MRP UPDATE RECORD

Mine Name: **File #:**

MRP Approval Date: _____ Mid-Term approval: _____

Rev. #	Date Received	Stipulated Approval Date	Final Approval Date	Insert In MRP	Comments
—	9-16-90			9-25-90	This insertion consists of 23 pages of correspondence and text plus 3
					drawings. All have to do with the Elk
					Canyon Storage Pad. In accordance with
					instructions in the text (p 4 of 23, 9-16-88)
					all of this information was put in the
					plan before the introduction,
					(Deer Creek Waste Rock Storage Facility)
	1-12-90		7-20-90	10-3-90	p. 2-10, 2-10.0, MAP 4-5

MRP Update Register

Mine Name	File Number
Deer Creek Waste Rock	ACT/015/018

Date Rec.	Page #s	Plate #s	Approval Date	Insert By	Content/Remarks
6/10/88	all Text	4-5 thru 9-1		RVS	Completeness Submittal
8/8/88	2-10, 2-8, 3-6 3-8, 3-11, 3-12 7-1, 7-4	5-1, 7-1		RVS	Tech. Def. Response
8/15/88	4, 2-7, 2-8, 4-7 7-2, 7-3, 7-3.1 2-10.	7-2, 4-10		RVS	Tech Def Response #2
8/15/88	4-9 Thru 4-13, Exhibits B thru J	4-4, 4-9		RVS	"
8/23/88	1-14.1, 1-19 1-19.1, 1-19.2 2-10.1, 3-7, 3-9			RVS	Tech. Def. Response #3
8/23/88	4-32 thru 4-52, 6.3-1 9-2.1, 9-2.2			RVS	"
8/29/88	1-9, 2-9, 2-9.1, 2-10, 2-10.2, 2-10.3, 3-1, 3-1.1	4-5, 4-6, 4-7 5-1		RVS	Tech. Def. Response #4
8/29/88	6-3, 7-4, 7-5	7-1, 7-2, 8-1, 9-1		RVS	
9/7/88	1-14, 1-19.2, 3-1 4-13.1, 4-13.2, 7b. Exhibits K→Q	Exhibit A		RVS	Tech. Def. Response #5
9/9/88		4-8 (2 sheets) 1-1	PAP approved 9/14/88	RVS	Tech Def. Response #6
4/11/89	3-8		4/11/89	BS	Revised seed mix
4/14/89	1-9, 2-1, 3-1, 5-1 5-R. 08, 1098A MAPS 4, 4-5, 4-6, 4-7		3/28/89	TM	ROAD AMENDMENT APPROVAL
/	5-1, 7-1, 7-2, 8-1, 9-1				
6/21/89	6-3, 6-3.1 6-3.2	4-5	6/21/89	RVS	Amendment C15/018-89 F

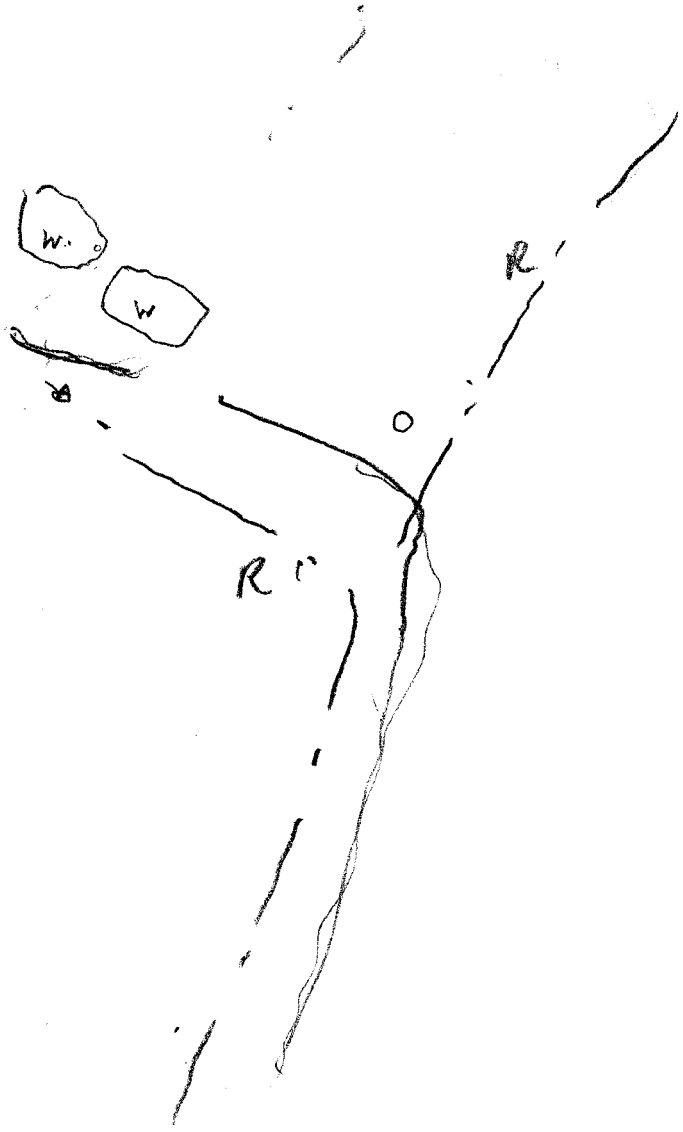

W
R'
O
R''

Table of Contents

MAPS - DRAWINGS

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	
5-1	Geologic Map & Cross-Section	CM-10782-DR
7-1	Soils Map	CM-10775 DR
7-2	Soil Stripping Isopach Map	CM-10788 DR
8-1	Vegetation Map	CM-10777 DR
9-1	Wildlife Habitat Map	CM-10776 DR

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

State of Utah

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

355 West North Temple
3 Triad Center, Suite 350
Salt Lake City, Utah 84180-1203
801-538-5340

August 17, 1988

Mr. David R. Smaldone, Director
Permitting, Compliance and
Services - Mining Division
Utah Power and Light Company
41 North Redwood Road
Salt Lake City, Utah 84140

Dear Mr. Smaldone:

Re: Conditional Approval, Elk Canyon Storage and Upgrade, Utah Power and Light Company, Deer Creek Mine, ACT/015/018-88B, Folder No. 2 and No. 3, Emery County, Utah

Division technical staff have reviewed your submittal received April 26, 1988 regarding the above-noted amendment. The amendment is approved with the following condition.

1. Utah Power and Light Company (UP&L) must submit by September 16, 1988 eight copies of the calculations, drawings and text approved for this amendment in a format which can be inserted into the approved Deer Creek Mine Plan. All figures, drawings and maps must be certified by a professional engineer.

In addition, UP&L should note that the Division does not agree with the hydrologic design methodology utilizing the Farmer-Fletcher rainfall distribution. Division hydrologist Tom Munson has reviewed the proposed ditch sizing and configuration utilizing the SCS 24-hour storm distribution and determined that the ditch would handle the design flow of 3.7 cfs indicated by this method. Therefore, UP&L should not construe this approval as an approval of the Farmer-Fletcher rainfall distribution.

ELK CANYON STORAGE
1/23

Please feel free to contact me if you should have any questions on this matter.

Sincerely,

John J. Whitehead
Permit Supervisor/
Reclamation Hydrologist

djh
cc: J. Helfrich
WP+7/2-3

ELK CANYON STORAGE
2/23

utah power
& LIGHT COMPANY
MINING DIVISION
P.O. Box 310
Huntington, Utah 84528

March 7, 1988

Mr. Lowell P. Braxton, Administrator
Mineral Resource Development and Reclamation Program
State of Utah
Department of Natural Resources
Division of Oil, Gas and Mining
355 West North Temple
3 Triad Center Suite 350
Salt Lake City, Utah 84180-1203

Dear Mr. Braxton:

Re: Deer Creek Mine - Elk Canyon Storage Pad Upgrade

Further to discussions with your staff concerning the above subject I have enclosed fourteen copies of the following documents:

1. Engineering Report narrative describing the project.
2. Reclamation cost estimate.
3. Drawing No. CM-10774-DR, Sheet 1 of 2, Site Plan.
4. Drawing No. CM 10774-DR, Sheet 2 of 2, Cross Sections.
5. Drawing No. DS 998 B, Drainage Details showing retaining wall at drainage inlet on east side of Elk Canyon and also silt fence detail.

As we have previously advised, we have been temporarily storing our underground development waste in this general area since the original storage site was completed several weeks ago. We plan to start placing the material in lifts to accomplish final contour and to construct the retaining wall at the drainage inlet on the east side of Elk Canyon in the very near future.

We will reference these changes in the Deer Creek MRP, at appropriate locations, during the upcoming mid-term review as we jointly have agreed to do on other projects.

ELK CANYON
STORAGE
3/23

Please call me at 687-9821 if you have any questions or concerns.

Sincerely,

Ray Christensen
Manager
Permitting and Compliance

RC:do

Enclosures

cc: L. Guymon UP&L
J. Hislop UP&L
M. Moon UP&L
K. Sinsel UP&L
V. Payne UP&L
J. Whitehead DOGM

4/23 ELK CANYON STORAGE

utah power
& LIGHT COMPANY
MINING DIVISION
P.O. Box 310
Huntington, Utah 84528

September 16, 1988

Mr. John Whitehead, Permit Supervisor
State of Utah
Department of Natural Resources
Division of Oil, Gas and Mining
355 West North Temple
3 Triad Center, Suite 350
Salt Lake City, Utah 84180-1203

Dear Mr. Whitehead:

RE: Elk Canyon Storage and Upgrade

This letter serves to meet the condition of the approval by the Division of Oil, Gas and Mining for the Elk Canyon Storage and Upgrade at the Deer Creek Mine. The information contained in this submittal is the approval by the Division along with correspondence from UP&L and the Division and calculations, drawings and text relating to the Elk Canyon Storage and Upgrade.

Eight (8) copies of this information has be provided to the Division. The information is provided in packets containing the following:

- 23 pages of correspondence, text and calculations
  The pages are labeled Elk Canyon Storage Number/23
- DWG. No. CM-10774-DR, sheet 1 of 2
  "Elk Canyon Site Plan", March 4, 1988
- DWG. No. CM-10774-DR, sheet 2 of 2
  "Elk Canyon Cross Sections", Feb. 18, 1988
- DWG. No. CM-10774-DR, sheet 1 of 2
  "Hydrological Area Map"

These packets should be placed at the very front of the "Deer Creek Waste Rock" notebook in front of the introduction section.

If you have any questions, please let me know.

Sincerely,

Dave Smaldone
Director of Permitting,
Compliance and Services

DS/do
Enclosures

March 3, 1988

ENGINEERING REPORT
DEER CREEK MINE
ELK CANYON STORAGE PAD UPGRADE

I. INTRODUCTION

This project will enhance the usefulness of the Elk Canyon storage area. Approximately 24,500 cubic yards of underground development waste and trommel screen rejects will be used as backfill to construct a storage pad with an active storage area of approximately 19,500 ft^2. This area will be used for additional coal and mine material storage. Approximately 17,000 additional tons of coal storage will be available.

The construction activities of the backfill and the subsequent use for storage of the area will be confined within the existing disturbed area of the canyon. Minor modifications to the undisturbed drainage structure will be required.

Final reclamation of the material can be done within the immediate area of the canyon.

II. CONSTRUCTION PLAN

A. UMC 817.71

This regulation allows underground development waste and spoil to be used as backfill on the disturbed area of the mine site. The area where the fill is to be placed has been previously disturbed and no topsoil or vegetation exists.

B. Slope Stability

The fill will be placed in horizontal lifts 18 inches thick or less and compacted as necessary to insure mass stability. The fill slope will be built on 1v:1.5h and will meet a long-term static safety factor of 1.5.

ELK CANYON STORAGE 5/23

A stability analysis is being completed and the results will be sent when completed.

C. Surface Run Off

The fill structure will be located in an area that is already in use as a storage area. All drainage from this area flows along the road to the tipple area and into the sediment pond. The surface area of the fill will be sloped at 3% on the upper section.

The concrete inlet structure on the second side canyon drainage will be modified to protect the undisturbed drainage in this area. A wing shaped structure will be added to the existing inlet and will extend 12" above the final grade of the fill material. (Refer to DWG DS998B.)

The main Elk Canyon undisturbed inlet structure will be protected with a silt fence structure along the toe of the fill. The new fill surface to be serviced by the silt fence is approximately 1,500 ft^2. Once the fill has been completed this area will be revegetated with the interm seed mix contained in the permit.

D. Chemical Analysis

The underground development waste and trommel reject is of the same origin and character as that previously sampled. Refer to permit application Waste Rock Site Page 3 - 56.

E. Final Reclamation

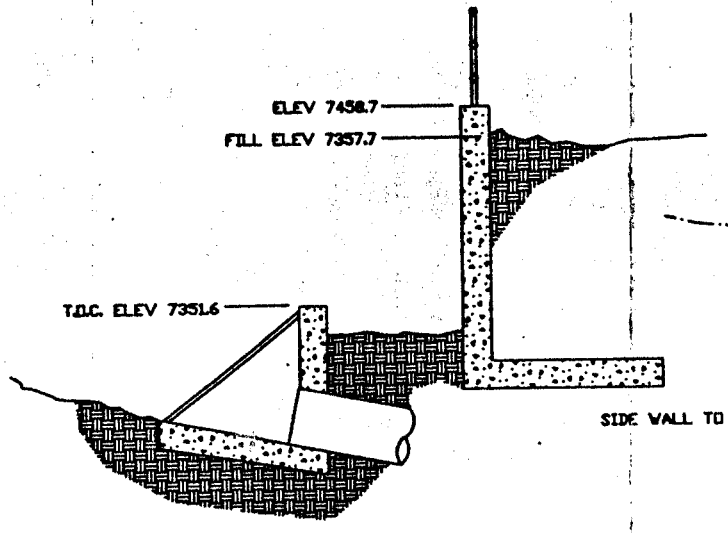
Once the need for this storage area no longer exists the material will be pushed against the west canyon wall and the pad area will be backfilled. Refer to final cross sections for detail.

6/23 ELK CANYON STORAGE

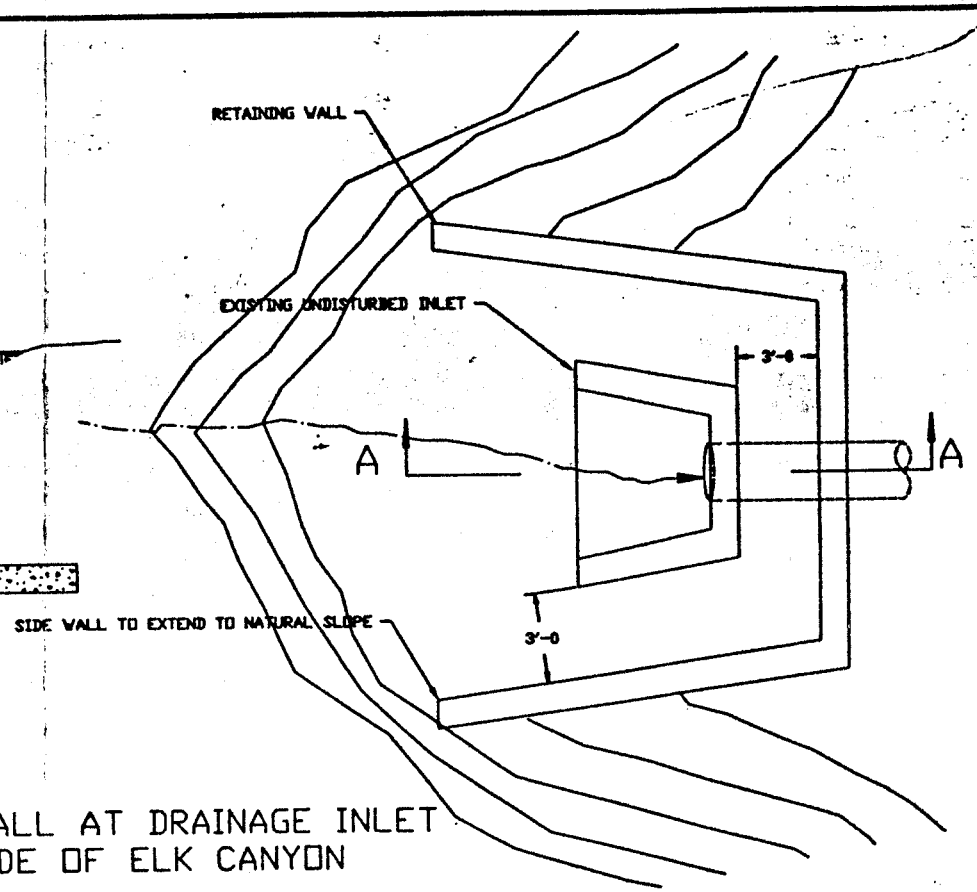
Deer Creek Mine
Reclamation Costs
Hauling - Backfilling, Compaction, Grading

Description	Equipment	Hrs	Labor	Hrs	Total	Construction Days
Backfill Elk Canyon Storage Pad	D8, 2 ea.	8.0	2 Operators	8.0	$ 1730	1.0

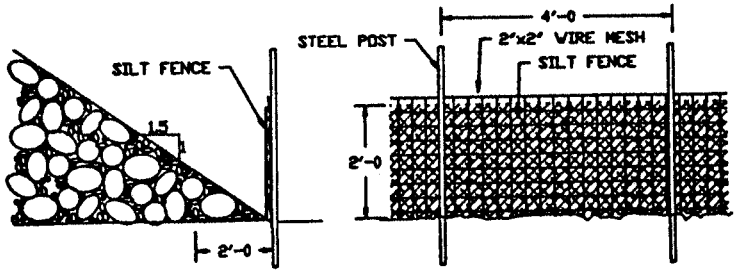
ELK CANYON STORAGE
7/23



SECTION A-A



RETAINING WALL AT DRAINAGE INLET
EAST SIDE OF ELK CANYON



SILT FENCE DETAIL

CAD FILE NAME/DISK: ENLKCANDVS

UTAH POWER & LIGHT
MINING DIVISION
P.O. BOX 310, HUNTINGTON, UTAH 84528

DEER CREEK - ELK CANYON
DRAINAGE DETAILS

DRAWN BY TJF	DRAWING # DS998B
SCALE NONE	
DATE 3/2/88	SHEET __ OF __ REV. ___

8/23 ELK CANYON STORAGE

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

April 15, 1988

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

Dear Mr. Christensen:

Re: Review of PAP Amendment, Elk Canyon Storage Upgrade Utah Power and Light Company (UP&L), Deer Creek Mine, ACT/015/018-88B, Folder #2, Emery County, Utah

Division technical review staff members Pamela Grubaugh-Littig and Tom Munson have reviewed the above noted amendment request. There are several items which need clarification or additional information prior to Division approval. Please refer to the attached Technical Memorandums for the specifics of what is required.

You have requested that the Division grant approval for UP&L to construct the concrete headwall extensions for the two undisturbed inlet points in the Elk Canyon storage pad area. By copy of this letter, the Division approves installation of these headwall extensions, but reserves final approval on the remainder of the amendment request until the information requested on the attached memorandums is provided. In the event that the amendment is denied, the additional headwall extensions for the undisturbed inlets would only enhance function of those structures.

Please feel free to contact me or the review staff members should you have specific questions in preparing your response. Please have the complete and adequate response for this amendment request to the Division offices no later than May 13, 1988.

Sincerely,

John J. Whitehead

John J. Whitehead
Permit Supervisor/
Reclamation Hydrologist

djh
Attachments
cc: R. Hagen J. Helfrich
T. Munson P. G.-Littig
0800R/69

Rec. 4-21-88 RayC
cc: L. Guynon
D. Jense
D. Smallhorn
U. Lyra
ELK CANYON STORAGE
9/23

STATE OF UTAH
NATURAL RESOURCES
Oil, Gas & Mining

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

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

March 21, 1988

TO: John Whitehead, Permit Supervisor

FROM: Pamela Grubaugh-Littig, Reclamation Engineer pgl

RE: Elk Canyon Storage Upgrade, Received March 10, 1988, Deer Creek Mine, Utah Power and Light Company, ACT/015/018-88B, Folder #2, Emery County, Utah

The Utah Power and Light Company (UP&L) submittal for the Elk Canyon storage site has several deficiencies:

UMC 817.71 (i) The applicant must commit to have the fill inspected for stability by a registered engineer or other qualified professional specialist experienced in the construction of earth and rockfill embankments, at least quarterly throughout construction, and during the following critical construction periods: (1) placement of underdrainage system, (2) installation of surface drainage systems, (3) placement and compaction of fill materials, and (4) revegetation. A certified report must be provided to the Division within two weeks after each inspection that the fill has been constructed as specified in the design approved by the Division.

UMC 817.72 (a) The applicant must submit a stability analysis demonstrating that the fill is designed to attain a long-term static safety factor of 1.5. The application mentioned that this analysis is forthcoming.

(b) A subdrain system for the fill should be constructed unless it can be demonstrated through approved "experimental practices" that a subdrain system is not needed.

UMC 784.13 (b)(2) Determination of bond amount - The reclamation cost estimate must reflect the cost for a third party to perform the reclamation. The total hours for the equipment and operator would total 16 hours, not 8 hours. The hourly costs should be based upon Rental Rate Bluebook rates or Means Costs.

djh
9075R/46

ELK CANYON STORAGE
10/23

STATE OF UTAH
NATURAL RESOURCES
Oil, Gas & Mining

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

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

March 30, 1988

TO: John Whitehead, Permit Supervisor

FROM: Tom Munson, Reclamation Hydrologist TM

RE: Elk Canyon Storage Pad and Upgrade, Utah Power and Light Company, Deer Creek Mine, ACT/015/018-88B, Folder #2, Emery County, Utah

History of Proposal

The operator's submittal dated March 10, 1988 proposes to construct a storage pad in the mouth of Elk Canyon. Several drainage concerns will need to be addressed.

Analysis

The operator does not address drainage along the road leading to the Tipple area. It is appropriate that the operator describe what kind of flows that may be expected from the 10-year, 24-hour storm event, and size a ditch that would convey drainage along the road to the Tipple area. The operator will also need to provide riprap protection for this ditch if erosive velocities are expected.

The second area of concern is the placement of the silt fence. The silt fence should be placed away from the toe of the fill in order to gain storage capacity behind the silt fence. In areas where the silt fence does not run parallel to the contour of the fill it may be necessary to use small check dams to check the velocity of the water running parallel to the silt fence to prevent undercutting of the toe of the fence. The operator has used silt fences successfully in other areas of the mine site. Therefore, it will not be necessary to request any other specifics on materials or design.

ELK CANYON STORAGE
11/23

The reclamation plan for this area does not differ from what was approved in the original Deer Creek PAP and the pad, when reclaimed, will not encroach upon the reclaimed channel. Therefore, it is not necessary to comment on the reclamation plan.

Recommendations

1. The operator shall determine if the drainage travelling down the road will be erosive in nature and will consequently require erosion protection. A ditch will have to be designed and implemented along the access road to prevent erosion of the road surface. Designs and supporting calculations must be supplied for this ditch.

2. Installation of the silt fence should be coordinated at the time of installation with a Division Hydrologist to ensure adequate treatment of disturbed drainage.

djh
9486R/41-42

ELK CANYON STORAGE
12/23

utah power & LIGHT COMPANY
1407 West North Temple
P.O. Box 899
Salt Lake City, Utah 84110

April 26, 1988

HAND DELIVERED

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

RE: Response to Review of PAP Amendment, Elk Canyon Storage Upgrade - Utah Power & Light Company (UP&L), Deer Creek Mine, ACT/015/018-88B, Folder #2, Emery County, Utah

Attached is information requested by your technical staff in regards to the Elk Canyon Storage Facility. This should provide clarification as requested in John Whitehead's letter of April 15, 1988. As we discussed five (5) copies are provided for your review.

Please call if you have any questions.

Sincerely,

David R. Smaldone, P.E.
Director Permitting, Compliance
and Services
Mining Division

DRS:bb:5956
Enclosure

ELK CANYON STORAGE
13/23

ENGINEERING REPORT (DEFICIENCIES)

DEER CREEK MINE

ELK CANYON STORAGE PAD UPGRADE

I. INTRODUCTION

This report is prepared in response to several concerns or deficiencies from the DOGM Technical Staff.

II. CONSTRUCTION PLAN

A. UMC 817.71

The upgrading of the fill structure using waste rock will be inspected for stability by a registered Professional Engineer at least quarterly and during the following specific activities: (1) installation of the surface drainage ditch, (2) modifications to the side canyon drainage inlet and construction of the silt fence at the main Elk Canyon drainage, (3) and during the revegetation of the slope above the main inlet. The placement and compaction of the fill material is a continual activity and will be inspected during construction and certified in writing as part of the quarterly report. A certified report for each of these activities will be submitted to the Division in writing within two weeks following the inspection.

B. Slope Stability

The finalized analysis has been completed and is presented as an attachment to this report. As stated in the analysis the fill slope will meet or exceed the 1.5 static safety factor.

The area where the fill is to be built is dry and the need for an under-drainage system is not required. There is any existing culvert system which by passes the canyon drainage past the disturbed area.

C. Surface Run Off

A hydrologic drainage analysis and ditch design is attached. As stated in the analysis the road will be sloped a 1% into the hillside and will serve as a surface ditch. The velocity of the run off doesn't require rip-rap protection.

The division will be notified prior to the installation of the silt fence. The concern for sediment volume behind the silt fence is noted and will be included as part of the installation.

ELK CANYON STORAGE
14/23

E. Final Reclamation

The bond determinations have been based on Rental Rate Bluebook rates and are presented below:

EQUIPMENT

D 8 DOZER
$162.65/HR X 8 HRS. X 2 DOZERS = $2602.40

LABOR

EQUIPMENT OPERATORS
$31.50/HR X 8 HRS X 2 OPERATORS = 504.00

TOTAL $3106.40

ELK CANYON STORAGE
15/23

SLOPE STABILITY ANALYSIS

ELK CANYON STORAGE PAD

The size of the storage pad in Elk Canyon will be increased by building up the slope on the west side of the canyon. The material that will be used to construct the slope consists of underground development waste and trommel reject. This material was sampled and tested to determine its suitability as fill for the proposed slope (see attached soils report by Rollins, Brown, and Gunnell).

The method used to determine the stability is Bishop's Simplified Method of Slices, T. William Lambe and Robert V. Whitman, Soil Mechanics, 1969, John Wiley and Sons, New York. The slope will be 1.5 horizontal to 1 vertical during the operating period. The maximum height of the slope is 50 feet. The soil density is 98.2 pounds per cubic feet, the angle of internal friction is 40.5 degrees and the cohesion value is 0. The slope is well drained with no ground water anticipated during the life of the project. The resulting safety factor is determined to be 1.5, which is adequate.

ELK CANYON STORAGE
16/23

ROLLINS, BROWN and GUNNELL, INC. professional engineers

March 15, 1988

Tom Faucheux
Utah Power and Light Company
Mining Division
P.O. Box 310
Huntington, Utah 84528

Dear Mr. Faucheux:

We have completed the requested laboratory testing for the soil sample submitted to our office as per P.O. JS-301606. The results are enclosed herein on the appropriate figures. The soil moisture density relationship resulted in a maximum density of 98.2 pcf at an optimum moisture content of 10.7 percent. The results of the grain-size analysis indicate the following:

Sieve Size	% Passing
3"	100
2"	89.9
1"	78.9
3/4"	71.6
1/2"	66.0
3/8"	61.9
No. 4	53.3
No. 10	39.4
No. 20	32.1
No. 50	23.6
No. 100	19.8
No. 200	16.4

The triaxial shear test envelope indicates a friction angle of 40.5 degrees and a cohesion of 0 psi.

If you have any further questions, please notify us.

Yours truly,

ROLLINS, BROWN AND GUNNELL, INC.

Ralph L. Rollins

Ralph L. Rollins

SLS/sly

1435 WEST 820 NORTH
POST OFFICE BOX 711
PROVO, UTAH 84603

PROVO 374-5771
SALT LAKE CITY 521-5771
AREA CODE 801

[redacted]

ELK CANYON STORAGE
17/23

ROLLINS, BROWN and GUNNELL, INC. professional engineers

1435 WEST 820 NORTH
POST OFFICE BOX 711
PROVO, UTAH 84603
(801) 374-5771 Provo
(801) 521-5771 SLC

SOIL MOISTURE DENSITY RELATIONSHIP

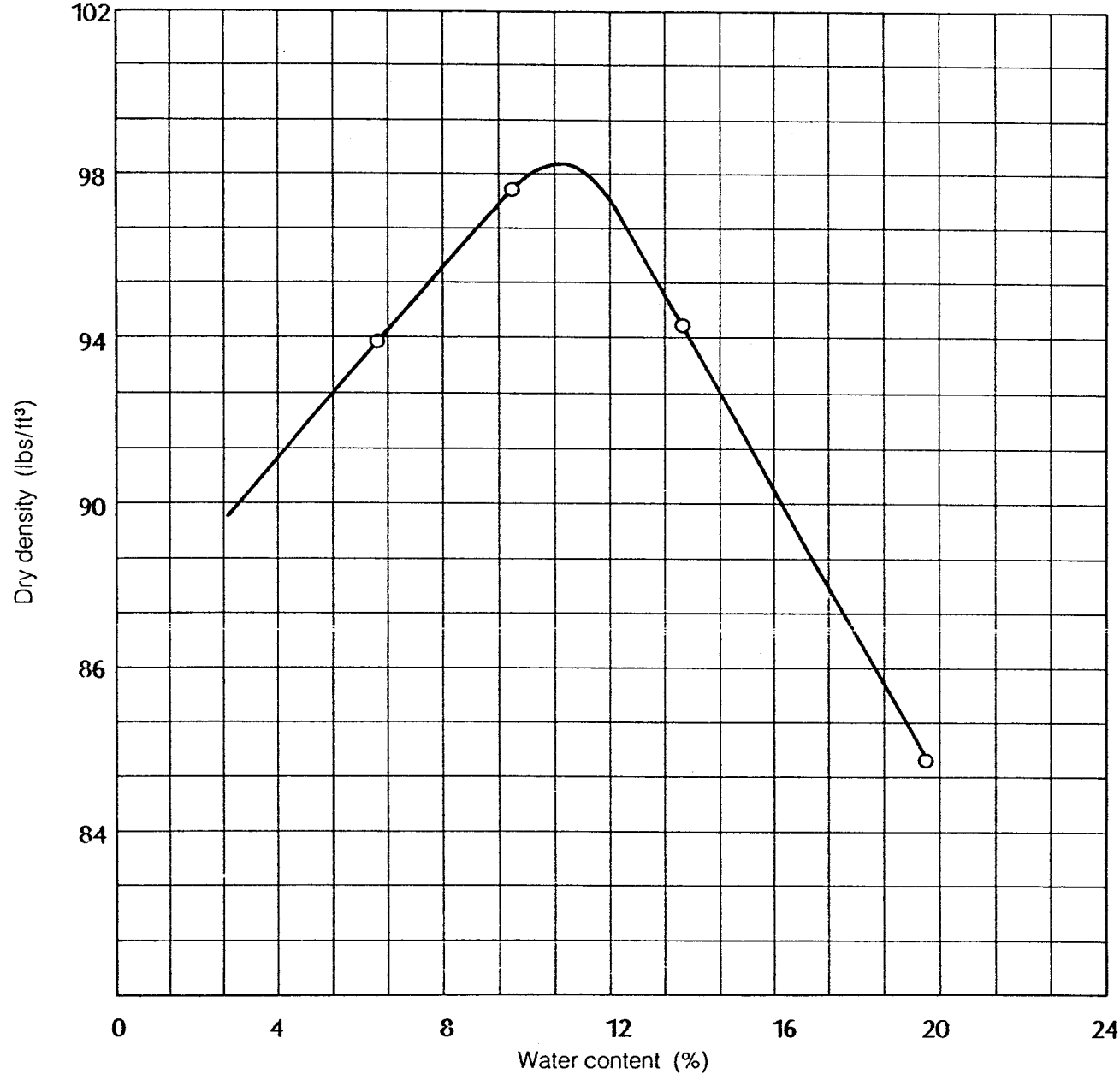
Project Utah Power and Light
Feature
Job technician S. Ahmad

Project no.
Test date March 4, 1988
Mailing date March 11, 1988

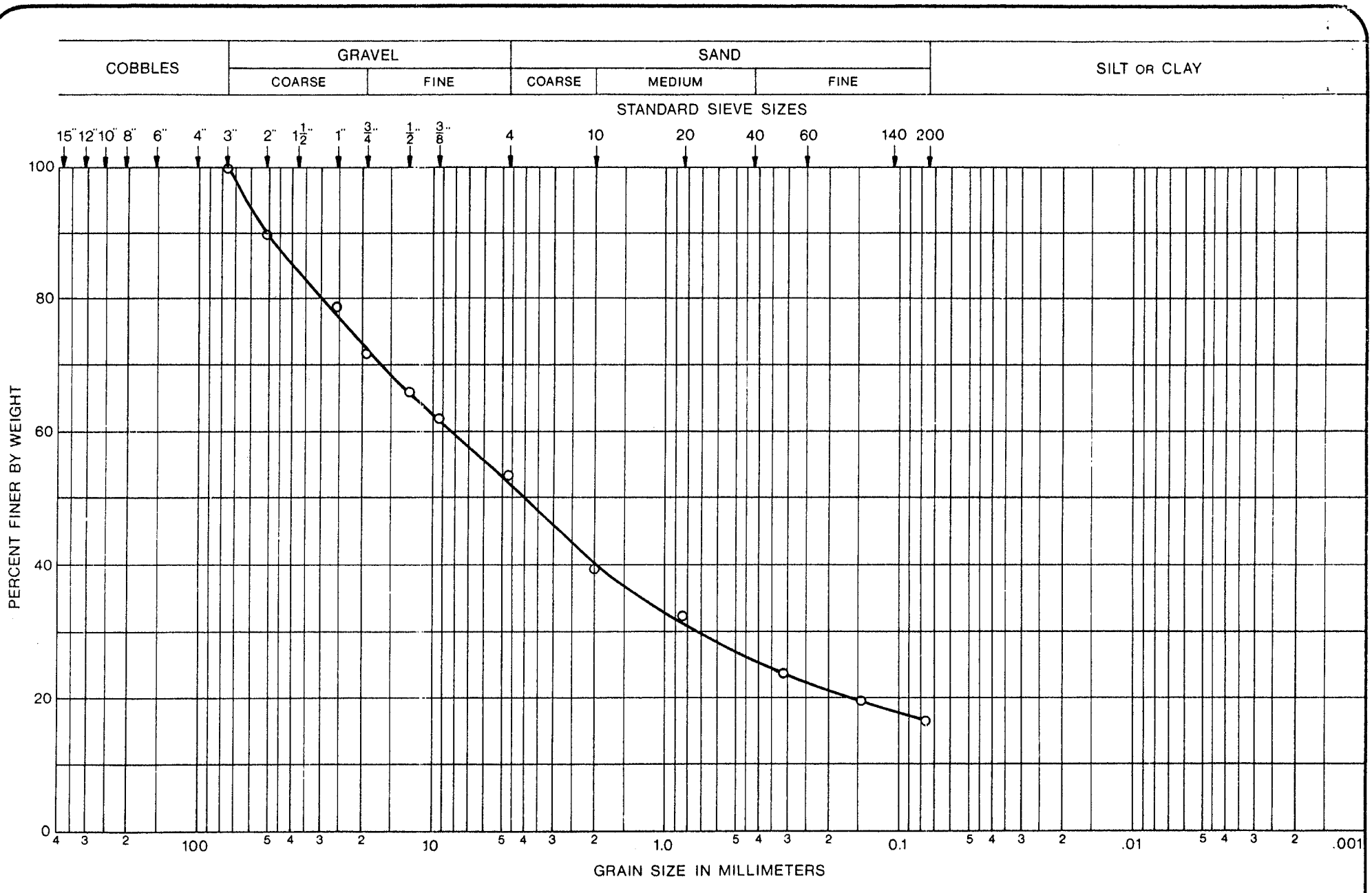
ASTM D 1557-78

Maximum dry density = 98.2 lbs/ft³

Optimum moisture = 10.7 %



18/23 ELK CANYON STORAGE



ROLLINS, BROWN AND GUNNELL, INC.
PROFESSIONAL ENGINEERS

GRAIN SIZE DISTRIBUTION CURVE

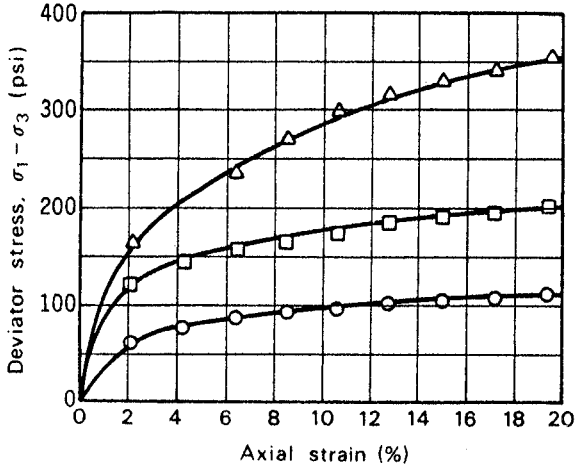
Project: Utah Power & Light

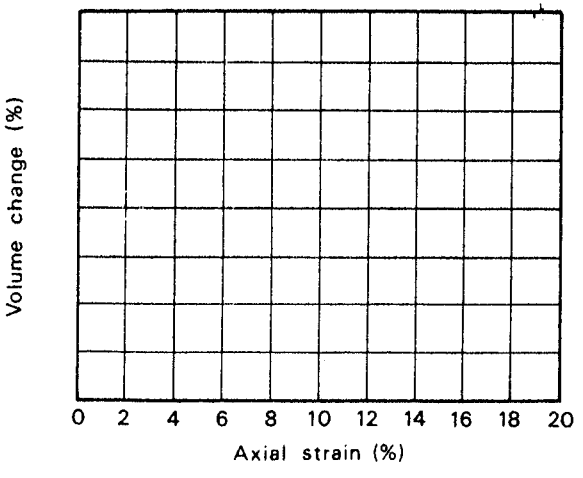
Location:

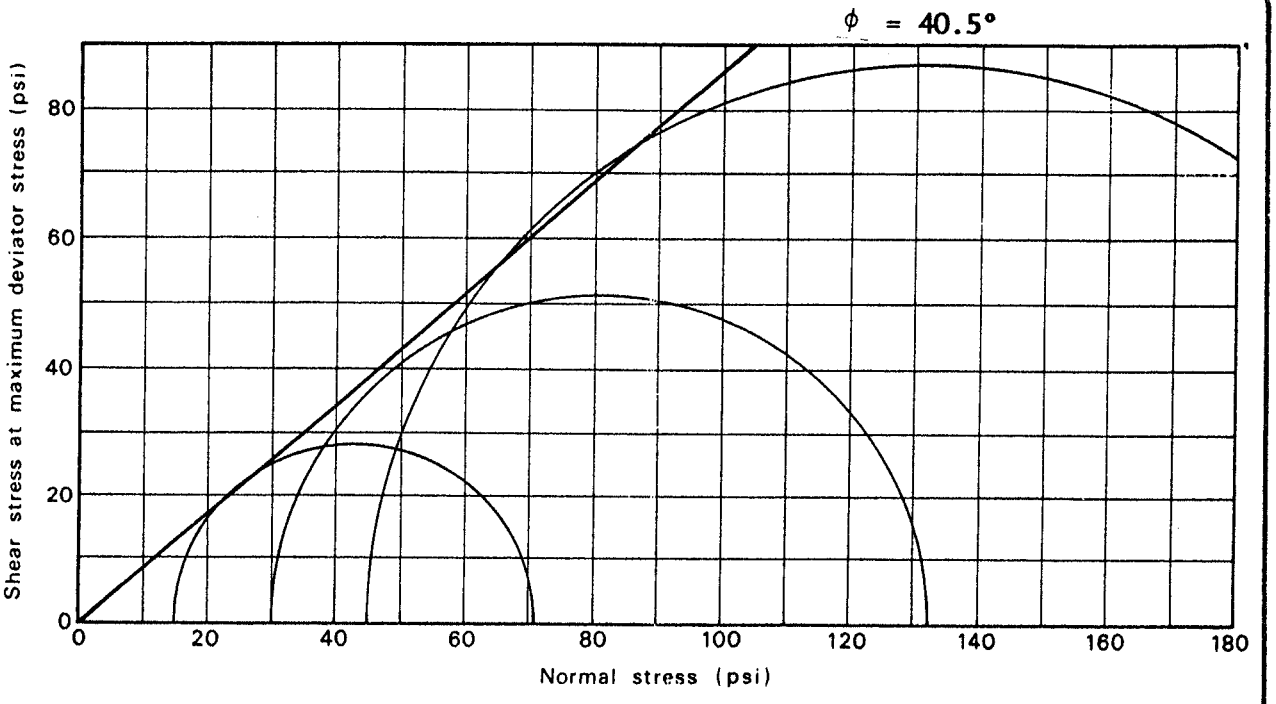
Sample No. 1

FIGURE NO.

19/23 GK Canyon Storage







Test no. or symbol	Boring no. or depth	Sample data		Degree of saturation (%)	Confining pressure (psi)	Maximum deviator stress (psi)	Strength values at failure		Sample size, L/D (inches)	Strain rate (inches/minute)
		Dry density (pcf)	Moisture content (%)				Friction angle ϕ (degrees)	Cohesion (c/psi)		
○		98	10.7		30	111				
□		97.7	10.7		60	205	40.5	0	2.8/1.32	.0024
△		98.1	10.7		90					

ROLLINS, BROWN AND GUNNELL, INC.
PROFESSIONAL ENGINEERS

TRIAXIAL SHEAR TEST
Project: Utah Power and Light

HOLE NO.
DEPTH:

FIGURE NO.

ELK CANYON STAGE
20/23

ELK CANYON STORAGE PAD DRAINAGE DITCH

HYDROLOGICAL ANALYSIS AND DITCH DESIGN

SCOPE:

The construction of the storage pad at Elk Canyon will change the drainage characteristics of the area and an analysis and design of the drainage structures is required. This report will detail the procedures used to design the ditch which will convey the disturbed area runoff into the surface collection system.

PROCEDURES:

The areas which will contribute runoff to the disturbed area where marked on drawing number CM-10774-DR, Elk Canyon Site Plan. These areas have not increased in size because of the construction of the storage pad but were necessary to determine the flow rate for the ditch design. The peak flow for a 10 year, 24 hour storm event was determined using a computer program, "Storm Hydrograh Program", by Richard H. Hawkins and Kim A. Marshall, Utah State University Foundation, Logan, Utah. The data used for input are tabulated below:

DRAINAGE AREA #	AREA ACRES	CURVE NUMBER	TIME OF CONCENTRATION
I	2.481	83	3 MIN.
II	.597	77	1
III	.398	83	1
IV	.723	83	1

TOTAL AREA 4.199 ACRES = 0.007 SQUARE MILES

WEIGHTED AVERAGE CURVE NUMBER = 82

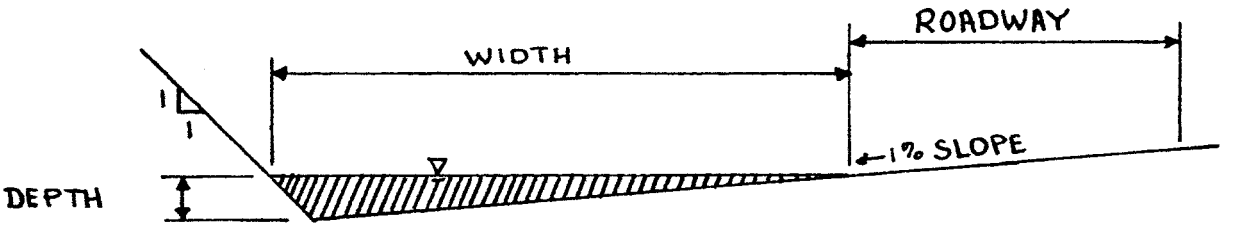
TIME OF CONCENTRATION = 4 MINUTES = 0.007 HOURS

RAINFALL DEPTH - 10 YEAR, 24 HOUR STORM EVENT = 2.2 INCHES

The peak flow rate from the program is 0.516 cubic feet per second for the entire 4.2 acres (see Exhibit A). The ditch is sized for the entire amount, although the total amount is not collected until it reaches the end of the new road at Station 0+78.8.

The ditch that will convey this runoff will be incorporated into the road itself as shown in the following diagram.

ELK CANYON STORAGE
21/23



FLOW RATE = 0.516 CFS

DITCH SLOPE	DEPTH	WIDTH	VELOCITY
3%	.086'	8.71'	1.38
10%	.069'	6.95'	2.15

Because of the low velocity of the runoff in the ditch, no special lining material is necessary to prevent erosion of the base material.

ELK CANYON DISTURBED DRAINAGE

INPUT SUMMARY:

DISTRIBUTION = FARMER-FLETCHER	RUNOFF AREA = .007 SQ. MILES
RAINFALL DEPTH = 2.2 INCHES	RUNOFF CURVE NO. = 82
STORM DURATION = 24 HOURS	TIME OF CONCENTRATION = .07 HRS.

OUTPUT SUMMARY:

TOTAL RUNOFF DEPTH = .784 IN.	TIME TO PEAK = 4.794 HOURS
INITIAL ABSTRACTION = .439 IN.	RUNOFF VOLUME CHECK = .785 IN.
PEAK FLOW = .516 CFS	

24.14	2.20	0.7839	0.0000	0.0000	0.00

EXHIBIT A
COMPUTER PRINTOUT
"STORM HYDROGRAPH PROGRAM"

ELK CANYON STORAGE
23/23

UTAH POWER & LIGHT COMPANY

DEER CREEK WASTE ROCK STORAGE FACILITY

APPLICATION FOR PERMIT

Chapter I INTRODUCTION AND LEGAL/FINANCIAL

Section I INTRODUCTION AND EXECUTIVE SUMMARY

This application for a permit is submitted to the State of Utah, Department of Natural Resources, Division of Oil, Gas & Mining, in accordance with the Utah Coal Mining and Reclamation Act, Title 40, Chapter 10, U.C.A., 1953 (as amended); the applicable rules and regulations adopted there under; the Surface Mining Control & Reclamation Act of 1977 (P.L. 95-87), and applicable regulations adopted thereunder; the Cooperative Agreement between the State of Utah and the United State Secretary of Interior, and other applicable laws and regulations.

A thirty year plus life of mine storage site for waste rock from the Deer Creek mine is needed. The location of the property covered by this permit application is not within the boundaries of any of the approved mining permits issued to Utah Power and Light Company and as such this application is being filed in accordance with Utah Rules R 614-1G-770.

The existing areas within the Deer Creek mining permit will not accommodate a Waste Rock Storage Facility without adverse impact to environmental resources. The selected site will experience minimal impact, and these will be able to be adequately mitigated.

As stated in Chapter X under UMC 783.22 Land Use Information the pre activity land use has primarily been for wildlife habitat and the post activity land use will be the same.

RECEIPT Date June 13 1988 No 4160

Received From Mark Smaldone

Address Utah Power and Light

Five and no/100 Dollars $5.00

For permit application fee
Deer Creek Waste Rock

ACCOUNT			HOW PAID		
AMT. OF ACCOUNT			CASH ✓	5	00
AMT. PAID			CHECK		
BALANCE DUE			MONEY ORDER		

By Craig T. Radden

8K 816 REDIFORM®

utah power & LIGHT COMPANY
1407 West North Temple
P.O. Box 899
Salt Lake City, Utah 84110

June 6, 1988

Mr. John Whitehead
Permit Supervisor
State of Utah
Department of Natural Resources
Division of Oil, Gas and Mining
355 West North Temple
3 Triad Center, Suite 350
Salt Lake City, Utah 84180-1203

Re: Completeness Review - Deer Creek Waste Rock Storage Facility

Dear Mr. Whitehead:

This is to verify that to the best of my knowledge all of the information contained in the Deer Creek Waste Rock Permit Application package is true and correct. This is given to meet the requirements of UMC 771.27 Verification of Application.

Sincerely,

David Smaldone
Director of Permitting,
Compliance & Services
Mining Division

DS:bb:5979

STATE OF UTAH)
: ss.
County of Salt Lake)

Subscribed and sworn to before me this 6th day of June, 1988.

Barbara Baldauf, Notary Public
Residing in Salt Lake City, Utah

My Commission Expires:

June 8, 1988

Section II LEGAL/FINANCIAL OWNERSHIP, ETC.

UMC 782.13 IDENTIFICATION OF INTERESTS

The permit applicant is:

Utah Power and Light Company
1407 West North Temple
Salt Lake City, Utah 84116
(801) 535-2000

Utah Power and Light Company is the legal owner of record of the areas to be effected. Coal mining will not take place within the areas of this permit.

The operator is:

Utah Power and Light Company
Mining Division
P.O. Box 310
Huntington, Utah 84528
(801(687-9821

The agent for service of process is:

Mr. J. Brett Harvey
Vice President & General Manager
Mining Division
P.O. Box 310
Huntington, Utah 84528
(801) 687-9821

Utah Power & Light Company is a corporation under the laws of the State of Utah. The names and address of every officer and director are shown below. Utah Power & Light Co. common stock is widely held by the public and it has no principal shareholders.

UTAH POWER & LIGHT COMPANY

OFFICERS

Frank N. Davis	President & Chief Executive Officer	Utah Power & Light Company 1407 West No. Temple Salt Lake City, Utah 84116
Sidney G. Baucom	Executive Vice President & General Counsel	Utah Power & Light Company 1407 West No. Temple Salt Lake City, Utah 84116
Verl R. Topham	Senior Vice President, Commercial Manager, & Chief Financial Officer	Utah Power & Light Company 1407 West No. Temple Salt Lake City, Utah 84116

Curtis L. Hoskins	Executive Vice President	Utah Power & Light Company 1407 West No. Temple Salt Lake City, Utah 84116
Harry Haycock	Senior Vice President	Utah Power & Light Company 1407 West No. Temple Salt Lake City, Utah 84116
Robert Gordon	Vice President & Corporate Secretary	Utah Power & Light Company 1407 West No. Temple Salt Lake City, Utah 84116
Orrin T. Colby, Jr.	Vice President & Controller	Utah Power & Light Company 1407 West No. Temple Salt Lake City, Utah 84116
J. Brett Harvey	Vice President	Utah Power & Light Company P.O. Box 310 Huntington, Utah 84528
John A. Bohling	Assistant Vice President	Utah Power & Light Company 1407 West No. Temple Salt Lake City, Utah 84116
Shelly R. Faigle	Assistant Vice President	Utah Power & Light Company 1407 West No. Temple Salt Lake City, Utah 84116
Thomas W. Forsgren	Assistant Vice President	Utah Power & Light Company 1407 West No. Temple Salt Lake City, Utah 84116
J. Lynn Rasband	Assistant Vice President	Utah Power & Light Company 1407 West No. Temple Salt Lake City, Utah 84116
Ernest Wessman	Assistant Vice President	Utah Power & Light Company 1407 West No. Temple Salt Lake City, Utah 84116
Sam F. Chamberlain	Assistant Secretary	Utah Power & Light Company 1407 West No. Temple Salt Lake City, Utah 84116
John E. Droubay	Treasurer	Utah Power & Light Company 1407 West No. Temple Salt Lake City, Utah 84116
Martin H. Craven	Assistant Treasurer	Utah Power & Light Company 1407 West No. Temple Salt Lake City, Utah 84116

BOARD OF DIRECTORS

DeeDee Corradini	Director	Utah Power & Light Company 1407 West No. Temple Salt Lake City, Utah 84116
Michael O. Leavitt	Director	Utah Power & Light Company 1407 West No. Temple Salt Lake City, Utah 84116
John A. Lindquist, Sr.	Chairman of the Board	Utah Power & Light Company 1407 West No. Temple Salt Lake City, Utah 84116
Chase N. Peterson	Director	Utah Power & Light Company 1407 West No. Temple Salt Lake City, Utah 84116
Rogers K. Rose	Director	Utah Power & Light Company 1407 West No. Temple Salt Lake City, Utah 84116
Robert V. Thompson	Director	Utah Power & Light Company 1407 West No. Temple Salt Lake City, Utah 84116
Richard L. Warner	Director	Utah Power & Light Company 1407 West No. Temple Salt Lake City, Utah 84116
Don M. Wheeler	Director	Utah Power & Light Company 1407 West No. Temple Salt Lake City, Utah 84116
Frank N. Davis	Director	Utah Power & Light Company 1407 West No. Temple Salt Lake City, Utah 84116
Sidney G. Baucom	Director	Utah Power & Light Company 1407 West No. Temple Salt Lake City, Utah 84116
Verl R. Thopham	Director	Utah Power & Light Company 1407 West No. Temple Salt Lake City, Utah 84116

Utah Power and Light Company Mining Division has operated coal mines and related facilities in Emery County, Utah since May 1986. Prior to May 1986 the Company contracted with an independent mining company to operate its mines. The name of the independent contractor that operated Utah Power & Light Company coal mines within the past five years was Emery Mining Corporation, Huntington, Utah (formerly known as American Coal Co.).

The information concerning permits, as required by UMC 782.13 (d) is as follows:

Cottonwood/Wilberg Mine
DOGM Act/015/019 issued May 11, 1978
U.S.G.S. issued January 23, 1978
MSHA ID No. 42-00080

Deer Creek Mine
DOGM Act/015/018A issued May 11, 1978
U.S.G.S. issued January 20, 1978
MSHA ID NO. 42-00121

Des-Bee-Dove Mine
DOGM Act/015/017 issued May 11, 1978
MSHA ID Nos.
Deseret 42-00988
Beehive 42-00082
Little Dove 42-01393

Owners of Surface and subsurface areas contiguous to any part of the permit area, (per UMC 782.13 e) are as follows:

Utah Power and Light Company
1407 West North Temple
Salt Lake City, Utah 84116

United States of America
Department of the Interior
Bureau of Land Management
900 North 700 East
Price, Utah 84501

The name of the area permitted will be the Deer Creek Waste Rock Storage Facility. The Mine Safety and Health Administration (MSHA) number for the Deer Creek Mine is ID NO. 42.00121. Based on our interpretation of a letter from MSHA dated 4-20-83, this site will not be subject to MSHA regulation or permitting. (See Attachment A at end of this chapter)

Utah Power and Light Co. is the owner of all fee lands contiguous to the permit area. Utah Power and Light Co. has no option, bid or other interest in any other contiguous acreage.

UMC 782.14 COMPLIANCE INFORMATION

Utah Power and Light Co. has never had a federal or state mining permit suspended or revoked nor forfeited a mining bond or similar security deposited in lieu of bond.

Following is a List of Notices of Violation received from the Division of Oil, Gas and Mining for coal mining activities for the past three years:

NOV 85-2-6-1 issued 4-24-85 at Des-Bee-Dove mine, ACT/015/017
(1) Failure to notify DOGM of non-compliance of sedimentation pond.
Assessment conference held - none
Final assessment paid 11-11-85

NOV 85-2-8-1 issued 6-6-85 at Beehive mine, ACT/015-017
(1) Failure to minimize erosion on Beehive access road near gate
Assessment conference held - none
Final assessment paid 9-17-85

NOV 85-2-15-1 issued 8-22-85 at Cottonwood Canyon, ACT/015/019
(1) Failure to Maintain road drainage. Crushed culvert by south sedimentation pond
Assessment conference held - 11-18-85
Final assessment paid N/A - Vacated

NOV 85-2-17-2 issued 9-4-85 at Wilberg mine, ACT/015/019
(1) Failure to protect redistributed topsoil and,
(2) Failure to pass surface drainage thru sediment control structure at waste rock disposal site
Assessment conference held - 1-29-86
Final assessment paid 3-24-86

NOV 85-2-20-1 issued 9-12-85 at Deer Creek mine, ACT/015/018
(1) Failure to construct and maintain sediment control measures at drain inlets
Assessment conference held - none
Final assessment paid 12-31-85

NOV 85-2-21-4 issued 9-12-85 at Wilberg mine, ACT/015/019
(1) Conducting mining activities without a permit (crane pad)
(2) Failure to pass disturbed water thru sedimentation pond before leaving permit area at load out and 4E belt
(3) Failure to minimize erosion on reclaimed area North of sedimentation pond
(4) Failure to maintain road drainage structures - Blocked culvert at Y in road below sediment pond
Assessment conference held - 1-29-86
Final assessment paid 3-24-86 on #2 only

NOV 85-2-22-1issued 9-13-85 at Des-Bee-Dove mine, ACT/015/017
(1) Failure to re-construct and maintain access road to sedimentation pond
Assessment conference held - none
Final assessment paid 12-31-85

NOV 85-6-14-1 issued 11-27-85 at Wilberg mine, ACT/015/019
(1) Failure to pass disturbed surface drainage through appropriate sediment controls before leaving the permit area - adding additional sediment to stream flow
Assessment conference held - 1-29-86
Final assessment paid N/A

NOV 86-9-2-2 issued 1-31-86 at Wilberg mine, ACT/015/019
(1) Failure to prevent additional sediment to stream flow outside of the permit area - Coal fines on haul road bypassing catch drains by sediment ponds and Y in the road
Assessment conference held - 5-30-86
Final assessment paid 8-7-86

NOV 86-9-2-2 issued 1-31-86 at Wilberg mine, ACT/015/019
(2) Failure to maintain undisturbed drainage in accordance with approved plan to prevent additional suspended solids to stream flow outside of the permit area
Assessment conference held - none
Final assessment paid 6-27-86

C 86-4-1-1 issued 2-19-86 at Des-Bee-Dove mine, ACT/015/017
(1) Failure to abate N.O.V. 85-2-22-1 within the 90 day maximum time
Assessment conference held - none
Final assessment paid 5-20-86

NOV 86-4-4-1 issued 3-26-86 at Wilberg mine, ACT/015/019
(1) Failure to conduct 3rd and 4th quarter inspections at the waste rock site
Assessment conference held - none
Final assessment paid 5-20-86

NOV 86-4-3-3 issued 3-26-86 at Deer Creek mine, ACT/015/018
(1) Failure to mine in accordance with approved permit (construction of diesel repair shop)
Assessment conference held - 5-30-86
Final assessment paid N/A - Vacated

NOV 86-4-3-3 issued 3-26-86 at Deer Creek mine, ACT/015/018
(2) Failure to conduct quarterly inspection at waste rock fill site
Assessment conference held - 5-30-86
Final assessment paid 6-27-86

NOV 86-4-3-3 issued 3-26-86 at Deer Creek mine, ACT/015/018
(3) Failure to maintain adequate drainage controls - Class II fan access road
Assessment conference held - 5-30-86
Final assessment paid N/A

NOV 86-8-9-1 issued 5-27-86 at Wilberg mine, ACT/015/019
(1) Failure to comply with water quality standards and effluent limitations at sedimentation pond. TDS exceeded maximum allowable
Assessment conference held -
Final assessment paid N/A - Vacated 9-18-86

NOV 86-10-1-1 issued 6-3-86 at Wilberg mine, ACT/015/019
(1) Failure to conduct soil sampling of completed waste rock cells prior to replacement of topsoil
Assessment conference held - none
Final assessment paid 7-14-86

NOV 86-10-2-1 issued 6-3-86 at Des-Bee-Dove mine, ACT/015/017
(1) Failure to maintain Class I road to minimize erosion and prevent runoff of suspended solids from leaving permit area
Assessment conference held -
Final assessment paid N/A Part vacated and the rest reduced to zero assessment

NOV 86-10-5-1 issued 8-22-86 at Deer Creek mine, ACT/015/018
(1) Discharge from sedimentation pond was not in compliance with NPDES permit TDS limits
Assessment conference held - N/A
Finals assessment paid N/A - In effect vacated

NOV 87-27-2-1 issued 10-7-87 at Deer Creek mine, ACT/015/018
(1) Failure to pass surface drainage through sediment pond
Assessment conference held -
Final assessment paid - Vacated

UMC 782.15 RIGHT OF ENTRY AND OPERATION INFORMATION

Utah Power and Light Co. is the owner in fee simple of all the land contained in the permit area. The permit area is within part of each of the following parcels

Sec. 5, T. 17 S., R. 8 E., S.L.M.
NW, NW, Lot 4
SW, NW, Lot 5

Sec. 6, T. 17 S., R. 8 E., S.L.M.
NE, NE, Lot 1
SE, NE
SW, NE

AMENDMENT TO
APPROVED Mining & Reclamation Plan
Approved, Division of Oil, Gas & Mining
date 3/25/89

The permit area is more precisely described as follows:

Deer Creek Waste Rock Site
Property Description

BEG 10 FT SOUTH OF NE COR OF SEC 6, TWP 17 S, RANGE 8 EAST, SLM, THENCE S 89-52-00 W 1272 FT; S-00-08-00 E 600 FT; S-83-28-43 E 302.035 FT; S-72-54-35 E 314.083 FT; S-63-06-41 E 224.508 FT; S-48-18-17 E 268.404 FT; S-20-00-18 W 1064.125 FT; S-39-27-40 W. 858.56 FT; S-41-10-40 E 100.000 FT; N-43-39-42 E 1635.00 FT; N-31-02-18 E 412.959 FT; N-22-58-45 E 1310.908 FT; N-89-40-41 W 740.000 FT; TO POINT OF BEG 48.69 ACRES.

Ownership in the above property is acknowledged by deeds on file with the Emery County Recorder identified as follows:

Warranty Deed dated 6-8-82
Entry No. 299246, Book 129, Page 580

Warranty Deed dated 6-22-82
Entry No. 299568, Book 129, Page 797

Quit Claim Deed dated 6-22-82
Entry No. 299569, Book 129, Page 798

Warranty Deed dated 1-26-72
Entry NO. 212962, Book 68, Page 319

UMC 782.16 AREA DESIGNATED UNSUITABLE FOR MINING

In consultation with the Division of Oil, Gas and Mining, no lands within or adjacent to the permit area have been identified as qualifying under UMC - 764 as areas unsuitable for surface effects of underground coal mining activities.

No facilities or operations will be conducted within 300 feet of an occupied dwelling.

UMC 782.17 PERMIT TERM

This application is for the five (5) year permit term; however, the storage site is designed to handle all of the Deer Creek waste rock from the Deer Creek mine for the life of the mine. Use of the storage site will start as soon as possible after permit approval. Anticipated construction will begin in late August 1988 and waste rock will be deposited for at least the following 30 years. See Page 3-1 Section I for description of acres disturbed.

UMC 782.18 PERSONAL INJURY AND PROPERTY DAMAGE INSURANCE

Evidence of this insurance was provided to the Division of Oil, Gas and Mining on December 28, 1987 in response to a request dated November 24, 1987. Division form number 7000 R-28, Certificate of Liability Insurance, issued to Utah Power and Light Co. was provided by the Fred A. Moreton and Co. of Salt Lake City, Utah. In addition, copies are kept on file at the Utah Power and Light Co. office in Huntington, Utah and copies are provided on the next pages following.

UMC 782.19 IDENTIFICATION OF OTHER LICENSES AND PERMITS

No permits are required from Emery County. The Utah Department of Health will require permits from the Bureau of Air Quality and Bureau of Water Pollution Control. Also form R69 needs to be completed from the State of Utah Natural Resources - Water Rights Division. These permits will be completed before construction begins. Licenses, permits and approvals associated with the Deer Creek Mine are listed in Volume 1, Page 24 of the Deer Creek permit ACT/015/018.

UMC 782.20 LOCATION OF PUBLIC OFFICE FOR FILING APPLICATION

This application when filed with the Division of Oil, Gas and Mining, 355 West North Temple, 3 Triad Center, Suite 350, Salt Lake City, Utah 84180-1203, will simultaneously be filed with the Emery County Recorder, Emery County Courthouse, Castle Dale, Utah 84513.

Revised November, 1987.

CERTIFICATE OF LIABILITY INSURANCE
Issued to:
State of Utah
Department of Natural Resources
Division of Oil, Gas and Mining
--oooOoo--

THIS IS TO CERTIFY THAT:

LLOYDS OF LONDON, LONDON COMPANIES, ILLINOIS INSURANCE EXCHANGE, AAI SYNDICATE
(Name of Insurance Company)

LONDON, ENGLAND
(Home Office Address of Insurance Company)

HAS ISSUED TO:

UTAH POWER & LIGHT COMPANY
(Name of Permit Applicant)

(Mine Name)	(Permit Number)
-DEER CREEK MINE	ACT/015/018
-COTTONWOOD/WILBERG MINE	ACT/015/019
-DESBEDOVE MINE	ACT/015/017

CERTIFICATE OF INSURANCE:

(Policy Number)	(Effective Date)
87D5006-1A, 87D5006-1A, 87D5006-1B	May 1, 1987

UNDER THE FOLLOWING TERMS AND CONDITIONS:

As Per UMC/SMC Part 800.60 Terms and Conditions for Liability Insurance;

A. The Division shall require the applicant to submit as part of its permit application a certificate issued by an insurance company authorized to do business in the state of Utah certifying that the applicant has a public liability insurance policy in force for the surface coal mining and reclamation operations for which the permit is sought. Such policy shall provide for personal injury and property damage protection in an amount adequate to compensate any persons injured or property damaged as a result of the surface coal mining and reclamation operations, including the use of explosives and who are entitled to compensation under the applicable provisions of state law. Minimum insurance coverage for bodily injury and property damage shall be $300,000 for each occurrence and $500,000 aggregate.

B. The policy shall be maintained in full force during the life of the permit or any renewal thereof, including the liability period necessary to complete all reclamation operations under this chapter.

CERTIFICATE OF LIABILITY INSURANCE

C. The policy shall include a rider requiring that the insurer notify the Division whenever substantive changes are made in the policy including any termination or failure to renew.

UNDERWRITING AGENT:

EDWARD B. MORETON (Broker's Name) — (801) 531-1234 (Phone)

FRED A. MORETON & COMPANY (Company Name)

P.O. BOX 8139 (Mailing Address) — SALT LAKE CITY, UTAH 84108 (City, State, Zip Code)

The undersigned affirms that the above information is true and complete to the best of his or her knowlege and belief, and that he or she is an authorized representative of the above-named insurance company.

Edward B. Moreton

(Date, Signature and Title of Authorized Broker of Insurance Company)

Signed and sworn before me by Sharron Rushton SHARRON RUSHTON (Name)

this 17th day of DECEMBER, 1987.

Sharron Rushton (Signature)

My Commission Expires: 7-1-91 (Date)

7000R-28

PRODUCER

FRED A. MORETON & COMPANY
P. O. BOX 8139
SALT LAKE CITY, UT 84108-0139

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW.

INSURED

UTAH POWER & LIGHT COMPANY
Attn: Blaine Hofeling
P. O. Box 899, Room 311
Salt Lake City
UT 84110

COMPANIES AFFORDING COVERAGE

COMPANY LETTER A	LLOYDS OF LONDON
COMPANY LETTER B	LONDON COMPANIES
COMPANY LETTER C	ILLINOIS INS. EXCHANGE AAI
COMPANY LETTER D	
COMPANY LETTER E	

COVERAGES

THIS IS TO CERTIFY THAT POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS, AND CONDITIONS OF SUCH POLICIES.

CO LTR	TYPE OF INSURANCE	POLICY NUMBER	POLICY EFFECTIVE DATE (MM/DD/YY)	POLICY EXPIRATION DATE (MM/DD/YY)	LIABILITY LIMITS IN THOUSANDS	EACH OCCURRENCE	AGGREGATE
	GENERAL LIABILITY						
A	X COMPREHENSIVE FORM	87D5006-1A	5/01/87	5/01/88	BODILY INJURY	$	$
	X PREMISES/OPERATIONS						
B	X UNDERGROUND EXPLOSION & COLLAPSE HAZARD	87D5006-1A			PROPERTY DAMAGE	$	$
	X PRODUCTS/COMPLETED OPERATIONS						
C	X CONTRACTUAL				BI & PD COMBINED	$ 1,000	$ 1,000
	X INDEPENDENT CONTRACTORS	87D5006-1B					
	X BROAD FORM PROPERTY DAMAGE						
	X PERSONAL INJURY				PERSONAL INJURY		$
	AUTOMOBILE LIABILITY						
A	X ANY AUTO	87D5006-1A	5/01/87	5/01/88	BODILY INJURY PER PERSON	$	
	X ALL OWNED AUTOS (PRIV PASS)						
B	X ALL OWNED AUTOS (OTHER THAN PRIV PASS)	87D5006-1A			BODILY INJURY PER ACCIDENT	$	
	X HIRED AUTOS						
C	X NON-OWNED AUTOS	87D5006-1B			PROPERTY DAMAGE	$	
	X GARAGE LIABILITY						
	EXCESS LIABILITY				BI & PD COMBINED	$ 1,000	
	UMBRELLA FORM						
	OTHER THAN UMBRELLA FORM				BI & PD COMBINED	$	$
	WORKERS' COMPENSATION AND EMPLOYERS' LIABILITY				STATUTORY		
					$	EACH ACCIDENT	
					$	DISEASE-POLICY	
					$	DISEASE-EACH	
	OTHER						

DESCRIPTION OF OPERATIONS/LOCATIONS/VEHICLES/SPECIAL ITEMS

ALL OPERATIONS.
LIMITS IN EXCESS OF SELF INSURED RETENTION OF $2,000,000
IN LIEU OF ALL PREVIOUS CERTIFICATES

KB

CERTIFICATE HOLDER

STATE OF UTAH
DEPT. OF NATURAL RESOURCES
DIVISION OF OIL,GAS & MINING
3 TRIAD CENTER #350
SALT LAKE CITY, UT 84180-1203

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, THE ISSUING COMPANY WILL ENDEAVOR TO MAIL 30 DAYS WRITTEN NOTICE TO THE CERTIFICATE HOLDER NAMED TO THE LEFT, BUT FAILURE TO MAIL SUCH NOTICE SHALL IMPOSE NO OBLIGATION OR LIABILITY OF ANY KIND UPON THE COMPANY, ITS AGENTS OR REPRESENTATIVES.

AUTHORIZED REPRESENTATIVE

746890

ACORD 25 (8/84)

UMC 782.21 NEWSPAPER ADVERTISEMENT AND PROOF OF PUBLICATION

The following newspaper advertisement, as required by UMC 786.11 (2), will be published in the Emery County Progress, 190 East Main St., Castle Dale, Utah 84513 at least once a week for four consecutive weeks as soon as the Division advises that this permit application is complete. Proof of publication of the advertisement will be filed with the Division within four weeks after the last date of publication.

NOTICE

Utah Power & Light Company, P.O. Box 310, Huntington, Utah 84528, hereby announces its intent to file an application for the Deer Creek Waste Rock Storage Facility Permit for the Deer Creek Mine with the Division of Oil, Gas and Mining under the laws of the State of Utah.

A copy of the complete application is available for public inspection at the Emery County Recorder's Office, Emery County Courthouse, Castle Dale, Utah 84513 and also at the State of Utah, Division of Oil, Gas and Mining, 355 West North Temple, 3 Triad Center, Suite 350, Salt Lake City, Utah 84180-1203.

Written comments on the application should be submitted to the State of Utah, Division of Oil, Gas and Mining, 355 West North Temple, 3 Triad Center, Suite 350, Salt Lake City, Utah 84180-1203.

The area to be used is contained on the U.S.G.S. 7.5-minute "Red Point" and "Hiawatha" quadrangle maps.

The approximately 46.22 acres contained in the permit area involve parts of sections 5 & 6, T17S, R8E, S.L.B.& M.. Utah Power and Light Company is owner of all the land within the permit area.

UMC 783.24 (a) & (b) MAPS - GENERAL REQUIREMENTS

Land Ownership drawing number GENS 999 D found in Map Packet #1-1 shows all boundaries of lands and names of present owners of record of those lands, both surface and subsurface, included in or contiquous to the permit area. This map also shows the boundaries of land within the permit area upon which Utah Power and Light Co. has the legal right to enter and begin construction and use of the Deer Creek Waste Rock Storage Facility.

AFFIDAVIT OF PUBLICATION

STATE OF UTAH }
County of Emery, } ss.

I, Dan Stockburger, on oath, say that I am the General Manager of the The Emery County Progress, a weekly newspaper of general circulation, published at Castle Dale, State and County aforesaid, and that a certain notice, a true copy of which is hereto attached, was published in the full issue of such newspaper for ....Four (4).... consecutive issues, and that the first publication was on the

....28th....day of.....June....., 19...88...

and that the last publication of such notice was in the issue of such newspaper dated the

....19th....day of.....July....., 19...88...

Dan Stockburger

Subscribed and sworn to before me this

....19th....day of....August....., 19...88...

Holly Jo Baker
Notary Public.

My Commission expires October 2, 1990
Residing at Price, Utah

Publication fee, $ ..57.60..

NOTARY PUBLIC
My Commission Expires October 2, 1990
HOLLY JO BAKER
76 West Main
Price,
UT 84501
STATE OF UTAH

NOTICE

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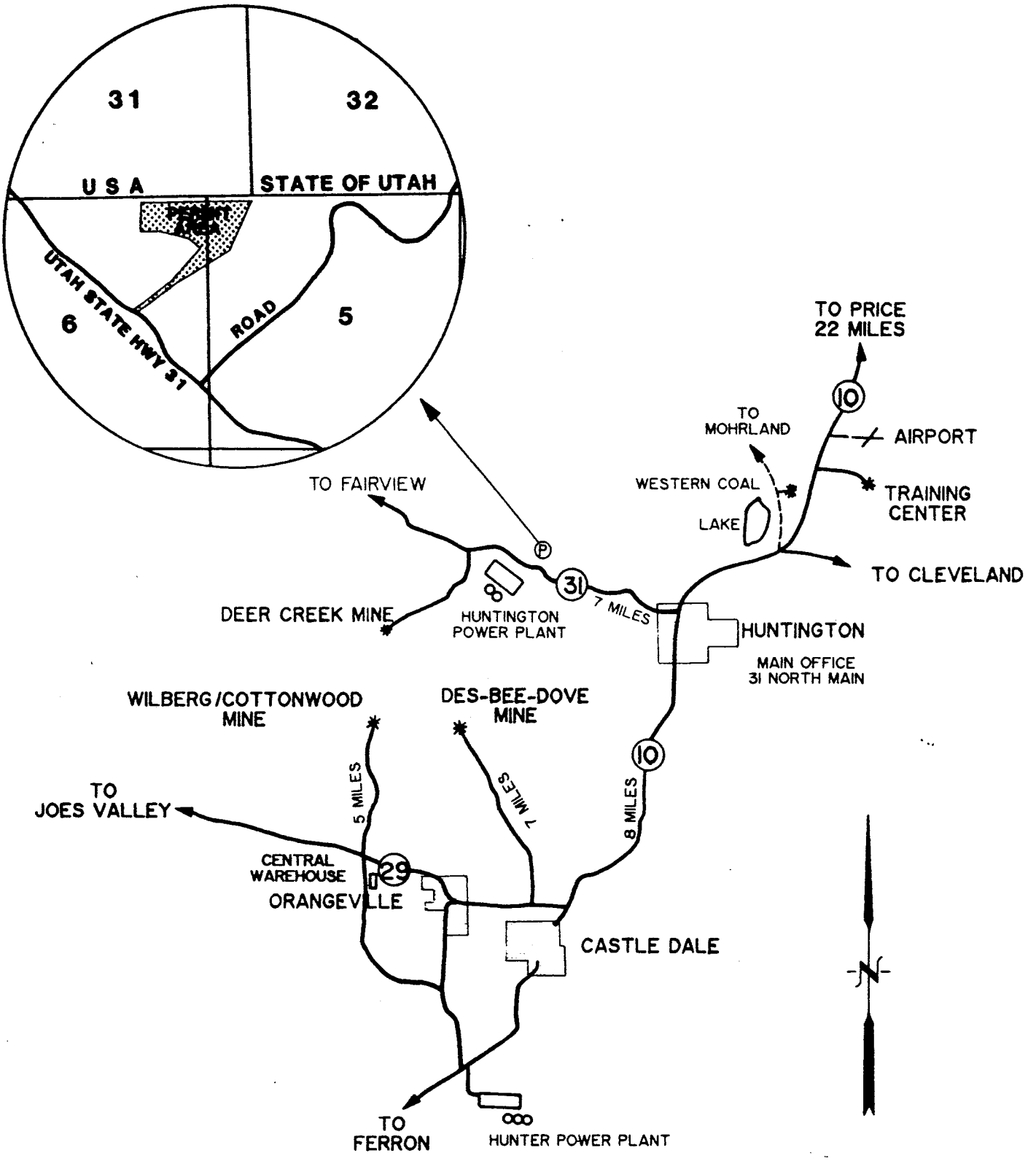
The area to be used is contained on the U.S.G.S. 7.5-minute "Red Point" and "Hiawatha" quadrangle maps.

The approximately 52.56 acres contained in the permit area involve parts of sections 5 & 6, T17S, R8E, S.L.B.&M. Utah Power and Light Company is owner of all the land within the permit area.

Published in the Emery County Progress June 28, July 5, 12 and 19, 1988.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WESTERN COAL
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TO FAIRVIEW
TO CLEVELAND
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DEER CREEK MINE
HUNTINGTON
POWER PLANT
HUNTINGTON
MAIN OFFICE
31 NORTH MAIN
WILBERG/COTTONWOOD
MINE
DES-BEE-DOVE
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TO
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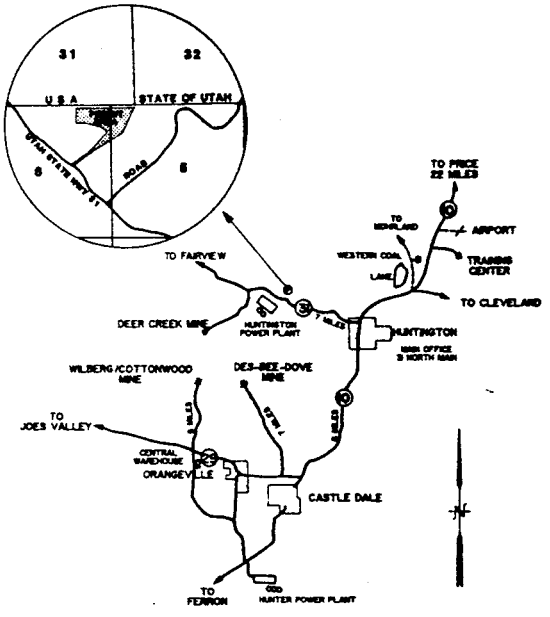
HUNTER POWER PLANT

PERMIT AREA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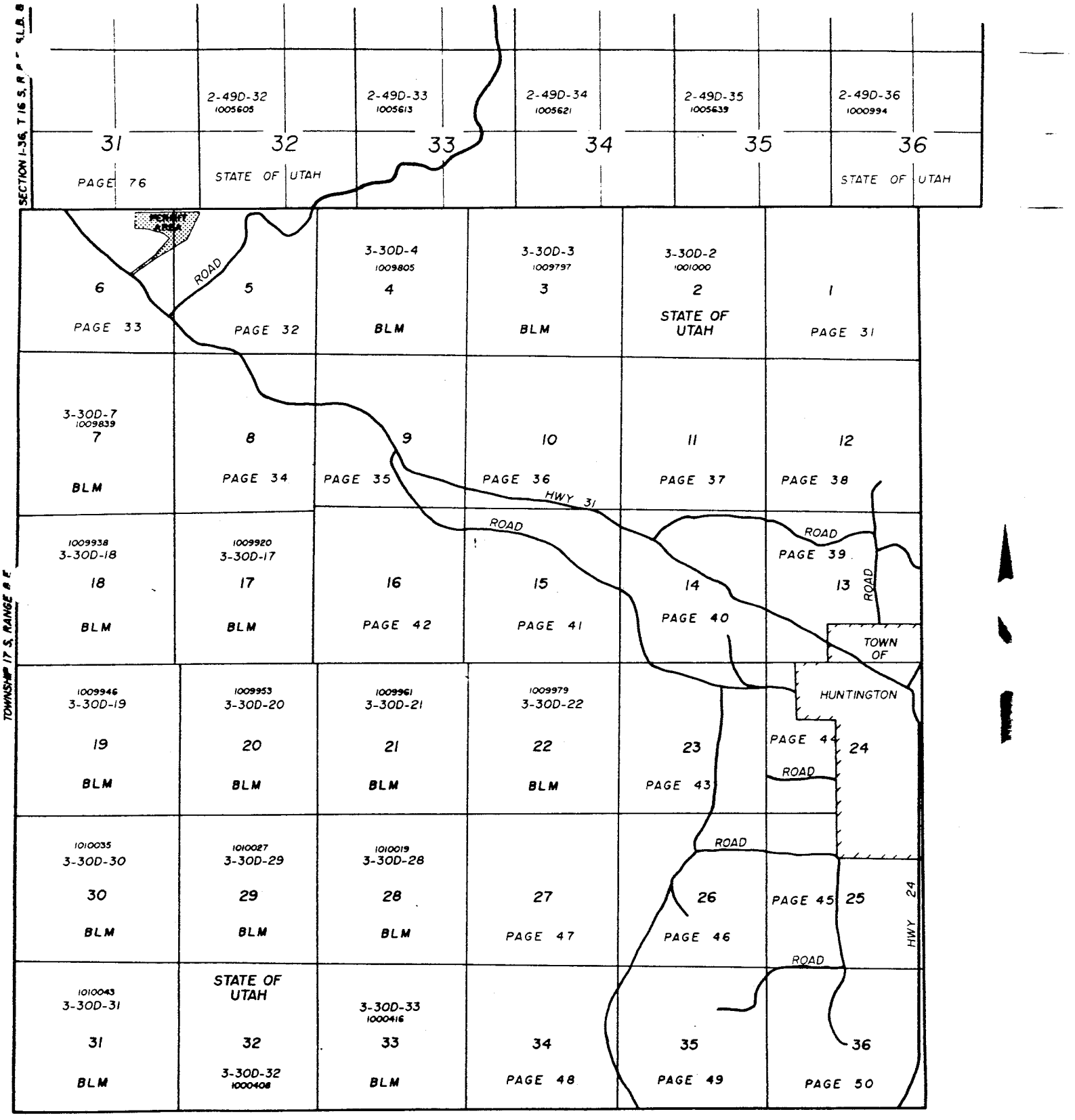
SECTION 1-36, T 16 S, R 6 E, S.L.B. & M.
TOWNSHIP 17 S, RANGE 6 E
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2-49D-33
1005613
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STATE OF UTAH
STATE OF UTAH
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STATE OF UTAH
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HWY 31
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ROAD
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HUNTINGTON
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ROAD
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1010027
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3-30D-28
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HWY 24
ROAD
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BLM
STATE OF UTAH
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3-30D-32
1000408
3-30D-33
1000416
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PAGE 48
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PAGE 49
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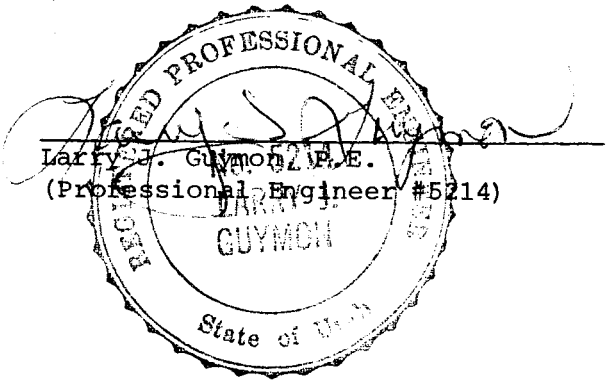
PAGE 50

CERTIFICATION

STATE OF UTAH)
: ss
County of Emery)

Except as otherwise indicated thereon, all maps, plans, and cross sections submitted with this application have been prepared under the supervision of Larry J. Guymon, a registered Professional Engineer of the State of Utah, who hereby certifies to the correctness thereof.



Larry J. Guymon, P.E.
(Professional Engineer #5214)

U. S. Department of Labor

Mine Safety and Health Administration
P.O. Box 25367
Denver, Colorado 80225-0367
Coal Mine Safety & Health
District 9

July 28, 1988

Dave D. Lauriski
Managing Director Health, Safety, and Training
Mining Division
P.O. Box 310
Huntington, UT 84528

Re: Deer Creek
ID No. 42-00121
Refuse Pile
ID No. 1211-UT-09-00121-02
New Refuse Site

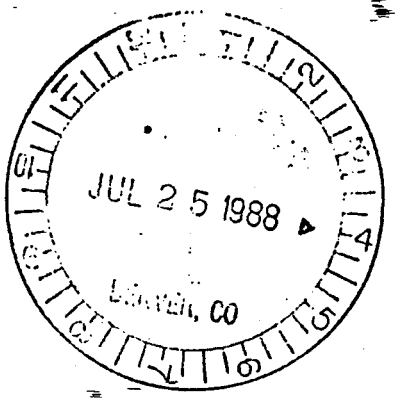
Dear Mr. Lauriski:

This is in response to your letter dated July 22, 1988, concerning a waste rock storage facility for the subject mine. MSHA personnel have reviewed the referenced refuse pile construction plan. The refuse pile design, consisting of two pages and seven maps, is accepted and has been made a part of the mine file.

Sincerely,

J M Smith
for

John M. DeMichiei
District Manager



ENGINEERING REPORT

DEER CREEK MINE

WASTE ROCK STORAGE FACILITY

INTRODUCTION:

This report is prepared in accordance to the applicable requirements of CFR 30 Part 77.214 and Part 77.215. This facility is designed to handle the life of mine needs for waste rock disposal. The volume of material to be disposed of was estimated using past history data from the mining operation and projecting these figures to estimated future production.

DISCUSSION:

A. 77.214 REFUSE PILES: GENERAL

A. The site is located well away from all activities associated with the mining operation.

B. No exposed coal seams are located in the area of the storage facility.

C. N/A

D. A perimeter fence will be constructed around the entire facility including the access road. The entrance to the facility will be secured with a locked gate to prevent unauthorized access.

B. 77.215-2 REFUSE PILES: REPORTING REQUIREMENTS

A. Utah Power and Light Mining Division
P. O. Box 310
Huntington, Utah 84528
Attn: Keith Sinsel

FACILITY NAME

DEER CREEK MINE, WASTE ROCK STORAGE FACILITY

MSHA ID NUMBER

1211-UT-09-00121-02

MINE ID NUMBER

42.00121

B. The facility will be located on lands owned by Utah Power and Light as follows:

Beg 10 Ft South of the NE Cor of SEC 6, TWP 17 S, Range 8 East, SLM, Thence S 89-52-00 W 1272 Ft; S 00-08-00 E 600 Ft; S 83-28-43 E 302.035 Ft; S 72-54-35 E 314.083 Ft; S 63-06-41 E 224.508 Ft; S 48-18-17 E 268.404 Ft; S 00-06-47 E 395.999 Ft; S 24-27-41 W 567.331 Ft; S 41-59-50 W 1009.675 Ft; S 41-10-40 E 100.00 Ft; N 43-39-42 E 2237.446 Ft; N 27-28-27 E 1266.136 Ft; N 89-40-41 W 1015.357 Ft; To Point of Beg 46.22 Acres.

Refer to the maps and drawings for further detail.

C. The construction of the facility will take place in phases as portrayed in the drawings Phase I - Phase IV. Drawing and cross-sections are provided of the facility.

The waste rock material (refuse) will be placed in compacted lifts of two foot maximum depth. Out slopes of the pile will be 2 horizontal to 1 vertical. Prior to placement of the waste rock material the area will be cleared of all vegetation matter and top soil.

The existing drainage in the area of the fill structure will be diverted around the fill in permanent channel designed to handle a 100 year storm event.

AMENDMENT TO

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

Chapter II OPERATION PLAN

Section I STRUCTURES AND FACILITIES

1. ACCESS ROAD

A. INTRODUCTION

The access road will begin at an intersection with U 31 and extend in a northerly direction approximately 3000 feet to Section 12+00 of the Deer Creek Waste Rock Storage Facility. The general location of the new road has been previously disturbed by activities associated with the Utah Power and Light Research Farm. The road is to be used by trucks carrying Deer Creek Waste Rock from the mine for disposal on the Deer Creek Waste Rock Storage Facility.

B. LOCATION

The road is located along the northeast bank of a small unnamed drainage in Township T17S, Range R8E, Section 5 & 6 on land owned by Utah Power and Light Co. The total area disturbed by the construction of the road will be 1.8 acres. (Refer to location map DS # 1012 E and surface ownership map # DS 999 D in map packets # 4-2 and # 1-1 respectively)

C. DESIGN

The horizontal and vertical alignment, the cuts and fills and the drainage structures have been located, designed and plotted to conform to the existing topography. The road encroaches upon the existing drainage channel at one location, between station 10+80 and station 11+50 (See Drawing DS1098A, Map Packet 4-1). The overall grade of the road is less than 3% with a maximum pitch grade of 7.5%. The road cross section will have a 24 foot wide graveled surface of 6" depth sloped at 1% toward the roadside drainage ditches. Road side drainage ditches will be installed to carry road drainage to the cross culverts. Embankment sections will have out slopes built on a 1 v to 1.5 h. Cut sections will be built on a 1 v to 1.5 h in unconsolidated areas. Rock cutslopes will be built in 1 v to 0.5 h slope. The road corridor will be fenced with a locked gate at the intersection of the road with U 31 to control unauthorized access.

2. DEER CREEK WASTE ROCK STORAGE FACILITY

A. INTRODUCTION

The original Deer Creek Waste Rock Storage Facility located on the mine permit area has been filled to capacity thus making it necessary to construct a new facility to handle the disposal needs of the mine. Calculations have been made, based on past history, of Deer Creek Waste Rock generated during mining operations, these quantities have been used to formulate the design of the new facility. (Refer to Chapter IV Engineering Designs)

B. LOCATION

The areas selected for the new site is located on lands owned by Utah Power and Light Co. The area is located in Township T17S, Range R8E, Sections 5 & 6 in an area just northeast of the Huntington Power Plant Evaporation pond. Some of the area to be used by the Deer Creek Waste Rock Storage Facility site has been previously disturbed by activities associated with the Power Plant and associated Research Farm. The total area disturbed by the Deer Creek Waste Rock Storage Facility, sediment control structures, topsoil, subsoil and drainage structures is 29.5 acres.

C. DESIGN

The facility is designed to compliment the existing topography of the area with as little disturbance to the existing drainage as possible and to use only those lands owned by Utah Power and Light. The construction, operation and reclamation of the facility is planned to take place in phases.

Phase I will include the following:

1. Construction of access road
2. Installation of perimeter fence
3. Construction of soil berms for area #1 from section 16+00 to section 9+50
4. Construction of sediment basin for area #1
5. Construction of permanent diversion #3, #4
6. Installation of silt fence along toe of soil berms
7. Interim revegetation on soil berms and roadfills
8. Placement of underground development waste and sediments in area #1

(See drawing Phase I, # CM-10778 DR, Map Packet 4-5)

Phase II

1. Construction of soil berms for area #2 from section 9+50 to section 2+80
2. Construction of diversion ditches #1, #2
3. Construction of disturbed ditches #1, #2
4. Reclamation of area #1
5. Install silt fences along toe of soil berms in area #2
6. Placement of underground development waste and sediments in area #2

(See drawing Phase II # CM-10779 DR, Map Packet 4-6)

Phase III

1. Reclaim area #2
2. Construction of disturbed ditches #3, #4, #5

(See drawing Phase III # CM-10780 DR, Map Packet 4-7)

Phase IV

1. Reclamation of sediment basins for both areas Storage Facility
2. Reclamation of the access road
3. Removal of perimeter fence
4. Diversion of disturbed ditches #1, #2, #3, #4 and #5 into permanent diversions

(See drawing Phase IV # CM-10781 DR, Map Packet 4-8)

Section II DRAINAGE CONTROLS

1. ACCESS ROAD

A. GENERAL

The drainage system for the road will consist of road side ditches and cross culverts. The drainage system is designed to safely pass the peak run off from a 10-year, 24-hour precipitation event. (Refer to Chapter IV Engineering Designs) The system is designed to minimize to the extent possible, degradation of surface runoff and erosion.

B. DITCHES

To minimize erosion on the road bed the road cross section will be sloped 1% toward the road side ditch. (See Chapter IV Engineering Designs - Road Cross section) Road side ditches will be provided along the entire length of the road to channel runoff into the cross culverts. (Refer to Chapter IV Engineering Designs, Road Section & Plan View)

C. CULVERTS

All drainage culverts are designed to safely pass the 10-year, 24-hour precipitation event without a head water at the inlet. The inlet of all culverts will be provided with a rock rip-rap headwall to protect against erosion. The outlet will be provided with a rip-rap fan to dissipate the erosion energy of the runoff. The culverts will have a minimum of 2' of compacted cover and will be installed at 30° angle. (Refer to Chapter IV Engineering Design)

D. OPERATION AND MAINTENANCE

On an as needed basis, as the road surface deteriorates due to usage and weather, a blade will be used to recontour the travel surface of the road. The rills and gullies will be backfilled and a smooth surface will be developed with side slopes of 1%. Road base gravel will be added to the surface as needed.

The ditches along the access road will be maintained at the same time as the road surface. A blade will be used to clean sediment and debris from the ditch. In areas where excessive erosion occurs rock rip-rap will be placed to help control it.

The inlet and outlet works of all culverts will be maintained as needed. Any debris clogging these structures will be removed. Rock rip-rap will be used to control erosion. Any erosion that occurs on the fill or cut slopes deeper than 9 inches will be either backfilled or in those cases where a small channel has developed due to drainage concentration a rip-rap channel will be established.

The silt fences along the toe of the road fill sections will be cleaned of sediment accumulation by backhoe or hand methods. This material will be either used to backfill rills and gullies or disposed in the waste rock site.

2. DEER CREEK WASTE ROCK STORAGE FACILITY

A. GENERAL

The drainage of the area is confined to several small ephemeral streams. The undisturbed drainage plan for the site will consist of two permanent diversion systems that will divert the ephemeral stream flows around the Deer Creek Waste Rock Storage Facility fill structure and into an existing drainage channel in one case and into a natural drainage channel in the other. The disturbed drainage plan, will consist of a sediment basin, small diversion ditches along the toe of the reclamated Deer Creek Waste Rock Storage Facility slopes and sheet flow off the top surface of the Deer Creek Waste Rock Storage Facility fill pad.

B. PHASE I

During this initial stage of construction and operation, two undisturbed drainage ditches will be built to convey the ephemeral drainages past the disturbed area #1. Ditch #3 is approximately 1010 feet long and extends from section 9+50 to section 17+60 where it will discharge into ditch #4. Ditch #4 is approximately 250 feet long and is located on the west side of the site. Ditch #4 will discharge into the existing diversion channel. (Refer to Chapter IV Engineering designs for the detail on the ditch designs and sizing)

The disturbed drainage system for this initial area will consist of a sediment basin and a overland flow along the inside toe of the south soil berm. The sediment basin for area #1 will contain runoff volume equal to 2.2 Ac. Ft. and sediment volume of .98 Ac.Ft., this serves an area of approximately 10 acres. The south soil berm will collect and direct the overland flow from the working area of the fill into the sediment basin. As the site fills with Deer Creek Waste Rock the working pad level will be sloped on a .5% toward the sediment basin for drainage purposes. The basin will be formed by the soil berm on the south and west sides and the Deer Creek Waste Rock Storage Facility on the east side. Area is provided for the retention of runoff from two back to back 100 year storms from areas #1. (Refer to Chapter IV Engineering Designs for design data) To provide drainage treatment for the soil berms of area #1 a silt fence filter will be installed along the outside toe of the berm fill.

Maintenance work on the ditches, sediment basin and silt fences will be done as the need arises. Sediment and debris accumulations will be removed by mechanical and hand methods.

A wet weather seep has been identified within the fill area #1. A drainage system to collect and channel this water to the existing diversion structure will be constructed prior to soil berm construction. It will consist of approximately 400 linear feet of 4" perforated drain pipe. This pipe will be enveloped in a gravel blanket of 2" rock, 12" thick around the pipe. This gravel blanket will be wrapped in a non-woven filter fabric. The drainage system will be covered with 12" of the existing clay material prior to waste rock fill placement. (Refer to Chapter IV Engineering Design and drawing Phase I # CM-10778 DR, Map Packet 4-5)

C. PHASE II

As area #1 is filled to capacity it will be necessary to begin construction on area #2. The diversion ditches #1, #2 will be constructed to divert the ephemeral drainage around the disturbed area #2. Ditch #1 will extend approximately 1000 feet along the east side and will divert drainage from this area into the natural drainage south of the fill area. Ditch #2 will run along the north side from station 3+00 to station 9+50 approximately 650 feet where it will discharge into the existing drainage diversion "Ditch #3".

The disturbed drainage system for area #2 will consist of a second sediment basin and several small ditches. The basin will be located between section 7+00 and 9+00 on the south side of the fill area. The area will be excavated to form a basin capable of holding 4.4 Ac.Ft. of runoff and 1.94 Ac.Ft. of sediment volume. The volume is sufficient to retain two 100 year storms with no discharge. Runoff from the fill area #2 will be directed into basin #2 by the south soil berm along area #2 and the east side of the waste rock fill of area #1.

Following the reclamation of area #1, two ditches will be built along the toe of the north and south reclamated slopes. These drainage structures will collect runoff from these slopes and convey it into the sediment basin for area #1. They are labeled ditch #1 D (northside) and ditch #2 D (southside). As the waste rock fill is built along the north slope will be diverted into ditch #1. The runoff from the top of the fill structure in area #2 will be diverted into the second sediment basin by a third ditch (#3 D). Ditch #3 D will be built along the interface of fill area #1 and fill area #2. To control erosion on the soil berms of area #2 a silt fence filter will be built along the outside toe of the fill.

(See drawing Phase II # CM-10779 DR, Map Packet 4-6)

Maintenance work on the ditches, sediment basin and silt fences will be done as the need arises. Sediment and debris accumulations will be removed by mechanical and hand methods.

SECTION III PLACEMENT AND HANDLING OF MATERIALS

1. ACCESS ROAD

A. GENERAL

The road is designed and laid out to minimize the amount of cut and fill operations required for construction. The cuts have been balanced with the fills such that no excess material will be generated.

B. TOPSOIL

The initial step of the road construction is to remove all vegetative matter from the area to be disturbed by road construction. Once the vegetative material is removed the top soil where existing in sufficient quantities to allow for mechanical collection will be removed, and temporarily stockpiled until it can be redistributed on the embankment slopes after their construction. The temporarily stockpiled soil will be placed in an area at the beginning of road construction away from the activities of the road construction.

Silt fences will be installed along the toe of the embankment slopes to provide erosion protection until the interim vegetation is established. (Refer to Chapter III Reclamation - for Interim Vegetation Plan)

C. SUBGRADE

Following removal of the topsoil, the subgrade material will be removed to the lines and grades shown on the plans as required to construct the cuts and fills. Each layer of embankment will be placed, leveled and compacted in 12" maximum lifts. Large rocks will be worked into the fill to avoid creating voids, etc. in the fills. If any acid or toxic forming materials are found these shall be disposed of in accordance with UMC 817.48, 817.71 (j), 817.81 and 817.103 and will not be used in the embankment.

D. ROAD SURFACE

Following the construction of the subgrade 6" (compacted depth) of crushed stone will be spread and compacted on the road surface. This will serve as the final travel surface. The final configuration of the road will be to the lines and grades shown on the plans. (Refer to Chapter IV Engineering Designs)

E. DUST CONTROL

During construction of the road fills and soil berms water will be spread over the working level of the fill surface to aid in compaction and to control fugitive dust.

2. DEER CREEK WASTE ROCK STORAGE FACILITY

A. GENERAL

During the operation of the mine certain waste products are generated that are not part of the coal product, they include; underground development waste, trommel screen reject, and sediment from the pond and drainages. These materials will compose the fill material for the Deer Creek Waste Rock Storage Facility.

Past history of coal production versus Deer Creek Waste Rock generation was compiled to calculate the quantity of underground development waste per ton of coal mined. This value was then used to estimate the volume of Deer Creek Waste Rock to be generated during the remaining mine life and to design the Deer Creek Waste Rock Storage Facility plan. (Refer to Chapter IV Engineering Design)

B. TOPSOIL

After the vegetative matter is removed the top six inches (minimum) of suitable soil material will be removed and temporarily stockpiled. The topsoil temporary stockpile will be located in the N.W. corner of area #1 during construction activity until it is redistributed over the soil berms. After the subsoil material has been excavated to the depth specified and hauled and placed in the soil berms surrounding the disposal areas, the temporarily stockpiled topsoil will be spread evenly over the soil berm's top width and out slope. Care will be taken to avoid unnecessary compaction of the topsoil layer. Following soil placement the soil berms will be planted with an interim seed mix. (Refer to Chapter IV Engineering Designs and Chapter VIII Vegetation.

C. SUBSOIL

Following removal of the topsoil material the remaining material needed for soil berm construction will be excavated to the lines and grades specified on the cross sections. The material will be placed, leveled and compacted in 12" maximum lifts. Rocks larger than the lift thickness will be worked into the fill to avoid forming voids. Those rocks that will make good rip-rap will be separated and hauled and stored for future use as rip-rap. If any acid or toxic forming material

is found this material will be segregated from the berm construction and not used as fill. It will be treated as spoil and placed on the bottom of the Deer Creek Waste Rock Storage Facility. (Refer to soil analysis data, Pages 7-2 through 7-3.1 and Map CM-10788-DR, Packet 7-2 for soil quality and soil stripping plans.)

D. UNDERGROUND DEVELOPMENT WASTE

The underground development waste generated during coal mining, sediments from the sediment pond and trommel rejects will be hauled to the site by truck and dumped. The composition of this material i.e. waste rock will be a mixture from the various sources. It is estimated that the coal rock ratio should be less than 50/50. As the material is spread and placed in the fill it will be thoroughly mixed helping to blend the materials. When the quantity of material dumped at the site needs to be leveled it will be spread, placed and compacted in 24" thick horizontal lifts. Large rock etc., will be worked into the fill to avoid forming voids. As the fill lifts are made the top working surface will be sloped to allow for drainage. Any acid or toxic forming material will be buried in the fill with at least 4 foot of non-toxic cover material.

During the leveling process extraneous material, trash, and etc. will be separated from the fill material and disposed of in an approved sanitary landfill. (Refer to Chapter VII "Soil" for composition of the waste rock fill material)

SECTION IV OPERATIONAL MONITORING PLANS

A. UMC 784.13 (b) (7)

Any acid-forming or toxic-forming materials encountered during construction will be hauled to the Deer Creek Waste Rock Storage Facility and buried by at least 4 feet of nontoxic or acid forming material. The vegetative material removed prior to topsoil removal will be broken up and used as mulch during interim reclamation. Any material left over will be disposed of in an approved sanitary landfill.

B. UMC 784.14 (a),(b)

Refer to Chapter VI - Hydrology.

C. UMC 784.16

The design of the facility has been prepared and certified under the direction of a qualified registered professional engineer. A preliminary hydrologic survey and a geological survey have been conducted for the area. (Refer to Chapter IV Engineering Designs: for certifications, refer to Chapter V Geology and Subsidence: Geotechnical Analysis and to Chapter VI "Hydrology": for hydrologic information)

D. CERTIFICATION

The operation of the facility will be inspected for stability by a qualified, registered professional engineer at least quarterly and during the following critical construction periods:

1. Removal of all organic material and topsoil
2. Placement of the underdrainage system
3. Installation of surface drainage system
4. Construction of soil berms
5. Revegetation

This report will be submitted in writing to the Division within two weeks following the inspection, a copy will be maintained at the mining division offices for inspection.

E. EXPLOSIVES UMC 817.61-68

All blasting operations will be conducted by persons who have been trained, examined and certified as provided by 30 CFR 850 and applicable regulations of the State Industrial Commission. No resident or owner of a dwelling or structure is located within one-half mile of where surface blasting activity will occur.

All blasting will be conducted between sunrise and sunset. Warning and all-clear signals will be given before and after blasting. Access to the area possibly subject to fly rock from blasting shall be regulated. Access to the area shall be blocked until an authorized representative has determined that after blasting no unusual circumstances and that access to and travel in or through the area can be safely resumed.

Records of blasting will be kept on file at the Utah Power and Light office in Huntington. The records shall contain the following:

- Name of operator - Utah Power and Light
- Location - Deer Creek Waste Rock Site - date and time of blast
- Name, signature and license number of blaster-in-charge
- Direction and distance to Utah Power and Light Research Farm office
- Temperature, wind directions and approximate velocity
- Type of material blasted
- Number of holes, burden and spacing
- Diameter and depth of holes
- Types of explosives used
- Total weight of explosives used
- Maximum weight of explosives detonated within any 8-millisecond period
- Maximum number of holes detonated within any 8-millisecond period
- Initiation system

- Type and length of stemming
- If applicable - mats or other protection used
- Type of delay detonator and delay periods used
- Sketch of delay pattern
- Number of persons in blasting crew

SECTION V SUMMARY OF ENVIRONMENTAL IMPACT AND MITIGATION

A. UMC 784.18 RELOCATION OR USE OF PUBLIC ROADS
N/A

B. UMC 784.19 UNDERGROUND DEVELOPMENT WASTE
N/A

C. UMC 784.20 SUBSIDENCE CONTROL PLAN
N/A

D. UMC 784.21 FISH AND WILDLIFE PLAN
Refer to Chapter IX "Wildlife".

E. UMC 785.13 EXPERIMENTAL PRACTICES MINING
N/A

F. UMC 785.17 PRIME FARMLAND
The area used has not been used as cropland therefore, this section does not apply.

G. UMC 786.21 EXISTING DRAINAGE CHANNEL
N/A

817.11 SIGNS AND MARKERS

Signs and markers shall be made of durable material such as thin sheet metal or painted and water proofed plywood. All signs and markers will be maintained during the life of the Waste Rock Site.

At the turnoff from Highway 31 an entrance sign such as depicted on Page 2-10.2 will be posted. This sign shall remain until after the release of all bonds from the permit area.

Perimeter markers will be marked the following way: If a fence is used as a perimeter, then every fifth post will be painted "safety yellow". If there is no fence then posts painted "safety yellow" will be placed every 200 feet or closer along the perimeter boundary.

No stream buffer zone markers are required as there are no streams adjacent to the permit area.

Topsoil markers such as depicted on page 2-10.3 will be placed on all soil berms. Those signs will be used on all soil material which is vegetation supporting even if not classified as true topsoil.

On the day in which blasting occurs, a portable sign which says "Warning: Explosives in Use" will be displayed near the entrance sign. The immediate vicinity of blasting will be marked with red flagging or red cones.

Upon cessation of operations or bond release signs and markers will be removed as appropriate.

817.42(3) ALTERNATIVE SEDIMENT CONTROL AREAS

Disturbed areas which cannot be reasonably treated by a siltation structure (i.e., sediment pond) due to remote geographic locations and small areas not justifying a sediment pond but which cannot meet effluent limitations without treatment, are considered Alternative Sediment Control Areas (ASCA). These areas are treated by the best control technology available which includes, but is not limited to: silt fences, berms, catch basins, strawbales, gravel filter dikes, check dams, sediment traps and mulches.

A list of the ASCA's within the permit area is found in Table I (page 2-10.0).

TABLE I
DEER CREEK WASTE ROCK STORAGE FACILITY
ALTERNATIVE SEDIMENT CONTROL AREA (ASCA)

SITE LOCATION	SEDIMENT CONTROL	ACREAGE	DRAWINGS
Waste Rock Site Access Road	Silt Fence	.69	WRS Packet 4-5 CM-10778-DR
Waste Rock Site Berm Outslope	Silt Fence	1.72	WRS Packet 4-5 CM-10778-DR
	TOTAL	2.41 Acres	

UMC 817.46R and 817.46T

Each pond referred to in this permit application package will be designed and inspected during construction under the supervision of, and certified after construction by, a registered professional engineer.

Water impoundments and dams will be examined four times per year and reports will be sent to the Division quarterly beginning in the Fall of 1988. Structural weakness, erosion and other hazardous conditions, if identified, will be reported.

UMC 817.99 - Slides and Other Damage

At any time a slide occurs which may have a potential adverse effect on public, property, health, safety, or the environment a Utah Power and Light representative will contact the Division of Oil, Gas and Mining by the fastest available method, probably telephone. Remedial measures required by the Division will be complied with.

UMC 817.106 - Regrading or Stabilizing Rills and Gullies

When rills and gullies deeper than 9 inches form in areas that have been regraded and topsoiled, the rills and gullies will be filled, graded or otherwise stabilized in a reasonable timeframe, i.e., weather conditions, lack of equipment, or manpower, etc. The area will be reseeded or replanted using the approved seed mixes of this permit.

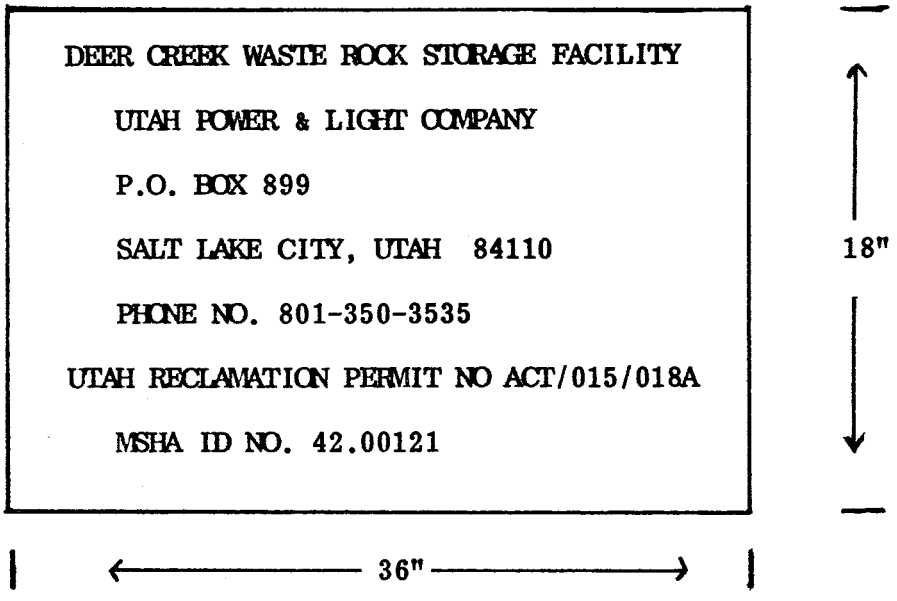
UMC 817.131 - Cessation of Operations: Temporary (PGL)

If underground operations cease the surface access openings will be effectively supported and maintained as if mining was operational. As soon as it is known that temporary cessation of underground operations will extend beyond 30 days a notice of intention to cease or abandon operations will be sent to the Division. The notice will contain the following information:

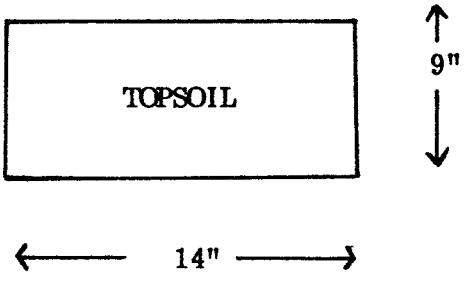
1. Number of surface acres and the horizontal and vertical extent of sub-surface strata located in the permit area prior to cessation or abandonment. This will be calculated by Utah Power and Light customarily used engineering methods.

2. The extent and kind of reclamation of surface area which has already been accomplished.

3. The identification of backfilling, regrading, revegetation, environmental monitoring, underground opening closures and water treatment activities that will continue during temporary cessation.



MINE PERMIT IDENTIFICATION SIGN



TOPSOIL MARKERS

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

CHAPTER III RECLAMATION PLAN

SECTION I GENERAL

The proposed permit area consists of approximately 29.5 acres of disturbed land the Deer Creek Waste Rock Storage Facility, this includes the area occupied by the soil berms, drainage ditches, sediment basin, underground development waste storage and underground development waste fill. The access road will use approximately 1.8 acres of disturbed land. This includes the cuts and fills and the drainage facilities. The total permit area contains approximately 48.69 acres.

The proposed post mining land use will be to return it to mainly wildlife habitat. It's present condition for this use is poor at best. Through the development of the facility it's condition will be enhanced.

The use of the area is planned to take place in phases. This approach will mitigate several impacts that the facility development will have on the area. The timing and sequence of the different phases will take place as follows:

PHASE I CONSTRUCTION

1. 3000 feet of access road
2. Install 9600 feet of perimeter fence
3. Excavate permanent diversion #3,#4
4.* Strip topsoil and subsoil to form the soil berms
5. Excavate for the sediment basin in area #1
6. Install 2100 feet of silt fence filter and plant interim revegetation on soil berms

This stage of Phase I will require approximately 3 months to complete. The installation of the silt fence filter along the outside toe of the soil berms will be done immediately following completion of the soil berm construction. The interim vegetation will be done during the fall - early winter time period.

(See drawing Phase I # Cm-10778 DR, Map Packet 4-5)

* (Prior to removal of subsoil material, Utah Power and Light will place temporarily stockpiled topsoil away from construction activity. Silt fences will be established around the perimeter of the temporary stockpile if the temporary stockpile exists for more than seven days.)

PHASE I OPERATION

To completely fill area #1 with Deer Creek Waste Rock will require approximately 468,215 cubic yards of material. Based on anticipated coal production it will take approximately 15 years to generate this volume. The filling operation will be staged from the north side of area #1 and developed toward the south. Once the north half of area #1 is filled to capacity the north soil berm will be spread over the Deer Creek Waste Rock Storage Facility and this area will be permanently reclaimed to provide mitigation acreage for wildlife prior to disturbance of area #2 during Phase II. This reclamation will take place about 7 years after the initial construction begins, this will allow 8 years for this area to develop ahead of the construction in area #2.

(See drawing Phase I # CM-10778 DR, Map Packet 4-5)

PHASE II CONSTRUCTION

1. Completion of final reclamation on area #1
2. Construction of disturbed ditches #1, #2
3. Strip topsoil and subsoil from the fill area and place in the soil berms
4. Install 1350 feet of silt fence filter along the outside toe of soil berms in area #2
5. Construction of diversion ditches #1,#2

(See drawing Phase II # CM-10779 DR, Map Packet 4-6)

PHASE II OPERATION

The Deer Creek Waste Rock capacity of area #2 is approximately 872,372 cubic yards. Based on anticipated coal production this area will handle the needs for Deer Creek Waste Rock disposal for 28 years. The Deer Creek Waste Rock Storage Facility will be developed from the north berm toward the south. When the fill has reached the mid point of area #2 the north berm will be spread over this area and final reclamation will be done. The final reclamation of the north half of area #2 will be done approximately 14 years following the construction of area #2.

(See drawing Phase II # CM-10779 DR, Map Packet 4-6)

PHASE III CONSTRUCTION

1. Completion of final reclamation on area #2
2. Construction of disturbed ditches #3, #4, #5

This work will require roughly 2 months to complete.
(See drawing Phase III # CM-10780 DR, Map Packet 4-7)

PHASE IV CONSTRUCTION

1. Backfill the sediment basins and reclaim area
2. Remove perimeter fence
3. Divert the disturbed ditches into permanent ditches
4. Reclaim the access road
5. Installation of silt fence

This work will be done following the bonding period for area #1 and area #2.

(See drawing Phase IV # CM-10781 DR, Map Packet 4-8)

Section II STRUCTURE REMOVAL AND SITE CLEAN UP

Does not apply.

Section III BACKFILLING AND GRADING - TOPSOIL AND SUBSOIL

1. ACCESS ROAD

The road gradient has been designed to minimize the volume of material to be disturbed during the construction of the cuts and fills. Following the initial removal of the vegetative matter, the top six (6) inches of soil matter will be removed and temporarily stockpiled. This material will serve as topsoil. After the topsoil has been removed the subsoil will be excavated and placed as fill along the road section. Prior to the fill placement on embankment sections the area will be scarified to insure good bond between the surfaces. The subsoil or subgrade will then be placed in level lifts 12" thick and compacted with a sheepsfoot roller. Water will be used if necessary to insure optimum moisture during compaction and aid in dust control. Rocks larger than 18" will be sorted from the fill and stored as rip-rap. The road cuts and fills will be made on 1 v to 1.5 h.

Following completion of the subgrade work the material temporarily stockpiled as topsoil will be evenly spread over the embankment outslopes. Care will be taken to insure that a good bond between the two surfaces of fill materials is made and yet not compact the topsoil more than is necessary.

The final road surface will be made of imported crushed gravel. Six (6) inches of 1" minus material will be hauled in and placed to provide the road travel surface.

Final reclamation of the road will take place as detailed below. The gravel road surface material and bottom ash road subgrade material will be removed and placed against the inside cut slope of the road crossection. The topsoil off the embankment outslope will be removed and temporarily stockpiled in an area at the road construction beginning. The subsoil material from the embankment slopes will then be spread over the road crossection to obliterate the road. The topsoil material from the temporary stockpile will then be evenly spread over the area and seeded.

2. DEER CREEK WASTE ROCK STORAGE FACILITY

Approximately 7 years following the initial construction of area # 1 the north half should be filled to capacity with waste rock material. Reclamation of this north half will then take place. The topsoil material from the north berm will be removed and placed in a temporary stockpile located in the north west corner of area #1. Following this top soil removal the remaining soil material will be spread evenly over the north half of area #1 waste rock fill. The topsoil material from the temporary stockpile will then be disturbed over the subsoil layer. The spreading of the subsoil and topsoil will be done in a manner to minimize compaction so as not to interfere with plant root development. Following the complete filling of the south half of area #1 with waste rock, the south berm will be spread over the south half of area #1. This will be done similar to the operation that took place for the north half of area #1. Using a 225 excavator the

topsoil material will be removed from the soil berm outslope and top width. This material will be loaded into an end dump truck, and then hauled to the temporary stockpile area and dumped. Following the topsoil removal the subsoil will be spread over the waste rock fill area using dozers. Upon completion of the subsoil placement the topsoil will again be loaded and hauled and dumped over the subsoil material. A motor grader will be used to evenly spread the topsoil over the top sections of the fill and a D6 dozer will spread the topsoil over the fill slopes. This operation will limit the amount of compaction to the material.

Scarifiers on the blade and D6 dozer will be used to loosen the subsoil layers prior to topsoil placement. Following the leveling of the topsoil material the scarifiers will be used to loosen the topsoil layers prior to seed placement. This operation will be duplicated for area #2 also.

The Deer Creek Waste Rock is to be hauled by truck to the site and dumped, when sufficient quantity accumulates this material will be leveled and compacted. During this operation any extraneous material, trash, etc. will be segregated and removed for disposal in an approved sanitary landfill. The placement of the Deer Creek Waste Rock in both area #1 and #2 will take place from the north berm toward the south. This will allow final reclamation of approximately half of each area to take place early in the operation. This will allow some of the area to be returned sooner to post mining land use ie. wildlife habitat.

Section IV DRAINAGE CONTROL

1. ACCESS ROAD

The road cross section will be insloped at 1% for drainage away from the fill slopes. Road side ditches will be built to collect road and hill side drainage. These ditches will channel this flow to the 18" cross culvert. The discharge of this culvert will be onto rip-rap channels then into the natural drainage system. This drainage system will avoid any concentrated flows on the fill slopes.

At the toe of the interim reclamated fill slopes a silt fence filter will be installed to retain any soil eroded due to precipitation.

During the last stages of final reclamation a silt fence filter will be installed at the downslope edge of the reclamated slopes to provide topsoil retention. Where the reclaimed road corridor crosses a natural drainage channel a rip-rap lined channel will be built across the reclaimed corridor. The design and sizing will be the same as the culvert discharge channels used during operation.

2. DEER CREEK WASTE ROCK STORAGE FACILITY

A. Phase II

Following reclamation of the waste rock fill area #1 disturbed drainage ditches will be constructed along the toe of the fill slopes. These ditches will convey water to the sediment basin at the west end of Area #1. Dirt berms 12" high will be built along the top edges of the reclaimed fill surface. These berms will keep the surface runoff from causing erosion down the fill slopes. A rip-rap channel will be installed down the west face of the waste rock fill to bring water from the top level to the sediment basin.

(See drawing Phase II # CM-10779 DR, Map Packet 4-6)

B. Phase III

After the 1st 14 year segment of operation for area #2 the north berm will be spread over the north slope and top area and planted. To collect the drainage of the north reclaimed slope of the waste rock fill in area #2 a disturbed drainage ditch #3 D will be built along the toe of the fill and will discharge into disturbed ditch #1 D. Ditch #1 D discharges into the sediment basin in area #1. A dirt berm 12" high will be installed along the north top edge of the waste rock fill in area #2 to keep run-off off of the reclamated slope.

Once the south half of area #2 is filled and reclaimed. disturbed ditches #4 D and #5 D will be built. Ditch #4 D will run along the toe of the south slope of area #2 to the sediment basin. Ditch #5 D will run across the final fill surface at the interface of areas #1 and #2 and down the south fill slope to the sediment basin in area #2. A 12" dirt berm will be built along the top edge of the south side of area #2 to keep water off the slope face.

(See drawing Phase III # CM-10780 DR, Map Packet 4-7)

C. Phase IV

The reclamation work will take place at two different times. The sediment basin in area #1 will be backfilled and reclaimed following the ten year bonding period for the north half of area #2. The disturbed ditches #1 D, #2 D, #3 D will be diverted into the permanent diversion at intervals of approximately 300 feet.

After the ten year bonding for the south half of area #2 the sediment basin in area #2 and the access road will be backfilled and reclaimed. The disturbed diversion ditches #4 D, #5 D will be diverted into the permanent or natural channel at approximately 300 foot intervals.

The runoff from both basin areas will be treated with a silt fence filter.

(See drawing Phase IV # CM-10781 DR, Map Packet 4-8)

Section V TOPSOIL REDISTRIBUTION AND SURFACE PREPARATION

Addressed in Section III of this Chapter.

Section VI REVEGETATION
UMC 817.100, .111 - .114

INTERIM REVEGETATION

Interim revegetation will be implemented on the road embankment slopes, the top and outslopes of the soil berm and the sediment pond banks. Timing of interim revegetation will be in accordance with UMC 817.113.

The primary purpose of interim revegetation is soil stabilization: therefore, plant species were selected for their suitability to site conditions, ease of establishment, rate of growth and growth forms. Species selected include some that occur naturally at the site. (Refer to Chapter VIII for Vegetation baseline data)

Interim Revegetation species list:

Common Name	Scientific Name	lbs./Acre(PLS)*
GRASSES:		
Thickspike Wheatgrass	Agropyron dasystachyum	2
Streambank Wheatgrass	A. riparium	2
Basin Wildrye	Elymus cinereus	3
Indian Ricegrass	Oryzopsis hymenoides	2
Bottlebrush Squirreltail	Sitanion hystrix	1
Sandberg Bluegrass	Poa sandbergii	0.5
Alkali Sacaton	Sporobolus airoides	0.25
FORBS:		
Prairie Aster	Aster tanacetifolius	0.5
Northern Sweetvetch	Hedysarum boreale	1
Yellow Sweetclover	Melilotus officinalis	3
Firecracker Penstemon	Penstemon eatonii	0.5
Alfalfa	Medicago sativa var. Ladak	1
SHRUBS:		
Shadscale	Atriplex confertifolia	3
Castle Valley Saltbush	A. cuneata	3
Winterfat	Ceratoides lanata	3
Basin Big Sagebrush	Artemisia tridentata tridentata	0.25
	TOTAL	26.00

*PLS = Pure Live Seed

The proposed seed mixture and application rates results in approximately 115 seeds per square foot (55 grass, 45 forb, 15 shrub).

Interim Revegetation Methodology

1. Seedbed Preparation

   Seeding will take place as contemporaneously as practicable following soil placement; therefore, the seedbed will be in a condition suitable for seed application. However, if a surface crust has developed it will be broken up by hand or mechanical tilling. Final seedbed preparation will be delayed until late September.

2. Seeding

   The seed mixture will be hand broadcast with "hurricane spreaders" or applied by hydroseeder at the specified rate. Seeding will take place during the late part of the Fall Season and no earlier than October 1.

3. Fertilizer Application

   The following fertilizer combination will be applied by hand broadcasting with "hurricane spreaders" or as a separate operation of hydroseeding:

Ammonium Nitrate	50 lbs/acre
Triple Superphosphate	75 lbs/acre

4. Seed Covering

   Following hand broadcasting of the seed mixture and fertilizer, the sites will be hand or mechanically raked to cover the seeds.

5. Mulch Application

   Following hand broadcasting and raking, the seeded areas will be covered with an erosion control mulch blanket. The blanket will be mechanically anchored per the manufacturers specifications.

   Following hydroseeding, a hydromulch with tacifier will be applied at the rate of approximately 2000 lbs/acre.

The criteria for interim revegetation success will be the establishment of a reproducing vegetative cover, on the majority of the slope, which prevents or minimizes erosion. This will be determined by spring and fall site inspections. If erosion damage occurs, it will be repaired and revegetated as needed.

FINAL REVEGETATION

Final revegetation will be implemented in areas disturbed by construction of the permanent undisturbed diversion ditches, which will not be subject to further disturbance, the completed disposal areas at various stages and the remaining areas at the time of final reclamation. (Refer to Chapter II, Operation Plan)

The post-mining land use for the area is wildlife habitat, primarily deer and elk winter range. Therefore, the species selected for final revegetation were chosen for that purpose.

Final Revegetation Species List

Common Name	Scientific Name	lbs/acre(PLS)*
GRASSES:		
Thickspike Wheatgrass	Agropyron dasystachyum	2
Streambank Wheatgrass	A. riparium	2
Basin Wildrye	Elymus cinereus	3
Galleta	Hilaria jamesii	1
Indian Ricegrass	Oryzopsis hymenoides	2
Sandberg Bluegrass	Poa sandbergii	0.5
Bottlebrush Squirreltail	Sitanion hystrix	1
Alkali Sacaton	Sporobolus airoides	0.25
FORBS:		
Prairie Aster	Aster tanacetifolius	0.5
Northern Sweetvetch	Hedysarum boreale	1
Yellow Sweetclover	Melilotus officinalis	3
Firecracker Penstemon	Penstemon eatonii	1
Scarlet Globemallow	Sphaeralcea coccinea	0.5
Alfalfa	Medicago sativa var. Ladak	1
SHRUBS:		
Black Sagebrush	Artemisia nova	1
Fourwing Saltbush	Atriplex canescens	5
Shadscale	A. confertifolia	3
Castle Valley Saltbush	A. cuneata	5
Low Rabbitbrush	Chrysothamnus viscidiflorus	1
Green Mormon Tea	Ephedra viridis	5
Mat Saltbush	Atriplex corrugata	5
Winterfat	Ceratoides lanata	2
Basin Big Sagebrush	Artemisia tridentata tridentata	0.25
	TOTAL	46.0

*PLS = Pure Live Seed

The proposed seed mixture and application rates result in approximately [illegible] seeds per square foot (62 grass, 58 forb, 70 shrub). The shrub seeding rate results in approximately 3049 stems per acre (based on an establishment rate of 1:1,000).

AMENDMENT TO
APPROVED Mining & Reclamation Plan
Approved, Division of Oil, Gas & Mining
by BS date 4/11/89

Revised 6-7-88
Revised 7-15-88
Revised 3-23-89

Final Revegetation Methodology

1. Seedbed Preparation

Seeding will take place as contemporaneously as practicable following soil placement; therefore, the seedbed will be in a condition suitable for seed application. However, if a surface crust has developed it will be broken up by hand or mechanical tilling. Final seedbed preparation will be delayed until late September.

2. Seeding

The proposed seed mixture will be applied at the specified rates on sloping sites by hand broadcasting with "hurricane spreaders" or with a hydroseeder. Seed application on level areas will be completed by the above methods or through drill seeding. If drill seeding is utilized, the application rates of grasses and forbs will be reduced by fifty (50) percent. Seeding will take place during the late part of the Fall Season and no earlier than October 1.

3. Fertilizer Application

The following fertilizer combination will be applied by broadcasting or as a separate operation of hydroseeding:

Ammonium Nitrate	50 lbs/acre
Triple Superphosphate	75 lbs/acre

4. Seed Covering

Following hand broadcasting of the seed mixture and fertilizer, the sites will be hand or mechanically raked to cover the seeds. If drill seeding is employed, seed covering will not be required.

5. Mulch Application

Following hand broadcasting and raking, the seeded slope areas will be covered with an erosion control mulch blanket. The blanket will be mechanically anchored per the manufacturers specifications.

Following hydroseeding, a hydromulch with tacifier will be applied at the rate of approximately 2000 lbs/acre.

Following drill seeding, alfalfa hay mulch will be applied at the rate of two (2) tons per acre. The mulch will be mechanically crimped into the soil.

Section VII MONITORING AND MAINTENANCE
UMC 817.116 - .117

INTERIM REVEGETATION

1. Signs will be placed around the planted slopes for their protection.

2. Weed control will not be undertaken unless it is determined necessary due to weed dominance and delayed rate or succession. Studies indicate that competition from weeds, including Salsola kali, is greatly reduced within three (3) years after revegetation.

3. Rodent damage, on revegetated areas, will be assessed and species specific control measures will be implemented as necessary. Persistent pesticides will not be used unless approved by the Division.

4. A site visit will be scheduled each spring and fall to check on fitness of the sites and check progress of the plant growth.

5. An annual report that summarizes the year's work will be placed in the Company's files and forwarded to D.O.G.M.

6. The soil materials on the sites will be sampled at five year intervals to record productivity changes. Analysis will include:

   Organic Nitrogen
   Phosphorous (ppm)
   Potassium (ppm)
   Nitrate Nitrogen
   Sodium Absorption Ratio
   Electrical Conductivity (mmhos/cm)
   pH

FINAL REVEGETATION

1. Signs will be placed around the planted slopes for their protection.

2. Weed control will not be undertaken unless it is determined necessary due to weed dominance and delayed rate or succession. Studies indicate that competition from weeds, including Salsola kali, is greatly reduced within three (3) years after revegetation.

3. Rodent damage, on revegetated areas, will be assessed and species specific control measures will be implemented as necessary. Persistent pesticides will not be used unless approved by the Division.

4. A site visit will be scheduled each spring and fall to check on fitness of the sites and check progress of the plant growth.

5. Annual monitoring will include inspection for rills and gullies. Should these be present, they will be filled and replanted as required.

Sampling (Ten Year Responsibility Period - Bond Release)

1. All sampling will be done in the late summer to insure maximum plant growth.

2. Estimates of ground cover and density of woody plant species will be made for the revegetated areas and the reference areas using methods described in Chapter VIII.

3. Sample adequacy for cover and woody species density will be sufficient to insure that the required statistical confidence is achieved.

4. Productivity measurements will involve double sampling methods (clipped plots and ocular estimates). Rectangular plots (6.27" X 100") will be randomly located in the revegetated and reference areas. Sampling adequacy will insure an 80 percent confidence level is achieved.

   Live woody plant stocking estimates will be conducted on revegetated sites and reference areas as outlined in UMC 817.117 (a) (1), (2,i,ii,iii), (3) and (4) (c) (1,i,ii,iii,iv,v).

5. Reference areas will be monitored to detect any changes resulting from man-induced activities. The area will be marked to insure proper management.

6. Revegetation Success:

   a. Reference areas and revegetation sites are inventoried at the end of the ten (10) year responsibility period according to methods used for initial inventory and/or approved by D.O.G.M.

b. Ground cover is established for two (2) consecutive years at the end of the responsibility period, at 70 percent of reference area ground cover, with 90 percent statistical confidence. The stocking of live woody plants on the revegetated sites is equal to or greater than 90 percent of the stocking of live woody plants, of the same life form, on the reference areas with 80 percent statistical confidence.

c. Productivity of the revegetated sites, for two (2) consecutive years at the end of the responsibility period, shall be considered successful if it is equivalent to 90 percent of the productivity of the reference areas with 90 percent statistical confidence.

7. Supplemental Shrub Stocking

If monitoring indicates adequate shrub density is not being achieved, supplemental shrub stocking will be initiated.

Containerized shrub species will be hand planted in the spring according to the following plan:

a. Species selection

Species will be selected from those listed on page 3-8.

Species selected will be those that have not established from seed.

b. Species grouping

Species will be intermixed to achieve three (3) layered clumps:

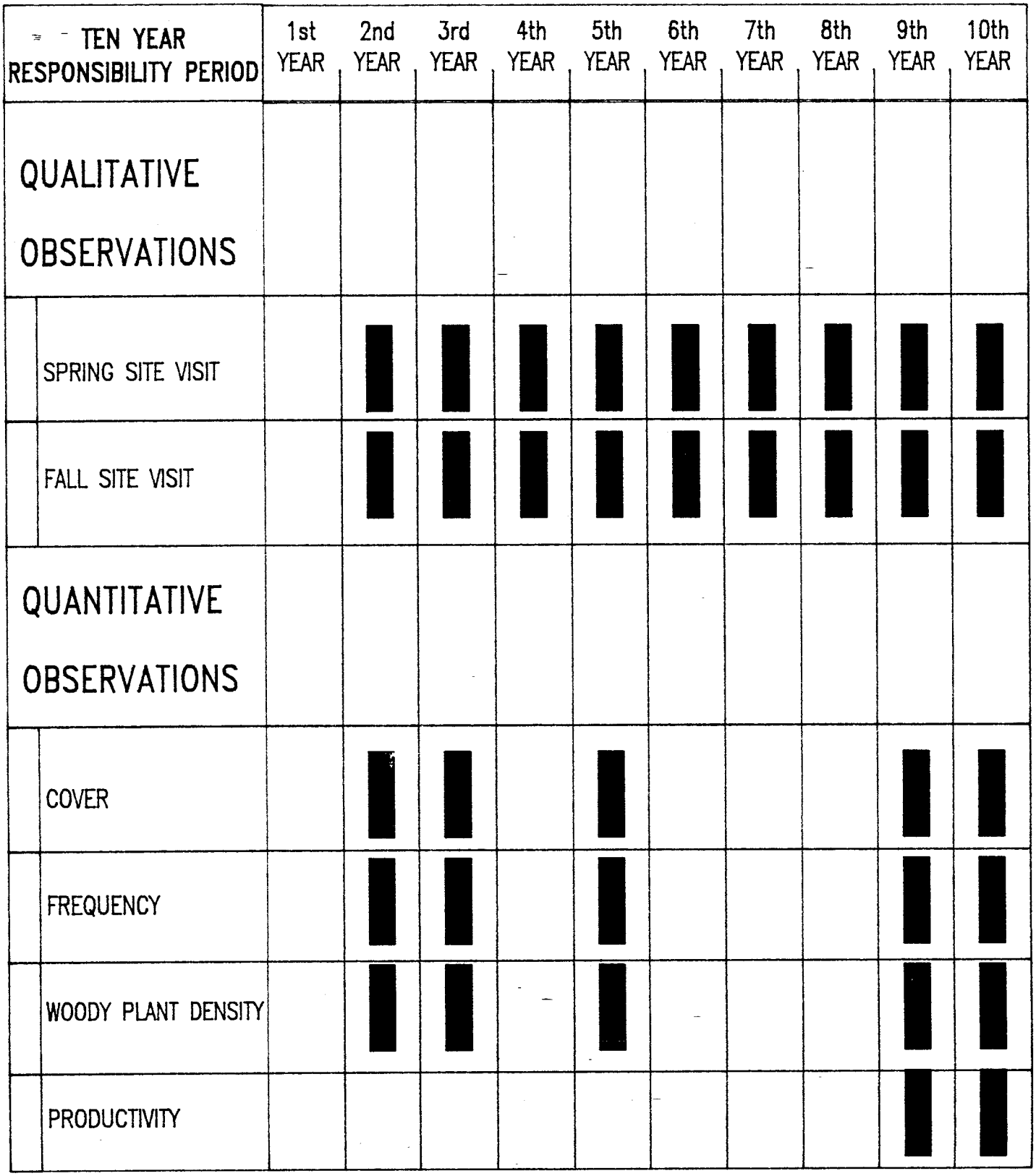
Low: (6"-12")	Atriplex cuneata A. confertifolia Artemisia nova
Medium: (12"-24")	Ceratoides lanata Eriogonum corymbosum Chrysothamnus viscidiflorus
High: (24"+)	Ephedra viridis Atriplex canescens

c. Clump size and spacing will be determined from the location of seed-established shrubs.

d. Fertilizing and Irrigation

A single 21 grain fertilizer tablet (20-10-5) will be placed adjacent to the plant at the root zone level. Each plant will be hand watered at the time of planting.

DEER CREEK MINE
WASTE ROCK STORAGE FACILITY
FINAL RECLAMATION MONITORING



Chapter IV ENGINEERING DESIGNS

Section I ACCESS ROAD

a. Description:

The access road has been located and designed and will be constructed, repaired, maintained and reclaimed according to the design criteria of the Division. Primary usage of the road will be by trucks hauling waste rock to the disposal site. Anticipated usage is 5 days per month.

b. Design & Specification:

1. Alignment:

The horizontal & vertical alignment shall be as shown on the plan and profile drawings. Average overall grade is 3%. Maximum pitch grade is 7.5% for 400 feet.

2. Road Section:

See Typical Road Cross section Exhibit I.

3. Construction:

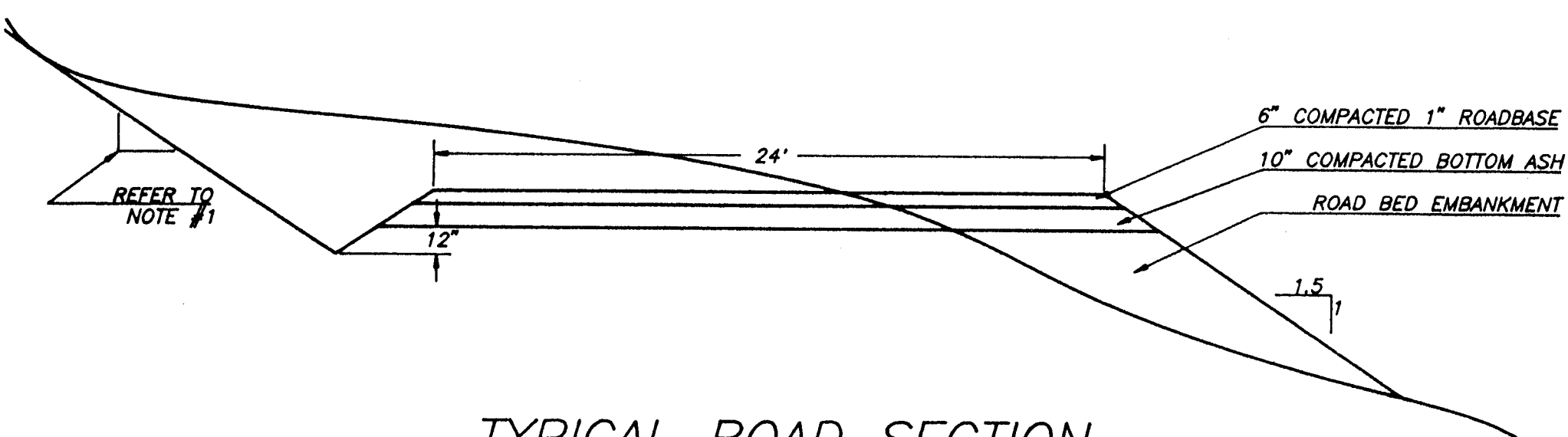
All foundations for embankments shall be free from organic material and topsoil. The top layer of the ground under lying the proposed roadway embankment will be moistened and scarified to a depth of 6" and then compacted to 90 percent of standard proctor according to AASHTO Designation T-99 Method D. Placement of the embankment material shall be in 12" maximum lifts. All rock will be worked into the fill to avoid forming voids.

The road subgrade will be made of 10" of bottom ash supplied from the Huntington Power Plant. This material will be watered and thoroughly mixed and compacted in one lift to 95% of standard as determined by AASHTO Designation T-99 Method D. An analysis of the bottom ash material is provided, see Exhibit II. Additional analyses will be performed according to the Analysis Plan found on page 7-5.

The untreated roadbase will consist of crushed stone meeting the gradation requirements listed in Exhibit III. The material will be thoroughly mixed with water to optimum moisture content. The material will then be placed and compacted in a single lift. This material will be compacted to 95 % of standard as determined by AASHTO Designation T-180 Method D. The finish grade will be smooth and uniform with surface deviations not exceeding 0.5 inch plus or minus in 10 feet.

c. Drawings - Maps

See drawings Cross Sections of Access Road # DS 1011 E, Map Packet 4-1 and Profile - Center Line of Access Road # DS 1012 E, Map Packet 4-2.



TYPICAL ROAD SECTION

NOTE:

1– CUT SLOPE 1 V TO 1.5 H IN UNCONSOLIDATED MATERIAL
CUT SLOPE 1 V TO 0.5 H IN ROCK MATERIAL.

EXHIBIT I

UP&L MINING DIVISION - FUEL QUALITY
HUNTINGTON PLANT ASH SAMPLES
Generalized Chemical Components

lement	<- *Concentration -> Avg	Std Dev
Aluminum (Al2O3)	18.4%	1.0%
Antimony	2.0	1.1
Arsenic (As203)	7.1	2.5
Barium		
Beryllium (BeO)	0.4	0.8
Bismuth	0.4	0.3
Bromine	2.8	0.8
Cadmium	1.3	0.8
Cerium	111.2	39.6
Cesium	4.8	1.0
Chromium	114.0	58.6
Cobalt	11.2	11.4
Copper	75.5	26.4
Dysprosium	5.2	1.8
Erbium	2.4	0.9
Europium	1.2	0.5
Gadolinium	3.9	1.0
Gallium	54.5	19.7
Germanium (GeO2)	3.2	0.9
Hafnium	4.8	3.5
Holmium	3.2	1.1
Iron (Fe2O3)	3.8%	0.8%
Lanthanum	101.7	38.4
.ead	48.2	64.6
Lithium		
Lutetium	0.4	0.3

Element	<- *Concentration -> Avg	Std Dev
Magnesium (MgO)	2.5%	0.6%
Manganese	77.5	37.9
Molybdenum	9.6	3.9
Neodymium	26.4	11.4
Nickel	49.6	24.9
Niobium	43.6	14.4
Phosphorus (P2O5	0.5%	0.2%
Potassium (K20)	1.1%	0.3%
Praseodymium	14.8	4.3
Rubidium	46.9	24.9
Samarium	9.7	2.9
Scandium (ScO)	33.8	15.9
Selenium	25.2	13.6
Strontium		
Terbium	0.8	0.2
Thallium	0.6	0.3
Thorium (ThO2)	31.5	22.9
Tin	3.3	1.3
Titanium (TiO2)	1.1%	0.3%
Tungsten	24.0	57.6
Uranium	15.9	6.5
Vanadium	195.7	87.7
Ytterbium	2.7	2.2
Yttrium	74.0	63.6
Zinc	115.3	49.1

*Concentrations listed in PPM unless otherwise noted

Minor components represent average of 13 separate spark source analyses

Exhibit II

UNTREATED ROAD BASE SPECIFICATION

1 INCH GRADATION

Sieve Size	Ideal Gradation (percent passing)	Ideal Gradation Tolerance
1 inch	100	0
1/2 inch	85	±6
No. 4	55	±6
NO. 16	31	±4
No. 200	9	±2

3/4 INCH GRADATION

Sieve Size	Ideal Gradation (percent passing)	Ideal Gradation Tolerance
3/4 inch	100	0
3/8 inch	85	±7
No. 4	61	±6
No. 16	33	±5
No. 200	9	±2

Note:

1. That portion of the material passing the No. 40 sieve shall be non-plastic when tested by AASHTO Designation T-90

2. The above gradation specifications are to be done by AASHTO Designation T-27

3. The aggregate shall be of uniform density and quality and shall have a rodded weight of not less than 75 pounds per cubic foot according to AASHTO Designation T-19

Exhibit III

Section II WASTE ROCK STORAGE FACILITY

a. Description

The material that will comprise the fill will be a combination of underground development waste, clean up material from the mine yard surface areas, trommel screen rejects (Boney) and sediments from the drainage system and sediment pond. The fill has been designed according to prudent engineering standards and the applicable regulations pertaining to "Disposal of Excess Spoil and Underground Development Waste." By definition the fill doesn't fall within the definition of any of the fill categories i.e. Valley Fill, Head of Hollow Fill, and Durable Rock Fill.

b. Location

The fill site is located in an area of moderately sloping terrain. Average slope of the area is 2%. The completed fill structure will fit well into the existing topography of the area, and will enhance the post mining land use.

c. Design

The quantity of material to be disposed of was estimated using past history of waste rock generation by the mining operation. The average quantity generated per year is 21,600 cubic yards. Annual coal production for this same time period was 1.86 million tons.

Average waste rock generation per ton of coal mined:
21,600 ÷ 1,860,000 = 0.012 cubic yards/ton of coal.

The fill structure is separated into two areas:
Area #1 will fill an area from station 9+50 to station 16+00. By volumetrics the storage capacity of this area is 460,000 cubic yards. Estimated time to fill area #1 is:

Estimated Annual Coal Production 2.6 million
Estimated Annual Waste Rock Generation
2,600,000 x 0.012 = 31,200 cubic yards
Estimated time to fill area
460,000 ÷ 31,200 = 15 years

Area #2 will occupy an area from station 9+50 to station 2+00. By end area the storage capacity of this area is 870,000 cubic yards.

Estimated time to fill area
870,000 ÷ 31,200 = 28 years

The fill when completed will form a gently sloping flat area of approximately 20 acres. The top of the fill will slope at .5% east to west. The fill sides slopes will be built on 1 v to 2 h. A slope stability analysis has been completed for the fill slopes. (Refer to Section VI Waste Material Pile - Slope Stability Analysis)

The drainage for the site has been designed according to the regulations. The undisturbed drainage will be diverted around the site by a ditch sized for 100 year 24 hour event. The disturbed drainage provides for total containment of 2 back to back 100 year storms. Runoff from the top area of the fill structure will not be allowed on the fill slopes.

The suitable soil material will be excavated from the site and used to form the soil berms that border the fill structure. (Refer to Map CM-10788-DR, Packet 7-2.) Upon completion of the fill these soil berms will be used to cover the waste rock for final reclamation.

The waste rock will be hauled to the site by truck and dumped. When sufficient quantities of material has accumulated the material will be spread and leveled. Each lift will be a maximum of 24" thickness. During the placing of the waste rock, extraneous materials, trash, etc. will be hand sorted and hauled away and disposed of in an approved sanitary land fill. As each lift is made the waste rock material will be thoroughly mixed to give a homogeneous mixture. The ratio of coal to rock (i.e. combustible to non-combustible material) will not exceed one to one. Any material determined to be acid or toxic forming will be placed in the fill with at least 4 feet of non-toxic and non-acid forming cover material.

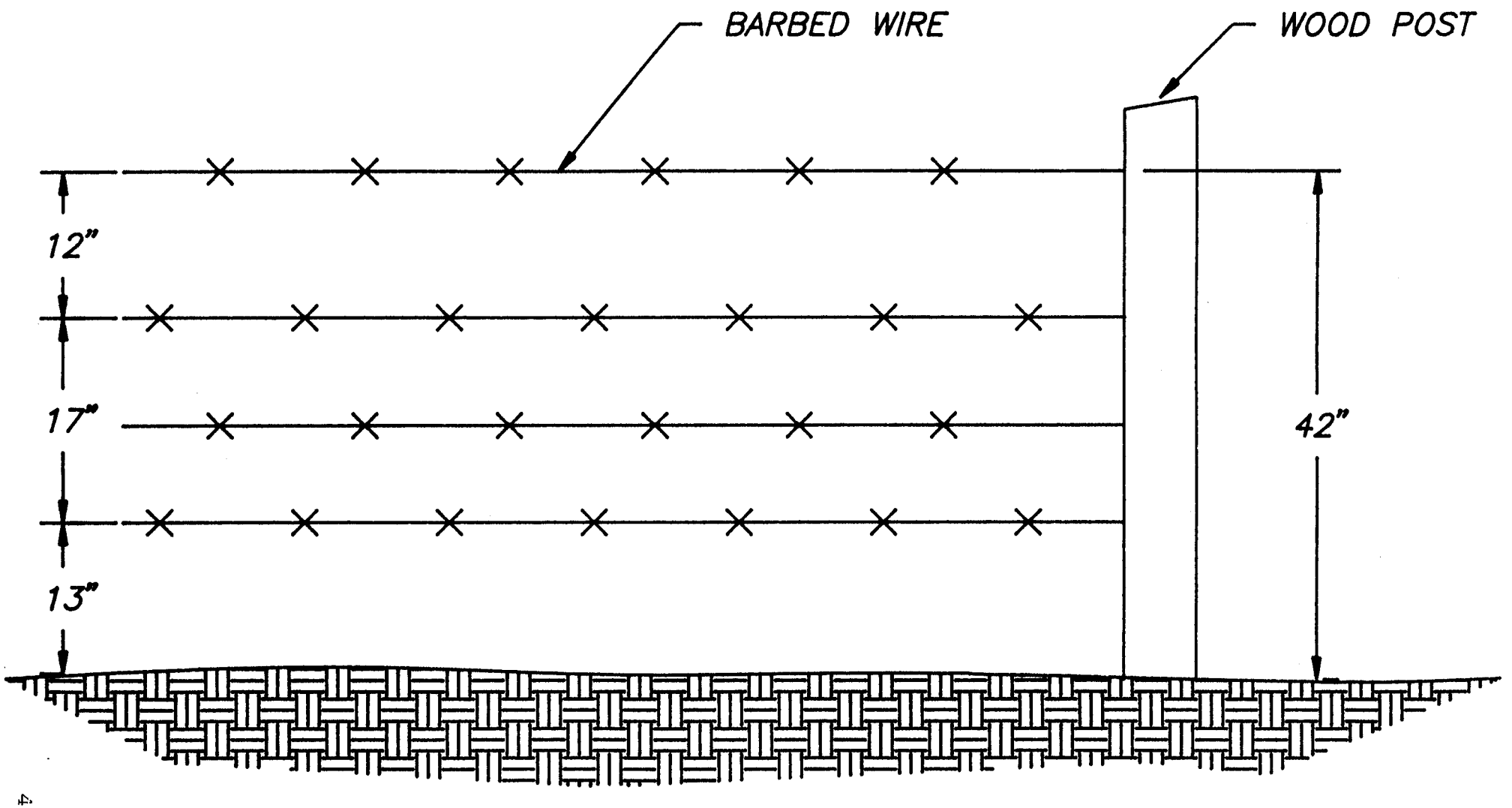
The entire area including the access road will be fenced. (Refer to Exhibit IV, page 4-7b for details on the fence construction)

As required by UMC 817.71 (i) the facility construction will be certified by a qualified registered professional engineer. A copy of this inspection will be provided to the division as required by this regulation.

d. Drawings - Maps

See drawings Cross Sections thru Facility # DS 984 E, Map Packet # 4-3 and Drainage Details # DS 1000 C, Map Packet # 4-4.

Also encluded is a Waste Rock Storage Facility - Schedule found in Map Packet # 4-11 showing the timing schedule for construction, operation and reclamation for Phases I, II & III and the final reclamation for Phase IV.



4-7b

WASTE ROCK STORAGE FACILITY FENCE DETAIL

EXHIBIT IV

Section III HYDROLOGICAL ANALYSIS

PURPOSE:

To evaluate the hydrological characteristics of the Deer Creek Mine waste rock storage facility and determine the design of ditches and culverts to properly handle the storm runoff, for both disturbed and undisturbed areas.

DESCRIPTION OF PROJECT:

The waste rock storage facility consists of 29.5 acres of distrubed land which are bordered by an earth berm and collection ditch. The berm retains the mine waste rock which is hauled in by truck and the ditch collects the undisturbed storm runoff which would normally flow through the storage site. The ditch conveys the water around the border of the site and discharges it into an existing man made channel in one case and into the natural drainage channel in another. (See drawing CM-10779 DR, Map Packet # 4-6) The access road is crossed in several cases by culverts which discharge into the natural drainage.

DESIGN PROCEDURE:

The waste rock storage facility was marked on a topographical map and separated into four drainage areas which would contribute runoff into the collection ditch at the perimeter of the site and a fifth area being the site itself. (See Exhibit A.) Peak runoff values were calculated by use of the "Storm Hydrograph Program" by Richard H. Hawkins and Kim A. Marshall, September 1979, Utah State University Foundation. (See Table 1 and Exhibits B thru F.)

TABLE 1

STORM RUNOFF VALUES FOR 100 YEAR, 24 HOUR EVENT
RAINFALL DEPTH: 3.4 INCHES
DISTRIBUTION: SOIL CONSERVATION SERVICE TYPE II

DRAINAGE #	AREA SQ.M.	DRAINAGE LENGTH FT	SLOPE	VELOCITY FPS	T.O.C. HRS	PEAK FLOW/CFS	TIME TO PEAK/HR
1	.0214	1482	.22	4.7	.0876	8.58	11.99
2	.0867	3360	.49	7.1	.1315	34.59	11.99
3	.0361	2223	.58	7.8	0.792	13.06	12.06
4	.0619	2866	.48	7.0	.1137	24.72	11.99
5	.0459	1400	.005	0.7	.5556	12.50	12.05

CURVE NUMBER FOR #1 THRU #4 = 85 (See Exhibit I)

CURVE NUMBER OF #5 = 77

UNDISTURBED DRAINAGE DITCH

The design of the collection ditch is based on Manning's equation for open channels. The design channel is a trapezoid shape with 1:3 side slopes and a varying bottom width. The value for Manning's N was calculated based on the size of the rocks in the channel lining. The riprap 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 (see Riprap Sizing Program, exhibit G). The ditch lining design requires a median rock diameter (D_{50}) of 3.5 inches in one case and up to 14 inches in another. As far as practical, the actual rock size will be graded to give a smooth distribution curve with the largest rock size (D_{100}) roughly equal to twice the D_{50} and the D_{20} equal to one half the D_{50}.

TABLE 2

UNDISTURBED DITCH AND CHANNEL LINING DESIGN VALUES

DITCH #	DRAINAGE AREAS CONTRIBUTING	PEAK FLOW CFS	CHANNEL SLOPE	BOTTOM WIDTH FT.	VELOCITY FPS	FLOW DEPTH FT.	D50 FT.	S.F. DITCH BOTTOM	S.F. BANKS
1	1	8.58	2%	2	3.56	0.618	.296	1.80	1.50
2	2	34.59	2%	3	4.72	1.14	.547	1.80	1.50
3	2 AND 3	47.65	2%	4	5.03	1.23	.590	1.80	1.50
4	2, 3, AND 4	72.37	4%	5	6.59	1.25	1.17	1.69	1.50

The area of the discharge from ditch 4 into the existing channel will be protected from erosion by a rock apron consisting of the same size and distribution of rocks as the channel lining used on the ditch itself. The apron will be fan shaped with the wide end 12 feet wide and will extend 15 feet from the end of the ditch.

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.

DISTURBED RUNOFF COLLECTION

The runoff which collects within the storage site will be confined within the perimeter berm and collected into one of two detention basins. This water will be retained and allowed to dissipate through evaporation. The total volume of the runoff to be collected was taken from the hydrograph analysis for Area 5, Exhibit F. The total runoff depth for the 100 year, 24 hour storm event was determined to be 1.357 inches over the 29.5 acre facility. Storage capacity of each basin is planned to allow for two 100 year storms plus sediment equal to 0.1 acre foot for each acre drained.

The operating plan for the storage site involves dividing the site into two sections and using only one section at a time. This limits the amount of area disturbed at any one time. Phase I will encompass the western end of the site to station 9+50. During Phase I, all runoff will be drained to the basin on the west end of the site. When the area of Phase I is filled, the soil in the berm will be used to cover the waste rock material and the area will be reclaimed. Runoff from the top of the reclaimed Phase I area will still run westward to the basin and runoff from the slopes will be conveyed in ditches to the basin until final approval to remove the basin. Thereafter drainage from Phase I areas will be directed into the existing drainage channels south of the site.

During Phase II of the operating plan, runoff will be collected in a detention basin located along the south berm at station 7+80. Runoff during Phase II will be handled as previously described for Phase I. Basin design values and volumes are listed in Table 3.

TABLE 3

	AREA	100 YR STORM RUNOFF VOLUME	SEDIMENT VOLUME	TOTAL REQUIRED VOLUME
PHASE I	9.8 ACRES	1.1 AC FT	.98 AC FT	3.18 AC FT
PHASE II	19.4 ACRES	2.2 AC FT	1.94 AC FT	6.34 AC FT

RUNOFF VOLUME = 1.357" X AREA

TOTAL REQUIRED VOLUME = 2 X 100 YEAR STORM RUNOFF + SEDIMENT VOLUME

Each of the detention basins will have an emergency spillway capable of discharging the runoff anticipated from a 100 year, 24 storm event. Because of the extra storage capacity built into the basins to ensure total containment, no principal spillway is provided. The emergency spillway will consist of an open channel with grouted bottom and sides to prevent erosion. The spillway crest will be at the top of the water elevation shown on the accompanying drawings. The spillway flow rate was determined using the Soil Conservation Service National Engineering Handbook Section 4, Hydrology, Chapter 21. (Exhibit H) The spillways are designed as broad crested weirs, with flow depths slightly above one foot. The channel design parameters are listed below:

	Peak Flow	Channel Width	Flow Depth
Basin 1	10.77cfs	3 ft	1.18 ft
Basin 2	19.76cfs	6 ft	1.11 ft

Each of the spillway channels will have a minimum 1.5 foot depth to ensure the channel capacity will not be exceeded. An energy dissipation section will be constructed on the end of each channel to prevent erosion of the receiving channel streambanks. Details of each spillway are shown on drawings of each respective basin.

Ditches used to collect the disturbed runoff are designed as vee shaped, one foot deep, with 1:3 side slopes. These ditches will generally convey the runoff from the side slopes of the waste pile to the detention basin. The ditch between Phase I and II areas will carry the most runoff and only the design of this ditch is given, the others obviously meeting the capacity requirements.

The flow rate for the separation ditch is taken as a percentage of the peak flow for the entire site. The maximum area which could be drained by the separation ditch (the entire area of Phase II) is 19.4 acres. The peak flow is:

19.4 X 12.50 cfs / 29.4 acres = 8.25 cfs.

The depth of flow for a 2% channel slope is 0.61 feet, which leaves more than adequate freeboard. (See Exhibit J and Ditch Design Program, Exhibit G.)

ACCESS ROAD DRAINAGE

Culverts will be used to convey the anticipated storm runoff across the access road. The ditch on the east end of the storage site discharges into the natural channel which crosses the access road. An 18 inch diameter culvert will be installed with a rock head wall on the inlet end and discharge into the natural channel. Three additional culverts will be located along the access road between the storage site and the highway. The culverts will also be 18 inch diameter and will have a rock head wall and discharge into a natural channel or a rock apron if no natural channel exists. The culverts will be spaced not more than 600 feet apart along the road which has a 3.8% grade. The 18 inch culverts will handle a flow of 5.5 cfs without exceeding a headwater depth equal to the diameter of the pipe. The sizing of the culverts is based on Area 1 at the beginning of this section. The 100 year storm event, with total precipitation of 3.4 inches, yielded a design flow of 8.58 cfs. The 10 year storm event is the basis of the design of the culverts and has a total precipitation of 2.2 inches (NOAA ATLAS 2, Volume VI Utah, Figure 27). From the SCS NEH 4, Hydrology, Fig 10.1 the direct runoff from the 100 year event, P=3.4 inches and CN = 85, is 1.9 inches, and the runoff from the 10 year event, P=2.2 inches and CN=85, is 0.95 inches. Therefore the flow rate for the culvert can be estimated as 8.58 cfs x (0.95/1.9) = 4.29 cfs. This is well below the capacity at the 18 inch culvert.

Rock aprons used on the discharge end of the 18 inch diameter culverts are designed according to Applied Hydrology, page 538. Using the design flow of 4.29 cfs and a tailwater depth less than one half the diameter, the length of the apron is 8 feet and the D_{50} is three inches. The width of the apron is 9.5 feet.

FINAL RECLAMATION CHANNEL LINING DESIGN

For final reclamation, when the two sediment basins will be removed, the excess rainfall from the top of the waste pile will be conveyed down the slope in a trapezoidal channel lined with rip - rap. These channels and the required linings are designed for a 100 year, 24 hour storm event. The "Storm Hydrograph Program" was used to determine the peak flows for the three channels as shown on Map 4-8. The following table lists the outcome of the analysis. The total rainfall for the 100 year event is 3.4 inches. The curve number used in this analysis is 86 for range land in poor condition with soil Group C. The slope of the top of the waste pile is 0.5% and the velocity of the runoff in 0.7 feet per second. (See Exhibits K,L and M)

TABLE 4

Drainage Area #	Area $Miles^2$	Drainage Length, ft	T.O.C. Hrs	Peak Flow cfs	Time to Peak hrs
1	0.0086	775	0.307	3.47	11.99
2A	0.0166	1260	0.500	6.53	12.00
2B	0.0021	390	0.155	0.86	11.98

The design at the channel lining is based on two slopes for each channel, i.e. 50% coming off the top of the waste pile and 10% from the toe of the pile to the end of the channel. The Rip-Rap Sizing Program was again used to determine the proper size of material to ensure that the safety factor is greater than one. (See Exhibits N,O and P)

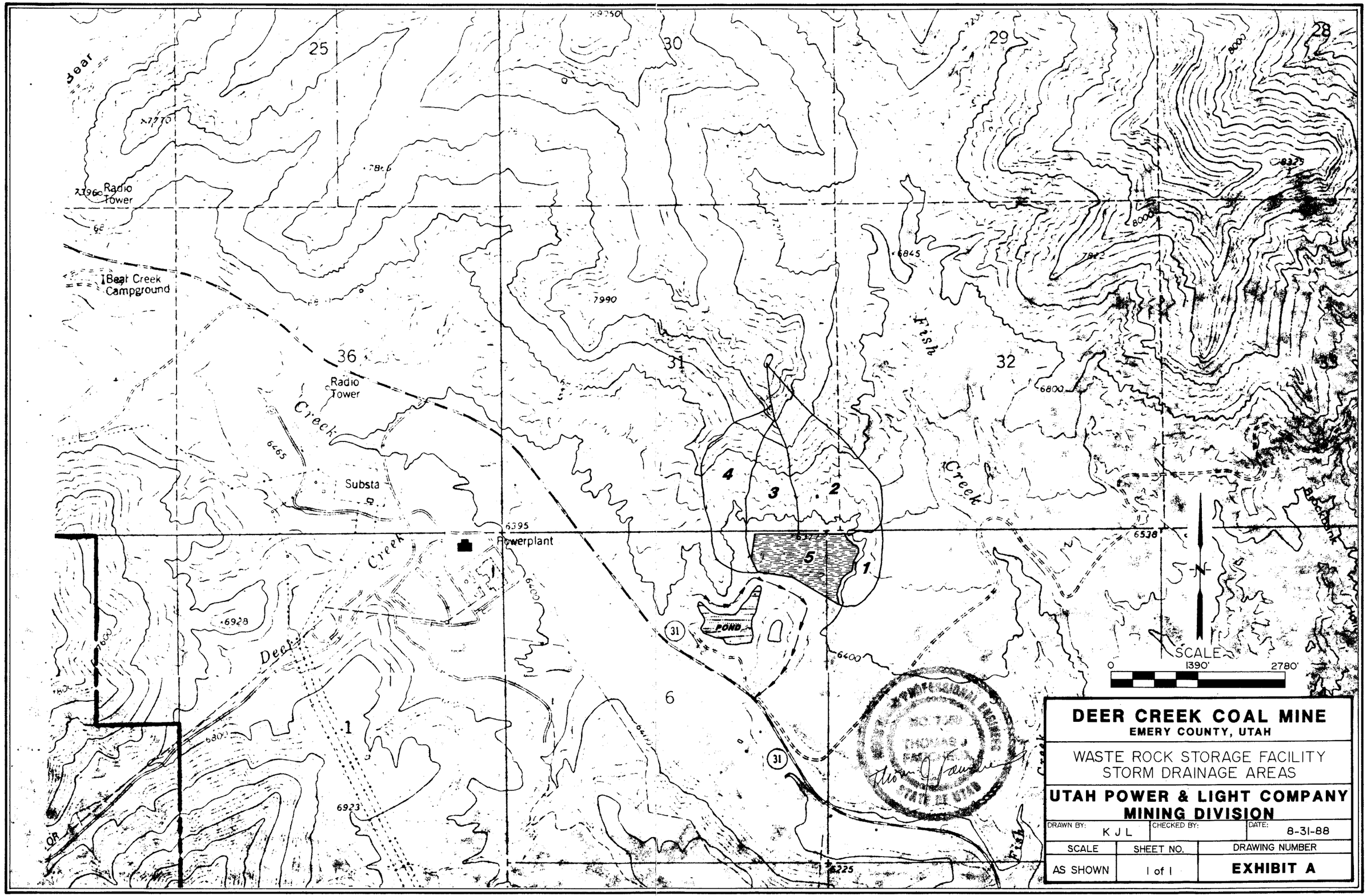
TABLE 5

Channel	Slope	Flow,cfs	Bottom Width, ft	Side Slope	Velocity fps	Depth ft	D50 ft
1	50%	3.47	8	.5	4.84	.088	1.5
	10%	3.47	8	.5	3.55	.119	0.25
2A	50%	6.53	10	.5	5.54	.115	1.97
	10%	6.53	10	.5	4.06	.156	0.33
2B	50%	0.86	4	.5	3.78	.055	1.02
	10%	0.86	4	.5	2.79	.074	0.16

The culverts along the access road will be replaced with lined channels for final reclamation. The design of these channels is conservatively based on the runoff for Area 1, Table 1, Page 4-9. The most severe slope of the four channels is 20%. The following Table gives the design parameters and dimensions for two typical channel slopes for a trapezoidal ditch with 3 to 1 side slopes.

TABLE 6

Slope	Bottom Width, ft	Flow cfs	Velocity fps	Depth ft	D50 ft
20%	6'	8.58	5.98	.216	.73
10%	6'	8.58	5.09	.250	.41



DEER CREEK COAL MINE
EMERY COUNTY, UTAH

WASTE ROCK STORAGE FACILITY
STORM DRAINAGE AREAS

UTAH POWER & LIGHT COMPANY
MINING DIVISION

DRAWN BY:	CHECKED BY:	DATE:
K J L		8-31-88

SCALE	SHEET NO.	DRAWING NUMBER
AS SHOWN	1 of 1	**EXHIBIT A**

TABLE 1

STORM RUNOFF DETERMINATION
FOR
DEER CREEK WASTE ROCK SITE #1

INPUT SUMMARY:

DISTRIBUTION = SCS TYPE II	RUNOFF AREA = .0214 SQ. MILES
RAINFALL DEPTH = 3.4 INCHES	RUNOFF CURVE NO. = 85
STORM DURATION = 24 HOURS	TIME OF CONCENTRATION = .0876 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
0.01	0.00	0.0000	0.0000	0.0000	0.00
0.02	0.00	0.0000	0.0000	0.0000	0.00
0.04	0.00	0.0000	0.0000	0.0000	0.00
0.05	0.00	0.0000	0.0000	0.0000	0.00
0.06	0.00	0.0000	0.0000	0.0000	0.00
0.07	0.00	0.0000	0.0000	0.0000	0.00
0.08	0.00	0.0000	0.0000	0.0000	0.00
0.09	0.00	0.0000	0.0000	0.0000	0.00
0.11	0.00	0.0000	0.0000	0.0000	0.00
0.12	0.00	0.0000	0.0000	0.0000	0.00
0.13	0.00	0.0000	0.0000	0.0000	0.00
0.14	0.00	0.0000	0.0000	0.0000	0.00
0.15	0.01	0.0000	0.0000	0.0000	0.00
0.16	0.01	0.0000	0.0000	0.0000	0.00
0.18	0.01	0.0000	0.0000	0.0000	0.00
0.19	0.01	0.0000	0.0000	0.0000	0.00
0.20	0.01	0.0000	0.0000	0.0000	0.00
0.21	0.01	0.0000	0.0000	0.0000	0.00
0.22	0.01	0.0000	0.0000	0.0000	0.00
0.23	0.01	0.0000	0.0000	0.0000	0.00
0.25	0.01	0.0000	0.0000	0.0000	0.00
0.26	0.01	0.0000	0.0000	0.0000	0.00
0.27	0.01	0.0000	0.0000	0.0000	0.00
0.28	0.01	0.0000	0.0000	0.0000	0.00
0.29	0.01	0.0000	0.0000	0.0000	0.00
0.30	0.01	0.0000	0.0000	0.0000	0.00
0.32	0.01	0.0000	0.0000	0.0000	0.00
0.32	0.01	0.0000	0.0000	0.0000	0.00
0.34	0.01	0.0000	0.0000	0.0000	0.00
0.35	0.01	0.0000	0.0000	0.0000	0.00
0.36	0.01	0.0000	0.0000	0.0000	0.00
0.37	0.01	0.0000	0.0000	0.0000	0.00
0.39	0.01	0.0000	0.0000	0.0000	0.00

11.54	1.87	0.7002	0.0068	0.5730	7.91
11.55	1.88	0.7070	0.0068	0.5744	7.93
11.56	1.89	0.7137	0.0068	0.5759	7.95
11.57	1.90	0.7206	0.0068	0.5773	7.97
11.59	1.91	0.7274	0.0068	0.5787	7.99
11.60	1.92	0.7342	0.0069	0.5801	8.01
11.61	1.93	0.7411	0.0069	0.5815	8.03
11.62	1.94	0.7480	0.0069	0.5828	8.05
11.63	1.94	0.7549	0.0069	0.5842	8.07
11.64	1.95	0.7618	0.0069	0.5855	8.09
11.66	1.96	0.7687	0.0069	0.5868	8.10
11.67	1.97	0.7756	0.0069	0.5882	8.12
11.68	1.98	0.7826	0.0070	0.5895	8.14
11.69	1.99	0.7895	0.0070	0.5908	8.16
11.70	2.00	0.7965	0.0070	0.5921	8.18
11.71	2.01	0.8035	0.0070	0.5933	8.19
11.73	2.02	0.8105	0.0070	0.5946	8.21
11.74	2.03	0.8175	0.0070	0.5958	8.23
11.75	2.04	0.8245	0.0070	0.5971	8.25
11.76	2.05	0.8316	0.0071	0.5983	8.26
11.77	2.06	0.8387	0.0071	0.5995	8.28
11.79	2.07	0.8457	0.0071	0.6008	8.30
11.80	2.08	0.8528	0.0071	0.6020	8.31
11.81	2.09	0.8599	0.0071	0.6032	8.33
11.82	2.10	0.8670	0.0071	0.6043	8.35
11.83	2.11	0.8742	0.0071	0.6055	8.36
11.84	2.12	0.8813	0.0072	0.6067	8.38
11.86	2.13	0.8884	0.0072	0.6078	8.39
11.87	2.14	0.8956	0.0072	0.6090	8.41
11.88	2.14	0.9028	0.0072	0.6101	8.43
11.89	2.15	0.9100	0.0072	0.6112	8.44
11.90	2.16	0.9172	0.0072	0.6123	8.46
11.91	2.17	0.9244	0.0072	0.6134	8.47
11.93	2.18	0.9316	0.0072	0.6145	8.49
11.94	2.19	0.9389	0.0073	0.6156	8.50
11.95	2.20	0.9461	0.0073	0.6167	8.52
11.96	2.21	0.9534	0.0073	0.6178	8.53
11.97	2.22	0.9607	0.0073	0.6188	8.55
11.98	2.23	0.9679	0.0073	0.6199	8.56
12.00	2.24	0.9752	0.0044	0.6209	8.58
12.01	2.25	0.9797	0.0024	0.6145	8.49
12.02	2.25	0.9821	0.0024	0.5956	8.22
12.03	2.25	0.9845	0.0024	0.5640	7.79
12.04	2.26	0.9870	0.0024	0.5199	7.18
12.05	2.26	0.9894	0.0024	0.4631	6.40
12.07	2.26	0.9919	0.0024	0.4056	5.60
12.08	2.26	0.9943	0.0024	0.3554	4.91
12.09	2.27	0.9968	0.0024	0.3127	4.32
12.10	2.27	0.9992	0.0024	0.2774	3.83
12.11	2.27	1.0016	0.0024	0.2496	3.45
12.12	2.28	1.0041	0.0025	0.2292	3.16
12.14	2.28	1.0065	0.0025	0.2162	2.99
12.15	2.28	1.0090	0.0025	0.2108	2.91

23.92	3.40	1.9272	0.0003	0.0295	0.41
23.93	3.40	1.9276	0.0003	0.0295	0.41
23.94	3.40	1.9279	0.0003	0.0295	0.41
23.96	3.40	1.9283	0.0003	0.0295	0.41
23.97	3.40	1.9286	0.0003	0.0295	0.41
23.98	3.40	1.9289	0.0003	0.0295	0.41
23.99	3.40	1.9293	0.0003	0.0295	0.41
24.00	3.40	1.9296	0.0000	0.0293	0.40
24.01	3.40	1.9296	0.0000	0.0282	0.39
24.03	3.40	1.9296	0.0000	0.0262	0.36
24.04	3.40	1.9296	0.0000	0.0234	0.32
24.05	3.40	1.9296	0.0000	0.0197	0.27
24.06	3.40	1.9296	0.0000	0.0154	0.21
24.07	3.40	1.9296	0.0000	0.0116	0.16
24.08	3.40	1.9296	0.0000	0.0084	0.12
24.10	3.40	1.9296	0.0000	0.0057	0.08
24.11	3.40	1.9296	0.0000	0.0035	0.05
24.12	3.40	1.9296	0.0000	0.0018	0.03
24.13	3.40	1.9296	0.0000	0.0007	0.01
24.14	3.40	1.9296	0.0000	0.0001	0.00
24.15	3.40	1.9296	0.0000	0.0000	0.00
24.17	3.40	1.9296	0.0000	0.0000	0.00
24.18	0.00	0.0000	0.0000	0.0000	0.00

OUTPUT SUMMARY:

TOTAL RUNOFF DEPTH = 1.93 IN. TIME TO PEAK = 11.991 HOURS
INITIAL ABSTRACTION = .353 IN. RUNOFF VOLUME CHECK = 1.933 IN.
PEAK FLOW = 8.523999 CFS

TABLE 2

STORM RUNOFF DETERMINATION
FOR
DEER CREEK WASTE ROCK SITE #2

INPUT SUMMARY:

DISTRIBUTION = SCS TYPE II	RUNOFF AREA = .0867 SQ. MILES
RAINFALL DEPTH = 3.4 INCHES	RUNOFF CURVE NO. = 85
STORM DURATION = 24 HOURS	TIME OF CONCENTRATION = .1315 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
0.02	0.00	0.0000	0.0000	0.0000	0.00
0.04	0.00	0.0000	0.0000	0.0000	0.00
0.05	0.00	0.0000	0.0000	0.0000	0.00
0.07	0.00	0.0000	0.0000	0.0000	0.00
0.09	0.00	0.0000	0.0000	0.0000	0.00
0.11	0.00	0.0000	0.0000	0.0000	0.00
0.12	0.00	0.0000	0.0000	0.0000	0.00
0.14	0.00	0.0000	0.0000	0.0000	0.00
0.16	0.01	0.0000	0.0000	0.0000	0.00
0.18	0.01	0.0000	0.0000	0.0000	0.00
0.19	0.01	0.0000	0.0000	0.0000	0.00
0.21	0.01	0.0000	0.0000	0.0000	0.00
0.23	0.01	0.0000	0.0000	0.0000	0.00
0.25	0.01	0.0000	0.0000	0.0000	0.00
0.26	0.01	0.0000	0.0000	0.0000	0.00
0.28	0.01	0.0000	0.0000	0.0000	0.00
0.30	0.01	0.0000	0.0000	0.0000	0.00
0.32	0.01	0.0000	0.0000	0.0000	0.00
0.33	0.01	0.0000	0.0000	0.0000	0.00
0.35	0.01	0.0000	0.0000	0.0000	0.00
0.37	0.01	0.0000	0.0000	0.0000	0.00
0.39	0.01	0.0000	0.0000	0.0000	0.00
0.40	0.01	0.0000	0.0000	0.0000	0.00
0.42	0.01	0.0000	0.0000	0.0000	0.00
0.44	0.01	0.0000	0.0000	0.0000	0.00
0.46	0.02	0.0000	0.0000	0.0000	0.00
0.47	0.02	0.0000	0.0000	0.0000	0.00
0.49	0.02	0.0000	0.0000	0.0000	0.00
0.51	0.02	0.0000	0.0000	0.0000	0.00
0.53	0.02	0.0000	0.0000	0.0000	0.00
0.54	0.02	0.0000	0.0000	0.0000	0.00
0.56	0.02	0.0000	0.0000	0.0000	0.00
0.58	0.02	0.0000	0.0000	0.0000	0.00

11.75	2.04	0.8229	0.0106	0.5932	33.19
11.76	2.05	0.8335	0.0106	0.5951	33.30
11.78	2.07	0.8441	0.0106	0.5970	33.40
11.80	2.08	0.8548	0.0107	0.5988	33.51
11.82	2.10	0.8654	0.0107	0.6007	33.61
11.83	2.11	0.8761	0.0107	0.6025	33.71
11.85	2.12	0.8869	0.0108	0.6043	33.81
11.87	2.14	0.8976	0.0108	0.6060	33.91
11.89	2.15	0.9084	0.0108	0.6077	34.00
11.91	2.17	0.9192	0.0108	0.6095	34.10
11.92	2.18	0.9301	0.0109	0.6112	34.19
11.94	2.20	0.9409	0.0109	0.6128	34.29
11.96	2.21	0.9518	0.0109	0.6145	34.38
11.98	2.22	0.9627	0.0109	0.6161	34.47
11.99	2.24	0.9737	0.0067	0.6177	34.56
12.01	2.25	0.9804	0.0037	0.6119	34.24
12.03	2.25	0.9840	0.0037	0.5936	33.21
12.05	2.26	0.9877	0.0037	0.5626	31.48
12.06	2.26	0.9914	0.0037	0.5190	29.04
12.08	2.27	0.9950	0.0037	0.4627	25.89
12.10	2.27	0.9987	0.0037	0.4054	22.68
12.12	2.28	1.0024	0.0037	0.3555	19.89
12.13	2.28	1.0060	0.0037	0.3129	17.51
12.15	2.28	1.0097	0.0037	0.2777	15.54
12.17	2.29	1.0134	0.0037	0.2499	13.98
12.19	2.29	1.0171	0.0037	0.2295	12.84
12.20	2.30	1.0208	0.0037	0.2166	12.12
12.22	2.30	1.0245	0.0037	0.2112	11.82
12.24	2.31	1.0282	0.0037	0.2103	11.77
12.26	2.31	1.0319	0.0037	0.2105	11.78
12.27	2.32	1.0356	0.0037	0.2107	11.79
12.29	2.32	1.0393	0.0037	0.2108	11.80
12.31	2.33	1.0430	0.0037	0.2110	11.80
12.33	2.33	1.0467	0.0037	0.2111	11.81
12.34	2.34	1.0504	0.0037	0.2113	11.82
12.36	2.34	1.0541	0.0037	0.2115	11.83
12.38	2.35	1.0578	0.0037	0.2116	11.84
12.40	2.35	1.0616	0.0037	0.2118	11.85
12.41	2.36	1.0653	0.0037	0.2119	11.86
12.43	2.36	1.0690	0.0037	0.2121	11.87
12.45	2.37	1.0727	0.0037	0.2122	11.87
12.47	2.37	1.0765	0.0037	0.2124	11.88
12.48	2.38	1.0802	0.0037	0.2125	11.89
12.50	2.38	1.0839	0.0037	0.2127	11.90
12.52	2.39	1.0877	0.0037	0.2128	11.91
12.54	2.39	1.0914	0.0037	0.2130	11.92
12.55	2.39	1.0951	0.0037	0.2131	11.92
12.57	2.40	1.0989	0.0037	0.2133	11.93
12.59	2.40	1.1026	0.0038	0.2134	11.94
12.61	2.41	1.1064	0.0038	0.2136	11.95
12.62	2.41	1.1101	0.0038	0.2137	11.96
12.64	2.42	1.1139	0.0038	0.2139	11.97
12.66	2.42	1.1177	0.0038	0.2140	11.97

23.83	3.39	1.9245	0.0005	0.0295	1.65
23.85	3.39	1.9250	0.0005	0.0295	1.65
23.86	3.40	1.9255	0.0005	0.0295	1.65
23.88	3.40	1.9260	0.0005	0.0295	1.65
23.90	3.40	1.9266	0.0005	0.0295	1.65
23.92	3.40	1.9271	0.0005	0.0295	1.65
23.93	3.40	1.9276	0.0005	0.0295	1.65
23.95	3.40	1.9281	0.0005	0.0295	1.65
23.97	3.40	1.9286	0.0005	0.0295	1.65
23.99	3.40	1.9291	0.0004	0.0295	1.65
24.00	3.40	1.9296	0.0000	0.0293	1.64
24.02	3.40	1.9296	0.0000	0.0282	1.58
24.04	3.40	1.9296	0.0000	0.0263	1.47
24.06	3.40	1.9296	0.0000	0.0235	1.31
24.07	3.40	1.9296	0.0000	0.0198	1.11
24.09	3.40	1.9296	0.0000	0.0153	0.87
24.11	3.40	1.9296	0.0000	0.0117	0.65
24.13	3.40	1.9296	0.0000	0.0084	0.47
24.14	3.40	1.9296	0.0000	0.0057	0.32
24.16	3.40	1.9296	0.0000	0.0035	0.20
24.18	3.40	1.9296	0.0000	0.0019	0.10
24.20	3.40	1.9296	0.0000	0.0007	0.04
24.21	3.40	1.9296	0.0000	0.0001	0.01
24.23	3.40	1.9296	0.0000	0.0000	0.00
24.25	3.40	1.9296	0.0000	0.0000	0.00
24.27	0.00	0.0000	0.0000	0.0000	0.00

OUTPUT SUMMARY:

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TOTAL RUNOFF DEPTH = 1.93 IN. TIME TO PEAK = 11.988 HOURS
INITIAL ABSTRACTION = .353 IN. RUNOFF VOLUME CHECK = 1.933 IN.
PEAK FLOW = 34.593 CFS

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TABLE 3

STORM RUNOFF DETERMINATION
FOR
DEER CREEK WASTE ROCK SITE #3

INPUT SUMMARY:

DISTRIBUTION = SCS TYPE II	RUNOFF AREA = .0361 SQ. MILES
RAINFALL DEPTH = 3.4 INCHES	RUNOFF CURVE NO. = 85
STORM DURATION = 24 HOURS	TIME OF CONCENTRATION = .792 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
0.11	0.00	0.0000	0.0000	0.0000	0.00
0.21	0.01	0.0000	0.0000	0.0000	0.00
0.32	0.01	0.0000	0.0000	0.0000	0.00
0.42	0.01	0.0000	0.0000	0.0000	0.00
0.53	0.02	0.0000	0.0000	0.0000	0.00
0.63	0.02	0.0000	0.0000	0.0000	0.00
0.74	0.03	0.0000	0.0000	0.0000	0.00
0.84	0.03	0.0000	0.0000	0.0000	0.00
0.95	0.03	0.0000	0.0000	0.0000	0.00
1.06	0.04	0.0000	0.0000	0.0000	0.00
1.16	0.04	0.0000	0.0000	0.0000	0.00
1.27	0.04	0.0000	0.0000	0.0000	0.00
1.37	0.05	0.0000	0.0000	0.0000	0.00
1.48	0.05	0.0000	0.0000	0.0000	0.00
1.58	0.05	0.0000	0.0000	0.0000	0.00
1.69	0.06	0.0000	0.0000	0.0000	0.00
1.80	0.06	0.0000	0.0000	0.0000	0.00
1.90	0.06	0.0000	0.0000	0.0000	0.00
2.01	0.07	0.0000	0.0000	0.0000	0.00
2.11	0.07	0.0000	0.0000	0.0000	0.00
2.22	0.08	0.0000	0.0000	0.0000	0.00
2.32	0.08	0.0000	0.0000	0.0000	0.00
2.43	0.09	0.0000	0.0000	0.0000	0.00
2.53	0.10	0.0000	0.0000	0.0000	0.00
2.64	0.10	0.0000	0.0000	0.0000	0.00
2.75	0.11	0.0000	0.0000	0.0000	0.00
2.85	0.11	0.0000	0.0000	0.0000	0.00
2.96	0.12	0.0000	0.0000	0.0000	0.00
3.06	0.12	0.0000	0.0000	0.0000	0.00
3.17	0.13	0.0000	0.0000	0.0000	0.00
3.27	0.13	0.0000	0.0000	0.0000	0.00
3.38	0.14	0.0000	0.0000	0.0000	0.00
3.48	0.14	0.0000	0.0000	0.0000	0.00

9.19	0.53	0.0160	0.0019	0.0121	0.28
9.29	0.54	0.0179	0.0020	0.0131	0.31
9.40	0.55	0.0199	0.0021	0.0141	0.33
9.50	0.56	0.0220	0.0022	0.0151	0.35
9.61	0.57	0.0242	0.0023	0.0161	0.38
9.72	0.58	0.0265	0.0024	0.0171	0.40
9.82	0.59	0.0289	0.0025	0.0180	0.42
9.93	0.60	0.0314	0.0083	0.0189	0.44
10.03	0.64	0.0397	0.0249	0.0215	0.50
10.14	0.72	0.0645	0.0296	0.0303	0.71
10.24	0.81	0.0942	0.0339	0.0468	1.09
10.35	0.90	0.1280	0.0376	0.0720	1.68
10.45	0.98	0.1656	0.0410	0.1071	2.50
10.56	1.07	0.2066	0.0440	0.1504	3.50
10.67	1.16	0.2507	0.0468	0.1953	4.55
10.77	1.24	0.2974	0.0492	0.2402	5.60
10.88	1.33	0.3467	0.0515	0.2842	6.62
10.98	1.41	0.3982	0.0536	0.3260	7.59
11.09	1.50	0.4517	0.0554	0.3648	8.50
11.19	1.59	0.5072	0.0571	0.3997	9.31
11.30	1.67	0.5643	0.0587	0.4300	10.02
11.40	1.76	0.6230	0.0602	0.4557	10.62
11.51	1.84	0.6832	0.0615	0.4784	11.15
11.62	1.93	0.7447	0.0628	0.4990	11.63
11.72	2.02	0.8075	0.0639	0.5178	12.06
11.83	2.10	0.8714	0.0650	0.5349	12.46
11.93	2.19	0.9363	0.0499	0.5506	12.83
12.04	2.25	0.9862	0.0221	0.5605	13.06
12.14	2.28	1.0084	0.0222	0.5565	12.96
12.25	2.31	1.0306	0.0223	0.5385	12.55
12.36	2.34	1.0529	0.0224	0.5065	11.80
12.46	2.37	1.0753	0.0225	0.4604	10.72
12.57	2.40	1.0978	0.0226	0.4072	9.49
12.67	2.43	1.1204	0.0227	0.3602	8.39
12.78	2.45	1.1431	0.0228	0.3192	7.44
12.88	2.48	1.1659	0.0229	0.2850	6.64
12.99	2.51	1.1888	0.0230	0.2574	6.00
13.09	2.54	1.2118	0.0230	0.2367	5.51
13.20	2.57	1.2348	0.0231	0.2231	5.20
13.31	2.60	1.2579	0.0232	0.2168	5.05
13.41	2.63	1.2811	0.0233	0.2160	5.03
13.52	2.66	1.3044	0.0234	0.2169	5.05
13.62	2.69	1.3278	0.0234	0.2177	5.07
13.73	2.71	1.3512	0.0235	0.2185	5.09
13.83	2.74	1.3747	0.0236	0.2193	5.11
13.94	2.77	1.3983	0.0174	0.2200	5.13
14.04	2.79	1.4156	0.0089	0.2190	5.10
14.15	2.80	1.4245	0.0089	0.2137	4.98
14.26	2.81	1.4334	0.0089	0.2042	4.76
14.36	2.82	1.4423	0.0089	0.1904	4.44
14.47	2.84	1.4512	0.0089	0.1723	4.01
14.57	2.85	1.4601	0.0089	0.1528	3.56
14.68	2.86	1.4690	0.0089	0.1358	3.16

23.34	3.38	1.9101	0.0031	0.0294	0.69
23.44	3.38	1.9132	0.0031	0.0294	0.69
23.55	3.38	1.9162	0.0031	0.0294	0.69
23.65	3.39	1.9194	0.0031	0.0294	0.69
23.76	3.39	1.9225	0.0031	0.0294	0.69
23.87	3.40	1.9256	0.0031	0.0294	0.69
23.97	3.40	1.9287	0.0008	0.0294	0.69
24.08	3.40	1.9296	0.0000	0.0288	0.67
24.18	3.40	1.9296	0.0000	0.0273	0.64
24.29	3.40	1.9296	0.0000	0.0249	0.58
24.39	3.40	1.9296	0.0000	0.0216	0.50
24.50	3.40	1.9296	0.0000	0.0174	0.41
24.60	3.40	1.9296	0.0000	0.0134	0.31
24.71	3.40	1.9296	0.0000	0.0099	0.23
24.82	3.40	1.9296	0.0000	0.0067	0.16
24.92	3.40	1.9296	0.0000	0.0045	0.11
25.03	3.40	1.9296	0.0000	0.0026	0.06
25.13	3.40	1.9296	0.0000	0.0012	0.03
25.24	3.40	1.9296	0.0000	0.0004	0.01
25.34	3.40	1.9296	0.0000	0.0000	0.00
25.45	3.40	1.9296	0.0000	0.0000	0.00
25.56	3.40	1.9296	0.0000	0.0000	0.00
25.66	0.00	0.0000	0.0000	0.0000	0.00

OUTPUT SUMMARY:

TOTAL RUNOFF DEPTH = 1.93 IN. TIME TO PEAK = 12.061 HOURS
INITIAL ABSTRACTION = .252 IN. RUNOFF VOLUME CHECK = 1.933 IN.
PEAK FLOW = 13.065 CFS

TABLE 4

STORM RUNOFF DETERMINATION
FOR
DEER CREEK WASTE ROCK SITE #4

INPUT SUMMARY:

DISTRIBUTION = SCS TYPE II	RUNOFF AREA = .0619 SQ. MILES
RAINFALL DEPTH = 3.4 INCHES	RUNOFF CURVE NO. = 85
STORM DURATION = 24 HOURS	TIME OF CONCENTRATION = .1137 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
0.02	0.00	0.0000	0.0000	0.0000	0.00
0.03	0.00	0.0000	0.0000	0.0000	0.00
0.05	0.00	0.0000	0.0000	0.0000	0.00
0.06	0.00	0.0000	0.0000	0.0000	0.00
0.08	0.00	0.0000	0.0000	0.0000	0.00
0.09	0.00	0.0000	0.0000	0.0000	0.00
0.11	0.00	0.0000	0.0000	0.0000	0.00
0.12	0.00	0.0000	0.0000	0.0000	0.00
0.14	0.00	0.0000	0.0000	0.0000	0.00
0.15	0.01	0.0000	0.0000	0.0000	0.00
0.17	0.01	0.0000	0.0000	0.0000	0.00
0.18	0.01	0.0000	0.0000	0.0000	0.00
0.20	0.01	0.0000	0.0000	0.0000	0.00
0.21	0.01	0.0000	0.0000	0.0000	0.00
0.23	0.01	0.0000	0.0000	0.0000	0.00
0.24	0.01	0.0000	0.0000	0.0000	0.00
0.26	0.01	0.0000	0.0000	0.0000	0.00
0.27	0.01	0.0000	0.0000	0.0000	0.00
0.29	0.01	0.0000	0.0000	0.0000	0.00
0.30	0.01	0.0000	0.0000	0.0000	0.00
0.32	0.01	0.0000	0.0000	0.0000	0.00
0.33	0.01	0.0000	0.0000	0.0000	0.00
0.35	0.01	0.0000	0.0000	0.0000	0.00
0.36	0.01	0.0000	0.0000	0.0000	0.00
0.38	0.01	0.0000	0.0000	0.0000	0.00
0.39	0.01	0.0000	0.0000	0.0000	0.00
0.41	0.01	0.0000	0.0000	0.0000	0.00
0.42	0.01	0.0000	0.0000	0.0000	0.00
0.44	0.01	0.0000	0.0000	0.0000	0.00
0.45	0.02	0.0000	0.0000	0.0000	0.00
0.47	0.02	0.0000	0.0000	0.0000	0.00
0.49	0.02	0.0000	0.0000	0.0000	0.00
0.50	0.02	0.0000	0.0000	0.0000	0.00

11.76	2.05	0.8331	0.0092	0.5965	23.83
11.78	2.06	0.8422	0.0092	0.5981	23.89
11.79	2.08	0.8514	0.0092	0.5997	23.95
11.81	2.09	0.8606	0.0092	0.6012	24.02
11.82	2.10	0.8699	0.0093	0.6028	24.08
11.84	2.11	0.8791	0.0093	0.6043	24.14
11.86	2.13	0.8884	0.0093	0.6059	24.20
11.87	2.14	0.8977	0.0093	0.6074	24.26
11.89	2.15	0.9070	0.0093	0.6088	24.32
11.90	2.16	0.9164	0.0094	0.6103	24.38
11.92	2.18	0.9257	0.0094	0.6118	24.44
11.93	2.19	0.9351	0.0094	0.6132	24.50
11.95	2.20	0.9445	0.0094	0.6146	24.55
11.96	2.21	0.9540	0.0094	0.6160	24.61
11.98	2.22	0.9634	0.0095	0.6174	24.66
11.99	2.24	0.9729	0.0067	0.6188	24.72
12.01	2.25	0.9796	0.0032	0.6147	24.55
12.02	2.25	0.9828	0.0032	0.5980	23.89
12.04	2.25	0.9859	0.0032	0.5687	22.72
12.05	2.26	0.9891	0.0032	0.5268	21.04
12.07	2.26	0.9923	0.0032	0.4722	18.86
12.08	2.27	0.9954	0.0032	0.4138	16.53
12.10	2.27	0.9986	0.0032	0.3626	14.49
12.11	2.27	1.0018	0.0032	0.3189	12.74
12.13	2.28	1.0050	0.0032	0.2825	11.28
12.14	2.28	1.0082	0.0032	0.2535	10.13
12.16	2.29	1.0113	0.0032	0.2320	9.27
12.17	2.29	1.0145	0.0032	0.2180	8.71
12.19	2.30	1.0177	0.0032	0.2114	8.44
12.20	2.30	1.0209	0.0032	0.2101	8.39
12.22	2.30	1.0241	0.0032	0.2103	8.40
12.23	2.31	1.0273	0.0032	0.2104	8.41
12.25	2.31	1.0305	0.0032	0.2106	8.41
12.26	2.32	1.0337	0.0032	0.2107	8.42
12.28	2.32	1.0369	0.0032	0.2108	8.42
12.29	2.32	1.0401	0.0032	0.2110	8.43
12.31	2.33	1.0433	0.0032	0.2111	8.43
12.32	2.33	1.0465	0.0032	0.2112	8.44
12.34	2.34	1.0497	0.0032	0.2114	8.44
12.36	2.34	1.0529	0.0032	0.2115	8.45
12.37	2.34	1.0561	0.0032	0.2116	8.45
12.39	2.35	1.0593	0.0032	0.2118	8.46
12.40	2.35	1.0626	0.0032	0.2119	8.47
12.42	2.36	1.0658	0.0032	0.2121	8.47
12.43	2.36	1.0690	0.0032	0.2122	8.48
12.45	2.37	1.0722	0.0032	0.2123	8.48
12.46	2.37	1.0754	0.0032	0.2124	8.49
12.48	2.37	1.0787	0.0032	0.2126	8.49
12.49	2.38	1.0819	0.0032	0.2127	8.50
12.51	2.38	1.0851	0.0032	0.2128	8.50
12.52	2.39	1.0884	0.0032	0.2130	8.51
12.54	2.39	1.0916	0.0032	0.2131	8.51
12.55	2.39	1.0948	0.0032	0.2132	8.52

23.82	3.39	1.9241	0.0004	0.0295	1.18
23.83	3.39	1.9246	0.0004	0.0295	1.18
23.85	3.39	1.9250	0.0004	0.0295	1.18
23.86	3.40	1.9255	0.0004	0.0295	1.18
23.88	3.40	1.9259	0.0004	0.0295	1.18
23.89	3.40	1.9264	0.0004	0.0295	1.18
23.91	3.40	1.9268	0.0004	0.0295	1.18
23.92	3.40	1.9273	0.0004	0.0295	1.18
23.94	3.40	1.9277	0.0004	0.0295	1.18
23.95	3.40	1.9282	0.0004	0.0295	1.18
23.97	3.40	1.9286	0.0004	0.0295	1.18
23.98	3.40	1.9290	0.0004	0.0295	1.18
24.00	3.40	1.9295	0.0001	0.0295	1.18
24.01	3.40	1.9296	0.0000	0.0287	1.15
24.03	3.40	1.9296	0.0000	0.0271	1.08
24.04	3.40	1.9296	0.0000	0.0246	0.98
24.06	3.40	1.9296	0.0000	0.0211	0.84
24.07	3.40	1.9296	0.0000	0.0169	0.67
24.09	3.40	1.9296	0.0000	0.0129	0.52
24.10	3.40	1.9296	0.0000	0.0095	0.38
24.12	3.40	1.9296	0.0000	0.0066	0.26
24.13	3.40	1.9296	0.0000	0.0042	0.17
24.15	3.40	1.9296	0.0000	0.0024	0.09
24.16	3.40	1.9296	0.0000	0.0011	0.04
24.18	3.40	1.9296	0.0000	0.0003	0.01
24.19	3.40	1.9296	0.0000	0.0000	0.00
24.21	3.40	1.9296	0.0000	0.0000	0.00
24.23	3.40	1.9296	0.0000	0.0000	0.00
24.24	0.00	0.0000	0.0000	0.0000	0.00

OUTPUT SUMMARY:

TOTAL RUNOFF DEPTH = 1.93 IN. TIME TO PEAK = 11.988 HOURS
INITIAL ABSTRACTION = .353 IN. RUNOFF VOLUME CHECK = 1.933 IN.
PEAK FLOW = 24.722 CFS

TABLE 5

STORM RUNOFF DETERMINATION
FOR
DEER CREEK WASTE ROCK SITE #5

INPUT SUMMARY:

DISTRIBUTION = SCS TYPE II
RAINFALL DEPTH = 3.4 INCHES
STORM DURATION = 24 HOURS
RUNOFF AREA = .0459 SQ. MILES
RUNOFF CURVE NO. = 77
TIME OF CONCENTRATION = .5556 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
0.07	0.00	0.0000	0.0000	0.0000	0.00
0.15	0.01	0.0000	0.0000	0.0000	0.00
0.22	0.01	0.0000	0.0000	0.0000	0.00
0.30	0.01	0.0000	0.0000	0.0000	0.00
0.37	0.01	0.0000	0.0000	0.0000	0.00
0.44	0.02	0.0000	0.0000	0.0000	0.00
0.52	0.02	0.0000	0.0000	0.0000	0.00
0.59	0.02	0.0000	0.0000	0.0000	0.00
0.67	0.02	0.0000	0.0000	0.0000	0.00
0.74	0.03	0.0000	0.0000	0.0000	0.00
0.81	0.03	0.0000	0.0000	0.0000	0.00
0.89	0.03	0.0000	0.0000	0.0000	0.00
0.96	0.03	0.0000	0.0000	0.0000	0.00
1.04	0.04	0.0000	0.0000	0.0000	0.00
1.11	0.04	0.0000	0.0000	0.0000	0.00
1.19	0.04	0.0000	0.0000	0.0000	0.00
1.26	0.04	0.0000	0.0000	0.0000	0.00
1.33	0.05	0.0000	0.0000	0.0000	0.00
1.41	0.05	0.0000	0.0000	0.0000	0.00
1.48	0.05	0.0000	0.0000	0.0000	0.00
1.56	0.05	0.0000	0.0000	0.0000	0.00
1.63	0.06	0.0000	0.0000	0.0000	0.00
1.70	0.06	0.0000	0.0000	0.0000	0.00
1.78	0.06	0.0000	0.0000	0.0000	0.00
1.85	0.06	0.0000	0.0000	0.0000	0.00
1.93	0.07	0.0000	0.0000	0.0000	0.00
2.00	0.07	0.0000	0.0000	0.0000	0.00
2.07	0.07	0.0000	0.0000	0.0000	0.00
2.15	0.08	0.0000	0.0000	0.0000	0.00
2.22	0.08	0.0000	0.0000	0.0000	0.00
2.30	0.08	0.0000	0.0000	0.0000	0.00
2.37	0.09	0.0000	0.0000	0.0000	0.00
2.44	0.09	0.0000	0.0000	0.0000	0.00

10.37	0.91	0.0305	0.0119	0.0286	0.85
10.45	0.93	0.0424	0.0137	0.0446	1.32
10.52	1.04	0.0561	0.0153	0.0635	1.88
10.59	1.10	0.0714	0.0168	0.0845	2.50
10.67	1.16	0.0882	0.0183	0.1071	3.17
10.74	1.22	0.1065	0.0197	0.1304	3.86
10.82	1.28	0.1262	0.0210	0.1540	4.56
10.89	1.34	0.1471	0.0223	0.1773	5.25
10.96	1.40	0.1694	0.0235	0.1996	5.91
11.04	1.46	0.1929	0.0246	0.2209	6.54
11.11	1.52	0.2175	0.0257	0.2411	7.14
11.19	1.58	0.2431	0.0267	0.2602	7.71
11.26	1.64	0.2699	0.0277	0.2785	8.25
11.33	1.70	0.2976	0.0287	0.2958	8.76
11.41	1.76	0.3263	0.0296	0.3123	9.25
11.48	1.82	0.3559	0.0305	0.3281	9.72
11.56	1.88	0.3864	0.0313	0.3431	10.16
11.63	1.94	0.4177	0.0321	0.3575	10.59
11.70	2.00	0.4498	0.0329	0.3712	10.99
11.78	2.06	0.4827	0.0336	0.3842	11.38
11.85	2.12	0.5163	0.0343	0.3968	11.75
11.93	2.18	0.5506	0.0347	0.4088	12.11
12.00	2.24	0.5853	0.0118	0.4201	12.44
12.08	2.26	0.5971	0.0119	0.4213	12.48
12.15	2.28	0.6090	0.0120	0.4122	12.21
12.22	2.30	0.6209	0.0120	0.3926	11.63
12.30	2.32	0.6330	0.0121	0.3622	10.73
12.37	2.35	0.6451	0.0122	0.3212	9.51
12.45	2.37	0.6572	0.0122	0.2845	8.43
12.52	2.39	0.6695	0.0123	0.2525	7.48
12.59	2.41	0.6818	0.0124	0.2252	6.67
12.67	2.43	0.6941	0.0124	0.2028	6.01
12.74	2.45	0.7066	0.0125	0.1856	5.50
12.82	2.47	0.7191	0.0126	0.1736	5.14
12.89	2.49	0.7316	0.0126	0.1671	4.95
12.96	2.51	0.7442	0.0127	0.1662	4.92
13.04	2.53	0.7569	0.0127	0.1671	4.95
13.11	2.55	0.7696	0.0128	0.1680	4.98
13.19	2.57	0.7825	0.0129	0.1688	5.00
13.26	2.59	0.7953	0.0129	0.1697	5.03
13.33	2.61	0.8082	0.0130	0.1705	5.05
13.41	2.63	0.8212	0.0130	0.1714	5.08
13.48	2.65	0.8342	0.0131	0.1722	5.10
13.56	2.67	0.8473	0.0131	0.1730	5.12
13.63	2.69	0.8605	0.0132	0.1738	5.15
13.70	2.71	0.8737	0.0133	0.1746	5.17
13.78	2.73	0.8869	0.0133	0.1754	5.20
13.85	2.75	0.9003	0.0134	0.1762	5.22
13.93	2.77	0.9136	0.0133	0.1770	5.24
14.00	2.79	0.9269	0.0050	0.1777	5.26
14.08	2.80	0.9319	0.0051	0.1749	5.18
14.15	2.80	0.9370	0.0051	0.1688	5.00
14.22	2.81	0.9421	0.0051	0.1592	4.71

22.15	3.34	1.3107	0.0018	0.0248	0.73
22.22	3.34	1.3125	0.0018	0.0248	0.73
22.30	3.34	1.3144	0.0018	0.0248	0.73
22.37	3.34	1.3162	0.0018	0.0248	0.73
22.45	3.35	1.3180	0.0018	0.0248	0.73
22.52	3.35	1.3199	0.0018	0.0248	0.73
22.59	3.35	1.3217	0.0018	0.0248	0.73
22.67	3.35	1.3235	0.0018	0.0248	0.73
22.74	3.36	1.3254	0.0018	0.0248	0.74
22.82	3.36	1.3272	0.0018	0.0248	0.74
22.89	3.36	1.3291	0.0018	0.0248	0.74
22.96	3.36	1.3309	0.0018	0.0248	0.74
23.04	3.37	1.3327	0.0018	0.0249	0.74
23.11	3.37	1.3346	0.0018	0.0249	0.74
23.19	3.37	1.3364	0.0018	0.0249	0.74
23.26	3.37	1.3383	0.0018	0.0249	0.74
23.34	3.38	1.3401	0.0018	0.0249	0.74
23.41	3.38	1.3419	0.0018	0.0249	0.74
23.48	3.38	1.3438	0.0018	0.0249	0.74
23.56	3.38	1.3456	0.0018	0.0249	0.74
23.63	3.39	1.3475	0.0018	0.0249	0.74
23.71	3.39	1.3493	0.0018	0.0249	0.74
23.78	3.39	1.3512	0.0018	0.0249	0.74
23.85	3.40	1.3530	0.0018	0.0249	0.74
23.93	3.40	1.3549	0.0018	0.0249	0.74
24.00	3.40	1.3567	0.0000	0.0249	0.74
24.08	3.40	1.3567	0.0000	0.0242	0.72
24.15	3.40	1.3567	0.0000	0.0227	0.67
24.22	3.40	1.3567	0.0000	0.0204	0.60
24.30	3.40	1.3567	0.0000	0.0174	0.52
24.37	3.40	1.3567	0.0000	0.0137	0.41
24.45	3.40	1.3567	0.0000	0.0104	0.31
24.52	3.40	1.3567	0.0000	0.0076	0.22
24.59	3.40	1.3567	0.0000	0.0052	0.15
24.67	3.40	1.3567	0.0000	0.0033	0.10
24.74	3.40	1.3567	0.0000	0.0018	0.05
24.82	3.40	1.3567	0.0000	0.0007	0.02
24.89	3.40	1.3567	0.0000	0.0001	0.00
24.96	3.40	1.3567	0.0000	0.0000	0.00
25.04	3.40	1.3567	0.0000	0.0000	0.00
25.11	0.00	0.0000	0.0000	0.0000	0.00

OUTPUT SUMMARY:

TOTAL RUNOFF DEPTH = 1.357 IN. TIME TO PEAK = 12.047 HOURS
INITIAL ABSTRACTION = .597 IN. RUNOFF VOLUME CHECK = 1.359 IN.
PEAK FLOW = 12.503 CFS

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1 CLS : REM                    RIPRAP SIZING PROGRAM TAKEN FROM
2 KEY OFF: REM     "APPLIED HYDROLOGY AND SEDIMENTOLOGY FOR DISTURBED AREAS"
3 REM:                      BY BARFEILD, WARNER AND HAAN,  PAGE 185
30 DEF FNSIND(I)=SIN(I*3.14159/180)
40 DEF FNCOSD(I)=COS(I*3.14159/180)
50 DEF FNTAND(I)=TAN(I*3.14159/180)
 0 DEF FNATND(I)=(180/3.14159)*ATN(I)
100 PRINT TAB(13)"R I P R A P  S I Z I N G   F O R"
110 PRINT TAB(11)"T R A P A Z O I D A L  D I T C H E S "
120 PRINT
130 PRINT TAB(13)"ENTER LISTED PARAMETERS"
140 PRINT TAB(13)"1. FLOW RATE (CFS)"
150 PRINT TAB(13)"2. CHANNEL SLOPE"
160 PRINT TAB(13)"3. BOTTOM WIDTH (FT)"
170 PRINT TAB(13)"4. SIDE SLOPE"
180 PRINT TAB(13)"5. PHI ANGLE"
190 PRINT TAB(13)"6. SPECIFIC GRAVITY OF RIPRAP"
195 PRINT
300 LOCATE 5,32:INPUT;"",Q
310 LOCATE 6,30:INPUT;"",S
320 LOCATE 7,34:INPUT;"",B
330 LOCATE 8,27:INPUT;"",SS
340 LOCATE 9,26:INPUT;"",PHI
350 LOCATE 10,43:INPUT;"",SG
360 LOCATE 12,13:INPUT;"DESIRED SAFETY FACTOR FOR CHANNEL BOTTOM  ",DSF
370 LOCATE 13,13:INPUT;"DESIRED SAFETY FACTOR FOR CHANNEL BANKS  ",DSFB
400 SA=FNATND(S) :SSA=FNATND(SS)
480 D50=1: D=1
490 Q=INT(Q*1000+.5)/1000
500 N=((D50)^(1/6))*(.0395)
502 D50=INT(D50*10000+.5)/10000
 05 Q1=1.49*(S^.5)/N
508 A=B*D+D*D/SS
510 Q2=Q1*A^(5/3)/(B+2*D*(1+1/(SS^2))^(.5))^(2/3)
512 Q3=INT(Q2*1000+.5)/1000
514 IF Q3=Q GOTO 520
516 D=(Q/Q2*D+D)/2
518 GOTO 505
520 T=62.4*D*S
525 VEL=Q/A
526 VEL=INT(VEL*1000+.5)/1000 :D=INT(D*1000+.5)/1000
530 NU=21*T/(62.4*(SG-1)*D50)
540 SF=FNCOSD(SA)*FNTAND(PHI)/(FNSIND(SA)+NU*FNTAND(PHI))
600 REM LAMBDA = CHANNEL SLOPE ANGLE SA
605 NU=.76*NU : REM ASSUME Tmax = .76*t AND NU(BANK)=.76*NU
610 BETA=FNATND(FNCOSD(SA)/(2*FNSIND(SSA)/(NU*FNTAND(PHI))+FNSIND(SA)))
620 NUP=NU*(1+FNSIND(SA+BETA))/2
630 SFB=FNCOSD(SSA)*FNTAND(PHI)/(NUP*FNTAND(PHI)+FNSIND(SSA)*FNCOSD(BETA))
700 SF=INT(SF*1000+.5)/1000
710 SFB=INT(SFB*1000+.5)/1000
720 LOCATE 16,10:PRINT"VELOCITY     DEPTH      D50     S.F. BTM      S.F. BANK"
730 LOCATE 17,11:PRINT VEL;"      ";D;"    ";D50;"     ";SF;"          ";SFB;"    "
740 IF SFB=0 GOTO 815
750 IF SFB=DSFB GOTO 800
760 D50=(DSFB/SFB*D50+D50)/2
765 K=K+1:IF K=100 THEN GOTO 860
770 GOTO 500
800 IF SF>=DSF GOTO 820
810 LOCATE 20,13:PRINT"ERRROR: SF BANK > SF BTM":END
815 LOCATE 20,13:PRINT"ERROR: SFB=0": END
820 LOCATE 20,13:PRINT"RUN COMPLETE"
850 END
860 PRINT"Exceeds allowable number of iterations (see line 765)":END
```

Exhibit G
Page 1 of 3

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) 8.5
2. CHANNEL SLOPE .02
3. BOTTOM WIDTH (FT) 2
4. SIDE SLOPE .333
5. PHI ANGLE 40
6. SPECIFIC GRAVITY OF RIPRAP 2.65

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

VELOCITY	DEPTH	D50	S.F. BTM	S.F. BANK
3.565	.618	.2965	1.803	1.5

RUN COMPLETE

Ok

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) 34.59
2. CHANNEL SLOPE .02
3. BOTTOM WIDTH (FT) 3
4. SIDE SLOPE .333
5. PHI ANGLE 40
6. SPECIFIC GRAVITY OF RIPRAP 2.65

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

VELOCITY	DEPTH	D50	S.F. BTM	S.F. BANK
4.725	1.14	.5467	1.803	1.5

RUN COMPLETE

Ok

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) 47.65
2. CHANNEL SLOPE .02
3. BOTTOM WIDTH (FT) 4
4. SIDE SLOPE .333
5. PHI ANGLE 40
6. SPECIFIC GRAVITY OF RIPRAP 2.65

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

VELOCITY	DEPTH	D50	S.F. BTM	S.F. BANK
5.033	1.23	.5901	1.809	1.5

RUN COMPLETE

Ok

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) 72.37
2. CHANNEL SLOPE .04
3. BOTTOM WIDTH (FT) 5
4. SIDE SLOPE .333
5. PHI ANGLE 41
6. SPECIFIC GRAVITY OF RIPRAP 2.65

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

VELOCITY	DEPTH	D50	S.F. BTM	S.F. BANK
6.59	1.253	1.1701	1.69	1.5

RUN COMPLETE

Ok

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) 3.64
2. CHANNEL SLOPE .02
3. BOTTOM WIDTH (FT) 0
4. SIDE SLOPE .333
5. PHI ANGLE 41
6. SPECIFIC GRAVITY OF RIPRAP 2.65

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

VELOCITY	DEPTH	D50	S.F. BTM	S.F. BANK
2.954	.641	.296	1.742	1.5

RUN COMPLETE

Ok

DISTURBED DITCH
SEPARATION BETWEEN
PHASE I AND PHASE II

EXHIBIT H

EMERGENCY SPILLWAY DESIGN - SEDIMENT PONDS 1 & 2

METHOD - See National Engineering Handbook, Section 4, Hydrology, Chapter 21, Design Hydrographs page 21.49

1. Design Storm Rainfall Amount

P=3.4 inches for 100 year, 24 hour storm event. No adjustment of this amount is required for the area or the time of concentration.

2. Determine the Runoff Amount

for CN = 77, P = 3.4 figure 10.1
Q_2 = 1.4"

3. Determine Hydrograph Family

From figure 21.3, Hydrograph Family = #5

4. Determine Duration of Excess Rainfall, T_o

From figure 21.4, T_o = 2.0 hrs.

5. Compute Initial Tp Valve

Pond #1, Length = 700', Velocity = 0.7 fps, Tc_1 = .278 hrs
Pond #2, Length = 700', Velocity = 0.7 fps, T = .278 hrs
700', Velocity = 1.4 fps, T = .139 hrs
Tc_2 = .417 hrs

$Tp_1 = .7\ (Tc_1) = 0.195$ hrs
$Tp_2 = .7\ (Tc_2) = 0.292$ hrs

6. Compute T_o/Tp

T_o/Tp_1 = 10.26 hrs
T_o/Tp_2 = 6.85 hrs

7. Select T_o/Tp Ratio

T_o/Tp_1 = 10 for Pond #1
T_o/Tp_2 = 6 for Pond #2

8. Revise Tp

Rev Tp_1 = 2.0/10.0 = .200
Rev Tp_2 = 2.0/ 6.0 = .333

9. Compute qp A_1 = 9.8 Acres = .015 sq. mi.
A_2 = 19.4 Acres = .030 sq. mi.

$$qp_1 = \frac{484*A}{\text{Rev } Tp_1} = 36.30 \text{ cfs}$$

$$qp_2 = \frac{484*A}{\text{Rev } Tp_2} = 43.60 \text{ cfs}$$

10. Compute Q qp

Qqp_1 = (1.4) (36.3) = 50.8 cfs
Qqp_2 = (1.4) (43.6) = 61.0 cfs

11. Construct Hydrograph & Determine Maximum Flow Rate

Pond #1 Max q = 10.77 cfs see table 1
Pond #2 Max q = 19.76 cfs see table 2

12. Design Spillway

Assume a broad crested weir

$$Q = CLh^{3/2}$$

Q = Flow in cfs
C = Coefficient, use C = 2.80
L = Length of Wier
h = Head in Feet

Pond #1 L = 3' Q = 10.77 cfs

$$h = \left(\frac{Q}{CL}\right)^{2/3} = \left(\frac{10.77}{(2.8)(3)}\right)^{2/3} = 1.18'$$

Pond #2 L = 6' Q = 19.76 cfs

$$h = \left(\frac{19.76}{(2.8)(6)}\right)^{2/3} = 1.11'$$

To provide the required freeboard, make the spillways 1.5 feet deep.

POND 1, EMERGENCY SPILLWAY HYDROGRAPH

HYDROGRAPH FAMILY 5, $T_o/Tp = 10$

	t/Tp	time,hrs	qc/qp	Flow,cfs	Qt/Q	Volume Inches
1	0.0	0.0	0.0	0.0	0.0	0.0
2	.67	.134	.013	.660	.003	.004
3	1.34	.268	.061	3.094	.022	.031
4	2.01	.402	.091	4.623	.059	.083
5	2.68	.536	.102	5.182	.107	.150
6	3.35	.670	.107	5.436	.159	.223
7	4.02	.804	.110	5.588	.213	.298
8	4.69	.938	.111	5.639	.268	.375
9	5.36	1.072	.111	5.639	.323	.452
10	6.03	1.206	.112	5.690	.378	.529
11	6.70	1.340	.112	5.690	.434	.608
12	7.37	1.474	.112	5.690	.490	.686
13	8.04	1.608	.116	5.893	.546	.764
14	8.71	1.742	.160	8.128	.615	.861
15	9.38	1.876	.198	10.058	.704	.986
16	10.05	2.010	.212	10.770	.805	1.127
17	10.72	2.144	.168	8.534	.900	1.260
18	11.39	2.278	.074	3.759	.960	1.344
19	12.06	2.412	.027	1.372	.985	1.379
20	12.73	2.546	.010	.508	.994	1.392

time = (t/Tp)* Rev Tp = (t/Tp)* (.200)
flow = (qc/qp)* Qqp = (qc/qp)* (50.8)
volume = (Q_T/Q)* Q = (Q_T/Q)* (1.4)

POND 2, EMERGENCY SPILLWAY HYDROGRAPH

HYDROGRAPH FAMILY 5, $T_c/Tp = 6.0$

	t/Tp	time,hrs	qc/qp	flow,cfs	Qt/Q	Volume Inches
1	0.0	0.0	0.0	0.0	0.0	0.0
2	.52	.173	.015	.915	.003	.004
3	1.04	.346	.070	4.270	.019	.027
4	1.56	.519	.130	7.930	.057	.080
5	2.08	.693	.159	9.699	.112	.157
6	2.60	.866	.172	10.492	.176	.246
7	3.12	1.039	.178	10.858	.242	.339
8	3.64	1.212	.182	11.102	.311	.435
9	4.16	1.385	.183	11.163	.381	.533
10	4.68	1.558	.184	11.224	.451	.631
11	5.20	1.732	.218	13.298	.527	.738
12	5.72	1.905	.285	17.385	.623	.877
13	6.24	2.078	.324	19.764	.740	1.036
14	6.76	2.251	.267	16.287	.852	1.193
15	7.28	2.424	.133	8.113	.929	1.301
16	7.80	2.597	.064	3.904	.966	1.352
17	8.32	2.771	.029	1.769	.984	1.378
18	8.84	7.994	.016	.976	.993	1.390
19	9.36	3.117	.007	.427	.997	1.396
20	9.33	3.290	.003	.183	.999	1.399

time = (t/Tp) * Rev Tp = (t/Tp) * (.333)
flow = (qc/qp) * Qqp = (qc/qp) * (61.0)
volume = (Qt/Q) * Q = (Q_T/Q) * (1.4)

Table 2
Exhibit H
Page 4 of 4

CURVE NUMBER DETERMINATION - AREAS 1 THRU 4

LAND USE - WESTERN RANGELAND
15 TO 20% GROUND COVER
JUNIPER - GRASS COMPLEX

SOIL GROUP C - SLOW INFILTRATION RATE
SOIL LAYER IMPEDES DOWNWARD
MOVEMENT OF WATER, SLOW
RATE OF WATER TRANSMISSION

FIGURE 9.6 AT GROUND COVER = 17%, CN ≈ 85

AREA 5 - SAME AS ABOVE WITH GROUND COVER = 40%
≈ CN 77

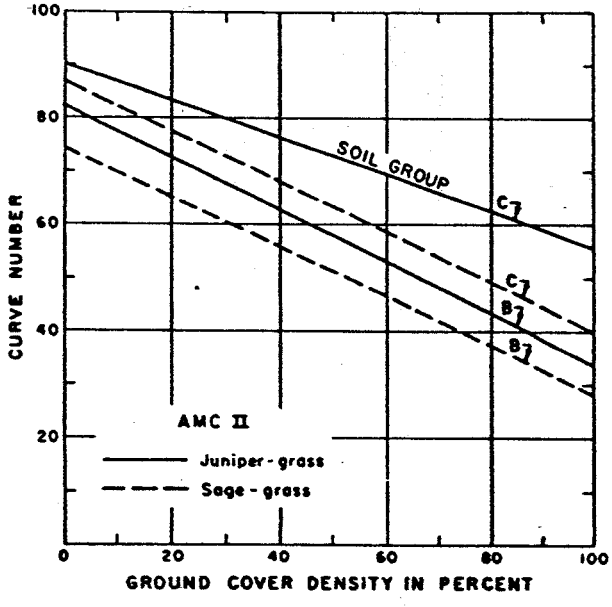

Figure 9.6.--Graph for estimating runoff curve numbers of forest-range complexes in western United States: juniper-grass and sage-grass complexes.

SCS NATIONAL ENGINEERING HANDBOOK
SECTION 4, HYDROLOGY

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) 8.25
2. CHANNEL SLOPE .02
3. BOTTOM WIDTH (FT) 2
4. SIDE SLOPE .333
5. PHI ANGLE 40
6. SPECIFIC GRAVITY OF RIPRAP 2.65

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

VELOCITY	DEPTH	D50	S.F. BTM	S.F. BANK
3.544	.608	.2918	1.803	1.5

RUN COMPLETE

Ok

DISTURBED DITCH
SEPERATION BETWEEN
PHASE I AND PHASE II

Exhibit J
Page 1 of 1

TABLE 1

STORM RUNOFF DETERMINATION
FOR
DCWRS FINAL AREA 1

INPUT SUMMARY:

DISTRIBUTION = SCS TYPE II	RUNOFF AREA = .0086 SQ. MILES
RAINFALL DEPTH = 3.4 INCHES	RUNOFF CURVE NO. = 86
STORM DURATION = 24 HOURS	TIME OF CONCENTRATION = .307 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
0.04	0.00	0.0000	0.0000	0.0000	0.00
0.08	0.00	0.0000	0.0000	0.0000	0.00
0.12	0.00	0.0000	0.0000	0.0000	0.00
0.16	0.01	0.0000	0.0000	0.0000	0.00
0.20	0.01	0.0000	0.0000	0.0000	0.00
0.25	0.01	0.0000	0.0000	0.0000	0.00
0.29	0.01	0.0000	0.0000	0.0000	0.00
0.33	0.01	0.0000	0.0000	0.0000	0.00
0.37	0.01	0.0000	0.0000	0.0000	0.00
0.41	0.01	0.0000	0.0000	0.0000	0.00
0.45	0.02	0.0000	0.0000	0.0000	0.00
0.49	0.02	0.0000	0.0000	0.0000	0.00
0.53	0.02	0.0000	0.0000	0.0000	0.00
0.57	0.02	0.0000	0.0000	0.0000	0.00
0.61	0.02	0.0000	0.0000	0.0000	0.00
0.65	0.02	0.0000	0.0000	0.0000	0.00
0.70	0.02	0.0000	0.0000	0.0000	0.00
0.74	0.03	0.0000	0.0000	0.0000	0.00
0.78	0.03	0.0000	0.0000	0.0000	0.00
0.82	0.03	0.0000	0.0000	0.0000	0.00
0.86	0.03	0.0000	0.0000	0.0000	0.00
0.90	0.03	0.0000	0.0000	0.0000	0.00
0.94	0.03	0.0000	0.0000	0.0000	0.00
0.98	0.03	0.0000	0.0000	0.0000	0.00
11.01	1.44	0.4309	0.0217	0.4235	2.69
11.05	1.47	0.4727	0.0220	0.4921	2.73
11.09	1.50	0.4947	0.0223	0.5004	2.78
11.13	1.54	0.5170	0.0226	0.5064	2.81
11.17	1.57	0.5398	0.0228	0.5160	2.86
11.22	1.60	0.5624	0.0230	0.5234	2.90

11.30	1.64	0.5854	0.0233	0.5305	2.94
11.30	1.67	0.6087	0.0235	0.5374	2.98
11.34	1.70	0.6322	0.0237	0.5440	3.02
11.38	1.74	0.6559	0.0239	0.5504	3.05
11.42	1.77	0.6798	0.0241	0.5566	3.09
11.46	1.80	0.7040	0.0243	0.5626	3.12
11.50	1.84	0.7283	0.0245	0.5683	3.15
11.54	1.87	0.7528	0.0247	0.5739	3.18
11.58	1.90	0.7775	0.0249	0.5793	3.21
11.63	1.94	0.8024	0.0251	0.5845	3.24
11.67	1.97	0.8275	0.0252	0.5895	3.27
11.71	2.00	0.8527	0.0254	0.5944	3.30
11.75	2.04	0.8781	0.0255	0.5991	3.32
11.79	2.07	0.9036	0.0257	0.6037	3.35
11.83	2.11	0.9293	0.0259	0.6081	3.37
11.87	2.14	0.9552	0.0260	0.6124	3.40
11.91	2.17	0.9812	0.0261	0.6165	3.42
11.95	2.21	1.0073	0.0263	0.6206	3.44
11.99	2.24	1.0336	0.0116	0.6245	3.47
12.03	2.25	1.0452	0.0088	0.6174	3.43
12.07	2.26	1.0540	0.0069	0.5973	3.31
12.11	2.28	1.0628	0.0088	0.5639	3.12
12.16	2.29	1.0716	0.0089	0.5173	2.87
12.20	2.30	1.0805	0.0089	0.4574	2.54
12.24	2.31	1.0894	0.0089	0.4014	2.23
12.28	2.32	1.0982	0.0089	0.3528	1.96
12.32	2.33	1.1071	0.0089	0.3115	1.73
12.36	2.34	1.1160	0.0089	0.2777	1.54
12.40	2.35	1.1250	0.0089	0.2514	1.40
12.44	2.36	1.1339	0.0089	0.2326	1.29
12.48	2.38	1.1428	0.0090	0.2215	1.23
12.53	2.39	1.1518	0.0090	0.2180	1.21
12.57	2.40	1.1608	0.0090	0.2180	1.21
12.61	2.41	1.1698	0.0090	0.2163	1.21
12.65	2.42	1.1788	0.0090	0.2184	1.21
12.69	2.43	1.1878	0.0090	0.2190	1.22
12.73	2.44	1.1968	0.0090	0.2193	1.22
12.77	2.45	1.2058	0.0090	0.2196	1.22
12.81	2.46	1.2149	0.0091	0.2199	1.22
12.85	2.48	1.2239	0.0091	0.2202	1.22
12.89	2.49	1.2330	0.0091	0.2205	1.22
12.93	2.50	1.2421	0.0091	0.2209	1.23
12.98	2.51	1.2512	0.0091	0.2212	1.23
23.00	3.37	1.9003	0.0012	0.0299	0.17
23.05	3.37	1.9815	0.0012	0.0299	0.17
23.09	3.37	1.9828	0.0012	0.0299	0.17
23.13	3.37	1.9840	0.0012	0.0299	0.17
23.17	3.37	1.9852	0.0012	0.0299	0.17
23.21	3.37	1.9864	0.0012	0.0299	0.17
23.25	3.37	1.9877	0.0012	0.0299	0.17
23.29	3.38	1.9889	0.0012	0.0299	0.17
23.33	3.38	1.9901	0.0012	0.0299	0.17

23.37	3.38	1.9913	0.0012	0.0299	0.17
23.41	3.38	1.9926	0.0012	0.0299	0.17
23.45	3.38	1.9938	0.0012	0.0299	0.17
23.50	3.38	1.9950	0.0012	0.0299	0.17
23.54	3.38	1.9962	0.0012	0.0299	0.17
23.58	3.39	1.9974	0.0012	0.0299	0.17
23.62	3.39	1.9987	0.0012	0.0300	0.17
23.66	3.39	1.9999	0.0012	0.0300	0.17
23.70	3.39	2.0011	0.0012	0.0300	0.17
23.74	3.39	2.0023	0.0012	0.0300	0.17
23.78	3.39	2.0036	0.0012	0.0300	0.17
23.82	3.39	2.0048	0.0012	0.0300	0.17
23.86	3.40	2.0060	0.0012	0.0300	0.17
23.91	3.40	2.0072	0.0012	0.0300	0.17
23.95	3.40	2.0085	0.0012	0.0300	0.17
23.99	3.40	2.0097	0.0004	0.0300	0.17
24.03	3.40	2.0101	0.0000	0.0294	0.16
24.07	3.40	2.0101	0.0000	0.0279	0.15
24.11	3.40	2.0101	0.0000	0.0254	0.14
24.15	3.40	2.0101	0.0000	0.0221	0.12
24.19	3.40	2.0101	0.0000	0.0179	0.10
24.23	3.40	2.0101	0.0000	0.0136	0.08
24.27	3.40	2.0101	0.0000	0.0102	0.06
24.31	3.40	2.0101	0.0000	0.0072	0.04
24.36	3.40	2.0101	0.0000	0.0047	0.03
24.40	3.40	2.0101	0.0000	0.0027	0.02
24.44	3.40	2.0101	0.0000	0.0013	0.01
24.48	3.40	2.0101	0.0000	0.0004	0.00
24.52	3.40	2.0101	0.0000	0.0001	0.00
24.56	3.40	2.0101	0.0000	0.0000	0.00
24.60	3.40	2.0101	0.0000	0.0000	0.00
24.64	0.00	0.0000	0.0000	0.0000	0.00

OUTPUT SUMMARY:

==========

TOTAL RUNOFF DEPTH = 2.01 IN. TIME TO PEAK = 11.988 HOURS

INITIAL ABSTRACTION = .326 IN. RUNOFF VOLUME CHECK = 2.014 IN.

PEAK FLOW = 3.466 CFS

==========

TABLE 2

STORM RUNOFF DETERMINATION
FOR
DCWRS FINAL AREA 2A

INPUT SUMMARY:

DISTRIBUTION = SCS TYPE II	RUNOFF AREA = .0166 SQ. MILES
RAINFALL DEPTH = 3.4 INCHES	RUNOFF CURVE NO. = 86
STORM DURATION = 24 HOURS	TIME OF CONCENTRATION = .5 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
0.07	0.00	0.0000	0.0000	0.0000	0.00
0.13	0.00	0.0000	0.0000	0.0000	0.00
0.20	0.01	0.0000	0.0000	0.0000	0.00
0.27	0.01	0.0000	0.0000	0.0000	0.00
0.33	0.01	0.0000	0.0000	0.0000	0.00
0.40	0.01	0.0000	0.0000	0.0000	0.00
0.47	0.02	0.0000	0.0000	0.0000	0.00
11.07	1.48	0.4805	0.0362	0.4610	4.94
11.13	1.54	0.5167	0.0369	0.4768	5.10
11.20	1.59	0.5536	0.0375	0.4906	5.26
11.27	1.65	0.5911	0.0381	0.5041	5.40
11.33	1.70	0.6292	0.0387	0.5168	5.54
11.40	1.75	0.6679	0.0392	0.5286	5.66
11.47	1.81	0.7071	0.0398	0.5398	5.78
11.53	1.86	0.7469	0.0403	0.5504	5.90
11.60	1.92	0.7871	0.0407	0.5604	6.00
11.67	1.97	0.8279	0.0412	0.5698	6.10
11.73	2.03	0.8690	0.0416	0.5787	6.20
11.80	2.08	0.9106	0.0420	0.5871	6.29
11.87	2.14	0.9526	0.0424	0.5951	6.38
11.93	2.19	0.9950	0.0422	0.6027	6.46
12.00	2.24	1.0378	0.0143	0.6099	6.53
12.07	2.26	1.0521	0.0144	0.6038	6.47
12.13	2.28	1.0665	0.0144	0.5843	6.26
12.20	2.30	1.0809	0.0144	0.5513	5.91
12.27	2.32	1.0953	0.0145	0.5046	5.41
12.33	2.33	1.1098	0.0145	0.4442	4.76
12.40	2.35	1.1243	0.0146	0.3907	4.19
12.47	2.37	1.1389	0.0146	0.3442	3.69
12.53	2.39	1.1535	0.0146	0.3045	3.27

12.60	2.41	1.1681	0.0147	0.2728	2.72
12.67	2.43	1.1828	0.0147	0.2481	2.66
12.73	2.44	1.1975	0.0147	0.2309	2.47
12.80	2.46	1.2122	0.0148	0.2212	2.37
12.87	2.48	1.2269	0.0148	0.2192	2.35
12.93	2.50	1.2417	0.0148	0.2197	2.35
13.00	2.52	1.2566	0.0149	0.2202	2.36
23.00	3.37	1.9802	0.0020	0.0299	0.32
23.07	3.37	1.9822	0.0020	0.0299	0.32
23.13	3.37	1.9842	0.0020	0.0299	0.32
23.20	3.37	1.9862	0.0020	0.0299	0.32
23.27	3.38	1.9882	0.0020	0.0299	0.32
23.33	3.38	1.9901	0.0020	0.0299	0.32
23.40	3.38	1.9921	0.0020	0.0299	0.32
23.47	3.38	1.9941	0.0020	0.0299	0.32
23.53	3.38	1.9961	0.0020	0.0299	0.32
23.60	3.39	1.9981	0.0020	0.0299	0.32
23.67	3.39	2.0001	0.0020	0.0299	0.32
23.73	3.39	2.0021	0.0020	0.0299	0.32
23.80	3.39	2.0041	0.0020	0.0300	0.32
23.87	3.40	2.0061	0.0020	0.0300	0.32
23.93	3.40	2.0081	0.0020	0.0300	0.32
24.00	3.40	2.0101	0.0000	0.0300	0.32
24.07	3.40	2.0101	0.0000	0.0291	0.31
24.13	3.40	2.0101	0.0000	0.0272	0.29
24.20	3.40	2.0101	0.0000	0.0246	0.26
24.27	3.40	2.0101	0.0000	0.0210	0.22
24.33	3.40	2.0101	0.0000	0.0165	0.18
24.40	3.40	2.0101	0.0000	0.0126	0.13
24.47	3.40	2.0101	0.0000	0.0092	0.10
24.53	3.40	2.0101	0.0000	0.0063	0.07
24.60	3.40	2.0101	0.0000	0.0039	0.04
24.67	3.40	2.0101	0.0000	0.0022	0.02
24.73	3.40	2.0101	0.0000	0.0009	0.01
24.80	3.40	2.0101	0.0000	0.0002	0.00
24.87	3.40	2.0101	0.0000	0.0000	0.00
24.93	3.40	2.0101	0.0000	0.0000	0.00
25.00	0.00	0.0000	0.0000	0.0000	0.00

OUTPUT SUMMARY:

TOTAL RUNOFF DEPTH = 2.01 IN. TIME TO PEAK = 12.003 HOURS
INITIAL ABSTRACTION = .326 IN. RUNOFF VOLUME CHECK = 2.014 IN.
PEAK FLOW = 6.534 CFS

TABLE 3

STORM RUNOFF DETERMINATION
FOR
DCWRS FINAL AREA 2B

INPUT SUMMARY:

DISTRIBUTION = SCS TYPE II	RUNOFF AREA = .0021 SQ. MILES
RAINFALL DEPTH = 3.4 INCHES	RUNOFF CURVE NO. = 86
STORM DURATION = 24 HOURS	TIME OF CONCENTRATION = .155 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
0.02	0.00	0.0000	0.0000	0.0000	0.00
0.04	0.00	0.0000	0.0000	0.0000	0.00
0.06	0.00	0.0000	0.0000	0.0000	0.00
0.08	0.00	0.0000	0.0000	0.0000	0.00
0.10	0.00	0.0000	0.0000	0.0000	0.00
0.12	0.00	0.0000	0.0000	0.0000	0.00
0.14	0.00	0.0000	0.0000	0.0000	0.00
0.17	0.01	0.0000	0.0000	0.0000	0.00
0.19	0.01	0.0000	0.0000	0.0000	0.00
0.21	0.01	0.0000	0.0000	0.0000	0.00
0.23	0.01	0.0000	0.0000	0.0000	0.00
0.25	0.01	0.0000	0.0000	0.0000	0.00
0.27	0.01	0.0000	0.0000	0.0000	0.00
0.29	0.01	0.0000	0.0000	0.0000	0.00
0.31	0.01	0.0000	0.0000	0.0000	0.00
0.33	0.01	0.0000	0.0000	0.0000	0.00
0.35	0.01	0.0000	0.0000	0.0000	0.00
0.37	0.01	0.0000	0.0000	0.0000	0.00
0.39	0.01	0.0000	0.0000	0.0000	0.00
0.41	0.01	0.0000	0.0000	0.0000	0.00
0.43	0.01	0.0000	0.0000	0.0000	0.00
0.45	0.02	0.0000	0.0000	0.0000	0.00
0.48	0.02	0.0000	0.0000	0.0000	0.00
0.50	0.02	0.0000	0.0000	0.0000	0.00
11.02	1.44	0.4532	0.0110	0.5084	0.69
11.04	1.46	0.4642	0.0110	0.5133	0.69
11.06	1.47	0.4752	0.0111	0.5181	0.70
11.08	1.49	0.4863	0.0112	0.5199	0.70
11.10	1.51	0.4975	0.0112	0.5235	0.71
11.12	1.52	0.5087	0.0113	0.5272	0.71

11.14	1.54	0.5200	0.0114	0.5307	0.72
11.16	1.56	0.5314	0.0114	0.5342	0.72
11.18	1.58	0.5428	0.0115	0.5376	0.73
11.20	1.59	0.5543	0.0116	0.5410	0.73
11.22	1.61	0.5659	0.0116	0.5443	0.74
11.24	1.63	0.5775	0.0117	0.5476	0.74
11.26	1.64	0.5892	0.0117	0.5508	0.75
11.28	1.66	0.6009	0.0118	0.5539	0.75
11.30	1.68	0.6127	0.0119	0.5570	0.75
11.32	1.69	0.6246	0.0119	0.5600	0.76
11.35	1.71	0.6365	0.0120	0.5630	0.76
11.37	1.73	0.6485	0.0120	0.5659	0.77
11.39	1.74	0.6605	0.0121	0.5686	0.77
11.41	1.76	0.6726	0.0121	0.5716	0.77
11.43	1.78	0.6847	0.0122	0.5744	0.78
11.45	1.79	0.6969	0.0122	0.5771	0.78
11.47	1.81	0.7091	0.0123	0.5798	0.79
11.49	1.83	0.7214	0.0123	0.5824	0.79
11.51	1.85	0.7337	0.0124	0.5850	0.79
11.53	1.86	0.7461	0.0124	0.5875	0.80
11.55	1.88	0.7585	0.0125	0.5901	0.80
11.57	1.90	0.7710	0.0125	0.5925	0.80
11.59	1.91	0.7835	0.0126	0.5950	0.81
11.61	1.93	0.7961	0.0126	0.5973	0.81
11.64	1.95	0.8087	0.0127	0.5997	0.81
11.66	1.96	0.8213	0.0127	0.6020	0.82
11.68	1.98	0.8340	0.0127	0.6043	0.82
11.70	2.00	0.8468	0.0128	0.6065	0.82
11.72	2.01	0.8596	0.0128	0.6087	0.82
11.74	2.03	0.8724	0.0129	0.6109	0.83
11.76	2.05	0.8852	0.0129	0.6130	0.83
11.78	2.06	0.8981	0.0129	0.6152	0.83
11.80	2.08	0.9111	0.0130	0.6172	0.84
11.82	2.10	0.9241	0.0130	0.6193	0.84
11.84	2.12	0.9371	0.0131	0.6213	0.84
11.86	2.13	0.9501	0.0131	0.6233	0.84
11.88	2.15	0.9632	0.0131	0.6252	0.85
11.90	2.17	0.9764	0.0132	0.6271	0.85
11.92	2.18	0.9895	0.0132	0.6290	0.85
11.95	2.20	1.0027	0.0132	0.6309	0.85
11.97	2.22	1.0160	0.0133	0.6327	0.86
11.99	2.23	1.0292	0.0101	0.6345	0.86
12.01	2.25	1.0394	0.0044	0.6317	0.86
12.03	2.25	1.0438	0.0044	0.6159	0.83
12.05	2.26	1.0483	0.0044	0.5872	0.80
12.07	2.26	1.0527	0.0045	0.5454	0.74
12.09	2.27	1.0572	0.0045	0.4905	0.66
12.11	2.27	1.0616	0.0045	0.4299	0.58
12.13	2.28	1.0661	0.0045	0.3769	0.51
12.15	2.29	1.0705	0.0045	0.3313	0.45
12.17	2.29	1.0750	0.0045	0.2934	0.40
12.19	2.30	1.0795	0.0045	0.2581	0.36
12.21	2.30	1.0839	0.0045	0.2404	0.33

12.23	2.31	1.0884	0.0045	0.2253	0.31
12.26	2.31	1.0929	0.0045	0.2180	0.30
12.28	2.32	1.0974	0.0045	0.2165	0.29
12.30	2.32	1.1019	0.0045	0.2167	0.29
12.32	2.33	1.1064	0.0045	0.2169	0.29
12.34	2.34	1.1109	0.0045	0.2170	0.29
12.36	2.34	1.1154	0.0045	0.2172	0.29
12.38	2.35	1.1199	0.0045	0.2174	0.29
12.40	2.35	1.1244	0.0045	0.2175	0.29
12.42	2.36	1.1289	0.0045	0.2177	0.30
12.44	2.36	1.1334	0.0045	0.2179	0.30
12.46	2.37	1.1379	0.0045	0.2181	0.30
12.48	2.38	1.1424	0.0045	0.2182	0.30
12.50	2.38	1.1469	0.0045	0.2184	0.30
12.52	2.39	1.1515	0.0045	0.2186	0.30
12.54	2.39	1.1560	0.0045	0.2187	0.30
12.57	2.40	1.1605	0.0045	0.2189	0.30
12.59	2.40	1.1651	0.0045	0.2191	0.30
12.61	2.41	1.1696	0.0045	0.2192	0.30
12.63	2.41	1.1741	0.0045	0.2194	0.30
12.65	2.42	1.1787	0.0045	0.2195	0.30
12.67	2.43	1.1832	0.0046	0.2197	0.30
12.69	2.43	1.1878	0.0046	0.2199	0.30
12.71	2.44	1.1923	0.0046	0.2200	0.30
12.73	2.44	1.1969	0.0046	0.2202	0.30
12.75	2.45	1.2015	0.0046	0.2203	0.30
12.77	2.45	1.2060	0.0046	0.2205	0.30
12.79	2.46	1.2106	0.0046	0.2207	0.30
12.81	2.47	1.2152	0.0046	0.2208	0.30
12.83	2.47	1.2197	0.0046	0.2210	0.30
12.85	2.48	1.2243	0.0046	0.2211	0.30
12.88	2.48	1.2289	0.0046	0.2213	0.30
12.90	2.49	1.2335	0.0046	0.2214	0.30
12.92	2.49	1.2381	0.0046	0.2216	0.30
12.94	2.50	1.2426	0.0046	0.2217	0.30
12.96	2.50	1.2472	0.0046	0.2219	0.30
12.98	2.51	1.2518	0.0046	0.2220	0.30
13.00	2.52	1.2564	0.0046	0.2222	0.30
23.52	3.38	1.9957	0.0006	0.0299	0.04
23.54	3.38	1.9963	0.0006	0.0300	0.04
23.56	3.39	1.9969	0.0006	0.0300	0.04
23.58	3.39	1.9975	0.0006	0.0300	0.04
23.60	3.39	1.9982	0.0006	0.0300	0.04
23.62	3.39	1.9988	0.0006	0.0300	0.04
23.64	3.39	1.9994	0.0006	0.0300	0.04
23.66	3.39	2.0000	0.0006	0.0300	0.04
23.68	3.39	2.0006	0.0006	0.0300	0.04
23.70	3.39	2.0012	0.0006	0.0300	0.04
23.73	3.39	2.0019	0.0006	0.0300	0.04
23.75	3.39	2.0025	0.0006	0.0300	0.04
23.77	3.39	2.0031	0.0006	0.0300	0.04
23.79	3.39	2.0037	0.0006	0.0300	0.04

23.81	3.39	2.0043	0.0006	0.0300	0.04
23.83	3.39	2.0050	0.0006	0.0300	0.04
23.85	3.39	2.0056	0.0006	0.0300	0.04
23.87	3.40	2.0062	0.0006	0.0300	0.04
23.89	3.40	2.0068	0.0006	0.0300	0.04
23.91	3.40	2.0074	0.0006	0.0300	0.04
23.93	3.40	2.0080	0.0006	0.0300	0.04
23.95	3.40	2.0087	0.0006	0.0300	0.04
23.97	3.40	2.0093	0.0006	0.0300	0.04
23.99	3.40	2.0099	0.0002	0.0300	0.04
24.01	3.40	2.0101	0.0000	0.0293	0.04
24.04	3.40	2.0101	0.0000	0.0278	0.04
24.06	3.40	2.0101	0.0000	0.0254	0.03
24.08	3.40	2.0101	0.0000	0.0221	0.03
24.10	3.40	2.0101	0.0000	0.0178	0.02
24.12	3.40	2.0101	0.0000	0.0137	0.02
24.14	3.40	2.0101	0.0000	0.0102	0.01
24.16	3.40	2.0101	0.0000	0.0071	0.01
24.18	3.40	2.0101	0.0000	0.0046	0.01
24.20	3.40	2.0101	0.0000	0.0027	0.00
24.22	3.40	2.0101	0.0000	0.0013	0.00
24.24	3.40	2.0101	0.0000	0.0004	0.00
24.26	3.40	2.0101	0.0000	0.0001	0.00
24.28	3.40	2.0101	0.0000	0.0000	0.00
24.30	3.40	2.0101	0.0000	0.0000	0.00
24.32	0.00	0.0000	0.0000	0.0000	0.00

OUTPUT SUMMARY:

==========

TOTAL RUNOFF DEPTH = 2.01 IN. TIME TO PEAK = 11.984 HOURS

INITIAL ABSTRACTION = .326 IN. RUNOFF VOLUME CHECK = 2.014 IN.

PEAK FLOW = .86 CFS

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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) 3.47
2. CHANNEL SLOPE .5
3. BOTTOM WIDTH (FT) 8
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 1.25

VELOCITY	DEPTH	D50	S.F. BTM	S.F. BANK
4.838	.088	1.4982	1.029	1.25

RUN COMPLETE

Ok

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) 3.47
2. CHANNEL SLOPE .1
3. BOTTOM WIDTH (FT) 8
4. SIDE SLOPE .5
5. PHI ANGLE 41
6. SPECIFIC GRAVITY OF RIPRAP 2.65

DESIRED SAFETY FACTOR FOR CHANNEL BOTTOM 1.0
DESIRED SAFETY FACTOR FOR CHANNEL BANKS 1.1

VELOCITY	DEPTH	D50	S.F. BTM	S.F. BANK
3.546	.119	.2507	1.387	1.1

RUN COMPLETE

Ok

Exhibit N
Channel 1

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) 6.53
2. CHANNEL SLOPE .5
3. BOTTOM WIDTH (FT) 10
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 1.25

VELOCITY	DEPTH	D50	S.F. BTM	S.F. BANK
5.54	.115	1.9677	1.029	1.25

RUN COMPLETE

Ok

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) 6.53
2. CHANNEL SLOPE .1
3. BOTTOM WIDTH (FT) 10
4. SIDE SLOPE .5
5. PHI ANGLE 41
6. SPECIFIC GRAVITY OF RIPRAP 2.65

DESIRED SAFETY FACTOR FOR CHANNEL BOTTOM 1.0
DESIRED SAFETY FACTOR FOR CHANNEL BANKS 1.1

VELOCITY	DEPTH	D50	S.F. BTM	S.F. BANK
4.059	.156	.3292	1.387	1.1

RUN COMPLETE

Ok

Exhibit O
Channel 2A

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) .86
2. CHANNEL SLOPE .5
3. BOTTOM WIDTH (FT) 4
4. SIDE SLOPE .5
5. PHI ANGLE 41
6. SPECIFIC GRAVITY OF RIPRAP 2.65

DESIRED SAFETY FACTOR FOR CHANNEL BOTTOM 1.0
DESIRED SAFETY FACTOR FOR CHANNEL BANKS 1.25

VELOCITY	DEPTH	D50	S.F. BTM	S.F. BANK
3.778	.055	1.0228	1.041	1.25

RUN COMPLETE

Ok

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) .86
2. CHANNEL SLOPE .1
3. BOTTOM WIDTH (FT) 4
4. SIDE SLOPE .5
5. PHI ANGLE 41
6. SPECIFIC GRAVITY OF RIPRAP 2.65

DESIRED SAFETY FACTOR FOR CHANNEL BOTTOM 1.0
DESIRED SAFETY FACTOR FOR CHANNEL BANKS 1.1

VELOCITY	DEPTH	D50	S.F. BTM	S.F. BANK	
2.79	.074	.1568	1.387	1.1	328

RUN COMPLETE

Ok

Exhibit P
Channel 2B

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) 8.58
2. CHANNEL SLOPE .2
3. BOTTOM WIDTH (FT) 6
4. SIDE SLOPE .333
5. PHI ANGLE 41
6. SPECIFIC GRAVITY OF RIPRAP 2.65

DESIRED SAFETY FACTOR FOR CHANNEL BOTTOM 1.0
DESIRED SAFETY FACTOR FOR CHANNEL BANKS 1.2

VELOCITY	DEPTH	D50	S.F. BTM	S.F. BANK
5.975	.216	.7307	1.003	1.2

RUN COMPLETE

Ok

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) 8.58
2. CHANNEL SLOPE .1
3. BOTTOM WIDTH (FT) 6
4. SIDE SLOPE .333
5. PHI ANGLE 41
6. SPECIFIC GRAVITY OF RIPRAP 2.65

DESIRED SAFETY FACTOR FOR CHANNEL BOTTOM 1.0
DESIRED SAFETY FACTOR FOR CHANNEL BANKS 1.2

VELOCITY	DEPTH	D50	S.F. BTM	S.F. BANK
5.089	.25	.4054	1.107	1.2

RUN COMPLETE

Ok

Exhibit Q
Culvert Replacement
Channels

DEER CREEK MINE
WASTE ROCK SITE
ROAD ALIGNMENT
CHANNEL CHANGE

AMENDMENT TO
APPROVED Mining & Reclamation Pla
Approved, Division of Oil, Gas & Mining
by T. Munson date 3/8/89

WATERSHED PARAMETERS (EXHIBIT A)

Distribution	SCS Type II
Design Storm Event	100-year, 24-hour
Rainfall Depth	3.4 inches
Area	0.2813 sq. miles
Curve Number	86
Watershed Length	4,448 feet
Watershed Slope	38.7%
Time of Concentration	0.2298 hrs.
Peak Flow (Table 1)	339 cfs

CHANNEL PARAMETERS (DRWG. DS1098A, SHEET 1 & 2)

Channel Slope	3.8%
Bottom Width	5 ft.
Side Slope	0.5 (2:1)
Manning's N	.025
Discharge	339 cfs
Flow Depth	2.34 ft.
Velocity	14.98 fps

Although the calculations indicate an erosive velocity, a field inspection by Division Hydrologist Tom Munson (3/6/89) verified the conclusion that the realigned channel is no more susceptible to erosional damage than is the natural channel. Therefore, it is proposed that no additional channel protection be installed.

The area will be inspected by UP&L personnel and Division Inspectors to insure the proposed measures are adequate.

DEER CREEK COAL MINE
EMERY COUNTY, UTAH

WASTE ROCK STORAGE FACILITY
STORM DRAINAGE AREAS

UTAH POWER & LIGHT COMPANY
MINING DIVISION

DRAWN BY:	CHECKED BY:	DATE:
K J L		8-31-88

SCALE	SHEET NO.	DRAWING NUMBER
AS SHOWN	1 of 1	Exhibit R

TABLE 1

AMENDMENT TO
APPROVED Mining & Reclamation Plan
Approved, Division of Oil, Gas & Mining

STORM RUNOFF DETERMINATION
FOR
DEER CREEK

by T. Munson date 3/28/89

INPUT SUMMARY:

DISTRIBUTION = SCS TYPE II
RAINFALL DEPTH = 3.4 INCHES
STORM DURATION = 24 HOURS
RUNOFF AREA = .2813 SQ. MILES
RUNOFF CURVE NO. = 86
TIME OF CONCENTRATION = .2298 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
0.03	0.00	0.0000	0.0000	0.0000	0.00
11.70	1.49	0.4851	0.0531	1.0103	183.40
11.74	1.57	0.5382	0.0545	1.1731	212.95
11.77	1.65	0.5927	0.0558	1.3197	239.58
11.80	1.73	0.6484	0.0570	1.4485	262.95
11.83	1.81	0.7054	0.0581	1.5576	282.76
11.86	1.89	0.7635	0.0591	1.6457	298.74
11.89	1.97	0.8226	0.0601	1.7113	310.65
11.92	2.04	0.8827	0.0610	1.7619	319.83
11.95	2.12	0.9437	0.0618	1.8063	327.90
11.98	2.20	1.0055	0.0445	1.8472	335.33
12.01	2.26	1.0500	0.0119	1.8674	338.98
12.04	2.27	1.0619	0.0119	1.8344	333.00
12.07	2.29	1.0739	0.0120	1.7479	317.29
12.10	2.30	1.0858	0.0120	1.6075	291.82
12.13	2.32	1.0978	0.0120	1.4130	256.50
12.16	2.33	1.1098	0.0120	1.1921	216.40
12.19	2.35	1.1218	0.0121	0.9969	180.96
24.33	3.40	2.0101	0.0000	0.0013	0.23
24.36	3.40	2.0101	0.0000	0.0004	0.07
24.39	3.40	2.0101	0.0000	0.0001	0.01
24.42	3.40	2.0101	0.0000	0.0000	0.00
24.45	3.40	2.0101	0.0000	0.0000	0.00
24.48	0.00	0.0000	0.0000	0.0000	0.00

OUTPUT SUMMARY:

TOTAL RUNOFF DEPTH = 2.01 IN.
INITIAL ABSTRACTION = .326 IN.
PEAK FLOW = 339.042 CFS
TIME TO PEAK = 12.007 HOURS
RUNOFF VOLUME CHECK = 2.014 IN.

Section IV DETENTION BASIN STABILITY ANALYSIS DEER CREEK WASTE ROCK STORAGE FACILITY

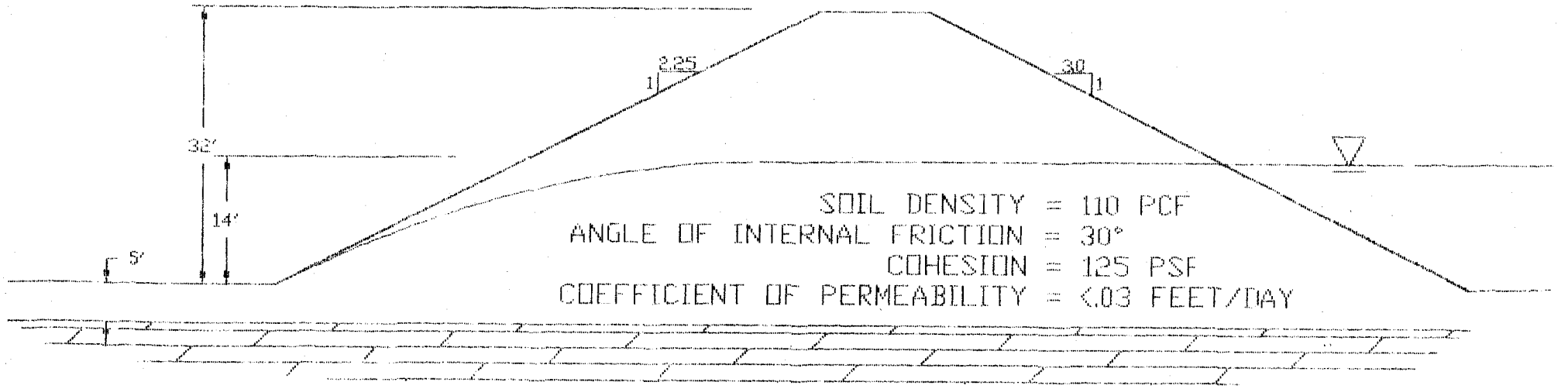
The operating plan for the Deer Creek Waste Rock Storage Facility calls for construction of two detention basins to collect and retain the surface runoff from the disturbed areas. Both basins are designed to provide total containment of the collected water and therefore no outlets or spillways are provided. To ensure an adequate safety factor against over topping the basins, the design storage was taken as twice the anticipated runoff from a 100 year, 24 hour storm event. (See the Hydrological Analysis portion of this application for complete design data)

Basin #1 is located in the west end of the project site and will be constructed by excavating approximately six feet of soil material. The resulting depression will have the required storage capacity with the top of water at or below the natural ground line. Because no dam will be constructed, no stability analysis is required. (Refer to Drawings CM 10778-DR and DS 1013E, Map Packet 4-5 and 4-9 respectively)

Basin #2 is located along the southern berm in area 2. The basin will be formed by excavating some soil and using the perimeter berm as a dam to achieve the required storage volume. The dam will be constructed to ensure that the safety factor against failure is 1.5 or more. The critical condition for analysis is when the basin is full and there is steady seepage through the earth dam. Because there is no outlet, the rapid draw down condition does not apply. (Refer to Drawings CM 10779-DR and DS 1014E, Map Packets 4-6 and 4-10 respectively)

The method used to analyze the stability of the earth slopes was the Simplified Bishop Method of Slices, from T. William Lambe and Robert V. Whitmore, Soil Mechanics, 1969, Wiley and Sons. The drawing on the following page gives the conditions assumed for analysis.

The soil strength parameters used for design are representative of the soil available for construction at the project site. Before actual construction of Basin #2 (in approximately 15 years) tests will be performed to determine if the quantity and quality of these materials is adequate for the construction of the dam. This data will be provided to the Division at least 120 days prior to construction. If sufficient material with these strength parameters or better is not available, the design will be recalculated and the slopes changed to insure the required safety factor is obtained.



TYPICAL CROSS SECTION OF EARTH DAM, BASIN #2

DEER CREEK MINE
WASTE ROCK STORAGE FACILITY
RECLAMATION COST SUMMARY

ITEM	DESCRIPTION	QUANTITIES	COST	CONSTRUCTION DAYS
1-Area #1				
Soil Placement	Excavate, Haul and Place	8,107 cubic yards	21,450	6
Drainage Work	Construct Disturbed Ditch #1 D, #2 D	1,430 feet	9,060	5
Revegetation	Plant and Place Mulch	6.7 acres	15,649	5
Total			46,159	16
2-Sediment Basin Area #1				
Soil Placement	Backfill and Spread Topsoil	3,630 cubic yards	6,780	4
Drainage Work	Install Silt Fence Filter	550 feet	6,296	4
Revegetation	Plant and Spread Mulch	3 acres	7,539	3
Total			20,615	11
3-Areas #2				
Soil Placement	Excavate, Haul and Place Topsoil	23,958 cubic feet	68,208	16
Drainage Work	Construct Disturbed Ditch #3 D, #4 D	1500 feet	10,552	6
Revegetation	Plant and Spread Mulch	19 acres	37,610	15
Total			116,370	37
4-Sediment Basin Area #2				
Soil Placement	Backfill and Spread Topsoil	2,300 cubic yards	8,475	5
Drainage Work	Install Silt Fence Filter	300 feet	2,848	2
Revegetation	Plant and Spread Mulch	0.8 acres	2,204	1
Total			13,527	8

ITEM	DESCRIPTION	QUANTITIES	COST	CONSTRUCTION DAYS
5-Access Road				
Soil Placement	Backfill and Spread Topsoil	5,682 cubic yards	23,674	7
Drainage Work	Install Rip-Rap Ditch Crossings	4 ea.	30,240	8
	Install Silt Fence	2,000 feet		
Fence Removal	Removal of Perimeter Fence	9,500 feet	7,386	6
Revegetation	Plant and Spread Mulch	1.8 acres	3,666	3
Total			64,966	24
6-10 Year Bonding Period				
Maintenance	Maintenance of ditches, silt fence and berms. Backfill rillies and gullies Seed and Mulch placement		144,820	100
7-Supplemental Shrub				
Stocking	Plant containerized shrubs (tubepak) Place fertilizer tablet Water plants		5,707	5
Reclamation Subtotal			412,164	201
Contingency		10%	4,122	
Escalation Factor		2.3%	958	
BOND TOTAL			$ 417,244	

DEER CREEK MINE
RECLAMATION COSTS

1- Area #1

Acreage	Top area	4.2 acres
	Slope area	2.5 acres
Quantity of Soil		8,107 cubic yards
Disturbed Ditch #1 D, #2 D		1430 lineal feet

A-Soil Placement

Construction time 6 days

-Equipment-

1 ea	215 Hoe	704/day	4,224
3 ea	12 cy End Dump Trucks	344/day	2,064
1 ea	D6 Dozer	564/day	3,384
1 ea	16 BLade	265/day	1,590
1 ea	Pickup	56/day	366
			11,598

-Crew-

1	Foreman	280/day	1,680
3 ea	Truck Drivers	202/day	3,636
3 ea	Operators	252/day	4,536
			9,852
			21,450

B-Drainage Work

Estimated Construction Time 5 days

-Equipment-

1 ea	225 Hoe	704/day	3,520
1 ea	Pickup	56/day	280
			3,800

-Crew-

1 ea	Foreman	280/day	1,400
1 ea	Operator	252/day	1,260
			2,660

-Material-

Rock Rip-Rap	325 cubic yards x 8.00 =	2,600
		$ 9,060

C-Revegetation

Hand broadcast seed mixture
Hay mulch on Top, Excelsior Blanket on Slopes
Estimated Construction time 5 days

-Equipment-

3/4 Ton Pickup	56/day	280
2 Ton Flat Bed Truck	107/day	535
		815

-Crew-

1 ea	Foreman	280/day	1,400
5 ea	Laborer	197/day	985
			2,385

-Material-

Seed		
	850/acre x 6.7 acres	5,695
Mulch		
	120/acre x 4.2 acres	504
Excelsior Blanket		
	2500/acre x 2.5 acres	6,250
		12,449
		15,649
Item Total		$46,159

2- Sediment Basin #1

Acreage 3 acres

Quantity of Soil = 3,630 cubic yards

A-Soil Placement

Construction Time = 4 days

-Equipment-

D8 Dozer	1,107/day	4,428
Pickup	56/day	224
		4,652

-Crew-

1 ea	Operator	252/day	1,008
1 ea	Foreman	280/day	1,120
			2,128
			6,780

B-Drainage Work

Install 550 feet of silt fence

Construction time 4 days

-Equipment-

Pickup	56/day	224
		224

-Crew-

1 ea	Foreman	280/day	1,120
4 ea	Laborers	197/day	3,152
			4,272

-Material-

Silt Fence	550 feet 6 rolls x 200	1,800
		1,800
		6,296

C- Revegetation

Hand broadcast seed
Hay mulch on Flat Area
Excelsior Blanket on Slopes
Construction time = 3 days

-Equipment-

	3/4 Ton Pickup	56/day	224
	2 Ton Flatbed	107/day	321
			545

-Crew-

1 ea	Foreman	280/day	840
4 Ea	Laborers	197/day	2,364
			3,204

-Material-

Seed		
	850/acre x 3 acres	2,550
Hay Mulch		
	120/acre x 2 acres	240
Exclesior Blanket		
	2500/acre x 1 acre	2,500
		5,290
		9,039
Item Total		$22,115

3- Area #2

Acreage	Top Area = 15	Slope = 4
Quantity of Soil	23,958 cubic yards	
Disturbed Ditches	1,500 feet	

A- Soil Placement

Construction time 16 days

-Equipment-

1 ea	225 Hoe	704/day	11,264
3 ea	12 cy Truck	344/day	16,512
1 ea	D6 Dozer	564/day	9,024
1 ea	16G Blade	265/day	4,240
1 ea	3/4 Ton Pickup	56/day	896
			41,936

-Crew-

1 ea	Foreman	280/day	4,480
3 ea	Operators	252/day	12,096
3 ea	Truck Drivers	202/day	9,696
			26,272
			68,208

B-Drainage Work

Construction time 6 days

-Equipment-

1 ea	225 Hoe	704/day	4,224
1 ea	3/4 Ton Pickup	56/day	336
			4,560

-Crew-

1 ea	Foreman	280/day	1,680
1 ea	Operator	252/day	1,512
			3,192

-Material-

	Rock Rip-Rap	350 cubic yards x 8	2,800
			2,800
			10,552

C-Vegetation

Hand broadcast seed
Construction time 15 days
Use Hay Mulch on Flat Area
Use Excelsior Blanket on Slopes

-Equipment-

1 ea	3/4 Ton Pickup	56/day	840
1 ea	2 Ton Flatbed	107/day	1,605
			2,445

-Crew-

1 ea	Foreman	280/day	4,200
5 ea	Laborer	197/day	2,955
			7,155

-Material-

Seed		
	850/acre x 19 acres	16,150
Hay Mulch		
	120/acre x 15.5	1,860
Excelsior Blanket		
	2500/acre x 4	10,000
		28,010
		37,610
Item Total		$116,370

4- Area #2 Sediment Basin
Acreage = 0.8 acre
Quantity of Soil = 2,300 cubic yards

A-Soil Placement
Construction time 5 days

-Equipment-

	D8 Dozer	1,107/day	5,535
	Pickup	56/day	280
			5,815

-Crew-

1 ea	Operator	252/day	1,260
1 ea	Foreman	280/day	1,400
			2,660
			8,475

B-Drainage Work
Install 300 feet of Silt Fence
Construction time 2 days

-Equipment-

	3/4 Ton Pickup	56/day	112
			112

-Crew-

1 ea	Foreman	280/day	560
4 ea	Laborer	197/day	1,576
			2,136

-Material-

Silt Fence		
300	3 ea roll x 200	600
		600
		2,848

C-Revegetation

Hand broadcast seed
Hay mulch
Construction time 1 day

		-Equipment-	
	3/4 Ton Pickup	56/day	56
	2Ton Flat Bed	103/day	107
			163
		-Crew-	
1 ea	Foreman	280/day	280
5 ea	Laborer	197/day	985
			1,265
		-Material-	
	Seed		
	850/acre x .8 acre		680
	Mulch		
	120/acre x .8 acre		96
			776
			2,204
	Item Total		13,527

5- Access Road

Acreage = 1.8 acres
Quantity of Soil = 2,178
Quantity of Backfill = 3,504
Permitter Fence = 9,500 feet

A-Soil and Backfill Placement

Construction time 7 days

-Equipment-

1 ea	225 Hoe	704/day	4,928
1 ea	D6 Dozer	564/day	3,948
1 ea	16G Blade	265/day	1,855
1 ea	3/4 Ton Pickup	56/day	3,927
			14,658

-Crew-

1 ea	Foreman	280/day	1,960
4 ea	Operators	252/day	7,056
			9,016
			23,674

B-Drainage

Install Silt Fence = 2,000 feet
Construct rip-rap drainage ditches 4 ea
Construction time 8 days

-Equipment-

1 ea	225 Hoe	704/day	5,632
1 ea	3/4 Ton Pickup	56/day	448
1 ea	2 Ton Flat Bed	107/day	856
1 ea	12 Dump Truck	344/day	2,752
			9,688

-Crew-

1 ea	Foreman	280/day	2,240
2 ea	Operator	252/day	4,032
5 ea	Laborer	197/day	7,880
			14,152

-Material-

Silt Fence	20 rolls x 200	4,000
Rip-Rap	300 cy x 8	2,400
		6,400
		30,240

C-Fence Removal

Remove 9,500 feet of fence
Construction time 6 days

-Equipment-

1 ea	3/4 Ton Pickup	56/day	336
4 ea	2 Ton Truck	107/day	642
			978

-Crew-

1 ea	Foreman	280/day	1,680
4 ea	Laborer	197/day	4,728
			6,408
			7,386

D-Revegetation

Hand broadcast seed
Hay mulch on reclaimed areas
Construction time 3 days

-Equipment-

3/4 Ton Pickup	56/day	168
2 Ton Pickup	107/day	321
		489

-Crew-

1 ea	Foreman	280/day	840
5 ea	Laborer	197/day	591
			1,431

- Material -

Seed	850/acre x 1.8 acres	1,530
Mulch	120/acre x 1.8 acres	216
		1,746
		3,666
Item Total		64,966

6- 10 Year Bonding Period - Maintenance

Maintenance of ditches, silt fence and berms
Backfilling rillies and gullies
Seeding and Mulching
Vegetation Monitoring

Estimate 10 days/year X 10 years = 100 days

- Labor -

1	Forman	280/day	28,000
1	Operator	252/day	25,200
1	Laborer	197/day	19,700
			72,900

- Equipment -

Pickup	56/day	5,600
225 Hoe	704/day x 50 days	35,200
12cy Dump Truck	394/day x 50 days	17,200
16 Blade	265/day x 50 days	13,250
		71,250

- Material -

Silt Fence	1 roll	200
Seed	1 acre x 350/acre	350
Hay mulch	1 acre x 120/acre	120
		670
Item Total		$144,820

7- Supplemental Shrub Stocking

		- Labor -	
1	Forman	280/day	1,400
2	Laborers	197/day	985
			2,385
		- Equipment -	
	Pickup	56/day	280
			280
		- Material -	
	Shrubs	2880 plants	2,592
	Fertilizer Tabs	6 cases	450
			3,042
	Item Total		5,707

Section VI WASTE MATERIAL PILE - SLOPE STABILITY ANALYSIS

The waste material to be deposited in the Deer Creek Waste Rock Storage Facility will be placed in compacted lifts of two feet with side slopes of 2 h to 1 v. The stability analysis of these slopes is based on the following soil strength parameters:

Density - 98.2 pounds per cubic foot

Angle of Internal Friction - 40.5 degrees

Cohesion - 0

(See Soils Report, Exhibit V)

Because the material is free draining and adequate drainage will be provided, it is assumed that no portion of the slope will be saturated with ground water.

The safety factor for this slope is 1.80 and is taken from figure 1.4, page 15, FACTOR OF SAFETY CHARTS FOR ESTIMATING THE STABILITY OF SATURATED AND UNSATURATED TAILINGS POND EMBANKMENTS, D.R. Tesavik and P.C. McWilliams, Report of Investigations 8564, Bureau of Mines, United States Department of the Interior.

The foregoing analysis is based on lab tests performed on a sample of the waste material. This sample was obtained from the existing waste material piles on the current waste disposal site. Because the material in the waste piles is not homogeneous, samples were taken from eight different locations representing as many different types of material as were present. These samples were mixed to achieve one total sample of approximately 60 pounds. This method of gathering accurately represents the typical material to be found on the waste pile for the following reasons:

First, as the waste material is transported from underground to the waste site, it is loaded, dumped and reloaded at least three times, creating a blended material.

Secondly, the material is deposited in two foot lifts, where it is spread out and compacted in place. The thickness of each layer is small in comparison to the total height of the waste pile.

Because there is a possibility that the type of material being deposited may change, that is, the soil strength parameters may change due to grain size, clay content, etc., Utah Power and Light will sample the waste material every five years to determine the strength of the material. If it is found that the strength of the material has decreased, a stability analysis will be performed to determine the proper slope for construction to maintain the minimum required factor of safety.

ROLLINS, BROWN and GUNNELL, INC. professional engineers

March 15, 1988

Tom Faucheux
Utah Power and Light Company
Mining Division
P.O. Box 310
Huntington, Utah 84528

Dear Mr. Faucheux:

We have completed the requested laboratory testing for the soil sample submitted to our office as per P.O. JS-301606. The results are enclosed herein on the appropriate figures. The soil moisture density relationship resulted in a maximum density of 98.2 pcf at an optimum moisture content of 10.7 percent. The results of the grain-size analysis indicate the following:

Sieve Size	% Passing
3"	100
2"	89.9
1"	78.9
3/4"	71.6
1/2"	66.0
3/8"	61.9
No. 4	53.3
No. 10	39.4
No. 20	32.1
No. 50	23.6
No. 100	19.8
No. 200	16.4

The triaxial shear test envelope indicates a friction angle of 40.5 degrees and a cohesion of 0 psi.

If you have any further questions, please notify us.

Yours truly,

ROLLINS, BROWN AND GUNNELL, INC.

Ralph L. Rollins

Ralph L. Rollins

SLS/sly

1455 WEST 820 NORTH
POST OFFICE BOX 711
PROVO, UTAH 84603

PROVO 374-5771
SALT LAKE CITY 521-5771
AREA CODE 801

Exhibit V

ROLLINS, BROWN and GUNNELL, INC. professional engineers

1435 WEST 820 NORTH
POST OFFICE BOX 711
PROVO, UTAH 84603
(801) 374-5771 Provo
(801) 521-5771 SLC

SOIL MOISTURE DENSITY RELATIONSHIP

Project Utah Power and Light
Project no. _____
Feature _____
Test date March 4, 1988
Job technician S. Ahmad
Mailing date March 11, 1988

ASTM D 1557-78

Maximum dry density = 98.2 lbs/ft³

Optimum moisture = 10.7 %

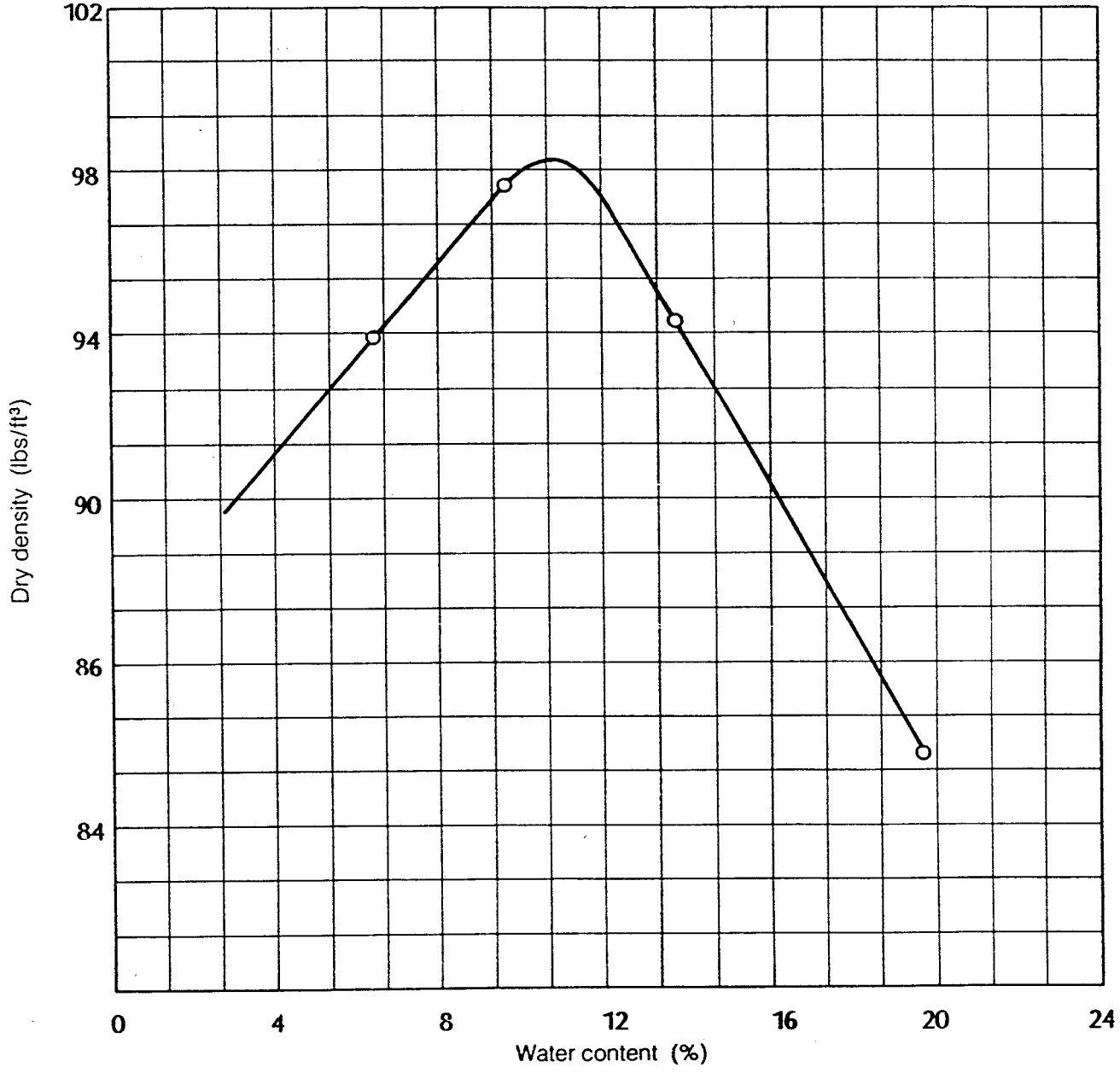
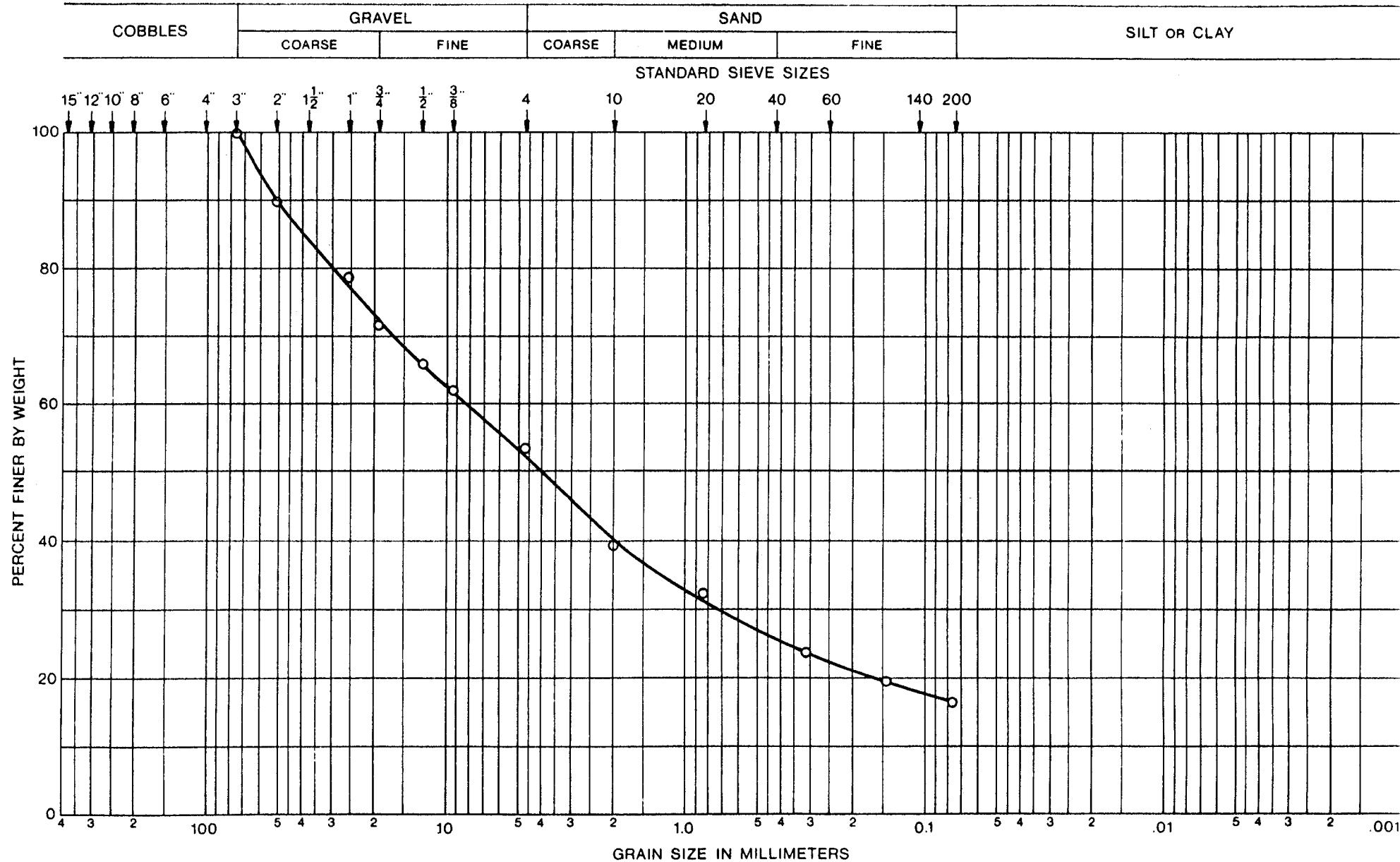


Exhibit A-2

Exhibit A-3



ROLLINS, BROWN AND GUNNELL, INC.
PROFESSIONAL ENGINEERS

GRAIN SIZE DISTRIBUTION CURVE

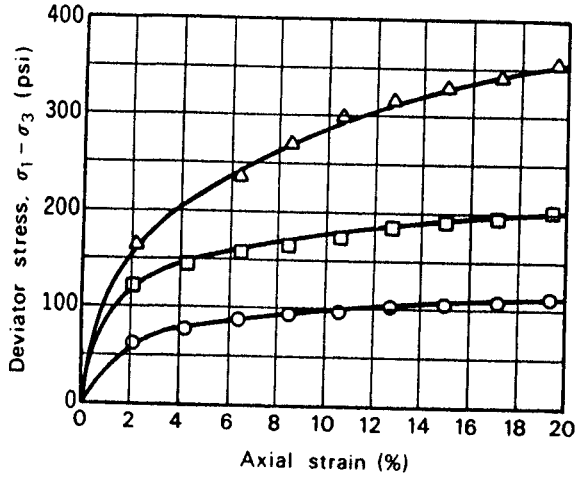
Project: **Utah Power & Light**

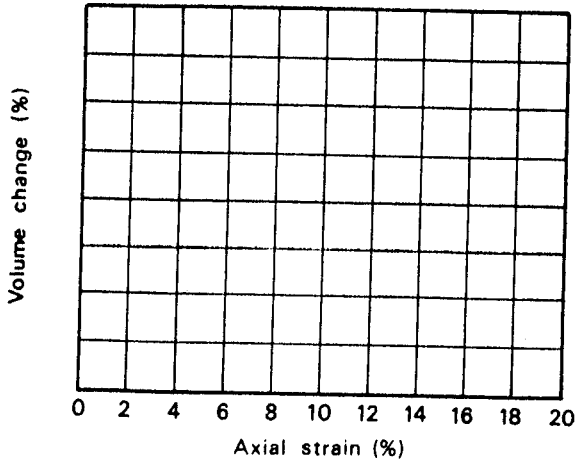
Location:

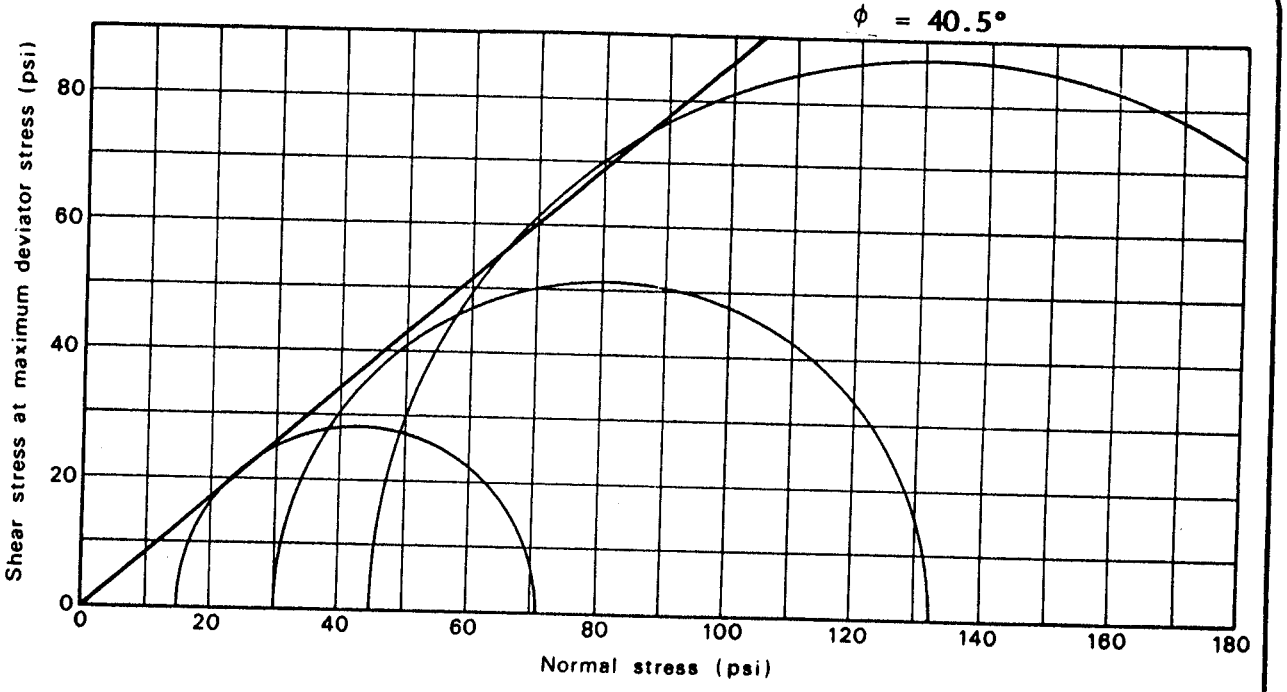
Sample No. 1

FIGURE NO.

Exhibit A-4







Test no. or symbol	Boring no. or depth	Sample data		Degree of saturation (%)	Confining pressure (psi)	Maximum deviator stress (psi)	Strength values at failure		Sample size, L/D (inches)	Strain rate (inches/minute)
		Dry density (pcf)	Moisture content (%)				Friction angle ϕ (degrees)	Cohesion (c/psi)		
O		98	10.7		30	111				
□		97.7	10.7		60	205	40.5	0	2.8/ 1.32	.0024
△		98.1	10.7		90					

ROLLINS, BROWN AND GUNNELL, INC.
PROFESSIONAL ENGINEERS

TRIAXIAL SHEAR TEST
Project: Utah Power and Light

HOLE NO.
DEPTH:

FIGURE NO.

SECTION VII GEOTECHNICAL INVESTIGATION

The proposed site for the Deer Creek Waste Rock Storage Facility is adjacent to an evaporation pond which is owned by Utah Power and Light Company and was built in conjunction with the Huntington Power Plant in 1973. A consultant Woodward-Clevenger and Associates, Inc was commissioned to perform a subsurface investigation for the construction of the evaporation pond. Their report included 17 test holes and 36 test pits in and around the site of the present pond. Two of the test holes are within the boundaries of the proposed waste storage facility and three of the test pits are either inside or immediately adjacent to the site.

The soil in the test holes, numbers TH66 and TH67, was classified as a clay, stiff to very still (CL). A soil strength test of a composite CL sample was performed and resulted in an angle of internal friction of 15 degrees and cohesion of 6000 pounds per square foot. Although this sample was not within the proposed waste rock site, it is believed that it is representative of the CL materials that are predominant in the proposed site. The data for these two holes is contained in Chapter VI, Hydrology, Page 6-4A - Page 6-29.

No ground water was found in the two holes within the proposed site. Both holes extend through the soil layer and into the bedrock. Because of the nature of the soil (clay) and the topography, it is not anticipated that the soil layer will become saturated in the area of the proposed site.

Several factors apply to the determination of the ability of the soil on the site to support the intended load. The soil itself is a cohesive soil which is subject to both immediate settlement and consolidation settlement. The depth of the soil is important relative to the size of the area to be loaded. The two test holes had soil depths of six and seven feet, which is very small in comparison to the width of the disposal site. The rate of loading will be very gradual, amounting to less than one, two foot lift of material per month. This rate of loading will provide for consolidation to occur as the height of the storage pile is increased, greatly adding to the stability of the soil.

Taking the above factors into consideration, it is believed that the soil present in the proposed site is adequate to support the intended waste rock storage facility. Some settlement will occur within the soil layer but will not adversely impact the stability of the waste pile.

Utah Power and Light Company proposes to conduct an additional geotechnical investigation on the site which will provide more data on the soils from within the site to verify the earlier test. The new investigation will consist of test holes to determine the soil character, depth of soil layer, presence of groundwater and permeability. Utah Power and Light Company will provide the results of this investigation prior to construction of the facility.

Pages 4-33 through 4-52 comprise the geotechnical investigation referred to at the bottom of page 4-31.

ROLLINS, BROWN AND GUNNELL, INC.
1435 WEST 820 NORTH
PROVO, UTAH 84601
(801) 374-5771

WASTE ROCK STORAGE FACILITY

Deer Creek Coal Mine

Utah Power & Light Co.
Emery County

August 1988

Soil & Foundation Investigation

WASTE ROCK STORAGE FACILITY

Deer Creek Coal Mine

Utah Power & Light Co
Emery County

Soil & Foundation Investigation

ROLLINS, BROWN AND GUNNELL, INC.

Professional Engineers

ROLLINS,
BROWN AND
GUNNELL,
INC.
1435 WEST 820 NORTH
PROVO, UTAH 84601
(801) 374-5771

August 9, 1988

Utah Power & Light Company
Mining Division
P.O. Box 310
Huntington, Utah 84528

Attn: Greg Cowan

Gentlemen:

In accordance with your request, we have completed a geotechnical investigation for the proposed waste rock storage facility at the Deer Creek Coal Mine in Huntington Canyon, Utah. The primary purpose of the investigation was to define the characteristics of the subsurface material throughout the soil profile in the waste rock storage area and to determine the slopes at which the rock pile could be safely constructed. The work has been completed in accordance with a modified proposal submitted to your organization for the work and the results of the investigation along with recommendations for constructing the slopes are outlined in the following sections of this report.

The information contained in the report is discussed under the following headings: (1) Existing Site Conditions, (2) Subsurface Soil and Water Conditions, (3) Slope Stability Considerations, and (4) The Results of Field and Laboratory Tests.

1. EXISTING SITE CONDITIONS

The proposed waste rock storage facility is located on the northeast side of State Highway 31, approximately 6 miles west of Huntington, Utah. The general features of the site are presented in Figure No. 1. The areas are designated as Area No. 1 and Area No. 2 and it

will be noted that the vegetative cover throughout the area is sparse and that the topography has generally rolling characteristics. A storage reservoir constructed to serve the power plant is located immediately southwest of the rock storage site. The soils throughout the proposed site are residual materials formed from the weathering of the shale which exists throughout the area. The area where the storage facility will be located is virgin terrain and no man-made fill exists throughout the site.

An irrigated area is located on the bench land north of the site which could effect the ground water in the area. Although some drainage channels exist throughout the general area, no water conveyance facilities other than the Huntington River appear to exist at this site which would affect the ground water level in the area. It is possible that some seepage could occur into the area from the reservoir located southwest of the site. The proposed site is located in seismic zone 2 according to the Uniform Building Code.

Other than the information provided above, no environmental factors appear to exist at this site which would affect the performance of the proposed structure.

2. SUBSURFACE SOIL AND WATER CONDITIONS

The characteristics of the subsurface material throughout the proposed site were defined by drilling two test holes to depths of approximately eighty feet at the approximate locations as shown in Figure No. 1. It will be observed that Test Hole No. 1 was drilled in Area No. 1 while Test Hole No. 2 was drilled in Area No. 2. The logs for these two test holes are presented in Figures 2 and 3 and it will be noted that the overburden material extends to a depth of approximately 15 to 16 feet in both test holes. The overburden material in Test Hole No. 1 generally consisted of a sandy gravel in a matrix of clay while in Test Hole No. 2, the subsurface material consisted of a gray weathered shale. Below a depth of 15 to 16 feet, the subsurface material throughout the depth investigated consisted of a dark gray shale.

In the upper 15 to 16 feet of the soil profile, sampling was performed at three-foot intervals throughout the depth investigated. Both disturbed and undisturbed samples were obtained during the field investigations. Disturbed samples were obtained by driving a 2-inch, split-spoon sampling tube through a distance of 18 inches using a 140-pound weight dropped from a distance of 30 inches. The number of blows to drive the sampling

spoon through each 6 inches of penetration is shown on the boring logs. The sum of the last two blow counts which represents the number of blows to drive the sampling spoon through 12 inches is defined as the standard penetration value. The standard penetration value provides a reasonable indication of the in-place density of sandy material; however, it only provides an indication of the relative stiffness of cohesive material since the penetration resistance in materials of this type is a function of the moisture content.

The standard penetration test only provides a good indication of the in-place density of gravelly-type material when the spoon can be driven through a distance of 18 inches with a reasonably good core recovery. The results of the standard penetration test performed in the drill holes at this site indicate that the cohesive material is in a medium stiff condition.

Undisturbed samples are obtained in Test Hole No. 2 by pushing a 2.5 inch, thin-walled shelby tube into the subsurface material using the hydraulic pressure on the drill rig. The locations where the undisturbed samples were obtained are shown on the boring logs. The in-place density and the natural moisture content were determined for the cohesive material in Test Hole No. 2 and the results of these tests are shown on the boring logs. It will be observed that the in-place density varies about 108 pounds pcf to 117 pounds pcf. In-place unit weights of this magnitude is compatible with the density of these materials indicated by the standard penetration value.

Each sample obtained in the field was classified in the laboratory according to the Unified Soil Classification System. The symbol designating the soil type according to this system is presented on the boring logs. A description of the Unified Soil Classification System is presented in Figure No. 4 and the meaning of the various symbols shown on the boring logs can be obtained from this figure. It will be observed that the cohesive material in the upper portion of the soil profile is generally classified as a CL-1 or CL-2 type material. This means that the cohesive material throughout the development area is low plasticity silts and clays.

Continuous cores were obtained in the bedrock in both test holes. Parameters used to characterize the bedrock throughout each test hole included the percent core recovery and the rock quality designation. The rock quality designation gives the percent of core which has a length greater than 4 inches. It

will be observed from Figures 1 and 2 that the percent core recovery was nearly 100% in both test holes. The rock quality designation was a little less than this value and generally varied from about 85% to 100%. Based upon the percent core recovery and the rock quality designation, the shale throughout the proposed site would be considered as competent rock.

Field permeability tests were performed at approximately ten-foot intervals throughout the depth drilled in each test hole. The field permeability tests were performed in accordance with designation E-18 of the U.S. Bureau of Reclamation Earth Manual. The permeability coefficient expressed in feet per year is tabulated on the boring logs for the various test intervals. It will be observed that in Test Hole No. 1, the subsurface material was relatively impervious in the upper 43 feet of the soil profile. Below this depth, however, the permeability coefficient varied from 347 fpy to 763 fpy. In Test Hole No. 2, the subsurface material was relatively impervious in the upper 38 feet of the soil profile. The interval from 38 to 48 feet below the ground surface indicated a permeability coefficient of 263 fpy. Below this interval, the permeability coefficient for the shale material is relatively low. A 3-inch ID Perforated PVC Pipe was installed in each test hole.

During the subsurface investigation, ground water was encountered in Test Hole Nos. 1 and 2 at approximately 33 feet and 28 feet respectively below the existing ground surface. The equilibrium ground water level at the end of drilling is shown on the boring logs. It will be noted that the ground water level existed at about 23 feet below the ground surface in Test Hole No. 1 and about 7 feet below the ground surface in Test Hole No. 2. Following the completion of each test hole, the water in the drill hole was blown out several times using an air compressor. The ground water level recovered within a period of about two hours and reached the equilibrium position shown on the boring logs.

It is our opinion that water is entering the drill hole in Test Hole No. 1 below a depth of 43 feet while the ground water is entering the profile in Test Hole No. 2 at a depth between 38 and 48 feet below the ground surface. The source of the artesian flow in each of the Test Holes are not known as of the preparation of this report. Several possible sources exist where the water could be coming from. A possible source would be the Huntington River upstream from the site. The high water level in the pond south of the site is several feet below the ground surface at each of the drill holes and it is doubtful that this is the source of water in the drill holes. The topography rises

upward to the north and west of the site and the source of the water could come from this direction. An irrigated farm is located on a plateau north of the site and is a possible source of the underground flow.

3. SLOPE STABILITY CONSIDERATIONS

It is our understanding that the waste rock storage facility will eventually cover both Areas 1 and 2 as shown in Figure No. 1. The maximum height of the rock storage facility will be approximately 60 feet and it is anticipated that this material will have a gradation curve defined approximately by Figure No. 5. It is expected that the rock material will be placed in the fill in lifts not exceeding two feet and that it will be densified to at least 95% of the maximum laboratory density as determined by ASTM D-698. Triaxial shear tests were performed on the minus one-half inch fraction of the waste rock materials densified to nearly 100% of the maximum laboratory density as determined by ASTM D-1557 indicated this material had a friction angle of 40.5 degrees. Since the actual density of the in-place material will be somewhat lower than the density at which the triaxial shear test was performed, and inasmuch as it is known that the friction angle of granular materials decreases as the particle size increases, stability computations performed during this investigation used a friction angle of 36 degrees for the waste rock material.

As indicated earlier in this report, the soil profile where the waste rock facility will be located consists of 15 feet of weathered shale underlain by a competent shale material which extended to the depth at which the borings where terminated in the vicinity of 80 feet below the ground surface. The results of consolidated drained direct shear tests and consolidated drained triaxial tests indicate that the friction angle for the weathered shale varies from about 25 degrees to 32 degrees and that the cohesion varies from about 4 psi to 9 psi. The results of the shear test performed on the shale material underlying the surface cohesive zone indicates that the unconfined compressive strength of this material is in excess of 1600 pounds psi.

A computer model of Spencer's method known as UTexas 2 was used in performing the stability computations for this site. Spencer's method satisfies both force and moment equilibrium and is currently a standard method used by the Corps of Engineers. An effective stress analysis was used in performing the stability computations for the proposed waste storage facility. The analysis was first performed assuming that the piezometric line existed at the ground surface. The factor of safety for various

side slopes using a range in the shear strength parameters was performed for this condition. The results of the analysis are summarized below in Table No. 1.

Table 1

Summary of Stability Analysis
Utah Power & Light Waste Pile

Case	Rock Waste Properties		Foundation Properties		Slope	F.S.
UPL.1*	ϕ =36°	C=0	ϕ=26°	C=50psf	1.75H:1V	1.39
UPL.2*	ϕ =36°	C=0	ϕ=26°	C=50psf	2.0H:1V	1.46
UPL.3*	ϕ =36°	C=0	ϕ=26°	C=50psf	2.25H:1V	1.50
UPL.4*	ϕ =36°	C=0	ϕ=32°	C=0psf	1.75H:1V	1.48
UPL.5*	ϕ =36°	C=0	ϕ=32°	C=0psf	2.0H:1V	1.62
UPL.6*	ϕ =36°	C=0	ϕ=32°	C=0psf	2.25H:1V	
UPL.7**	ϕ =36°	C=0	ϕ=26°	C=50psf	2.0H:1V	1.46 1.62
UPL.8**	ϕ =36°	C=0	ϕ=26°	C=50psf	1.75H:1V	1.50

* water table at ground surface
** water level well below the surface of the shale

It will be observed from this table that a factor of safety of 1.5 is obtained for side slopes of 2 to 1 using a friction angle of 26 degrees and a cohesion of 50 psf for the foundation material. The critical failure surface along with the side slopes and the shear strength parameters are presented in Figure No. 6.

While it is possible that the piezometric surface may exist at the ground surface at some time throughout the life of this structure, it is our opinion that this assumption is unduly conservative and that the factor of safety should be determined for the rock storage facility assuming that the piezometric surface is well below the surface of the shale zone. A stability analysis has therefore been performed assuming the shear strength parameters shown in Figure No. 6 for side slopes of 2 horizontal, 1 vertical and 1.75 horizontal, 1 vertical. With the piezometric surface below the surface of the shale, the factor of safety for side slopes of 1.75 horizontal to 1 vertical is equal to 1.5. The critical failure surface for this condition is shown in Figure No. 6. It is our recommendation, therefore, that the waste rock storage facility be constructed using side slopes of 1.75 horizontal to 1 vertical. The top of the waste rock facility should be covered with compacted cohesive material and sloped so that surface drainage will readily occur.

4. THE RESULTS OF FIELD AND LABORATORY TESTS

Field and laboratory tests performed during this investigation to define the characteristics of the subsurface material included: standard penetration test, in-place permeability test, in-place unit weight, natural moisture content, Atterberg Limits, unconfined compressive strength, consolidated drain direct shear tests, and consolidated drain triaxial shear tests. The standard penetration test and the field permeability test have been previously discussed and the results of these tests are shown on the boring logs. A summary of all other test data performed during the investigation with the exception of the direct shear test and the triaxial shear test are presented in Table No. 2, Summary of Test Data.

It will be observed that the plastic index of the weathered shale material in the upper portion of the soil profile varies from about 17.5 to 21.1 and that this material classifies as a CL-2 type material according to the Unified Soil Classification System. It should also be noted that the natural moisture content is within a few percentage points of the plastic limit. The plastic index of the shale material underlying the surface weathered zone varies from about 6.5 to 12 indicating that this material has low plasticity characteristics. This material classifies as a CL-1 type soil according to the Unified Soil Classification System.

Several unconfined compression tests were performed on samples of the shale throughout the soil profile and the results of these tests indicate that the unconfined compressive strength increases with depth and that it varies from about 1600 pounds psi to as high as 3300 pounds psi.

In order to obtain an indication of the shearing strength of the cohesive material overlying the shale, six direct shear tests were performed on representative samples obtained from a depth of 5 feet and 10 feet below the existing ground surface. The results of these tests are expressed in the form of a mohr envelope in Figure Nos. 7 and 8. These tests indicate a friction angle of about 25 degrees and a cohesion of about 4 psi.

Three consolidated drain triaxial shear tests were performed on the weathered shale at a depth of about 6 feet below the existing ground surface. The triaxial shear tests are expressed in the form of a mohr envelope as shown in Figure No. 9. These tests indicate a friction angle of 32 degrees and a cohesion of 9 psi, which is somewhat larger than the value obtained in the direct shear test.

The conclusions and recommendations presented in this report are based upon the results of the field and laboratory tests which in our opinion define the characteristics of the subsurface material throughout the site in a satisfactory manner. If there are any questions relative to the information contained herein, please advise us.

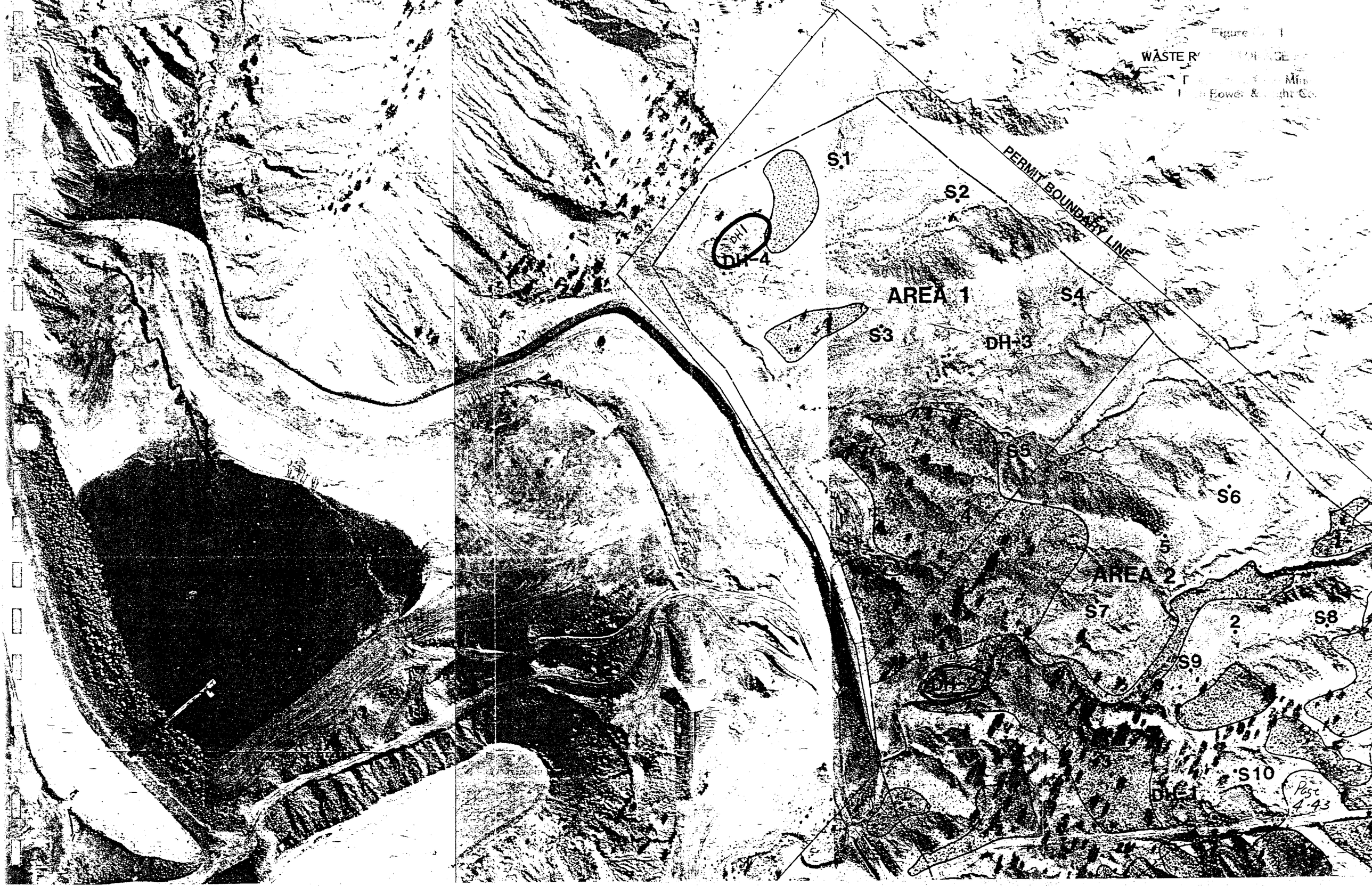
Yours truly,

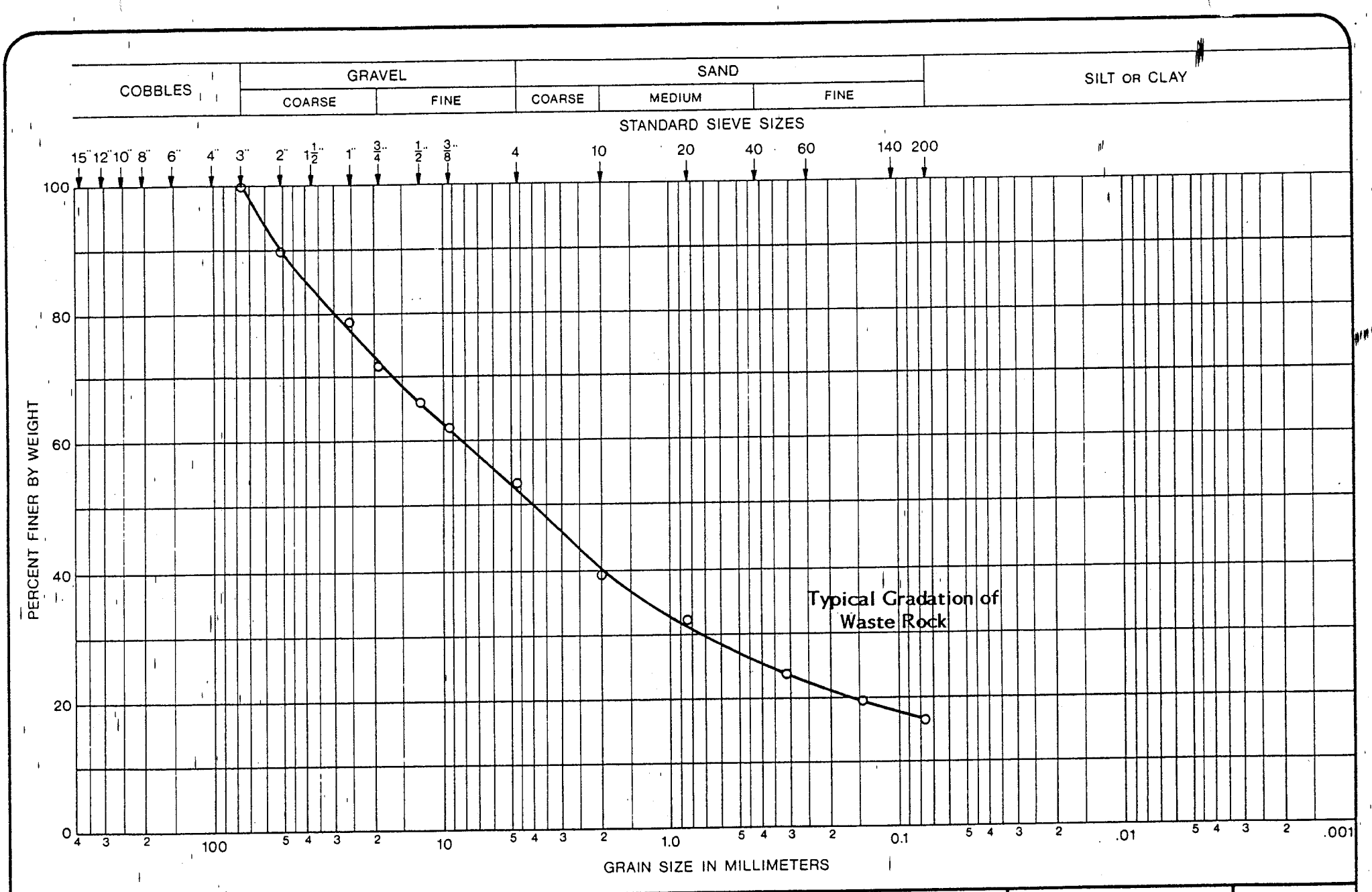
ROLLINS, BROWN AND GUNNELL, INC.

Ralph L. Rollins

Ralph L. Rollins

RLR:jsh


WASTE R
PERMIT BOUNDARY LINE
S1
S2
S3
S4
S5
S6
S7
S8
S9
S10
AREA 1
AREA 2
DH-1
DH-2
DH-3
DH-4
5
2
1
Past
4-43



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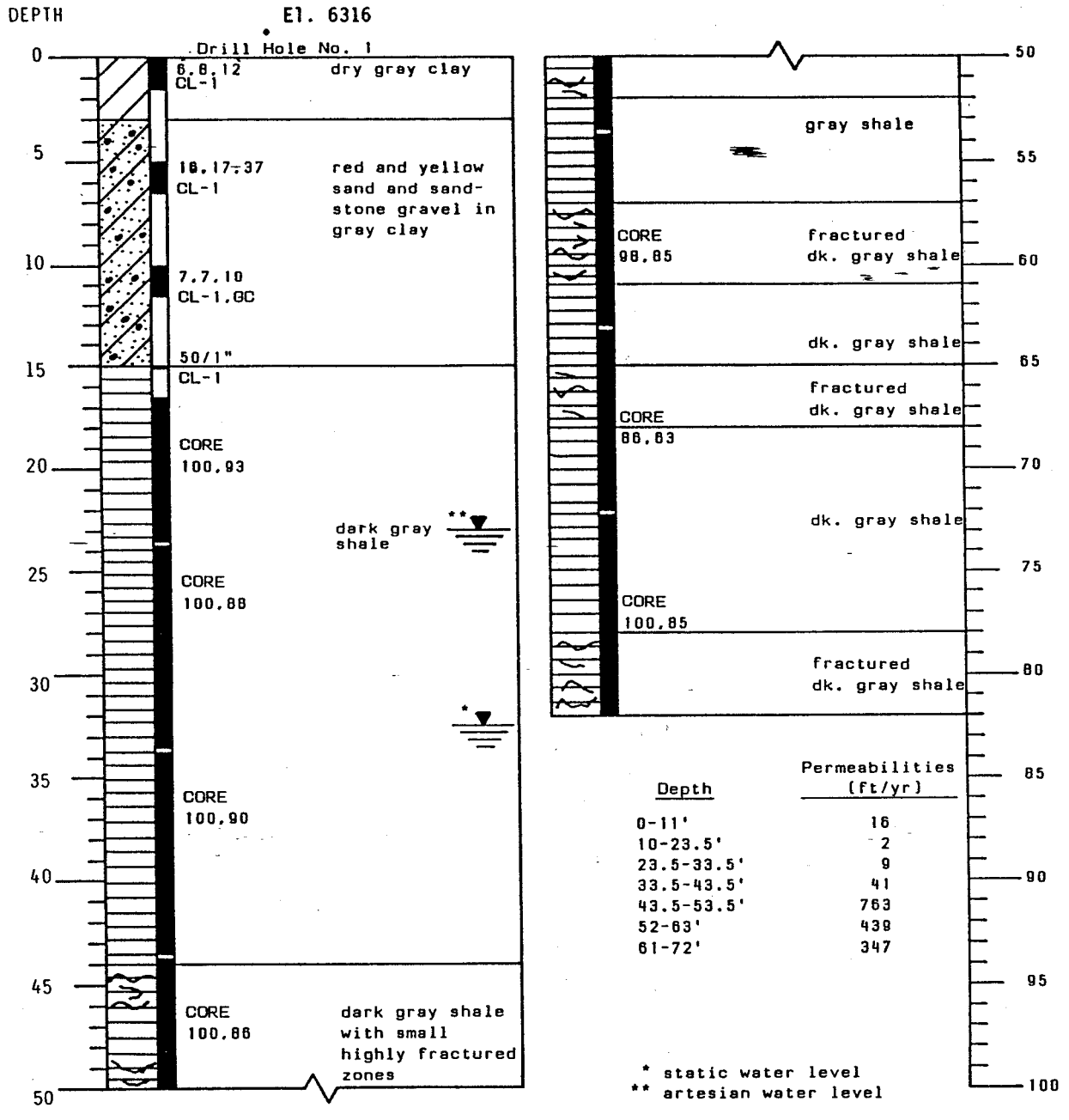
GRAIN SIZE DISTRIBUTION CURVE

Project: Waste Rock Storage Facility

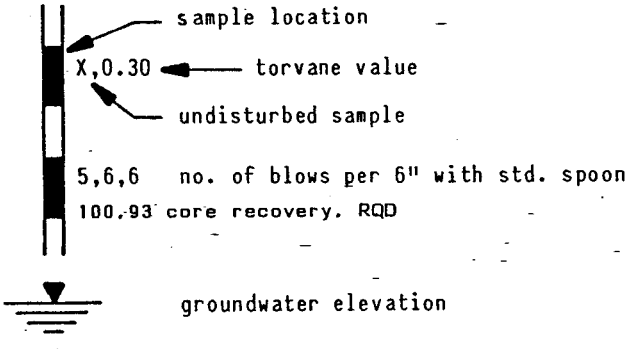
Location: Huntington Canyon

Sample No. 1

FIGURE NO. 5



LEGEND



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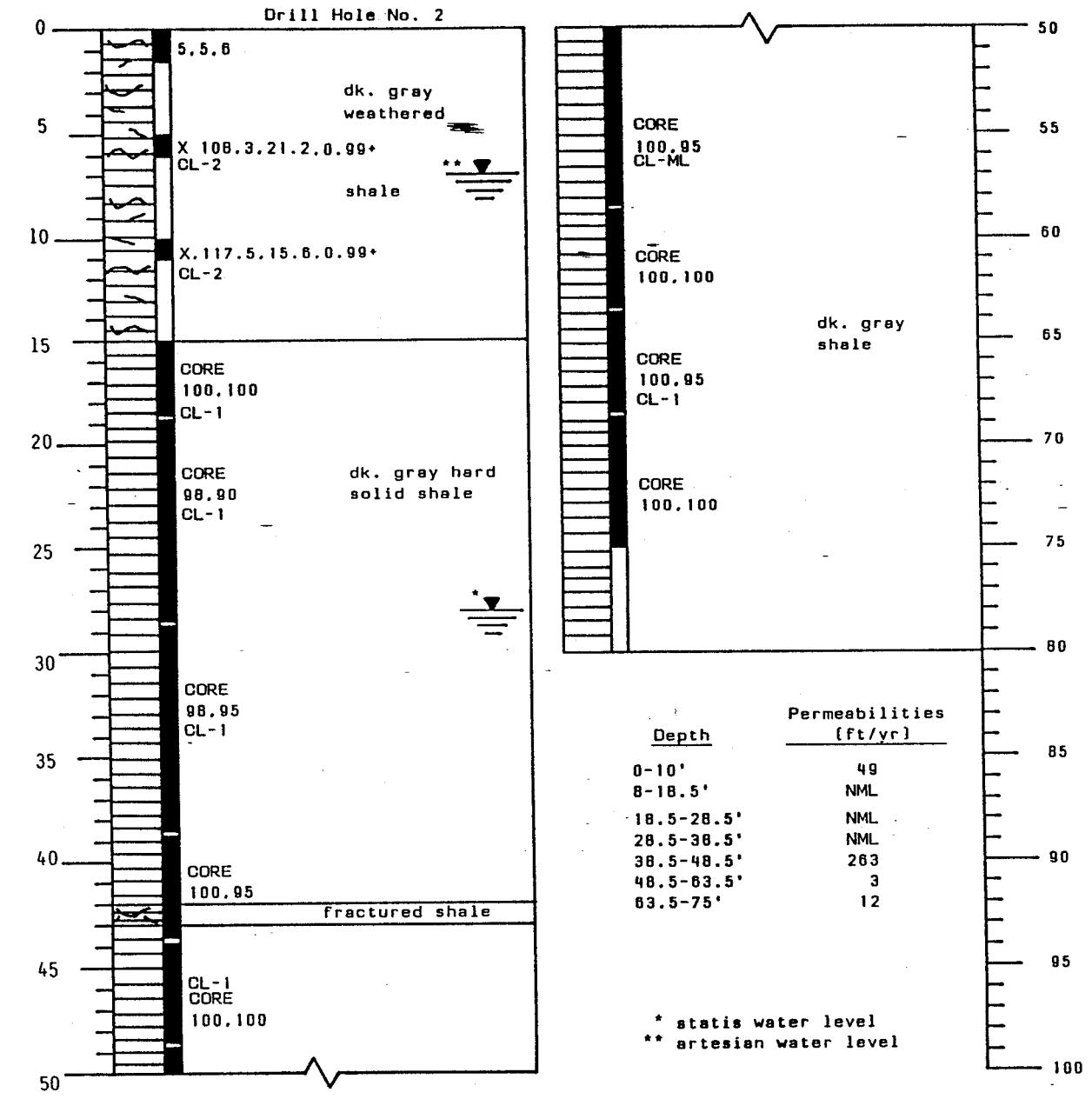
Log of Borings for:
Deer Creek Mine Waste Pile
Utah Power & Light

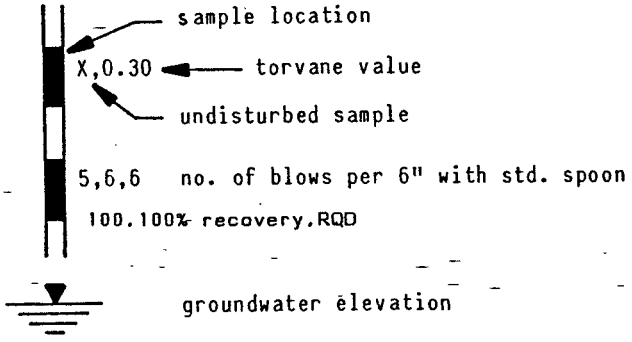
Figure No. 2



Depth	Permeabilities (ft/yr)
0-10'	49
8-18.5'	NML
18.5-28.5'	NML
28.5-38.5'	NML
38.5-48.5'	263
48.5-63.5'	3
63.5-75'	12

* statis water level
** artesian water level

LEGEND



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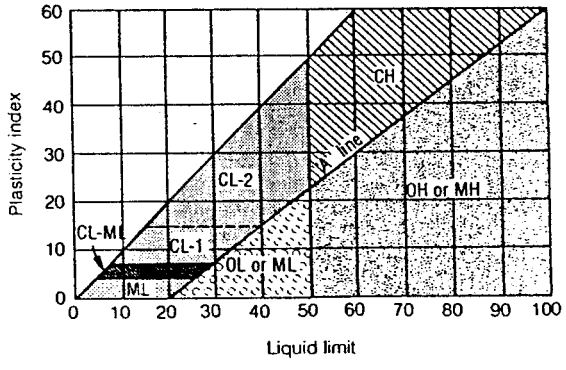
Log of Borings for:
Deer Creek Mine Waste Pile
Utah Power & Light

Figure No. 3

Unified Soil Classification System

Major Divisions			Group Symbols	Typical Names	Laboratory Classification Criteria
Course-grained Soils: More than half of material is larger than No. 200 sieve	Gravels: More than half of coarse fraction is larger than No. 4 sieve	Clean Gravels (Little or no fines)	GW	Well graded gravels, gravel-sand mixtures, little or no fines.	$C_u = \frac{D_{60}}{D_{10}}$ Greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines	Not meeting all gradation requirements for GW
		Gravels with fines (Appreciable amount of fines)	GM* d / u	Silty gravels, poorly graded gravel-sand-clay mixtures	Atterberg limits below "A" line, or PI less than 4 / Atterberg limits above "A" line, or PI greater than 7 — Above "A" line with PI between 4 and 7 are borderline cases requiring uses of dual symbols
			GC	Clayey gravels, poorly graded gravel-sand-clay mixtures	
	Sands: More than half of coarse fraction is smaller than No. 4 sieve size	Clean Sands (Little or no fines)	SW	Well graded sands, gravelly sands, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ Greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3
			SP	Poorly graded sands, gravelly sands, little or no fines.	Not meeting all gradation requirements for SW
		Sands with fines (Appreciable amount of fines)	SM* d / u	Silty sands, poorly graded sand-silt mixtures	Atterberg limits below "A" line, or PI less than 4 / Atterberg limits above "A" line, or PI greater than 7 — Above "A" line with PI between 4 and 7 are borderline cases requiring uses of dual symbols
			SC	Clayey sands, poorly graded sand-clay mixtures	
Fine-grained Soils: More than half of material is smaller than No. 200 sieve	Silt and Clays: Liquid limit less than 50		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	
			CL 1 / 2	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
			OL	Organic silts and organic silt-clays of low plasticity	
	Silts and Clays: Liquid limit greater than 50		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	
			CH	Inorganic clays of high plasticity, fat clays	
			OH	Organic clays of medium to high plasticity, organic silts	
Highly Organic Soils			Pt	Peat and other highly organic soils	

Determine percentage of gravel and sand from grain size curve.
Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:
Less than 5% ..... GW, GP, SW, SP
More than 12% ..... GM, GC, SM, SC
5% to 12% ..... Borderline cases requiring use of dual symbols**

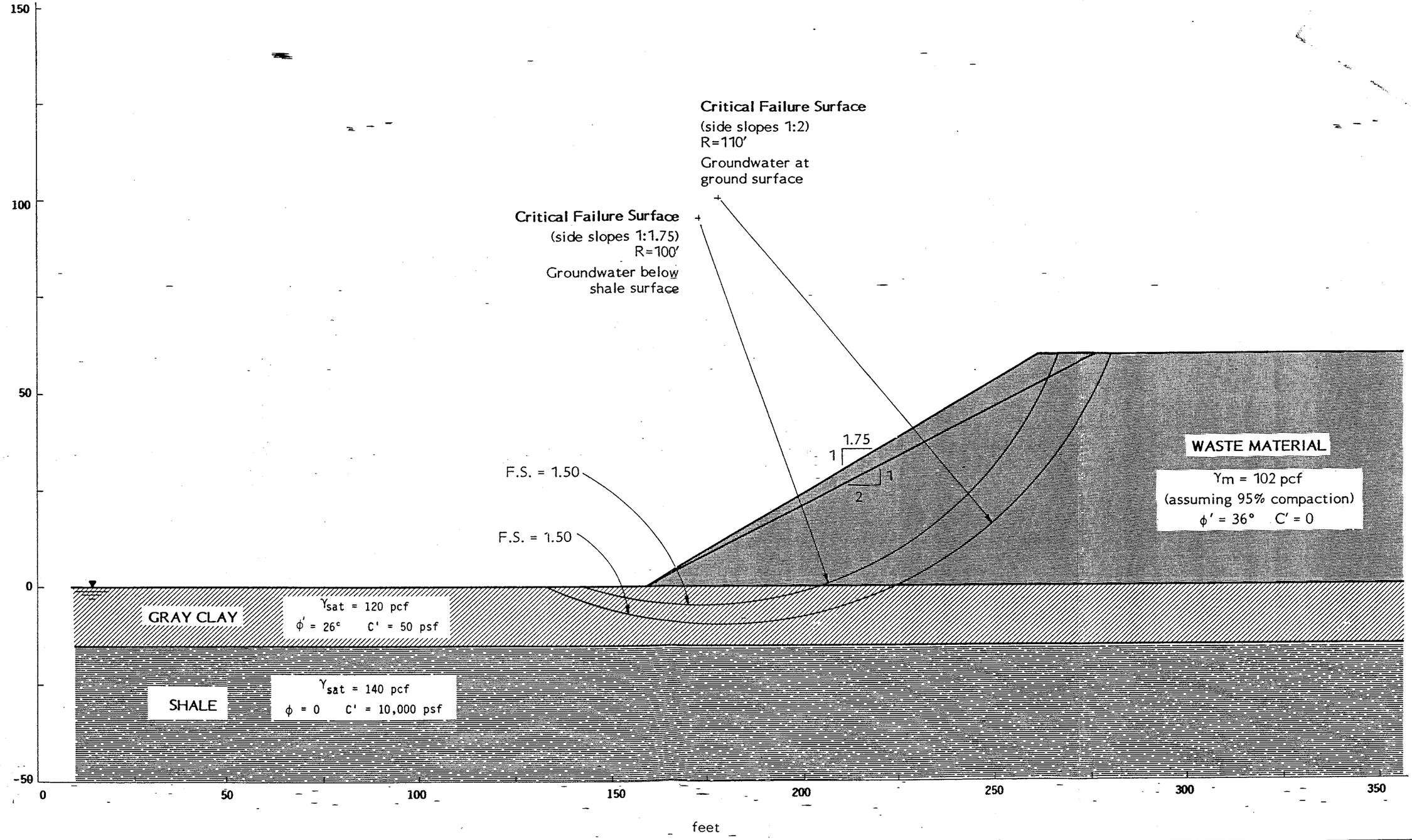


Plasticity Chart
For laboratory classification of fine-grained soils

*Division of GM and SM groups into subdivisions of d and u for roads and airfields only. Subdivision is based on Atterberg limits; suffix d used when liquid limit is 28 or less and the PI is 6 or less, the suffix u used when liquid limit is greater than 28.

**Borderline classification: Soils possessing characteristics of two groups are designated by combinations of group symbols. For example GW-GC, well graded gravel-sand mixture with clay binder.

Figure No. 4



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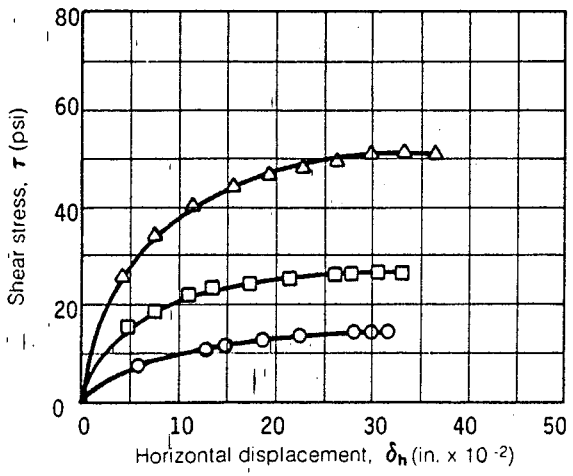
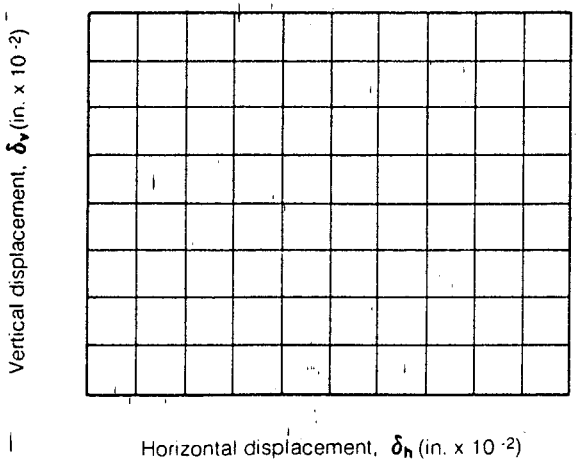
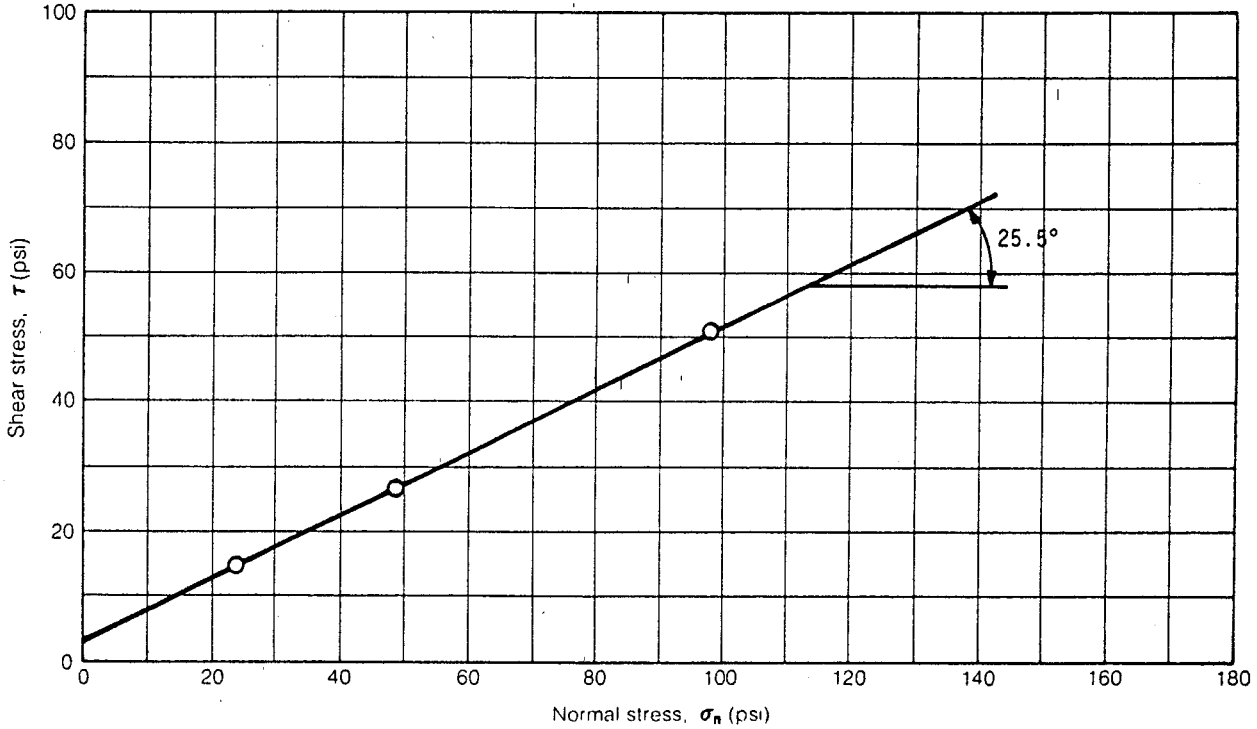
SLOPE STABILITY SUMMARY
Deer Creek Coal Mine

FIGURE
NO. 6







Test no. or symbol	Sample size (inches)	Sample data: Dry density (pcf)	Sample data: Moisture content (%)	Degree of saturation (%)	Normal stress σ_n (psi)	Maximum shear stress τ (psi)	Strain rate (inches / minute)	Shear strength parameters: Friction angle ϕ (degrees)	Shear strength parameters: Cohesion (c / psi)
○	2.375	108.3	21.2	100	23.7	14.4	0.0006	25.5°	3
□	2.375	106.8	22.7	100	48.2	26.8	0.0006		
△	2.375	108.3	20.8	100	97.8	51.0	0.0006		

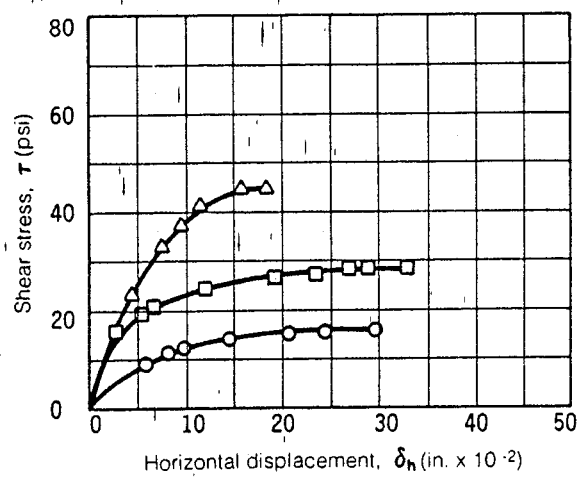
ROLLINS, BROWN AND GUNNELL, INC.
PROFESSIONAL ENGINEERS

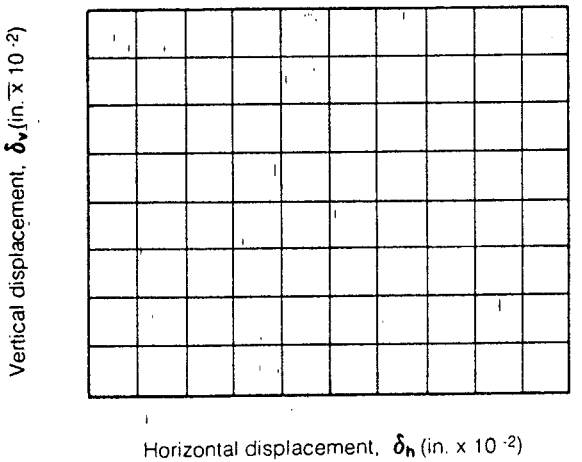
DIRECT SHEAR TEST
Project: Deer Creek Mine Waste Pile
Utah Power & Light

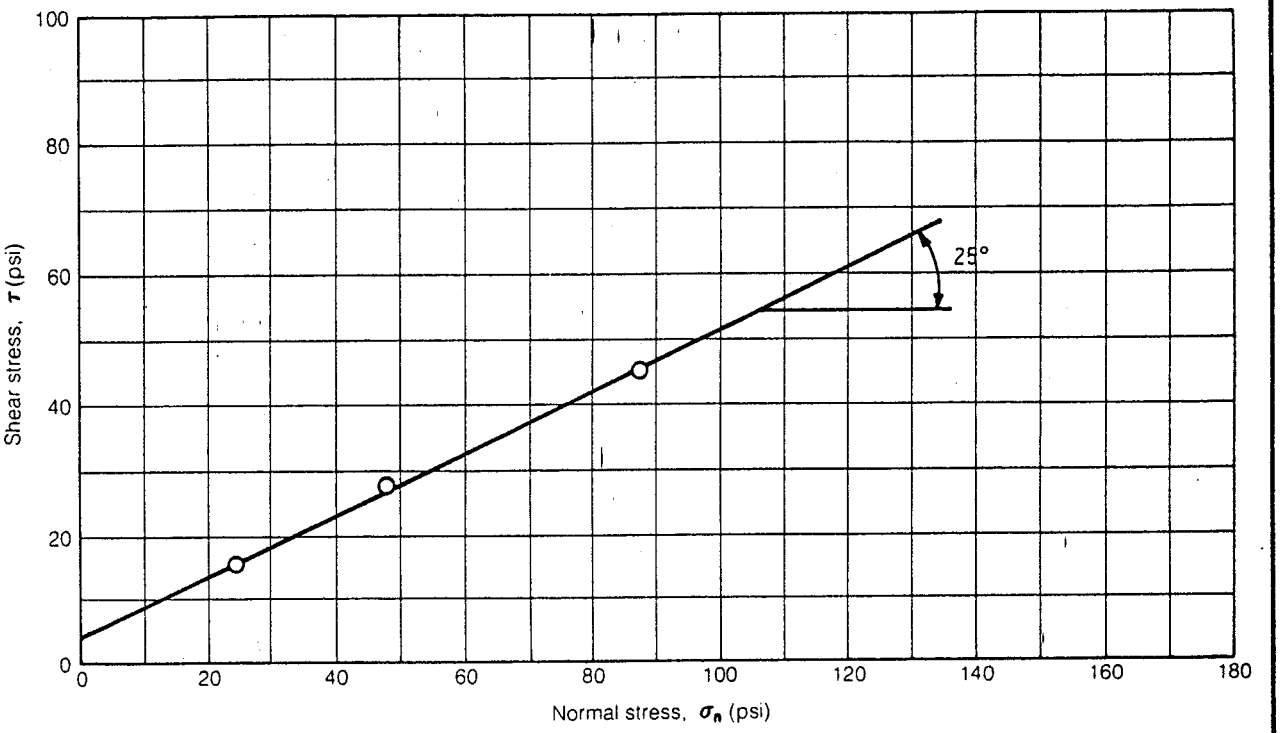
HOLE NO. 2
DEPTH: 5'

FIGURE NO. 7

4-49







Test no. or symbol	Sample size (inches)	Sample data: Dry density (pcf)	Sample data: Moisture content (%)	Degree of saturation (%)	Normal stress σ_n (psi)	Maximum shear stress τ (psi)	Strain rate (inches / minute)	Shear strength parameters: Friction angle ϕ (degrees)	Shear strength parameters: Cohesion (c / psi)
○	2.375	117.6	14.4		23.7	15.9	.0006	25°	4
□	2.375	117.4	15.9		48.2	28.7	.0006		
△	2.375	117.5	16.6		87.9	45.2	.0006		

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PROFESSIONAL ENGINEERS

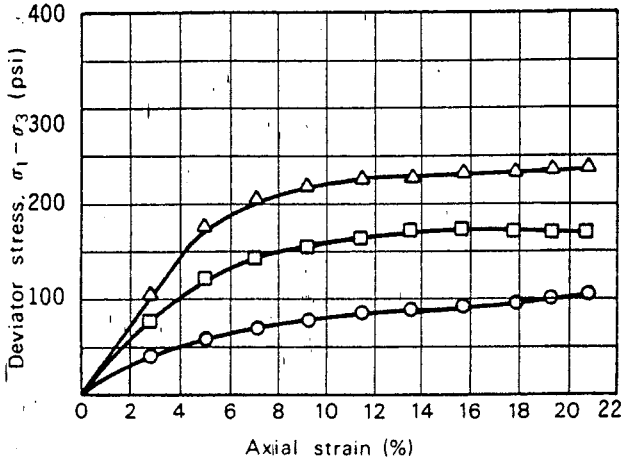
DIRECT SHEAR TEST

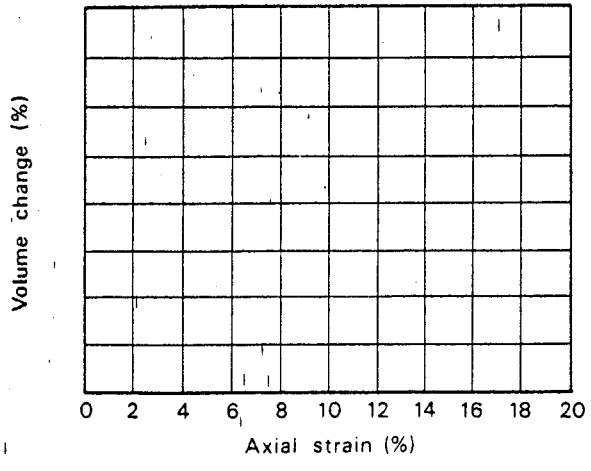
Project: Deer Creek Mine Waste Pile
Utah Power & Light

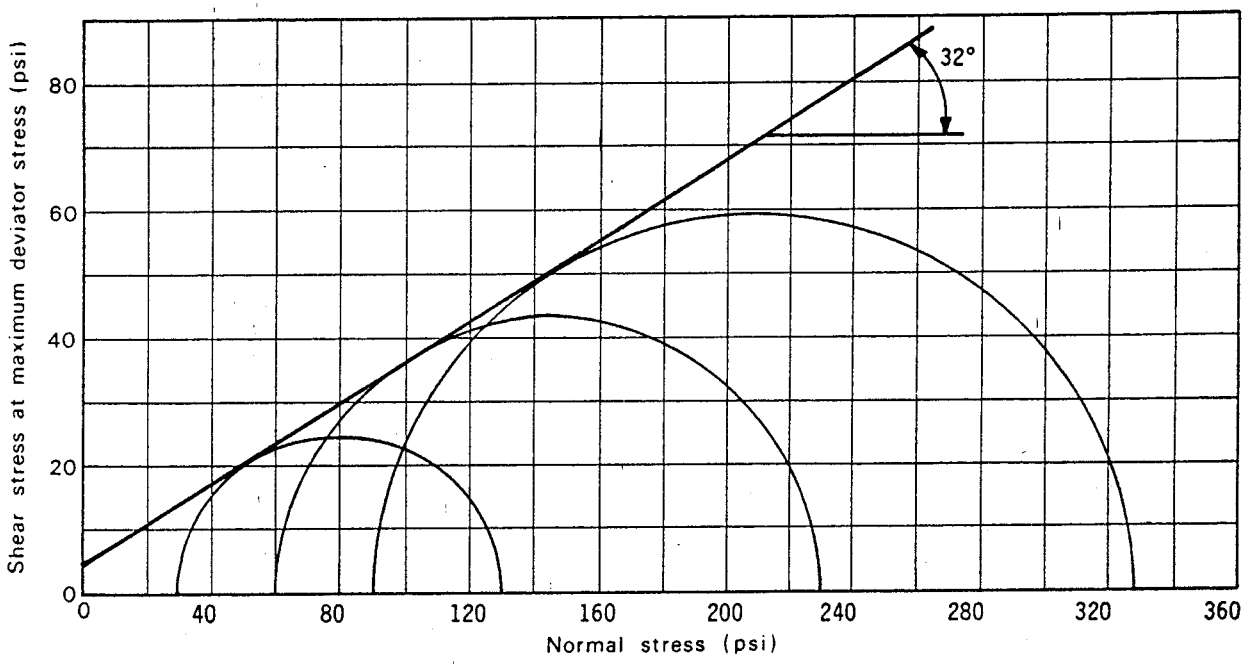
HOLE NO. 2
DEPTH: 10-11'

FIGURE NO. 8

4-50







Test no. or symbol	Boring no. or depth	Sample data: Dry density (pcf)	Sample data: Moisture content (%)	Degree of saturation (%)	Confining pressure (psi)	Maximum deviator stress (psi)	Strength values at failure: Friction angle ϕ (degrees)	Strength values at failure: Cohesion (c/psi)	Sample size, $l./l)$ (inches)	Strain rate (inches/minute)
○	1	108.3	21.2		30	133	32	9	1.32	.002
□	2	108.3	21.2		60	232				.002
△	3	108.3	21.2		90	327				.002

ROLLINS, BROWN AND GUNNELL, INC.
PROFESSIONAL ENGINEERS

TRIAXIAL SHEAR TEST
Project: Deer Creek Mine Waste Pile
Utah Power & Light

HOLE NO. 2
DEPTH: 6'

FIGURE NO. 9

Table No. 2 SUMMARY OF TEST DATA

Project Deer Creek Mine Waste Pile Feature _____ Location Near: Huntington, Utah

HOLE NO.	DEPTH BELOW GROUND SURFACE	STANDARD PENETRATION BLOWS PER FOOT	IN-PLACE			UNCONFINED COMPRESSIVE STRENGTH (lb/ft²)	FRICTION ANGLE ϕ	CONSISTENCY LIMITS			MECHANICAL ANALYSIS			UNIFIED SOIL CLASSIFICATION SYSTEM
			Unit Weight γ (lb/ft³)	Moisture (%)	Void Ratio			L.L. (%)	P.L. (%)	P.I. (%)	% Gravel	% Sand	% Silt & Clay	
2	5-6.5′		108.3	21.2				38.9	17.8	21.1				CL-2
	10-11.5′		117.5	15.6				39.6	22.1	17.5				CL-2
	15					1612		27.3	15.3	12.0				CL-1
	25					2287		22.5	14.5	8.0				CL-1
	35					2897		22.1	14.2	7.9				CL-1
	45					2954		23.5	15.3	8.2				CL-1
	55					3023		21.4	14.9	6.5				CL-ML
	65					3338		20.7	11.6	9.1				CL-1

4-52

CHAPTER V GEOLOGY AND SUBSIDENCE

The geology of the Deer Creek Waste Rock Storage Facility is fairly simple and straight forward. This site is located on the southern flanks of Gentry Mountain in the area just south of Wild Horse Ridge. Rocks exposed in the area are marine derived mudstones in the lower portion of the Masuk Member of the Mancos Shale. The Masuk Shale on the bench which adjoins the proposed site on the east and west is covered by a five to twenty foot thick layer of terrace gravel of Quaternary age. North-south trending normal faults have disrupted the strata in the region. However, no faults are known to exist within the area of the proposed Deer Creek Waste Rock Storage Facility.

Stratigraphy

The oldest rocks exposed in the region are part of the marine Mancos sequence deposited in Late Cretaceous time. This formation contains several alternating units of off-shore marine mudstones and near-shore marine sandstones. This discussion will address only the two upper members of the Mancos which are the Emery Sandstone and the Masuk Shales in ascending order.

Emery Sandstone

The Emery Sandstone member of the Mancos Shale is comprised of several upward fining transgressive sandstone deposits. Miles to the southeast, where the Emery Sandstone is exposed on the surface, it is approximately 800 feet in thickness. However, subsurface data collected from gas wells to the northwest of the site in Huntington Canyon indicate that the Emery Sandstone is positioned about 400-600 feet beneath the proposed Deer Creek Waste Rock Storage Facility and is probably very thin (< 100 feet). Regionally, this member is water-bearing and may be classified as a limited regional aquifer. However, its importance as an aquifer is minimal in respect to other major water-bearing formations located at depth (Navajo and Wingate Sandstones).

Masuk Shale

The Masuk Member of the Mancos Shales overlies the Emery Sandstone and consists of light to medium gray marine mudstones. It forms the bedrock in the vicinity of the site. The Masuk Shale is generally devoid of significant water.

Terrace Gravels

The benches surrounding the west and east sides of the Deer Creek Waste Rock Storage Facility are covered by a Quaternary terrace gravel deposit. These gravels are located on a gentle slop leading down from Wild Horse Ridge and are thought to be glacial outwash in origin. The gravel deposits are five to twenty feet in thickness and are moderately permeable. Because of this, much of the rainfall percolates into these deposits and flows down dip toward Huntington Creek.

STRUCTURE

The strata in the Deer Creek Waste Rock Storage Facility is dipping gently in a northwest direction into the Straight Canyon Syncline (2 to 3 degrees). The nearest known fault to this area is the Maple Gulch fault which is located approximately one mile to the west. No faults are thought to exist in the area of the site.

Regionally, the strata contains a set of vertical joints trending in both a northwest and northeast direction. It is hard to identify jointing in the weathered Masuk shale outcrops, but in fresh cuts the joints appear to be wide spaced. Very limited amounts of ground water migrate down these fractures because the clays present in the rock swell when in contact with water, thus sealing the fractures.

SUBSIDENCE CONTROL (UMC 817.121 AND 817.126)

These regulations do not apply.

OTHER

There are no wells or test borings within the proposed site.

There are no coal seams to be mined within the site nor are any known economic seams present at depth. Because of this, coal thickness, outcrop location, strike and dip information does not apply.

No gas or oil wells are present within the site.

Thickness and lithology of overburden is not applicable to this permit.

The casing or sealing of exploratory wells is not applicable to this permit.

Chapter VI HYDROLOGY

GROUND WATER AND SURFACE WATER

Some rain water migrates into the terrace gravels, where present, and flows down dip toward Huntington Creek. The Deer Creek Waste Rock Storage Facility should not impact this water occurrence because it is located at a lower elevation than the gravel terraces. Very limited quantities of ground water may be present by way of fractured permeability in the Masuk Shale.

The underground development waste site contains a few dry washes which flow water for a short time immediately following a storm. When flowing, water in these washes is diverted around a reservoir which supplies water for the Huntington Research Farm, and eventually flows into Huntington Creek 1/2 mile to the south.

The Mancos shale typically contains large quantities of soluble minerals such as gypsum. Therefore, any water passing through it or eroding it will be naturally high in dissolved solids. Seasonal variations in dissolved solids concentration in published reports range from less than 500 to near 1000 milligrams per liter for the section of Huntington Creek nearest the site. Vegetation that exists near the south-central portion of the Deer Creek Waste Rock Storage Facility (Tamarisk) indicates that a small amount subsurface water is present along a broad dry wash. It is felt that the subsurface quantities are very limited because no water has been observed emanating from this area.

UMC 783.13 Description of Hydrology and Geology - (RVS)

For the most part, the Masuk member of the Mancos Shale outcrops throughout the waste rock site. The higher buttes to the southeast of the site and to the northwest of the haulage road are capped by Tertiary pediment gravel and the Huntington Canyon valley floor is covered by Quaternary alluvium. As can be seen on Map 5-1 (geologic map and cross-section) the haulage road extends from the alluvial valley floor to the waste rock site which is approximately 1/2 mile northeast of the alluvial valley floor.

UMC 783.15 Ground-Water Information - (RVS)

Prior to construction of the Huntington Power Plant evaporation pond which is now present to the south of the proposed waste rock site, a geotechnical/hydrologic study was prepared. The data from this study follows beginning on Page 6-4. This study included the drilling of eighteen test wells to determine if groundwater is present and to identify the permeability of the strata present. Many of the holes completed penetrated strata to a depth at a lower elevation than that of Huntington Creek to the south and west.

From this data it can be seen that most of the holes completed failed to intersect water saturated strata. Most of the holes that did intersect water were drilled from on top of the gravel covered buttes and the water was found to exist near the base of the terrace gravel. Some of the holes did however, intersect water in the Masuk Shale. Permeability tests that were conducted on the water producing zones showed the terrace gravels to have a permeability which approached 950 feet per year (relatively low) and the Masuk Shale to have permeability of less than 100 feet per year (extremely low).

It is important to point out that no water zones were encountered near the surface in the Masuk Shale. This is due to the fact that the bentonitic clays in this strata swell upon weathering and form an impervious layer.

A copy of the geotechnical information follows beginning on Page 6-4.

UMC 784.14 Protection of Hydrologic Balance- (RVS)

The test wells completed prior to the construction of the evaporation pond have identified that a limited quantity of groundwater exists locally in the Masuk Shale. This water is most likely flowing along fractures in the strata. The rate of water migration has been shown to be extremely slow (§100 feet per year). From this it is felt that the proposed operations to be conducted at the waste rock site will not impact the hydrology of the area. The weathered Masuk Shale present on and near the surface of the ground will act as an effective barrier to prevent the surface waters from migrating to depths and intersecting groundwater.

The ground water present in the terrace gravels should not be impacted by the waste rock site because they are located at a higher elevation than the proposed site.

PROBABLE HYDROLOGIC CONSEQUENCES

It is not anticipated that the proposed rock site will have any effect on the groundwater of the area from a standpoint of quality or quantity. The surface water impacts will be limited to a detainment of water which enters the proposed site by way of precipitation. This water will be held in a non-discharge sediment pond.

CLIMATE

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.

OTHER

No water wells exist within the permit area.

Baseline regional hydrologic data is included in UP&L's Hydrologic Monitoring report for East Mountain. For information regarding the regional hydrologic data see this document.

There are no perennial streams or springs within the permit area.

WATER MONITORING

The water quality characteristics of the water which flows in the dry wash crossing the waste rock site has not been identified. It will be necessary for UP&L to identify the baseline characteristics of this water prior to reclamation of the site. Therefore, UP&L will install a stage water sampling system which will automatically collect samples during storm events. Samples will be analyzed for settleable solids only. This shall be done until the baseline water quality characteristics have been established.

Postmining monitoring points will be located at the inlets to each sediment basin (see Plate 4-7 for locations). Postmining analysis for settleable solids will be compared to baseline values. When postmining values fall below applicable effluent standards the basins can be removed.

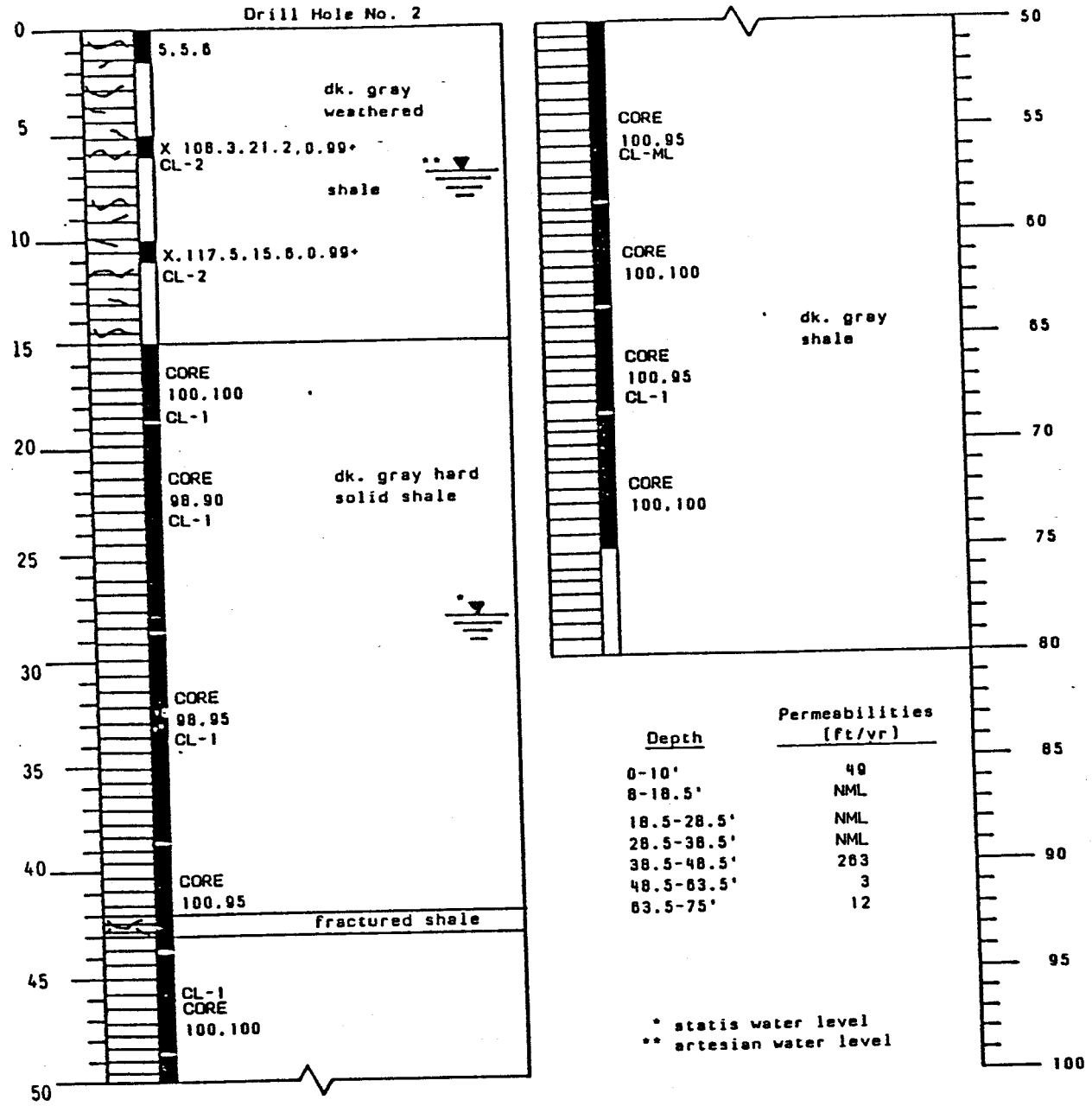
In order to identify if any groundwater migration exists from the waste rock area into the alluvial valley to the south, UP&L shall develop a monitoring well during the construction of Phase I of the waste rock site. If groundwater exists, samples will be collected and analyzed by UP&L in accordance with the Division's water monitoring guidelines. This should enable UP&L to identify any effect the waste rock site may have on the quality of water in the alluvial valley.

The well is located 20' north of the access road at station 23+45 shown on plate 4-5. The well is a four-inch diameter borehole drilled to an elevation of 6235 feet. Map 4-5 shows the location of the well. The lithologic data on the well is found on page 6-3.1

AMENDMENT TO

APPROVED Mining & Reclamation Plan
Approved, Division of Oil, Gas & Mining

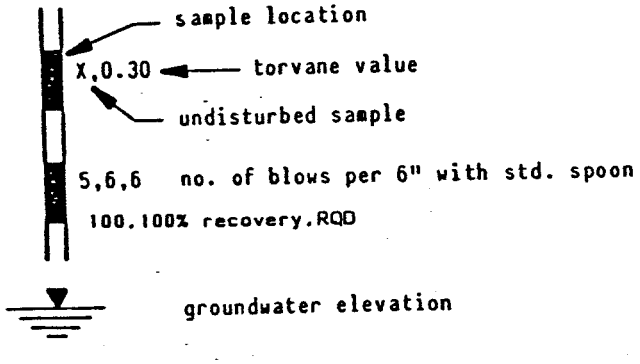
by RVS date 6/21/89



Depth	Permeabilities (ft/yr)
0-10'	49
8-18.5'	NML
18.5-28.5'	NML
28.5-38.5'	NML
38.5-48.5'	263
48.5-63.5'	3
63.5-75'	12

* statis water level
** artesian water level

LEGEND



AMENDMENT TO
APPROVED Mining & Reclamation P
Approved, Division of Oil, Gas & Mining
by RUS date 4/21/8

ROLLINS, BROWN AND GUNNELL, INC.
PROFESSIONAL ENGINEERS

Log of Borings for:
Deer Creek Mine Waste Pile
Utah Power & Light

Figure No. 3

Pages 6-4A through 6-29 are the body of a report which was done in 1972 for Utah Power and Light by Woodward-Clevenger & Associates, Inc. This report is being used to provide geotechnical, hydrological and soils information.

AMENDMENT TO
APPROVED Mining & Reclamation Plan
Approved, Division of Oil, Gas & Mining

by RJS date 6/21/89

WOODWARD-CLEVENGER & ASSOCIATES, INC.
CONSULTING ENGINEERS AND GEOLOGISTS
2900 WEST SEVENTH AVENUE
DENVER, COLORADO 80204
TELEPHONE 222-9434

An affiliate of
Woodward-Clyde Consultants

ENGINEERING & GEOLOGIC INVESTIGATIONS, DAMS AND EVAPORATION POND, HUNTINGTON CANYON PLANT, NEAR HUNTINGTON, UTAH

Prepared For

Stearns-Roger Corporation
P. O. Box 5988
Denver, Colorado 80217

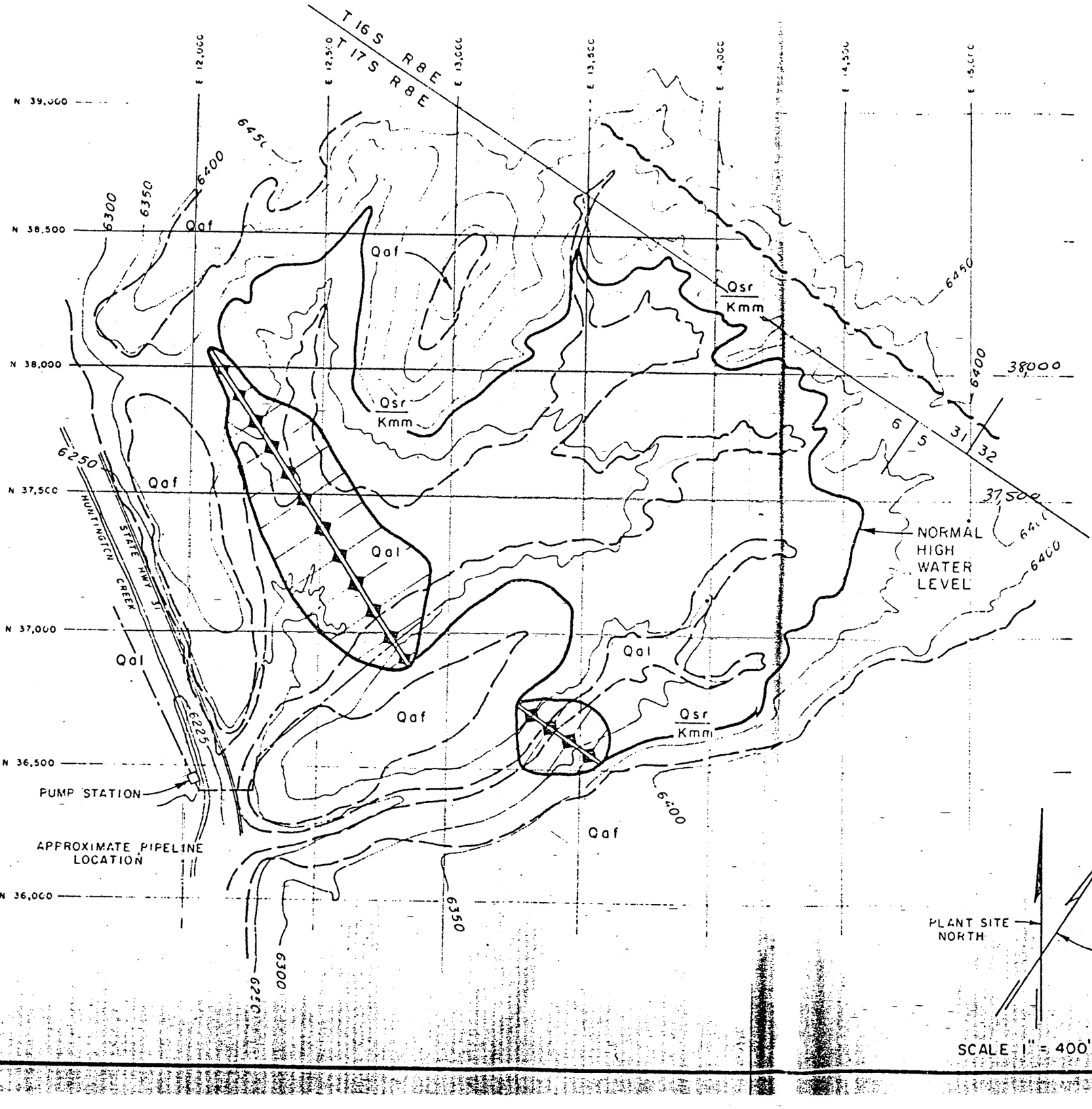
Attention: Mr. J. J. Donavan, Project Engineer

Job No. 15902-12575

December 29, 1972

6-4A

TABLE OF CONTENTS (Cont'd.)



LEGEND

Qal — ALLUVIUM: CREEK-DEPOSITED CLAYS AND SANDY CLAYS WITH MINOR GRAVEL, POORLY TO NON-STRATIFIED, STIFF TO VERY STIFF.

Qsr / Kmm — SLOPEWASH AND RESIDUAL SOILS MANTLING MASUK SHALE (MANCOS FORMATION): THE SOILS ARE PRIMARILY CLAYS WITH MINOR SANDS AND GRAVELS, AND RANGE FROM SOFT IN THE TOP FEW INCHES TO STIFF AND VERY STIFF. MASUK SHALE IS THIN-BEDDED, MODERATELY HARD, WELL CONSOLIDATED, POORLY CEMENTED, CLOSELY JOINTED COMMONLY AT THE OUTCROP BUT MASSIVELY JOINTED IN THE SUBSURFACE; ESSENTIALLY HORIZONTALLY BEDDED.

Qaf — ALLUVIAL FAN AND TALUS: SAND AND GRAVEL, SILTY TO CLAYEY, BOULDERY, MEDIUM DENSE TO DENSE, POORLY STRATIFIED, MAINLY OF SANDSTONE DETRITUS; BOULDERS COMMONLY 4 TO 5 FEET IN MAXIMUM DIMENSION, A FEW ARE 15 TO 20 FEET.

FAULT.

PROPOSED DAM AND NORMAL HIGH WATER LEVEL.

GEOLOGIC CONTACT

PLANT SITE NORTH

UTAH CENTRAL MODIFIED GRID NORTH

SCALE 1" = 400'

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

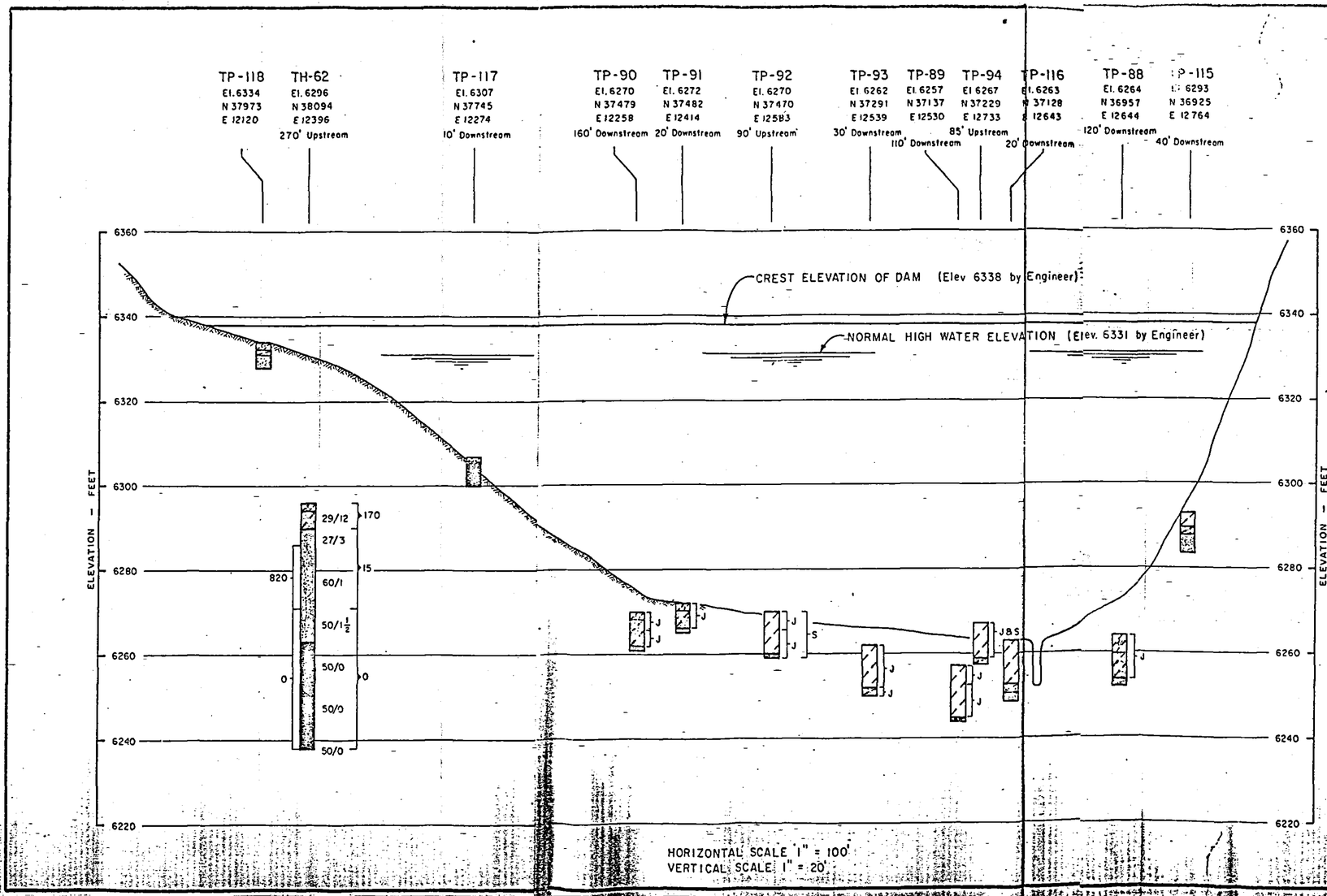
GEOLOGIC MAP
DAMS AND EVAPORATION POND
HUNTINGTON CANYON PLANT

Prepared by RLT

Job No. 15902-12575

6-4

FIG. 1



LEGEND

- CLAY, STIFF TO VERY STIFF, SLIGHTLY SANDY WITH SOME WEATHERED SANDSTONE CHIPS, GYPSIFEROUS, DRY TO SLIGHTLY MOIST, BROWN TO GRAY-BROWN (CL).
- CLAY, STIFF TO VERY STIFF, SLIGHTLY SANDY TO SANDY, SOME SANDSTONE GRAVEL, HIGHLY GYPSIFEROUS, SLIGHTLY MOIST TO MOIST, GRAY-BROWN (CL)(WEATHERED BEDROCK).
- CLAYSTONE, MEDIUM HARD TO HARD, SLIGHTLY SANDY TO SANDY, FRACTURED, GYPSUM SEAMS, SLIGHTLY MOIST TO MOIST, GRAY-BROWN TO GRAY (BEDROCK).
- CLAYSTONE, VERY HARD, SLIGHTLY SANDY, THIN BEDDED, FRACTURED, SOME GYPSUM SEAMS, DRY TO SLIGHTLY MOIST, BROWN-GRAY TO GRAY (BEDROCK).
- CLAYSTONE, VERY HARD, SLIGHTLY SANDY, THIN BEDDED, DRY TO SLIGHTLY MOIST, GRAY (BEDROCK).

29/12 INDICATES THAT 29 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE A 2-INCH DIAMETER SAMPLER 12 INCHES.

J INDICATES DISTURBED JAR SAMPLE.

S INDICATES DISTURBED SACK SAMPLE.

INDICATES DEPTH OF PACKER TYPE FIELD PERMEABILITY TEST AND AVERAGE CALCULATED PERMEABILITY IN FEET PER YEAR.

INDICATES DEPTH OF FALLING HEAD TYPE FIELD PERMEABILITY TEST AND AVERAGE CALCULATED PERMEABILITY IN FEET PER YEAR.

INDICATES BEDROCK AT GROUND SURFACE

FOR NOTES, SEE FIGURE 7

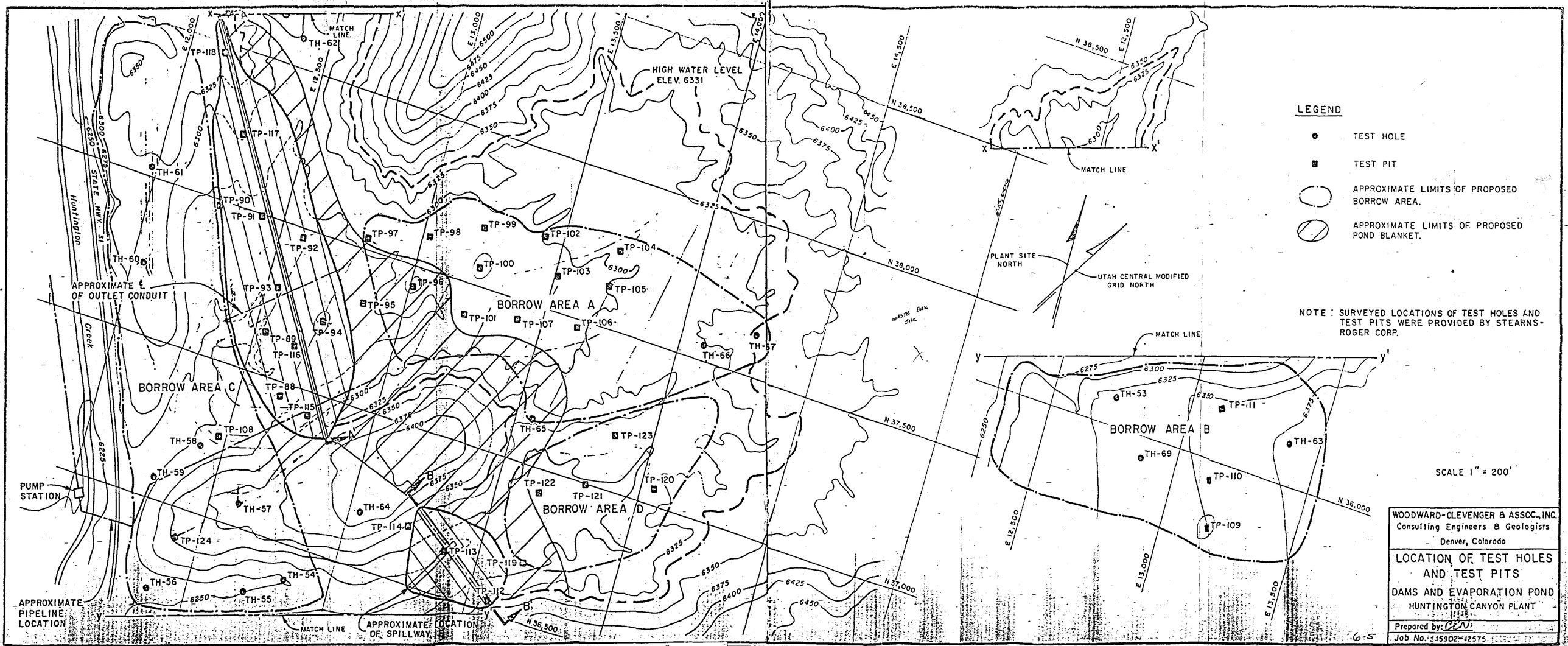
WOODWARD-CLEVENGER & ASSOC., INC.
Consulting Engineers & Geologists
Denver, Colorado

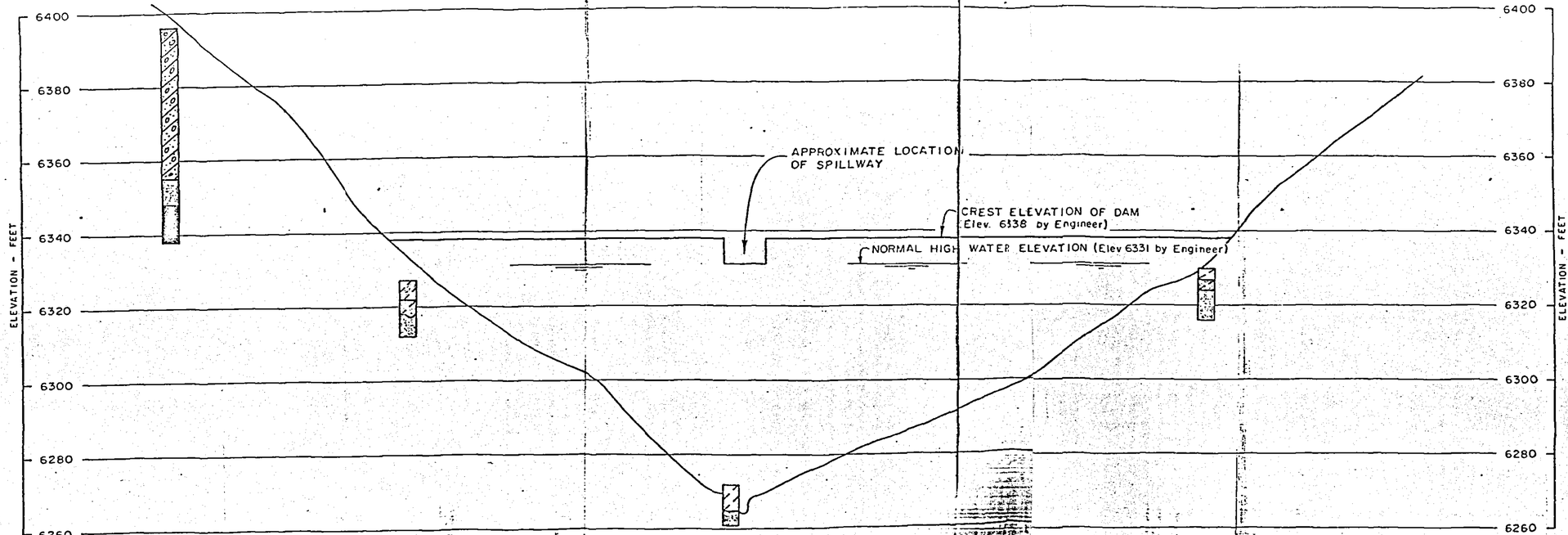
SUMMARY LOGS OF TEST HOLES
DAMS AND EVAPORATION POND
PROFILE A - A'
HUNTINGTON CANYON PLANT

Prepared by: CEN

Job No: 15902 - 12575

Fig 3


HIGH WATER LEVEL ELEV. 6331
BORROW AREA A
BORROW AREA B
BORROW AREA C
BORROW AREA D
APPROXIMATE ℄ OF OUTLET CONDUIT
PUMP STATION
APPROXIMATE PIPELINE LOCATION
APPROXIMATE LOCATION OF SPILLWAY
MATCH LINE
STATE HWY. 31
Huntington Creek
PLANT SITE NORTH
UTAH CENTRAL MODIFIED GRID NORTH
waste fuel site
LEGEND
TEST HOLE
TEST PIT
APPROXIMATE LIMITS OF PROPOSED BORROW AREA.
APPROXIMATE LIMITS OF PROPOSED POND BLANKET.
NOTE : SURVEYED LOCATIONS OF TEST HOLES AND TEST PITS WERE PROVIDED BY STEARNS-ROGER CORP.
SCALE 1" = 200'
WOODWARD-CLEVENGER & ASSOC., INC.
Consulting Engineers & Geologists
Denver, Colorado
LOCATION OF TEST HOLES AND TEST PITS
DAMS AND EVAPORATION POND
HUNTINGTON CANYON PLANT
Prepared by: CEN
Job No. 15902-12575
6-5



LEGEND

- CLAY, STIFF TO VERY STIFF, SLIGHTLY SANDY WITH SOME WEATHERED SANDSTONE CHIPS, GYPSIFEROUS, DRY TO SLIGHTLY MOIST, BROWN TO GRAY-BROWN (CL).
- GRAVEL, COBBLE AND BOULDERS, MEDIUM DENSE TO DENSE, PRIMARILY HIGHLY CEMENTED SANDSTONE IN A SILTY TO SLIGHTLY CLAYEY SAND MATRIX, DRY TO SLIGHTLY MOIST, BROWN (GM, COBBLE BOULDER).
- CLAY, STIFF TO VERY STIFF, SLIGHTLY SANDY TO SANDY, SOME SANDSTONE GRAVEL, HIGHLY GYPSIFEROUS, SLIGHTLY MOIST TO MOIST, GRAY-BROWN (CL) (WEATHERED BEDROCK).
- CLAYSTONE, MEDIUM HARD TO HARD, SLIGHTLY SANDY TO SANDY, FRACTURED, GYPSUM SEAMS, SLIGHTLY MOIST TO MOIST, GRAY-BROWN TO GRAY (BEDROCK).
- CLAYSTONE, VERY HARD, SLIGHTLY SANDY, THIN-BEDDED, FRACTURED, SOME GYPSUM SEAMS, DRY TO SLIGHTLY MOIST, BROWN-GRAY TO GRAY (BEDROCK).
- CLAYSTONE, VERY HARD, SLIGHTLY SANDY, THIN-BEDDED, DRY TO SLIGHTLY MOIST, GRAY (BEDROCK).
- GRADUAL CHANGE IN MATERIALS. EXACT STRATA CHANGE NOT LOCATED.

FOR NOTES, SEE FIGURE 7

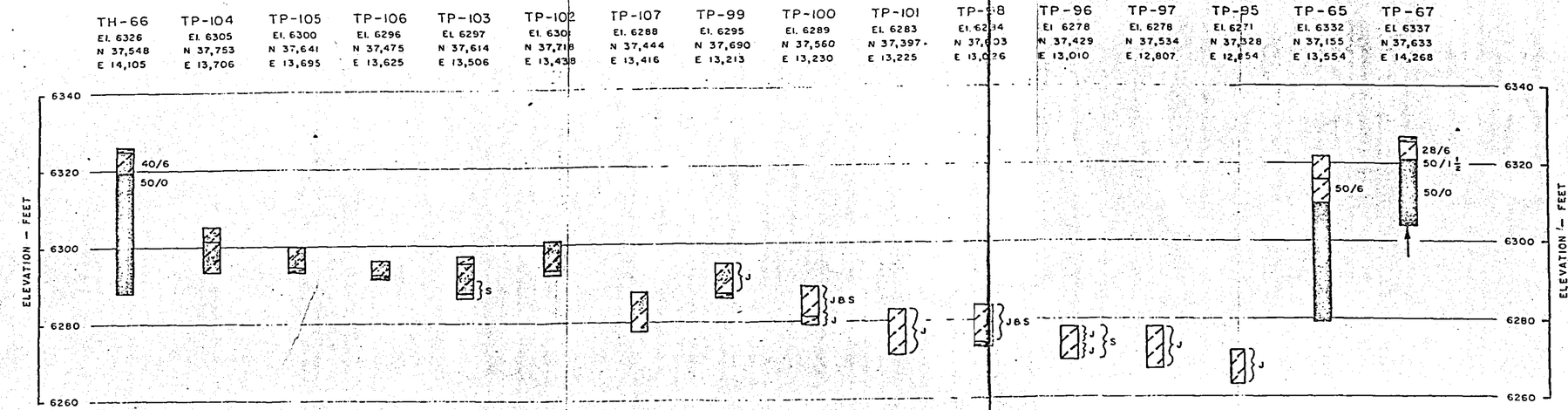
WOODWARD-CLEVENGER & ASSOC., INC.
Consulting Engineers & Geologists
Denver, Colorado

SUMMARY LOGS OF TEST HOLES AND TEST PITS
DAMS AND EVAPORATION POND
PROFILE B-B'
HUNTINGTON CANYON PLANT

Prepared by: [illegible]

Job No. 15902-12575

Fig 4



LEGEND

CLAY, STIFF TO VERY STIFF, SLIGHTLY SANDY WITH SOME WEATHERED SANDSTONE CHIPS, GYPSIFEROUS, DRY TO SLIGHTLY MOIST, BROWN TO GRAY-BROWN (CL).

CLAY, STIFF TO VERY STIFF, SLIGHTLY SANDY TO SANDY, SOME SANDSTONE GRAVEL, HIGHLY GYPSIFEROUS, SLIGHTLY MOIST TO MOIST, GRAY-BROWN (CL) (WEATHERED BEDROCK),

CLAYSTONE, MEDIUM HARD TO HARD, SLIGHTLY SANDY TO SANDY, FRACTURED, GYPSUM SEAMS, SLIGHTLY MOIST TO MOIST, GRAY-BROWN TO GRAY (BEDROCK).

CLAYSTONE, VERY HARD, SLIGHTLY SANDY, THIN BEDDED, FRACTURED, SOME GYPSUM SEAMS, DRY TO SLIGHTLY MOIST, BROWN-GRAY TO GRAY (BEDROCK).

CLAYSTONE, VERY HARD, SLIGHTLY SANDY, THIN BEDDED, DRY TO SLIGHTLY MOIST, GRAY (BEDROCK).

29/12 INDICATES THAT 29 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE A 2-INCH DIAMETER SAMPLER 12 INCHES.

J INDICATES DISTURBED JAR SAMPLE.

S INDICATES DISTURBED SACK SAMPLE.

INDICATES PRACTICAL RIG REFUSAL.

FOR NOTES, SEE FIGURE 7

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

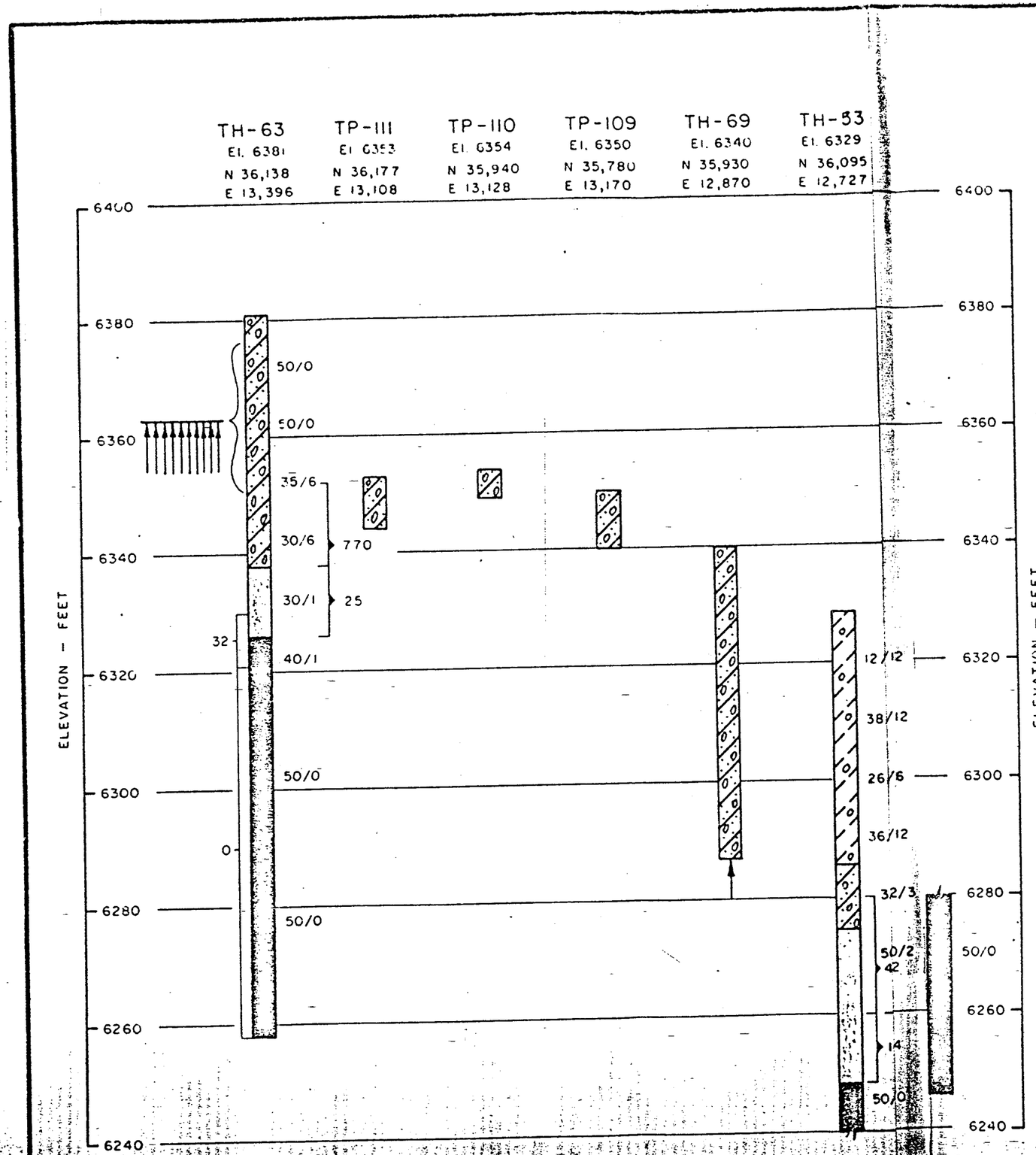
SUMMARY LOGS OF TEST HOLES AND TEST PITS
DAMS AND EVAPORATION POND
BORROW AREA A
HUNTINGTON CANYON PLANT

Prepared by: CEN

Job No. 15902 - 12575

6-8

FIG. 5



LEGEND

CLAY, STIFF TO VERY STIFF, SANDY TO VERY SANDY, GRAVELLY, OCCASIONALLY COBBLY AND BOULDERY, MOIST, BROWN TO GRAY BROWN (CL).

GRAVEL, COBBLE AND BOULDERS, MEDIUM DENSE TO DENSE, PRIMARILY HIGHLY CEMENTED SANDSTONE IN A SILTY TO SLIGHTLY CLAYEY SAND MATRIX, DRY TO SLIGHTLY MOIST, BROWN (GM, COBBLE BOULDER).

CLAYSTONE, VERY HARD, SLIGHTLY SANDY, THIN BEDDED, FRACTURED, SOME GYPSUM SEAMS, DRY TO SLIGHTLY MOIST, BROWN-GRAY TO GRAY (BEDROCK).

CLAYSTONE, VERY HARD, SLIGHTLY SANDY, THIN BEDDED, DRY TO SLIGHTLY MOIST, GRAY (BEDROCK).

12/12 INDICATES THAT 12 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE A 2-INCH DIAMETER SAMPLER 12 INCHES.

INDICATES PRACTICAL DRILL RIG REFUSAL. MORE THAN ONE SUCH SYMBOL INDICATES DEPTH IN ADJACENT HOLE ATTEMPTED AT SAME LOCATION.

32 INDICATES DEPTH OF PACKER-TYPE FIELD PERMEABILITY TEST AND AVERAGE CALCULATED PERMEABILITY IN FEET PER YEAR.

25 INDICATES DEPTH OF FALLING HEAD TYPE OF FIELD PERMEABILITY TEST AND AVERAGE CALCULATED PERMEABILITY IN FEET PER YEAR.

FOR NOTES, SEE FIGURE 7

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

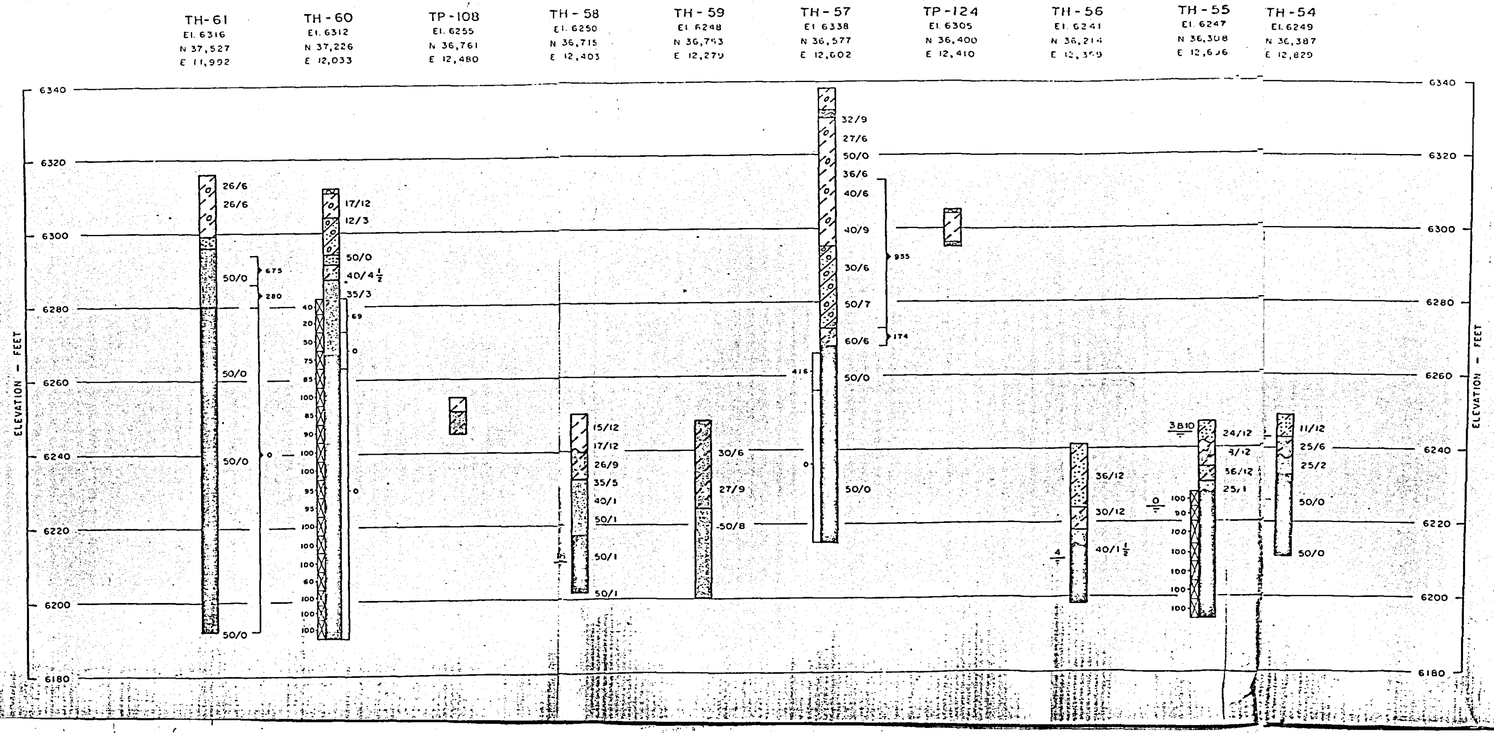
6-9
Fig 6

SUMMARY LOGS OF TEST HOLES AND TEST PITS
DAMS AND EVAPORATION PONDS
BORROW AREA B
HUNTINGTON CANYON PLANT

Prepared by: C.L.P.

Job No. 15902-12575

FIG



LEGEND

- TOPSOIL, CLAY, SANDY, MOIST, GRAY, BROWN ROOTS.
- CLAY, STIFF TO VERY STIFF, SANDY TO VERY SANDY, GRAVELLY, OCCASIONALLY COBBLY AND BOULDERY, DRY TO SLIGHTLY MOIST, BROWN TO GRAY-BROWN (CL).
- GRAVEL, COBBLE AND BOULDERS, MEDIUM DENSE TO DENSE, PRIMARILY HIGHLY CEMENTED SANDSTONE IN A SILTY TO SLIGHTLY CLAYEY SAND MATRIX, DRY TO SLIGHTLY MOIST, BROWN (GM, COBBLE BOULDER).
- SAND, MEDIUM DENSE TO DENSE, VERY CLAYEY, SLIGHTLY GRAVELLY, DRY TO SLIGHTLY MOIST, BROWN, BROWN-GRAY (SC).
- CLAY, STIFF TO VERY STIFF, SLIGHTLY SANDY WITH SOME WEATHERED SANDSTONE CHIPS, GYPSIFEROUS, DRY TO SLIGHTLY MOIST, BROWN TO GRAY-BROWN (CL).
- CLAY, STIFF TO VERY STIFF, SLIGHTLY SANDY TO SANDY, SOME SANDSTONE GRAVEL, HIGHLY GYPSIFEROUS, SLIGHTLY MOIST TO MOIST, GRAY-BROWN (CL) (WEATHERED BEDROCK).
- CLAYSTONE, MEDIUM HARD TO HARD, SLIGHTLY SANDY TO SANDY, FRACTURED, GYPSUM SEAMS, SLIGHTLY MOIST TO MOIST, GRAY-BROWN TO GRAY (BEDROCK).
- CLAYSTONE, VERY HARD, SLIGHTLY SANDY, THIN-BEDDED, FRACTURED, SOME GYPSUM SEAMS, DRY TO SLIGHTLY MOIST, BROWN-GRAY TO GRAY (BEDROCK).
- CLAYSTONE, VERY HARD, SLIGHTLY SANDY, THIN-BEDDED, DRY TO SLIGHTLY MOIST, GRAY (BEDROCK).
- SANDSTONE, VERY HARD, SLIGHTLY CLAYEY, DRY, BROWN (BEDROCK).
- 12/12 INDICATES THAT 12 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE A 2-INCH DIAMETER SAMPLER 12 INCHES.
- GRADUAL CHANGE IN MATERIALS. EXACT STRATA CHANGE NOT LOCATED.
- 4 ▽ FREE WATER LEVEL AND NUMBER OF DAYS AFTER DRILLING THAT MEASUREMENT WAS TAKEN.
- 100 INDICATES DEPTH OF NX CORE RUN AND PERCENT RECOVERY.
- 0 INDICATES DEPTH OF PACKER TYPE FIELD PERMEABILITY TEST AND AVERAGE CALCULATED PERMEABILITY IN FEET PER YEAR.
- 174 INDICATES DEPTH OF FALLING HEAD TYPE FIELD PERMEABILITY TEST AND AVERAGE CALCULATED PERMEABILITY IN FEET PER YEAR.

NOTES:

1. TEST HOLES WERE DRILLED ON JANUARY 13 TO 29, 1972 WITH A 4-INCH DIAMETER HELICAL AUGER, 3-INCH DIAMETER ROCK BIT WITH AIR, OR AN NX CORE BARREL POWERED WITH A CENTRAL MINE EQUIPMENT (CME 55) DRILL RIG. TEST PITS WERE BACKHOE EXCAVATED ON JANUARY 18 AND 24, AND JUNE 6, 1972.
2. ELEVATIONS AND COORDINATE LOCATIONS ARE APPROXIMATE AND WERE FURNISHED BY STEARNS-ROGER CORPORATION.
3. TEST HOLE AND TEST PIT LOGS IN THIS REPORT ARE SUBJECT TO LIMITATIONS, EXPLANATIONS AND CONCLUSIONS OF THIS REPORT.
4. THESE LOGS SUMMARIZE FINDINGS RELIED ON IN FORMULATING THE DESIGN CRITERIA PRESENTED IN THIS REPORT. THE EXPLORATIONS WERE NOT MADE TO DEFINE CONDITIONS FOR CONSTRUCTION NOR IS THE INFORMATION PRESENTED HEREIN FOR THAT PURPOSE.

6-10

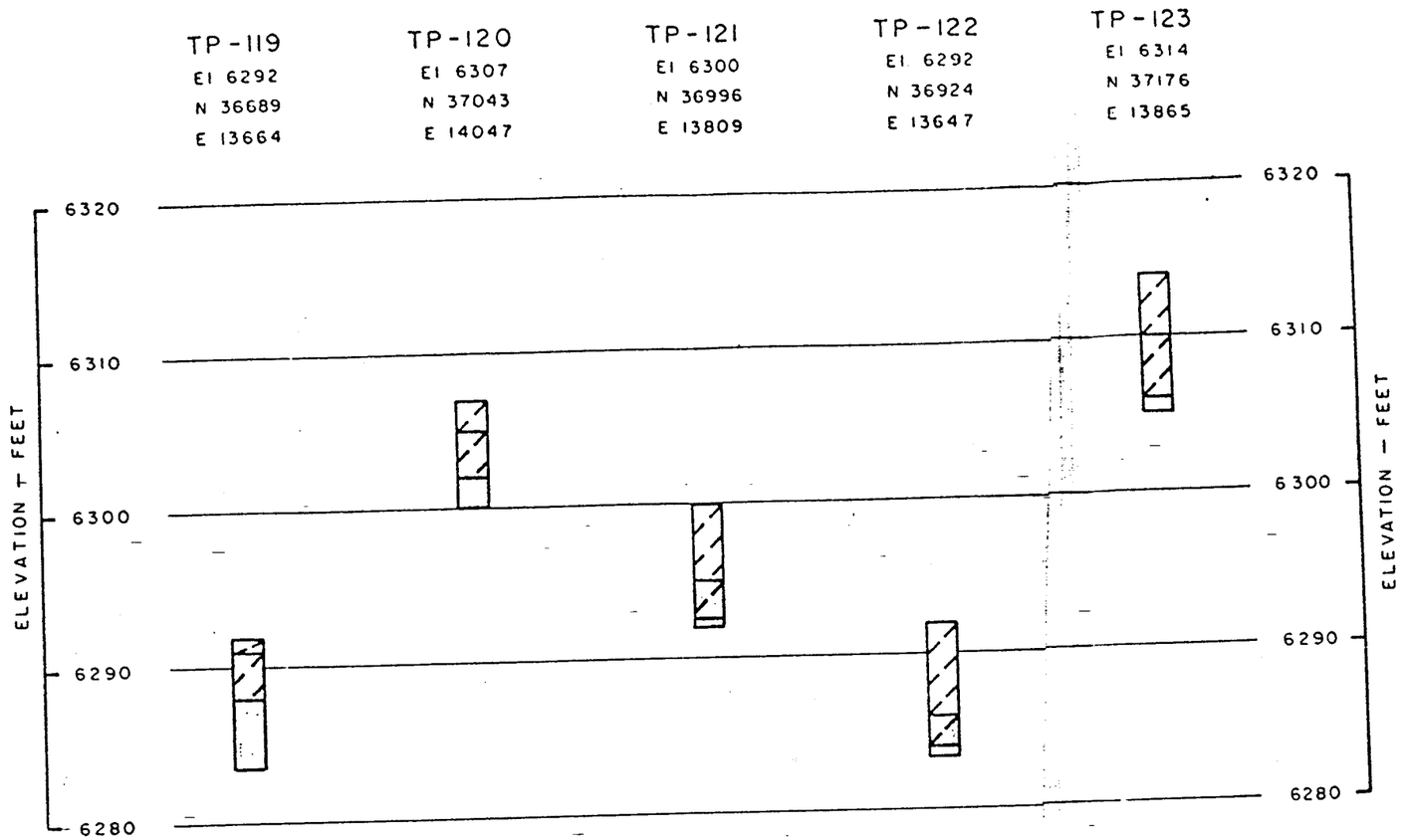
WOODWARD-CLEVENGER & ASSOC., INC.
Consulting Engineers & Geologists
Denver, Colorado

SUMMARY LOGS OF TEST HOLES AND TEST PITS
DAMS AND EVAPORATION POND
BORROW AREA C
HUNTINGTON CANYON PLANT

Prepared by: MJ

Job No. 15902-12575

FIG. 7



LEGEND

- CLAY, STIFF TO VERY STIFF, SLIGHTLY SANDY WITH SOME WEATHERED SANDSTONE CHIPS, GYPSIFEROUS, DRY TO SLIGHTLY MOIST, BROWN TO GRAY-BROWN (CL).
- CLAYSTONE, MEDIUM HARD TO HARD, SLIGHTLY SANDY TO SANDY, FRACTURED, GYPSUM SEAMS, SLIGHTLY MOIST TO MOIST, GRAY-BROWN TO GRAY (BEDROCK).
- CLAYSTONE, VERY HARD, SLIGHTLY SANDY, THIN BEDDED, FRACTURED, SOME GYPSUM SEAMS, DRY TO SLIGHTLY MOIST, BROWN-GRAY TO GRAY (BEDROCK).

NOTES:

1. TEST PITS WERE EXCAVATED JUNE 6, 1972 WITH A BACKHOE.
2. ELEVATIONS ARE APPROXIMATE AND WERE PROVIDED BY STEARNS-ROGER CORPORATION.
3. NO FREE WATER WAS FOUND IN TEST PITS AT THE TIME OF EXCAVATION.
4. TEST PIT LOGS IN THIS REPORT ARE SUBJECT TO LIMITATIONS, EXPLANATIONS, AND CONCLUSIONS OF THIS REPORT.
5. THESE TEST PIT LOGS SUMMARIZE FINDINGS RELIED ON IN FORMULATING THE DESIGN CRITERIA PRESENTED IN THIS REPORT. THE EXPLORATIONS WERE NOT MADE TO DEFINE CONDITIONS FOR CONSTRUCTION NOR IS THE INFORMATION PRESENTED HEREIN FOR THAT PURPOSE.

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Denver, Colorado

SUMMARY LOGS OF TEST PIT

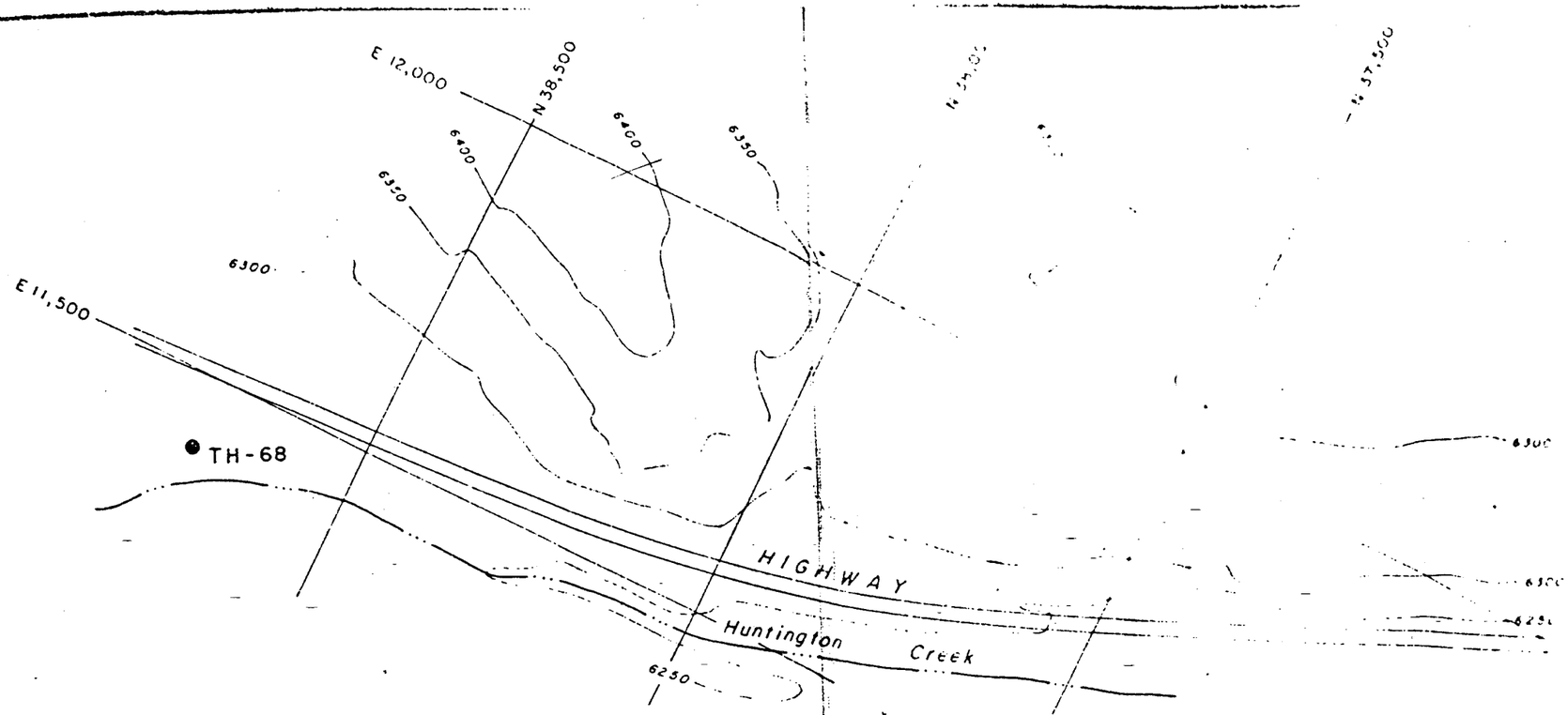
DAMS AND EVAPORATION PON
BORROW AREA D
HUNTINGTON CANYON PLANT

Prepared by: [illegible]

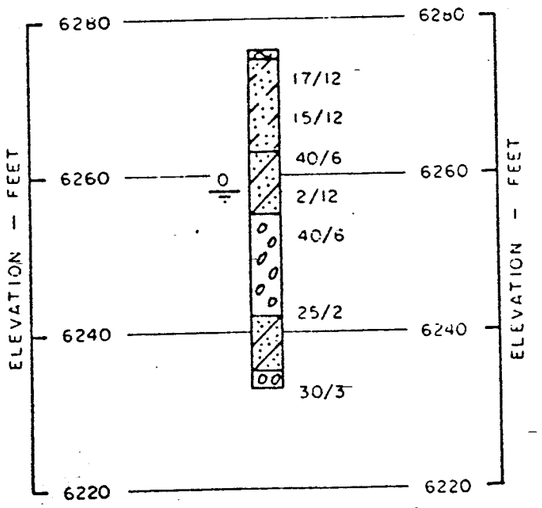
Job No. 15902-12575

Fig 8
6-11

FIG



TH-68
El. 6276
N 38,716
E 11,402



LEGEND

TOPSOIL, SAND, SILTY TO CLAYEY, GRAVELLY, ROOTS, DRY, BROWN.

SAND, MEDIUM DENSE, CLAYEY TO VERY CLAYEY, GRAVELLY, DRY, BROWN (SC).

SAND, DENSE, OCCASIONAL THIN LOOSE POCKETS, SILTY TO VERY SILTY, GRAVELLY, OCCASIONAL COBBLES, MOIST TO WET, BROWN, GRAY (SM).

GRAVEL, DENSE, SANDY, SILTY, COBBLY, WET, BROWN (GM).

17/12 INDICATES THAT 17 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE A 2-INCH DIAMETER SAMPLER 12 INCHES.

$\frac{0}{\nabla}$ FREE WATER LEVEL AND NUMBER OF HOURS AFTER DRILLING THAT MEASUREMENT WAS TAKEN.

FOR NOTES, SEE FIG. 7

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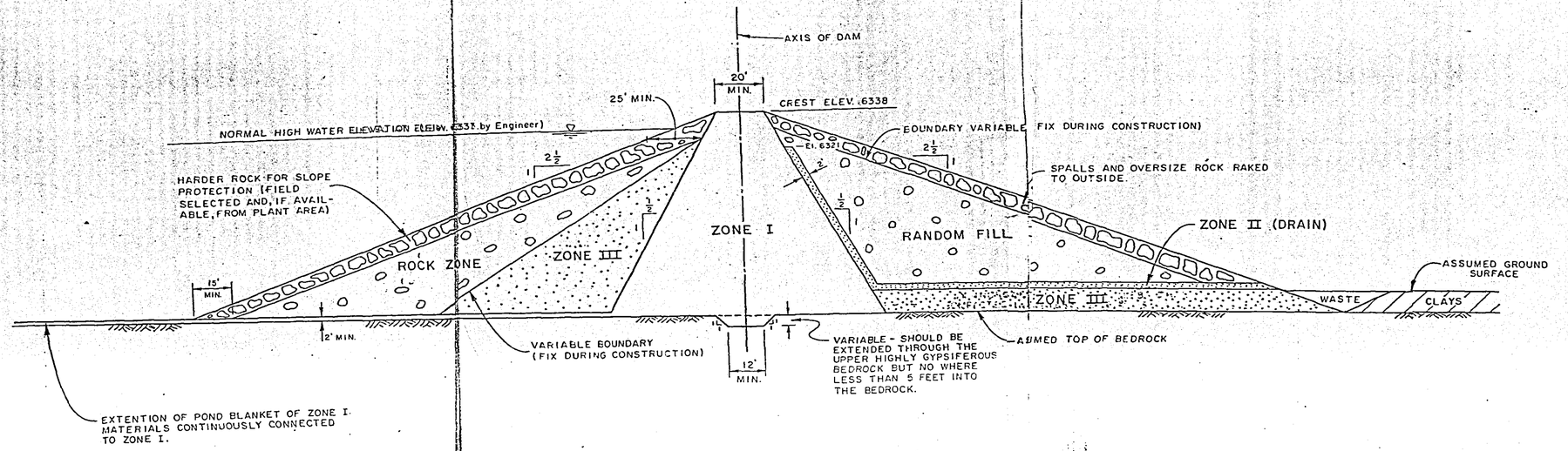
LOCATION AND SUMMARY LOG OF MISCELLANEOUS TEST HOLE

DAMS AND EVAPORATION POND
HUNTINGTON CANYON PLANT

Prepared by [illegible]
Job No. 15902.112575

6-12

FIG. 9



MAXIMUM SECTION

SCALE 1" = 30'

ZONE I – CLAYS, SILTS, CLAYEY AND SILTY SANDS AND GRAVELS WITH 100% FINER THAN 6 INCHES AND A MINIMUM OF 30% PASSING THE NO. 200 SIEVE, PLACED IN 6-INCH MAXIMUM LOOSE LIFTS AT OR ABOVE OPTIMUM MOISTURE CONTENT OPTIMUM FOR COMPACTION AND COMPACTED TO AT LEAST 98% OF MAXIMUM DENSITY (ASTM D1557) WITH HEAVY TRACTOR-TOWED ROLLERS. (CL, CH, ML, SM*, SC*, GM*, GC*, AND COMBINATIONS).

ZONE II – REASONABLY WELL GRADED, FREE-DRAINING SANDS AND GRAVELS WITH 100% FINER THAN 12 INCHES PLACED IN 18-INCH MAXIMUM LOOSE LIFTS AT THE MOISTURE CONTENT OPTIMUM FOR COMPACTION AND COMPACTED WITH A MINIMUM OF 4 PASSES OF A CATERPILLAR D-8 TRACTOR OR EQUIVALENT.

ZONE III – INORGANIC SOILS AND ROCK WITH 100% FINER THAN 8 INCHES PLACED IN 10-INCH LOOSE LIFTS AT THE MOISTURE CONTENT OPTIMUM FOR COMPACTION AND COMPACTED TO AT LEAST 95% OF MAXIMUM DENSITY (ASTM D1557) WITH HEAVY TRACTOR-TOWED ROLLERS.

RANDOM ZONE – INORGANIC SOILS AND ROCK PLACED IN 24-INCH MAXIMUM LOOSE LIFTS AT THE MOISTURE CONTENT OPTIMUM FOR COMPACTION AND COMPACTED WITH A MINIMUM OF 4 PASSES OF A HEAVY TRACTOR-TOWED ROLLER AND CONTROLLED ROUTING OF HAULING EQUIPMENT.

ROCK ZONE – CLEAN, OVERSIZE ROCK RAKED FROM FILL OR QUARRIED ROCK PLACED IN 3-FOOT THICK LOOSE LIFTS AND COMPACTED WITH A MINIMUM OF 4 PASSES OF A CATERPILLAR D-8 TRACTOR OR EQUIVALENT.

*MINIMUM OF 30% PASSING THE NO. 200 SIEVE.

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SUGGESTED EMBANKMENT SECTION

DAMS AND EVAPORATION POND

HUNTINGTON CANYON PLANT

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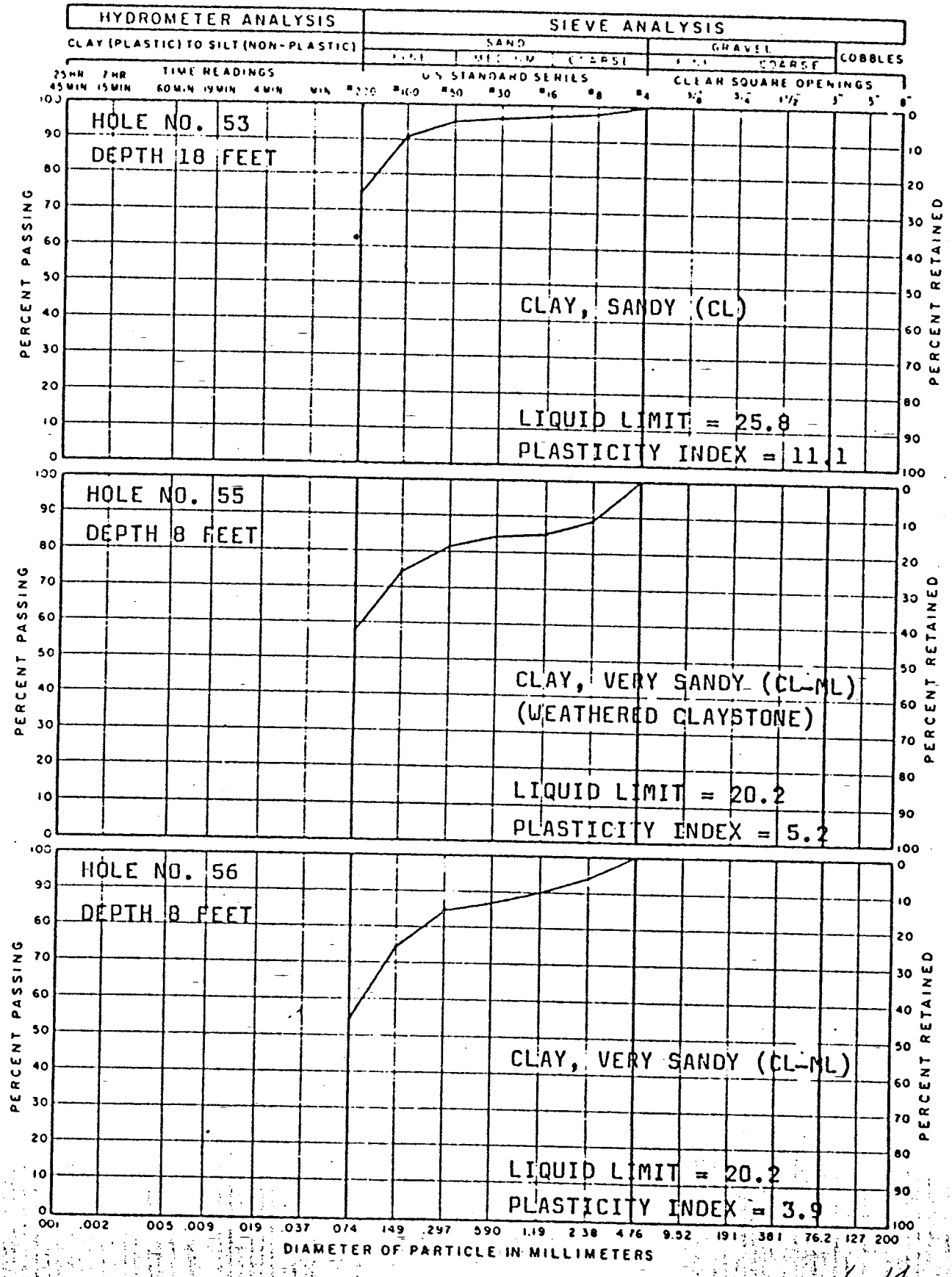
GRADATION ANALYSIS



Job No. 15902-12575

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FIG. 11