Appendix F

GEO-TECHNICAL SERVICES
Consulting Engineers & Geologists

JOB CATAWISSA CREEK

SHEET NO. _____ OF _____

CALCULATED BY SJM DATE 11/87

CHECKED BY _____ DATE _____

SCALE WLT#1

HYDROLOGY	F1 - F2
CHEMICAL PARAMETERS	F3
TREATMENT DESIGN	F4 - F9
LIMESTONE USAGE	F10

JOB WLI #1 CATAWISSA CREEK

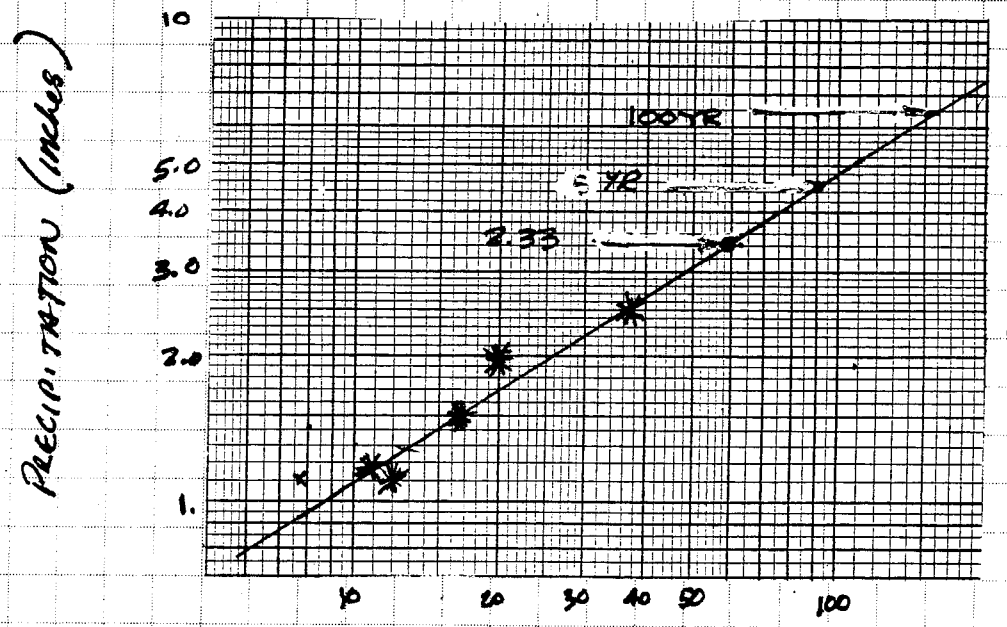
SHEET NO. _____ OF _____

CALCULATED BY SJM DATE 9/81

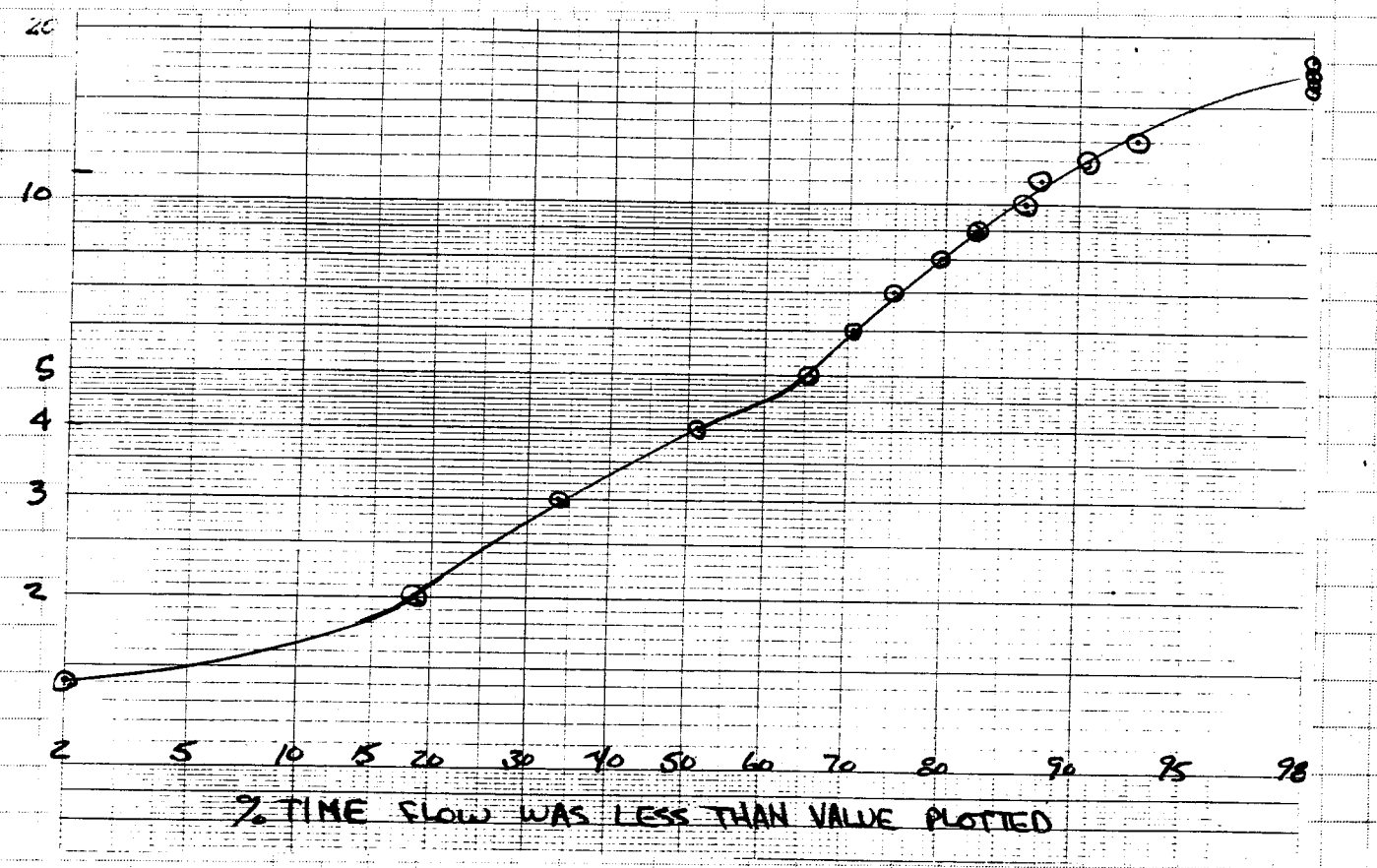
CHECKED BY _____ DATE _____

GEO-TECHNICAL SERVICES
Consulting Engineers & Geologists

PLOT PEAK DISCHARGES VS. PRECIPITATION 48 hr. duration
PRECIPITATION FREQUENCY CONTROLS AT THIS TUNNEL



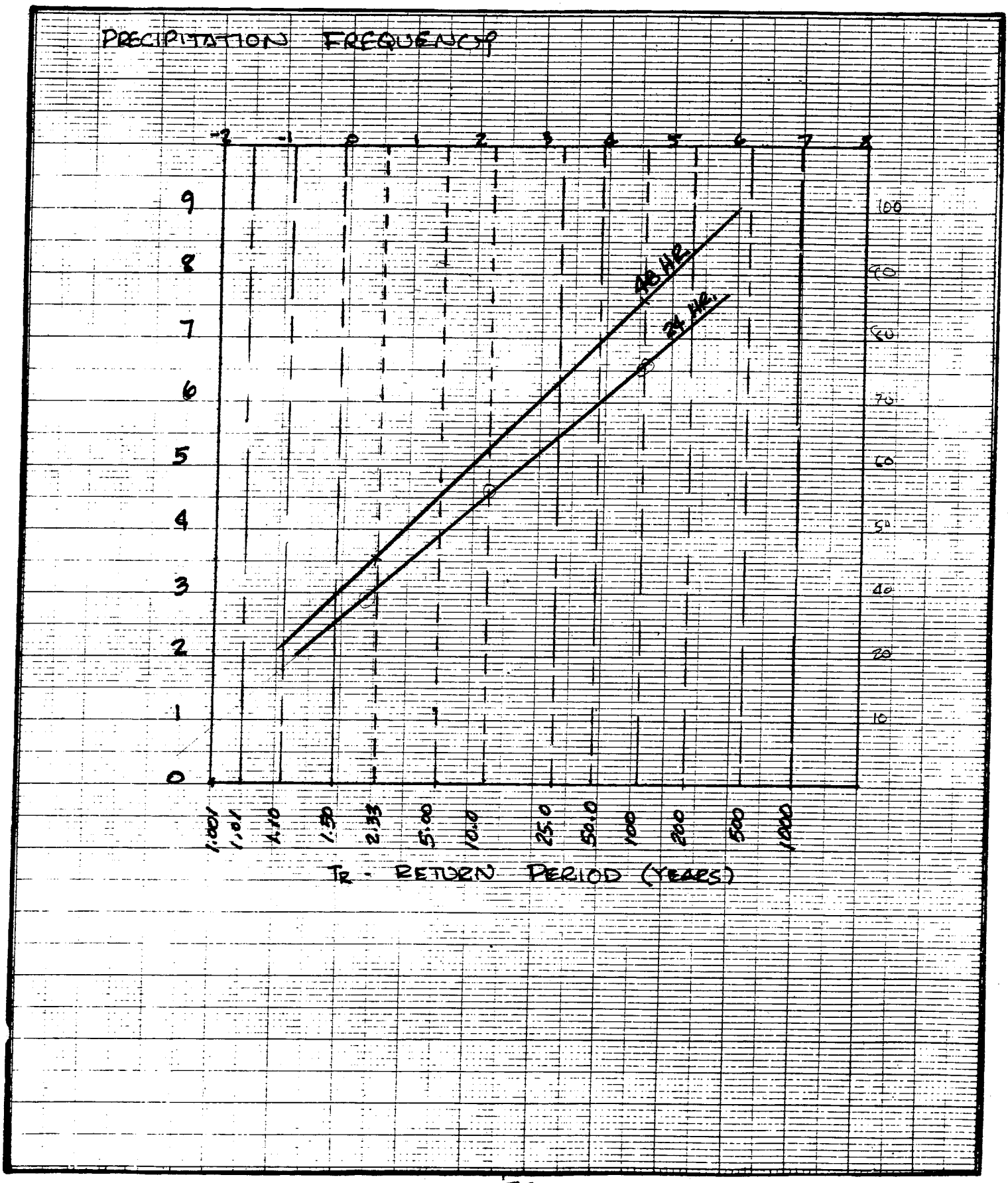
NOTE: PEAK FLOW FROM SNOW MELT = 20.9 cfs Tr = 5 yr.



CHIPWISSA CREEK

GEO-TECHNICAL SERVICES
Consulting Engineers & Geologists

SHEET NO _____ OF _____
CALCULATED BY SJM DATE 11/91
CHECKED BY _____ DATE _____
SCALE WLT#1



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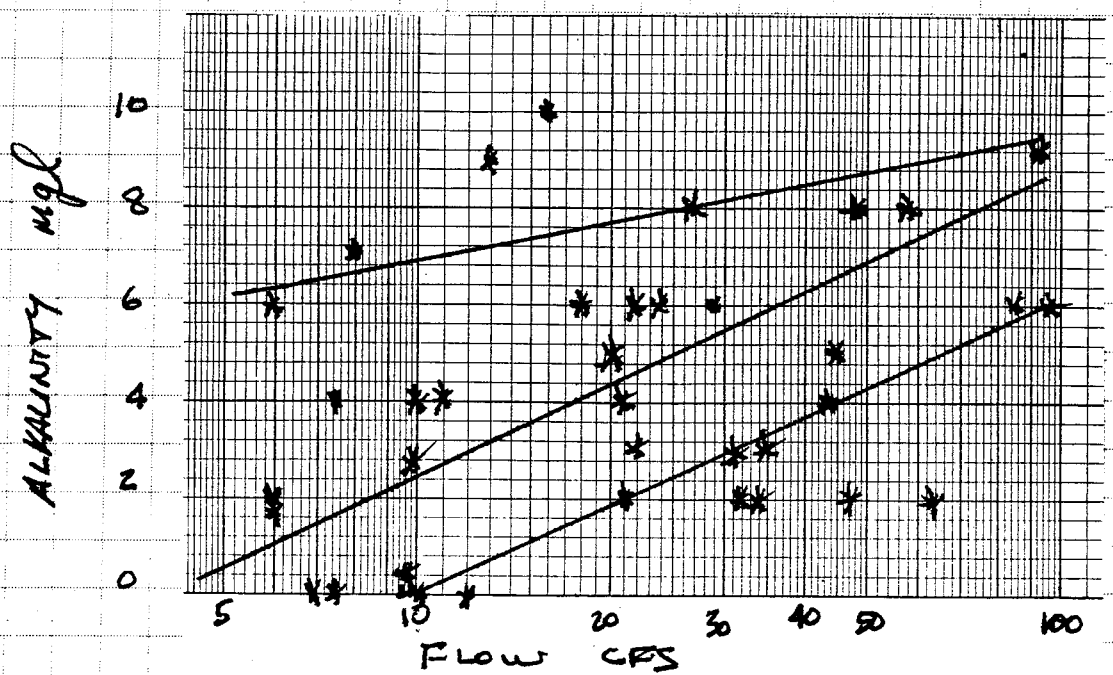
USE REQ'D PRODUCTION RATE - $U_R = 0.33 \Delta ALK\ Q$

Q	U_R
2	36
4	69
10	165
20	297
60	792

NOTE: TOMHICKEN CREEK ABOVE TC-1 IS ACIDIC & IF MORE THAN ONE DRUM REQUIRED THE INTAKE FOR THE 2nd UNIT IS EASY TO TAKE FROM THE STREAM

PLOT ALK vs FLOW for T.C. #1



NOTE: IF ONLY TUNNEL FLOW TREATED STREAM WILL REMAIN ACIDIC.

GEO-TECHNICAL SERVICES
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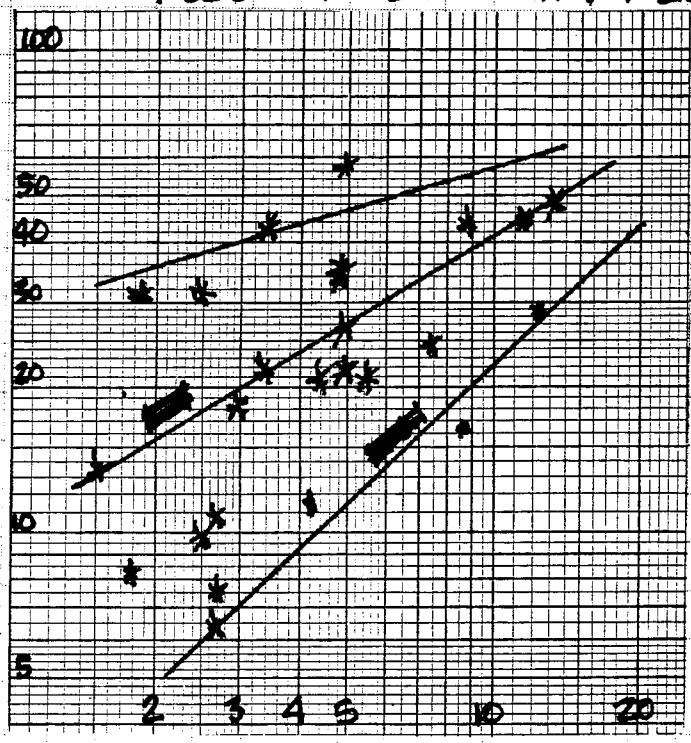
JOB CHIAWISSA WEEK
SHEET NO. ____ OF ____
CALCULATED BY S/M DATE 11/81
CHECKED BY ____ DATE ____
SCALE WLT #1

PLOT RATIO OF TUNNEL FLOW TO STREAM FLOW



As could be expected flow ration and Alkalinity Requirements vary considerably.

However Low flow from stream intake approx. 8 cfs
MAX ANNUAL > 100 cfs
USE MEAN VALUES TO ESTIMATE TOMHICKEN TREATMENT REQUIREMENTS.

MEAN REQUIREMENTS

Q_T	UR_S	Q_{STRM}	Alk_R	UR_{STR}	TOTAL UR
2	36	16	40	~~220~~ 211	~~~~ 247
4	69	24	40	~~~~ 317	~~~~ 386
10	165	40	38	~~~~ 502	~~~~ 667
20	297	66	36	~~~~ 784	~~~~ 1081
60	792	100	30	~~990~~ 990	~~1782~~ 1782

GEO-TECHNICAL SERVICES
Consulting Engineers & Geologists

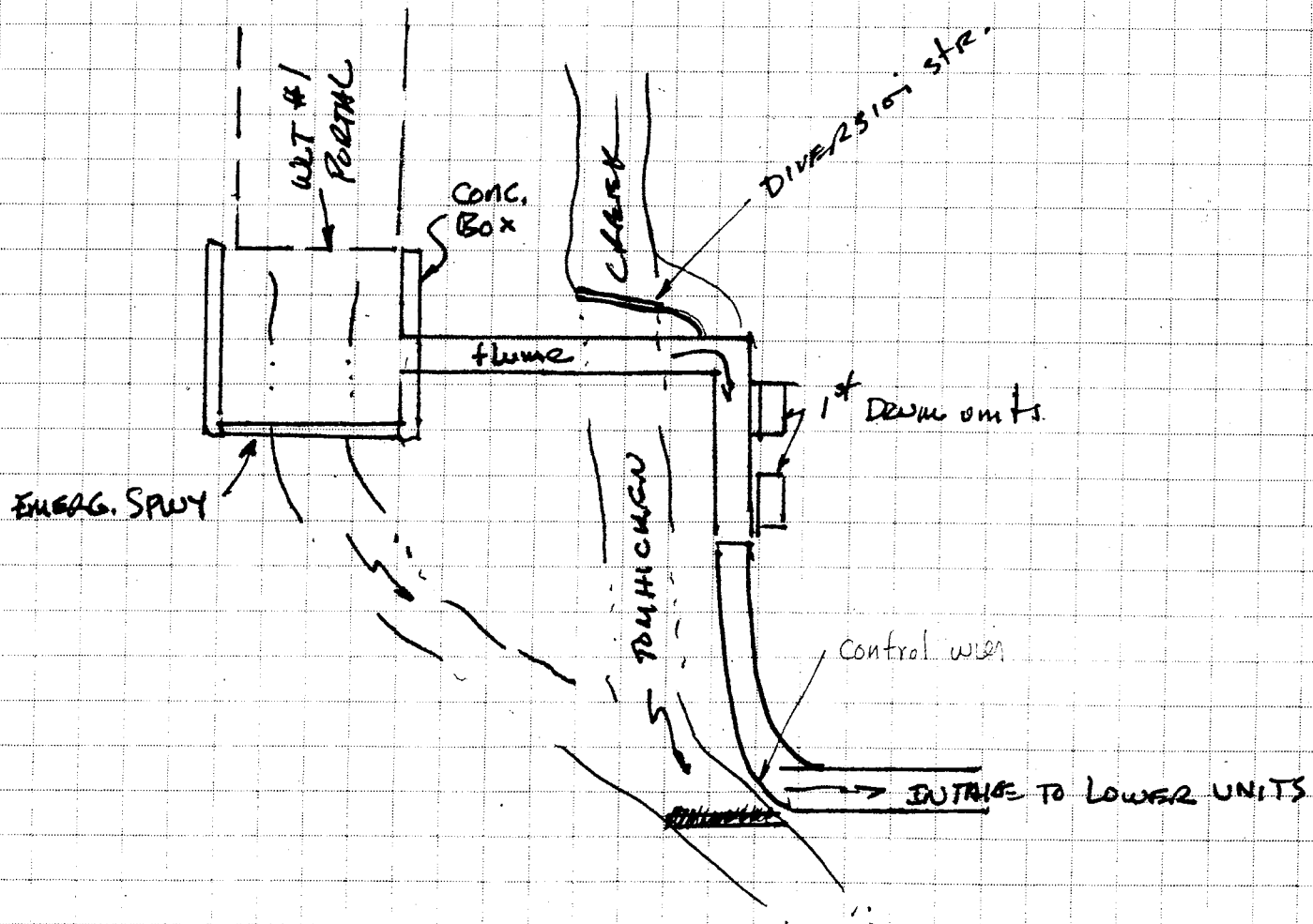
JOB CHAWISSH CREEK
SHEET NO. ____ OF ____
CALCULATED BY zpm DATE 11/81
CHECKED BY ____ DATE ____
SCALE WLT#1

TREATMENT SCHEME USE 2 DRUM SIZES

1.) 6'ϕ x 4'ϕ inner barrel x 2' wide
2.) 6'ϕ x 4'ϕ " " x 4' wide

3 TIERS OF DRUMS REQUIRED

DUE TO PHYSICAL LOCATION 1st SET OF DRUMS LOCATED ON FLUME OVER TOM HICKEN CREEK TO TREAT LOW-MED FLOW CONDITIONS



GEO-TECHNICAL SERVICES
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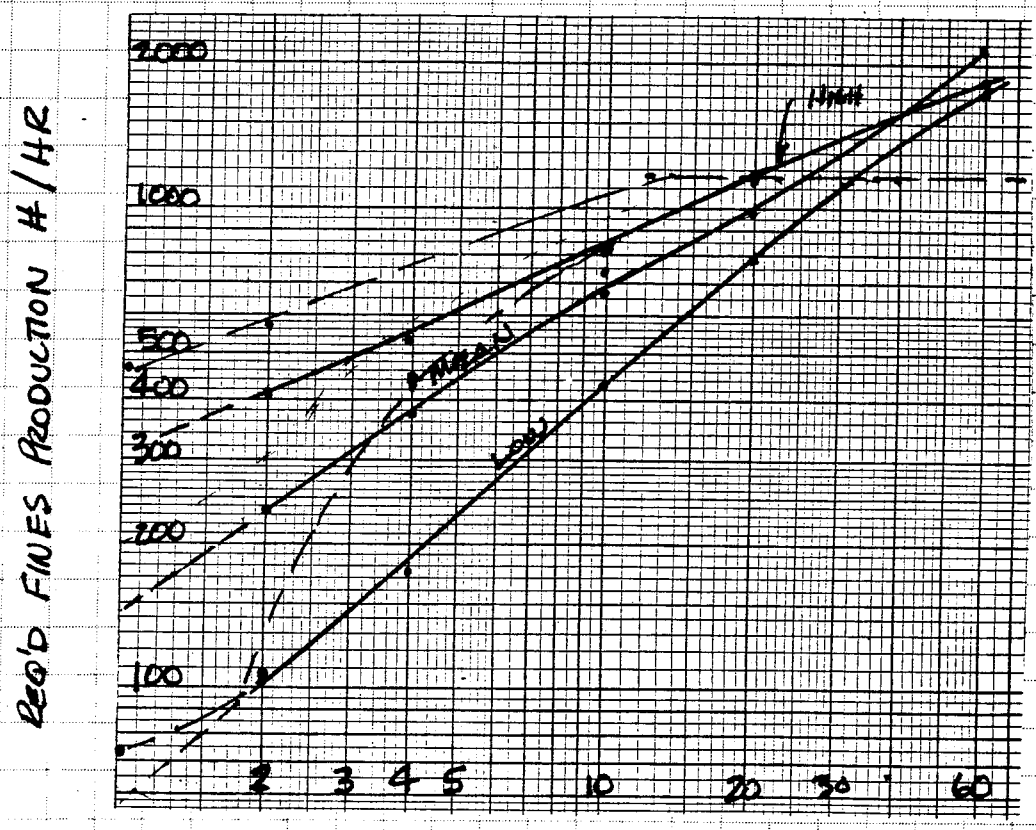
JOB CATAWISSA CREEK
SHEET NO. _____ OF _____
CALCULATED BY _____ DATE 11/81
CHECKED BY _____ DATE _____
SCALE WLT #1

LOW FLOW REQUIREMENTS

@T	@STRM	ALK	TOTAL UR
2	5	40	102
4	8	40	175
10	20	40	429
20	40	38	798
60	100	34	1914

HIGH FLOW REQUIREMENTS

@T	@STRM	ALK	TOTAL UR
2	35	32	406
4	45	31	529
10	58	30	739
20	70	30	990
60	200	20	2112



GEO-TECHNICAL SERVICES
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JOB CATAWISSA CREEK
SHEET NO. ____ OF ____
CALCULATED BY SJM DATE 4/81
CHECKED BY ____ DATE ____
WLT #1

FROM PREVIOUS COMPS. PRODUCTION RATES OF DRUMS

Q	6×4×2	6×4×4	
1	10	0	
2	21	0	
4	32	40	
6	-	64	← fines production lbs/day
8	-	80	
12	-	120	

ASSUMES MAX EFF. @ 1.5 cfs/ft.

$$Q_R = 6 \frac{23.5}{550} Q$$

1st SET OF DRUMS max flow = 16 cfs (flume design)

(1-6'ϕ×4'×2')
(1-6'ϕ×4'×4')

FLOW	PRODUCTION	REQ'D PRODUCTION
1	10	60 → 300
2	21	100 → 400
4	32	180 → 560
10	96	420 → 700
>16	152	700 → 1800

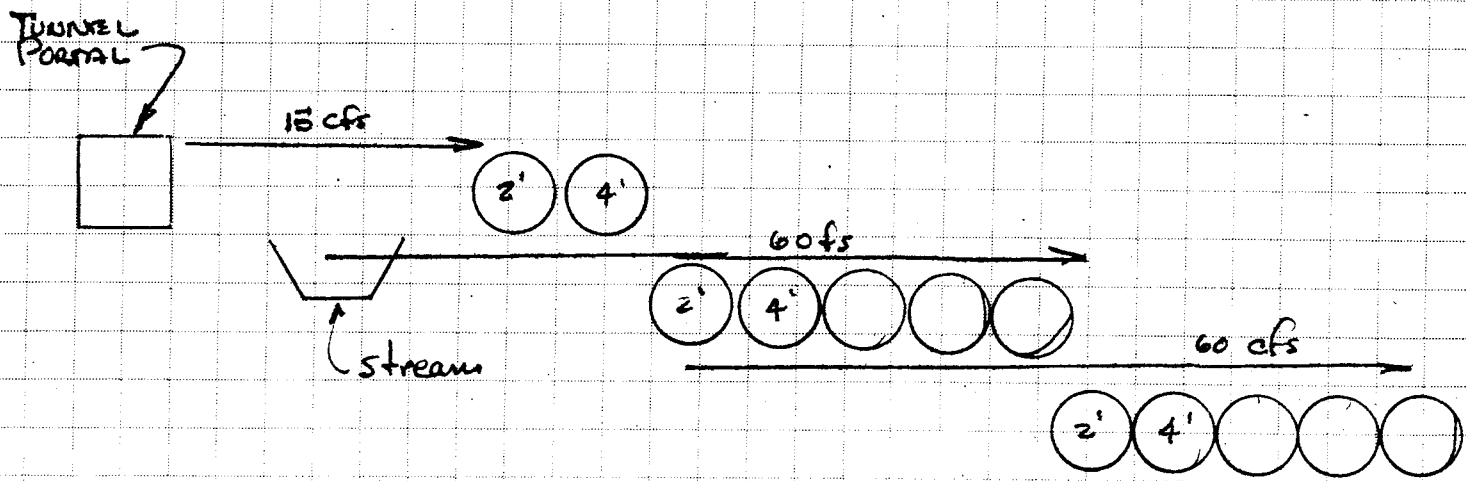
2nd SET OF DRUMS
(1-6'ϕ×4'×2' & 4-6'ϕ×4'×4')

TUNNEL FLOW	RANGE STR'M FLOW	CUMULATIVE PRODUCTION RANGE	
1	4 - 20	42 - 130	< REQ'D
2	7 - 38	73 - 293	"
4	22 - 50	184 - ~~344~~	"
10	30 - 70	368 - 608	"
20	60 - 90	~~664~~ - 664	"
60	160 - 200	664 664	"

3rd SET OF DRUMS.
1 - 6'x4'x2' & 4 - 6'x4'x4'

TUNNEL FLOW	CUMULATIVE PRODUCTION RANGE	REQ'D PROD. RANGE
1	74 - 250	60 - 300
2	125 - 565	100 - 400
4	336 - 796	180 - 560
10	640 - 1120	420 - 700
20	1176 - 1176	798 - 990
60	1176 - 1176	1914 - 2192

1. DESIGN PROVIDES TREATMENT TO 30 cfs ±
2. " MEETS LOW FLOW REQUIREMENTS
3. " OVER PRODUCES FOR MED. TO HIGH FLOWS (CAN BE REGULATED BY CONTROL WIERS).



TREATMENT SCHEME

GEO-TECHNICAL SERVICES
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JOB CATAWISSA CREEK
SHEET NO. ____ OF ____
CALCULATED BY TAG DATE 11/19/81
CHECKED BY ____ DATE ____
SCALE WLT 1

ANNUAL LIMESTONE USE:

DURATION %	DAYS /yr	FLOW cfs	-DRUMS- FINES lbs/hr.	TOT. FINES lbs	-DOWNFLOW- ACID mg/l	LBS NEUT. lbs	TOTAL TONS
0-2	7.2	1	200	34560			17.3
2-5	11	1.5	250	66000			33.0
5-10	18.3	1.6	260	114192			57.1
10-20	36.5	2	300	262800			131.4
20-30	36.5	2.5	400	350400			175.2
30-40	36.5	3	500	438000			219.0
40-50	36.5	3.5	550	481800			240.9
50-60	36.5	4	600	525600			262.8
60-70	36.5	5	700	613200			306.6
>-80	36.5	7	800	700800			350.4
80-90	36.5	10	1000	876000			438.0
90-95	18.3	13	1050	918800			459.9
95-98	11	16	1100	290400			145.2
98-100	7.2	60	1100	190080			95.0

NO DOWNFLOW UNITS INCLUDED IN DESIGN

ANNUAL LIMESTONE CONSUMPTION (TONS) 2931.8

USE RATE FORMULAS *

DRUMS TOT. FINES:

$$\text{TOTAL FINES} = \text{FINES (lbs/hr)} \times 24 \text{ hr/day} \times \text{days}$$

DOWNFLOW LBS. NEUT:

$$\text{LBS. ACID NEUTRALIZED} = 1.1\left[\frac{\text{ACIDITY}^{**}(\text{mg/l}) \times \text{FLOW (cfs)} \times 5.3901 \times \text{days}}{2}\right]$$

* Developed from experimental results at Quakake.
** Assumes complete Acid removal (conservative limestone use estimate)