

APPENDIX B

ENGINEERING ANALYSES

B.1 RADON Analyses - New for 2012 Update

B.2 - Retained from Original Closeout Plan, 1998

- SURFACE WATER HYDROLOGIC ANALYSIS
 - FLOOD HYDROGRAPH (HEC-1) ANALYSES
 - WATER SURFACE PROFILE (HEC-2) ANALYSES
- REVISED UNIVERSAL SOIL LOSS EQUATION (RUSLE) ANALYSES
- SLOPE STABILITY (SB-SLOPE) ANALYSES
- DESIGN RUNOFF AND SHEAR CALCULATIONS

These calculations were based on full build-out of the mine site.

As-is conditions are less than full build-out, therefore these

calculations are conservative for as-is conditions.

B.1 RADON ANALYSIS

WATER TREATMENT PONDS AND WASTE ROCK PILE AFTER CLOSURE

Table B.1 Input Parameters and Radon Flux - RADON modeling of Mine Water Treatment Pond Cover and Waste Rock Pile

Pond	Pond Sediment		Fill from Area A and Ore Stockpile Pad		Contaminated Soil Fill		Soil Cover		Total Fill Depth, ft (1)	Calculated Radon Flux from Cover, pCi/m ² S
	Average Thickness, ft (2)	Average Ra-226, pCi/g	Average Thickness, ft	Average Ra-226, pCi/g	Average Thickness, ft	Average Ra-226, pCi/g (3)	Average Thickness, ft	Average Ra-226, pCi/g		
1	1.5	119	1.0	214	11.0	44	2.0	6.8	14	19.7
2	1.5	224	0.0	NA	11.0	44	2.0	6.8	13	19.9
3	1.65	21	1.0	214	13.0	44	2.0	6.8	16	19.1
4	0.75	18	0.0	NA	10.0	44	2.0	6.8	12	18.8
5	1.7	11	0.0	NA	13.0	44	2.0	6.8	15	18.8
6	1.5	6	0.0	NA	13.0	44	2.0	6.8	15	18.8
7	1.4	10	0.0	NA	13.0	44	2.0	6.8	15	18.9
8	2.25	27	0.0	NA	7.0	44	2.0	6.8	9	18.4
Waste Rock Pile	Waste Rock				Contaminated Soil Fill		Soil Cover			
	17	50 (4)			1.6 (5)	44	2.0	6.8		19.9

- (1) Total fill depth is design top of cover to existing top of pond sediment
- (2) Pond sediment thicknesses are average values from test pit logs, April 2012. Pond 2 sediment thickness estimated because of standing water
- (3) Average of 10 pond surface sediment samples, to represent source of soil contamination
- (4) Conservative estimate based on low concentrations of Ra-226 in SPLP leachate from waste pile tests, Table 2, Kleinfelder, 2012
- (5) 1.4 ft over 21.7 acres based on 48,660 BCY contaminated soil, 1.6 ft thick with 15% swell for LCY placed.

The RADON model was run in accordance with:

U.S. Nuclear Regulatory Commission Office of Research, RADON, Version 1.2, May 22, 1989, and
U.S. Nuclear Regulatory Commission Office of Nuclear Regulatory Research, "Regulatory Guide 3.64,
"Calculation of Radon Flux Attenuation by Earthen Uranium Mill Tailings Covers", June 1989.

Pond #1

----- Input Parameters -----

Number of Layers: 4

Radon Flux into Layer 1: 0 pCi/m²s

Surface Radon Concentration: 0 pCi/L

Bare Source Flux (Jo) from Layer 1: 43.30 pCi/m²sSpecific Bare Source Flux from Layer 1: 0.364 pCi/m²s per pCi_Ra-226/g

Layer Thickness Ra-226 Emanat Porosity Moisture Diff Coeff

No. [m] [pCi/g] Fract [dry wt_%] [m²/s]

1 0.45 119 .25 0.4 5 2.704E-6

2 0.3 214 .25 0.4 5 2.704E-6

3 3.3 44 .25 0.4 10 1.602E-6

4 0.6 6.8 .25 0.4 10 1.602E-6

----- Results of Radon Diffusion Calculation -----

Layer Thickness Exit Flux Exit Conc. MIC

No. [m] [pCi/m²s] [pCi/L]

1 0.45 3.964 109.4E3 0.850

2 0.3 31.44 104.5E3 0.850

3 3.3 20.75 18.20E3 0.700

4 0.6 19.67 0E0 0.700

Total cover radon retention: 54.57%

Pond #2

----- Input Parameters -----

Number of Layers: 4

Radon Flux into Layer 1: 0 pCi/m2s

Surface Radon Concentration: 0 pCi/L

Bare Source Flux (Jo) from Layer 1: 81.50 pCi/m2s

Specific Bare Source Flux from Layer 1: 0.364 pCi/m2s per pCi_Ra-226/g

Layer Thickness Ra-226 Emanat Porosity Moisture Diff Coeff

No.	[m]	[pCi/g]	Fract		[dry wt_%]	[m2/s]
1	0.45	224	.25	0.4	5	2.704E-6
2	0.01	214	.25	0.4	5	2.704E-6
3	3.3	44	.25	0.4	10	1.602E-6
4	0.6	6.8	.25	0.4	10	1.602E-6

----- Results of Radon Diffusion Calculation -----

Layer Thickness Exit Flux Exit Conc. MIC

No.	[m]	[pCi/m2s]	[pCi/L]	
1	0.45	38.88	118.6E3	0.850
2	0.01	39.70	118.2E3	0.850
3	3.3	20.99	18.39E3	0.700
4	0.6	19.86	0E0	0.700

Total cover radon retention: 75.63%

Pond #3

----- Input Parameters -----

Number of Layers: 4

Radon Flux into Layer 1: 0 pCi/m2s

Surface Radon Concentration: 0 pCi/L

Bare Source Flux (Jo) from Layer 1: 9.818 pCi/m2s

Specific Bare Source Flux from Layer 1: 0.468 pCi/m2s per pCi_Ra-226/g

Layer Thickness Ra-226 Emanat Porosity Moisture Diff Coeff

No.	[m]	[pCi/g]	Fract		[dry wt_%]	[m2/s]
1	0.6	21	.25	0.4	5	2.704E-6
2	0.3	214	.25	0.4	5	2.704E-6
3	3.9	44	.25	0.4	10	1.602E-6
4	0.6	6.8	.25	0.4	10	1.602E-6

----- Results of Radon Diffusion Calculation -----

Layer Thickness Exit Flux Exit Conc. MIC

No.	[m]	[pCi/m2s]	[pCi/L]	
1	0.6	-23.6	72.31E3	0.850
2	0.3	12.41	73.85E3	0.850
3	3.9	20.04	17.62E3	0.700
4	0.6	19.10	0E0	0.700

Total cover radon retention: -94.5%

Pond #4

----- Input Parameters -----

Number of Layers: 4

Radon Flux into Layer 1: 0 pCi/m2s

Surface Radon Concentration: 0 pCi/L

Bare Source Flux (Jo) from Layer 1: 3.474 pCi/m2s

Specific Bare Source Flux from Layer 1: 0.193 pCi/m2s per pCi_Ra-226/g

Layer Thickness Ra-226 Emanat Porosity Moisture Diff Coeff

No.	[m]	[pCi/g]	Fract		[dry wt_%]	[m2/s]
1	0.23	18	.25	0.4	5	2.704E-6
2	0.01	214	.25	0.4	5	2.704E-6
3	3	44	.25	0.4	10	1.602E-6
4	0.6	6.8	.25	0.4	10	1.602E-6

----- Results of Radon Diffusion Calculation -----

Layer Thickness Exit Flux Exit Conc. MIC

No.	[m]	[pCi/m2s]	[pCi/L]	
1	0.23	-5.23	45.65E3	0.850
2	0.01	-3.79	45.69E3	0.850
3	3	19.68	17.34E3	0.700
4	0.6	18.82	0E0	0.700

Total cover radon retention: -442.%

Pond #5

----- Input Parameters -----

Number of Layers: 4

Radon Flux into Layer 1: 0 pCi/m2s

Surface Radon Concentration: 0 pCi/L

Bare Source Flux (Jo) from Layer 1: 4.474 pCi/m2s

Specific Bare Source Flux from Layer 1: 0.407 pCi/m2s per pCi_Ra-226/g

Layer Thickness Ra-226 Emanat Porosity Moisture Diff Coeff

No.	[m]	[pCi/g]	Fract		[dry wt_%]	[m2/s]
1	0.51	11	.25	0.4	5	2.704E-6
2	0.01	214	.25	0.4	5	2.704E-6
3	3.9	44	.25	0.4	10	1.602E-6
4	0.6	6.8	.25	0.4	10	1.602E-6

----- Results of Radon Diffusion Calculation -----

Layer Thickness Exit Flux Exit Conc. MIC

No.	[m]	[pCi/m2s]	[pCi/L]	
1	0.51	-10.8	37.92E3	0.850
2	0.01	-9.26	38.01E3	0.850
3	3.9	19.72	17.37E3	0.700
4	0.6	18.85	0E0	0.700

Total cover radon retention: -321.%

Pond #6

----- Input Parameters -----

Number of Layers: 4

Radon Flux into Layer 1: 0 pCi/m2s

Surface Radon Concentration: 0 pCi/L

Bare Source Flux (Jo) from Layer 1: 2.183 pCi/m2s

Specific Bare Source Flux from Layer 1: 0.364 pCi/m2s per pCi_Ra-226/g

Layer Thickness Ra-226 Emanat Porosity Moisture Diff Coeff

No.	[m]	[pCi/g]	Fract		[dry wt_%]	[m2/s]
1	0.45	6	.25	0.4	5	2.704E-6
2	0.01	214	.25	0.4	5	2.704E-6
3	3.9	44	.25	0.4	10	1.602E-6
4	0.6	6.8	.25	0.4	10	1.602E-6

----- Results of Radon Diffusion Calculation -----

Layer Thickness Exit Flux Exit Conc. MIC

No.	[m]	[pCi/m2s]	[pCi/L]	
1	0.45	-11.2	37.21E3	0.850
2	0.01	-9.68	37.31E3	0.850
3	3.9	19.72	17.37E3	0.700
4	0.6	18.84	0E0	0.700

Total cover radon retention: -763.%

Pond #7

----- Input Parameters -----

Number of Layers: 4

Radon Flux into Layer 1: 0 pCi/m2s

Surface Radon Concentration: 0 pCi/L

Bare Source Flux (Jo) from Layer 1: 3.417 pCi/m2s

Specific Bare Source Flux from Layer 1: 0.342 pCi/m2s per pCi_Ra-226/g

Layer Thickness Ra-226 Emanat Porosity Moisture Diff Coeff

No.	[m]	[pCi/g]	Fract		[dry wt_%]	[m2/s]
1	0.42	10	.25	0.4	5	2.704E-6
2	0.01	214	.25	0.4	5	2.704E-6
3	3.9	44	.25	0.4	10	1.602E-6
4	0.6	6.8	.25	0.4	10	1.602E-6

----- Results of Radon Diffusion Calculation -----

Layer Thickness Exit Flux Exit Conc. MIC

No.	[m]	[pCi/m2s]	[pCi/L]	
1	0.42	-9.87	39.37E3	0.850
2	0.01	-8.38	39.46E3	0.850
3	3.9	19.74	17.38E3	0.700
4	0.6	18.86	0E0	0.700

Total cover radon retention: -452.%

Pond #8

----- Input Parameters -----

Number of Layers: 4

Radon Flux into Layer 1: 0 pCi/m2s

Surface Radon Concentration: 0 pCi/L

Bare Source Flux (Jo) from Layer 1: 13.98 pCi/m2s

Specific Bare Source Flux from Layer 1: 0.518 pCi/m2s per pCi_Ra-226/g

Layer Thickness Ra-226 Emanat Porosity Moisture Diff Coeff

No.	[m]	[pCi/g]	Fract		[dry wt_%]	[m2/s]
1	0.68	27	.25	0.4	5	2.704E-6
2	0.01	214	.25	0.4	5	2.704E-6
3	2.1	44	.25	0.4	10	1.602E-6
4	0.6	6.8	.25	0.4	10	1.602E-6

----- Results of Radon Diffusion Calculation -----

Layer Thickness Exit Flux Exit Conc. MIC

No.	[m]	[pCi/m2s]	[pCi/L]	
1	0.68	-6.44	39.93E3	0.850
2	0.01	-4.96	39.99E3	0.850
3	2.1	19.10	16.86E3	0.700
4	0.6	18.35	0E0	0.700

Total cover radon retention: -31.2%

Waste Rock Pile

----- Input Parameters -----

Number of Layers: 3

Radon Flux into Layer 1: 0 pCi/m²s

Surface Radon Concentration: 0 pCi/L

Bare Source Flux (Jo) from Layer 1: 43.68 pCi/m²s

Specific Bare Source Flux from Layer 1: 0.874 pCi/m²s per pCi_Ra-226/g

Layer Thickness Ra-226 Emanat Porosity Moisture Diff Coeff

No.	[m]	[pCi/g]	Fract		[dry wt_%]	[m ² /s]
1	4.5	50	.25	0.4	7.000	2.216E-6
2	0.5	44	.25	0.4	10	1.602E-6
3	0.6	6.8	.25	0.4	10	1.602E-6

----- Results of Radon Diffusion Calculation -----

Layer Thickness Exit Flux Exit Conc. MIC

No.	[m]	[pCi/m ² s]	[pCi/L]	
1	4.5	13.07	35.47E3	0.790
2	0.5	21.08	18.47E3	0.700
3	0.6	19.94	0E0	0.700

Total cover radon retention: 54.35%

REVISED UNIVERSAL SOIL LOSS EQUATION INPUT/OUTPUT FILE

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File      Exit      Help      Screen
=====
Conservation Planning Alternatives - Soil Loss Computation Worksheet

filename  R      x      K      x      LS      x      C      x      P      =      A
=====
MTTAYLR2  27      0.12    0.62    0.203    0.50    =    0.2
MTTAYLR1  27      0.12    0.93    0.662    0.57    =    1.1
RGRPILE1  27      0.12    0.07    0.370    0.25    =    0.02
RGRPILE2  27      0.12    0.07    0.008    0.03    =    0
0         0         0         0         0         0         =    0
0         0         0         0         0         0         =    0
0         0         0         0         0         0         =    0
0         0         0         0         0         0         =    0
0         0         0         0         0         0         =    0
=====
F4 Calls Factor, Esc Returns to RUSLE Main Menu >=====
Tab Esc F1  F2  F4  F9
FUNC esc help clr call info

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Filename Key:

- MTTAYLR2 Reclaimed surface of stockpile and laydown areas east of WSP
- MTTAYLR1 Disturbed surface of stockpile and laydown areas east of WSP
- RGRPILE1 Pile surface before revegetation
- RGRPILE2 Pile surface after revegetation

GEOSYSTEM SLOPE STABILITY PROGRAM
SB-SLOPE

PROJECT DATA:

Project: Mt Taylor Mine Closeout Plan, Old Waste Rock Pile Stability
Location: San Mateo, NM
Filename: RGROLDPI Description: Old Waste Pile, Max Buildout, Mt. Taylor

ANALYSIS DATA:

Point Coordinates			Line Left Right Soil			Soil Density		Cohesion	Phi
No.	X	Y	No.	Point	Point	No.	pcf	psf	Deg
1	550.0	307.0	1	1	2	1	112.0	250	20.0
2	615.0	310.0	2	2	3	2	102.0	0	34.0
3	750.0	346.0	3	3	4	2			
4	775.0	346.0	4	4	5	2			
5	865.0	373.0	5	5	6	2			
6	1050.0	371.0	6	2	7	1			
7	1050.0	330.0							
8	0.0	0.0							
9	0.0	0.0							
10	0.0	0.0							
11	0.0	0.0							

Seismic coefficient, horizontal = 0.100
vertical = 0.100

Range search; initial parameters:

min max increment
left x 551.0 650.0 10.0
right x 775.0 1050.0 10.0
radius increment is 10.0
minimum perpendicular depth is 15.0
limit at elevation 270.0
OVERALL MINIMUM: x = 686.7, y = 562.5, r = 267.2, FS = 2.418

Range search; initial parameters:

min max increment
left x 551.0 750.0 10.0
right x 775.0 950.0 10.0
radius increment is 10.0
minimum perpendicular depth is 15.0
limit at elevation 270.0
OVERALL MINIMUM: x = 691.5, y = 567.7, r = 281.8, FS = 1.606

GEOSYSTEM SLOPE STABILITY PROGRAM
SB-SLOPE

PROJECT DATA:

Project: Mt Taylor Mine Closeout Plan, New Waste Rock Pile Stability

Location: San Mateo, NM

Filename: RGRNEWPI Description:

ANALYSIS DATA:

Point Coordinates			Line		Right Soil	Soil		Density	Cohesion	Phi
No.	X	Y	No.	Point	Point	No.	No.	pcf	psf	Deg
1	1.0	273.0	1	1	2	1	1	112.0	250	20.0
2	95.0	276.0	2	2	3	2	2	102.0	0	34.0
3	180.0	304.0	3	3	4	2				
4	205.0	304.0	4	4	5	2				
5	287.0	332.0	5	5	6	2				
6	312.0	332.0	6	6	7	2				
7	395.0	360.0	7	7	8	2				
8	545.0	359.0	8	2	9	1				
9	110.0	270.0	9	9	10	1				
10	545.0	270.0								
11	0.0	0.0								

Seismic coefficient, horizontal = 0.100
vertical = 0.100

OVERALL MINIMUM: x = 180.3, y = 550.9, r = 300.2, FS = 1.585

Range search; initial parameters:

min max increment
left x 2.0 180.0 10.0
right x 312.0 545.0 10.0
radius increment is 10.0
minimum perpendicular depth is 15.0
limit at elevation 250.0

OVERALL MINIMUM: x = 180.3, y = 550.9, r = 300.2, FS = 2.324

RUNOFF AND EROSION PROTECTION ANALYSIS PARAMETERS

MT. TAYLOR MINE RIO GRANDE RESOURCES

Design Precipitation Events

100 YR, 24 HR.	3.20 inches
100 YR, 1 HR TS	2.00 inches

C _r runoff coeff.	0.40	for woodlands on shallow clay over rock - undisturbed surface	(Table 4.5, NUREG/CR-4620)
	0.50	for rolling surface on cultivated clay loam soil, and bare clay	(Table 4.4 and 4.6, NUREG/CR-4620)
	0.40	for clay with light vegetation	(Table 4.6, NUREG/CR-4620)
	use: 0.45	for waste rock surface, unvegetated	
	use: 0.50	for clay cover surface before vegetation is reestablished	

Manning coeff., n,	0.050	for steep natural channels on rock with some vegetation	(Table B-6, USBR Design of Small Dams, 1987)
	0.035	for earth channels and slopes with small growth	(Table B-6, USBR Design of Small Dams, 1987)
	0.02	for sand, sandy loam and other non-colloidal soils (waste rock surface)	(Table 4.2, NUREG/CR-4620)
	0.025	for clays and shales (clay cover)	(Table 4.2, NUREG/CR-4620)

$$n = 0.0456(d_{50} \times S)^{0.159} \quad \text{for riprap channels}$$

(NUREG/CR-4651)

Cover Factor, Cf, for native soil and natural vegetation = 0.5 * 20%	0.1	for bare surface =	0	(USDA Ag. Handbook 667, Table 3.1)
d75				(USDA Ag. Handbook 667, page 12)

of native CL/SC soils =	0.14 mm, or	0.0055 inches
of waste rock =	0.3 mm, or	0.0118 inches

(USDA Ag. Handbook 667, page 12)

Soil Grain Roughness, = d75^(1/6)/39, min. of 0.0156		
for native CL/SC soils =	0.0156 inches	
for waste rock =	0.3962 mm, or	0.0156 inches

(USDA Ag. Handbook 667, Figure 3.2)

Void Ratio Correction Factor, Ce =	1.125	for native clay at 100 pcf d	1.10	for waste rock (SP to SM)
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(USDA Ag. Handbook 667, page 14)

Allowable shear stress, Ta, in psf,				
for native soil CL/SC with PI =	19	0.079	= (1.07 PI^2 + 14.3 PI + 47.7) x 10^-4 x Ce	
for waste rock (SP, SM) =		0.02 psf		(USDA Ag. Handbook 667, Figure 3.1)
riprap rock = 0.4*d75	= 0.4*1.25*d50 =	0.5*d50		

flow concentration factor, F =	3	assumed based on vegetation over 30 % or less of area	(p. 68, NUREG/CR-4620)
Stephenson factor, Cs =	0.27	for blasted/ crushed rock	(p. 48, NUREG/CR-4620)
rock cover porosity, P =	0.45		(Table B.1, NUREG/CR-4651)
rock spec. gravity, G =	2.65		

slope angle, SA (design values)			
channel banks	0.33	18.3 degrees,	0.3194 radians
cover slope =	0.30, or	16.7 degrees,	0.2915 radians
friction angle of rock, FA =		40 degrees,	0.6981 radians

(Figure 4.5, NUREG/CR-4620)

Sm, factor of safety against rock movement without flow, tan FA/tan SA=	0.00
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hydraulic gradient, S

EQUATIONS

tc, time of concentration: $0.00013(L^{0.77}/S^{0.385})$, and minimum value is 0.04

i, rainfall intensity = rainfall depth * 60/rainfall duration, inches/hr

q, unit discharge = C*i*a

Q, total runoff = C*i*A

y, max. flow depth = $(q^n/1.486*S^{0.5})^{0.6}$

v, max. flow velocity = $(1.486/n)*y^{0.667}*S^{0.5}$ for sheet flow = $(1.486/n)*R^{0.667}*S^{0.5}$ for channelized flow

R = hydraulic radius = cross section area of flow/ wetted perimeter

TP, peak shear stress = $62.4*S*y*(Ns/n)^2$ on bare soil, = $62.4*S*y*(1-Cf)*(Ns/n)^2$ on native soil with natural vegetation

Ss, critical slope (limiting value for erosional stability) for sheet flow = $((65*Ta^{0.5/3})/(i*L*F^n))^{6/7}$

d50, mean rock diameter

by Safety Factors Method,
for flow down slopes with gradient < 0.1, Safety Factor, SF = $(\cos SA)*(tan FA)/((21*y^2/(G-1)*d50)*(tan FA)+\sin SA)$
for horizontal flow, Safety Factor, SF = $(Sm^2)*((Sm^2*(21*y^2/((G-1)*d50))^2*(\sec SA)^2+4)^{0.5}-Sm*(21*y^2/((G-1)*d50))*\sec SA)$

for slopes with gradients > 0.1

Stephenson Method, d50 = $[(q^2*(tan SA)^{7/6}*P^{1/6})/(Cs*g^{0.5}*((1-P)*(G-1)*(cos SA)*(tan FA-tan SA))^{1.667})^{1/12}$

100-YEAR STORM RUNOFF AND RESULTING PEAK SHEAR STRESSES ON WASTE ROCK PILES

SEGMENT	FLOW PATH PARAMETERS				PEAK RUNOFF PARAMETERS							
	LENGTH ft	GRADIENT S	SLOPE ANGLE degrees	ELEMENT tc hours	RAINFALL WITHIN tc (1)	RAINFALL INTENSITY i in./hr.	RATE q cfs/ft	DEPTH y ft	VELOCITY v fps	SHEAR STRESS psf	ALLOWABLE SHEAR STRESS psf	
FLOW OVER WASTE ROCK												
	400	0.050	2.86	0.042	0.40	9.52	0.21	0.012	0.87	0.02	0.02	
	400	0.035	2.00	0.048	0.70	14.69	0.32	0.014	0.81	0.019	0.02	
	80	0.10	5.71	0.042	0.40	9.52	0.04	0.006	0.74	0.02	0.02	
	80	0.33	18.26	0.042	0.40	9.52	0.04	0.008	1.71	0.10	0.02	
FLOW OVER CLAY COVER												
	1070	0.01	0.57	0.165	1.60	9.72	0.57	0.016	0.37	0.004	0.079	
	383	0.010	0.57	0.075	0.85	11.39	0.240	0.009	0.26	0.002	0.079	
	92.4	0.33	18.26	0.115	1.10	9.59	0.289	0.029	3.25	0.235	0.079	
	10	0.01	0.57	0.155	1.30	8.41	0.294	0.010	0.28	0.003	0.079	
	82	0.33	18.26	0.042	0.40	9.52	0.04	0.009	1.51	0.075	0.079	
	140	0.267	14.95	0.042	0.40	9.52	0.07	0.012	1.62	0.079	0.079	
	350	0.010	0.57	0.042	0.92	21.90	0.42	0.013	0.33	0.003	0.079	
	89	0.33	18.42	0.084	0.92	10.95	0.48	0.040	3.99	0.321	0.079	
	90	0.33	18.42	0.042	0.40	9.52	0.05	0.010	1.58	0.080	0.079	
		79	0.33	18.42	0.042	0.40	9.52	0.04	0.009	1.50	0.074	0.079
		383	0.01	0.57	0.075	0.40	5.36	0.11	0.006	0.19	0.001	0.079
FLOW TO TOP SURFACE CHANNELS												

ROCK SIZES REQUIRED FOR MT TAYLOR WASTE ROCK PILE EROSION PROTECTION

RUNOFF FROM	ELEMENT LENGTH L ft	ELEMENT WIDTH W ft	MAX. ELEV.	MIN. ELEV.	GRADIENT S	SLOPE ANGLE degrees	tc (minimum is 0.042) hours	RAINFALL WITHIN tc (") inches	I in/hr	Peak Unit Discharge q cfs/ft	d50 for S<0.1, inches	S<0.1, inches	Manning Coeff. n	Peak Flow Depth, y ft	Peak Flow Velocity on Rock v fps	Safety Factor of Rock
OLD WASTE ROCK PILE	TOP SURFACE SLOPING EAST	383	7371	7366.2	0.0100	0.57	0.075	0.80	10.72	0.0942		0.20	0.0170	0.10	1.87	1.25
	TOP SURFACE SLOPING N & S	350	7373	7371	0.0100	0.57	0.070	0.75	10.77	0.0865						
	EAST SLOPE WITH RUN-ON	92	7366.2	7338	0.3330	18.42	0.081	0.90	11.10	0.0973	2.7		0.0448	0.06	3.02	
	UPPER SLOPES W/O RUN-ON	82	7371	7346	0.3330	18.42	0.042	0.40	9.52	0.0287	1.2		0.0394	0.03	2.00	
	LOWER SLOPES W/O RUN-ON	140	7346	7326	0.2670	14.95	0.042	0.40	9.52	0.0490	1.2		0.0381	0.04	2.37	
NEW WASTE ROCK PILE	UPPER SLOPES WITH RUN-ON	90	7371	7342.5	0.3330	18.42	0.076	0.80	10.53	0.1213	3.1					
	PILE TOP SURFACE	1070	7377.5	7376	0.0100	0.57	0.165	1.60	9.72	0.2387		0.30	0.0181	0.18	2.52	1.03
	EAST SIDE SLOPE	75	7376	7351	0.3330	18.42	0.170	1.65	9.70	0.2654	5.3		0.0499	0.12	4.25	
	OTHER SIDE SLOPE	90	7313	7276	0.3330	18.42	0.042	0.40	9.52	0.0315	1.3		0.0398	0.03	2.08	
	COMPOSITE SIDE SLOPES	210			0.3330	18.42	0.054	0.60	11.07	0.0854	N/A					

DIVERSION DITCHES AND BENCH CHANNELS

DIVERSION LOCATION	CAPACITY NEEDED cfs	DRAINAGE AREA acres	DITCH DIMENSIONS			HYDRAULIC PARAMETERS			PEAK VELOCITY fps	AVERAGE SHEAR psf	ROCK SIZE d ₅₀ inches
			DEPTH ft	WIDTH ft	LENGTH ft	AREA ft ²	Capacity cfs	R			
OLD WASTE ROCK PILE	21.54										
	WEST BENCH		2	20.00	355	50	11.65	1.62	0.0176	1.01	0.3
	NORTH 7346 BENCH	15.17	2	20.00	250	50	11.65	1.62	0.0176	1.01	0.3
	WEST BENCH OUTFALL	36.70	2	25.00	210	60	20.50	1.68	0.0463	21.42	5.4
NEW WASTE ROCK PILE	27										
	EAST TOE OF TOP SLOPE		1	150.00	550	152.5	9.19	0.98	0.0168	0.68	0.2
	BENCH DITCHES	8.50	1	20.00	540	22.5	8.56	0.89	0.0160	0.55	0.1
	BENCH CHUTES ON BENCHES ON SLOPES	8.50	1	10.00	30	13	10.20	0.84	0.0225	1.58	0.4
EAST TOE (OUT-OF-BANKS FLOW NORTH AND SOUTH TOES	31.8										
			10	150.00	90	1750	32.84	8.58	0.0321	15.30	3.8
			7	50.00	91	472.5	28.69	5.38	0.0356	16.79	4.2

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

ID PRECIP DEPTH- AREA SIMULATION FOR MARQUEZ CANYON WATERSHED - MT. TAYLOR MINE
 ID 100 YEAR, 24 HOUR STORM EVENT
 ID 15
 ID 1
 ID 0
 ID 0
 ID 96

PH JD 3.2 5.02 1.2 1.70 2.00 2.1 2.3 2.5 2.7 3.2

KK 10 RUNOFF FROM UPPER MARQUEZ CANYON TO MARUCA JUNCTION
 KO 0
 BA 2.76
 BF 0
 LS 0
 UD .57

KK 20 RUNOFF FROM MARUCA CANYON
 KO 0
 BA 1.63
 BF 0
 LS 0
 UD .54

KK 2040 ROUTE MARQUEZ RUNOFF TO JUNCTION TRAP
 RD 26805 .067 .06 4.5 1.9
 UD .57

KK 30 RUNOFF FROM LOWER MARQUEZ CANYON
 KO 0
 BA .63
 BF 0
 LS 0
 UD .20

KK 2040 ROUTE MARUCA RUNOFF TO JUNCTION TRAP
 RD 26214 .074 .06 4.5 1.9
 UD .54

KK 40 COMBINE 10, 20, 30 RUNOFF
 KM COMBINE RUNOFF FROM UPPER MARQUEZ AND MARUCA CANYONS AND LOWER MARQUEZ
 HC 3
 KO 0

KK 4050 ROUTE COMBINED 10, 20, AND 30 RUNOFF TO WEST SIDE OF MINE PROPERTY
 RD 5507 .068 .06 4.5 1.9
 UD .20

KK 4050 ROUTE COMBINED 10, 20, AND 30 RUNOFF TO WEST SIDE OF MINE PROPERTY
 RD 5507 .068 .06 4.5 1.9
 UD .20

KK 4050 ROUTE COMBINED 10, 20, AND 30 RUNOFF TO WEST SIDE OF MINE PROPERTY
 RD 5507 .068 .06 4.5 1.9
 UD .20

KK 4050 ROUTE COMBINED 10, 20, AND 30 RUNOFF TO WEST SIDE OF MINE PROPERTY
 RD 5507 .068 .06 4.5 1.9
 UD .20

KK 4050 ROUTE COMBINED 10, 20, AND 30 RUNOFF TO WEST SIDE OF MINE PROPERTY
 RD 5507 .068 .06 4.5 1.9
 UD .20

C1 S/N: 1343001323

HMVersion: 6.33

Data file: MARQUEZ.HCT
 RUNOFF SUMMARY
 FLOW IN CUBIC FEET PER SECOND
 TIME IN HOURS, AREA IN SQUARE MILES

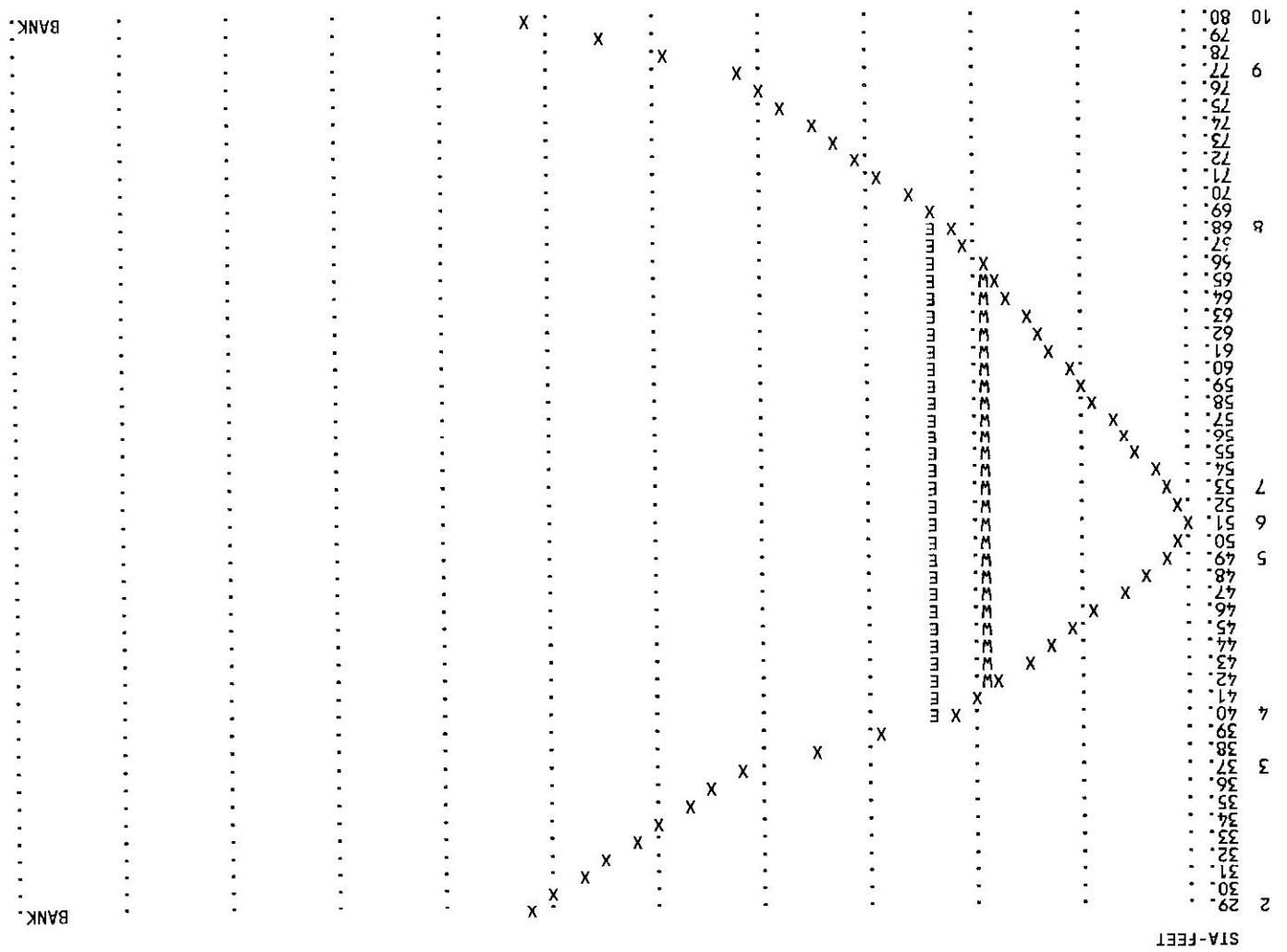
OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	10	990.	12.50	213.	65.	65.	2.76	2.76
ROUTED TO	1040	929.	13.00	210.	63.	63.	2.76	2.76
HYDROGRAPH AT	20	604.	12.50	126.	38.	38.	1.63	1.63
ROUTED TO	2040	593.	13.00	131.	39.	39.	1.63	1.63
HYDROGRAPH AT	30	625.	12.00	73.	22.	22.	0.63	0.63
3 COMBINED AT	40	1579.	13.00	407.	123.	123.	5.02	5.02
ROUTED TO	4050	1502.	13.00	406.	123.	123.	5.02	5.02

100 YEAR - 24 HOUR EVENT											
SUMMARY PRINTOUT TABLE 150											
SECCNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRWS	EG	10*KS	VCH	AREA
3.000	0.00	0.00	0.00	318.50	361.00	320.18	320.73	320.73	232.10	5.94	60.75
2.000	800.00	0.00	0.00	331.75	361.00	333.96	334.73	334.43	135.64	5.51	65.48
1.000	900.00	0.00	0.00	344.00	361.00	346.37	346.15	346.94	141.74	6.10	59.21
100 YEAR - 24 HOUR EVENT											
SUMMARY PRINTOUT TABLE 150											
SECCNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH				
3.000	361.00	320.18	0.00	0.00	0.00	56.32	0.00				
2.000	361.00	333.96	0.00	13.78	0.00	45.22	800.00				
1.000	361.00	346.37	0.00	12.41	0.00	36.07	900.00				

[illegible]

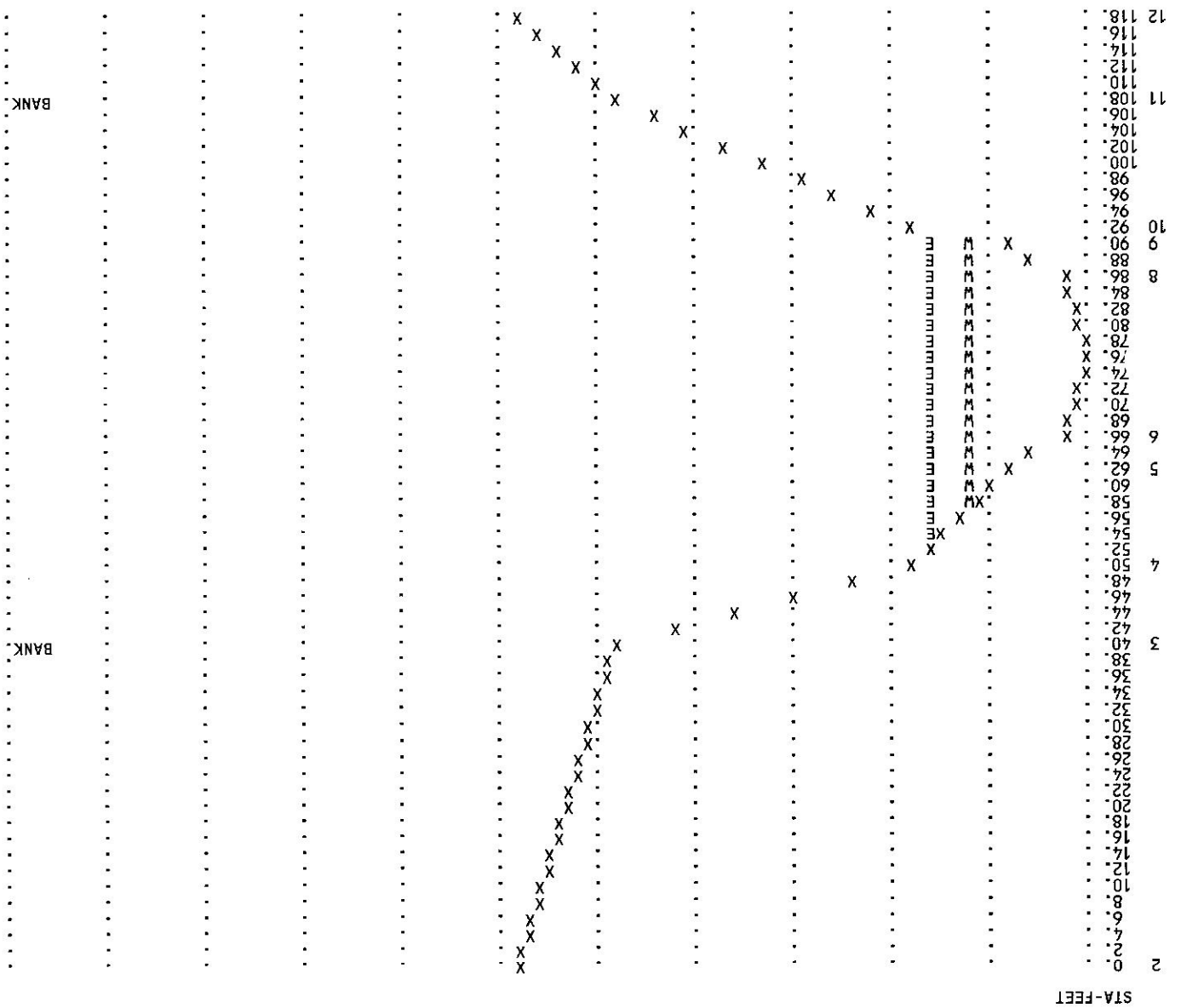
CROSS SECTION
STREAM 100 YEAR- 24 HOUR EVENT
DISCHARGE= 1579.
1.00

PLOTTED POINTS (BY PRIORITY)-B=BOTTOM BRIDGE,T=TOP BRIDGE,X=GROUND,W=WATER SUR,E=ENERGY GRADIENT,C=CRITICAL WSEL

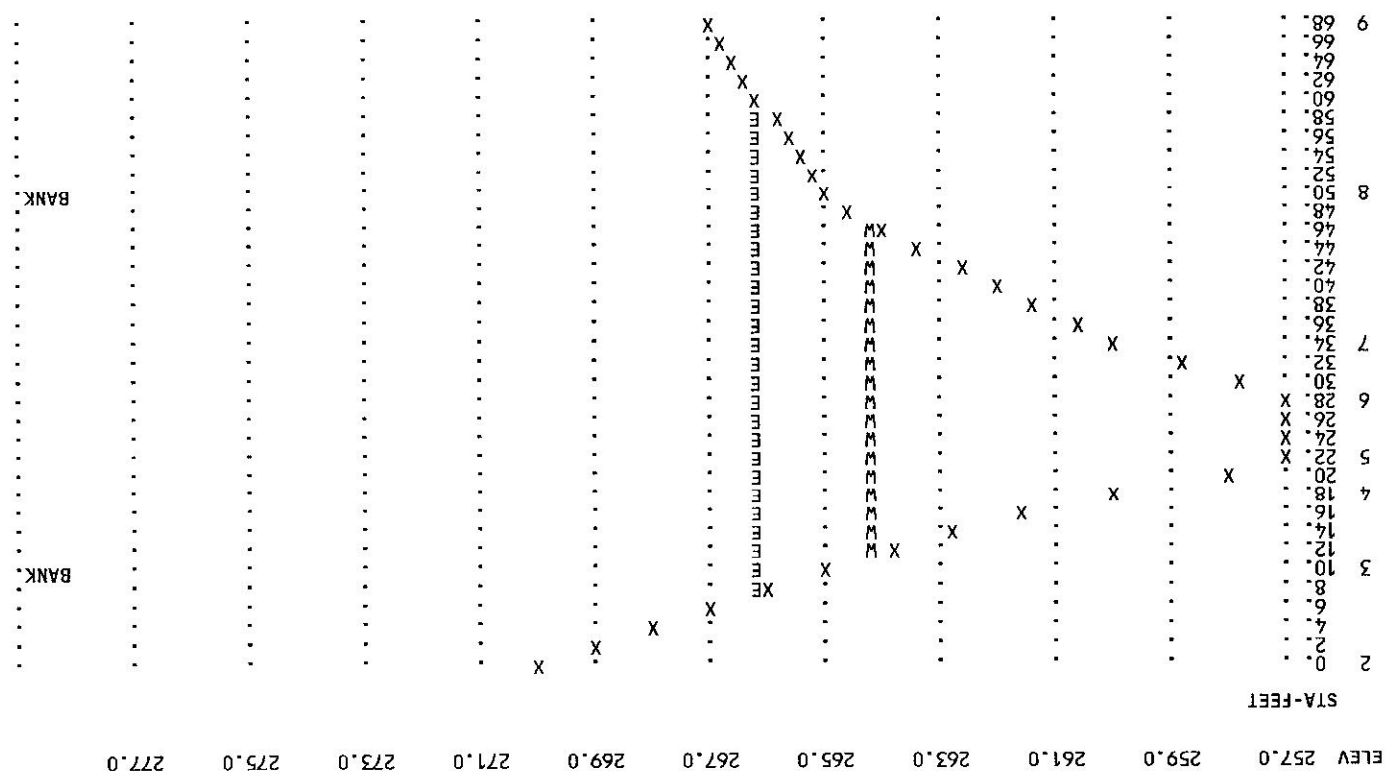


CROSS SECTION
STREAM 100 YEAR- 24 HOUR EVENT
DISCHARGE= 1579.

PLOTTED POINTS (BY PRIORITY)-B=BOTTOM BRIDGE,T=TOP BRIDGE,X=GROUND,W=WATER SUR,E=ENERGY GRADIENT,C=CRITICAL WSEL
E. 276.0 281.0 286.0 291.0 296.0 301.0 306.0 311.0 316.0 321.0 326.0



P. ED POINTS (BY PRIORITY)-B=BOTTOM BRIDGE,T=TOP BRIDGE,X=GROUND,W=WATER SUR,E=ENERGY GRADIENT,C=CRITICAL WSEL



100 YEAR - 24 HOUR EVENT												
SUMMARY PRINTOUT TABLE 150												
SECTNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIMS	EG	10*KS	VCH	AREA	.01K
*	3.000	0.00	0.00	257.00	1579.00	264.15	264.15	266.10	168.24	11.23	140.58	121.74
	2.000	1200.00	0.00	276.00	1579.00	282.16	281.77	283.90	132.33	10.60	148.91	137.26
*	1.000	350.00	0.00	289.00	1579.00	298.49	298.49	301.07	194.22	12.89	122.54	113.30
100 YEAR - 24 HOUR EVENT												
SUMMARY PRINTOUT TABLE 150												
SECTNO	Q	CWSEL	DIFWSP	DIFMSX	DIFKMS	TOPWID	XLCH					
*	3.000	1579.00	264.15	0.00	0.00	35.90	0.00					
	2.000	1579.00	282.16	0.00	0.00	34.04	1200.00					
*	1.000	1579.00	298.49	0.00	0.00	24.38	350.00					

*
*
* U.S. ARMY CORPS OF ENGINEERS *
* HYDROLOGIC ENGINEERING CENTER *
* 609 SECOND STREET *
* DAVIS CALIFORNIA 95616 *
* (916) 756-1104 *

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XXX      XXXXX  XXXXXXXX  X      X
X        X      X          X      X
X        X      X          X      X
X  XXXXX  X      X      XXXX  XXXXXXXX
X        X      X          X      X
XX       X      X          X      X
X        XXXXX  XXXXXXXX  X      X

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Full Microcomputer Implementation
by
Haestad Methods, Inc.

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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1G, HEC1DB, AND HEC1KW.
THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED IN THE 1973-STYLE INPUT STRUCTURE.
NEW OPTIONS: DAMBREAK OUTLUM SUBSEQUENCE, SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL, LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

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LINE	1	2	3	4	5	6	7	8	9	10
1D	PRECIP DEPTH - AREA SIMULATION FOR HUMMER WATERSHED - MT. TAYLOR MINE									
1D	100 YEAR, 24 HOUR STORM EVENT									
11	15	0	0	96						
10	1									
9D	3.2	.54	1.2	1.70	2.00	2.1	2.3	2.5	2.7	3.2
PH										

7	KK	10	RUNOFF FROM EAST HUMMER							
8	KO	0								
9	BA	.40								
10	BF	0								
11	LS	0								
12	UD	.22								
13	KK	1030	ROUTE EAST HUMMER RUNOFF TO JUNCTION 30							
14	RD	9513	0.10	.06						
15	KK	20	RUNOFF FROM WEST HUMMER							
16	KO	0								
17	BA	.14								
18	BF	0								
19	LS	0								
20	UD	0.15								
21	KK	2030	ROUTE WEST HUMMER RUNOFF TO JUNCTION 30							
22	RD	5644	0.088	.06						
23	KK	30	COMBINE 10 AND 20 RUNOFF							
24	KM		COMBINE RUNOFF FROM EAST AND WEST HUMMER							
25	HC	2								
26	KO	0								
27	KK	3040	ROUTE COMBINED 10 AND 20 RUNOFF TO WEST SIDE OF MINE PROPERTY							
28	RD	968	.036	.03						
29	KK	22								

HMVersion: 6.33 Data file: hummer.hcl
 RUNOFF SUMMARY
 FLOW IN CUBIC FEET PER SECOND
 TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW	6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	10	226	12.00	31	9			0.40		
ROUTED TO	1030	254	12.25	35	10			0.40		
HYDROGRAPH AT	20	118	12.00	11	3			0.14		
ROUTED TO	2030	107	12.25	11	3			0.14		
2 COMBINED AT	30	361	12.25	46	14			0.54		
ROUTED TO	3040	334	12.25	46	14			0.54		

* U.S. ARMY CORPS OF ENGINEERS *
* HYDROLOGIC ENGINEERING CENTER *
* 609 SECOND STREET, SUITE D *
* DAVIS, CALIFORNIA 95616-4687 *
* (916) 756-1104 *

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                  X    X        X       X
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X             X      X         X       X
X            XX     X         X       X
XXXXXXXXXX    XXXXXX  XXXXXXXX XXXXXXXX

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: FULL MICRO-COMPUTER IMPLEMENTATION
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H A F S T A D M E T H O D S

37 Brookside Road * Waterbury, Connecticut 06708 * (203) 755-1666

THIS RUN EXECUTED 6SEP96 16:05:18

IEC-2 WATER SURFACE PROFILES

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*****
version 4.6.2: May 1991
*****
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WATER PROFILE ANALYSES FOR HUMMER WATERSHED WITHOUT IMPROVEMENTS
MT. TAYLOR MINE
100 YEAR - 24 HOUR EVENT

100 YEAR - 24 HOUR EVENT

ICHECK	IND	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FO
0	0	0	0	-1	0	0	361	0	0
MPROF	IPLT	PRVS	XSECV	XSECH	FN	ALDCL	IBM	CHNIM	ITRACE
-1	1	0	0	0	0	-1	0	0	1

: VARIABLE CODES FOR SUMMARY PRINTOUT

150

NUMSEC	LPRT
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*****REQUESTED SECTION NUMBERS*****

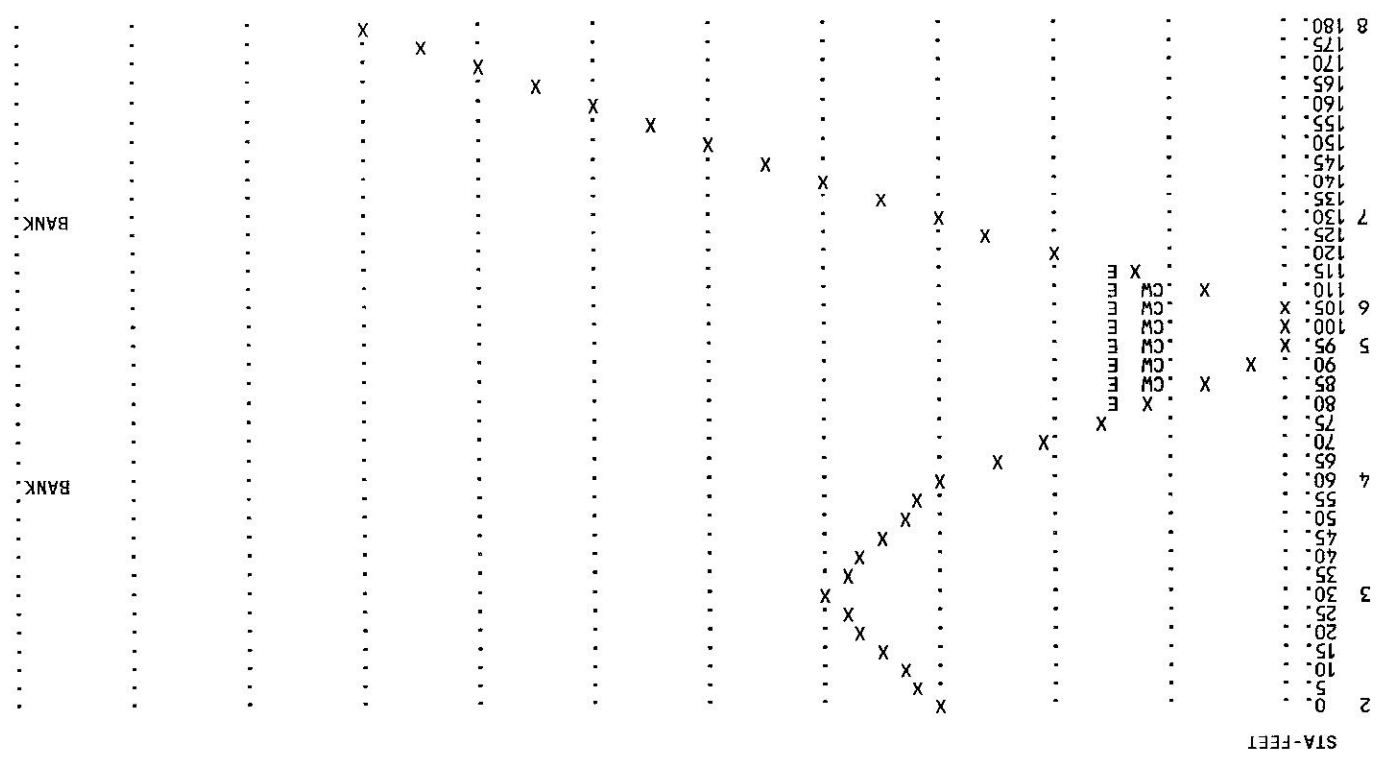
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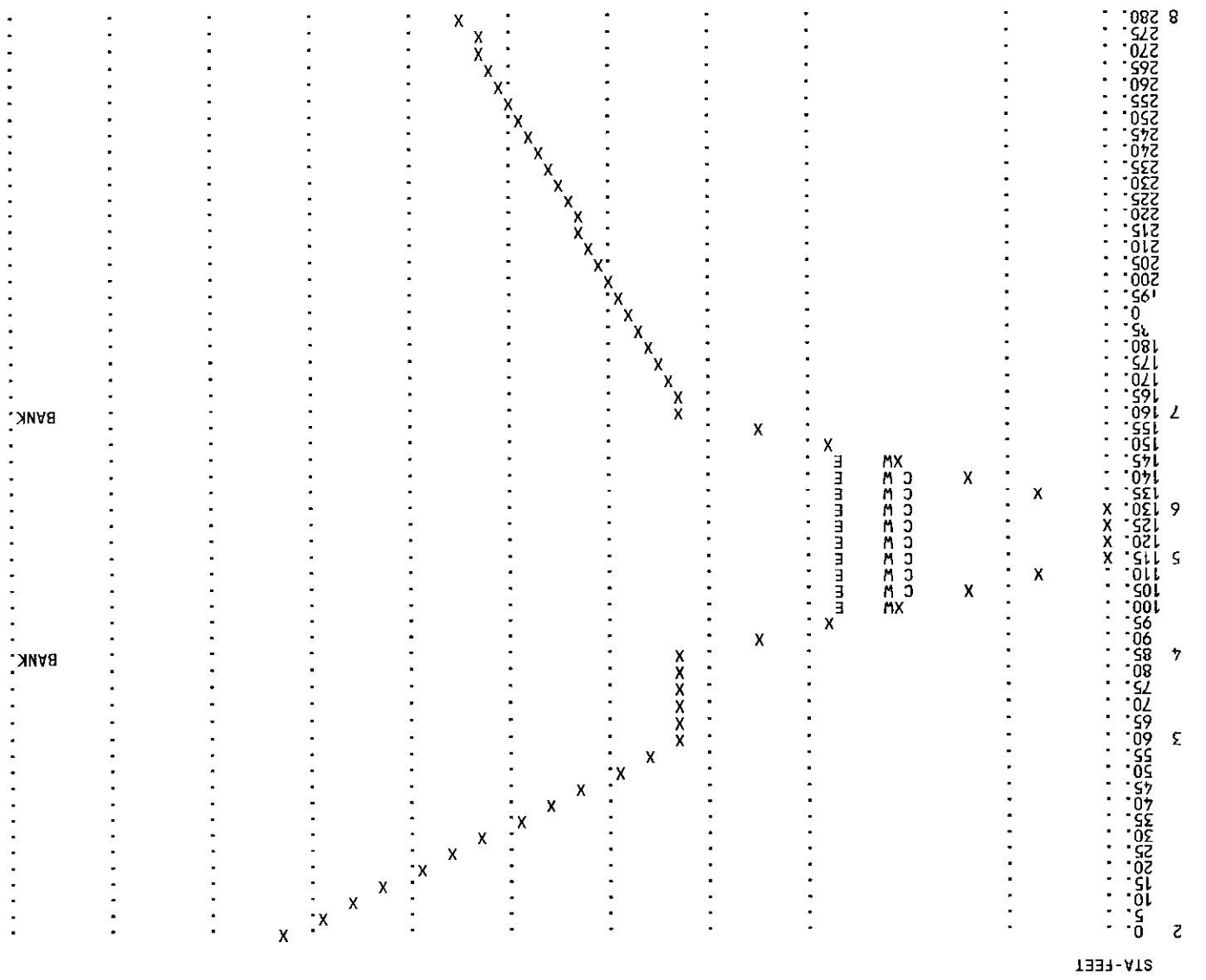
1 INLEO 1 COPY SUBDIV STRIDS RMILE

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GROSS SECTION
1.00
STREAM 100 YEAR- 24 HOUR EVENT
DISCHARGE= 361.

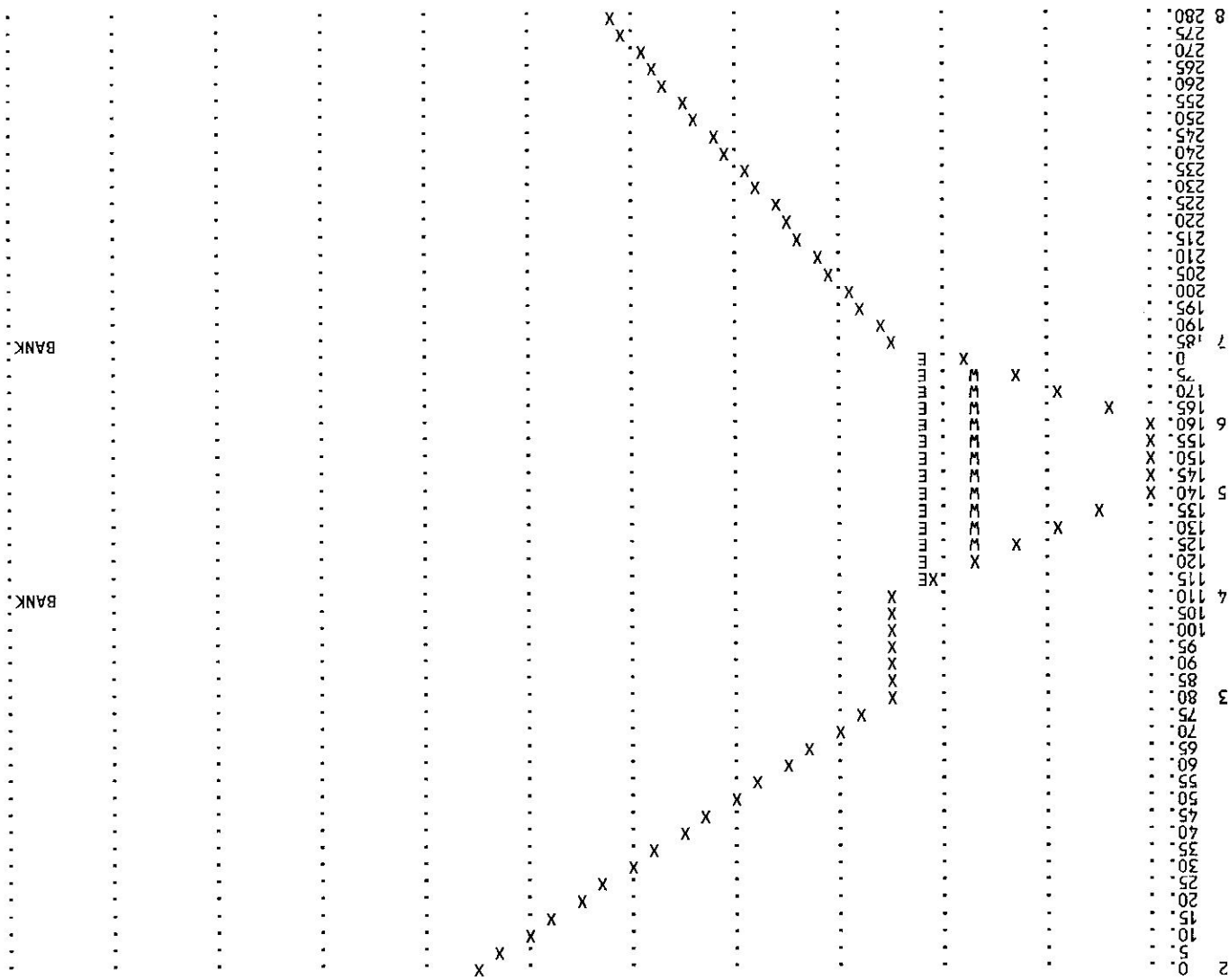
PLOTTED POINTS (BY PRIORITY)-B=BOTTOM BRIDGE,T=TOP BRIDGE,X=GROUND,W=WATER SUR,E=ENERGY GRADIENT,C=CRITICAL WSEL



[illegible]

ED POINTS (BY PRIORITY)-B=BOTTOM BRIDGE,T=TOP BRIDGE,X=GROUND,W=WATER SUR,E=ENERGY GRADIENT,C=CRITICAL WSEL
ELEV 318.5 319.5 320.5 321.5 322.5 323.5 324.5 325.5 326.5 327.5 328.5

STA- FEET



SURFACE WATER RUNOFF HYDROLOGIC ANALYSIS

GENERAL PARAMETRIC EVALUATION AND MODEL INPUT DATA SELECTION FOR HEC-1 (WATERSHED RUNOFF) AND HEC-2 (FLOOD ROUTING)

Design Storm Precipitation (Inches) for Various Frequency Intervals and Durations

Interval years	Duration in Hours					
	1	2	3	6	12	24
2	0.89	1.00	1.07	1.20	1.30	1.50
5	1.03	1.17	1.27	1.45	1.60	1.90
10	1.15	1.32	1.44	1.65	1.83	2.20
25	1.38	1.59	1.73	2.00	2.23	2.70
50	1.71	1.91	2.04	2.30	2.50	2.90
100	1.97	2.15	2.27	2.50	2.73	3.20

** Duration selected must be $\geq$ time of concentration, T_c

Unit Duration $\approx L_g/5.5$

Time of Concentration, t_c

For watersheds ≤ 10 sq. mi.

$$t_c = 0.00013(L^{0.77}/S^{0.385})$$

where S = gradient

For watersheds > 10 sq. mi.

$$t_c = 0.385(11.9L^3)/H$$

where H = elevation difference

Curve Number, CN

CN = 71 for P-J uplands (Group D), = 78 for Group B/C soils

Time to Peak Discharge, T_p , hours

$$T_p = 0.5dt + T_{lag}$$

where dt = duration of excess, or computation interval

T_{lag} = time between center of rainfall excess and time of peak discharge

Peak flow of unit hydrograph, Q_p , cfs/in

$$Q_p = 484 \text{Area} / T_p \quad \text{where Area} = \text{subbasin area in sq mi}$$

Average Manning's

Coefficient, K_n =

0.26 for uplands, general storm

0.13 for PMF and well-developed drainage courses

0.05 for uplands thunderstorm

0.073 for thunderstorm in well-developed drainage
courses

For Southwest region

0.07 for coniferous forest areas

0.042 for desert terrain

Grants Airport (1986-1995) and San Mateo (1986-1987) Stations

AVERAGE MONTHLY PRECIPITATION, INCHES

	J	F	M	A	M	J	JL	A	S	O	N	D	Annual
1986	0.00	0.55	0.32	0.47	1.29	1.94	1.75	1.53	1.10	1.55	2.25	1.35	14.10
1987	1.60	1.24	0.54	0.28	0.89	0.26	2.61	3.05	0.72	0.50	0.82	1.25	13.76
1988	0.19	0.09	0.07	1.74	0.20	1.06	1.22	2.30	1.46	0.85	0.15	0.13	9.46
1989	0.77	0.45	0.16	0.00	0.08	0.10	0.98	0.90	1.64	1.07	0.05	0.11	6.31
1990	0.35	0.17	0.88	1.54	1.02	0.37	1.96	3.99	2.13	1.27	0.62	1.59	15.89
1991	0.66	0.05	1.04	0.65	0.26	0.99	1.05	1.66	1.83	0.27	1.33	1.76	11.55
1992	0.72	0.27	0.93	0.67	2.68	0.46	1.68	1.86	1.23	0.90	0.90	1.26	13.56
1993	1.91	1.15	1.94	0.25	1.10	0.00	0.43	4.23	0.35	0.60	0.43	0.18	12.57
1994	0.10	0.38	0.77	0.52	2.02	0.18	0.84	1.50	1.42	1.82	1.84	0.30	11.69
1995	0.49	0.30	0.38	0.09	0.29	0.49	0.45	1.92	0.86	0.00	0.30	0.37	5.94
AVE	0.68	0.47	0.70	0.62	0.98	0.59	1.30	2.29	1.27	0.88	0.87	0.83	11.48

	FREEZE-FREE DAYS	ANNUAL TEMP., °F	
		LOW	HIGH
1986	141	0	96
1987	132	-18	NA
1988	120	-6	94
1989	167	-15	101
1990	159	-33	99
1991	154	-7	98
1992	183	-9	99
1993	138	-4	98
1994	140	-3	101
1995	129	2	102
AVE	146.3	-9.3	98.7

	J	F	M	A	M	J	JL	A	S	O	N	D	Annual
1986	0.04	0.13	0.45	0.38	0.73	0.84	3.45	1.78	1.90	1.91	3.88	0.57	16.06
1987	0.92	2.81	0.84	0.14	0.78	0.73	0.39	3.97	0.23	0.72	0.54	2.00	14.07
1988	2.64												10.22
1989													6.82
1990													17.17
1991													12.48
1992													14.66
1993													13.59
1994													12.63
1995													6.42
AVE	1.20	1.47	0.65	0.26	0.76	0.79	1.92	2.88	1.07	1.32	2.21	1.29	12.41

	FREEZE-FREE	ANNUAL TEMP., F	
	DAYS	LOW	HIGH
1986	155	4	89
1987	181	0	89
1988	146	5	87
1989	204	-4	94
1990	194	-22	92
1991	188	4	91
1992	223	2	92
1993	168	7	91
1994	171	8	94
1995	157	13	95
AVE	179	2	91

0.8195 11 -7

[illegible]

SURFACE WATER RUNOFF HYDROLOGIC ANALYSIS - MT. TAYLOR MINE

A1.J71

RAINFALL PARAMETERS

Design Storm Precipitation (Inches) for Various Frequency Intervals and Durations

Interval years	Duration in Hours					
	1	2	3	6	12	24
2	0.9	1.0	1.1	1.2	1.3	1.5
5	1.0	1.2	1.3	1.45	1.6	1.9
10	1.2	1.3	1.4	1.65	1.8	2.2
25	1.4	1.6	1.7	2.0	2.2	2.7
50	1.7	1.9	2.0	2.3	2.5	2.9
100	2.0	2.1	2.3	2.5	2.7	3.2

** Duration selected must be => time of concentration, Tc

Fraction of one hour

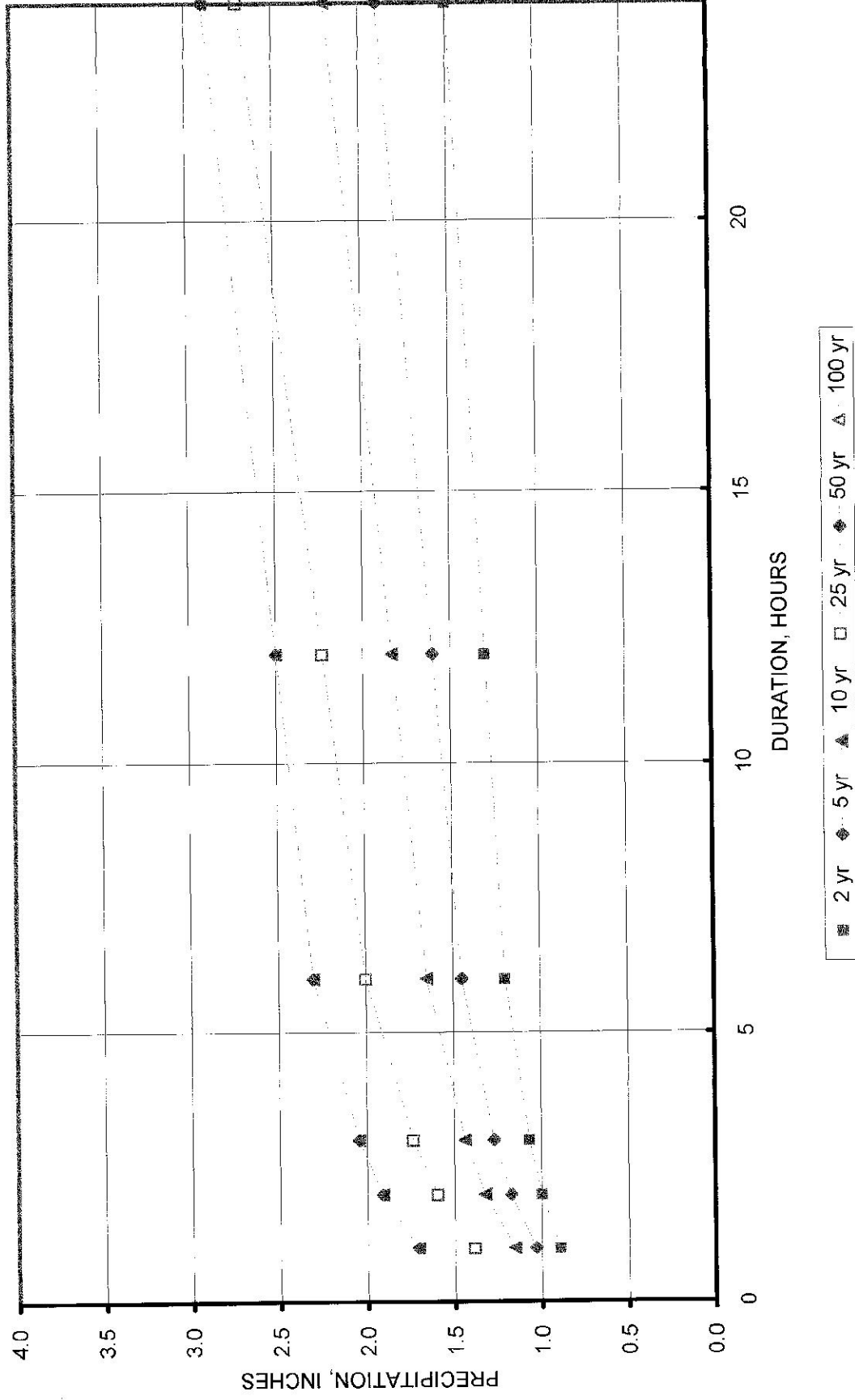
depth10 = 0.59 depth15 + 0.41 depth5
depth30 = 0.49 depth60 + 0.51 depth15

Minutes	Hours	Fraction of 1-Hr Depth inches
0	0	0.00
5	0.08	0.60
10	0.17	0.75
15	0.25	0.85
30	0.50	0.93
45	0.75	0.97
60	1.00	1.00

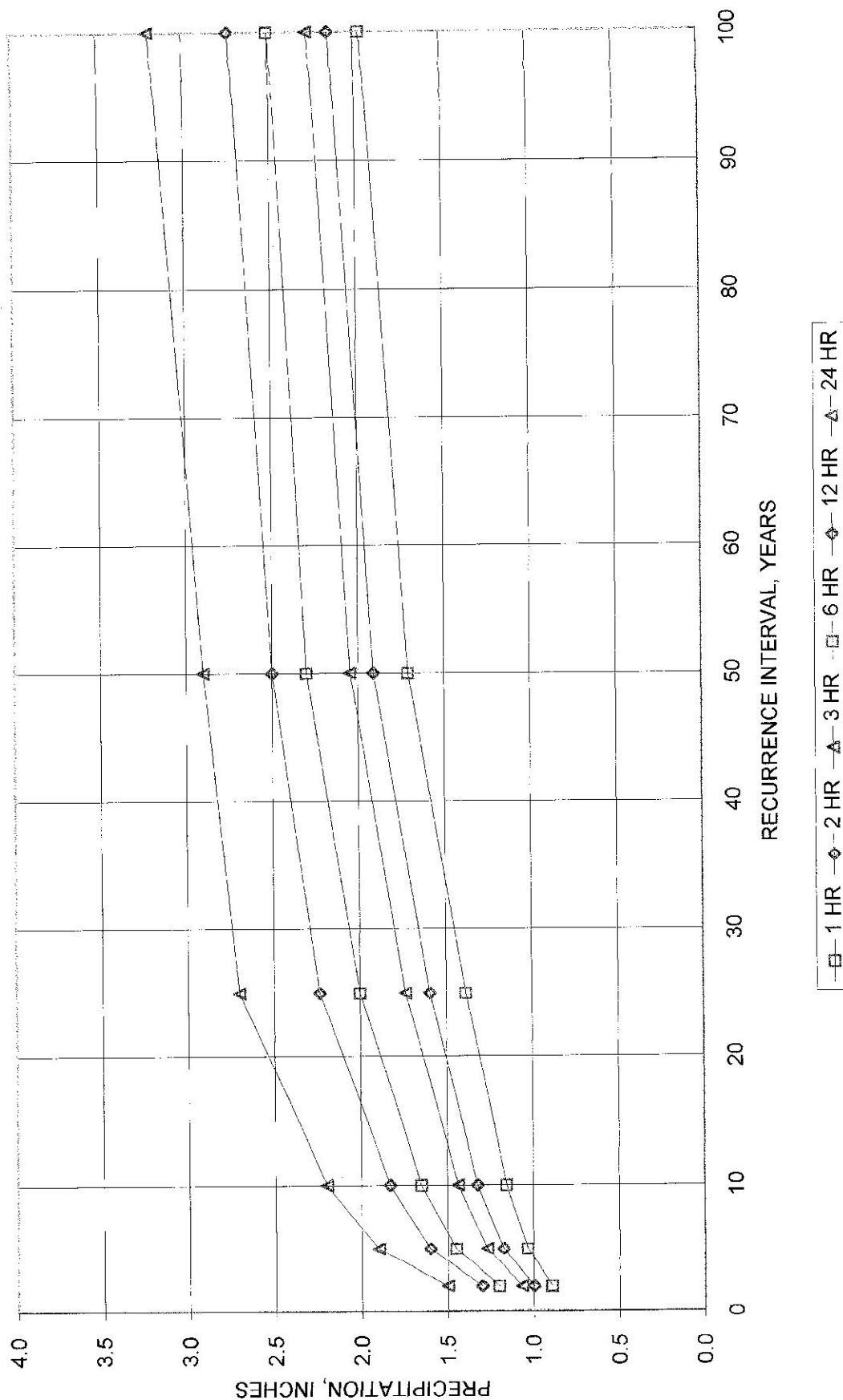
Triangular Precipitation Distribution for 24 hr/100 yr Event

Time Step hours	Cum Precip	Interval Depth	Balanced Storm Hyetograph
0	0	0	0
1	1.97	1.9686	0.0300
2	2.15	0.1812	0.0367
3	2.27	0.1212	0.0400
4	2.35	0.0790	0.0400
5	2.42	0.0700	0.0400
6	2.50	0.0800	0.0400
7	2.54	0.0400	0.0400
8	2.58	0.0400	0.0400
9	2.62	0.0400	0.0400
10	2.66	0.0400	0.0700
11	2.69	0.0300	0.0800
12	2.73	0.0433	0.1812
13	2.77	0.0367	1.9686
14	2.81	0.0400	0.1212
15	2.85	0.0400	0.0790
16	2.89	0.0400	0.0433
17	2.93	0.0400	0.0400
18	2.97	0.0400	0.0400
19	3.00	0.0300	0.0400
20	3.04	0.0400	0.0400
21	3.08	0.0400	0.0400
22	3.12	0.0400	0.0400
23	3.16	0.0400	0.0400
24	3.20	0.0400	0.0300

PRECIPITATION DEPTH VS DURATION MT TAYLOR MINE WATERSHED



PRECIPITATION VS INTERVAL AND DURATION MT TAYLOR MINE WATERSHED



SURFACE WATER RUNOFF HYDROLOGIC ANALYSIS - MT. TAYLOR MINE WATERSHED PARAMETERS

A73.K145

PARAMETERS	Marquez/ Maruca Basin				Hummer Basin		
	Total Basin	Marquez Canyon above junction	Maruca Canyon	Lower Marquez Canyon	Total Basin	East Hummer	West Hummer
L, length of longest watercourse, ft =	32312	26805	26214	7000	10481	9513	5644
Maximum elevation	9250	9250	9380	7928	8300	8300	7810
Minimum elevation	7260	7450	7450	7450	7315	7350	7315
H, difference in elevation	1990	1800	1930	478	985	950	495
S, slope gradient = in ft/mi =	0.062 325	0.067 355	0.074 389	0.068 361	0.094 496	0.100 527	0.088 463
Time of Concentration, tc, hrs (watersheds < 10 sq. mi.) = $0.00013 \cdot (L^{0.77}/S^{0.385})$ =	1.13	0.94	0.90	0.33	0.40	0.37	0.26
Area, sq. mi.	5.02	2.76	1.63	0.63	0.54	0.4	0.14
Lag Time, Lg, hrs							
USBR method, $Lg = C \cdot (L \cdot Lc / S^{0.5})^N$ =	1.58	1.38	1.34	0.57	0.70	0.65	0.47
Constant, C = $26 \cdot Kn$ =	1.56	1.56	1.56	1.56	1.56	1.56	1.56
Constant, N =	0.33	0.33	0.33	0.33	0.33	0.33	0.33
Length of Longest Watercourse, L, mi =	6.12	5.08	4.96	1.33	1.99	1.80	1.07
Length Along L to Point Opposite Watershed Centroid, Lc, mi =	3.06	2.54	2.48	0.66	0.99	0.90	0.53
Overall Slope of L, S, ft/mi =	325	355	389	361	496	527	463
Average Manning's Coefficient, Kn = 0.06 average based on: For Southwest region 0.07 for coniferous forest 0.042 for desert terrain	0.06	0.06	0.06	0.06	0.06	0.06	0.06
SCS Method, $Lg = 0.6 Tc$	0.68	0.57	0.54	0.20	0.24	0.22	0.15
Unit Duration, dt, hours $\approx Lg/5.5$ rounded to	0.12 0.1	0.10 0.1	0.10 0.1	0.04 0.04	0.04 0.04	0.04 0.04	0.03 0.03
Time to Peak Discharge, Tp, hours							
$Tp = 0.5 \cdot dt + Lg$	0.73	0.62	0.59	0.22	0.26	0.24	0.17
Peak flow of unit hydrograph, Qp, cfs/in							
$Qp = 484 \cdot Area / Tp$	3344	2166	1342	1384	999	810	401
Vol. = volume of runoff, cfs-day from 1 inch rainfall	134.99	74.22	43.83	16.94	14.52	10.76	3.76
Curve Number, CN							
CN = 71 for P-J upland (Group D) = 78 for Group B/C soils							

Temporal Distribution - Dimensionless Unit Hydrograph

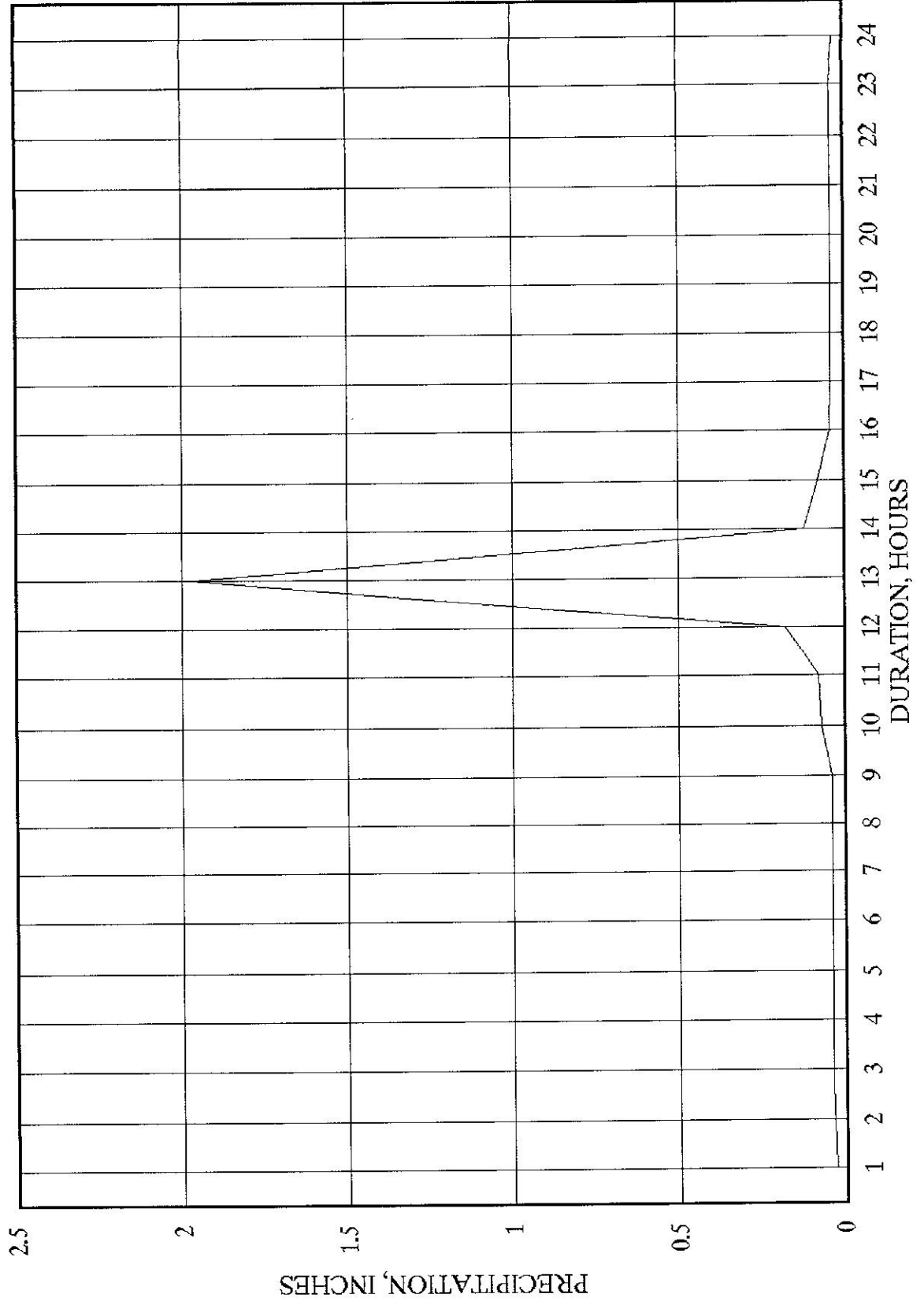
m1.u71

**	**						
% of (Lg+D/2)	q	$q^*(Lg+D/2)/V$	differential $q^*(Lg+D/2)/Vol.$	Time hours	% of (Lg+D/2)	Ordinate	Unit q cfs
5	0.19	0.0016		0.25	40.5	0.032	3.86
10	0.32	0.0027	0.0011	0.50	81.1	0.239	28.73
15	0.48	0.0040	0.0013	0.75	121.6	0.101	12.11
20	0.74	0.0061	0.0022	1.00	162.1	0.129	15.49
25	1.21	0.0101	0.0039	1.25	202.7	0.220	26.46
30	1.81	0.0150	0.0050	1.50	243.2	0.225	27.06
35	2.63	0.0219	0.0068	1.75	283.7	0.167	20.13
40	3.68	0.0306	0.0087	2.00	324.3	0.112	13.46
45	5.47	0.0455	0.0149	2.25	364.8	0.080	9.61
50	8.41	0.0699	0.0244	2.50	405.3	0.060	7.16
55	12.61	0.1048	0.0349	2.75	445.9	0.048	5.74
60	16.5	0.1371	0.0323	3.00	486.4	0.040	4.79
65	20.5	0.1704	0.0332	3.25	526.9	0.034	4.07
70	23.97	0.1992	0.0288	3.50	567.5	0.029	3.46
75	27.75	0.2306	0.0314	3.75	608.0	0.024	2.93
80	28.91	0.2403	0.0096	4.00	648.5	0.021	2.48
85	28.07	0.2333	-0.0070	4.25	689.1	0.018	2.12
90	26.38	0.2192	-0.0140	4.50	729.6	0.015	1.80
95	24.18	0.2009	-0.0183	4.75	770.1	0.013	1.52
100	21.55	0.1791	-0.0219	5.00	810.7	0.011	1.31
105	18.92	0.1572	-0.0219	5.25	851.2	0.009	1.11
110	16.08	0.1336	-0.0236	5.50	891.7	0.008	0.94
115	14.19	0.1179	-0.0157	5.75	932.3	0.007	0.80
120	12.61	0.1048	-0.0131	6.00	972.8	0.006	0.68
125	11.04	0.0917	-0.0130	6.25	1013.3	0.005	0.58
130	9.99	0.0830	-0.0087	6.50	1053.9	0.004	0.49
135	9.04	0.0751	-0.0079	6.75	1094.4	0.003	0.42
140	8.2	0.0681	-0.0070	7.00	1135.0	0.003	0.36
145	7.36	0.0612	-0.0070	7.25	1175.5	0.002	0.30
150	6.78	0.0563	-0.0048				
155	6.2	0.0515	-0.0048				
160	5.83	0.0484	-0.0031				
165	5.47	0.0455	-0.0030				
170	5.15	0.0428	-0.0027				
175	4.84	0.0402	-0.0026				
180	4.57	0.0380	-0.0022				
185	4.31	0.0358	-0.0022				
190	4.1	0.0341	-0.0017				
195	3.87	0.0322	-0.0019				
200	3.68	0.0306	-0.0016				
205	3.47	0.0288	-0.0017				
210	3.28	0.0273	-0.0016				
215	3.1	0.0258	-0.0015				
220	2.93	0.0243	-0.0014				
225	2.75	0.0229	-0.0015				
230	2.63	0.0219	-0.0010				
235	2.47	0.0205	-0.0013				
240	2.33	0.0194	-0.0012				
245	2.22	0.0184	-0.0009				
250	2.1	0.0175	-0.0010				
255	1.99	0.0165	-0.0009				
260	1.88	0.0156	-0.0009				
265	1.78	0.0148	-0.0008				
270	1.68	0.0140	-0.0008				
275	1.59	0.0132	-0.0007				
280	1.5	0.0125	-0.0007				
285	1.43	0.0119	-0.0006				
290	1.36	0.0113	-0.0006				
295	1.28	0.0106	-0.0007				
300	1.21	0.0101	-0.0006				
305	1.15	0.0096	-0.0005				
				Lg =	0.57	0.54	0.20
				D =	0.1	0.1	0.04
				Lg+D/2 =	0.62	0.59	0.22
				Vol. =	74.22	43.83	16.94

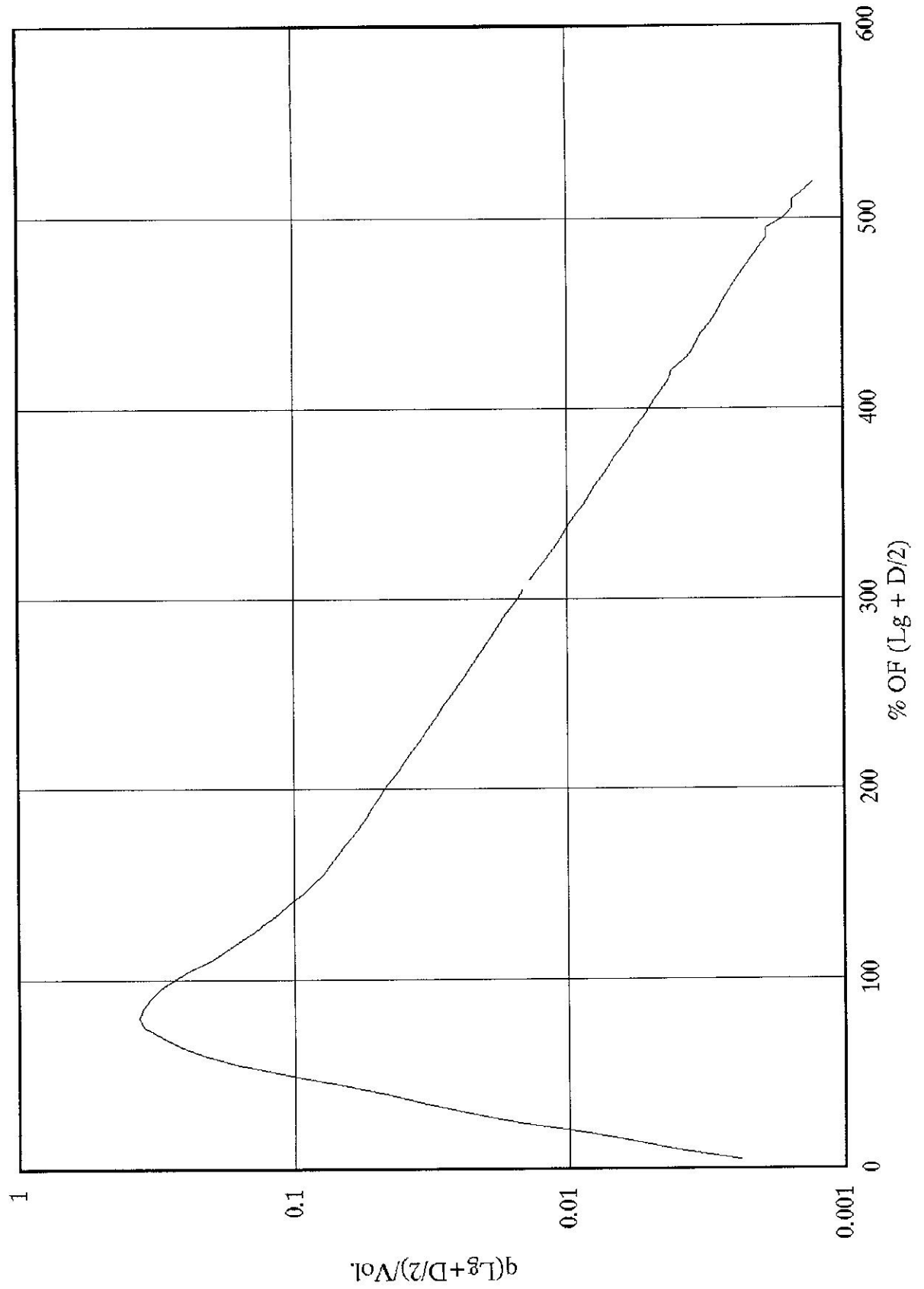
** from Table 3-13, USBR 1987

BALANCED STORM HYETOGRAPH - 24 HR/100YR

MT TAYLOR MINE WATERSHED

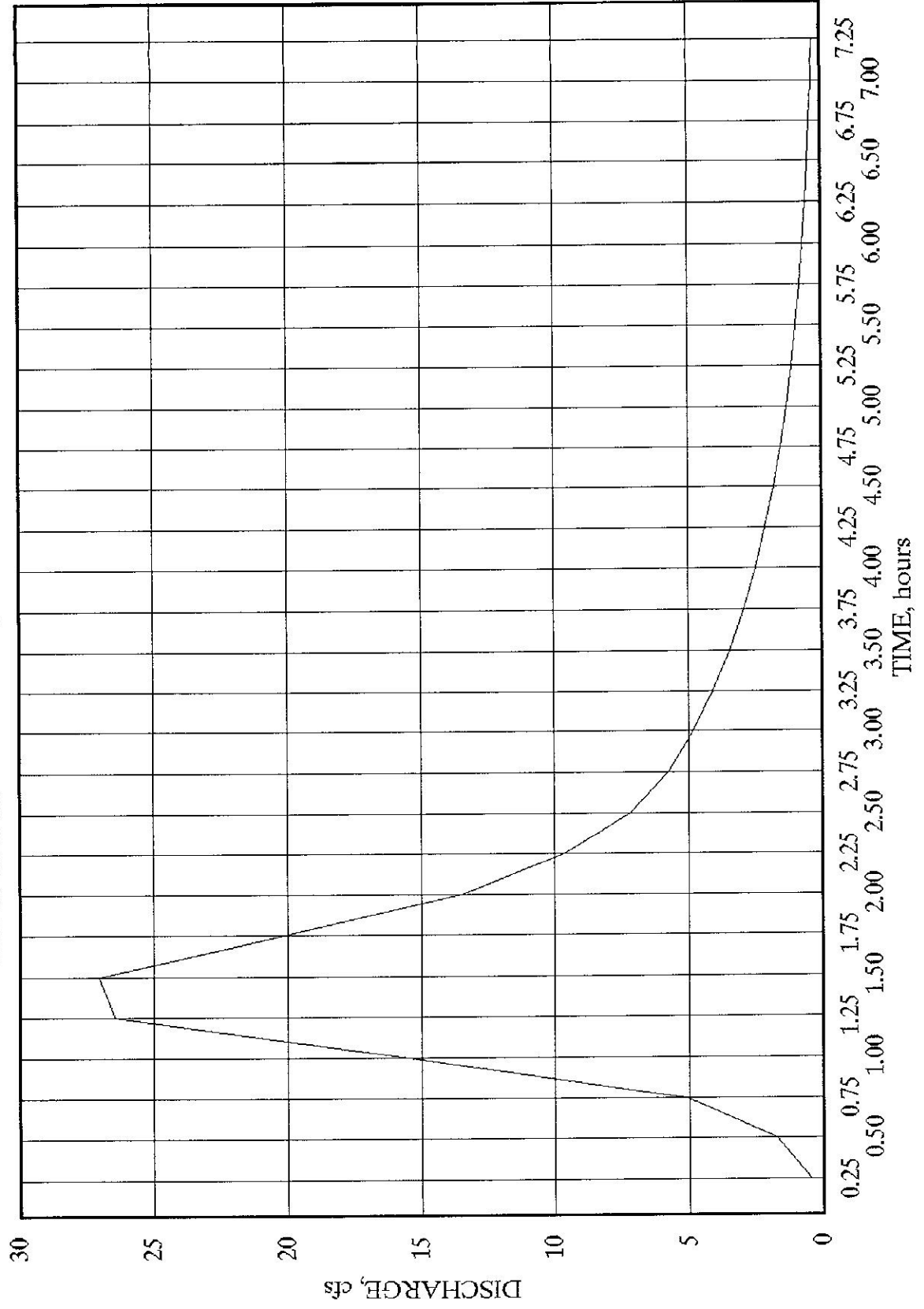


DIMENSIONLESS UNIT HYDROGRAPH FOR MARQUEZ WATERSHED
MT TAYLOR MINE



UNIT HYDROGRAPH AT SITE WEST BOUNDARY

MT. TAYLOR MINE - MARQUEZ CANYON WATERSHED



24 HR/100YR RAINFALL DISTRIBUTION
MT TAYLOR MINE - MARQUEZ CANYON WATERSHED

