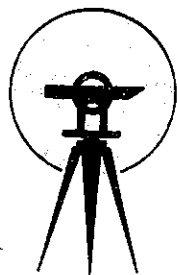


City Engineers Copy

DRAINAGE STUDY
FOR
HARRISON CREEK BASIN
IN
COLORADO SPRINGS, COLORADO

*Approved D Jefferson
by CA 4/16/77*



Drexel, Barrell & Co.

SURVEYORS • ENGINEERING CONSULTANTS

1425 PEARL ST.

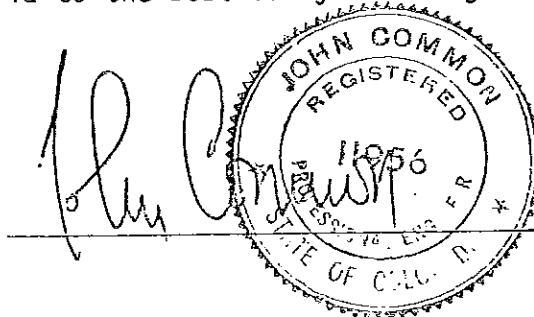
BOULDER, COLO. 80302

TELEPHONE 442-4338

DRAINAGE STUDY
FOR
HARRISON CREEK BASIN
IN
COLORADO SPRINGS, COLORADO

CERTIFICATIONS

I, John Common, a registered engineer in the State of Colorado, hereby certify that the attached drainage plan and report for Harrison Creek Basin were prepared under my direction and supervision and are correct to the best of my knowledge and belief. I further certify that said drainage report is in accordance with all City of Colorado Springs ordinances, specifications, and criteria to the best of my knowledge.



The developer has read and will comply with all of the requirements specified in this drainage report as approved by the City Engineer.

By Gates Land Co
Robert D. [Signature]
Title Project Engineer

DRAINAGE REPORT
HARRISON CREEK BASIN
COLORADO SPRINGS, COLORADO

The Harrison Creek Basin is located in the NW $\frac{1}{4}$ of Section 33, Township 14 South, Range 66 West of the 6th P.M., City of Colorado Springs, El Paso County, Colorado. More particularly, the site is located south of South Circle Drive and east of I-25.

The property contains approximately 277.51 acres of which 105.36 acres are being developed at this time. Only 201 acres are developable because of existing rights-of-way. Nearly 250 acres are tributary to it from the west.

A peak flow of 350 cfs for a storm with a 100-year frequency passes under I-25 in an existing 6' x 10' concrete box culvert. The flow and its hydrograph are documented in the "Master Drainage Plan, Harrison Street - I-25 Vicinity, Cheyenne Mountain Ranch," prepared by Hartzell-Pfeiffenberger and Associates, Inc. in November 1970. This flow is routed through the subdivision in a proposed drainage channel which is sized to carry the 100-year runoff entering it.

With the exception of the above mentioned drainage channel the subdivision has been analyzed using a rainfall frequency of 50 years. The drainage basins studied here are sufficiently large that the Synthetic Triangular Hydrograph Method, which is similar to the method used by the Soil Conservation Service, is used to determine peak flows. Soil conditions as shown on the drainage plan and rainfall patterns for a 1-hour storm are important factors in this type of analysis.

The streets within the subdivision are adequate for the flows generated in the design storm. The direction of flow in the streets is shown on the drainage plan. All street flow in the southern portion will drain toward a proposed double 7' x 4' concrete box culvert shown between Areas IV and IX. Here two inlets will pick up the flow.

Four drainage culverts and one irrigation culvert have been placed under the recently constructed frontage road by the State Highway Department. With the exception of the box culvert and the C.M.P. culvert immediately north of it, these culverts will be abandoned. Flow from Areas V and VII which presently passes through two of these culverts is carried in a storm sewer on the east side of the frontage road to the major drainage channel mentioned previously. This ditch section is shown on the drainage plan.

The natural 100-year flood plain limits for Fountain Creek as calculated by the U.S. Army Corps of Engineers extend into the property as shown on the drainage plan. The eastern portion of the subdivision needs to be filled and graded such that all lots are protected against encroachment of flood waters. Bank protection will be required along Fountain Creek and on the major drainage channel which passes through the property. This may be rock rip-rap or any other bank protection which is approved by the City of Colorado Springs.

In the eastern portion of the property some of the land is within the Fountain Creek flood plain and some of it is within the rights-of-way of Denver & Rio Grande Railroad and A.T. & S.F. Railroad. No additional improvements are proposed for these areas as they will continue to drain as they presently do.

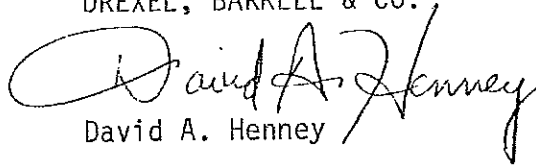
DRAINAGE REPORT
HARRISON CREEK BASIN (Continued)

The costs of the proposed drainage facilities will be approximately \$164,584.20. These costs are summarized in the table which follows this text. This figure is used to calculate the drainage basin fee of \$818.83 per acre.

Hydrographs and other hydrologic information are shown at the end of this report.

Respectfully submitted,

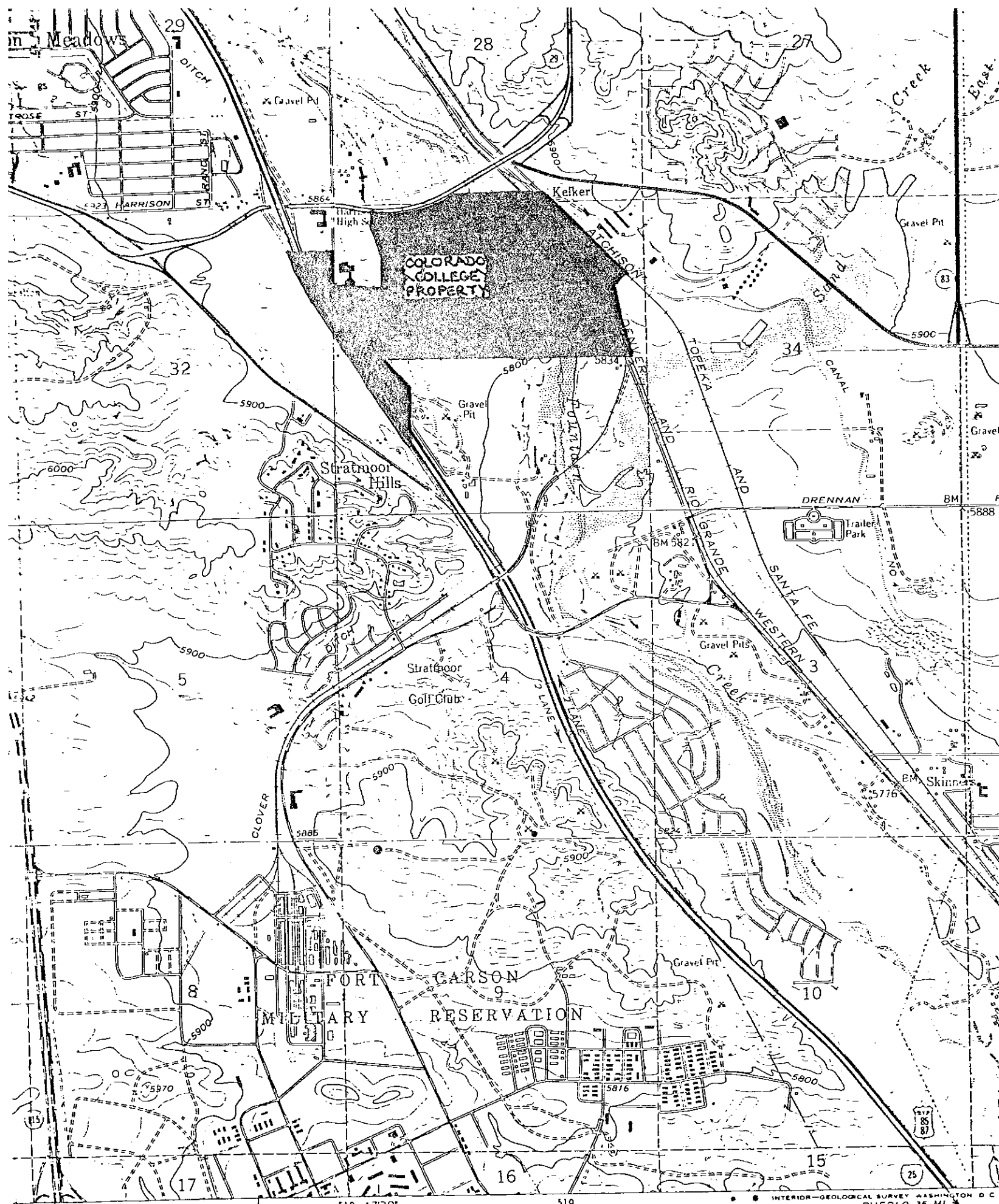
DREXEL, BARRELL & CO.


David A. Henney

COST SUMMARY

1. One double 7' x 4' x 55' C.B.C. at \$20,000.00 each	\$ 20,000.00
2. Five 5' curb opening inlets at \$800.00 each	4,000.00
3. Two 14' curb opening inlets at \$1,800.00 each	3,600.00
4. One headwall for 30" RCP at \$300.00 each	300.00
5. One headwall for 36" RCP at \$420.00 each	420.00
6. 30 L.F. of 30" RCP at \$26.00/L.F.	780.00
7. 555 L.F. of 36" RCP at \$30.00/L.F.	16,650.00
8. 880 L.F. of 42" RCP at \$36.00/L.F.	31,680.00
9. 208 L.F. of 24" CMP at \$21.00/L.F.	4,368.00
10. 208 L.F. of 27" x 43" CMP arch at \$28.00/L.F.	5,824.00
11. One 8' x 7' x 79' C.B.C. at \$30,000.00 each	30,000.00
12. 1,600 C.Y. of rock rip-rap at \$20.00/C.Y.	<u>32,000.00</u>
Sub-Total	\$149,622.00
13. 10% contingencies	<u>14,962.20</u>
TOTAL	\$164,584.00

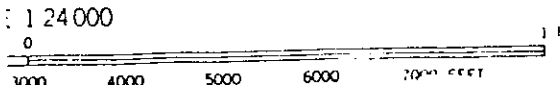
Drainage basin fee for 201 acres = \$818.83/acre



TAINI PENROSE 28 MI.
CANON CITY 46 MI

518 4730' 519

INTERIOR GEOLOGICAL SURVEY WASHINGTON D C
520000m E. PUEBLO 36 MI



ROAD CLASSIFICATION

Heavy duty Light duty

E-1644

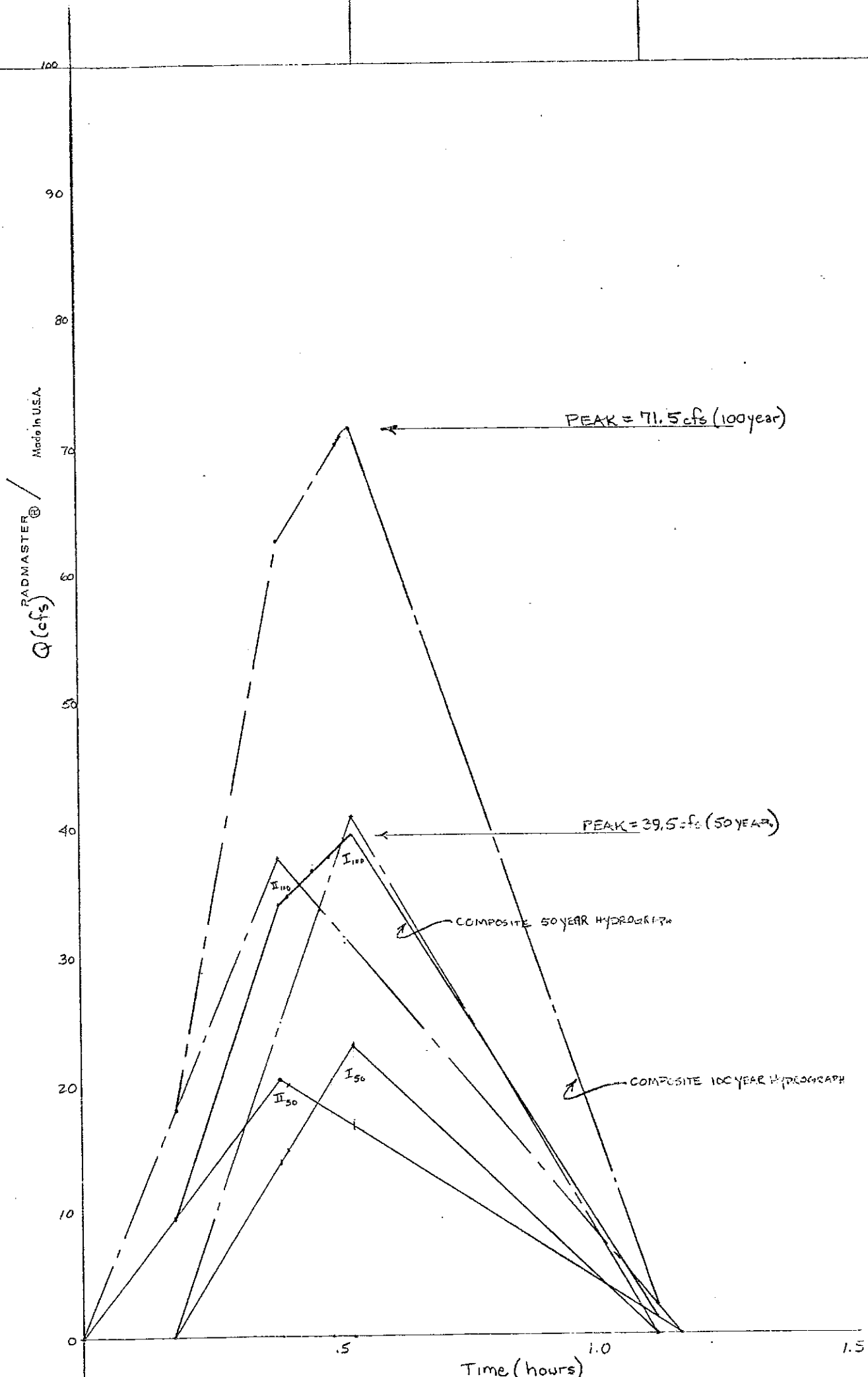
December 8, 1976

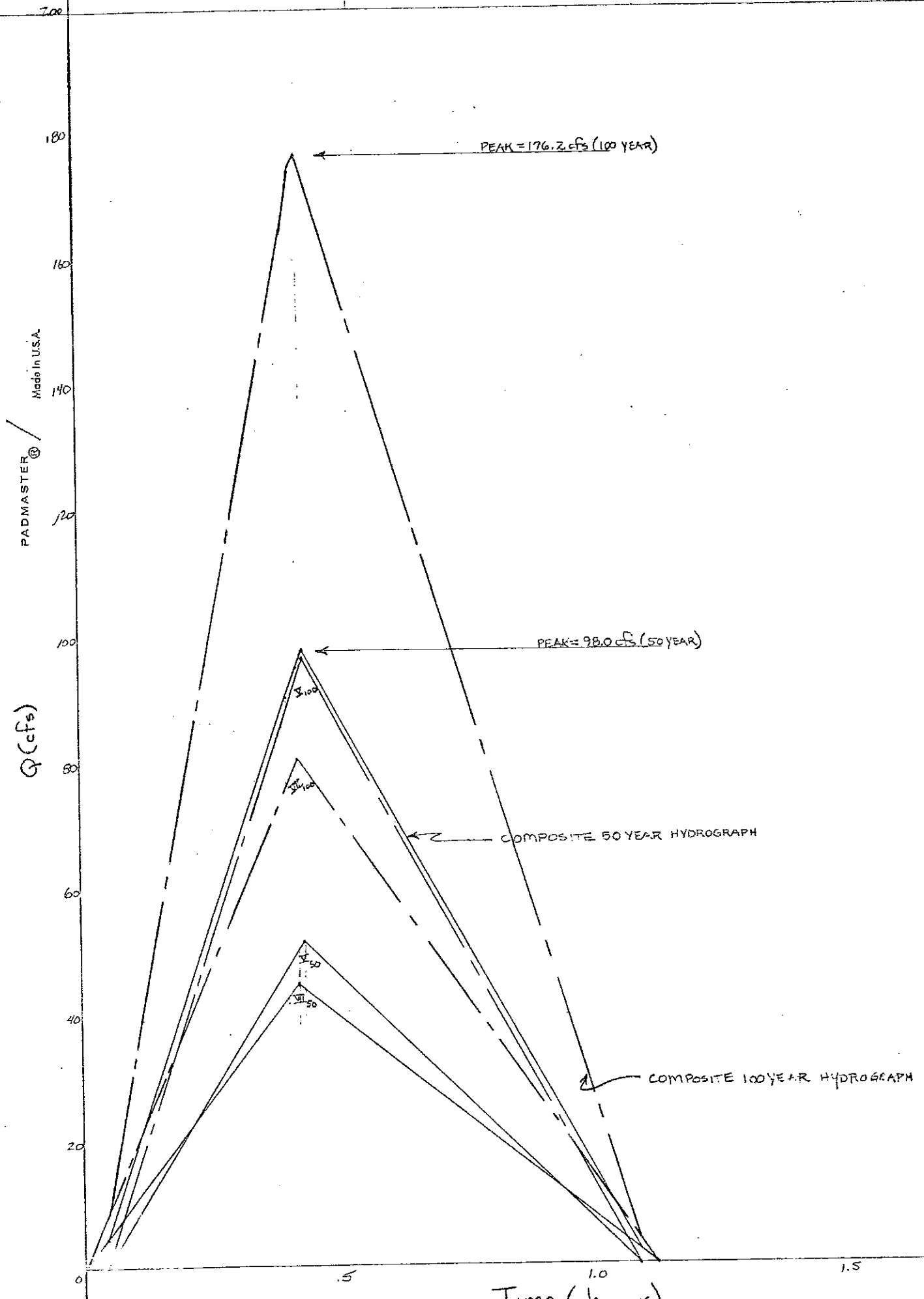
1-hour value for Colorado Springs = 2.0 inches, 50-year frequency
3.0 inches 100-year frequency

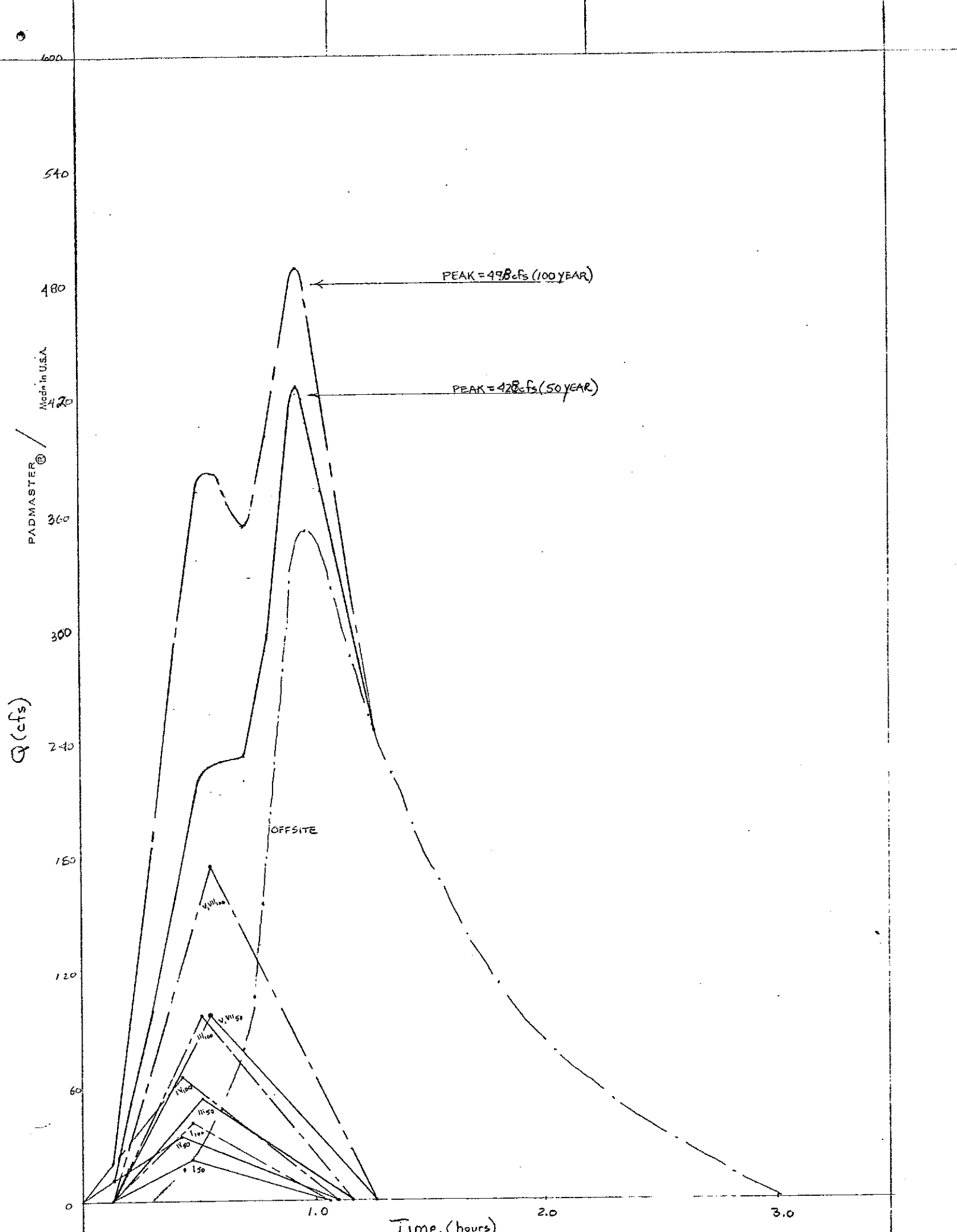
Determination of S.C.S. Curve Number:

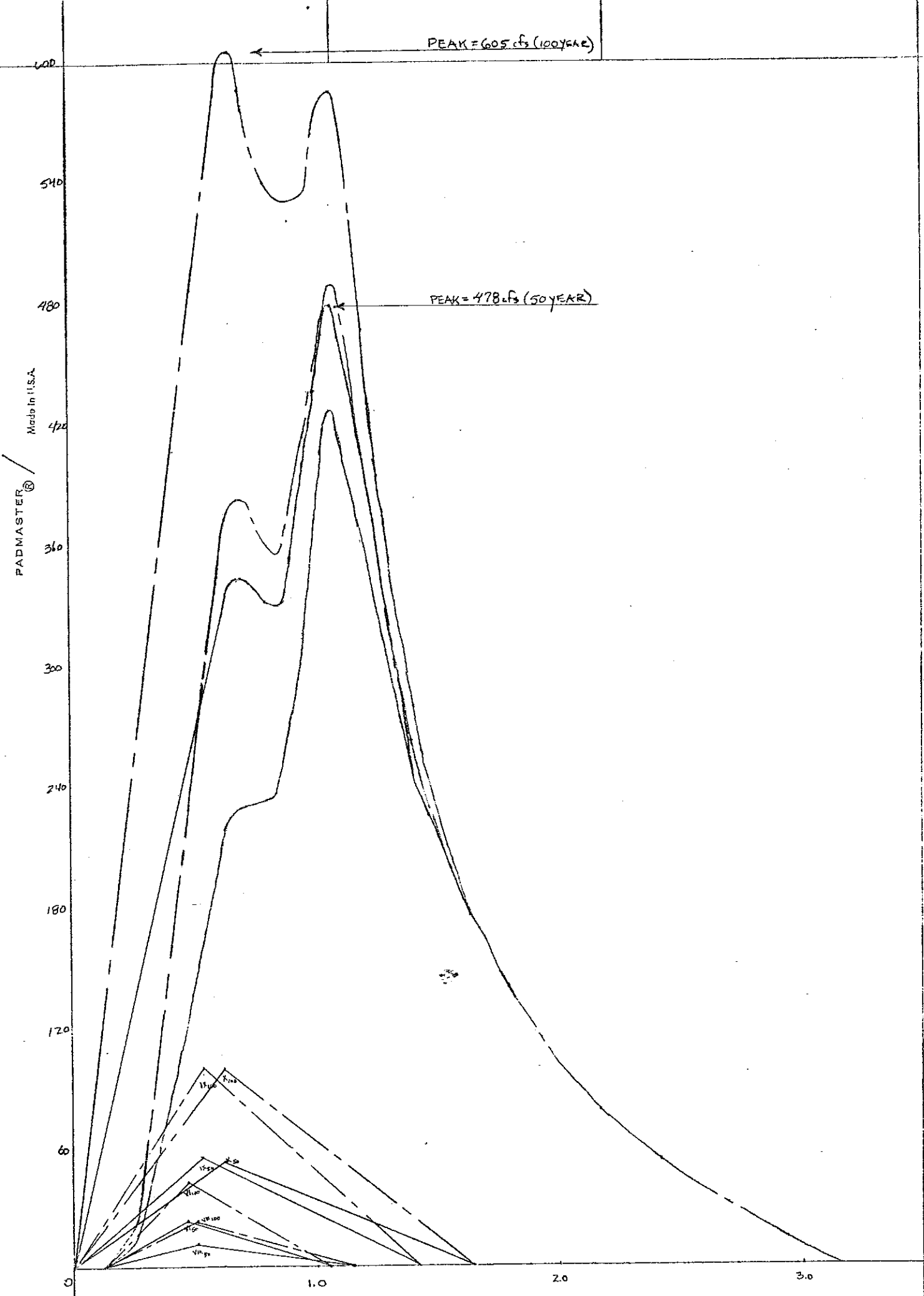
Industrial; Hydrologic Soil Type C (Nunn Series) = 91
Industrial; Hydrologic Soil Type B (Ustic Torrifluvents Series) = 88
Industrial; Hydrologic Soil Complex (Schamber-Razor Complex) = 90

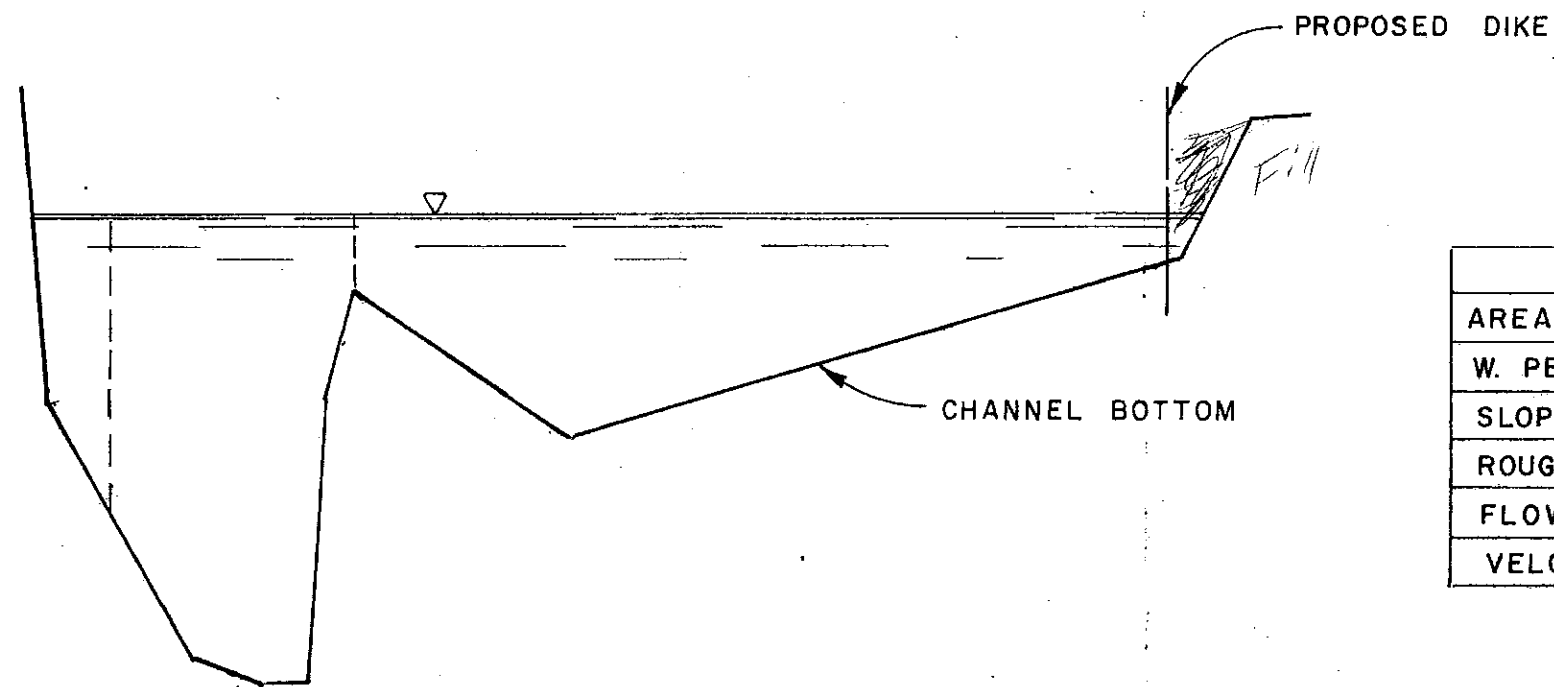
Basin No.	Area Sq. Mi.	Length of Channel Feet	Elevation Difference Feet	Tc Hours	Tp Hours	Tb Hours	Weighted Curve Number	Slope %	50-Year Runoff Inches (100-yr.)	50-Year Flow CFS (100-yr.)	
I	.01438	1,370	30	.310	.353	.942	91	2.19	1.16 (2.07)	22.9 (40.8)	Note: Duration of excess rainfall (D) is 20 minutes.
II	.01859	1,560	26	.444	.434	1.158	88	1.67	.97 (1.82)	20.1 (37.7)	
Offsite	SEE HARTZELL-PFEIFFENBERGER MASTER DRAINAGE STUDY										
III	.03781	1,420	23	.371	.390	1.040	91	1.62	1.16 (2.07)	54.4 (97.1)	
IV	.03031	1,320	20	.408	.412	1.099	88	1.52	.97 (1.82)	34.5 (64.8)	
V	.03766	1,840	44	.376	.392	1.048	91	2.39	1.16 (2.07)	53.9 (96.3)	
VI	.01688	700	7	.302	.348	.930	88	1.00	.97 (1.82)	22.8 (42.7)	
VII	.03375	2,000	43	.423	.421	1.124	91	2.15	1.16 (2.07)	45.0 (80.3)	
VIII	.00969	750	6	.357	.381	1.018	88	0.80	.97 (1.82)	11.9 (22.4)	
IX	.06203	1,250	8	.601	.528	1.409	88	0.64	.97 (1.82)	55.2 (103.5)	
X	.06875	2,100	20	.747	.615	1.642	88	0.95	.97 (1.82)	52.5 (98.5)	
XI	.08094	700	27	.154	.259	.693	88	3.86	.97 (1.82)	146.7 (275.3)	
XII	.03406	3,000	28	1.005	.770	2.055	88	0.93	.97 (1.82)	20.8 (39.0)	
XIII	.00844	800	12	.244	.313	.836	91	1.50	.97 (1.82)	15.1 (27.0)	











NATURAL CHANNEL SECTION

SCALE
 VERTICAL 1" = 5'
 HORIZONTAL 1" = 200'

	L. OVBANK	MAIN CHANNEL	R. OVBANK
AREA	477.222 SQ. IN.	2549.11 SQ. IN.	3193.53 SQ. IN.
W. PERIMETER	92.642'	364.398'	889.132'
SLOPE	.005 1/4	.005 1/4	.005 1/4
ROUGHNESS	.07	.035	.07
FLOW	2136.67 C.F.S.	34666.86 C.F.S.	11242.99 C.F.S.
VELOCITY	4.48 F.P.S.	13.60 F.P.S.	3.52 F.P.S.

CROSS SECTION III
 OF
 HARRISON CREEK DRAINAGE
 STUDY



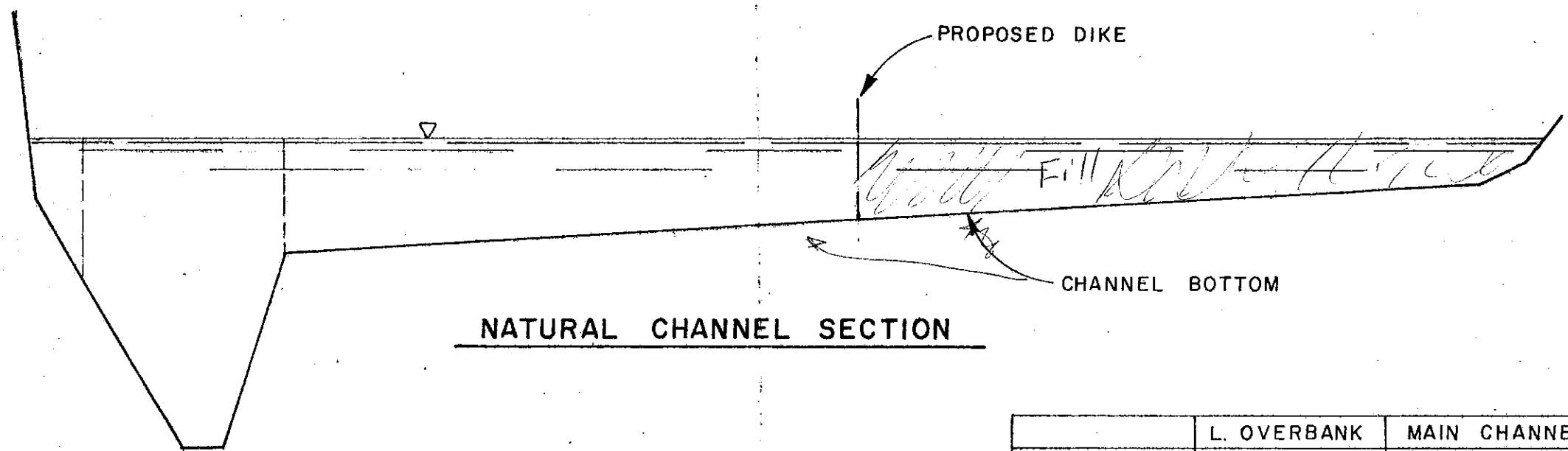
DREXEL, BARRELL & CO.

REGISTERED SURVEYORS
 CONSULTING ENGINEERS

BOULDER, COLORADO

E-1644

DATE	12/8/76	DRAWN	B. HUBER	NO.
SCALE	AS SHOWN			




SCALE
 VERTICAL = 1" = 5'
 HORIZONTAL = 1" = 200'

NATURAL CHANNEL SECTION

	L. OVBANK	MAIN CHANNEL	R. OVBANK
AREA	284.179 SQ. FT.	2482.398 SQ. FT.	4863.980 SQ. FT.
W. PERIMETER	84.507'	297.141'	1781.094'
SLOPE	.00465	.00465	.00465
ROUGHNESS	.06	.035	.06
FLOW	1077 C.F.S.	29591 C.F.S.	16049 C.F.S.
VELOCITY	3.79 F.P.S.	11.92 F.P.S.	3.29 F.P.S.

CROSS SECTION II2
 OF
 HARRISON CREEK DRAINAGE
 STUDY

	DREXEL, BARRELL & CO. REGISTERED SURVEYORS CONSULTING ENGINEERS BOULDER, COLORADO		E-1644
	DATE 12/8/76 SCALE AS SHOWN	DRAWN B. HUBER	

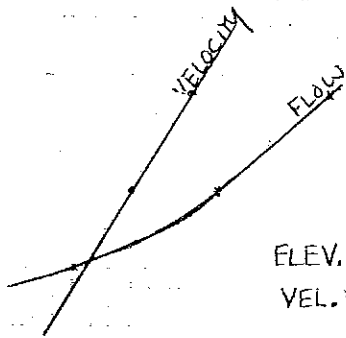
SECTION III

ELEVATION

5807.7

5807.6

5807.5



ELEV. = 5807.60 feet
VEL. = 3.61 fps

47K

48K

49K

TOTAL
Q (cfs)

3.5

3.6

3.7

RIGHT
OVERBANK
V (fps)

SECTION 112

