

FILE ACT/943/001
13 July 1981

Hydrology

James W. Smith
Coordinator of Mined Land Development
Division of Oil, Gas, and Mining
1588 West North Temple
Salt Lake City, Utah 84116

Re: Blackhawk Mine N.O.V. #N81-2-2-1 ACT/043/001

Dear Mr Smith:

Utah Coal and Energy, Inc. would like to submit the attached plans and design criterion for review by the Division of Oil, Gas, and Mining. As per our agreement after meeting with Sandy Pruitt and Sally Kefer on 10 July 1981, we are submitting one (1) set of as built drawings and one (1) set of design plans and specifications for review.

Although the existing basins do have adequate volume to handle runoff from a 10 year 24 hour precipitation event, it is quite obvious that major modifications will be necessary to comply with UMC 817.46. Utah Coal and Energy would like to modify these basins as per the design plans and has applied for a construction permit from the Bureau of Water Pollution Control to implement these necessary modifications.

I, personally would like to thank the Division personnel who have been more than willing to cooperate and help us in resolving this issue. Hopefully through cooperative efforts by all parties concerned, future situations of this nature can be avoided.

If any further information is necessary or any matter needed to be clarified, please advise.

Sincerely,

Eric Quam
Eric Quam, P.E.
Mining Engineer

RECEIVED

JUL 1 1981

DIVISION OF
OIL, GAS & MINING

DESIGN CRITERION:

Rainfall expected from a 10 year, 24 hour precipitation event is 1.90 inches from the estimated return period chart for Echo Dam (Table 1.)

The area of the watershed which is expected to pass through basin "C" is 131,115 ft² or 3.01 acres as delineated on the topo map attached.

All other calculations are done on the attached work sheets and are self explanatory and properly referenced.

Note: The disturbed acreage is not the full 3.01 acre drainage and 0.10 acre-feet of additional sediment storage volume per acre was used

Time of concentration was determined using the attached nomograph. In this case a minimal value of 8 minutes was used

The intensity for a 25 year precipitation event was derived from the curve derived from the Echo Dam data (Table 1.) and the curves are attached

A runoff coefficient C of 0.35 was obtained from Table 111-4 in EPA 025 3-70-000 Erosion and Sediment Control.

Basin Number SILT BASIN "C"

Application Number 12: /043/001

HYDROLOGIC DATA

Runoff Volume *

Runoff curve number (CN) 3.01^{***} acres @ CN = 75
 _____ acres @ CN = _____
 _____ acres @ CN = _____
 Composite CN = 3.01 acres @ CN = 75

** P (10 yr. - 24 hr.) = 1.90 inches

For CN = 75 and P = 1.90 --- Q(direct runoff) = 0.33 inches
from Figure 10.1 (1 of 2) - Antecedent Moisture Condition II.

Q = 0.33 inches/12 = 0.0275 feet

*Reference = "National Engineering Handbook", Section 4, Hydrology, Soil Conservation Service.

** Table *1 - attached

*** see attached topo map

RUNOFF FOR INCHES OF RAINFALL

Tenths Inches	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0								0.00	0.01	0.02
1	0.03	0.05	0.07	0.10	0.13	0.17	0.20	0.24	0.29	0.33
2	0.38	0.43	0.48	0.54	0.59	0.65	0.71	0.77	0.83	0.90
3	0.96	1.03	1.10	1.16	1.23	1.30	1.37	1.45	1.52	1.59
4	1.67	1.74	1.82	1.90	1.97	2.05	2.13	2.21	2.29	2.37
5	2.45	2.53	2.61	2.70	2.78	2.86	2.95	3.03	3.11	3.20
6	3.28	3.37	3.46	3.54	3.63	3.71	3.80	3.89	3.98	4.06
7	4.15	4.24	4.33	4.42	4.51	4.59	4.68	4.77	4.86	4.95
8	5.04	5.13	5.22	5.32	5.41	5.50	5.59	5.68	5.77	5.86
9	5.95	6.05	6.14	6.23	6.32	6.42	6.51	6.60	6.69	6.79
10	6.88	6.97	7.07	7.16	7.25	7.35	7.44	7.53	7.63	7.72
11	7.82	7.91	8.00	8.10	8.19	8.29	8.38	8.48	8.57	8.67
12	8.76	8.86	8.95	9.05	9.14	9.24	9.33	9.43	9.52	9.62
13	9.71	9.81	9.90	10.00	10.09	10.19	10.29	10.38	10.48	10.57
14	10.67	10.77	10.86	10.96	11.05	11.15	11.25	11.34	11.44	11.54
15	11.63	11.73	11.82	11.92	12.02	12.11	12.21	12.31	12.40	12.50
16	12.60	12.69	12.79	12.89	12.99	13.08	13.18	13.28	13.37	13.47
17	13.57	13.67	13.76	13.86	13.96	14.05	14.15	14.25	14.35	14.44
18	14.54	14.64	14.74	14.83	14.93	15.03	15.13	15.22	15.32	15.42
19	15.52	15.61	15.71	15.81	15.91	16.00	16.10	16.20	16.30	16.40
20	16.49	16.59	16.69	16.79	16.88	16.98	17.08	17.18	17.28	17.37

NOTE: Runoff value determined by equation $Q = \frac{(P-0.2S)^2}{P+0.8S}$

REFERENCE: National Engineering Handbook, Section 4, HYDROLOGY

TABLE 1.

ESTIMATED RETURN PERIODS FOR SHORT DURATION PRECIPITATION

Station: Echo Dam

Elevation: 5500

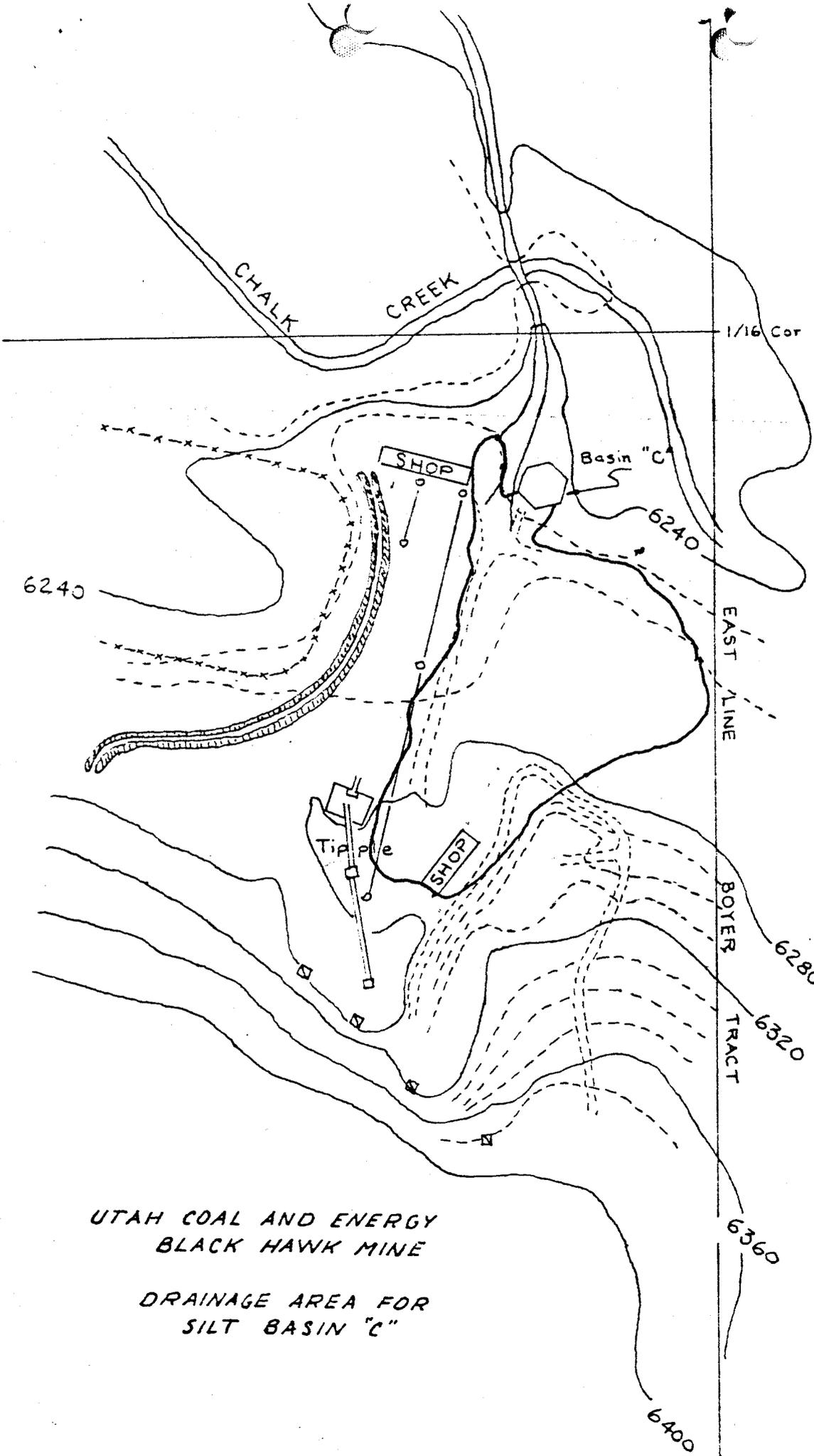
Latitude: 40° 58'

Longitude: 111° 26'

RETURN PERIOD
(years)

D U R A T I O N (inches)

	5 Min	10 Min	15 Min	30 Min	1 Hr	2 Hr	3 Hr	6 Hr	12 Hr	24 Hr
1	.17	.26	.32	.45	.57	.60	.62	.68	.73	.79
2	.18	.28	.35	.49	.62	.68	.73	.86	.98	1.10
5	.20	.31	.39	.54	.68	.78	.88	1.13	1.35	1.58
10	.21	.33	.42	.58	.74	.87	1.00	1.32	1.60	<u>1.90</u>
25	.23	.35	.44	.62	.78	.96	1.14	<u>1.58</u>	1.97	<u>2.38</u>
50	.26	.41	.51	.71	.90	1.10	1.30	1.79	2.23	2.68
100	.27	.42	.54	.74	.94	1.18	1.41	1.98	2.49	3.02



SCALE: 1" = 200'
 CI = 40'

UTAH COAL AND ENERGY
 BLACK HAWK MINE
 DRAINAGE AREA FOR
 SILT BASIN "C"

Basin Number SILT BASIN "C"

Application Number ACT/043/001

SIZE REQUIREMENTS FOR IMPOUNDMENTS

Design Detention Time 24 hours = t

Direct Runoff 0.0275 feet = Q

$Q_{total} = Q \times A = (0.0275) \times (3.010)$ acre-feet = 0.083 acre-feet

$V_r = Q (t / 24) = (0.083) (24/24)$ acre-feet = 0.083 acre-feet

$V_s = A_d \times C = (1.090) \times (0.100)$ acre-feet = 0.109 acre-feet

$V_t = V_r + V_s = (0.109) + (0.083)$ acre-feet = 0.192 acre-feet

Therefore the impoundment needs:

0.192 acre-feet of volume

V_t = Total volume needed in the impoundment (in acre-feet)

V_r = Volume needed for Design Detention Time (in acre-feet)

V_s = Volume needed for Sediment Storage (in acre-feet)

Q_{total} = Total direct runoff for drainage area for design storm (in acre-feet)

* Q = Direct runoff (in feet)

* A^a = Drainage area (in acres)

* A_d = Disturbed area in drainage area (in acres)

t = Design detention time (in hours)

C = Sediment storage volume needed per acre of disturbed area (in acre-feet)

* from Hydrologic Data Sheet

BASIN NUMBER SILT BASIN "C"

APPLICATION NUMBER ACT/043/001

HYDROLOGIC DATA

Drainage Area = 3.01 acres

Distance to most remote point = 650 feet

Height of critical point above structure = 52 feet

*** Time of concentration = 8 minutes

** Intensity (25 yr. frequency) = 2.38 inches per hour

Runoff Coefficient = 0.35

Q = CIA = (0.35)(2.38)(3.01) = 2.51 c.f.s.

EMERGENCY SPILLWAY DESIGN

$Q = CH^{1.5} L$ assume broad crested weir C=3.0

$$L = \frac{Q}{CH^{1.5}}$$

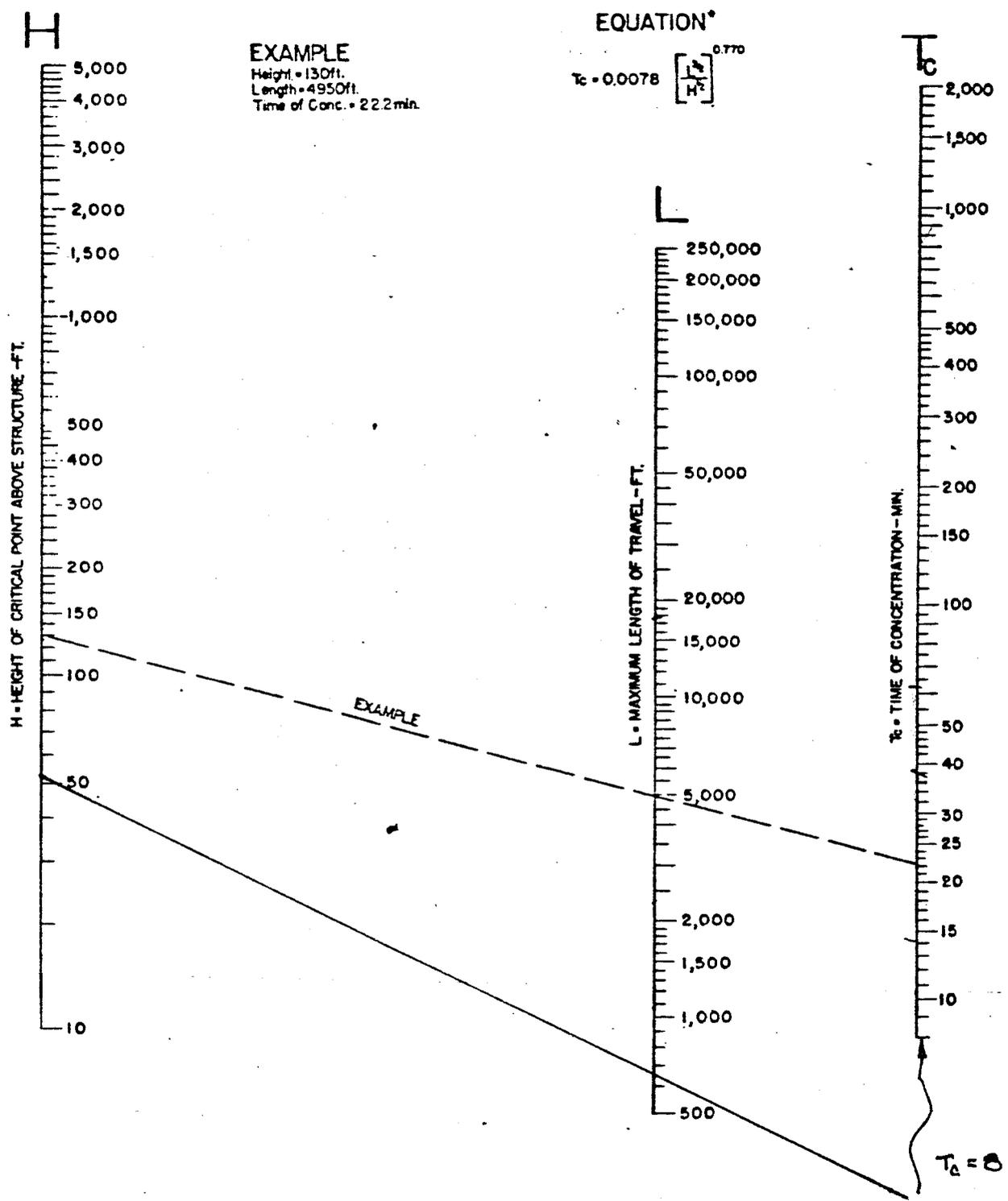
$$L = \frac{(2.51)}{(3.0)(1)^{1.5}} = 0.837 \text{ ft.}$$

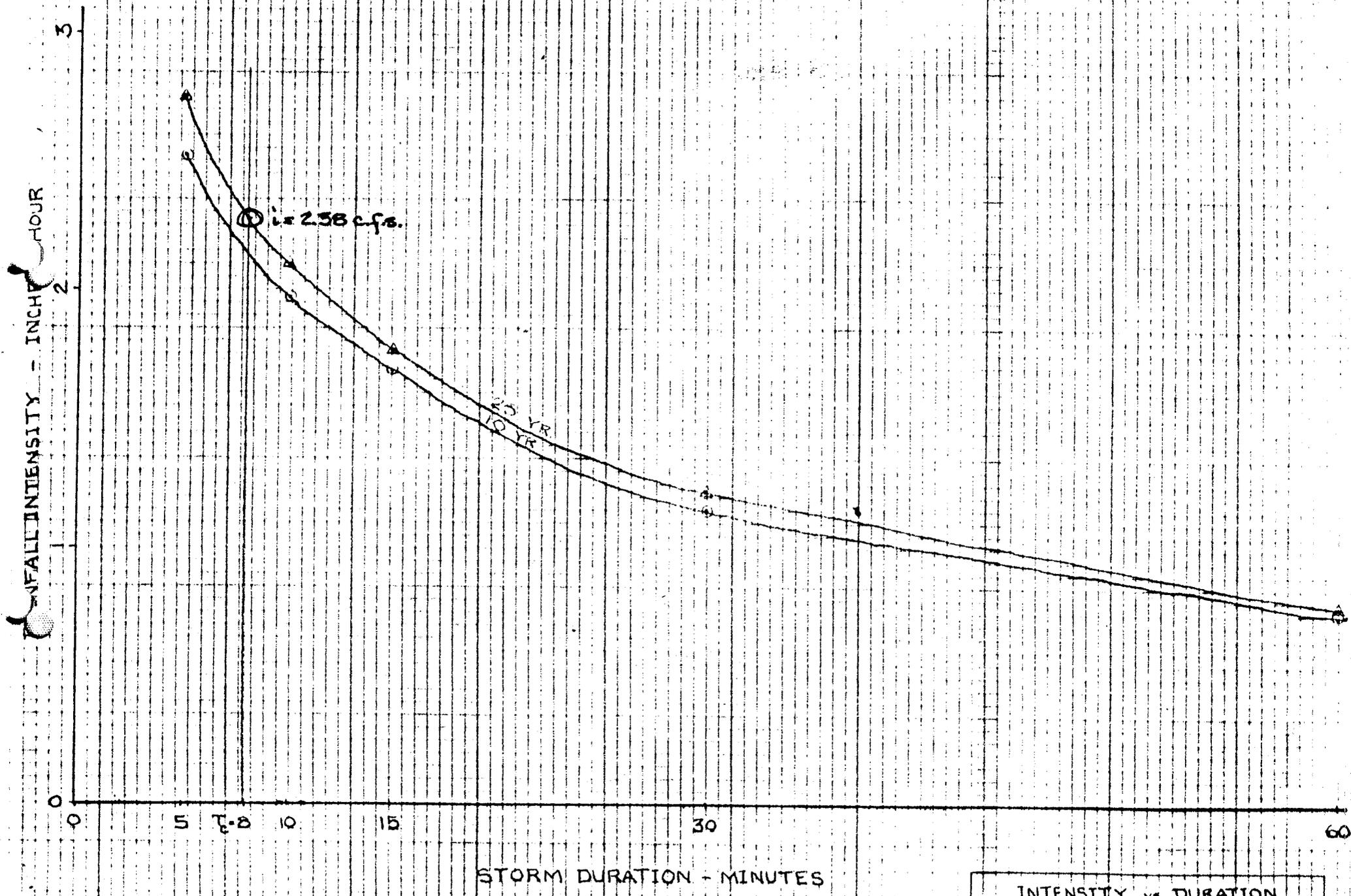
* L = 14.00 ft. = Bottom width of spillway

* for design purposes L = 14' which is blade width of HD-16 tractor.

** see attached rainfall intensity curve

*** derived from attached nomograph





INTENSITY vs DURATION
 DERIVED FROM ECHO DAM DATA
 REFER TO ATTACHED TABLE I

EMERGENCY SPILLWAY DESIGN

Total Head Calculations (Hp)

assume broad crested weir, trapezoidal channel

$$*Q = CLH^{1.5} \quad C = 3.0$$

solve for H

$$H = (Q/CL)^{0.667}$$

$$Q = \underline{2.51} \text{ c.f.s. (from Hydrologic Data-Emergency Spillway Design)}$$

$$L = \underline{14.00} \text{ ft. (emergency spillway bottom width)}$$

$$H = \underline{0.15} \text{ ft. (total head on entrance crest)}$$

$$H_p \text{ used in spillway design} = \underline{0.15} \text{ ft.}$$

*"M.E.S.A. Engineering and Design Manual for Coal Refuse Disposal Facilities", page 6.134, Figure 6.38c.

.817

.412

.4985

.392

3727 ac.

406 .418

3837 acre

Bob Morgan
Dam Safety

Health

as-built
Submission

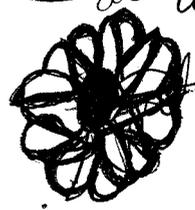
??
Final ??

3.01

Eric Quam + Matt Haaga

502-338-1960

- also drain area a mix of dist + undist. runoff?
- what are dotted lines for? on map
- ^{are those} diversions running N-S on W side
Shop + tipple?



~~drain area consume~~

Boron <u>5/</u>	Boron	ppm	Extraction by A.S.A. Mono. No. 9 Part 2, pg 1062. Analysis by the carmine method (Standard Methods, 1976).
	Nitrate-nitrogen	ppm	Extraction by A.S.A. Mono. No. 9 Part 2, Method 84-5.3.3, page 1216. Analysis by Nitrogen electrode (Tabatabai, 1974).
Organic matter		Percent	A.S.A. Mono No. 9 Part 2, method 90-3, pg. 1372-1376.
	Molybdenum	ppm to a lower detection limit of 0.5.	(NH ₄) ₂ CO ₃ extractable Vlek P.O.G.6., 1975 Acceptable procedures available from LQD.
	Copper	ppm	DTPA Extraction (Follett and Lindsay, 1971) Analysis by Atomic Absorption Spectrophotometry.
	Acid-base	Acid potential in me H ⁺ /100 g neutralization potential in tons $\frac{\text{CaCO}_3 \text{ equivalent}}{1000}$ acid neutralization account/+ tons CaCO ₃ tons.	Smith, R.M. <u>et. al.</u> 1974.
	Lead <u>3/</u>	ppm	DTPA extraction (Follett and Lindsay, 1971) and analysis by atomic absorption spectrophotometry.
	Arsenic	ppm	Soluble (method yet to be determined).