4.20	0.013	0.082	*	4.30	0.013	0.083
4.40	0.013	0.084	*	4.50	0.013	0.085
4.60	0.010	0.072	*	4.70	0.010	0.070
4.80	0.010	0.071	*	4.90	0.010	0.071
5.00	0.010	0.072	*	5.10	0.009	0.066
5.20	0.009	0.065	*	5.30	0.009	0.066
5.40	0.009	0.066	*	5.50	0.009	0.067
5.60	0.010	0.073	*	5.70	0.010	0.075
5.80	0.010	0.075	*	5.90	0.010	0.076
6.00	0.010	0.076	*	6.10	0.000	0.012

APPENDIX XII

ADDED 4/24/92

DITCH DESIGN SUMMARY

DD-1

- See Ditch Drainage Summary Sheet
- Length - 690 Feet
- Erosion Protection - Rip-rap to Fuel Area
  (See Drainage Ditch Rip-rap Summary)
- Carries Flows From Drainage Areas 5, 7, 8, 9, 10, & 11

DD-2

- See Ditch Drainage Summary Sheet
- Length - 460 Feet
- Erosion Protection - Pavement Bottom or Rip-rap
  (See Drainage Ditch Rip-rap Summary)
- Carries Flows From Drainage Areas 7 & 8

DD-3

- See Ditch Drainage Summary Sheet
- Length - 700 Feet
- Drains Area 8
- Erosion Protection - Bedrock with Natural Cobble and Boulder

DRAINAGE DITCH SUMMARY SHEET

```
Title of run: DD-1
    Solving for.................= CFS & FPS
Triangle
    Flow depth (ft)............=      1.00
    First Side slope...........=       2.0
    Second Side slope..........=       2.0
    Slope of diversion.........=    0.0900
    Manning"s n................=     0.035
    CFS........................=     14.94
    Cross section area (sqft)..=      2.00
    Hydrualic radius...........=      0.45
    fps........................=      7.47
    Froude number..............=      1.97
```

```
Title of run: DD-2
    Solving for.................= CFS & FPS
Parabola
    Flow depth (ft)............=      1.50
    Top width (ft).............=      3.00
    Slope of diversion.........=    0.0800
    Manning"s n................=     0.035
    CFS........................=     25.70
    Cross section area (sqft)..=      3.00
    Hydrualic radius...........=      0.60
    fps........................=      8.57
    Froude number..............=      1.95
```

```
Title of run: DD-3
    Solving for.................= CFS & FPS
Triangle
    Flow depth (ft)............=      1.00
    First Side slope...........=       2.0
    Second Side slope..........=       2.0
    Slope of diversion.........=    0.1500
    Manning"s n................=     0.035
    CFS........................=     19.28
    Cross section area (sqft)..=      2.00
    Hydrualic radius...........=      0.45
    fps........................=      9.64
    Froude number..............=      2.54
```

APPENDIX XII

ADDED 4/24/92

CULVERT DESIGN SUMMARY

CD-2

1. Length - 65'
2. See Flowmaster Calculation CD-2
3. Collects Flow From Drainage Area 2
4. Erosion Protection

   Culvert Inlet - Metal End Section
   Culvert Outlet - Bedrock with Natural Cobble and Boulder

CD-3

1. Length - 40'
2. See Flowmaster Calculation CD-3
3. Collects Flow From Drainage Area 3
4. Erosion Protection

   Culvert Inlet - Metal End Section
   Culvert Outlet - Bedrock with Natural Cobble and Boulder

CD-4

1. Length - 180'
2. See Flowmaster Calculation CD-4
3. Collects Flow From Drainage Area 4
4. Erosion Protection

   Culvert Inlet - Metal End Section
   Culvert Outlet - Rip-rap, D_{50} = 2.5 ft.
   (See Rip-rap Sizing Calculation CD-4)

APPENDIX XII
ADDED 4/24/92

CD-5

1. Length - 45'

2. See Flowmaster Calculation CD-5

3. Collects Flow From Drainage Area 5

4. Erosion Protection

   Culvert Inlet - Concrete Drop Inlet
   Culvert Outlet - Flows Into CD-1

CD-6

1. Length - 40'

2. See Flowmaster Calculation CD-6

3. Collects Flow From Drainage Area 8

4. Erosion Protection

   Culvert Inlet - Concrete Drop Inlet
   Culvert Outlet - 18" Rip-rap

CD-7

1. Length - 80'

2. See Flowmaster Calculation CD-7

3. Collects Flow From Drainage Areas 7, 8 & 9

4. Erosion Protection

   Culvert Inlet - Rip-rap
   Culvert Outlet - Concrete Headwall

CD-8

1. Length - 270'

2. See Flowmaster Calculation CD-8

3. Collects Flow From Drainage Areas 10 & 11

4. Erosion Protection

   Culvert Inlet - Drop Inlet
   Culvert Outlet - Concrete Headwall

CD-9

1. Length - 227'

2. See Flowmaster Calculation CD-9

3. Collects Flow From Drainage Area 11

4. Erosion Protection

   Culvert Inlet - Concrete Drop Inlet
   Culvert Outlet - Flows Into CD-8

CD-10

1. Length - 30'

2. See Flowmaster Calculation CD-10

3. Collects Flow From Drainage Area 12

4. Erosion Protection

   Culvert Inlet - Metal End Section
   Culvert Outlet - Concrete Energy Dissipation Box

FLOWMASTER CALCULATION CD-2

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: CD-2

Comment:

Solve For Actual Depth

Given Input Data:

Diameter..........	2.50 ft
Slope.............	0.1900 ft/ft
Manning's n.......	0.024
Discharge.........	5.12 cfs

Computed Results:

Depth.............	0.39 ft
Velocity..........	10.45 fps
Flow Area.........	0.49 sf
Critical Depth....	0.75 ft
Critical Slope....	0.0141 ft/ft
Percent Full......	15.62 %
Full Capacity.....	96.84 cfs
QMAX @.94D........	104.18 cfs
Froude Number.....	3.55 (flow is Supercritical)

Open Channel Flow Module, Version 3.21 (c) 1990
Haestad Methods, Inc. * 37 Brookside Rd * Waterbury, Ct 06708

APPENDIX XII

ADDED 4/24/92

FLOWMASTER CALCULATION CD-3

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: CD-3

Comment:

Solve For Actual Depth

Given Input Data:

Diameter..........	1.25 ft
Slope.............	0.4600 ft/ft
Manning's n.......	0.024
Discharge.........	0.60 cfs

Computed Results:

Depth.............	0.14 ft
Velocity..........	8.22 fps
Flow Area.........	0.07 sf
Critical Depth....	0.30 ft
Critical Slope....	0.0179 ft/ft
Percent Full......	10.96 %
Full Capacity.....	23.73 cfs
QMAX @.94D........	25.53 cfs
Froude Number.....	4.74 (flow is Supercritical)

APPENDIX XII

ADDED 4/24/92

FLOWMASTER CALCULATION CD-4

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: CD-4

Comment:

Solve For Actual Depth

Given Input Data:

Diameter..........	1.25 ft
Slope.............	0.4500 ft/ft
Manning's n.......	0.024
Discharge.........	0.42 cfs

Computed Results:

Depth.............	0.12 ft
Velocity..........	7.32 fps
Flow Area.........	0.06 sf
Critical Depth....	0.25 ft
Critical Slope....	0.0183 ft/ft
Percent Full......	9.29 %
Full Capacity.....	23.47 cfs
QMAX @.94D........	25.25 cfs
Froude Number.....	4.59 (flow is Supercritical)

APPENDIX XII

ADDED 4/24/92

FLOWMASTER CALCULATION CD-5

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: CD-5

Comment:

Solve For Actual Depth

Given Input Data:

Diameter..........	2.00 ft
Slope.............	0.1100 ft/ft
Manning's n.......	0.024
Discharge.........	1.30 cfs

Computed Results:

Depth.............	0.25 ft
Velocity..........	5.90 fps
Flow Area.........	0.22 sf
Critical Depth....	0.39 ft
Critical Slope....	0.0157 ft/ft
Percent Full......	12.26 %
Full Capacity.....	40.64 cfs
QMAX @.94D........	43.72 cfs
Froude Number.....	2.54 (flow is Supercritical)

FLOWMASTER CALCULATION CD-6

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: CD-6

Comment:

Solve For Actual Depth

Given Input Data:

Diameter..........	2.00 ft
Slope.............	0.1250 ft/ft
Manning's n.......	0.024
Discharge.........	7.81 cfs

Computed Results:

Depth.............	0.57 ft
Velocity..........	10.45 fps
Flow Area.........	0.75 sf
Critical Depth....	0.99 ft
Critical Slope....	0.0166 ft/ft
Percent Full......	28.75 %
Full Capacity.....	43.32 cfs
QMAX @.94D........	46.60 cfs
Froude Number.....	2.87 (flow is Supercritical)

Open Channel Flow Module, Version 3.21 (c) 1990
Haestad Methods, Inc. * 37 Brookside Rd * Waterbury, Ct 06708

APPENDIX XII

ADDED 4/24/92

FLOWMASTER CALCULATION CD-7

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: CD-7

Comment:

Solve For Actual Depth

Given Input Data:

Diameter..........	2.00 ft
Slope.............	0.0300 ft/ft
Manning's n.......	0.024
Discharge.........	8.83 cfs

Computed Results:

Depth.............	0.90 ft
Velocity..........	6.45 fps
Flow Area.........	1.37 sf
Critical Depth....	1.06 ft
Critical Slope....	0.0171 ft/ft
Percent Full......	44.97 %
Full Capacity.....	21.22 cfs
QMAX @.94D........	22.83 cfs
Froude Number.....	1.37 (flow is Supercritical)

APPENDIX XII

ADDED 4/24/92

FLOWMASTER CALCULATION CD-8

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: CD-8

Comment:

Solve For Actual Depth

Given Input Data:

Diameter..........	2.00 ft
Slope.............	0.0300 ft/ft
Manning's n.......	0.024
Discharge.........	0.38 cfs

Computed Results:

Depth.............	0.19 ft
Velocity..........	2.59 fps
Flow Area.........	0.15 sf
Critical Depth....	0.21 ft
Critical Slope....	0.0177 ft/ft
Percent Full......	9.30 %
Full Capacity.....	21.22 cfs
QMAX @.94D........	22.83 cfs
Froude Number.....	1.28 (flow is Supercritical)

APPENDIX XII

ADDED 4/24/92

FLOWMASTER CALCULATION CD-9

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: CD-9

Comment:

Solve For Actual Depth

Given Input Data:

Diameter..........	2.00 ft
Slope.............	0.1000 ft/ft
Manning's n.......	0.024
Discharge.........	0.21 cfs

Computed Results:

Depth.............	0.11 ft
Velocity..........	3.29 fps
Flow Area.........	0.06 sf
Critical Depth....	0.16 ft
Critical Slope....	0.0191 ft/ft
Percent Full......	5.29 %
Full Capacity.....	38.75 cfs
QMAX @.94D........	41.68 cfs
Froude Number.....	2.17 (flow is Supercritical)

APPENDIX XII

ADDED 4/24/92

FLOWMASTER CALCULATION CD-10

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: CD-10

Comment:

Solve For Actual Depth

Given Input Data:

Diameter..........	2.00 ft
Slope.............	0.7000 ft/ft
Manning's n.......	0.024
Discharge.........	0.38 cfs

Computed Results:

Depth.............	0.09 ft
Velocity..........	7.75 fps
Flow Area.........	0.05 sf
Critical Depth....	0.21 ft
Critical Slope....	0.0177 ft/ft
Percent Full......	4.43 %
Full Capacity.....	102.52 cfs
QMAX @.94D........	110.28 cfs
Froude Number.....	5.59 (flow is Supercritical)

APPENDIX XII

ADDED 4/24/92

DRAINAGE DITCH RIP-RAP SUMMARY
FOLLOWING "STATE ROAD HYDRAULICS"
PP. 3-27 THROUGH 3-30

DD-1

- **Estimated Rip-rap Diameter - .4'**
- **.4'/Depth of Flow**

  .4'/.88' = .45

- **Fig. 3-29,** $\frac{V_s}{V}$ **= .75**
- **6.84 fps x .75 = 5.1 Vs**
  (6.84 fps = Velocity at Flow of 10.51 cfs)
- **Fig. 3-30 = .3' Rip-rap Size**

DD-2

- **Estimated Rip-rap Diameter - .4'**
- **.4'/Depth of Flow**

  .4'/.64' = .62

- **Fig. 3-29,** $\frac{V_s}{V}$ **= .83**
- **6.31 fps x .83 = 5.2 Vs**
  (6.31 fps = Velocity at Flow of 8.06 cfs)
- **Fig. 3-30 = .3' Rip-rap Size**

R I P R A P   S I Z I N G   F O R
T R A P A Z O I D A L   D I T C H E S

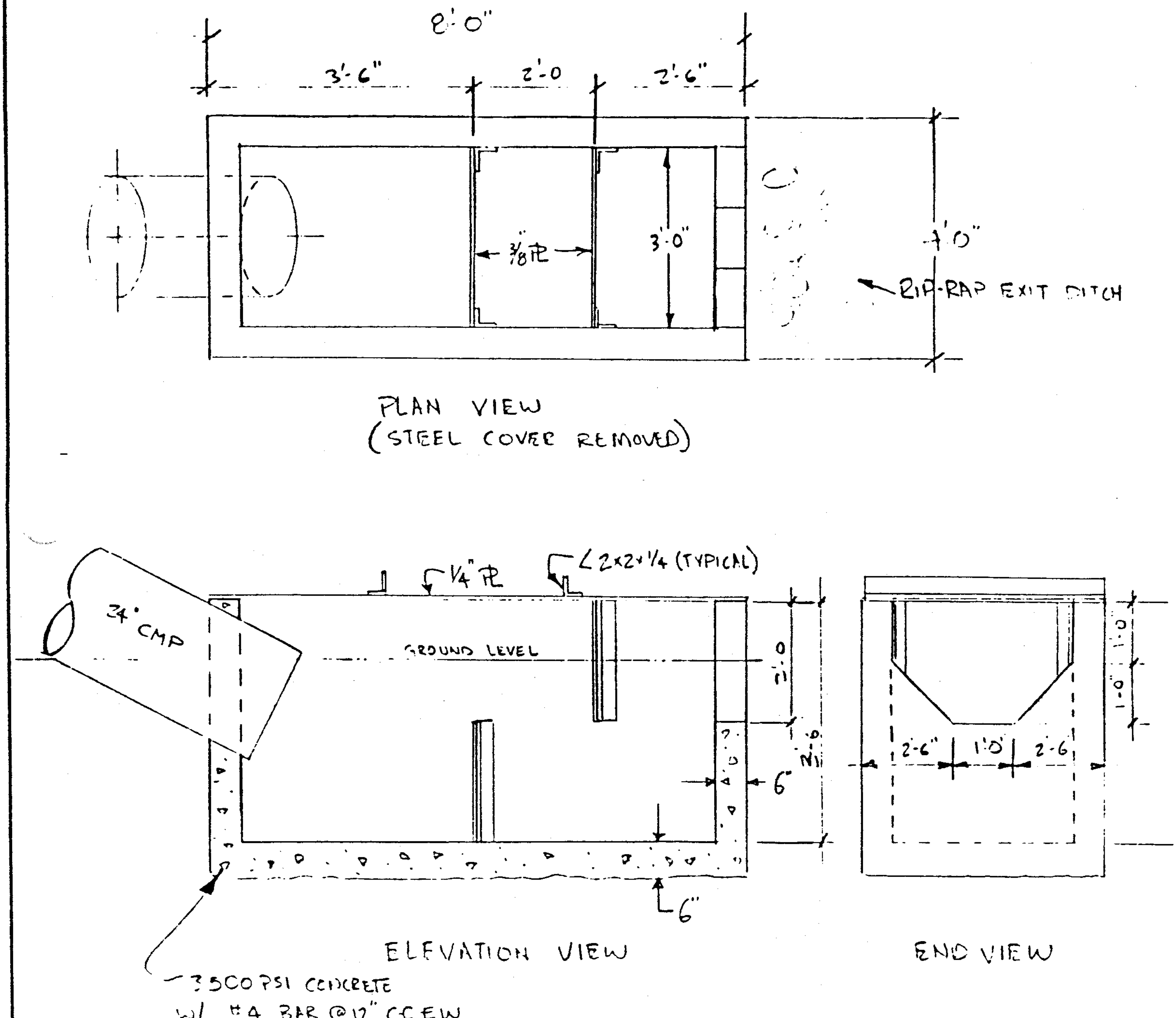
ENTER LISTED PARAMETERS
1. FLOW RATE (CFS) .42
2. CHANNEL SLOPE .29
3. BOTTOM WIDTH (FT) 12
4. SIDE SLOPE .5
5. PHI ANGLE 42
6. SPECIFIC GRAVITY OF RIPRAP 2.63

DESIRED SAFETY FACTOR FOR CHANNEL BOTTOM 1.5
DESIRED SAFETY FACTOR FOR CHANNEL BANKS 1.6

VELOCITY	DEPTH	D50	S.F. BTM	S.F. BANK
1.662	.021	.633	2.217	1.6

RIPRAP SIZING CALCULATION CD-4

ENERGY DISSIPATION BOX CD-10



APPENDIX XII ADDED 4/24/92

EMERY MINING CORP.

HUNTINGTON, UTAH 84528

ENERGY DISSIPATION BOX
BEEHIVE SUBSTATION DRAINAGE

MARK	REVISIONS	DATE

DRAWN BY:	APPROVED BY:	DRAWING NO.
TJF		CS-765-A
SCALE: 1"=2'-0"	DATE: 6-28-85	

State of Utah
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WILDLIFE RESOURCES

Michael O. Leavitt
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DIVISION OF
OIL, GAS & MINING

January 3, 1994

Ira W. Hatch
Manti-LaSal National Forest
Ferron Ranger District
P.O. Box 310
Ferron, Utah 84523

File ACT/015/018
#2 Copy Pam

Dear Ira:

The Division of Wildlife Resources (DWR) has reviewed the proposed readjustment of Federal Coal Lease SL-064900 held by PacifiCorp. We have the following comments and recommendations regarding this action.

The Grimes Wash area provides important wildlife habitat which is utilized by a variety of species. This area has been classified as critical elk winter range and provides both summer and winter habitat for mule deer. There are also a number of raptor nests located in the vicinity of this lease. Three golden eagle nests and a prairie falcon eyrie are located within one mile of the lease area. Other raptors, including red-tailed hawks, American kestrels and a number of owls species could also potentially nest in this area. Springs and other water sources exist within or near the lease boundaries. These water sources and their associated riparian communities provide critical habitat for a number of other aquatic and terrestrial species. Readjustment of this lease should consider the potential impacts of underground coal mining on important wildlife habitats.

Underground mining can impact wildlife habitat in a number of ways. The most significant impacts result from surface disturbance for mining facilities and subsidence of the surface due to the removal of coal. The application of the Special Coal Lease Stipulations found in Appendix B of the Forest Plan will help to reduce any impacts to wildlife resulting from mining activity within the lease area. We want to emphasize the importance of these stipulations as they provide guidelines for reducing impacts due to surface disturbance and subsidence.

We are particularly concerned with the effect of subsidence on available water sources and raptor cliff nests. We fully support those stipulations calling for the monitoring of subsidence and water sources. Pacificorp has participated with the DWR in conducting annual raptor surveys of the lease area. We urge that this practice continue so that the impacts of mining on raptors can be better understood.

It is important that, if impacts due to subsidence are detected, appropriate mitigation measures be implemented in order to replace lost habitat values. Again, we support those stipulations which outline appropriate mitigation for impacts to wildlife habitat.

We appreciate the opportunity to review this action. We support your efforts to coordinate mining activities with the protection of other natural resources, including wildlife. If you have any questions regarding our comments, please contact Ken Phippen, Regional Habitat Manager.

Sincerely,

Miles Moretti
Regional Supervisor

Copy: Ralph Miles, DWR
Pamela Grubaugh-Littig, DOGM

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the cut-and-fill sections. Of the 86+ acres of road right-of-way approximately 50 acres of disturbance requires reclamation. Reclamation is included under R645-301-534, R645-301-353 and R645-301-242 thru R645-301-252.

The mine access road is approximately 3,300' long beginning at the mine gate and terminating at the mine offices. Plans and selected cross-sections are included in Map 3-9.

During operation, the mine access road is used daily for access by mine labor and service personnel. Twice yearly the mine access road is utilized for cattle drives to and from East Mountain grazing area.

Details of road removal are included in Reclamation Plan.

ANCILLARY ROADS (R645-301-527.110)

All roads which are not designated as primary roads are considered ancillary roads. No delivery and/or service personnel use these roads. The ancillary roads include:

1. Portal Access Road
2. Pumphouse Access Road
3. Sediment Pond Access Road
4. Beehive Mine Substation Access Road

Twice yearly the portal access and Beehive Mine substation access roads are used for cattle drives to and from the East Mountain grazing area.

The portal access road construction consists of compacted soil and gravel surface. Road width averages 20'.

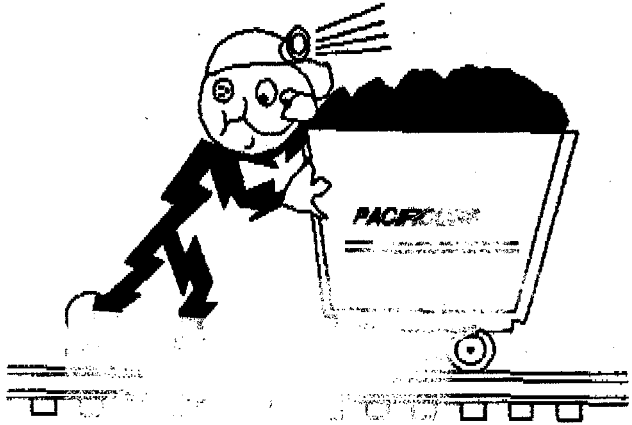
Because of steep terrain, large soil berms or steel quardrails have been constructed for safety. The road gradient averages about 10% overall. Again, the steep terrain prohibits more gradual gradients without further extensive construction.

Ancillary road maintenance includes periodic resurfacing, snow removal, and drainage inspection and cleaning as needed.

EAST MOUNTAIN ACCESS

A steep, narrow trail was constructed from the Beehive

PACIFICORP
FIELD OFFICE
P.O. BOX 1005
HUNTINGTON, UTAH 84528



TELEFAX TRANSMISSION
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TO: Pam
COMPANY: DOGM **DATE:** 9-2-93
FAX NO.: **NO. OF PAGES INCLUDING THIS PAGE:** 9
FROM: Delia
COMMENTS/INSTRUCTIONS:

When do these
Des-Bee-Dove
docs belong?
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DES BEE DOVE TEST PLOT PLAN - 1992

INTRODUCTION

The focus of the 1992 Des Bee Dove Test Plots is primarily the Mancos shale. Specifically, to help develop reclamation procedures, plot treatments/soil admixtures will be tested to aid in the reclamation of the Mancos shale. Results from these 1992 test plots will determine the treatments to be tested on the "future" test plot planned in 3 to 5 years.

LOCATION

The individual plots will be approximately 10' x 14' each located in the raw Mancos material on top of the major fill slope between stations 131+00 to 142+00. The plots are part of the area redisturbed in the fall of 1991 as part of a violation abatement. (See attached Drawing CM-10874-DS.)

The location and size of the total plot area were based on the apparent universal soil and the availability of the test treatments. Each individual treatment will extend from the top of the waterbar slope to the top of the next waterbar slope (see Figure 1). All areas of the treatment, including the waterbars, will be observed and evaluated. The waterbar area is included because they are proposed in the final reclamation plan.

PLOT PREPARATION

All vegetation on the test plot area will be sprayed with two applications of Roundup two weeks prior to planting to kill any existing plant species. Applications will be spaced four (4) days apart.

PLOT TREATMENTS/ADMIXTURES

As a result of the May 15, 1992 meeting with Division representatives, the following treatments were agreed upon. All treatments will be done randomly on the plot location in triplication.

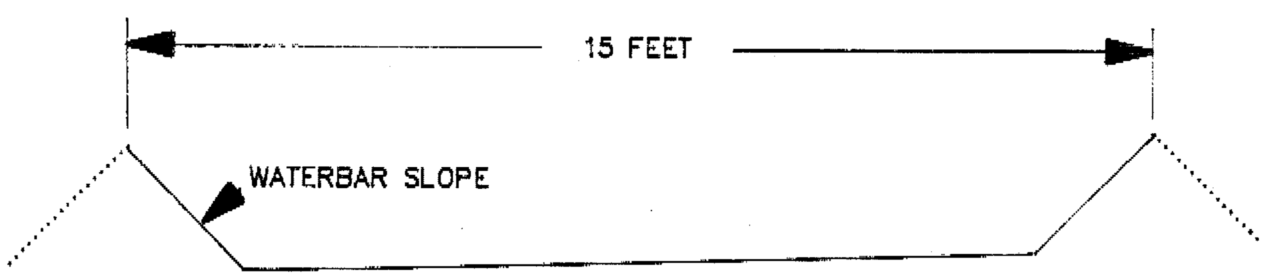
1. Rocky Soil (Native Soil)

   This soil will be borrowed from near the site and will be placed on top of the Mancos soil. It is anticipated that one cubic yard of rocky soil will be used per individual plot. This will cover the Mancos surface with 2" or greater of soil. The treatment of rocky soil will be similar to the natural surrounding areas, so volume may vary following native soil sample results.

FIGURE 1

DES BEE DOVE TEST PLOTS – 1992

CROSS–SECTION



* NO SCALE

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2. **Coal Waste**

Refuse waste <2" will be placed on top of the Mancos. On cubic yard of material will be required to cover one plot with 2" of refuse.

3. **Live Earth**

A soil admixture called "Live Earth" will be applied to the top of the Mancos material at 1200 lbs/acre. Application of this admixture will be done by Keith Littlefield, a supplier of the product. It is anticipated that addition will lower high pH and sulfate concentrations typical of the Mancos. The "Live Earth" will be applied in a dry form.

4. **Combination Of Rocky Soil And "Live Earth"**

This combination admixture will consist of 1 cubic yard of native rocky soil placed on top of 800 lbs/acre "Live Earth" product. The "Live Earth" may be applied in either the dry or liquid form per supplier preference. "Live Earth" representative will aide in the plot treatments application.

5. **Combination Of Refuse Waste And "Live Earth"**

This combination admixture will consist of 1 cubic yard/plot of less than 2" waste coal material placed on top of 800 lbs/acre "Live Earth" product. The "Live Earth" may be applied in either the dry or liquid form per the representative's preference. "Live Earth" representative will aide in the plot treatments application.

6. **Sewage Treatment Plant Sludge**

Sewage Treatment Plant sludge will be used as a treatment only if approved by the State Division of Water Pollution and Solid and Hazardous Waste. This approval will be obtained by Division personnel. Treatment volume will be determined after approval is received.

7. **Native Seed**

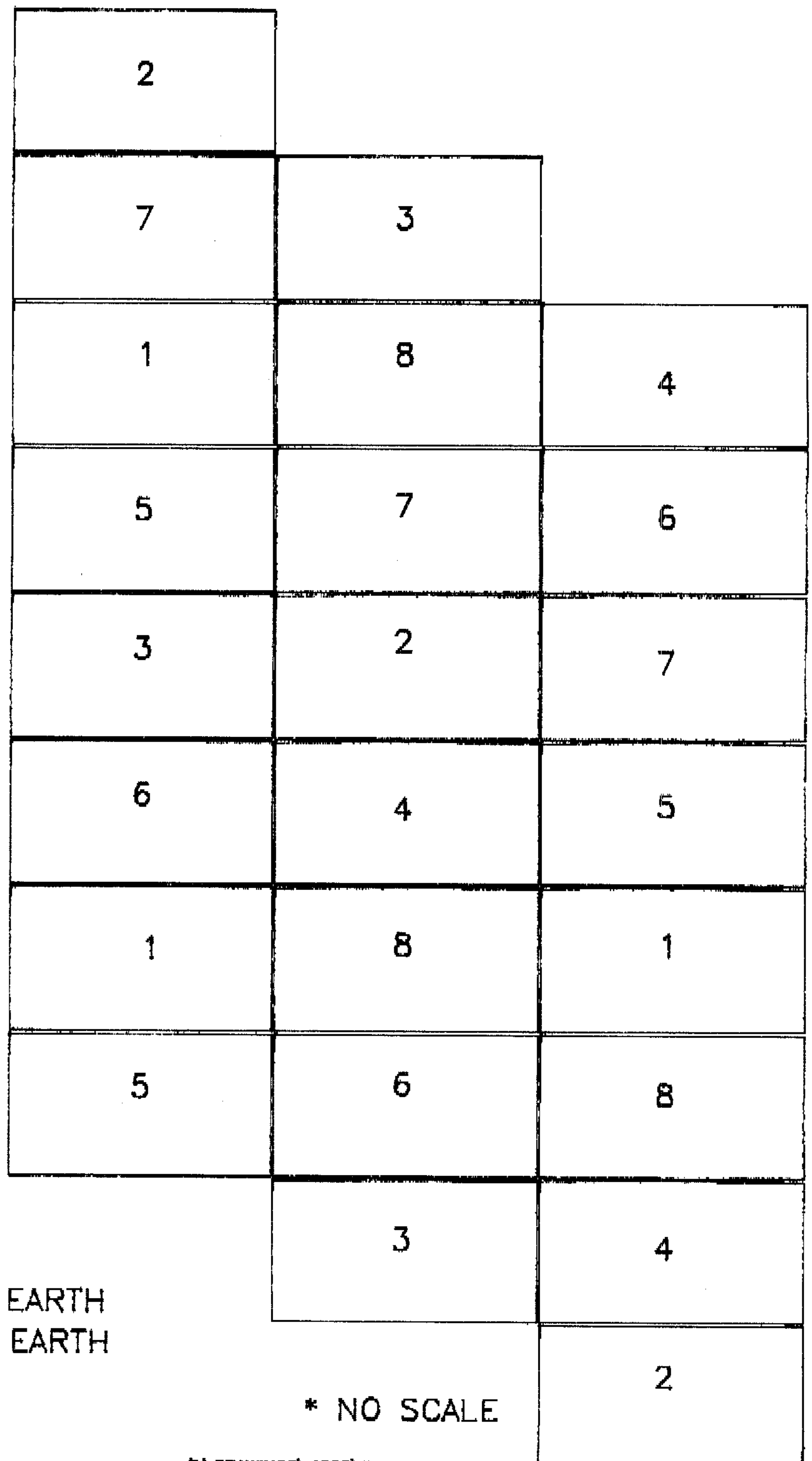
Native seed from the adjacent area will be collected and applied to 3 test plots. The seed mixture will be tested for viability prior to seeding. The quantity and variety of seed will be determined by availability at time of collection (see Figure 2).

It is anticipated that the following seed could be available at undetermined quantities:

FIGURE 2

DES BEE DOVE TEST PLOTS – 1992

PLOT TREATMENTS/ADMIXTURES



LEGEND

1. ROCKY SOIL
2. COAL WASTE
3. LIVE EARTH
4. ROCKY SOIL AND LIVE EARTH
5. COAL WASTE AND LIVE EARTH
6. SEWAGE SLUDGE
7. NATIVE SEED
8. NURSERY SEED

* NO SCALE

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COMMON NAME	SCIENTIFIC NAME	COLLECTION
Fourwing Saltbush	Atriplex canescens	Mid Oct.- Nov.
Shadscale	A. confertifolia	Mid Oct. - Nov.
Cuneate Saltbush	A. cuneata	Mid July - Aug.
Greasewood	Sarcobatus vermiculatus	October
Fat-hen Saltbush	Atriplex patula	June
Corymbed Eriogonum	Eriogonum corymbosum	Mid Aug. - Sept.
Rock Goldenrod	Petradoria pamila	June
Salina Wildrye	Elymus salinus	Mid June
Squirreltail	Sitanion hystrix	June
Indian Ricegrass	Oryzopsis hymenoides	Late June
Mormon Tea	Ephedra viridis	Mid July
Prince's Plume	Stanleya pinnate	Mid June
Rabbit brush	Chrysothamnus nauseosus	Mid Oct. - Nov.

8. Nursery Seed

Nursery seed will be planted in 3 plots for comparison to the native seed plots. Nursery seed will also be seed source for all other treatments/admixtures. The seed mixture and planting amounts will be the approved final seedmix of the permit.

COMMON NAME	SCIENTIFIC NAME	LBS/ACRE PLS
Thickspike wheatgrass	Agropyron dasystachyum	3
Western wheatgrass	A. smithii	4
Indian ricegrass	Oryzopsis hymenoides	3
Basin wildrye	Elymus cinereus	4
Alkali sakatoon	Sporobolus airoides	.25
Yellow sweetclover	Melilotus officinalis	2
Lewis flax	Linum lewisii	1
Globemallow	Sphaeralcea grossularifolia	.5
Fourwing Saltbush	Atriplex canescens	2
Mat Saltbush	A. corrugata	2
Shadscale	A. confertifolia	1

Winterfat	Ceratoides lanata	2
Prostrate Kochia	Kochia prostrata	.5
TOTAL		25.25

Random treatment locations are shown on Figure 2. Each treatment will be staked and identified by a surveyor stake at each corner.

SOIL TESTING

Initially, the general test plot area will be sampled for the following parameters at 3 random locations. The sampling locations will be marked by a roofbolt for future identification.

Texture (% sand, silt clay)
SAR (meq/l)
pH (standard units)
Electrical Conductivity (mmhos/cm)
Saturation (%)
Organic Carbon (%)
Total N (%)
Available Phosphorus (mg/kg)
Available Potassium (mg/kg)
Water Extractable Boron (mg/kg)
Water Extractable Selenium (mg/kg)
Acid Base Potential
Available Water (%)
1/3 and 15 atmospheres
Soluble Ca, Mg, Na (meq/l)

At the end of the test plot observation period (3 to 5 years) soil samples from each of the individual plots will be taken and analyzed for the same parameters. Three of these locations, will be the same locations as the initial soil sample locations.

SURFACE POCKING

The entire test plot area will be pocked by mechanical device or hand tools after the admixtures have been applied but prior to any seeding. The pocking will be randomly spaced over the entire area of each plot including the waterbar slopes.

SEEDING

All seeding will take place in the late fall, after the native seed collecting is complete. All plots will be seeded by hand broadcasting after the surface has been pocked. The seed will be lightly covered by dragging a chain between two workers.

MULCHING

All treatments/admixtures will be covered with curlex blanket. The blanket will be anchored as recommended by the manufacturer.

FERTILIZER

No fertilizer will be added initially because of the inherent high salt content of the Mancos. Fertilizer application may be considered in subsequent years.

MONITORING

Plots will be monitored annually by visual observation and photos. Vegetative monitoring for density, cover and diversity will be done during the 3rd growing season. Vegetative productivity will be monitored at the end of the test plot schedule.

Soil testing will be done at the commencement and end of the plots observation period. (See Soil Testing.)

PACIFICORP

ONE UTAH CENTER

201 SOUTH MAIN • SUITE 2100 • SALT LAKE CITY, UTAH 84140-0021 • (801) 220-2000

June 12, 1992

Ms. Pamela Grubaugh-Littig
Permit Supervisor
Division of Oil, Gas and Mining
355 West North Temple
3 Triad Center, Suite 350
Salt Lake City, Utah 84180-1203

RE: ADDITIONAL RESPONSE TO PERMIT CONDITIONS, DES BEE DOVE TEST PLOT PLAN, PACIFICORP, DES BEE DOVE MINE, ACT/015/017

Dear Ms. Grubaugh-Littig:

In response to your letter dated May 5, 1992, the attached Des Bee Dove Test Plots Plan - 1992 is submitted.

Upon approval this plan will be included at the end of Appendix XVI as an amendment.

If there are any questions, please call Guy Davis or me at 653-2312.

Sincerely,

Guy Davis

For Val Payne
Sr. Environmental Engineer

GD/dw
Enclosure

cc: J. Blake Webster
File