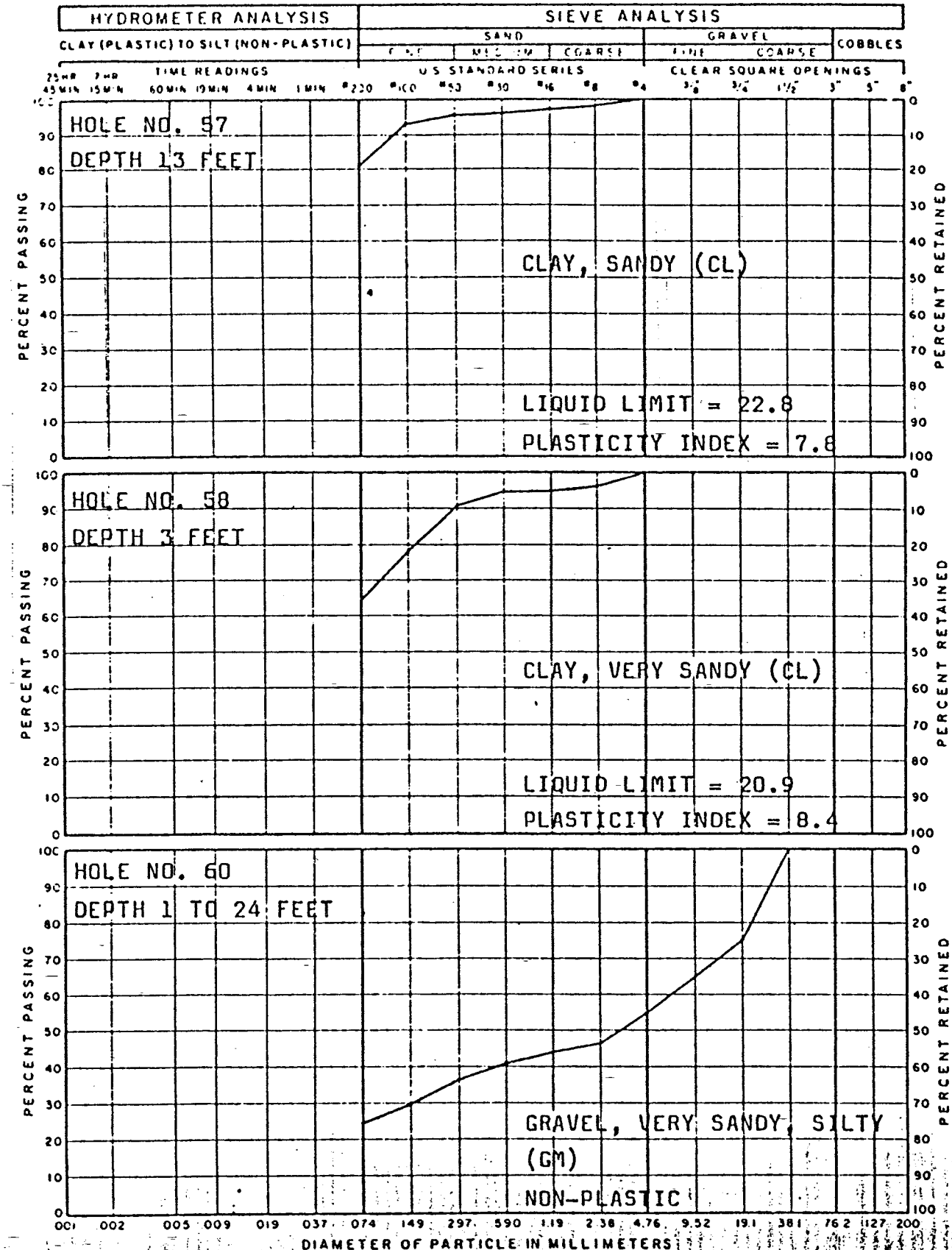
WOODWARD—CLEVENGER & ASSOCIATES, INC.

GRADATION ANALYSIS



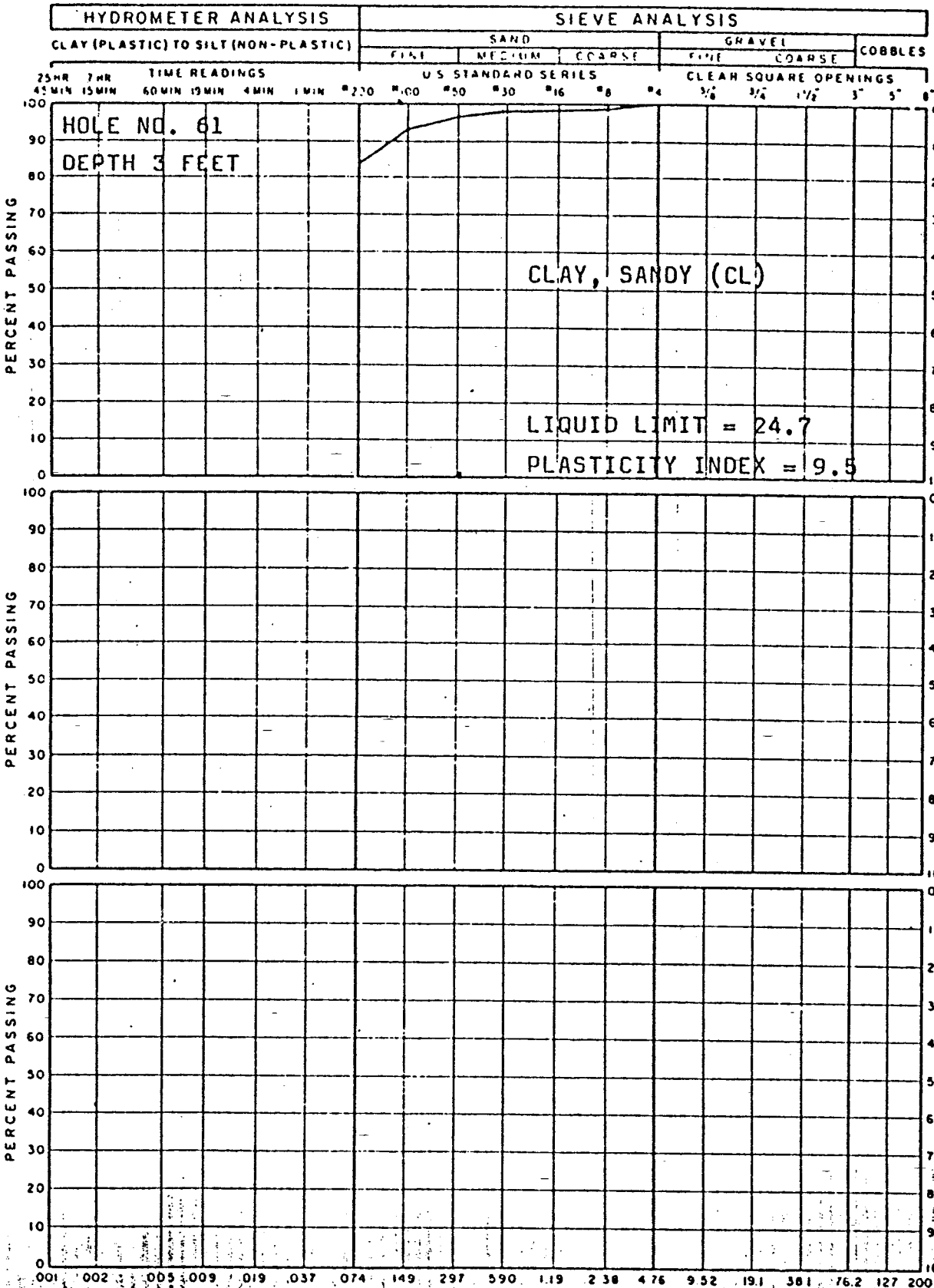
Job No. 15902-12575

FIG. 12

FORM NO
WCAI-4

WOODWARD—CLEVENGER & ASSOCIATES, INC.

GRADATION ANALYSIS



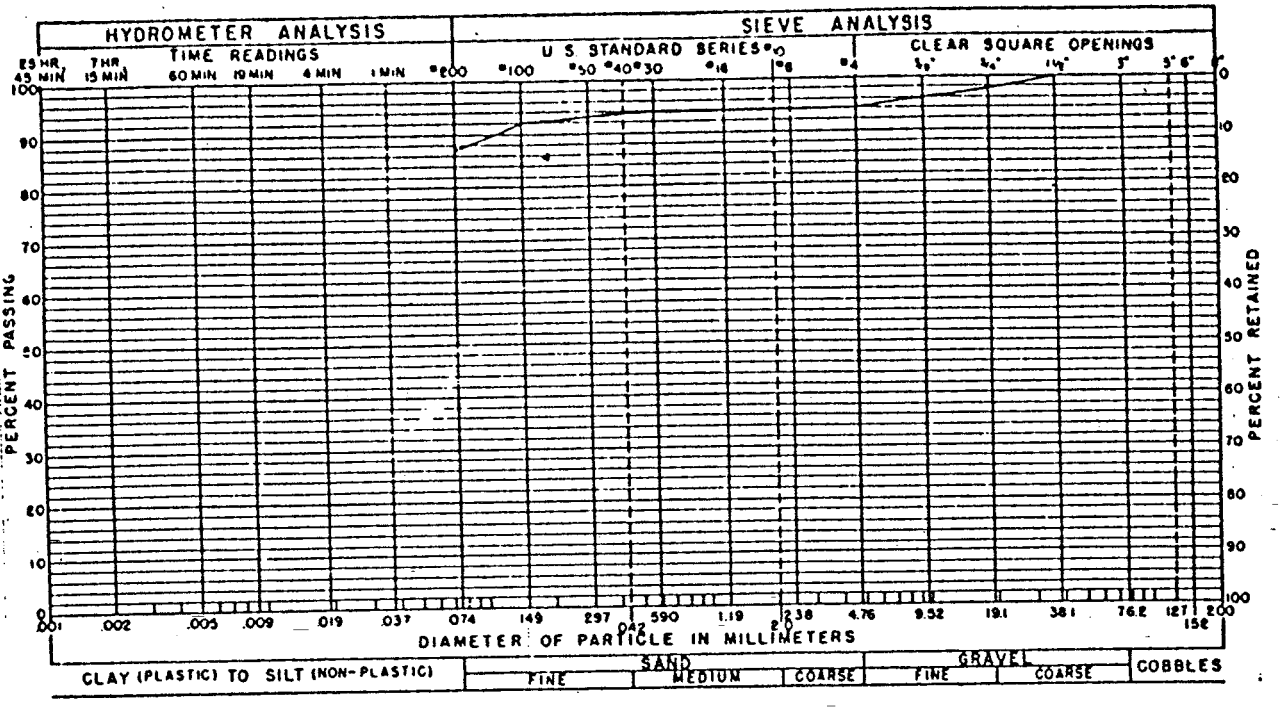
Job No. 15902-12575

FIG. 13

6-16

NO. 1

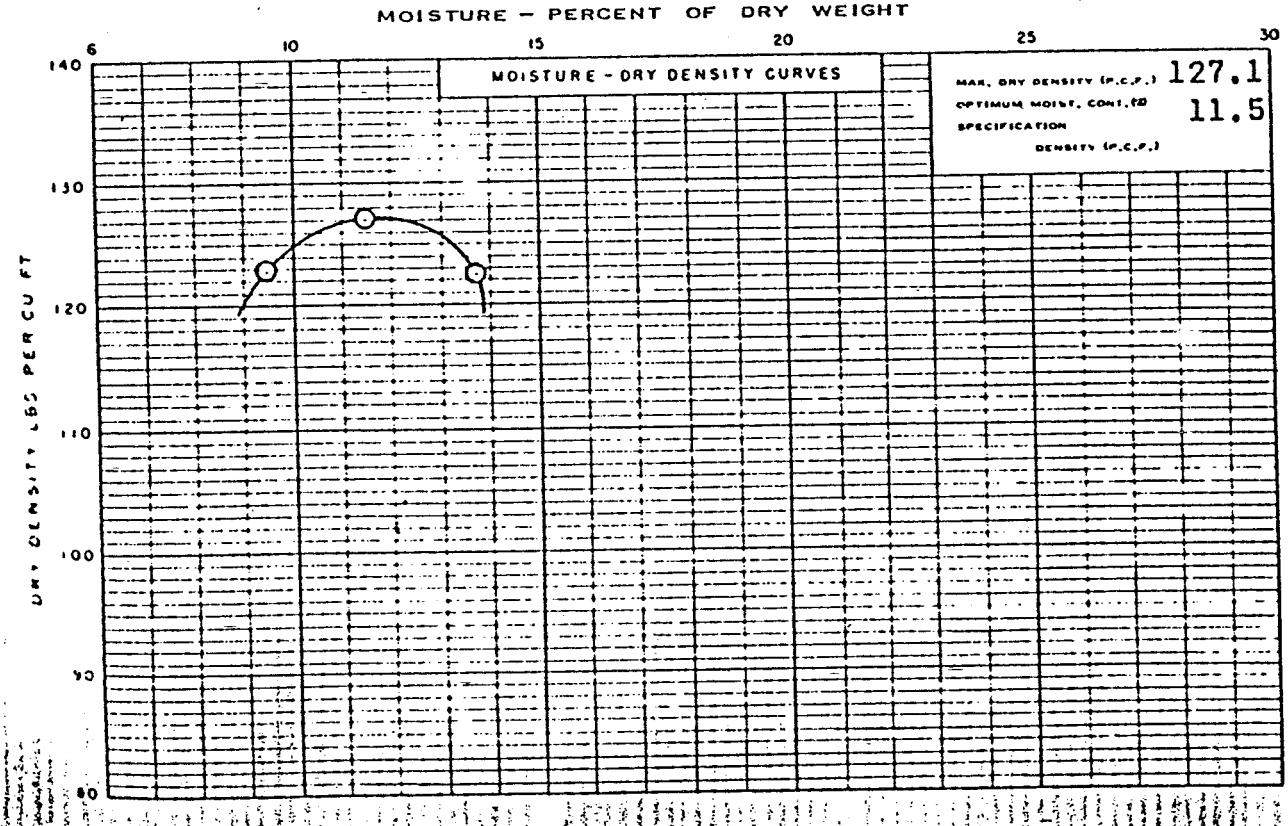
WOODWARD—CLEVENGER & ASSOCIATES, INC.



GRADATION TEST RESULTS

GRAVEL 4.7 % SAND 8.1 % SILT AND CLAY 87.7 %

LIQUID LIMIT 33.5 % PLASTICITY INDEX 15.4 %



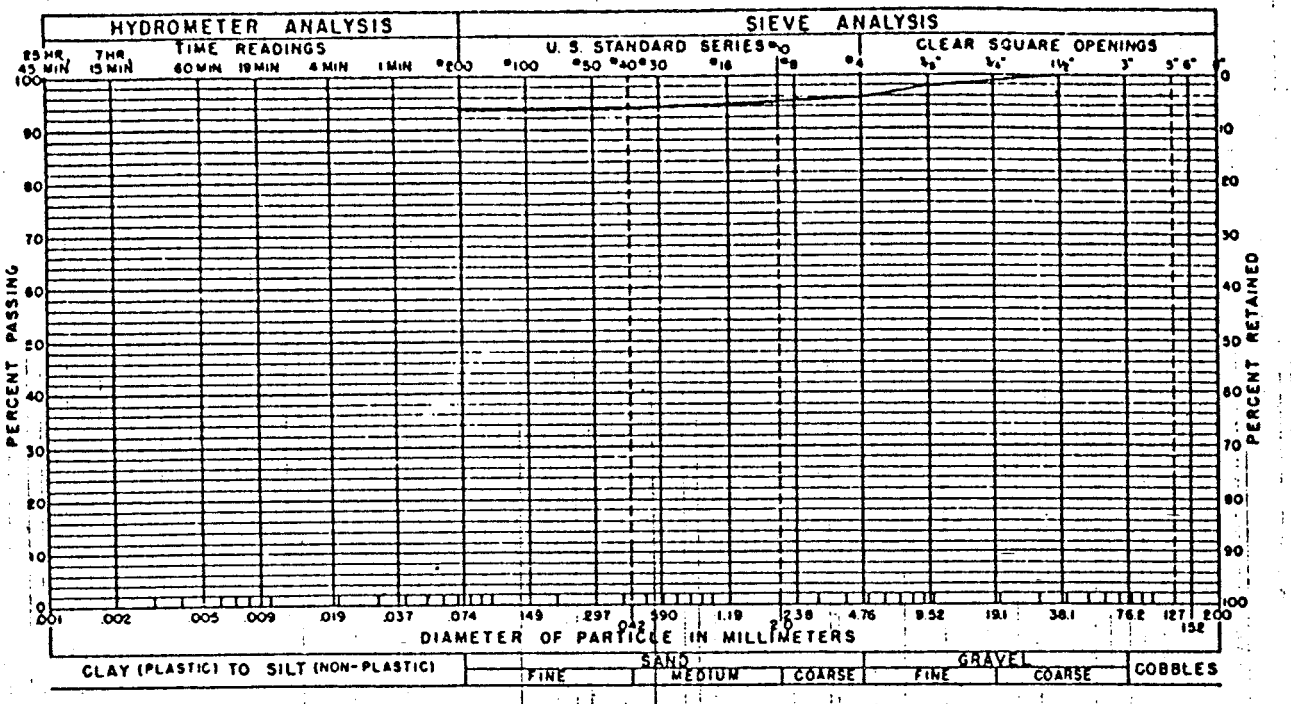
COMPACTION TEST RESULTS

COMPACTION TEST PROCEDURE ASTM D1557, Method "C"

SAMPLE OF CLAY (CL) Fig. 14

FROM Composite Sample from DEPTH 0' to 8'

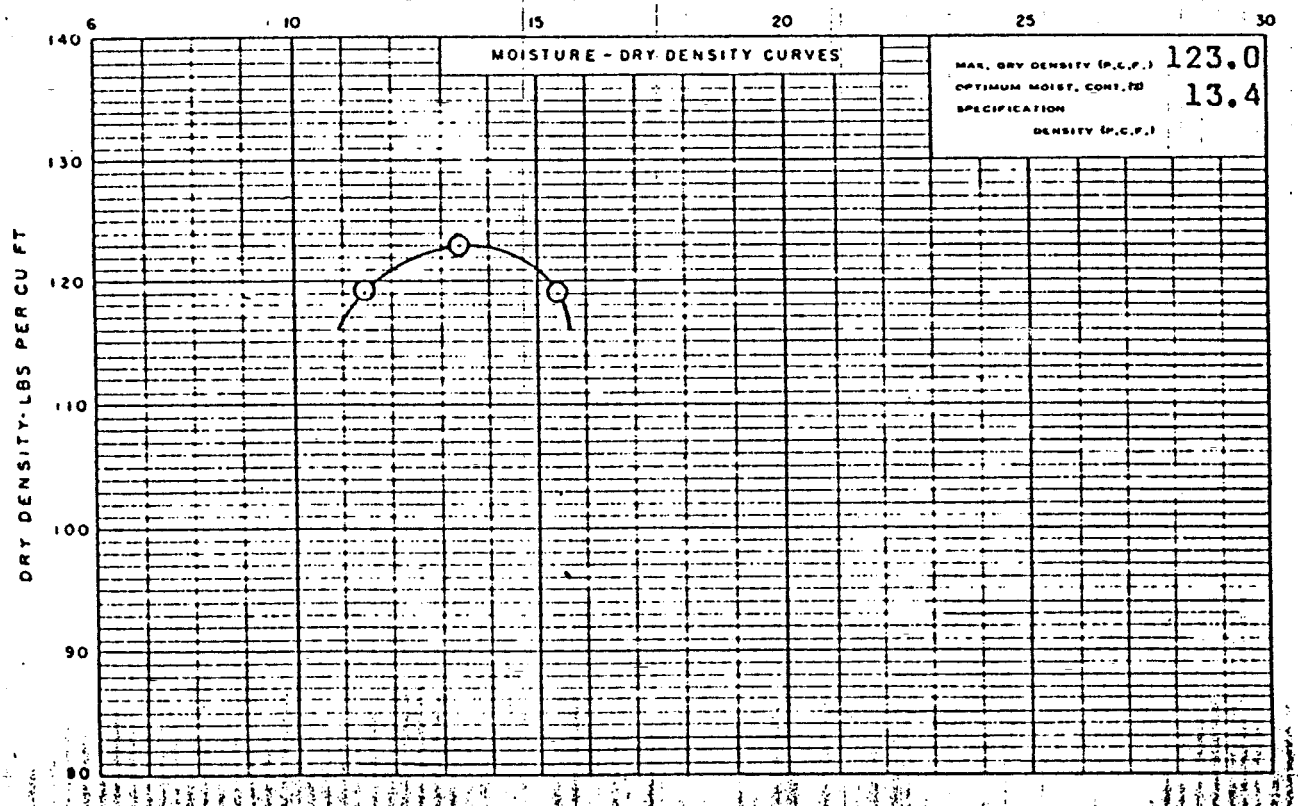
WOODWARD—CLEVENGER & ASSOCIATES, INC.



GRADATION TEST RESULTS

GRAVEL 3.8 % SAND 1.8 % SILT AND CLAY 94.4 %

LIQUID LIMIT 27.0 % PLASTICITY INDEX 12.1 %

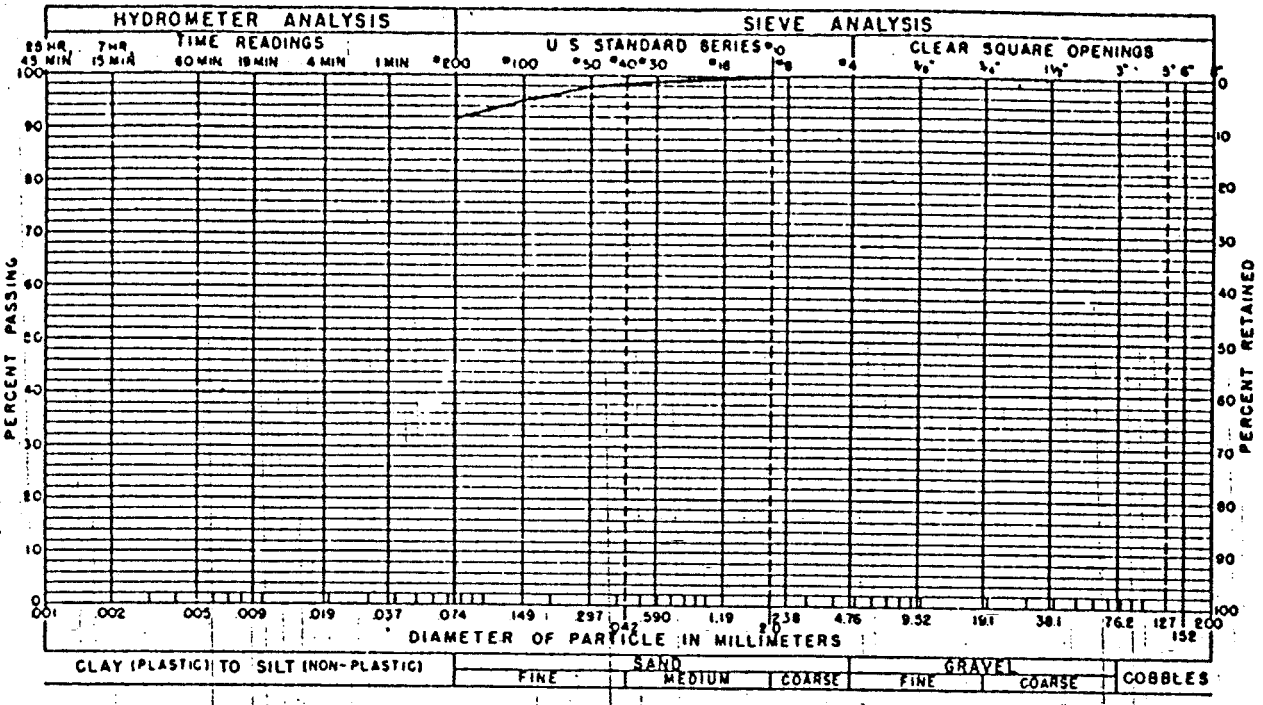


COMPACTION TEST RESULTS

COMPACTION TEST PROCEDURE ASTM D1557, Method "C"

SAMPLE OF CLAY (CL)

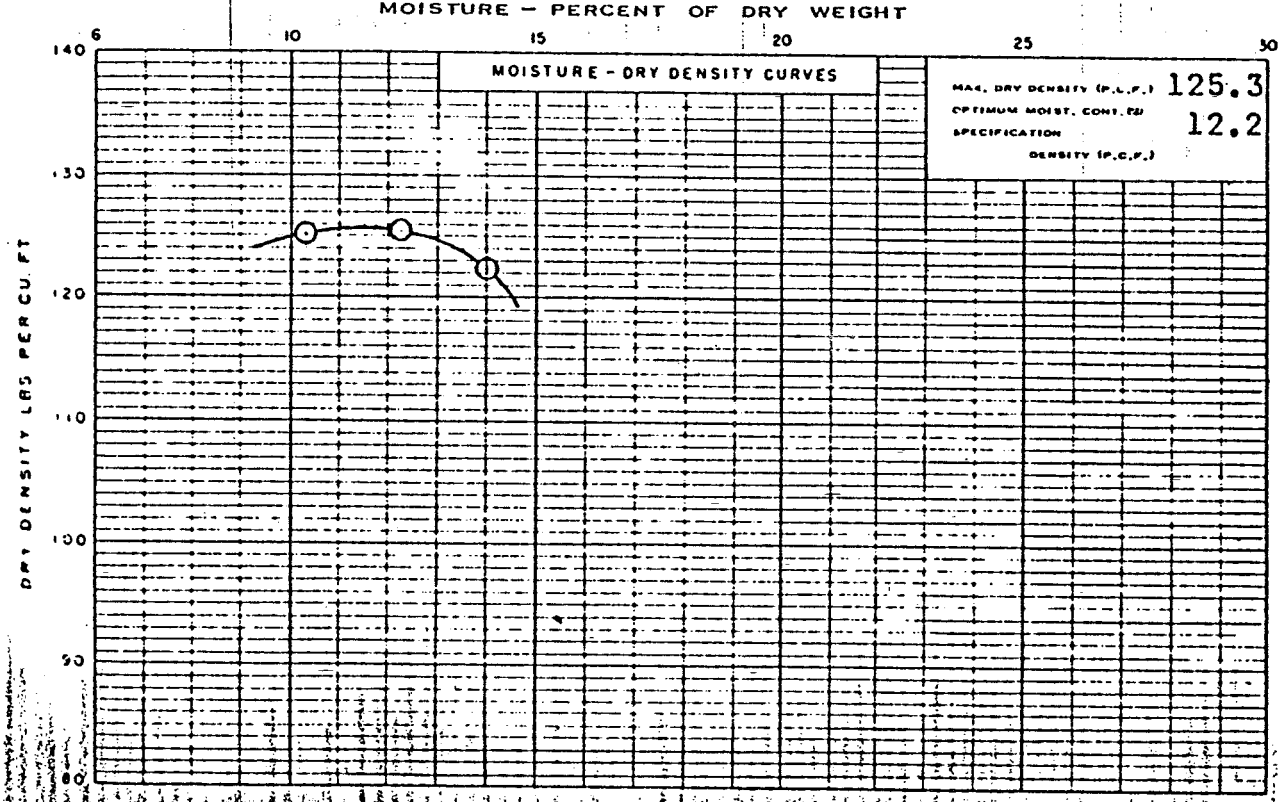
FROM TP-96 DEPTH 0 to 8' FIG. 15



GRADATION TEST RESULTS

GRAVEL 0 % SAND 7.8 % SILT AND CLAY 92.2 %

LIQUID LIMIT 30.8 % PLASTICITY INDEX 13.4 %



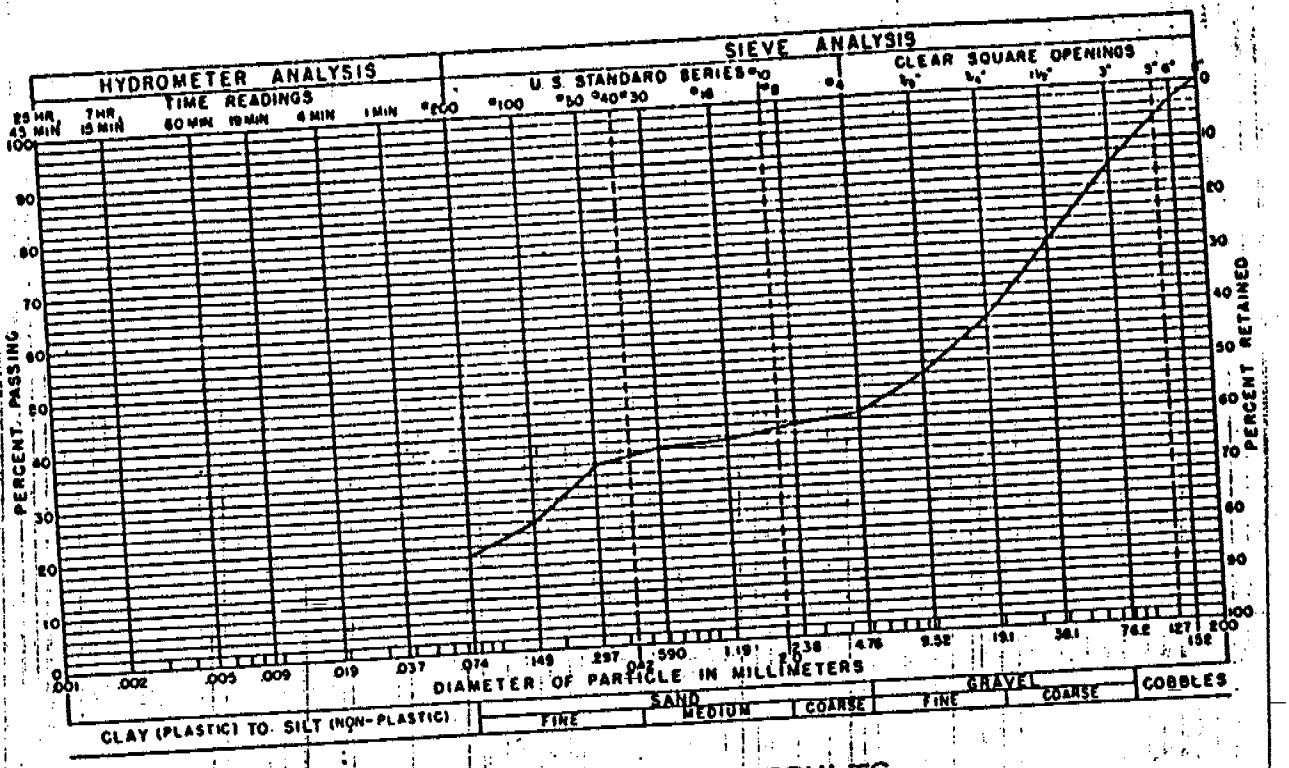
COMPACTION TEST RESULTS

COMPACTION TEST PROCEDURE ASTM D1557, Method "A"

SAMPLE OF CLAY, SANDY (CL)

FROM Composite Sample – DEPTH 0' to 8'

WOODWARD—CLEVENGER & ASSOCIATES, INC.

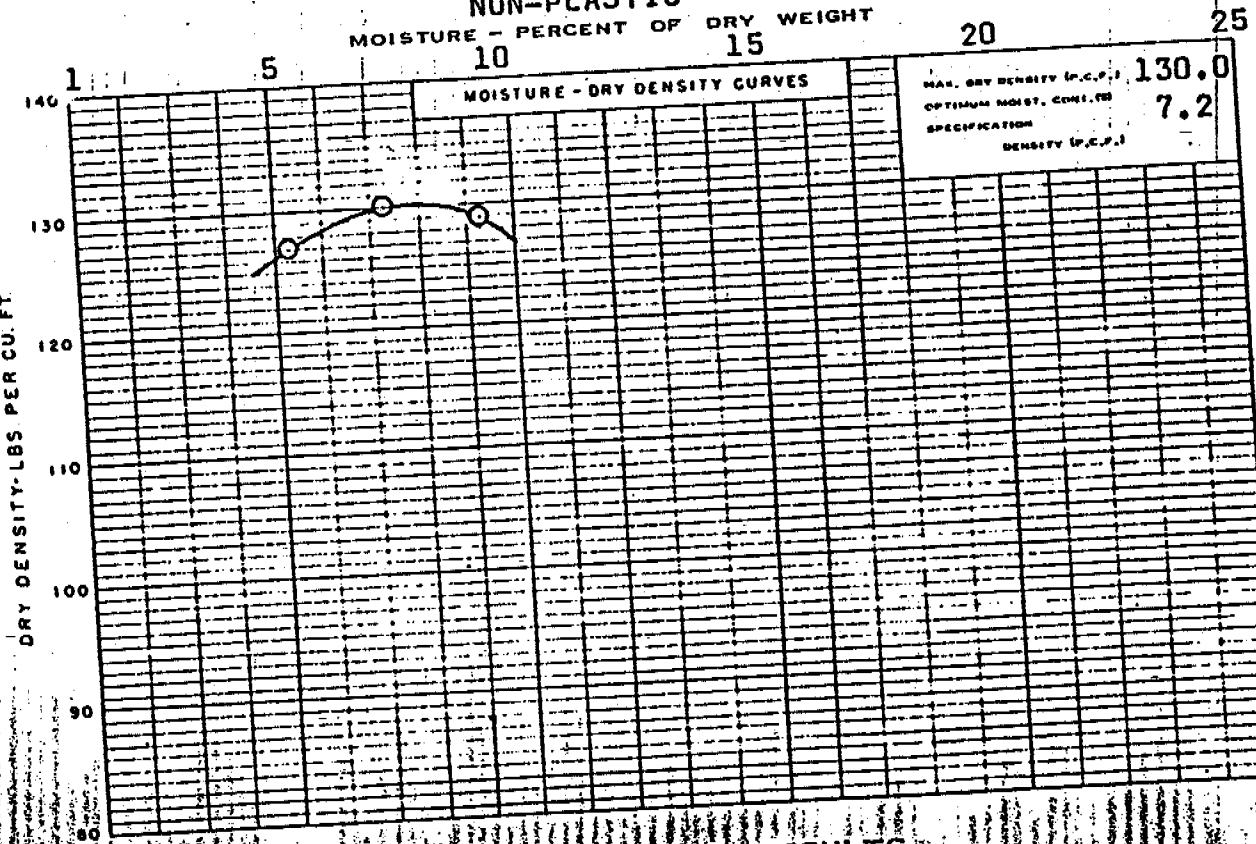


GRADATION TEST RESULTS

GRAVEL 59.6 % SAND 22.2% SILT AND CLAY 18.2 %

LIQUID LIMIT % PLASTICITY INDEX %

NON-PLASTIC



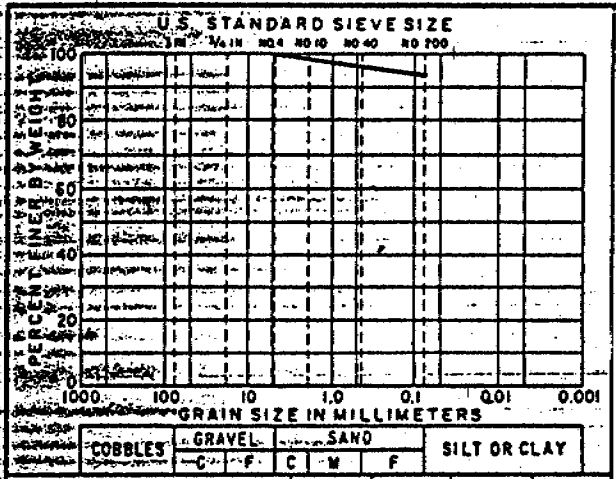
COMPACTION TEST RESULTS

COMPACTION TEST PROCEDURE ASTM D1557, Method "C"

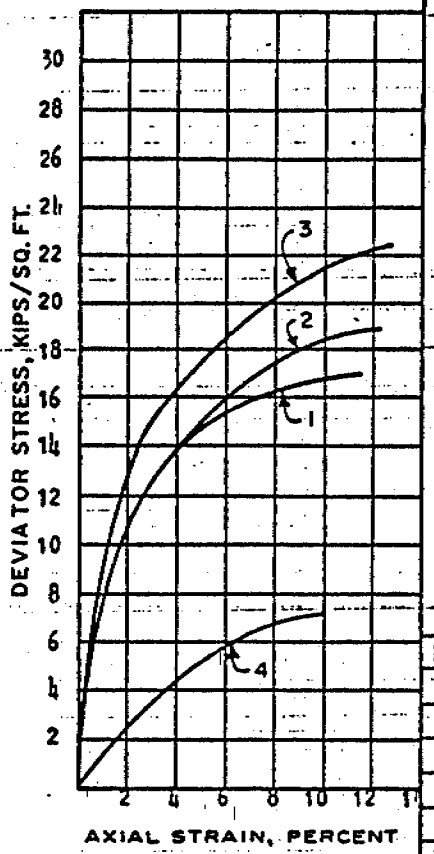
SAMPLE OF Gravel, Silty (GM) DEPTH 0 to 10 FIG. 17

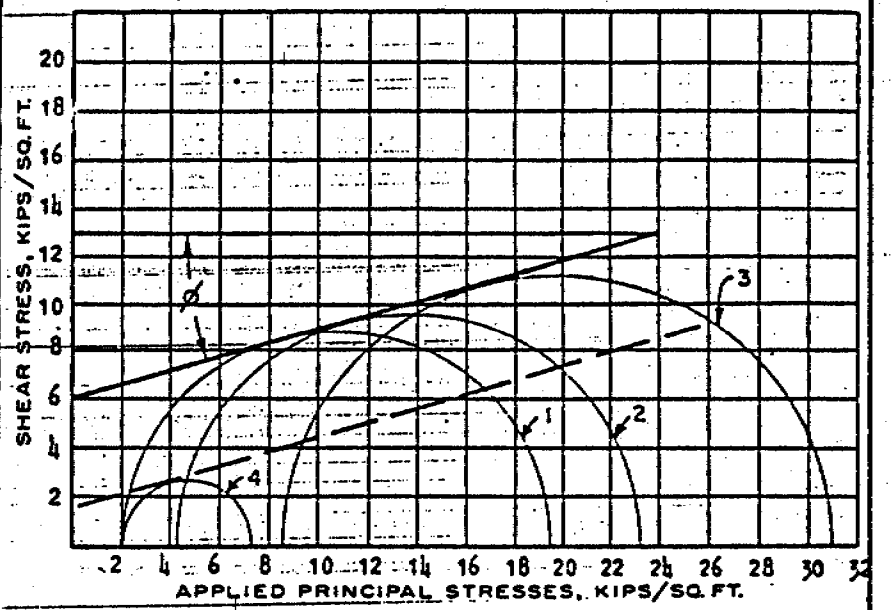
FROM TP-109

WOODWARD—CLEVENGER & ASSOCIATES, INC.



	Test No.	1	2	3	4
INITIAL CONDITIONS BEFORE TEST	Water Content, W_o %	12.2	12.2	12.2	12.2
	Dry Density, Lbs/Cu Ft	122.8	122.8	122.8	122.8
	Void Ratio, e_o				
	Saturation, S_o %				
	W.C. after Saturation, W_s %				
	Saturation, S_s %				SATURATED
	Consol. Pressure, K/Sq Ft				
	W.C. after Consol, W_c %				
	Void Ratio after Consol, e_c				
AT FAILURE	Maj. Prin Stress, σ_1 K/Sq Ft	18.76	23.32	30.81	9.36
	Min. Prin Stress, σ_m K/Sq Ft	2.16	4.32	8.64	2.16
	Water Content, W_f %				16.6
	Void Ratio, e_f				
Specimen Diameter Inches		1.93	1.93	1.93	1.93
Initial Height Inches		4.00	4.00	4.00	4.00
Test Time to Failure Min		9.5	11.0	13.0	3.0





Remarks: Specimens remolded to 98% maximum density (ASTM D1557) and optimum moisture content. Specimen No. 4 saturated.

Type of Test
Constant RATE OF STRESS Control 2 KSF/Min
UU Consolidated UU Drained

Type of Specimen REMOLDED

ϕ = 15 ° | Tan ϕ = 0.27 | c = 6.0 K/Sq Ft

Classification CL | C_c = 1.5 SATURATED

LL 30.8 | G

PL 17.4 | D_{10}

PROJECT NO. 15902-12575

PROJECT NAME EVAPORATING POND AND DAMS

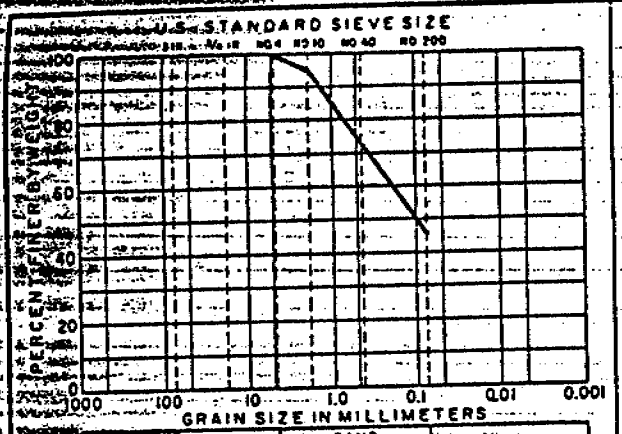
BORING NO. Composite | DEPTH 0-8 Feet

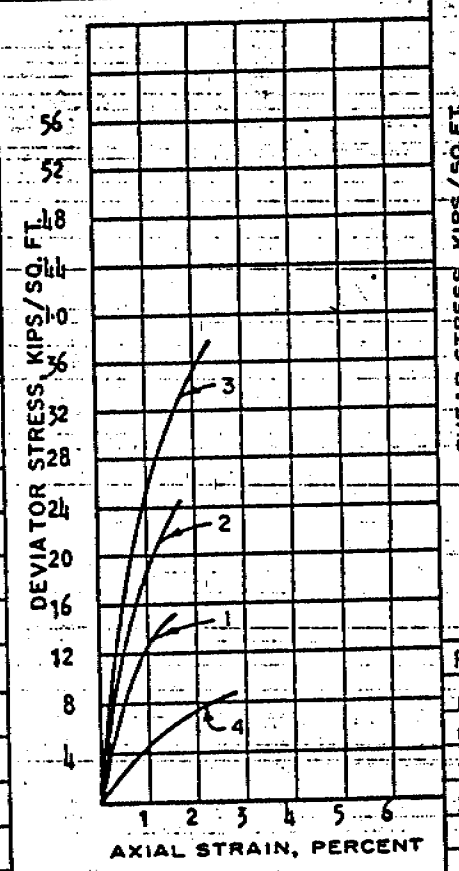
Test Pits 94, 96, 100 | DATE 3/2/72

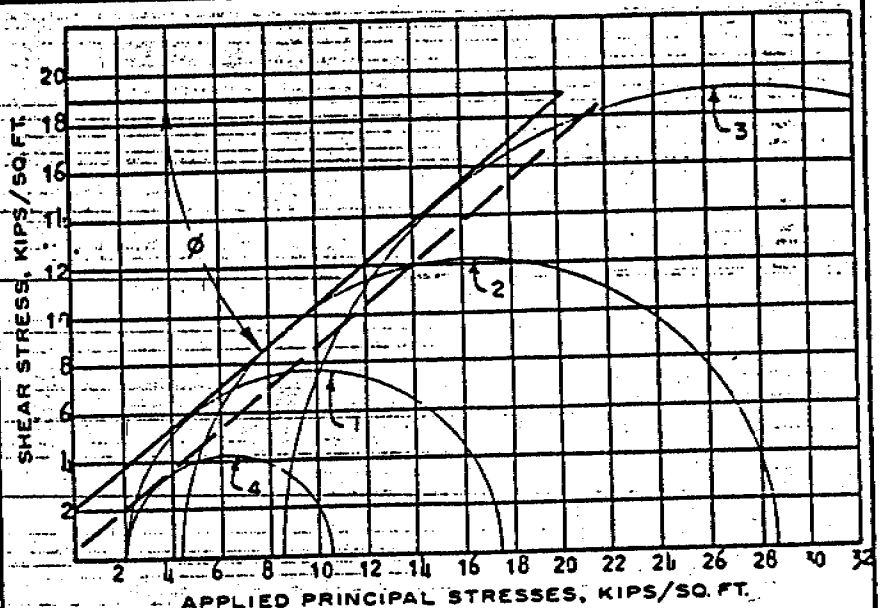
TRIAXIAL COMPRESSION TEST REPORT

FORM NO. WCAV-1

WOODWARD—CLEVENGER & ASSOCIATES, INC.







	Test No.	1	2	3	4
INITIAL	Water Content, W_o %	7.2	7.2	7.2	7.2
	Dry Density Lbs/Cu Ft	124.4	124.4	124.4	124.4
	Void Ratio, e_o				
	Saturation, S_o %				
BEFORE TEST	WC after Saturation, W_s %				
	Saturation, S %				SATURATED
	Consol Pressure K/Sq Ft				
	WC after Consol, W_c %				
	Void Ratio after Consol. e_c				
AT FAILURE	Maj Prin Stress, σ_1 K/Sq Ft	17.46	28.52	46.44	10.27
	Min Prin Stress, σ_{3m} K/Sq Ft	2.16	4.32	8.64	2.16
	Water Content, W_f %				12.6
	Void Ratio, e_f				
Specimen Diameter Inches		1.93	1.93	1.93	1.93
Initial Height Inches		4.00	4.00	4.00	4.00
Test Time to Failure Min.		8.0	12.5	19.5	4.5

Type of Test
Constant RATE OF STRESS
Control 2 KSF/Min
Consolidated — Drained

Type of Specimen REMOLDED

ϕ = 40 ° | Tan ϕ = 0.84 | c = 2.0 K/Sq.Ft.

Classification SM C= 0.2 SATURATED

LL NON-PLASTIC | G

PL | D_{10}

Remarks: Specimens remolded to 95% maximum density (ASTM D1557) and optimum moisture content using material passing No. 4 sieve, total sample classified as a Gravel, Sandy Silty (GM).

Specimen No. 4 Saturated.

PROJECT NO. 15902-12575

PROJECT NAME EVAPORATING POND AND DAMS

BORING NO. Test Pit | DEPTH 0-10 Feet

No. 109 | DATE 3/2/72

TRIAXIAL COMPRESSION TEST REPORT

FORM NO. WCAL-6

JOB NO. 15902-12575

WOODWARD—CLEVENGER & ASSOCIATES, INC.

TABLE I

SUMMARY OF LABORATORY TEST RESULTS

HOLE	DEPTH (FEET)	NATURAL MOISTURE (%)	NATURAL DRY DENSITY (PCF)	ATTERBERG LIMITS		UNCONFINED COMPRESSIVE STRENGTH (PSF)	TRIAXIAL SHEAR TESTS			SOIL TYPE
				LIQUID LIMIT (%)	PLASTICITY INDEX (%)		DEVIATOR STRESS (PSF)	CONFINING PRESSURE (PSF)		
TP-89	4'-12'	12.8								CLAY, sandy with occasional gypsum streaks, gray and tan (CL)
TP-92	0'- 4'	8.2								CLAY, sandy with occasional gypsum streaks, gray and tan (CL)
TP-93	0'-10'	11.4								CLAY, sandy with occasional gypsum streaks, gray and tan (CL)
TP-94	0'- 9'	11.6								CLAY, sandy with occasional gypsum streaks, gray and tan (CL)
TP-95	0'- 8'	11.6								CLAY, sandy with occasional gypsum streaks, gray and tan (CL)

JOB NO. 15902-12575

FORM NO. WCAI - 6

WOODWARD—CLEVENGER & ASSOCIATES, INC.

TABLE I

SUMMARY OF LABORATORY TEST RESULTS

HOLE	DEPTH (FEET)	NATURAL MOISTURE (%)	NATURAL DRY DENSITY (PCF)	ATTERBERG LIMITS		UNCONFINED COMPRESSIVE STRENGTH (PSF)	TRIAXIAL SHEAR TESTS			SOIL TYPE
				LIQUID LIMIT (%)	PLASTICITY INDEX (%)		DEVIATOR STRESS (PSF)	CONFINING PRESSURE (PSF)		
TP 94 & 100	0'- 8'			33.5	15.4					CLAY, sandy, silty, occasional gypsum streaks, gray (CL)
TP 96	0'- 8'			27.0	12.1					CLAY, sandy, silty, occasional gypsum streaks, gray (CL)
TP 94, 96, & 100	0'- 8'			30.8	13.4					CLAY, sandy silty, occasional gypsum streaks, gray (CL)
TP 109	0'-10'				N.P.					GRAVEL, sandy, silty, broun (GM)
TP 110	0'-10'				N.P.					GRAVEL, sandy, silty, tan (GM)
TP 111	0'-10'			21.0	6.7					GRAVEL, clayey, sandy, tan (GC)

Sheet 2 of 5.

U-24

FORM NO
WCAI - 6

JOB NO. 15902-12575

WOODWARD—CLEVENGER & ASSOCIATES, INC.

TABLE I

SUMMARY OF LABORATORY TEST RESULTS

HOLE	DEPTH (FEET)	NATURAL MOISTURE (%)	NATURAL DRY DENSITY (PCF)	ATTERBERG LIMITS		UNCONFINED COMPRESSIVE STRENGTH (PSF)	TRIAXIAL SHEAR TESTS			SOIL TYPE
				LIQUID LIMIT (%)	PLASTICITY INDEX (%)		DEVIATOR STRESS (PSF)	CONFINING PRESSURE (PSF)		
TP 97	0'-10'	8.4								CLAY, sandy with occasional gypsum streaks, gray and tan (CL)
TP 98	0'-10'	11.4								CLAY, sandy with occasional gypsum streaks, gray and tan.
TP 99	0'- 8'	9.2								CLAY, sandy with occasional gypsum streaks, gray and tan (CL)
TP 100	0'- 6'	7.5								CLAY, sandy with occasional gypsum streaks, gray and tan (CL)
TP 101	0'-10'	6.9								CLAY, sandy with occasional gypsum streaks, gray and tan (CL)

FORM NO
WCAI .6

JOB NO. 15902-12575

WOODWARD—CLEVENGER & ASSOCIATES, INC.

TABLE I

SUMMARY OF LABORATORY TEST RESULTS

HOLE	DEPTH (FEET)	NATURAL MOISTURE (%)	NATURAL DRY DENSITY (PCF)	ATTERBERG LIMITS		UNCONFINED COMPRESSIVE STRENGTH (PSF)	TRIAXIAL SHEAR TESTS			SOIL TYPE
				LIQUID LIMIT (%)	PLASTICITY INDEX (%)		DEVIATOR STRESS (PSF)	CONFINING PRESSURE (PSF)		
53	18	10.2	122.7	25.8	11.1	11,000				CLAY, sandy with sandstone chips, occasional gravel, thin sand lenses, gray and tan (CL)
55	8	11.5	115.1	20.2	5.2	8,820				CLAY, sandy with sandstone chips, occasional thin sand lenses, occasional gravel, gypsum streaks, gray and tan (CL) (Weathered bedrock)
56	8			20.2	3.9					CLAY, very sandy, gray, tan (CL)
57	13	9.5	119.1	22.8	7.8	20,130				CLAY, very sandy, tan, gray and orange (CL)

42-0

WCAI - 6

JOB NO 15902-12575

WOODWARD—CLEVENGER & ASSOCIATES, INC.

TABLE I

SUMMARY OF LABORATORY TEST RESULTS

HOLE	DEPTH (FEET)	NATURAL MOISTURE (%)	NATURAL DRY DENSITY (PCF)	ATTERBERG LIMITS		UNCONFINED COMPRESSIVE STRENGTH (PSF)	TRIAXIAL SHEAR TESTS			SOIL TYPE
				LIQUID LIMIT (%)	PLASTICITY INDEX (%)		DEVIATOR STRESS (PSF)	CONFINING PRESSURE (PSF)		
58	3	11.2	114.9	20.9	8.4	4,550				CLAY, very sandy, with sand pockets and occasional gypsum streaks, olive brown, gray and orange (CL)
60	1 - 24			NON-PLASTIC						GRAVEL, very sandy, silty, brown (GM)
61	3	10.8	101.9	24.7	9.5					CLAY, very sandy, with slight gypsum streaks, tan (CL)

12-27

TABLE II
LABORATORY
PERMEABILITY TEST RESULTS

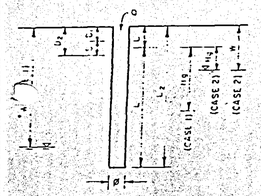
SAMPLE NUMBER	Packing Data: Dry Density (PCF)	Packing Data: Moisture %	Packing Data: Dry Density % *	Applied Load (PSF)	Permeability Rate (Ft./Yr)
Composite Test Pits 94, 96, and 100	122.8	12.2	98	6600	.018
Test Pit 109	124.4	7.2	95	6600	1.270

*Specimens compacted ASTM D1557

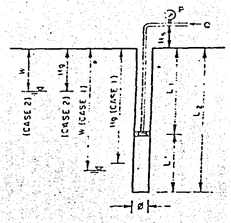
6-28

TEST DIAGRAMS

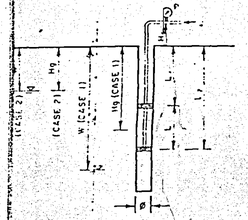
GRAVITY TEST



SINGLE PACKER TEST



DOUBLE PACKER TEST



EQUATIONS

$K = \left[Q/2\pi L H\right]\left[\ln(L/R)\right]$, $L \geq 10R$, $R = \emptyset/2$

LN = NATURAL LOG (TO BASE e)

$Q = \pi R^2 D/T$ OR IS MEASURED WITH METER

(CASE 1) $W \geq L_1 + L/2$, $\begin{cases} Hg = L/2 \text{ (GRAVITY)} \\ Hg = L/2 + L_1 \text{ (PACKER)} \end{cases}$

(CASE 2) $W < L_1 + L/2$, $\begin{cases} Hg = W - L_1 \text{ (GRAVITY)} \\ Hg = W \text{ (PACKER)} \end{cases}$

FOR GRAVITY TESTS $H = Hg$
FOR PACKER TESTS $H = Hp + Hs + Hg$
FOR PACKER TESTS $Hp = 2.31\,P$

NOTES:

1. HOLES WERE SATURATED WITH CLEAR WATER BEFORE START OF EACH TEST.
2. "B" INDICATES GROUNDWATER LEVEL WAS BELOW BOTTOM OF TEST HOLE (CASE 1).

REFERENCES

1. USBR EARTH MANUAL pp 541-546
2. USBR DESIGN OF SMALL DAMS p 146

HOLE NO.	TEAM OF HOLE (NO. 1-4)	FOR GRAVITY TESTS: DEPTH H₂O START TEST (FT)	DEPTH H₂O END TEST (FT)	DROP H₂O DURING TEST (FT)	DEPTH TOP LENGTH TESTED (FT)	DEPTH BOTTOM LENGTH TESTED (FT)	LENGTH OF HOLE TESTED (FT)	DURATION OF TEST (MIN)	FOR PACKER TESTS: APPL PRESS AT SWIVEL (PSI)	HEAD H₂O DUE TO PRESS (FT)	HEAD H₂O DUE TO HT SWIVEL (FT)	DEPTH FREE H₂O LEVEL (FT)	HEAD H₂O DUE TO GRAVITY (FT)	TOTAL ASSUMED HEAD H₂O (FT)	EST. QUANT. H₂O INFLOW (GPM)	CALC. PERMEABILITY (FT/YR)
SYMBOL	Ø	D_1	D_2	D	L_1	L_2	L	T	P	H_p	H_s	U	H_g	H	Q	K
53	3	52	68	16	52	83	23	195			Gravity Test		8	8	0.12	42
	3	68	83	15	68	183	7.5	1200			Gravity Test		7.5	7.5	0.018	14
57	3	24	70	46	24	70	23	7			Gravity Test		23	23	8.8	955
	3	70	78	8	70	82	12	50			Gravity Test		8	8	0.24	174
	3	17	51	34	17	70	53	10			Gravity Test		53	53	6.7	165
	3		Packer Test		36	41	5	5	30	69	2		77	148	12.5	416
	3		Packer Test		41	62	21	5	30	69	2		51	122	0	0
60	3		Packer Test		29	49	20	5	30	69	2		41	110	7.5	69
	3		Packer Test		39	49	10	5	30	69	2		46	115	0	0
	3		Packer Test		49	122	73	5	50	115.5	2		87.5	203	0	0
61	3	22.5	30.5	8	22.5	36	13.5	5			Gravity Test		9.5	9.5	2.4	675
	3	30.5	36	5.5	30.5	36	5.5	85			Gravity Test		3	3	0.095	280
	3	36	36	0	0	62	26	1000			Gravity Test		0	0	0	0
62	3	1	6	5	1	23.5	18	10			Gravity Test		12	12	0.748	170
	3	6	23.5	17.5	6	23.5	9	1000			Gravity Test		9	9	0.026	15
	3		Packer Test		9	23.5	7.5	5	30	69	2		16	87	2.0	820
53	3	29	43	14	29	54	25	23			Gravity Test		7	7	0.9	770
	3	43	53	10	43	53	10	1000			Gravity Test		5	5	0.015	25
	3		Packer Test		51	123	72	5	30	69	2		87	158	0.8	32
	3		Packer Test		51	60	11	5	30	69	2		59	130	0	0

FLOW BOTTOM OF HOLE

WOODWARD-CLEVENGER & ASSOC., INC
Consulting Engineers & Geologists
Denver, Colorado

SUMMARY OF FIELD PERMEABILITY TESTS

TABLE III

Prepared by: TRM

Job No 15902-12575

Chapter VII - SOILS

The soils in the area of the Deer Creek Waste Rock Storage Facility are fairly typical of much of the slopes surrounding the escarpments of the Wasatch Plateau. The United States Department of Agriculture (Soil Survey Carbon-Emery Area, Utah, December 1970) has mapped two different types of soils in the area. These are the Badland and the Persayo soils. Samples of each have been analyzed for their physical and chemical properties. The results of these tests are shown on the attached tables (Soil Analysis), and the locations are shown on map #CM-10775-DR, Map packet #7-1.

Badland Soils

Most of the northern two-thirds of the site is covered by Badland soils. These soils formed by the erosion of shale and thin sandstone beds within the shale and occur on strongly dipping to very steep actively eroding surfaces. The soils are generally thin (12") and are highly variable in character. Badland is usually a fine-textured (clayey) soil but on this site ranges from a clay to a silty clay loam. Where this type of soil occurs, vegetation is sparse.

It is estimated that 32,000 cubic yards of the badland soil is present within the site. Its characteristics will not allow this soil to support abundant vegetation.

Persayo Soils

The Persayo soils, also derived from the shale bedrock, can be found on slopes of 1 to 20% and is classified as a loam to clayey loam on the Deer Creek Rock Storage Facility. These fine- to medium-textured soils are rarely over 20 inches thick and are well drained. Depth to the seasonal water table is generally over 6 feet where Persayo occurs.

An estimated 22,000 cubic yards of the Persayo soil occurs within the area to be disturbed by the underground development waste site. In addition to this amount another 850 cubic yards can be taken from along the access road when it is upgraded. This material along with a large quantity of the Badland soil will be stored for future use in reclaiming the site.

Soil profile descriptions for both soil types are found on page 6-8 (test holes 66 and 67). Locations of test holes are indicated on map CM-10782-DR, Packet 5-1.

The description of a representative profile of Persayo soil, as found in the SCS Soil Survey, Carbon-Emery Area, Utah, 1970, is as follows:

A1-0 to 1 inch, light brownish-gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) when moist; weak, thin, platy structure breaking to moderate, very fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine pores; strongly calcareous; mildly alkaline (pH 7.7); clear, smooth boundary.

C1-1 to 3 inches, light brownish-gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) when moist; weak, thin, platy structure; slightly hard, firm, slightly sticky and slightly plastic; few fine roots; few fine pores; strongly calcareous; mildly alkaline (pH 7.7); gradual, smooth boundary.

C2cs-3 to 8 inches, light brownish-gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) when moist; weak, moderately thick, platy structure; hard, firm, sticky and plastic; common fine roots; few, fine, discontinuous pores; many fine gypsum crystals and mycelialike veins; 5 percent weathered shale; strongly calcareous; mildly alkaline (pH 7.5); gradual, irregular boundary.

C3cs-8 to 12 inches, light brownish-gray (2.5Y 6/2) very shaly silty clay loam, dark grayish-brown (2.5Y 4/2) when moist; weak, moderately thick, platy structure; hard, firm, sticky and plastic; few fine roots; many fine gypsum crystals or nodules; 70 percent of horizon is weathered shale fragments; strongly calcareous; mildly alkaline.

R-12 inches +, slightly weathered shale.

As a rule, Persayo soils are dry when not frozen, unless they are irrigated. In the A1 horizon, hue ranges from 2.5Y to 5Y; value is 6 or 7 when the soils are dry and is 4 or 5 when they are moist; and chroma is 2. The part of the profile below 10 inches is silty clay loam that contains less than 35 percent clay. Weathered fragments of shale make up 5 to 70 percent of the material in this part of the profile, and the proportion of fragments of shale increases with depth. All of the upper 20 inches has about the same color. In the C3cs horizon, the content of gypsum ranges from 0.5 to 10 percent and gypsum crystals are few to common.

The soil survey contains no profile description for the Badland soil series.

SOIL ANALYSIS
UTAH POWER AND LIGHT
4/30/87

Sample Name	pH	EC	% $CaCo_3$	P ppm	K ppm	Ca (meq/l)	Mg (meq/l)	Na (meq/l)	SAR	% Sand	% Silt	% Clay	Text. Class	NO_3N ppm
Sec 5, Site 1 Sample 1, 6"	7.47	1.31	26.75	.8	72	11.7	4.4	3.3	1.2	23.1	40.0	36.9	CL	2.2
Sec 5, Site 1 Sample 2, 12"	7.53	2.18	25.50	.8	64	22.0	3.5	3.3	.9	29.1	36.0	34.9	CL	2.2
Sec 5, Site 1 Sample 3, 18"	7.60	2.57	21.15	.8	61	20.2	4.3	9.6	2.7	25.1	40.0	34.9	CL	2.2
Sec 5, Site 1 Sample 4, 24"	7.56	3.0	22.60	.8	70	22.1	12.7	7.7	1.8	49.1	30.0	20.9	L	2.2
Sec 5, Site 2 Sample 1, 6"	8.05	9.82	17.10	.8	131	3.9	41.1	119.6	25.2	9.1	36.0	54.9	C	2.2
Sec 5, Site 2 Sample 2, 12"	7.99	11.43	16.54	.8	130	3.5	39.2	143.5	31.0	9.1	38.0	52.9	C	2.2
Sec 5, Site 3 Sample 1, 6"	7.72	1.88	23.10	.8	153	13.9	8.9	3.8	1.1	23.1	36.0	40.9	C	2.2
Sec 5, Site 3 Sample 2, 12"	7.85	0.57	24.81	.8	92	4.0	2.4	1.9	1.1	33.1	32.0	34.9	CL	2.2
Sec 5, Site 3 Sample 3, 18"	7.68	2.73	20.26	.8	106	16.5	25.7	2.9	.6	23.1	38.0	38.9	CL	2.2
Sec 6, Site 4 Sample 1, 6"	7.63	2.07	19.49	.8	63	22.7	4.1	1.9	.5	29.1	40.0	30.9	CL	2.2
Sec 6, Site 4 Sample 2, 12"	7.35	2.27	18.19	.8	57	23.3	2.1	2.9	.8	35.1	44.0	20.9	L	2.2
Sec 6, Site 4 Sample 3, 18"	7.50	2.18	21.02	.8	48	20.7	3.4	2.4	.7	37.1	34.0	28.9	CL	2.2

Revised 8-4-88

Sample Name	pH	EC	% $CaCo_3$	P ppm	K ppm	Ca (meq/l)	Mg (meq/l)	Na (meq/l)	SAR	% Sand	% Silt	% Clay	Text. Class	NO_3N ppm
Sec 6, Site 5 Sample 1, 6"	7.74	2.50	47.19	.8	111	20.4	6.4	3.8	1.0	33.1	42.0	24.9	L	2.2
Sec 6, Site 5 Sample 2, 12"	7.98	6.25	17.16	.8	109	11.6	50.8	57.4	10.3	15.1	48.0	36.9	SiCL	2.2
Sec 6, Site 5 Sample 3, 18"	8.05	9.24	22.05	.8	100	5.0	95.3	57.4	8.1	15.1	46.0	38.9	SiCL	2.2
Site 6 Sample 1, 6-9"	7.75	1.85	29.75	.8	138	18.3	3.5	2.4	.7	26.6	34.6	38.9	CL	2.2
Site 6 Sample 2, 14"	7.83	1.74	32.04	.8	128	16.9	5.4	3.3	1.0	34.6	28.6	36.9	CL	2.2
Site 6 Sample 3, 18-20"	7.90	2.27	27.07	.8	111	20.3	8.5	3.8	1.0	28.6	30.6	40.9	C	2.2
Site 7 Sample 1, 0-6"	7.90	1.88	31.84	.8	115	18.6	5.3	2.4	.7	34.6	26.6	38.9	CL	2.2
Site 7 Sample 2, 16"	7.97	3.02	4.03	.8	92	18.9	7.4	12.4	3.4	30.6	36.6	32.9	CL	2.2
Site 8 Sample 1, 0-1'	8.3	12.7	8.4	3.0	28.9	22.5	19.2	140.0	30.7	6	43	51	SiC	1.0
Site 9 Sample 1, 0-.3'	8.0	2.9	15.4	1.5	37.9	30.6	8.0	3.4	.77	10	52	38	SiCL	6.0
Site 9 Sample 2, .3-1.0'	8.4	11.4	15.3	<.1	24.6	21.1	19.2	125.0	27.8	10	53	37	SiCL	1.0
Site 9 Sample 3, 1.0-1.7'	8.5	16.4	14.3	.5	35.2	21.6	39.0	197.0	35.8	10	54	36	SiCL	4.0
Site 9 Sample 4, 1.7-2.5'	8.2	16.2	11.6	2.5	50.8	22.0	45.7	187.0	32.1	8	51	41	SiC	46.5
Site 10 Sample 1, 0-0.5'	8.0	5.9	7.3	2.5	50.0	24.5	22.2	37.3	7.7	10	48	42	SiC	4.0

Sample Name	pH	EC	% $CaCo_3$	P ppm	K ppm	Ca (meq/l)	Mg (meq/l)	Na (meq/l)	SAR	% Sand	% Silt	% Clay	Text. Class	NO_3N ppm
Site 10 Sample 2, .5-2.0'	8.0	17.1	7.8	1.8	37.2	21.4	71.4	189.0	27.8	15	50	35	SiCL	1.0
Site 10 Sample 3, 2.0-2.5'	8.2	17.8	8.7	1.2	45.4	21.4	71.7	199.0	29.2	16	51	33	SiCL	1.0
Site 11 Sample 1, 0-0.3'	8.1	4.3	12.0	1.2	27.8	27.2	7.3	26.6	6.4	24	46	30	CL	6.0
Site 11 Sample 2, .3-1.7'	8.4	13.4	12.2	.7	38.7	21.9	26.9	150.0	30.4	21	50	29	CL	2.0
Site 11 Sample 3, 1.7-2.4'	8.4	15.5	12.8	.3	45.0	21.2	36.1	180.0	33.6	20	51	29	CL/SiCL	5.0
Site 11 Sample 4, 2.4-2.9'	8.4	14.6	13.3	1.0	39.5	21.0	37.7	157.0	29.0	22	50	28	CL	6.0

CL = Clay Loam
L = Loam
C = Clay
SiCL = Silty Clay Loam

NPI Soil Testing/Plant Tissue Analysis Lab
417 Wakara Way, Salt Lake City, UT 84108
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CHARACTERISTICS OF ROCK TO BE STORED IN SITE

In order to better understand the chemical and physical properties of the rock that will be placed in the Deer Creek Waste Rock Storage Facility, over 130 samples from both outcrop and drill cores were analyzed.

Samples were selected that would best represent the material that would be placed in the site over its useful life. The samples were tested individually and the results are summarized in the Table (Waste Rock Chemical and Physical Properties) according to the common rock types that will be stored in the site.

In addition to these analyses, representative samples were tested for their potential alkalinity, pyrite/marcasite content and clay content. The results are shown below.

Zone Sampled	Number of Samples	pH	%FeS2 Pyrite/Marcasite	% Clay	Potential Alkalinity
Hiawatha roof	3	7.8	3.3	-	218,400
Hiawatha floor	3	7.5	1.3	5.5	127,300
Blind Canyon roof	2	8.1	0.5	-	252,600
Blind Canyon floor	3	8.3	1.3	9.0	3,500

A review of the above data concerning the sodium adsorption ratio of the Blind Canyon floor reveals that three out of four samples have values less than 5.0 (4.8, 1.5 and 1.3). One sample has a value of 60.4 which raised the sample mean to 17.36 and created a high standard deviation of 25.14. This indicates that in general the Blind Canyon floor rock will not pose a problem from its high SAR but from time to time higher than average values will be encountered. These concentrations should be diluted by other rocks with low SAR values when stored in the Deer Creek Waste Rock Storage Facility.

To identify the acid-or toxic-forming potential of materials disposed of at the waste rock site, the following sampling, analysis and reporting plan will be implemented:

SAMPLING

1. Sampling will be conducted bi-annually beginning the fall of 1988 in conjunction with operational inspections discussed on page 2-8, revised 8/1/88.

   In addition to the chemical and physcial properties shown on Page 7-6, revised 6/7/88, the following will be sampled: percent non sulfate, percent calcium carbonate and selenium. This will be sampled within 30 days after rock disposal and results submitted to the Division when received. The units of measurement and methodology of analysis will be explained with the results.

2. The upper one (1) foot of material will be grab sampled at the rate of two (2) samples per acre.

3. If initial sampling indicates acid-or toxic-forming material, sufficient additional sampling will be implemented to define the extent of problem material.

ANALYSIS

1. Physio-chemical analysis of the material will include the following:

   USDA Texture Class (% sand, silt, clay)
   Electrical conductivity (mmhos/cm25^{o}C)
   pH (standard units)
   Sodium adsorption ratio
   Water extractable Boron (mg/Kg)
   Water Extractable Selenium (mg/Kg)
   Rock fragments (%)
   $CaCO_3$ (%)

   Sulfur (non-sulfate, pyritic and organic) (%)
   Saturation percentage

2. Analysis will be conducted in accordance with Division Guidelines on Management of Topsoil and Overburden Materials.

REPORTING

1. Sampling results will be submitted to the Division within two (2) weeks following the operational inspection or upon receipt of the analysis data, which ever occurs first.

2. A copy of the report will be maintained at the Mining Division offices for inspection.

WASTE ROCK CHEMICAL AND PHYSICAL PROPERTIES

Lithology	Chemical Test	Physical Test	CHEMICAL TESTS Ca Meg/L	Mg Meg/L	Na Meg/L	^{1}SAR	Fe ppm	Zn ppm	SO_4 ppm	Mo ppm	B ppm	pH Paste	E.C.^{2} mhos/cm	PHYSICAL TESTS Sat. %	Pyrite FeS_2	Sand %	Silt %	Clay %	Rock Texture
Blackhawk Formation:																			
Sandstone:	26	2																	
Mean			4.37	8.18	2.13	1.05	8874	11.47	409.6	.1	.06	8.0	1.55	21.7	-	84.5	11.0	4.5	Sandy
S.D.			3.91	5.13	1.08	0.69	6672	9.7	353.1	0.0	.06	0.96	0.89	3.36	-	0.71	1.41	2.12	Loam
Siltstone:	24	5																	
Mean			3.06	6.24	2.30	1.69	14512.88	38.26	464.41	.1	0.18	7.88	1.41	20.81	2.3	71.6	17.8	10.6	Sandy
S.D.			2.63	7.23	2.78	3.72	8782.4	21.29	1222.63	0.0	0.16	1.08	1.72	1.82	0.0	23.5	16.57	7.7	Loam
Mudstone:	24	4																	
Mean			3.12	3.13	4.70	4.28	11074.13	70.31	233.96	.1	0.28	8.0	1.10	23.99	-	71.5	20.5	8.0	Sandy
S.D.			2.36	2.89	12.76	12.58	5350.17	79.99	275.10	0.0	0.23	0.31	1.12	4.88	-	13.77	15.2	3.56	Loam
Interbeds:	15	3																	
Mean			4.34	7.98	2.79	1.30	10982.13	21.58	346.95	.1	0.12	8.05	1.58	20.56	-	75.33	17.00	7.67	Loamy
S.D.			3.13	6.37	1.85	1.36	6584.59	9.97	359.46	0.0	0.11	0.23	0.92	1.33	-	7.64	9.54	3.06	Sandy
Carb-mudstone:	25	3																	
Mean			6.19	6.51	3.7	2.4	9933.76	58.04	438.86	.1	0.42	7.53	1.54	34.76	2.3	73.33	18.00	5.76	Sandy
S.D.			4.85	8.42	4.85	3.98	6112.12	38.94	378.81	0.0	0.34	0.85	1.14	9.94	3.29	20.60	16.82	3.53	Loam
Coal (Blind Canyon)	8	0																	
Mean			1.55	1.81	1.68	1.63	2089.38	10.19	103.88	.1	.06	8.0	.36	60.66	0.44				
S.D.			0.59	2.88	1.35	1.27	2557.56	8.82	66.88	0.0	.05	0.25	.05	18.59	0.06				
Coal (Hiawatha)	2	0																	
Mean			1.52	2.85	1.41	1.58	2532.41	10.82	97.32	.1	0.12	7.95	0.34	60.24	0.51				
S.D.			0.66	3.64	0.95	1.18	2718.02	8.41	72.14	0.0	0.21	0.24	0.07	16.84	0.06				
Starpoint Sandstone																			
Sandstone	11	4																	
Mean			5.14	8.58	3.42	3.57	3798	9.47	1457.0	.1	0.11	6.76	2.49	30.46	-	90.75	4.75	4.50	Sandy
S.D.			3.89	4.69	2.97	5.18	2965.0	6.98	2578.0	0.0	0.24	1.54	1.20	4.8	-	4.80	3.50	1.91	Loam

1 SAR = Sodium Absorption Ration
2 EC - Electrical Conductivity

DEER CREEK MINE
WASTE ROCK MATERIAL
ANALYSIS[1]

SAMPLE	pH	EC	% $CaCO_3$	SAR	% SAND	% SILT	% CLAY	TEXTURE CLASS	BORON (mg/kg)	SELENIUM (mg/kg)	% ROCK FRAGMENTS	SATURATION %	% SULFUR NON-SULFATE	% SULFUR PYRITIC	ORGANIC
1-82988[2]	7.43	5.12	26.3	5.0	55.3	23.3	21.4	SCL	1.2	0.098	88.8	30.6	0.31	0.03	0.28

1- Analysis completed according to methods identified in DOGM Guidelines for Management of Topsoil and Overburden for Underground and Surface Coal Mining.

2- Sample is a representative sample composited from five (5) sample sites.

7-6.1

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Chapter VIII VEGETATION

Section I Environmental Baseline Description
UMC 783.19, .24
Refer to the following report titled:
Vegetation of the Proposed Deer Creek
Waste Rock Storage Facility

Section II Detailed Designs and Calculations
UMC 783.19
Refer to the Chapter III Reclamation Plan,
Section VI and the above mentioned report.

Section III Demonstration of Compliance with Performance Standards
UMC 817.100, .111 - .117
Refer to Chapter III Reclamation Plan,
Section VI and VII.

VEGETATION OF THE PROPOSED

DEER CREEK MINE

WASTE ROCK STORAGE FACILITY

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Date: June 1987

TABLE OF CONTENTS

SCOPE

The following is a report of the vegetation of the proposed Deer Creek Waste Rock Storage Facility for the Deer Creek Mine, Emery County, Utah. The primary purpose of this report is to supply meaningful and scientific data that will provide accurate standards for future reclamation of this area. Proposed disturbance areas and reference areas similar to the proposed disturbance areas, were studied on the site. Studies were performed in accordance to the guidelines supplied by the State of Utah, Division of Oil, Gas and Mining (DOGM).

A METHODS section is included in this report to provide the reviewers with all methodologies used to obtain the data. Within the INTRODUCTION of the report, a General Site Description section is provided to give an overview of the entire site. The RESULTS section specifically describes each proposed disturbed plant community, reference areas and also supplies results of data analyses and statistical testing from ecological sampling. A VEGETATION MAP of each area is also included in this report. (See map # CM-10777 DR, Map Packet 8-1)

INTRODUCTION

General Site Description

The study site for the Deer Creek Waste Rock Storage Facility for the Deer Creek Mine is located in Huntington Canyon, West of Huntington, Utah. The area is located on the north side of Huntington Canyon, northeast of the power plant, and north of the Utah Power & Light agricultural farms. Elevation ranges around 6,300 ft above sea level.

The major vegetation type proposed to be disturbed on this site is a Gardner Saltbush/Mat Saltbush community. It is comprised, however, of several, relatively small, isolated plant communities. The area has many small slopes ranging from 2 to 21 degrees. The aspects are nearly as variable with exposures to the east, west and south. The variations in slope and aspect provide variable habitats for plant species. For example, there is a small area on the border of the disturbed area that supports a small stand of pinyon and juniper trees. There are also fingers on the ridges and on the more gently sloped areas that support nearly monocultures of mat saltbush (Atriplex corrugata). Moreover, the steeper slopes, often with east exposures, are dominated by Gardner saltbush. Furthermore, some of the more gentle slopes and part way up the west facing steeper slopes, stands of black sagebrush (Artemisia nova) and shadscale (Atriplex confertifolia) are the dominant plant species.

METHODS

Quantitative and qualitative data were taken on and adjacent to the proposed disturbed areas. Bi-directional random placement of sampling plots were designed to provide unbiased accuracy of the data compiled. Cover estimates were made using ocular methods with meter square quadrats. Also recorded on data sheets were estimated precipitation, slope, exposure, grazing use, animal disturbance and other appropriate notes.

Density of woody plant species were recorded using the point quarter distance method (Cottom and Curtis 1956). In this method, random points were placed on the sample sites and measured into four quarters. The distances to the nearest woody plant species were then recorded in each quarter. The average point-to-individual distance was equal to the square root of the mean area per individual.

The areas were surveyed on a grid system for threatened and endangered plant species. Voucher specimens for many on the species will be filed at the Brigham Young University herbarium. Plant nomenclature follows Welch et al. (1987).

Sampling adequacy for cover and woody species density was achieved using formulas from Snedocor and Cochran (1980), insuring that 80% of the samples were within 10% of the true mean for the shrub communities of the area. Student's t-tests were also employed to compare the proposed disturbance and reference areas of all sites for cover and woody plant species density. Jaccard's Community Coefficient's were used to make species composition comparisons. All sample means, standard deviations, and sample sizes were included in this report to enable the reviewers to apply further statistical tests if desired.

Productivity was estimated and range condition was evaluated by Soil Conservation Service personnel. (See attached letter from George S. Cook - following Table #8, page 8-17)

Vegetation mapping was done by walking the area and using aerial photos and contour maps. Sampling locations are also shown on these maps. (See maps number CM-10777 DR, located in map packet # 8-1)

RESULTS

Proposed Disturbed Gardner Saltbush/Mat Saltbush Community

Because of the variability and diversity of habitats in this area, and because these areas were often relatively small and isolated, long transects were randomly placed on the area to insure that vegetation sampling would include a representation of the community type as a whole.

The community is identified as a Gardner Saltbush/Mat Saltbush Community. Woody plant species and grasses dominate this community comprising 78.89% and 19.70% of the living cover, respectively (Table 1). Total cover was estimated at 39.05%. Dominant shrub species of the community were Gardner Saltbush (Atriplex gardneri) and mat saltbush (Atriplex corrugata). Dominant grass species are salina wildrye (Elymus salinus) and Indian ricegrass (Oryzopsis hymenoides). For a listing of cover by species, refer to Table 2. Density of woody plants was estimated at 5,894.45 individuals per acre (Table 3).

Reference Area for the Gardner Saltbush/Mat Saltbush Community.

A reference area with similar slope, soils, exposure, species composition, precipitation, elevation and other environmental variables was chosen as a standard for future reclamation of the site. For total cover and species composition of this reference area, refer to Table 4. For cover estimated by species, refer to Table 5. For total woody species density and density by species, refer to Table 6. A combined species list for the two areas is shown on Table 7.

Statistical analyses indicated that the proposed disturbed and reference areas to be 74.07% similar by species. The two communities were not significantly different by cover or densities when compared by t-tests. For a summary on the statistics employed, refer to Table 8.

Threatened and Endangered Plant Species

No threatened or endangered plant species were found during the course of the study. As mentioned previously, voucher specimens will be donated to the herbarium at Brigham Young University.

Supplemental Vegetation Sampling

Supplemental vegetation sampling will be conducted in the Pinyon-Juniper community during the 1988 growing season, prior to disturbance. Data similar to that found in this report will be generated for the proposed disturbed and reference areas in this community. This information will be forwarded to the Division for inclusion in the existing permit.

TABLE 1 The proposed disturbed area of the Gardner Saltbush/Mat Saltbush Community. The table shows the mean percent cover and composition with standard deviations and sample sizes.

TOTAL COVER	% MEAN COVER	STANDARD DEVIATION	SAMPLE SIZES
Total Living Cover*	39.05	12.34	20
Litter	4.35	4.18	20
Rock	8.45	12.25	20
Bareground	48.65	15.12	20
COMPOSITION			
Shrubs	78.89	32.60	20
Forbs	1.41	4.10	20
Grasses	19.70	30.01	20

* Sample size insures 80% accuracy within 10% of the true mean.

TABLE 2 The proposed disturbed area of the Gardner Saltbush/Mat Saltbush Community. The table shows the mean percent cover, standard deviation, sample size and relative frequency by species.

SPECIES	% MEAN COVER	STANDARD DEVIATION	SAMPLE SIZE	RELATIVE FREQUENCY
SHRUBS				
Artemisia nova	3.40	8.86	20	20.00
Atriplex gardneri	17.00	16.46	20	75.00
Atriplex confertifolia	3.25	11.50	20	10.00
Atriplex corrugata	4.35	11.29	20	20.00
Chrysothamnus viscidiflorus	1.10	1.92	20	30.00
Sarcobatus vermiculatus	.75	2.45	20	10.00
FORBS				
Cryptantha flava	.25	.91	20	10.00
Cymopterus purpureus	.05	.22	20	5.00
Eriogonum gordonii	.25	1.12	20	10.00
GRASSES				
Elymus salinus	4.60	10.96	20	20.00
Oryzopsis hymenoides	3.10	7.79	20	30.00
Sitanion hystrix	.60	1.57	20	15.00

TABLE 3 Woody species densities of the proposed disturbed area of the Gardner Saltbush/Mat Saltbush Community.

	NUMBER/ACRE*
Artemisia nova	343.89
Atriplex gardneri	2,406.90
Atriplex confertifolia	785.93
Atriplex corrugata	1,277.13
Chrysothamnus nauseosus	49.12
Chrysothamnus viscidiflorus	687.69
Sarcobatus vermiculatus	49.12
Suaeda torreyana	245.60
Tetradymia spinosa	49.12
TOTAL	5,894.45

* Sample size was 30 (n=30) and insured that 80% accuracy within 10% of the true mean.

TABLE 4 The reference area of the Gardner Saltbush/Mat Saltbush Community. The table shows the mean percent cover and composition with standard deviations and sample sizes.

TOTAL COVER	% MEAN COVER	STANDARD DEVIATION	SAMPLE SIZES
Total Living Cover*	38.93	14.79	30
Litter	8.40	5.01	30
Rock	7.50	6.63	30
Bareground	45.33	17.21	30
COMPOSITION			
Shrubs	84.09	24.91	30
Forbs	1.13	3.05	30
Grasses	14.78	24.70	30

* Sample size insures 80% accuracy within 10% of the true mean.

TABLE 5 The reference area of the Gardner Saltbush/Mat Saltbush Community. The table shows the mean percent cover, standard deviation, sample size and relative frequency by species.

SPECIES	% MEAN COVER	STANDARD DEVIATION	SAMPLE SIZE	RELATIVE FREQUENCY
SHRUBS				
Artemisia nova	6.50	11.23	30	30.00
Atriplex gardneri	11.37	17.17	30	46.67
Atriplex confertifolia	4.23	7.85	30	36.67
Atriplex corrugata	.57	3.10	30	3.33
Chrysothamnus nauseosus	.17	.91	30	3.33
Chrysothamnus viscidiflorus	6.10	6.82	30	53.33
Ephedra viridis	.50	2.74	30	6.67
Eriogonum corymbosum	2.33	5.86	30	26.67
FORBS				
Cryptantha flava	.07	.25	30	10.00
Cymopterus purpureus	.17	.91	30	6.67
Phacelia crenulata	.07	.25	30	6.67
GRASSES				
Elymus salinus	3.50	8.11	30	16.67
Oryzopsis hymenoides	2.70	5.53	30	30.00

TABLE 6 Woody species densities of the reference area of the Gardner Saltbush/Mat Saltbush Community.

	NUMBER/ACRE*
Artemisia nova	893.32
Atriplex gardneri	1,914.25
Atriplex confertifolia	1,148.55
Atriplex corrugata	723.16
Chrysothamnus nauseosus	127.62
Chrysothamnus viscidiflorus	1,744.10
Ephedra viridis	42.54
Eriogonum corymbosum	127.62
Suaeda torreyana	85.08
TOTAL	6,806.25

* Sample size was 40 (n=40) and insured that 80% accuracy within 10% of the true mean.

TABLE 7 Species list for the Gardner Saltbush/Mat Saltbush Community.

SCIENTIFIC NAME	COMMON NAME
SHRUBS	
Artemisia nova	Black sagebrush
Atriplex gardneri var. cuneata	Castle Valley saltbrush
Atriplex confertifolia	Shadscale
Atriplex corrugata	Mat saltbush
Chrysothamnus nauseosus	Rubber rabbitbrush
Chrysothamnus viscidiflorus	Low rabbitbrush
Ephredra viridis	Mormon tea
Eriogonum corymbosum	Corymb buckwheat
Juniperus osteosperma	Utah juniper
Pinus edulis	Pinyon pine
Sarcobatus vermiculatus	Greasewood
Tetradymia spinosa	Cottonthorn horsebrush
FORBS	
Cryptantha flava	Cryptantha
Cymopterus purpureus	Spring parsley
Eriogonum gordonii	Gordon's buckwheat
Eriogonum jamesii	James wild buckwheat
Eriogonum sp.	Buckwheat
Haplopappus sp.	Goldenweed
Parthenium sp.	Parthenium
Phacelia crenulata	Phacelia
Phacelia sp.	Phacelia
GRASSES	
Elymus salinus	Salina wildrye
Oryzopsis hymenoides	Indian ricegrass
Sitanion hystrix	Squirreltail

TABLE 8 Statistical summary sheet for the Gardner Saltbush/Mat Saltbush Community.

PROPOSED DISTURBED				
Total Living Cover	x = 39.05	s = 12.34	n = 20	NMin = 16.36
Density	x = 28.71	s = 15.76	n = 30	NMin = 49.06
Aspect	E,W,S			
Slope	2 - 21 deg.			
REFERENCE AREA				
Total Living Cover	x = 38.93	s = 14.79	n = 30	NMin = 23.49
Density	x = 27.51	s = 13.00	n = 40	NMin = 36.59
Aspect	E,W,S			
Slope	2 - 21 deg.			

Jaccards Similarity Coefficient = 80.77%

Student's t-value (cover) = 0.030
Degrees of freedom = 48
Significance level = N.S.

Student's t-value (density) = 0.349
Degrees of freedom = 68
Significance level = N.S.

x = sample mean, s = sample standard deviation,
n = sample size, NMin = Minimum sample size for statistical adequacy,
p = significance level, N.S. = nonsignificant

United States Department of Agriculture
Soil Conservation Service
350 North 4th East
Price, Utah 84501

Huntington Power Plant
Huntington Canyon
Huntington, Utah

Dear Sir:

proposed waste rock storage facility (WC)

On June 4, 1987, I visited your reference areas for the ~~ash stockpiles~~ with Patrick Collins to determine production and range condition.

The chained reference area is in fair condition and the production of the site is about 800 lbs. per acre.

The reference area east of the chained area in the sagebrush grass area is in fair condition and producing about 500 pounds. The mature P.J. slope is in good condition and is producing about 75 to 100 lbs. of understory vegetation and about 800 to 900 lbs. of Pinyon Juniper.

The Mat Saltbush, Gardner Saltbush site is producing about 250 lbs. of vegetation and is in a low good condition.

George S. Cook
Range Conservationist
Soil Conservation Service
Price, Utah

AMENDMENT TO

APPROVED Mining & Reclamation Plan
Approved, Division of Oil, Gas & Mining
by [signature] date 3/28/89

Chapter IX WILDLIFE

Section I ENVIRONMENTAL BASELINE DESCRIPTION
UMC 783.20

The proposed Deer Creek Mine Waste Rock Storage Facility site occupies portions of an Upper Sonoran/Transition life zone ecotone, within the Wasatch Plateau biogeographic area. A general discussion of wildlife species associated with these ecological zones is contained in Volume 2 of the Deer Creek Coal Mine Permit Application, following page 4-54. This material provides adequate information for impact assessment; therefore, site-specific wildlife studies are not necessary. (See letter from Brent A. Stettler, DOGM, Dec.28,1987, attachment #1 at end of this chapter)

The present primary land use at the site is wildlife habitat, specifically critical winter habitat for mule deer (Odocoileus hemionus) and elk (Cervus canadensis). Specific wildlife use areas associated with the site include migration routes, open areas and bedding areas. These are indicated on Map CM-10776 DR, Map Packet # 9-1 (Refer to Chapter V-VIII for additional site descriptions).

UMC 783.25 (B) Not Applicable

Section II COMPLIANCE WITH PERFORMANCE STANDARDS
UMC 817.97

The waste rock storage facility, including access road, drainage control diversion, sediment ponds and disposal areas, will occupy approximately 48.69 acres. Of the total acreage, approximately 4.5 acres is critical winter habitat. (See Map CM-10776 DR, Map Packet #9-1 and letter from Larry Dalton, DWR, Jan. 25, 1988, attachment #2 at end of this chapter)

As discussed in Chapter II, Operation Plan, disturbance of the critical habitat will be avoided until the year 2002. Also, as indicated on Map CM-10776 DR, Map Packet # 9-1, the disposal area has been designed to minimize or avoid disturbance of some of the higher valued critical habitat, i.e. bedding areas.

No threatened or endangered species, nor habitat for such species, are present within the waste rock site permit area. The nearest know raptor nests are approximately 1.3 miles (2.1 km) northeast of the site. Golden eagles have been observed in flight above the general area wherein the site is located.

No electric power lines or other transmission facilities will be constructed to serve the waste rock storage facility.

No fish species or fish supporting habitat are present on the site and no streams containing biological communities, as defined by UMC 817.57 (c), exist within the site permit area. However, the access road and the waste rock storage area have been designed, and will be

constructed and operated, in such a manner as to minimize the potential for impact to Huntington Creek which is the nearest fishery supporting stream. (Please refer to Chapter II, Operation Plan and Chapter III, Reclamation Plan).

Fences will be constructed to allow uninhibited big game passage. It is not anticipated that the sediment ponds will contain hazardous concentrations of toxic-forming materials; therefore, fencing of the ponds is not proposed. It is anticipated that the ponds will achieve wildlife habitat enhancement resulting from the creation of riparian areas which do not presently exist.

As described in Chapters II and III the waste rock storage facility will be constructed and operated in phases. This facilitates delayed critical habitat impact in conjunction with impact mitigation and habitat enhancement.

As the Operation Plan discusses, the north portion of Area 1, approximately 4.5 acres, will be utilized and permanently reclaimed approximately seven (7) years into the project (ca. 1995). Construction of Area 2, which results in disturbance of the critical habitat, will not begin until approximately 2002. This allows seven (7) years for establishment of useable forage production prior to impacting of the critical habitat. It is expected that productivity, achieved on the 4.5 acres reclaimed in Area 1 and areas where interim revegetation is conducted, will be sufficient to mitigate for the impact to the 4.5 acres of critical habitat.

The phased construction and operation approach results in mitigation and enhancement being achieved prior to significant habitat impacts. (Letter pending from Larry Dalton, UDWR, indicating acceptance of proposed mitigation.)

No persistent pesticides will be used on the area, unless approved by the Division. If it is determined that pest control is needed, approved species-specific control measures will be implemented.

To the extent possible, range or forest fires will be prevented, controlled or suppressed, unless directed otherwise by the Division.

As stated in Chapter III, Section VI, the primary post-mining land use is to be wildlife habitat. Final reclamation plant species were selected for that purpose and generally follow information provided to Utah Power and Light by UDWR, which is identified as "Recommended Plant Materials and Rates of Application for Restoration or Enhancement of Wildlife Habitats." Adequate wildlife cover is available adjacent to the waste rock storage site; therefore, plant species were chosen primarily for forage production.

Initially three mitigation measures were outlined by the Utah Division of Wildlife Resources regarding impacts to wildlife. They finally concluded that the permit application package mitigation strategy adequately addresses impacts to wildlife. See Page 9-2.2.

STATE OF UTAH
NATURAL RESOURCES
Wildlife Resources

Norman H. Bangerter, Governor
Dee C. Hansen, Executive Director
William H. Geer, Division Director

1596 West North Temple • Salt Lake City, UT 84116-3154 • 801-533-9333

June 10, 1988

Dr. Dianne R. Nielson, Director
Utah Division of Oil, Gas and Mining
355 West North Temple
3 Triad Center, Suite 350
Salt Lake City, UT 84180-1203

Attn: John Whitehead

Dear Dianne:

The Division has evaluated Utah Power and Light Company's plans titled "Deer Creek Waste Rock Storage Facility". The development operation and mitigation strategy adequately addresses impacts to wildlife. It is recommended that the interim revegetation seed list (page 3-6) and the final revegetation seed list (page 3-8) be modified to include ladak alfalfa (1 lb./acre) and Great Basin sagebrush (0.5 lb/acre). Also, the streambank wheatgrass should be replaced with Basin wildrye. These vegetation species will likely establish under the reclaimed conditions and will enhance the site for big game use.

Thank you for an opportunity to review the MRP and provide comment.

Sincerely,

William H. Geer
Director

STATE OF UTAH
NATURAL RESOURCES
Oil, Gas & Mining

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

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

December 28, 1987

Mr. Ray Christensen, Manager
Utah Power and Light Company
Permitting and Compliance
Mining Division
P. O. Box 310
Huntington, Utah 84528

Attachment No.1

Dear Mr. Christensen:

Re: UMC 783.20 Fish and Wildlife Resources, Information for Proposed Waste Rock Disposal Site, Utah Power and Light Company, Deer Creek Mine, ACT/015/018, Folder #2, Emery County, Utah

You telephoned John Whitehead more than a week ago, asking what wildlife studies and level of detail were needed for permitting the Deer Creek Mine waste rock disposal site (T.17S, R.8E S.6NE), pursuant to UMC 783.20.

I consulted with Clark Johnson of the U.S. Fish and Wildlife Service (USFWS) who believes site-specific wildlife studies are unnecessary. The USFWS is more interested in effective, wildlife-oriented reclamation. Specifically, Mr. Johnson expressed concern that (1) the site be adequately reclaimed; (2) reclamation include shrubs and forbs beneficial to wildlife; and (3) the reclaimed surface be contoured to provide topographic variation for micro-habitat development.

I was unable to reach Larry Dalton of the Utah Division of Wildlife Resources (UDWR) as he is on annual leave until January 4, 1988. However, he expressed UDWR's concerns during our November 20, 1987 visit to the site. These concerns involved mitigation for the loss of big game winter range.

Two impact-mitigation options were suggested. The first involved chaining and re-seeding nearby tracts at five-year intervals over the life of the disposal site. The second called for the lowering of an existing fence around a pasture (above the disposal site) managed by the Utah Power and Light Farm Research Division. Modification was to meet 42-inch range fence standards.

The Division finds that no site-specific wildlife studies are necessary, as published wildlife information is available for determination of impacts. The permit application shall nonetheless include existing wildlife resource information. Previously published data may be summarized and referenced. Attention should be given to the site's classification as big game winter habitat, which justifies habitat enhancement/impact mitigation measures proposed by UDWR. The concerns of federal and state wildlife management agencies must be addressed, as these relate to performance standards compliance.

Sincerely,

Brent A Stettler

Brent A. Stettler
Reclamation Biologist

djh
cc: C. Johnson
L. Dalton
J. Whitehead
1369R/13

STATE OF UTAH
NATURAL RESOURCES
Wildlife Resources

Norman H. Bangerter, Governor
Dee C. Hansen, Executive Director
William H. Geer, Division Director

Southeastern Region • 455 West Railroad Avenue • Price, UT 84501-2829 • 801-637-3310

January 25, 1988

Attachment No. 2

Mr. Brent Stettler
Utah Division of Oil, Gas & Mining
355 West North Temple
3 Triad Center, Suite 350
Salt Lake City, UT 84180-1203

Dear Brent:

In regards to Utah Power & Light Company's most recent proposed site for waste rock disposal . . . north of the Huntington Canyon highway near the power plant's evaporation pond (NENE Sec. 6, T 17 S, R 8 E) the following is provided.

(1) The 22 acre site has about five acres that represents critical valued winter range for mule deer and Rocky Mountain elk. It is comprised of pinyon/juniper, browse species and salina wild rye. The remainder of the site is of limited value to wildlife due to soil derived from mancos shale.

(2) This site is preferred for burial of waste rock as compared to the earlier site identified in Stump Flat. All of the Stump Flat site represented critical valued winter range for mule deer.

(3) Between 1970 and now, substantial acreage of critical valued big game winter range (habitat loss is estimated to have exceeded 1,000 acres due to development of industrial facilities) along and adjacent to the floor of Huntington Canyon in this locale has been lost. Such loss means a permanent reduction in the size of the local big game herds due to decreased carrying capacity of the range.

Brent, it is recommended that UP&L be allowed to develop this new waste rock disposal site so long as acceptable mitigation for the loss of critical valued big game winter range is achieved. Mitigation options that would be acceptable are as follows (note that either option (a) or (b) would serve as compensation for lost habitat):

(a) UP&L develop a rangeland treatment consisting of at least five acres in the area local to the proposed perturbation that would double the usable forage production as currently being sustained. Since the site being damaged supports elk and deer from Gentry Mountain, the mitigation area must lie north of the Huntington Canyon highway. Additionally, the treatment must be replicated on five year increments for the life of the waste rock facility. These replications need only be to the extent that maximum effectiveness in forage production is maintained. Such replications are necessary since the waste rock area

will not be reclaimed until closure of the Deer Creek Mine and maximum effectiveness of rangeland treatments begin to decrease after five years.

Relocation and design of a vegetation treatment for benefits to big game must be approved by DWR.

(b) An existing rangeland conversion owned by UP&L and which approximates 80 acres exists on Poison Springs Bench adjacent to the proposed waste rock site. Waste water from the Huntington Power Plant is spread there to grow forage for UP&L's livestock. Unfortunately, a fence exceeding 50 inches height precludes big game from making safe use of the pasture. Modification by UP&L of the entire fence to allow big game passage and uninhibited use by those game animals of the pastures would be satisfactory mitigation. Design "D" on the enclosed fence specification figure would allow big game passage while containing livestock.

Regardless of mitigation selected, the waste rock site must be contemporaneously revegetated with forage species having value to wintering elk and deer.

Thank you for an opportunity to provide comment.

Sincerely,

Larry B. Dalton, Resource Analyst
Southeastern Region

LBD/dd

Enclosure

cc: Darrell Nish, DWR
Clark Johnson, USFWS
Val Payne, UP&L

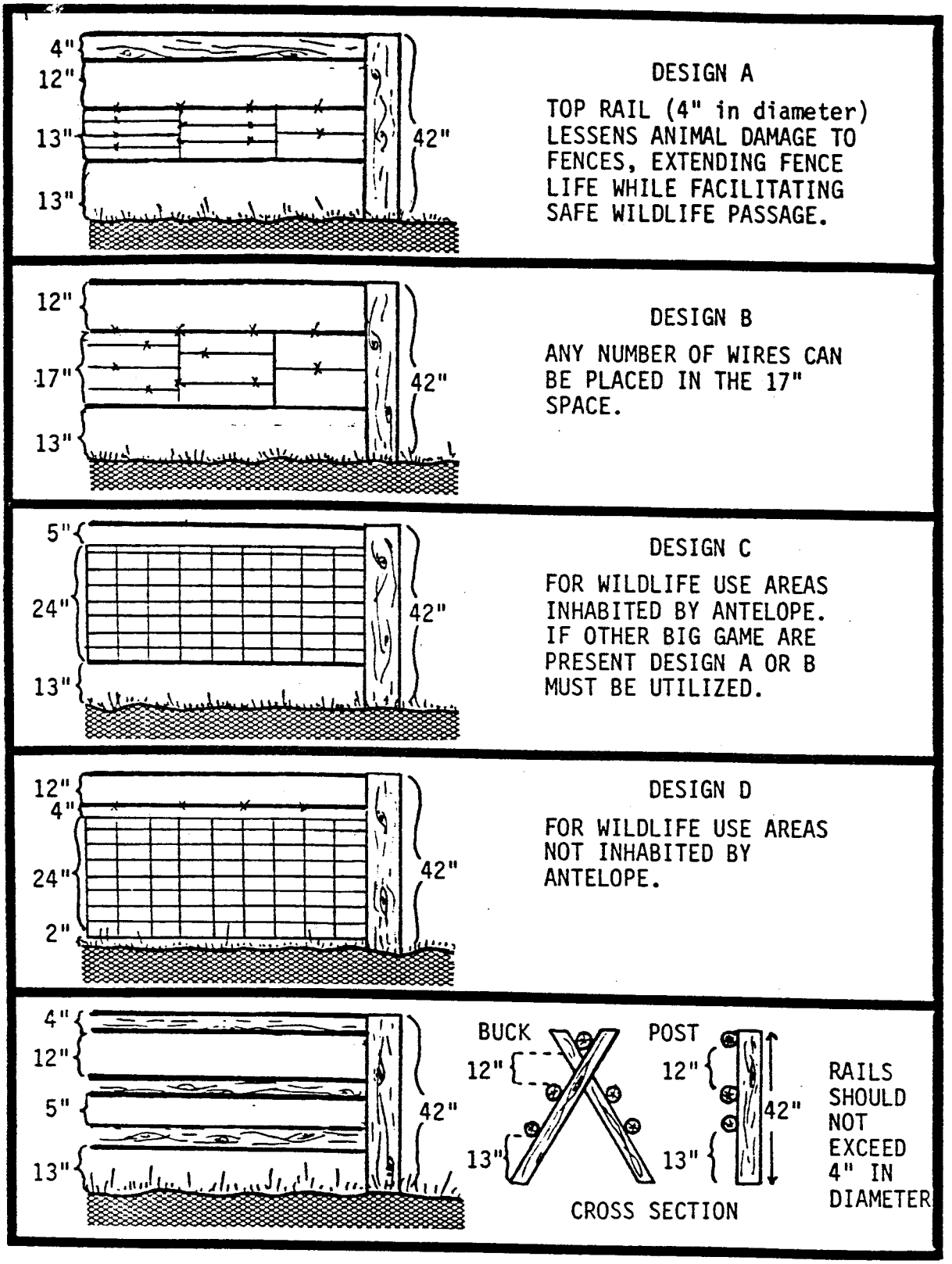


FIGURE F5. Fence specifications for containing livestock while allowing big game passage. Total fence height must not exceed 42". The space between the two top wires should be at least 12" to allow passage of juvenile big game; a smooth top wire is needed. The bottom wire should be at least 13" from the ground and smooth to allow big game to crawl beneath, particularly antelope.

Chapter X CLIMATE, AIR QUALITY, CULTURAL RESOURCES, LAND USE

UMC 783.12 (b) Cultural Resources

Consultant F.R. Hauck, Ph. D. of Archeological-Environmental Research Corporation has conducted an examination of the Deer Creek Waste Rock Storage Facility and found that "no cultural resources or sites were observed or recorded during the evaluation". He consulted The National Register of Historic Places (NRHP) and found that no registered properties will be effected by the proposed development. His literature search included the Utah State Historical Preservation Office (SHPO) and the Price Area BLM Office.

Dr. Hauch's report follows on the next three pages.

Bureau of Land Management
Utah State Office
(AERC FORMAT)

Summary Report of
Inspection for Cultural Resources

1 10
Report Acceptable Yes __ No __

Mitigation Acceptable Yes __ No __
Comments:_____
_____

W A S T E R O C K D I S P O S A L S I T E

Report Title . . . . . 11 **Utah Power & Light Co., Parcel in Huntington Canyon**

2. Development Company_____

3. Report Date 41 42 **0 4** 43 **1 5** 46 **1 9 8 7**

4. Antiquities Permit No. **87-UT-54937**

5. Responsible Institution . . . . . **A E R C U P L - 8 7 - 2** County **Emery**

6. Fieldwork Location: TWN . . . . . 47 **1 7 S** RNG . . . . . 61 **0 8 E** Section. . . **0 5 0 6**
62 65 66 69 70 71 72 73 74 75 76 77

7. Resource Area **.P.R.** 110 111 TWN . . . . . RNG . . . . . Section. . .
78 81 82 85 86 87 88 89 90 91 92 93
94 97 98 101 102 104 106 108

8. Description of Examination Procedures:
The archeologist, F.R. Hauck, walked a series of 15 to 20 meter wide transects within the large parcel. The existing access road was also examined on each flank by walking 15 meter wide transects. As a result this roadway can be upgraded for 50 additional feet on either side of the existing road.

9. Linear Miles Surveyed and/or Definable Acres Surveyed and/or Legally Undefinable Acres Surveyed . . . . . **. 5** 112 117 118 123 **7 0** 124 129

10. Inventory Type . . **I** 130
R = Reconnaissance
I = Intensive
S = Statistical Sample

11. Description of Findings:
No cultural resources or sites were observed or recorded during the evaluation.

12. Number Sites Found . . . . . **.0.** (No sites = 0) 131 135

13. Collection: **.N.** Y = Yes, N = No) 136

14. Actual/Potential National Register Properties Affected:
The National Register of Historic Places (NRHP) has been consulted and no registered properties will be affected by the proposed development.

15. Literature Search, Location/ Date: **Utah SHPO - 4-13-87**
Price Area BLM Office - 4-14-87

16. Conclusion/ Recommendations:
AERC recommends that a cultural resource clearance be granted to Utah Power & Light Company based upon adherence to the following stipulations: **(see** next page **)**

17. Signature of Administrator & Field & Field Supervisor

Administrator **F. R. Hauck**

Field Supervisor **F. R. Hauck**

UT 8100-3
(2/85)

16. continued:

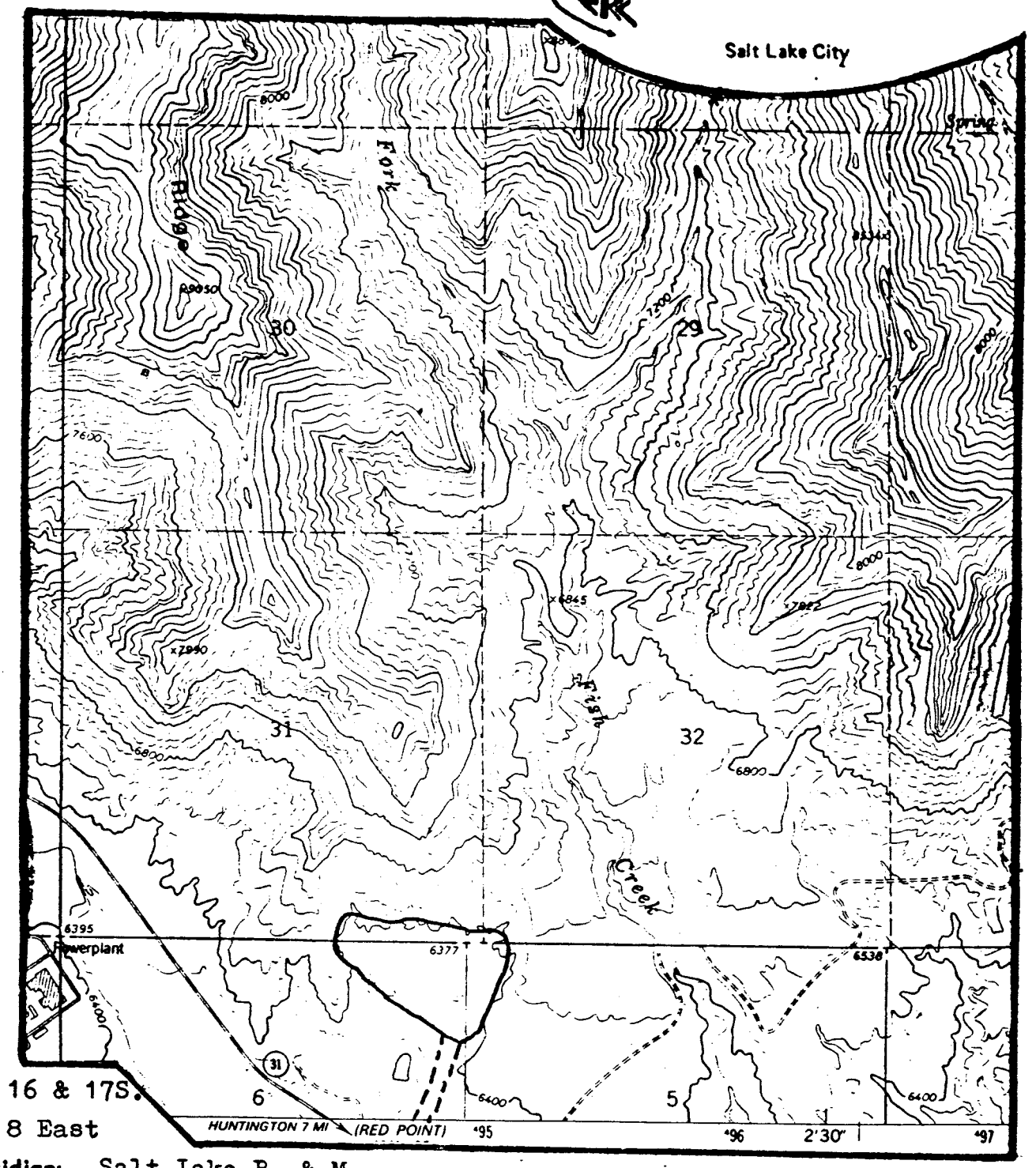
1. All vehicular traffic, personnel movement, and construction should be confined to the locations examined as referenced in this report, and to the existing roadways and/or evaluated access routes.

2. All personnel should refrain from collecting artifacts and from disturbing any cultural resources in the area.

3. The authorized official should be consulted should cultural remains from subsurface deposits be exposed during construction work or if the need arises to relocate or otherwise alter the location of the construction area.

ARCHEOLOGICAL-ENVIRONMENTAL RESEARCH CORPORATION

Salt Lake City



T. 16 & 17S.

R. 8 East

Meridian: Salt Lake B. & M.

Quad: Hiawatha, Utah 7.5 minute-USGS

Project: UPL-87-2

Series: Central Utah

Date: 4-15-87

Cultural Resource Survey of a Waste Rock Disposal Location in the Huntington Canyon Locality of Emery County, Utah

Legend:

Intensive Survey Area

Access Corridor

N

2.64" = 1 mile

Scale

UMC 783.18 CLIMATOLOGICAL INFORMATION

Utah Power and Light Co. has maintained a weather station at its Huntington Power Plant located one mile to the west since 1970. Historical records collected there show an average of 8.69 inches of precipitation annually. Much of this precipitation comes in the form of late summer thunder showers.

Temperatures in the area range from highs in the upper 80's to lows to ten below zero. The area experiences a frost-free period of about 120-140 days annually.

UMC 783.22 LAND USE INFORMATION

(a) (1) The pre-application permit area is shown on the Vegetation Map number CM-10777 DR, Map packet # 8-1; and the Soil Map number CM-10775 DR, Map packet # 7-1.

Land use has primarily been for wildlife habitat and will be returned to that use as referenced in Chapter III, Reclamation Plan, Section I.

(a) (2) The Soil Survey, Carbon-Emery Area, Utah, published December 1970 by the U.S. Department of Agriculture identifies soils in this area as "Badlands" and "Persayo":

> Badland (Ba) consists of nearly bare, strongly sloping to very steep, actively eroding shale; of areas of shale interbedded with sandstone; and of occasional small sandstone-capped hills (fig.10). The channels of numerous intermittent streams form a branching pattern in most places. Mapped with Badland are minor inclusions of shallow soils, especially in the drainageways.
>
> Badland is in the Mancos geologic formation throughout most of the survey area, but it is in the Cedar Mountain formation along the eastern edge. (Capability unit VIIIs-7, nonirrigated; not rated for other uses)
>
> CAPABILITY UNIT VIIIs-7 (NONIRRIGATED)
>
> This capability unit consists of rough, broken, and nearly bare areas of Badland and of the 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.

Persayo Series

Soils of the Persayo series are calcareous, well drained, gently sloping to steep, and moderately fine textured. They occur on hills and have formed in residuum that weathered from shale. The vegetation is mainly galleta-grass and shadscale. Elevations range from 4,000 to 6,500 feet. The annual rainfall is 6 to 11 inches and the mean annual soil temperature ranges from 47° to 54° F. The frost-free season is 110 to 160 days.

In a typical profile, the surface layer is light brownish-gray loam about 1 inch think. The underlying material is light brownish-gray loam and silty clay loam that contains a weak to moderate gypsum horizon. Shale bedrock is at a depth of about 12 inches. (The Persayo soil is in capability unit VIIe-D4, nonirrigated; Desert Loamy Shale range site.)

CAPABILITY UNIT VIIe-D4 (NONIRRIGATED)

In this capability unit are the Persayo soils that are intermingled with Chipeta soils and were mapped with those soils. These Persayo soils are generally less than 20 inches deep over shale bedrock, but in some places they are deeper than 20 inches.

The Persayo soils have a loam surface layer. They are slowly permeable and are highly susceptible to further erosion. Most areas are eroded. In some places gullies 3 to 6 feet deep and 100 to 300 feet apart have cut through the underlying shale. These soils retain about 2.5 inches of water that is available to plants, but they are usually dry because of the limited rainfall. Salinity ranges from slight to moderate.

These soils are used only for range and are suited to that purpose. Reseeding of grasses and clearing of brush or other mechanical practices that would improve the range are not feasible.

Additional information concerning land capability and productivity can be found in Chapter VIII, Vegetation and Chapter IX, Wildlife.

UMC 783.22 (b) Mining has not previously taken place within the permit area.

UMC 783.24 (i) Not Applicable

UMC 783.24 (j) Not Applicable

UMC 783.24 (k) Not Applicable

UMC 783.25 (b) Nothing is planned for air quality monitoring stations.

UMC 784.13 (b) (9) As described in the Operation Plan, Chapter II, the construction, design and operation of the Deer Creek Waste Rock Storage Facility is planned to meet compliance with the Clean Air Act and other air quality laws.

UMC 784.17 Not Applicable

UMC 784.26 Not Applicable

UMC 817.95 Not Applicable

UMC 817.13 See Reclamation Plan, Chapter III

Chapter XI ALLUVIAL VALLEY FLOORS

UMC 785.19

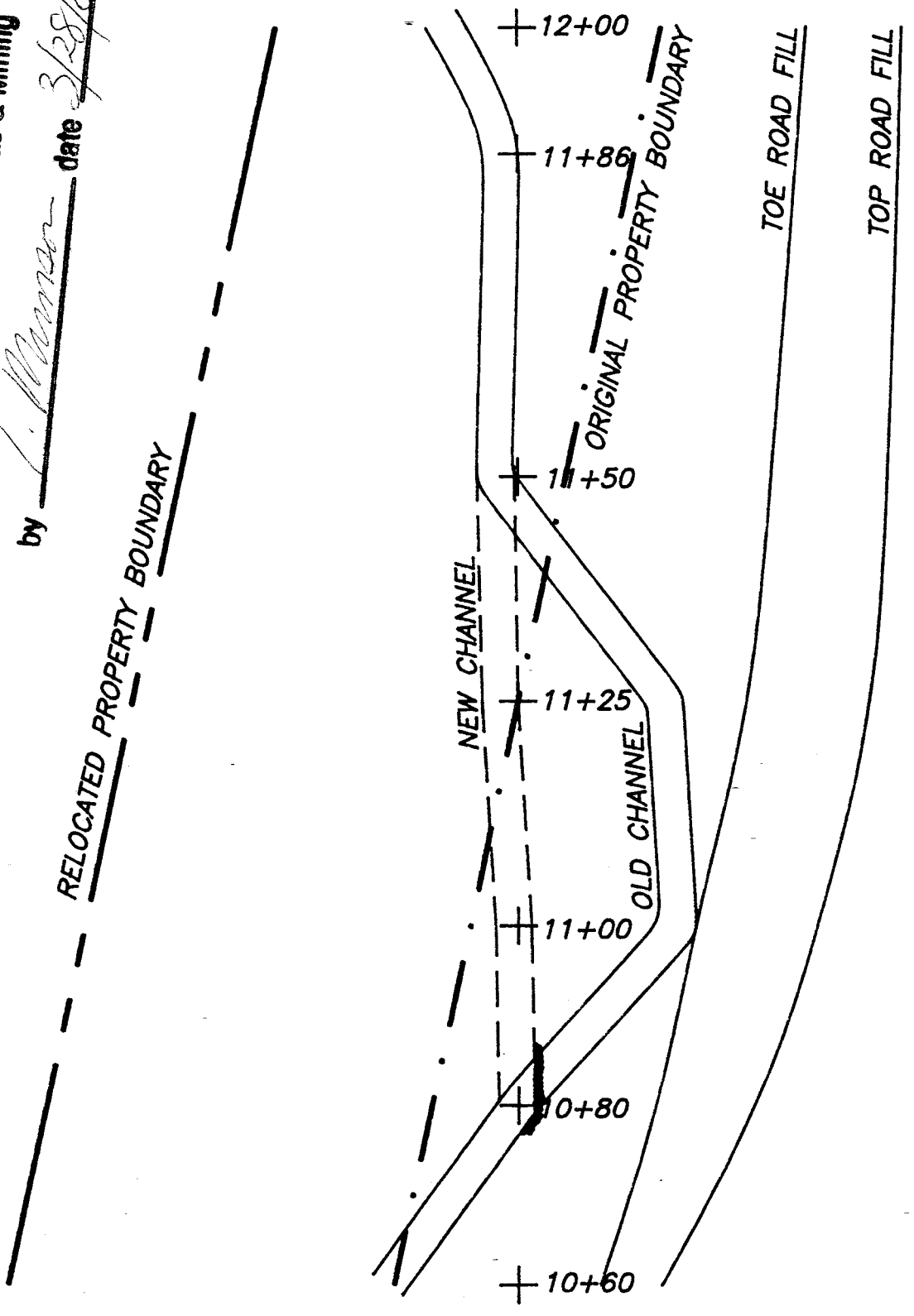
Underground Coal Mining Activities on areas or adjacent to areas including Alluvial Valley Floors in the Arid or Semi-Arid areas of Utah- (RVS)

The geologic map and cross-section (Map #5-1) clearly shows the relationship of the alluvial valley to the proposed waste rock site. The site is located approximately 2400 feet from the alluvial valley. Because of the hydrologic conditions present as determined by drilling and discussed in Chapter V, it is not felt that the activities proposed at the waste rock site will have any impact on the groundwater present in the alluvial valley.

MAPS - DRAWINGS

Map Packet Location Number	Description	Map - Drawing Number
1-1	Land Ownership	DS 999 D
4-1	Cross Sections of Access Road	DS 1011 E
4-2	Profile & Center Line of Access Road	DS 1012 E
4-3	Cross Section thru Waste Rock Storage Facility	DS 984 E
4-4	Drainage Details	DS 1000 C
4-5	Phase I	CM-10778 DR
4-6	Phase II	CM-10779 DR
4-7	Phase III	CM-10780 DR
4-8	Phase IV	CM-10781 DR
4-9	Sediment Basin Area #1	DS 1013 E
4-10	Sediment Basin Area #2	DS 1014 E
4-11	Waste Rock Storage Facility - Schedule	
7-1	Soils Map	CM-10775 DR
8-1	Vegetation Map	CM-10777 DR
9-1	Wildlife Habitat Map	CM-10776 DR

AMENDMENT TO
APPROVED Mining & Reclamation Plan
Approved, Division of Oil, Gas & Mining
by _____ date 3/28/89



NOTE:
2 1/2"ø RIP RAP PLACED BETWEEN STATIONS 10+76 & 10+87.

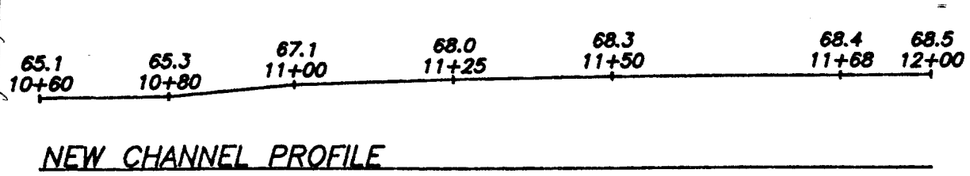
CAD FILE NAME/DRWG NUMBER

UTAH POWER & LIGHT
MINING DIVISION

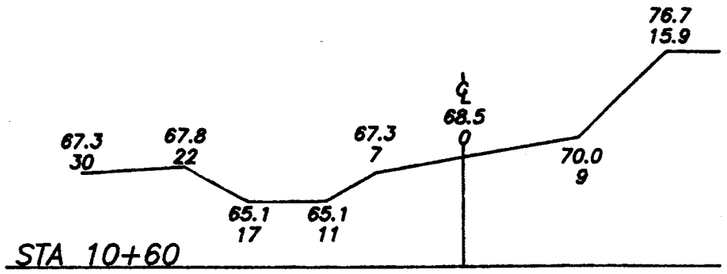
DEER CREEK WASTE ROCK SITE
NEW CHANNEL AND BOUNDARY
CHANGE PLAN VIEW

DRAWN BY: J. GARRETT	DS1098A
SCALE: N T S	DRAWING #
DATE: DEC. 7, 1988	SHEET 1 OF 2 REV.

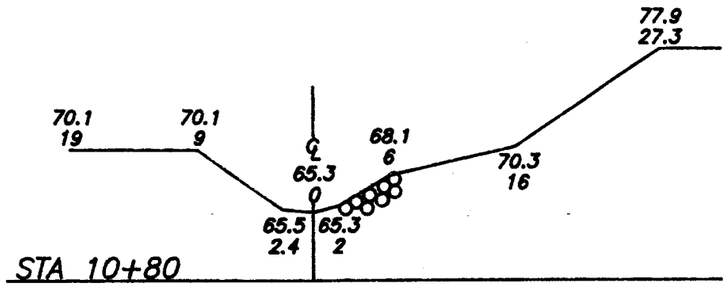
AMENDMENT TO
APPROVED Mining & Reclamation Plan
Approved, Division of Oil, Gas & Mining
by I. Munson date 3/28/89



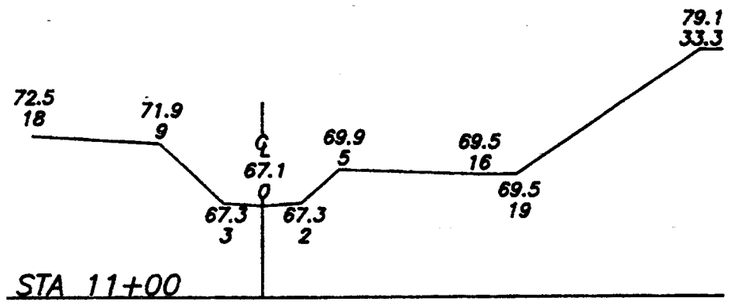
NEW CHANNEL PROFILE



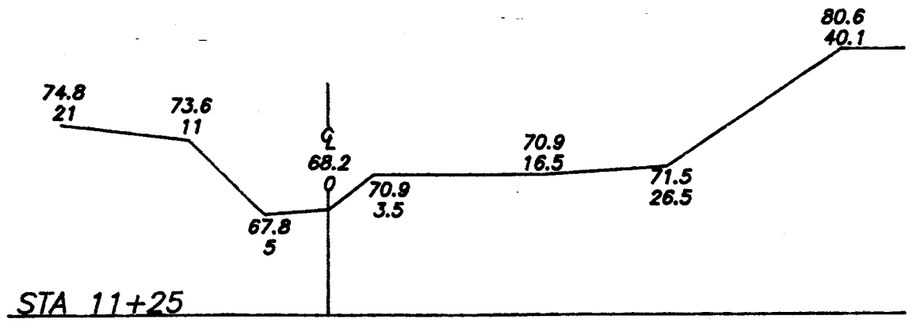
STA 10+60



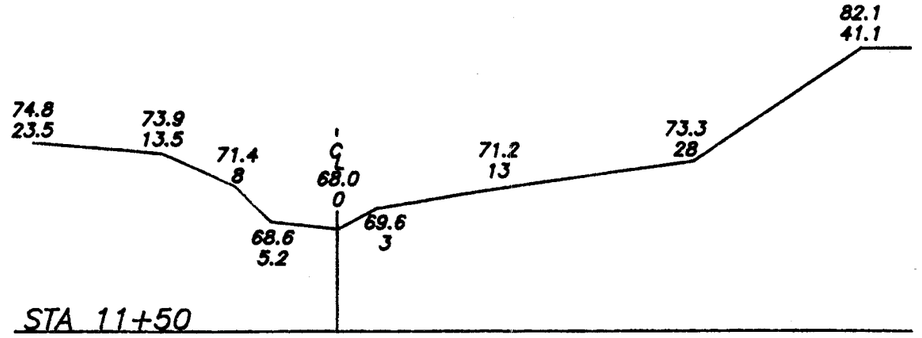
STA 10+80



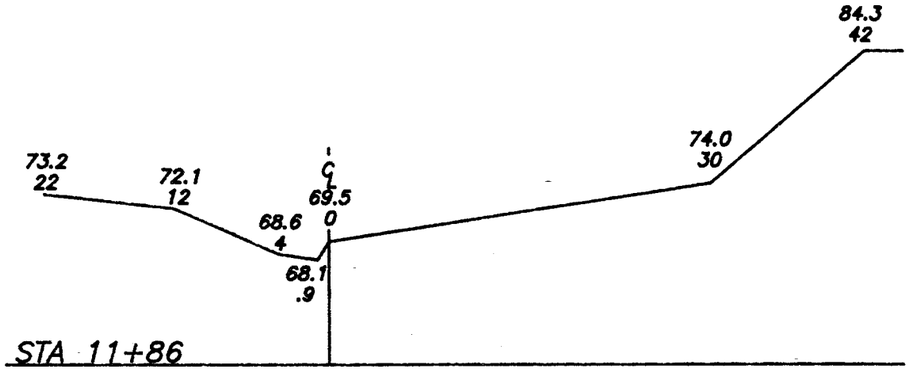
STA 11+00



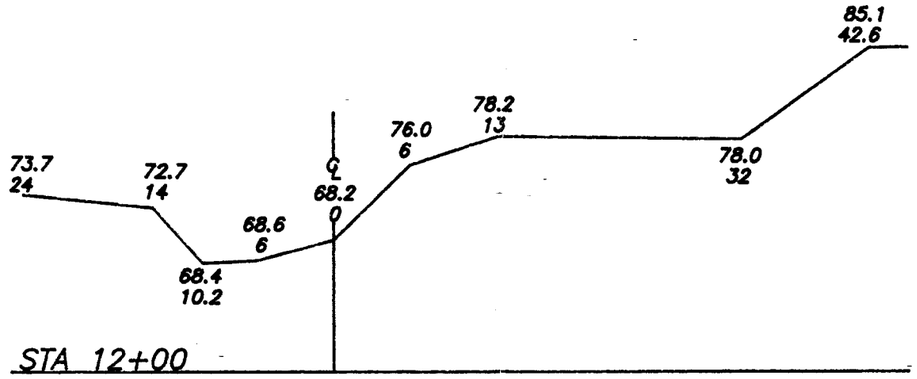
STA 11+25



STA 11+50



STA 11+86



STA 12+00

OLD FILE NAME/DRWG NUMBER

UTAH POWER & LIGHT MINING DIVISION	
DEER CREEK WASTE ROCK SITE NEW CHANNEL CROSS-SECTIONS AND PROFILE	
DRAWN BY J. GARRETT	DS1098A
SCALE N T S	DRAWING #
DATE DEC. 7, 1988	SHEET 2 OF 2 REV.

WASTE ROCK STORAGE FACILITY – SCHEDULE