APPENDIX 3-D

Flood reconstitutions and worksheets, Walnut Gulch.

387 pgs.

C:\

Volume in drive A has no label ARS #1
Directory of A:\

4-1	I2	482	10-13-87	11:10a
4-1	O2	21534	10-13-87	11:12a
8-1	I6	518	10-16-87	12:29p
8-1	O6	20067	10-16-87	12:31p
11-1	I4	458	10-14-87	12:25p
11-1	O4	21213	10-14-87	12:26p
15-1	I2	480	10-14-87	2:41p
15-1	O2	20943	10-14-87	2:43p
103-1	I1	454	10-12-87	2:58p
103-1	O1	20138	10-12-87	2:59p
103-2	I1	420	10-12-87	9:24p
103-2	O1	22202	10-12-87	9:26p
4-2	I2	399	10-23-87	1:15p
4-2	O2	20719	10-23-87	1:17p
11-2	I3	385	10-23-87	7:44p
11-2	O3	18548	10-23-87	7:45p
8-2	I1	422	10-23-87	2:30p
8-2	O1	18355	10-23-87	3:20p
111-1	I1	449	10-23-87	8:46p
111-1	O1	19995	10-23-87	8:47p
111-2	I1	381	10-23-87	9:22p
111-2	O1	20546	10-23-87	9:24p
111-3	I1	353	10-23-87	9:48p
111-3	O1	19977	10-23-87	9:50p

24 File(s) 99328 bytes free

4-1 I1
4-1 Ø1

Summary of Walnut Gulch Events

Watershed	Date	in. Rain	in. Runoff	cfs Qp		acres Area	Analyzed
W-1	13 Aug 69					36,900	
W-2	13 Aug 75					28,100	
W-3	8 Sept 70	1.29	.08	293		2,220	
W-4	17-18 Aug 61	1.75	.44	355	✓✓	560	
	10-11 Aug 71	1.43	.39	401	✓✓		4WG1 4-1
	18-19 Aug 71	.89	.17	139			
	8 Sept 70	1.54	.19	203			
W-8	10-11 Aug 71	1.62	.15	1282	✓✓	3,830	
	24 July 72	.92	.02	191			
	6 Sept 76	.75	.15	588	✓✓		8WG1 8-1
W-11	19 Aug 63	1.47	.22	827		2,035	
	22 July 64	2.06	.94	4,422	✓		
	17-18 July 65	1.24	.11	726			
	30 July 66	2.21	.26	1073			
	20 July 70	1.88	.13	493			11-1
	13 Sept 75	.90	.18	698	✓✓		11WG1
W-15	31 Aug 68					5,912	
	13 Sept 75						15-1
	6 Sept 76	.70	.08	543	✓✓		15WG1
W-103	13 Aug 65	1.55	.53	17		8.3	103-2
	8 Sept 70	1.44	.60	17	✓✓		3 WG 2
	10 Aug 71	1.08	.48	19	✓✓		103-1 3 WG 1
	6 Sept 72	.92	.33	7			
	24 Sept 67	.49		7			
	27 July 73	1.57		17			
	28 July 74	.77		5			
W-111	19 Aug 63	1.12	.40	264	✓	143	111-1
	11 Sept 64	1.96	.82	291	✓		
	4 Sept 65	.84	.22	90	✓		
	28 July 66	2.10	.74	185			
	11 Aug 67	1.12	.02	10			

$1700 - 2100$

Table 4.- Continued

Station		Storm Date	Rainfall Depth inches	Rainfall Max Intensity in/hr	Rainfall Duration hr-min	Runoff Peak Discharge cfs	Runoff Depth inches
(1)		(2)	(3)	(4)	(5)	(6)	(7)
		Walnut Gulch Experimental Watershed, Arizona					
63.001	acres 36,900	13 Aug 69	.54 ✓ ✗	3.7		1,422.	
63.002	28,100	13 Sep 75	1.14 ✓ ✗	2.4		299.	
63.004	560	watershed was ripped '61, '62 17 Aug 61	1.96	4.05		355.	
		10 Aug 71 ✓	1.45 ✓	3.4		401.	
63.006	23,500	25-26 July 62	2.03 ✗	3.07		1,771.	
		4 Sep 62	1.61 ✗	4.2		1,078.	
63.008	3,830	24 Jul 72	.80 ✓	9.0		191.	
		6 Sep 76	.67 ✓	3.3		588.	
63.011	2,035	22 Jul 64	2.06 OK	12.4		4,422.	
		1 Aug 74	2.0 ✓	5.2		138.	
		13 Sep 75	.93 ✓	5.0		698.	
63.015	5,912	31 Aug 68	1.16 ✓	4.2		1,081.	
		13 Sep 75	.64 ✓	2.2		118.	
		6 Sep 76	.68 ✓	7.2		550.	
63.103	8.3	24 Sep 67	.44 ✓	2.2		5.0	
		10 Aug 71 ✓	.18 ✓	5.2		18.9	
		8 Sep 70 ✓	.23 ✓	3.7		16.8	
		27 Jul 73	1.57 ✓	4.8		16.8	
		28 Jul 74	.77 ✓	4.5		5.6	
63.111	143	11 Sep 64	1.96	4.4		291.	
		24 Sep 64	.58	4.5		128.	

10 Sept 67 } big storm events on
22 Jul 64 } watershed

12 Oct 87

Watershed	Area acres			
63.001	36,900	×	too large	
63.002	28,100	×	too large	
63.003	2,220		no data	
63.004 ✓	560		(2) events	4 WG
63.006	23,500	×	to large	
63.007	3,340		no data	
63.008	3,830		(2) events	8 WG
63.011	2,035		(3) events	11 WG
63.015	5,912		(3) events	15 WG
63.103 ✓✓	8.3		(5) events	(1) raingage 3 WG
63.111	143		(2) events	1 WG

GEORGE V. SABOL Ph.D., P.E.
1351 EAST 141st AVENUE
BRIGHTON, COLORADO 80601
(303) 457-0989

4 September 1987

Mr. Gary Frasier
USDA, ARS, Southwest Watershed Research Center
442 East 7th Ave.
Tucson, Arizona 85705

Dear Mr. Frasier:

Thank you for your assistance when I visited the research center on 3 September 1987. I'm sure that I will be able to make good use of the water harvesting information that you provided.

Dr. Osborn provided good advice on the use of the rainfall-runoff data from the watershed, and other related matters regarding my project for the Flood Control District of Maricopa County. In this matter I have the following requests:

1. Please provide copies of the best available topographic maps for Walnut Gulch watersheds 1, 2, 4, 6, 8, 11, 15, 103, and 111.
2. I would like to obtain a copy of the SCS soil survey for the Walnut Gulch watershed. Who should I contact if you do not have one that is available for me?
3. I would like to obtain an IBM-PC/Compatible copy of the WALRUS Program and supporting user documentation. I have immediate use for this program for my ongoing project for the Flood Control District of Maricopa County, and would have use for it in support of an Arizona Department of Transportation study and for the upcoming Sinai Project.

I will have need for the watershed maps within the next few weeks. Please have them sent to me when they are available. Thank you in advance for your assistance with these request. I will keep you informed of my progress with the Sinai Project.

Sincerely yours,

George V. Sabol

GVS/jr

3 Sept. 87

1. Gary Frasier – water harvesting
   literature – water harvesting manual
   Phoenix 1974 water harvesting symp.
   ARS
   Israeli

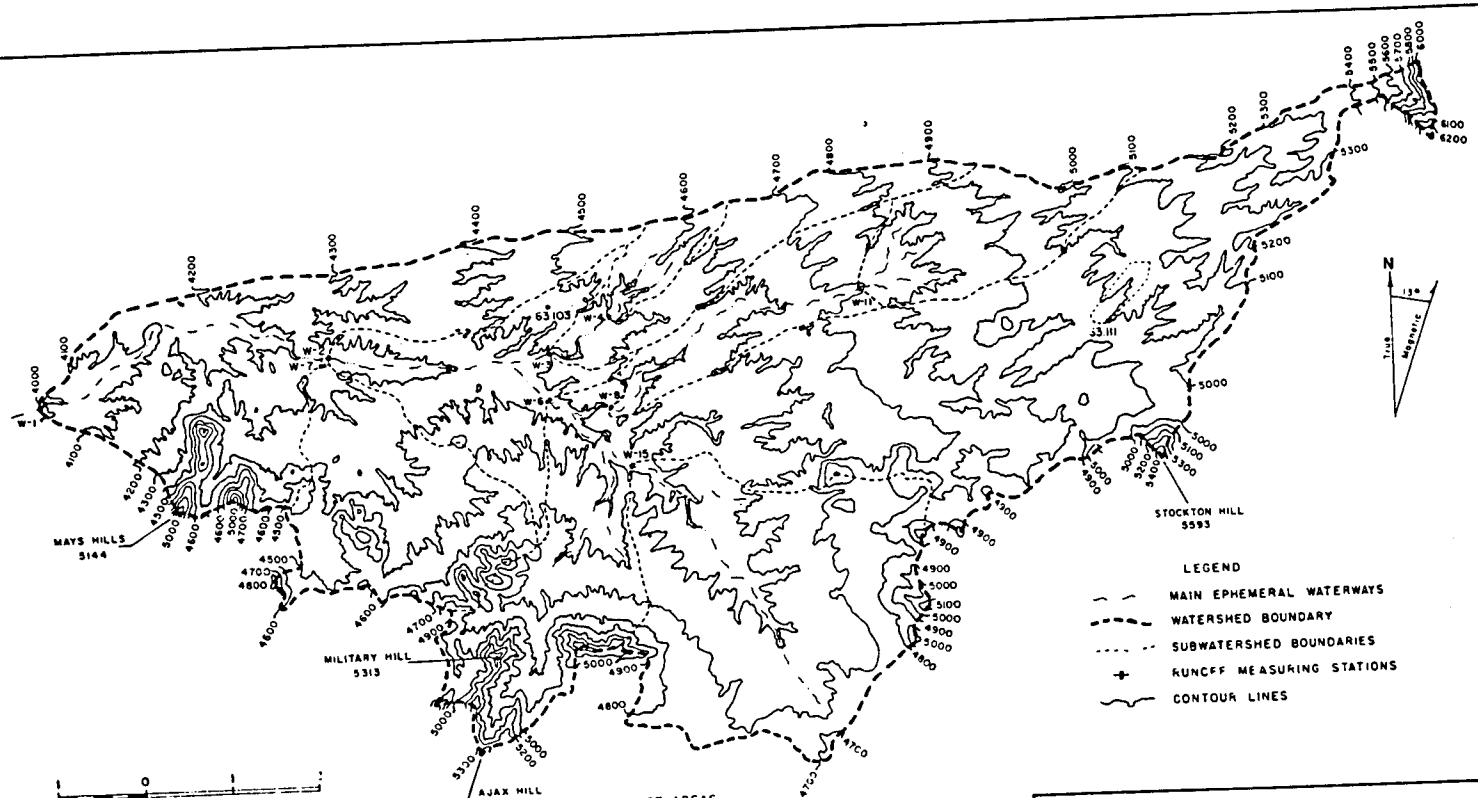
Water harvesting in U.S. is oriented toward expensive labor and cheap materials. In developing countries this may be reversed.

2. Herb Osborn / Ken Rennard
   Beltsville Lab 1977

   3 mi^2 – limit for correlation of rainfall

look @ → #387 – Osborn & Lane point to area coverage & frequency

   8,9,10,11 Watersheds simulated for KINEROS
   WALRUS → PC version
   9-10 mi^2 max size limit
   3 mi^2 works well
   1-1½% slope avg. for watersheds



SCALE IN MILES

CONTOUR INTERVAL 100 FEET

For additional cultural, topographic features and raingage network, see map page 631-5 in "Hydrologic Data for Experimental Agricultural Watersheds in the United States 1956-1959", Misc. Pub. No. 945, U.S.D.A., Agricultural Research Service, November 1963.

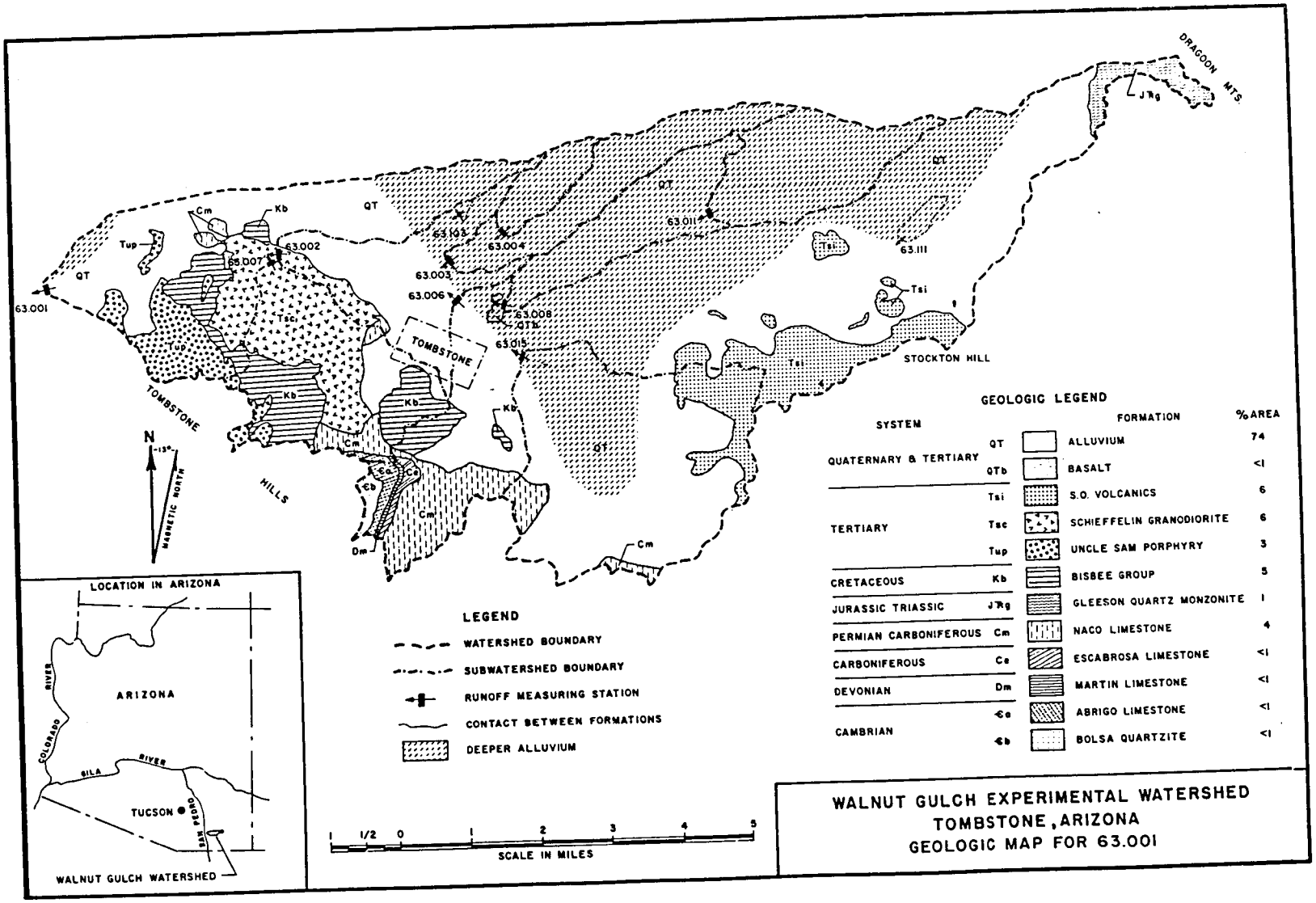
DRAINAGE AREAS

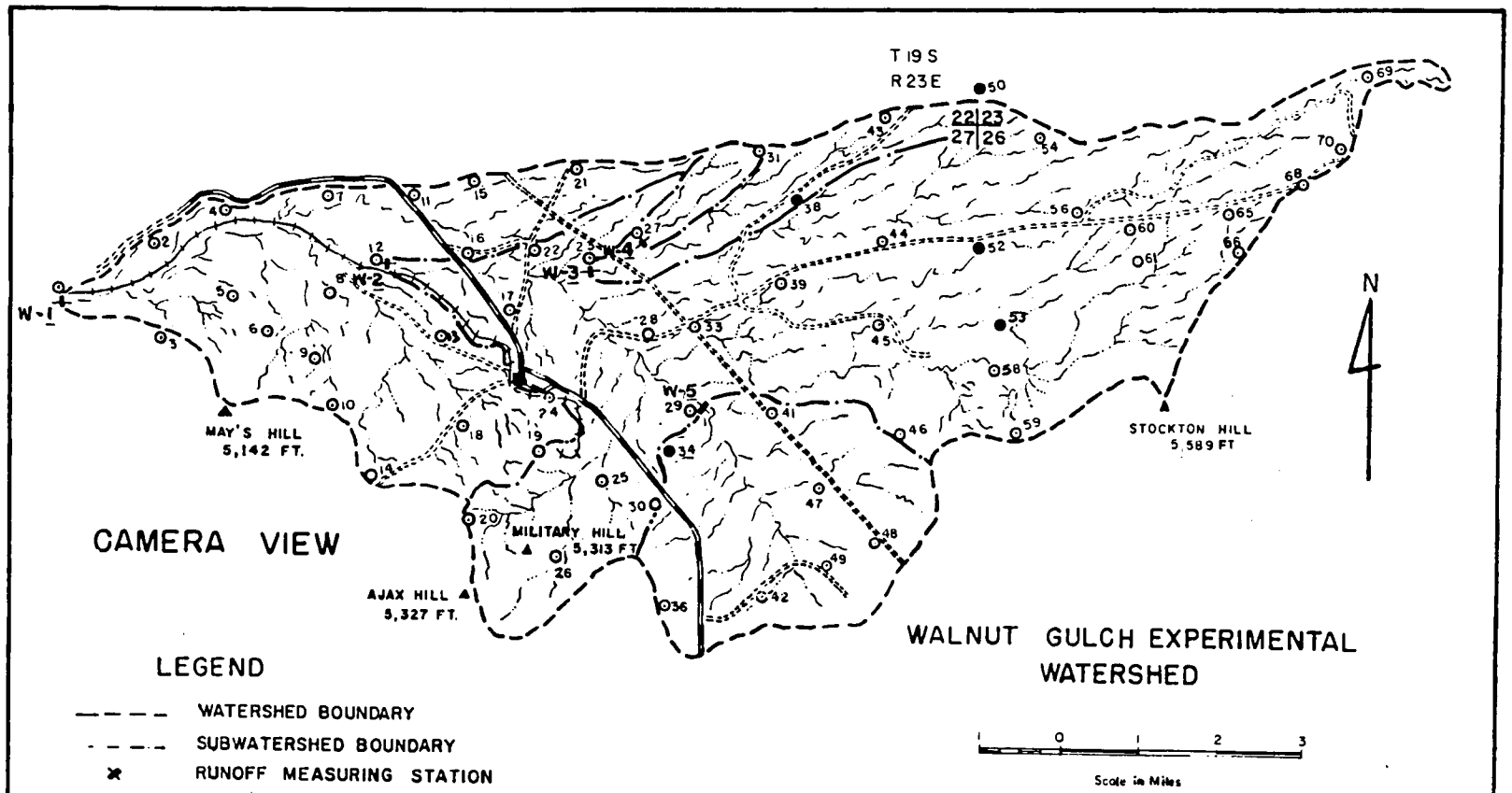
63.001	W-1	36,900 ACRES	57.7 SQUARE MILES
63.002	W-2	28,100 ACRES	43.9 SQUARE MILES
63.003	W-3	2,220 ACRES	3.47 SQUARE MILES
63.004	W-4	560 ACRES	0.88 SQUARE MILES
63.006	W-6	23,500 ACRES	36.7 SQUARE MILES
63.007	W-7	3,340 ACRES	5.22 SQUARE MILES
63.008	W-8	3,830 ACRES	5.98 SQUARE MILES
63.011	W-11	2,035 ACRES	3.18 SQUARE MILES
63.015	W-15	5,912 ACRES	9.24 SQUARE MILES
63.103		8.3 ACRES	
63.111		143 ACRES	

WALNUT GULCH EXPERIMENTAL WATERSHED

TOMBSTONE, ARIZONA

CONTOUR MAP


DRAGOON MTS.
STOCKTON HILL
TOMBSTONE HILLS
TOMBSTONE
QT
Cm
Kb
Tup
Tsc
Tsi
J Rg
Ce
Dm
63.001
63.002
63.003
63.004
63.006
63.007
63.008
63.011
63.015
63.111
QTb
N
-13°
MAGNETIC NORTH
LOCATION IN ARIZONA
ARIZONA
COLORADO RIVER
GILA RIVER
SAN PEDRO
TUCSON
WALNUT GULCH WATERSHED
LEGEND
WATERSHED BOUNDARY
SUBWATERSHED BOUNDARY
RUNOFF MEASURING STATION
CONTACT BETWEEN FORMATIONS
DEEPER ALLUVIUM
1/2 0 1 2 3 4 5
SCALE IN MILES
GEOLOGIC LEGEND
SYSTEM
FORMATION
% AREA
QUATERNARY & TERTIARY
QT ALLUVIUM 74
QTb BASALT <1
Tsi S.O. VOLCANICS 6
TERTIARY
Tsc SCHIEFFELIN GRANODIORITE 6
Tup UNCLE SAM PORPHYRY 3
CRETACEOUS
Kb BISBEE GROUP 5
JURASSIC TRIASSIC
J Rg GLEESON QUARTZ MONZONITE 1
PERMIAN CARBONIFEROUS
Cm NACO LIMESTONE 4
CARBONIFEROUS
Ce ESCABROSA LIMESTONE <1
DEVONIAN
Dm MARTIN LIMESTONE <1
CAMBRIAN
Ꞓe ABRIGO LIMESTONE <1
Ꞓb BOLSA QUARTZITE <1
WALNUT GULCH EXPERIMENTAL WATERSHED
TOMBSTONE, ARIZONA
GEOLOGIC MAP FOR 63.001

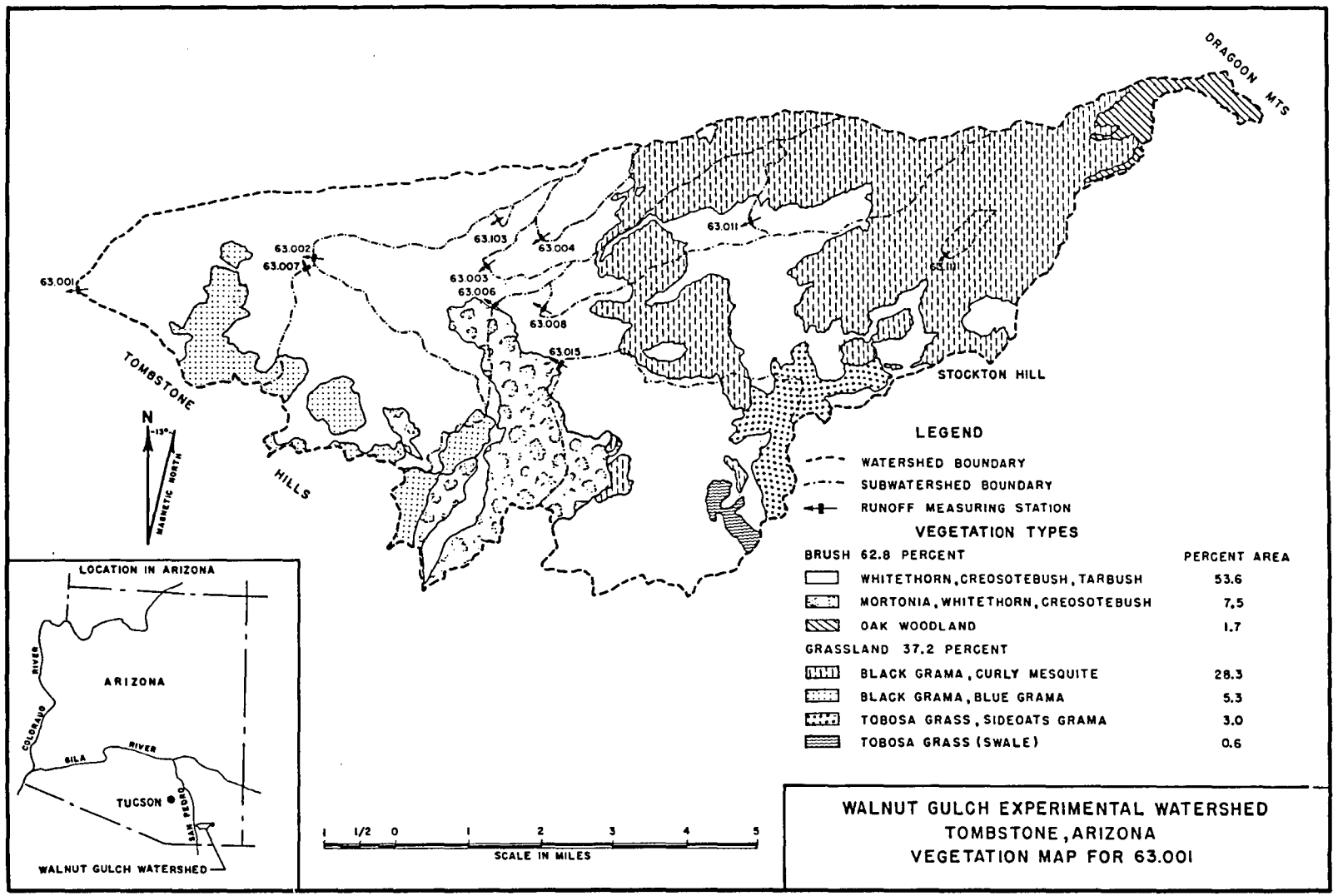


LEGEND

- WATERSHED BOUNDARY
- SUBWATERSHED BOUNDARY
- RUNOFF MEASURING STATION
- RECORDING RAINGAGES
- STANDARD RAINGAGES
- SECONDARY ROADS
- RAILROAD
- HIGHWAY

Note: Slope of principal channel approximately 1%

TOMBSTONE, ARIZONA
WATERSHEDS W-1, 2, 3, 4 AND 5
(WALNUT GULCH EXPERIMENTAL WATERSHED)



WALNUT GULCH EXPERIMENTAL WATERSHED
TOMBSTONE, ARIZONA
VEGETATION MAP FOR 63.001

United States Department of Agriculture
Agricultural Research Service
Beltsville Area
Beltsville Agricultural Research Center
Beltsville, Maryland 20705

Rec'd. 26 Sept

September 24, 1987

George V. Sabol
1351 East 141st Avenue
Brighton, CO 80601

Dear Mr. Sabol:

Enclosed is a diskette containing rainfall/runoff data for the storm events which you requested. As we discussed on the phone, I do not have any data for the large watersheds at Tucson, Arizona prior to 1968 so the storms that are included are:

Station	Storm Date	# of Raingages
63.001	13 Aug 69	90
63.002	13 Sep 75	69
63.004	10 Aug 71	4
63.008	24 Jul 72	17
	6 Sep 76	
63.011	1 Aug 74	10
	13 Sep 75	
63.015	31 Aug 68	15
	13 Sep 75	
	6 Sep 76	
63.103	24 Sep 67	1
	8 Sep 70	
	10 Aug 71	
	27 Jul 73	
	28 Jul 74	

The data are stored by watershed, one each for rainfall and runoff. There were two gages on watershed W-1 that had no rainfall for the August 1969 storm. They are gages 28 and 72. All other gages on the watersheds are represented for each storm.

Also included separately are detailed descriptions of the formats of the rainfall and runoff data. Please call me if you have any questions about the data.

Sincerely,

Jane L. Thurman

JANE L. THURMAN
Water Data Center
Hydrology Lab

Enclosures

```
0         1         2         3         4         5         6
1.........0.........0.........0.........0.........0.........0...0
 25001000004  1  5 63  300  0.0000  0.00 238.04 0    471
 25001000004  1  5 63 2400  0.0057  0.12 238.12 S    472
 25001000004  1  6 63 1500  0.0056  0.08 238.20 S    473
 25001000004  1 10 63  600  0.0000  0.00 238.20 0    474
 25001000004  1 10 63 2400  0.0006  0.01 238.21 S    475
```

Data column	Precipitation data field description	FORTRAN format
1	Carriage control character.	I1
2-3	Unique identification number for each location.	I2
4-6	Numeric identification for each station (unique for location).	I3
7-12	Unique rain gage identification (alphanumeric).	A6
13-21	Date of occurrence (month, day, year).	3I3
22-26	Time of day that activity occurred (24-hour clock).	I5
27-34	Precipitation intensity, in inches per hour, that occurred in time interval starting with previous time and ending with time recorded.	F8.4
35-40	Amount of precipitation in inches that occurred in time interval defined for intensity.	F6.2
41-47	Precipitation accumulation in inches that occurred during year through recorded time.	F7.2
48	Blank.	1X
49	Precipitation type codes: 0 or blank = rainfall, S = snow, N = rain and snow, L = sleet, H = hail, M = mixed, T = trace of precipitation, E = estimated value.	A1
50	Blank.	1X
51	Precipitation codes: 0 or blank = normal reading, 1 = total value for a series of days proportioned equally among the days.	I1
52-56	Sequential number. Records are numbered sequentially through each year of data.	I5
57-60	Blank columns. Record length = 60.	4X

Exhibit 1.--Standard precipitation data format.

```
0         1         2         3         4         5         6    6    7
1........0.........0.........0.........0.........0.........0....6...0
 25001 10 18 41 2127  0.00       .000 0.0000 0.0000  0.0000     121
 25001 10 18 41 2200  0.00    141.791 0.0051 0.0014  0.0014     122
 25001 10 18 41 2210  0.00    182.612 0.0040 0.0008  0.0022     123
 25001 10 18 41 2232  0.00    201.233 0.0015 0.0010  0.0032     124
 25001 10 18 41 2250  0.00    178.591 0.0038 0.0008  0.0040     125
```

Data column	Runoff data field description	FORTRAN format
1	Carriage control character.	A1
2-3	Unique identification number for each location.	I2
4-6	Numeric identification for each station (unique for location).	I3
7-15	Date of occurrence (month, day, year).	3I3
16-20	Time of day that activity occurred (24-hour clock).	I5
21-26	Flow depth in feet, if available.	F6.2
27-36	Runoff rate in cubic feet per second.	F10.3
37-43	Runoff rate in inches per hour.	F7.4
44-50	Runoff amount in inches that occurred in time interval starting with previous time and ending with time recorded.	F7.4
51-58	Runoff accumulation in inches that occurred during year through recorded time.	F8.4
59	Blank.	1X
60	Estimate code: E = estimate, blank = nonestimated.	A1
61	Rate type code: 0 or blank = rates in record are instantaneous, 1 = rates are averages for time interval.	I1
62-66	Sequential number. Records are numbered sequentially through each year of data.	I5
67-70	Blank columns. Record length = 70.	4X

Exhibit 2.--Standard runoff data format.

GEORGE V. SABOL Ph.D., P.E.
1351 EAST 141st AVENUE
BRIGHTON, COLORADO 80601
(303) 457-0989

30 August 1987

Ms. Jane Thurman
USDA, ARS, Hydrology Lab
Water Data Center
Rm. 139 Bldg. 007 BARC-West
Beltsville, MD 20705

Dear Ms. Thurman:

I am performing a unit-hydrograph study for the Flood Control District of Maricopa County Phoenix, Arizona. I plan to use some of the rainfall-runoff data for the Walnut Gulch Experimental Watershed and I am requesting your assistance in obtaining that data. I understand that I can obtain storm event data on a floppy disk.

I will need runoff data and all pertinent raingage data for the following stations and storm event dates:

Station	Storm Date
63.001	13 Aug 69
63.002	13 Sep 75
63.004	17 Aug 61
	10 Aug 71
63.006	25-26 July 62
	4 Sep 62
63.008	24 Jul 72
	6 Sep 76
63.011	22 Jul 64
	1 Aug 74
	13 Sep 75
63.015	31 Aug 68
	13 Sep 75
	6 Sep 76
63.103	24 Sep 67
	10 Aug 71
	8 Sep 70
	27 Jul 73
	28 Jul 74
63.111	11 Sep 64
	24 Sep 64

Please call me if you have any questions concerning this data request.

Sincerely yours,

George V. Sabol

Copy: Mr. Tim Sutko, Flood Control District of Maricopa County

15 Sept 87

phone call from Jane Thurman:

1. she does not have data for:

.004	17 Aug 61
.006	25-26 July 62
	4 Sept 62
.011	22 July 64
.111	11 Sept 64
	24 Sept 64

(Generally they do not have data prior to 1968.)

2. she is sending all raingage data for watersheds .001 & .002.

3. The data will probably not be sent before the end of next week.
I should receive about <u>28 Sept.</u>

16 April 87

call to Jane Thurman 301-344-3550

data stored by station-year (or) storm event

Floppy disk.

data 1968-1976
data 1977-1980 is forthcoming

Hydrologic Data for Experimental Agriculture Watersheds in U.S.
ARS Misc. Publication Series
start #945 → not consec.
20 volumes

#(200) A11M

42A

Denver CIR Colo. Water Cons. Bd.
SEO
U.C. Boulder

1526 Coal Blvd
Bldg. 3 Denver West Office Park
Colfax & I-70 (east)
N side of Colfax
(13600) Colfax & Coal Blvd traffic light
1st Bldg on right

7:30-4:00 M-F

22 April 1987

USGS Library
P(200)
Allm

No. 945	1956-59
994	1960-61
1070	1962
1164	1963
1194	1964

Dib. No.	Year	Stat. No.	Area	Storm Date	Rainfall	Intensity	Peak Q
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
945	59	45. W-II	682 ac	16 July	1.47	8.0	1.2035 * 687.68
	58	45. W-IV	764 ac	16 Aug	1.96	6.5	.6565 * 770.36
	57	47. W-II	40.5 ac	24 Aug.	1.30	2.4	2.793 * 40.837

52 ft/mile = 1%

Pub. No.	Year	Stat. No.	Area	Storm Date	Rainfall	Intensity	Peak Q	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
1216	1965	45.002	1.07	3 Sept.	2.27	4.8	.826 * 688.08	? rainfall
		47.001	246 ac	31 July	.65	5.9	.480 * 248.05	simple, good recession
1194	1964	63.011	3.18	22 July	2.06	12.4	2.155 * 2651.9	fair
1164	1948	47.003	168.3 ac	4 Aug	.52	3.3	.0484 * 169.4	fair
	1962	63.006	36.7	25 26 July	2.03	3.07	.07473 * 23,695	good
		63.006		4 Sept	1.61	4.2	.04551 * 23,695	fair
1070	1961	W-4		17 Aug	1.96	4.05	.6284 * 565	good
994 revision	1961	45.001 W-1	519 ac	28 July	1.12	7.5	.2770 * 523.32	good recession
	1961	45. W-V	723 ac	13 July	1.37	4.8	.1713 * 729.02	simple, good recession
	1961	63. W-4	560 ac	18 Aug	1.92	5.7	.6284 * 565	good recession

Pub. No.	Year	Station No.	Area	Storm Date	Rainfall inches	Intn.	Peak Q	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
1370	1969	63.001	57.66	13 Aug	.54	3.7	1422	very simple
		63.015	9.24	15 Sept.	.46	1.6	.36	good hg.) too low runoff!
1330	1968	47.001	246 acres	31 July	1.98	3.5	67/90	(2) simple hgs.
		47.002	40.1 ac	31 July	2.05	3.3	25/53	(2) simple hgs.
		~~63.001 57.66 5 Aug~~						
		63.015	9.24	31 Aug - 1 Sept.	1.16	4.2	1081	very simple, good recession
1262	1967	45.002	1.07	30 July	.92	6.0	1.22 * 688	very simple
		45.005	1.13	22 July	1.42	5.2	.926 * 729	very simple
		47.002	40.1 ac	13 Aug.	1.18	5.7	2.25 * 40.43	—
		63.103	8.3 ac	24 Sept.	.44	2.25	.5950 * 8.37	very simple, good recession
1226	1966	45.001	519.3 ac	15 Sept.	1.13	3.5	.342 * 523.63	simple, good recession
		45.002	1.07	27 July	.98	5.7	.238 * 688.08	simple, good recession
		45.005	1.13	14 Aug	2.15	4.8	.196 * 729.02	good recession
		47.001	246 ac	10 June	1.0	9.0	.770 * 248.05	simple, good recession
		47.002	40.1 ac	10 June	1.2	10.2	1.907 * 40.43	simple, good recession
	1962	63.111	143 ac	24 Sept	.58	4.5	.888 * 144.19	simple, good recession
	1964	63.111	143 ac	11 Sept	1.96	4.4	2.018 * 144.19	simple, ? rainfall

Publication No.	Year	Station No.	Area sq. mi.	Storm Date	Rainfall inches	Max Intensity in/hr	Peak Discharge in/hr	Comment
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
1451	1976	64.001	67.0	3-4 July	1.01	3.45	987	very simple hg. good recession
		63.008	5.98	6 Sept.	.67	3.3	588	—
		63.015	9.24	6 Sept.	.68	7.2	550	good recession
								—
1446	1975	63.003	3.47	13 Sept.	1.14	2.4	299	
		63.011	3.18	13 Sept.	.93	5.0	698	fairly simple
		63.015	9.24	13 Sept.	.64	2.25	118	good recession
		64.001	67.0	15-16 Aug.	2.20	4.50	639	fairly simple fair recession
1437	1974	63.011	3.18	1 Aug.	2.0	5.2	138	very simple, good recession
		63.103	9.10 acres	28 July	.77	4.5	5.6	fair recession
1420	1973	63.103	9.10 acres	27 July	1.57	4.8	16.6	fair recession
1412	1972	63.008	5.98	24 July	.80	9.0	191	very simple, good recession
	1970	63.103	9.10 acres	8 Sept.	.23	3.7	16.8	fair
	1971	63.103	9.10 acres	10 Aug.	.18	5.2	18.9	fair
	1972	64.001	67.0	3-4 July	1.43	4.5	1740	very simple, good recession
1383	1971	63.004	560 acres	10 Aug	1.45	3.4	401	- simple

4847523

Hydrologic Data for Experimental Agricultural Watersheds in the United States, Misc. Publication No. 1451 1976

Safford AZ (45)
Albuquerque (47)
Mexican Springs (48)
Tombstone (63)
Santa Rosa (64)

45 M -I (.001)	519 ac	II	
-II (.002)	682 ac	IIII	
M -IV	764 ac	I	
M -V (.005)	723 ac	III	
47			
M -II (.002)	40.5 ac	IIII	
M .003	168.3 ac	I	
.001	246 ac	III	
63 ✓ .003 ✓	3.47 mi²	I	—
✓ -4 (.004) ✓	560 ac	II	—
✓ .006 ✓	36.7 mi²	II	—
✓ .011 ✓	3.18 mi²	III	—
✓ .111 ✓	143 ac	II	—
✓ .103 ✓	8.3 ac (9.1 acres)	~~IIII~~	—
✓ .015 ✓	9.24 mi²	IIII	—
M ✓ .001 ✓	57.66 mi²	I	—
✓ .008 ✓	5.98 mi²	II	—
M 64.001	67.0 mi²	III	

63.007
.005
.002

Hydrologic Data for Experimental Agricultural Watersheds in the United States, 1976

This is the 20th publication in the series on hydrological data by the U.S. Department of Agriculture. The first three volumes are described in the following section and the others are summarized in table 1. Since the decimal paging system used (see explanation on preceding page) is consistent with that at the bottom of pages in the other 19 publications, previously published records and general descriptions associated with each study can be readily found.

This publication contains selected hydrologic data from 93 watersheds for 1976. It includes data on monthly precipitation and runoff for all the watersheds; annual maximum discharge and maximum volumes of runoff for intervals of 1, 2, 6, and 12 hours and 1, 2, and 8 days for 90 watersheds; daily precipitation for 92 watersheds; mean daily discharge for 93 watersheds; applicable daily maximum and minimum air temperatures for 81 watersheds; and detailed information on 1 or more selected typical storm events for 79 watersheds.

Information on selected storm events includes (1) tabular data for antecedent rainfall and runoff, (2) data on rainfall intensity and runoff for the event and on accumulated depth of rainfall and runoff, (3) description of watershed conditions at the time of the selected events, and (4) plottings of runoff hydrographs and rainfall histograms.

Newly established watersheds include descriptions of watershed physical characteristics, instrumentation, land management, graphs, maps and recommended area of application of the results.

The first 11 publications in this series resulted from the cooperative efforts of several watershed research projects of the Agricultural Research Service and the editing staff in Beltsville, Md. Hydrologic data were summarized, arranged according to standardized formats, recorded on preprinted data sheets, and submitted to the editing office for final review, assemblage, and publication.

A computer-oriented system, designed and developed by the Water Data Laboratory, is now used to produce camera copy for these publications. This is the ninth publication that has been compiled using the computerized system. Hydrologic data submitted from research projects, in digital computer form, are accepted by the system. The required data analyses and summaries are performed and the tabular listings and plottings are provided within and by the system. Narrative information is incorporated into the system as uppercase and lowercase alphameric data using computer-compatible word-processing equipment. The format of hand-compiled references (4-11) has been retained where practicable in the computer-compiled versions of the publications.

PUBLICATIONS OF EARLIER DATA

Historical hydrologic data on the experimental agricultural watersheds, both terminated and active, have been previously summarized in three looseleaf publications (reprints in bound volumes) by the Agricultural Research Service. They are described in the following three reference summaries. Beginning with the hydrologic data for 1956 through 1976, the types of data previously published separately in these three references are combined in U.S. Department of Agriculture Miscellaneous Publications 945, 994, 1070, 1164, 1194, 1216, 1226, 1262, 1330, 1370, 1380, 1383, 1412, 1420, 1437, 1446, and 1451. These 17 publications are listed in table 1 as references 4-20. These reference numbers have been assigned to simplify citations to them in this and future publications. The first three looseleaf, and the first eight miscellaneous publications have been recorded on 16-mm microfilm. Copies can be made available for the cost of the film processing.

Reference 1.—"Monthly Precipitation and Runoff for Small Agricultural Watersheds in the United States," Soil and Water Conservation Research Branch, (691 pages, 1957) includes physical descriptions and land use of 334 experimental agricultural watersheds at 60 locations in 27 States from 1923 through 1957. Many of these watersheds were discontinued before 1955.

Reference 2.—"Annual Maximum Flows From Small Agricultural Watersheds in the United States," Soil and Water Conservation Research Division, (330 pages, 1958) includes records from 322 watersheds at 59 locations in 27 States from 1923 through 1957. Many of these watersheds were discontinued before 1957.

Reference 3.—"Selected Runoff Events for Small Agricultural Watersheds in the United States," Soil and Water Conservation Research Division, (374 pages, 1960) includes a sampling of 1 to 6 typical runoff events from 68 watersheds at 40 locations in 25 States from 1933 through 1959. The publication has maps of each watershed, information on watershed conditions for each event, including the 30-day antecedent rainfall and runoff, and tabular as well as graphic data on each storm.

Copies of all these publications have been furnished to the Soil Conservation Service and other Federal, State, and local government agencies. Upon request, they have also been distributed to State agricultural experiment stations, university libraries and engineering departments, private engineers and individuals, and similar foreign institutions and individuals.

Table 2 lists a historical summary of the 20 publications including the designated watershed locations, area, record years of data, and a publication reference number indicating the specific data storage location in the ARS Water Data Bank.

Table 3 summarizes the location of each watershed under study and reported in this 20th publication.

Table 4 lists the watershed units where studies were discontinued in 1975.

FORM OF DATA PRESENTATION

The data in this publication are presented for each watershed in the following order: (1) Watershed description, if not previously published; (2) monthly precipitation and runoff; (3) average monthly precipitation and runoff for period of record; (4) annual maximum flows; (5) daily temperature extremes for some watersheds, daily precipitation, and mean daily discharge; (6) selected runoff events; (7) graphs of selected runoff events; and (8) watershed maps, if not previously published or if revised.

Continuing Watersheds

For current watersheds for which the descriptive information has been published in references 1 and 4-19, the tabular data begin at the top of the first page. On each page at the bottom outside corner is a sequential page number and the decimal paging system is shown at the bottom center.

The geographic location associated with each study, usually a city and State, and the local name and number of the watershed are recorded at the top of the first page for each watershed. This identification is followed by detailed information on the geographic location, including latitude and

Table 1.--Description of references 4-20 of "Hydrologic Data for Experimental Agricultural Watersheds in the United States"

Reference	For calendar year (19--)	Miscellaneous Publication No.	Year published (19--)	Total pages	Number of watersheds for which indicated data are given: Monthly precipitation and runoff	Annual maximum discharge and runoff for selected time intervals	Selected runoff events	New watersheds	Daily precipitation, discharge, and/or temperature (max.-min.)
4....	56-59	945	63	672	157	142	134	45	...
5....	60-61	994	65	496	160	145	133	24	...
6....	62	1070	68	447	164	155	136	13	50
7....	63	1164	70	465	168	156	142	9	57
8....	64	1194	71	460	163	163	143	8	57
9....	65	1216	72	568	189	178	122	22	60
10....	66	1226	72	399	198	185	106	11	60
11....	67	1262	73	634	216	204	174	26	62
12....	68	1330	76	542	174	174	116	1	174
13....	69	1370	79	602	167	150	139	5	167
14....	70	1380	79	515	153	139	113	2	150
15....	71	1383	80	509	145	135	122	1	145
16....	72	1412	81	433	131	117	98	0	131
17....	73	1420	82	404	100	97	88	1	100
18....	74	1437	83	417	98	95	82	0	98
19....	75	1446	84	580	98	95	82	8	98
20....	76	xxxx	86	324	93	90	79	0	93

Table 2.--Index to information on experimental agricultural watersheds included in references 1-20[1/]

Watershed ident. code[2/]	Study location: Town	State	Watershed name-No.	Area in acres[3/]	Record (19--) B	E[4/]	Index to information in reference[1/]-- (Revised References underlined)[5/]: 01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
44019*	Hastings	NE	15-H	3.62	39	54	01	02																		
44020*	Hastings	NE	16-H	3.57	39	54	01	02																		
44021*	Hastings	NE	17-H	3.96	39	54	01	02																		
44022*	Hastings	NE	18-H	3.74	39	67	01	02		04	05	06	07	08	09	10	11									
44023*	Hastings	NE	19-H	4.10	41	54	01	02																		
44024*	Hastings	NE	20-H	4.05	41	54	01	02																		
44025*	Hastings	NE	21-H	3.94	41	54	01	02																		
44026*	Hastings	NE	22-H	3.83	41	67	01	02				06	07	08	09	10	11									
44027*	Hastings	NE	23-H	4.20	41	67	01	02				06	07	08	09	10	11									
44028*	Hastings	NE	24-H	4.21	41	54	01	02																		
44029*	Hastings	NE	25-H	2.24	63	67							07	08	09	10	11									
45001*	Safford	AZ	W-I	519.	39	76	01	02		04	05	06	07	08	09	10	11									
45002*	Safford	AZ	W-II	682.	39	76	01	02	03	04	05	06		08	09	10	11									
45003*	Safford	AZ	W-IV	764.	39	76	01	02		04	05	06		08	09	10	11									
45004*	Safford	AZ	W-V	723.	39	76	01	02		04	05	06	07	08	09	10	11									
46001	Colorado Spr.	CO	W-1	10.6	38	46	01	02																		
46002	Colorado Spr.	CO	W-2	39.7	38	46	01	02																		
46003	Colorado Spr.	CO	W-3	35.4	38	46	01	02																		
46004	Colorado Spr.	CO	W-4	35.6	38	46	01	02	03																	
47001*	Albuquerque	NM	W-I	246.	39	76	01	02	03	04	05	06		08	09	10	11	12								
47002*	Albuquerque	NM	W-II	40.5	39	76	01	02		04	05	06	07	08	09	10	11	12								
47003*	Albuquerque	NM	W-III	176.	39	76	01	02		04	05	06	07	08	09	10	11	12								
48001	Mexican Spr.	NM	W-1	187.	38	42	01	02																		
48002	Mexican Spr.	NM	W-2	610.	37	42	01	02	03																	
48003	Mexican Spr.	NM	W-3	1,325.	38	42	01	02																		
48004	Mexican Spr.	NM	W-6	5,550.	37	42	01	02	03																	
48005	Mexican Spr.	NM	W-7	8,495.	38	42	01	02																		
48006	Mexican Spr.	NM	W-8	20,910.	37	42	01	02	03																	
48007	Mexican Spr.	NM	W-10	17,220.	37	42	01	02																		
48008	Mexican Spr.	NM	W-11	46,080.	37	39	01	02	03																	
48009	Mexican Spr.	NM	W-12	2,550.	37	39	01	02																		
48010	Mexican Spr.	NM	W-13	3,360.	37	39	01	02																		
48011	Mexican Spr.	NM	W-14	3,560.	37	38	01	02																		
48012	Mexican Spr.	NM	W-15	4,740.	37	39	01	02																		
49001	Santa Fe	NM	W-I	141.	39	48	01	02	03																	
49002	Santa Fe	NM	W-II	790.	39	48	01	02																		
49003	Santa Fe	NM	W-III	51.6	39	48	01	02																		
50001	Placerville	CA	W-1	41.	35	44	01	02	03																	
51001	Santa Paula	CA	W-1	413.	38	42	01	02																		
51002	Santa Paula	CA	W-3	106.	38	42	01	02																		
51003	Santa Paula	CA	W-4	44.4	38	42	01	02																		
51004	Santa Paula	CA	W-5	55.1	38	42	01	02																		
51005	Santa Paula	CA	W-6	163.	38	42	01	02																		
51006	Santa Paula	CA	H.B.R.	735.	36	42	01	02																		
51007	Santa Paula	CA	L.A.	1,607.	34	40	01	02																		
51008	Santa Paula	CA	H.P.R.	1,832.	34	43	01	02																		
51009	Santa Paula	CA	H.A.B.	5,939.	34	37	01	02																		
52001	Sebastopol	CA	W-1	83.	36	43	01	02	03																	
52002	Sebastopol	CA	W-2	56.	36	40	01	02																		
53001	Vacaville	CA	W-I	40.	37	42	01	02																		
54001	Watsonville	CA	W-1	16.8			01	02																		
54002	Watsonville	CA	W-2	18.5			01	02																		
54003	Watsonville	CA	W-3	27.4	38	42	01	02	03																	
54004	Watsonville	CA	W-4	10.1	38	42	01	02																		
55001	Emmett	ID	W-1	219.4	38	41	01	02																		
55002	Emmett	ID	W-2	69.4	38	41	01	02	03																	

See footnotes at end of table.

Table 2.--Index to information on experimental agricultural watersheds included in references 1-20[1]

Water-shed ident. code[2]	Study location: Town	State	Water-shed name-No.	Area in acres[3]	Record (19--) B[4]	E[4]	Index to information in reference[1]-- (Revised References underlined)[5]: 01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
56001*	Moscow	ID	W-1	146.8	37	42	01	02	03																	
56002*	Moscow	ID	W-2	177.9	37	42	01	02	03																	
57001	Newberg	OR	W-1	13.2	38	42	01	02	03																	
57002	Newberg	OR	W-2	21.6	38	42	01	02																		
57003	Newberg	OR	W-3	12.8	38	42	01	02	03																	
57004	Newberg	OR	W-4	6.2	38	42	01	02	03																	
58001	Dayton	WA	W-1	19.2	39	42	01	02																		
59001	Pullman	WA	S.F.P.R.	51,900.	34	40	01	02																		
59002	Pullman	WA	M.F.C.	17,600.	34	40	01	02																		
59003	Pullman	WA	F.M.C.	46,000.	34	40	01	02																		
60001	Pullman	WA	G.S.2	68.2	31	46	01	02	03																	
60002	Pullman	WA	G.S.4	2.33	31	38	01	02																		
60003	Pullman	WA	G.S.5	14.4	32	46	01	02																		
60004	Pullman	WA	G.S.6	15.2	32	46	01	02																		
60005	Pullman	WA	G.S.7	16,700.	32	38	01	02																		
60006	Pullman	WA	G.S.8	762.	34	41	01	02	03																	
60007	Pullman	WA	G.S.9	879.	41	46	01	02																		
60008	Pullman	WA	G.S.10	4,430.	41	47	01	02	03																	
61001*	Monticello	IL	IA	82.	49	59	01	02	03	04														18	19	20
61002*	Monticello	IL	IB	45.5	49	59	01	02	03	04														18	19	20
62001*	Oxford	MS	W-4	2,000.	57				03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18		
62002*	Oxford	MS	W-5	1,000.	57				03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18		
62003*	Oxford	MS	W-10	5,530.	57				03	04	05	06	07	08	09	10	11	12	13	14	15					
62004*	Oxford	MS	W-12	22,800.	57					04	05	06	07	08	09	10	11	12	13	14	15					
62005*	Oxford	MS	W-17	32,100.	57					04	05	06	07	08	09	10	11	12	13	14	15	16	17	18		
62006	Oxford	MS	W-19	243.	57	64				04	05	06	07	08												
62007*	Oxford	MS	W-24	512.	57					04	05	06	07	08	09	10	11	12	13	14	15					
62008*	Oxford	MS	W-28	1,080.	57					04	05	06	07	08	09	10	11	12	13	14	15					
62009	Oxford	MS	W-30	113.	57	59				04																
62010*	Oxford	MS	W-32	20,000.	57					04	05	06	07	08	09	10	11	12	13	14	15	16	17	18		
62011*	Oxford	MS	W-34	75,000.	57				03	04	05	06	07	08	09	10	11	12	13		15	16	17	18		
62012*	Oxford	MS	W-35	7,550.	57	77				04	05	06	07	08	09	10	11	12	13	14	15					
62013	Oxford	MS	WC-1	3.88	58					04	05	06	07	08	09	10	11									
62014*	Oxford	MS	WC-2	1.45	58					04	05	06	07	08	09	10	11									
62015	Oxford	MS	WC-3	1.61	58					04	05	06	07	08	09	10	11									
62016	Oxford	MS	WP-4	3.01	58	63				04	05	06	07													
62017*	Oxford	MS	W-17A	3,200.	57						05	06	07	08	09	10	11	12	13	14	15					
62018*	Oxford	MS	W-35A	1,090.	57						05	06	07	08	09	10	11	12	13	14	15					
63001*	Tombstone	AZ	W-1	36,900.	54	74				04	05	06	07	08	09	10		12	13	14	15	16	17	18	19	20
63002*	Tombstone	AZ	W-2	28,100.	54	74				04	05	06	07		09	10		12	13	14	15	16	17	18	19	20
63003*	Tombstone	AZ	W-3	2,220.	54	74				04	05	06	07		09	10	11	12	13	14	15	16	17	18	19	20
63004*	Tombstone	AZ	W-4	560.	54	74				04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
63005*	Tombstone	AZ	W-5	5,510.	54	73				04	05	06	07													
63006*	Tombstone	AZ	W-6	23,500.	62	74							07	08	09	10		12	13	14	15					
63007*	Tombstone	AZ	6307	3,340.	66	74										10	11									
63008*	Tombstone	AZ	6308	3,830.	63	74								08	09	10		12	13	14	15	16	17	18	19	20
63011*	Tombstone	AZ	6311	2,035.	63	74								08	09	10		12	13	14	15	16	17	18	19	20
63015*	Tombstone	AZ	6315	5,912.	65	74									09	10	11	12	13	14	15	16	17	18	19	20
63103*	Tombstone	AZ	63103	8.3	65											10	11	12				16	17	18	19	20
63111	Tombstone	AZ	63111	143.	62	68										10	11	12								
64001*	Santa Rosa	NM	W-1	42,880.	55	79				04	05	06	07	08	09	10		12	13	14	15	16	17	18	19	20
65002	Newell	SD	W-2	115.	58	73				04	05	06	07	08	09	10	11	12	13	14	15	16				
65003	Newell	SD	W-3	90.	58	61				04	05															
65004	Newell	SD	W-4	105.	58	61				04	05															
65005	Newell	SD	W-5	46.	58	73				04	05	06	07	08	09	10	11	12	13	14	15	16				
65006	Newell	SD	W-6	30.	58	61				04	05															

See footnotes at end of table.

Table 2.--Index to information on experimental agricultural watersheds included in references 1-20[1/]

Watershed ident. code[2/]	Study location: Town	State	Watershed name-No.	Area in acres[3/]	Record (19--) B[4/]	E	Index to information in reference[1/]-- (Revised References underlined)[5/]: 01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
69032*	Chickasha	OK	C-3	44.3	65	76									09	10	11	12	13	14	15	16	17	18	19	20
69033*	Chickasha	OK	C-4	29.9	65	76									09	10	11	12	13	14	15	16	17	18	19	20
69034*	Chickasha	OK	C-5	12.8	65	76									09	10	11	12	13	14	15	16	17	18	19	20
69035*	Chickasha	OK	C-6	13.0	65	76									09	10	11	12	13	14	15	16	17	18	19	20
69036*	Chickasha	OK	C-7	26.5	65	76									09	10	11	12	13	14	15	16	17	18	19	20
69037*	Chickasha	OK	C-8	27.3	65	76									09	10	11	12	13	14	15	16	17	18	19	20
69038	Chickasha	OK	R-1	17.8	62	74									09	10	11	12	13	14	15	16	17	18		
69039	Chickasha	OK	R-2	24.1	62	74									09	10	11	12	13	14	15	16	17	18		
69040	Chickasha	OK	R-3	25.8	62	74									09	10	11	12	13	14	15	16	17	18		
69041	Chickasha	OK	R-4	18.1	62	74									09	10	11	12	13	14	15	16	17	18		
69042*	Chickasha	OK	R-5	23.7	66	78										10	11	12	13	14	15	16	17	18	19	20
69043*	Chickasha	OK	R-6	27.2	66	78										10	11	12	13	14	15	16	17	18	19	20
69044*	Chickasha	OK	R-7	19.2	66	78										10	11	12	13	14	15	16	17	18	19	20
69045*	Chickasha	OK	R-8	27.6	66	78										10	11	12	13	14	15	16	17	18	19	20
70001*	Sonora	TX	W-14	30,720.	61	73											11	12	13	14	15	16				
70002*	Sonora	TX	S-9	1,774.	61	73											11	12	13	14	15	16				
70003*	Sonora	TX	S-10	5,392.	61	73											11	12	13	14	15	16				
70004*	Sonora	TX	S-11	10,787.	61	73											11	12	13	14	15	16				
70005*	Sonora	TX	S-12	2,801.	61	73											11	12	13	14	15					
70006*	Sonora	TX	S-13	686.	61	73											11	12	13	14	15	16				
70007*	Sonora	TX	W-1	10.2	63	75											11	12	13	14	15	16				
70008*	Sonora	TX	W-2	8.6	65	75											11	12	13	14	15	16				
70009*	Sonora	TX	W-3	6.7	65	75											11	12	13	14	15	16				
70010*	Sonora	TX	W-4	4.5	66	75											11	12	13	14	15	16				
70011*	Sonora	TX	W-5	7.2	66	75											11	12	13	14	15	16				
70012*	Sonora	TX	W-6	6.9	66	75											11	12	13	14	15	16				
70013*	Sonora	TX	W-7	12.2	65	73											11	12	13	14	15	16				
71001*	Treynor	IA	W-1	74.5	64									08	09	10	11	12	13	14	15	16	17	18	19	20
71002*	Treynor	IA	W-2	82.8	64									08	09	10	11	12	13	14	15	16	17	18	19	20
71003*	Treynor	IA	W-3	107.	64									08	09	10	11	12	13	14	15	16	17	18	19	20
71004*	Treynor	IA	W-4	150.	64									08	09	10	11	12	13	14	15	16	17	18	19	20
71005*	Treynor	IA	W-5	389.	63	73								08	09	10	11	12	13	14	15					
72001*	Cottonwood	SD	H-2	2.13	63	73									09	10	11	12	13	14	15	16				
72002*	Cottonwood	SD	L-2	2.38	63	73									09	10	11	12	13	14	15	16				
72005*	Cottonwood	SD	M-1	2.35	63	73									09	10	11	12	13	14	15	16				
73002*	Fort Staunton	NM	7302	32.2	66											10										
74002*	Tifton	GA	W-TB	82,624.	69																				19	20
74003*	Tifton	GA	W-TN	3,872.	68																				19	20
74004*	Tifton	GA	W-TO	3,936.6	68																				19	20
74005*	Tifton	GA	W-TF	28,403.8	68																				19	20
74006*	Tifton	GA	W-TI	12,358.	68																				19	20
74007*	Tifton	GA	W-TJ	5,466.	70																				19	20
74008*	Tifton	GA	W-TK	4,141.	68																				19	20
74009*	Tifton	GA	W-TM	672.	68																				19	20
75001*	Ahoskie	NC	W-A1	36,480.	64	74									09	10	11	12	13	14	15	16				
75002*	Ahoskie	NC	W-A2	15,360.	64	74									09	10	11	12	13	14	15	16				
75003*	Ahoskie	NC	W-A3	2,368.	64	74									09	10	11	12	13	14	15	16				
75004*	Ahoskie	NC	W-A4	1,664.	64	74									09	10	11	12	13	14	15	16				

1/ For description of references 1-20, see page 1 and table 1.
2/ * = streamflow data for all or part of record period are stored in ARS Water Data Bank.
3/ (a) area changed from 63,170 acres (1-1-1967).
(b) area changed from 10,050 acres (1-1-1967).
(c) area changed from 22,656 acres (1-1-1967).
(d) = total drainage area.
(e) = total study area.
4/ B = year (19--) record began; E = year (19--) record ended.
5/ Reference in which additional or revised watershed information has been included.

longitude when available, and the size of the watershed. In the space to the right of the first table title, MONTHLY PRECIPITATION AND RUNOFF (inches), the location and watershed number (or designation) are given.

In the table for the current calendar year, the precipitation (P) in inches is given in the monthly columns and the yearly total in the last column, headed annual. In the line below, the corresponding runoff (Q) in inches is similarly given for each month and the total for the year. For some watersheds, data are included for years prior to the current year. Underneath, in two lines, are given the (P) and (Q) station average amounts (STA AV) by months, with average annual total for the period of record.

In the second table, entitled ANNUAL MAXIMUM DISCHARGE (in/hr) AND MAXIMUM VOLUMES OF RUNOFF (inches) FOR SELECTED TIME INTERVALS, data are also given for the calendar year listed in the first column. Under the maximum discharge heading, the date column shows the month and day that the instantaneous peak in inches per hour occurred. In computing this rate, corrections were made, where needed, for any significant pondage above the runoff-measuring device. Under the maximum volume heading, the date refers to the month and day on which the interval began; for example, if the interval began August 30 at 2359, the entry in the date column would be 8-30. The depths for 1 hour to 8 days are the annual maximum values recorded, without regard to entire clock hours or days; thus, if the 6-hour interval began at 1332, the interval would end exactly 6 hours later at 1932. The volume given is in inches of average depth over the watershed for each of the seven selected time intervals (1, 2, 6, and 12 hours and 1, 2, and 8 days). In the last section of the table, the maximum discharges and depths for the various periods are given under MAXIMUMS FOR PERIOD OF RECORD.

Notes and footnotes below the first two tables include (1) a general statement as to watershed conditions and other physical changes for the period covered; (2) location (publication) where the most recent map may be found; (3) length of precipitation and runoff records; and (4) location of the nearest longtime National Weather Service precipitation station together with the record length.

For some watersheds, tables of daily air temperature (maximum and minimum in degrees Fahrenheit), daily precipitation (inches), and mean daily discharge (cfs) are next, with explanation of the data in footnotes at the end of each table. The multiplier to convert mean daily discharge in cubic feet per second to inches per day is given as the first note following the mean daily discharge table. Cooperating agencies are identified at the bottom of the first page for each watershed just above the index page number.

If no daily tables are given, the tabular data for selected runoff events begin in the remaining space on the first page and are carried forward on continuation sheets (or pages) until completed. In general, the selected runoff events were those in which runoff was produced by a relatively uniform rainfall excess of short duration. The information for each event includes tabulation of (1) antecedent rainfall and runoff that occurred on the day of the event prior to the beginning of the event, (2) rainfall intensities and accumulated amounts for the event, (3) runoff rates and accumulated amounts for the event, and (4) specific watershed conditions at the time of the event.

Simple graphs of rainfall and runoff rates for all events follow the tabular data. Runoff rates expressed in both cubic feet per second (CFS) and inches per hour (IN/HR) are shown on the graphs. Some very low runoff rates expressed in IN/HR are given in the "E" format, such as 7.25 E-4, which is equal to 0.000725 IN/HR.

Maps follow the graphs unless previously published in references 3-19 or unless shown herein on the map of another watershed.

In the Notes at the bottom of the first page for runoff events, the multiplier to convert runoff rates in cubic feet per second to inches per hour is given. The notes on continuation pages contain the statement on the multiplier and similar explanations of the data on each page.

New Watersheds

For the watersheds installed in recent years and not reported previously (see table 3), the presentation begins with the watershed description in the upper part of the first page. The explanations and definitions on which the description is based are given in the next section.

The first line, centered at the top of the sheet, indicates the project location, which is the nearest city or town, the number or name of the watershed used locally, and the latitude and longitude of the stream gage. The descriptive material is then given under the 12 major topics listed generally down the left side of the sheet: Location, Area, Slopes, Soils, Erosion, Land Capability, Watershed Geology, Surface Drainage, Character of Flow, Instrumentation, Watershed Conditions, and Generally Represents.

After this description, the tabular data are summarized in the first two tables and data are included as previously described for contributing watersheds. The tabular data for daily air temperature, precipitation, and discharge, if presented, precede the tabular data for SELECTED RUNOFF EVENTS. The rest of the material of this series for this particular watershed follows in the same order as previously indicated.

WATERSHED DESCRIPTIONS

The following definitions and explanations were used in describing watershed location, watershed characteristics, instrumentation, land management, and recommended area of application of the hydrologic data.

LOCATION gives county and State, distance and direction of the runoff gaging station from the nearest city or town, the major river basin in which it lies, and latitude and longitude. When two or more basins are involved, the tributary or subbasin is mentioned first, followed by the major basin.

AREA of watershed is given in acres if less than 640 acres and in both acres and square miles if more than 1 square mile. If areas are revised, additional values are included with notes identifying the date of change.

SLOPES are given in terms of the ranges commonly used in survey work in the locality. The percentages of the watershed lying in each slope class are listed. As an example, 8% is in 0-2% class means that 8 percent of the watershed area has slopes ranging from 0 to 2 percent.

SOILS are described briefly, according to definitions from the U.S. Department of Agriculture's "Soil Survey Manual," Agriculture Handbook 18, published in 1951. Soil descriptions are given for the new watersheds. Soil-type name consists of the soil series plus the textural class, determined primarily by the texture of the upper part of the soil profile.

Soil texture refers to the relative proportions of the various size groups (or separates) of individual soil grains in a mass of soil. Specifically it refers to the proportions of clay, silt, and sand less than 2 mm in diameter. The various classes of texture in order of increasing percentages of the smaller size groups are (1) sand, (2) loamy sand, (3) sandy loam, (4) loam, (5) silt loam, (6) silt, (7) sandy clay loam, (8) clay loam, (9) silty clay loam, (10) sandy clay, (11) silty clay, and (12) clay. In some of the descriptions the broader classification of coarse, moderately coarse, medium, moderately fine, or fine has been used—the coarse soils are the sands and the fine soils the clays.

Soil structure refers to the aggregation of primary soil particles into compound particles, or clusters of primary particles, that are separated from adjoining aggregates by surfaces of weakness. Structure grade, or the durability of the aggregates when subjected to disturbance, is described as structureless, weak, moderate, or strong. For some soils the structureless grade is described as massive, if coherent, or

single grain, if noncoherent. The size of the aggregates is reported as very fine, fine, medium, coarse, or very coarse. Structure shape is given as being platy, prismatic, columnar, angular blocky, subangular blocky, granular, or crumb.

Permeability is the quality of a soil that enables it to transmit water or air. This quality is indicated by the terms very slow, slow, moderately slow, moderate, moderately rapid, rapid, or very rapid.

Internal soil drainage is the quality of a soil that permits the downward flow of excess water through it. Internal drainage is reflected in the frequency and duration of periods of saturation with water. It is determined by the texture, structure, and other characteristics of the soil profile and of underlying layers and by the height of the water table, either permanent or perched, in relation to the water added to the soil. Internal drainage is described as none, very slow, slow, medium, rapid, or very rapid.

Soils may be grouped into soil drainage classes, based on observations and inferences used to obtain classes of runoff, soil permeability, and internal soil drainage. These classes are given in some soils descriptions to identify internal drainage. They are very poorly drained, poorly drained, imperfectly or somewhat poorly drained, moderately well drained, well drained, somewhat excessively drained, or excessively drained.

EROSION conditions on the watershed are described according to the following classification for water and wind erosion, also briefed from Agriculture Handbook 18. The percentage of the watershed in the following erosion classes is given.

Class 1.—The soil has a few rills or places with thin A horizons that give evidence of accelerated erosion, but not to an extent to alter greatly the thickness and character of the A horizon. Except for soils having very thin A horizons (less than 8 inches), the surface soil consists entirely of A horizon throughout nearly all the delineated areas. Up to about 25 percent of the original A horizon, or original plowed layer in soils with thin A horizons, has been removed from most of the area. This class also includes the areas with no erosion.

Class 2.—The soil has been eroded to the extent that ordinary tillage implements reach through the remaining A horizon or well below the depth of the original plowed layer in soils with thin A horizons. Generally the plowed layer consists of a mixture of the original A horizon and the underlying horizons. Mapped areas of eroded soil usually have patches in which the plowed layer consists entirely of the original A horizon and others in which it consists entirely of underlying horizons. Shallow gullies may be present. Approximately 25 to 75 percent of the original A horizon or surface soil may have been lost from most of the area.

Class 3.—The soil has been eroded to the extent that all or practically all the original surface soil, or A horizon, has been removed. The plowed layer consists essentially of materials from the B or other underlying horizons. Patches in which the plowed layer is a mixture of the original A horizon and the B horizon, or other underlying horizons, may be included within mapped areas. Shallow gullies, or a few deep ones, are common in some soil types. Approximately 75 percent of the original surface soil, or A horizon, and commonly part or all the B horizon, or other underlying horizons, have been lost from most of the area.

Class 4.—The land has been eroded until it has an intricate pattern of moderately deep or deep gullies. Soil profiles have been destroyed except in small areas between the gullies. Such land is not useful for crops in its present condition. Reclamation for crop production or for improved pasture is difficult, but may be practicable if other characteristics of the soil are favorable and erosion can be controlled.

Class +.—Recent alluvial and colluvial deposition.

LAND CAPABILITY is given as classified by Klingebiel and Montgomery in U.S. Department of Agriculture's "Land-Capability Classification," Agriculture Handbook 210, published in 1961. The classification expresses the suitability of land for use without deterioration. The eight land-capability classes are distinguished according to the risk of land damage or difficulty of land use. Classes I-IV are suitable for cultivation and other uses, whereas classes V-VIII are not suitable for cultivation.

Class I.—Very good land for cultivation; nearly level and productive; not subject to erosion; needs only ordinary good farming methods.

Class II.—Good land for cultivation; mostly gently sloping; not more than moderately subject to erosion; some land may be rather wet; can be farmed safely with easily applied practices.

Class III.—Moderately good land for cultivation; mostly moderately sloping; some areas too wet or too dry; can be farmed safely with practical conservation measures, carefully applied; usually a combination of two or more measures is needed.

Class IV.—Fairly good land, suitable for occasional cultivation; generally strongly sloping; often shallow or very sandy; often found in dry climate.

Class V.—Land very well suited for grazing or forestry; requires good range or woodland management.

Class VI.—Land well suited for grazing or forestry; steeply sloping land, or stony or shallow soil; eroded, droughty, or wet land; requires careful management.

Class VII.—Land fairly well suited for grazing or forestry; severely limited in use by such factors as very steep slope, shallow or droughty soil, wetness, severe erosion, or excessive salinity; requires very careful management.

Class VIII.—Land not suitable for cultivation, grazing, or forestry; may be useful for wildlife, recreation, or protection of water supplies.

WATERSHED GEOLOGY information, when available, for new watersheds is reported here. The parts of each watershed occupied by various geological formations or series are briefly described, together with strike and dip of the strata, thickness, and relative position, when known. Faults, perched water tables, outcrops, if present, and other details relating to the movement of water within the drainage area or affecting the hydrology of the watershed are described.

SURFACE DRAINAGE refers to the ease with which excess water flows from the watershed area. The length of the principal waterway is the distance from the gaging station to the most remote point on the watershed boundary, measured along the flood plain of the watercourse.

CHARACTER OF FLOW describes the flow of the principal watercourse with respect to permanence and space. The following definitions are from Meinzer's "Outline of Ground-Water Hydrology," U. S. Geological Survey Water-Supply Paper 494, published in 1923. As to permanence, streams may be divided into perennial, intermittent, and ephemeral. A perennial stream, or stretch of a stream, flows continuously. Perennial streams are generally fed in part by springs, and their upper surfaces usually stand lower than the water table in the localities through which they flow.

Intermittent streams may be divided, with respect to their water source, into spring-fed intermittent streams and surface-fed intermittent streams. They also flow in direct response to precipitation.

A spring-fed intermittent stream, or stretch of a stream, flows only at certain times when it receives water from springs. The intermittent character of streams of this type is generally caused by fluctuations of the water table, whereby the stream channels stand sometimes below and other times above the water table. This is the ordinary type of intermittent stream.

A surface-fed intermittent stream, or stretch of a stream, flows during protracted periods when it receives water from some surface source, generally the gradual and long-continued melting of snow in a mountainous or other cold tributary area. The term may be arbitrarily restricted to streams or stretches of streams that flow continuously during periods of at least 1 month.

An ephemeral stream, or stretch of a stream, flows only in direct response to precipitation. It receives no water from springs and no long-continued supply from melting snow or other surface source. Its stream channel is at all times above the water table. The term may be arbitrarily restricted to streams or stretches of streams that do not flow continuously for as long as 1 month.

With respect to continuity in space, streams may be divided into continuous and interrupted streams. An interrupted stream contains (1) perennial stretches with intervening, intermittent, or ephemeral stretches or (2) intermittent stretches with intervening ephemeral stretches. These two classes of interrupted streams are designated, respectively, perennial interrupted streams and intermittent interrupted streams. A continuous stream does not have interruptions in space. It may be perennial, intermittent, or ephemeral, but it does not habitually have wet and dry stretches.

INSTRUMENTATION describes the type of runoff control or measuring device, number and type of precipitation gages, type of charts used, and snow courses, if employed.

WATERSHED CONDITIONS describe the general use and farm, forest, or range practices before the period of record and the conservation measures, crops, yields, and general cultural operations and practices during the period of record. Rotation crops are listed in the order grown. Operations are described with commonly used agricultural terms, and only those that appear to have a significant relationship to the hydrology of the watershed are mentioned.

GENERALLY REPRESENTS gives the broad area of application for which the data of the specific watershed are recommended. The land resource areas named are those delineated on the map titled "Location of Experimental Agricultural Watersheds of the Agricultural Research Service," on pages 20 and 21. Solid circles show the approximate locations of the continuing or new watersheds; open circles show approximate locations of the discontinued studies. For a few studies the circles indicate the locations of the project headquarters instead of the watershed locations. A larger index map with more detail is included in reference 4.

For some studies there is an apparent contradiction between the watershed location on the maps and the descriptive information under Generally Represents. This is caused by the small scale of maps; it is difficult to show many small local variations in boundaries of the land resources areas. The descriptive statements, instead of the map location, should be the guide to the application of the data.

STANDARD SYMBOLS FOR TABULAR DATA

The following capital letters have been used as standard symbols throughout this publication to designate specific items or meanings:

Symbol	Meaning
E	- value is estimated or partially estimated.
H	- precipitation in form of hail.
L	- precipitation in form of sleet or freezing rain.
M	- mixed precipitation in form of rain, snow, and sleet.
N	- precipitation in form of rain and snow.
NR	- when used in place of value, "no record."
P	- monthly or annual precipitation in inches.
Q	- monthly or annual runoff in inches.
RG	- rain gage, generally followed by gage number.
S	- precipitation in form of snow.
STA AV (or AVG)	- station average for period of record.
T	- trace, indicates that the value is not large enough to round to the lowest significant digit. In some arrays a trace value is indicated by all zeros, with more than one zero located to the right of the decimal.
Z	- indicates an accurately measured total for a series of days that has been equally divided among coded days.

Time-of-day symbols or designations a, p, m, and n used in previous publications through 1961 have been discontinued, and military time (0001 through 2400) has been substituted in subsequent publications. Unless stated otherwise, time used in tables is eastern, central, mountain, or Pacific standard, whichever applies to the given location.

PERSONNEL RESPONSIBLE FOR DATA PREPARATION

At each research location many individuals have contributed to the planning and establishment of the watershed and the collection, compilation, and analysis of the data. Some of those who were directly responsible for preparing the data and information for this report are—

	Location
C. A. Burroughs, J. M. Sheridan, H. D. Wade, P. Yates	8
A. P. Barnett, A. W. Thomas, M. Murphy	10
R. N. Weaver	16
L. A. Kramer, M. Mazzocco	25, 71
T. J. Harlukowicz, V. Dreher	26
F. R. Crow, B. Wilson, W. R. Gwinn	37
C. W. Richardson, D. A. Wright	42
J. K. Mitchell	61
F. Lopez	63, 64
A. L. Huber, S. Jackson	68
D. E. Gregory, A. D. Nicks, R. R. Schoof, N. H. Welch	69
C. A. Burroughs, J. M. Sheridan, R. G. Williams, P.Yates	74

ADDITIONAL PUBLICATIONS

In references 1 and 4-19 (see pp. 1 and 2), citations to other publications, which present watershed data and interpretations of results in various journals, bulletins, and periodicals, are given at the end of the introduction for many of the locations. A listing of publications resulting from related work follows. Unless otherwise noted, the publication year is 1976. The scope of the selected publications varies from a specific study to an overall program of hydrology.

Allen, L. H., Jr., E. H. Stewart, W. G. Knisel, Jr., and R. A. Slack.
Seasonal variation in runoff and water quality from the Taylor Creek Watershed, Okeechobee County, Florida. Florida Soil and Crop Science Society, November 18-20, 1975, Proceedings 35:126-138.

Asmussen, L. E., and J. M. Sheridan.
Downstream dilution of urban-suburban streamflow by rural-agricultural runoff in the coastal plain of Georgia. Georgia Agricultural Experiment Station, Research Bulletin 191.

Blaisdell, F. W.
Discussion: "Discharge equations for HS, H, and HL flumes" by Wendell R. Gwinn and Donald A. Parsons. In Proceedings of the American Society Civil Engineers, Journal of Hydraulics Division 102(HY-11):1704-06.

Blaisdell, F. W., and C. L. Anderson.
Hydraulic model investigation of Marsh Creek Dam principal spillway in Contra Costa County, California. U. S. Dept. Agr. ARS-NC-35, 21p., illus.

Dave Woolhiser 15 April 87

Beltsville – Jane Thurman 301-3443550

ARS Water Data Bank

ARS black books late 50's (miscellaneous publications)

mag tape data or remote data access

CSU has copies of black books

(12-15 years of data)

Walnut Gulch @ Tombstone

Santa Rita watershed

"Selected Events"

ERC library

TOMBSTONE, ARIZONA WALNUT GULCH WATERSHED W-3 (63.003)

LOCATION: Cochise County; 1.3 miles north of Tombstone; Walnut Gulch, San Pedro River, Gila River, Colorado River Basin.

AREA: 3.47 sq. mi. (2220 ac.) SHAPE: Long and narrow, approximately 5 miles long by 1 mile wide.

SLOPES: Not available.

SOILS: Tombstone 55%, Earp 45% (see W-1 and 2 for descriptions).

GEOLOGY: The W-3 area represents the broad alluvium-filled basins between the isolated mountain blocks of the Basin and Range Province. The northern edge forms the middle fifth of the north boundary of W-1 and covers 6 percent of its area. Quaternary and Tertiary alluvium of the Tombstone pediment occupies 100 percent of this subwatershed, which includes W-4. The alluvium is made up of permeably lensed and interbedded sand, gravel, conglomerate, caliche conglomerate, and some clay. Two series of conglomerate are recognized beneath the Recent alluvium of the Tombstone formation: A younger conglomerate whose bedding is nearly conformable to the pediment surface and probably considerably older than that surface; and an older Tertiary conglomerate lying unconformably beneath that. These conglomerates are known to persist to depths exceeding 1200 feet. Topographic expression of the alluvium is that of low undulating hills dissected by present stream channels. Caliche conglomerates of the above units are fairly resistant to erosion and form steep cliffs of low relief in some of the present stream channels. See geologic map on page 63.1-2, this publication.

Stratigraphy and Hydrogeology of Walnut Gulch Subwatershed W-3

System	Formation and percent of area	Description
Quaternary & Tertiary	Recent alluvium ≈ 96%	Gravel, sand, and clay.
	Younger conglomerate ≈ 3%	Gravel, sand, conglomerate, caliche conglomerate, and clay, some boulders
	Older conglomerate ≈ 1%	Gravel, sand, conglomerate, caliche conglomerate, and clay, some boulders

Source of Data: General Geology of Cochise County, Arizona by James Gilluly, U. S. Geological Survey, Professional Paper 281, 1956, and extended field studies by project staff.

INSTRUMENTATION: (Revision) Precipitation: Measured by 7 recording gages with 24-hour charts. Runoff: Runoff data for Watershed W-3 have been re-evaluated and no hydrologic data are being submitted for publication until they have been retabulated. Previously reported runoff data for this watershed should be disregarded.

WATERSHED CONDITIONS: (Revision) Includes subwatershed W-4. Vegetation cover: Desert shrubs (whitethorn, creosote bush, and tarbush) with a crown spread approximating 30 percent and grasses with basal area of approximately 0.8 percent cover occupy 55 percent of the area. Grasses (black grama, curly mesquite grass, tobosa grass) with a basal area of 2.6 percent cover and a shrub cover of 2 percent occupy the remaining 45 percent of the area.

NOTES: NO MONTHLY OR ANNUAL P AND Q, ANNUAL MAXIMUM DISCHARGES AND ANNUAL MAXIMUM VOLUMES, OR SELECTED RUNOFF EVENTS ARE REPORTED FOR 1963. (SEE EXPLANATION UNDER REVISED INSTRUMENTATION ABOVE). FOR WATERSHED TOPOGRAPHIC MAP SEE HYDROLOGIC DATA FOR EXPERIMENTAL AGRICULTURAL WATERSHEDS IN THE UNITED STATES, 1960-61, USDA MISC. PUB., 994, P. 63.1-2. FOR GEOLOGIC AND VEGETATION MAPS, SEE P. 63.1-2 and 63.1-3 OF THIS VOLUME.

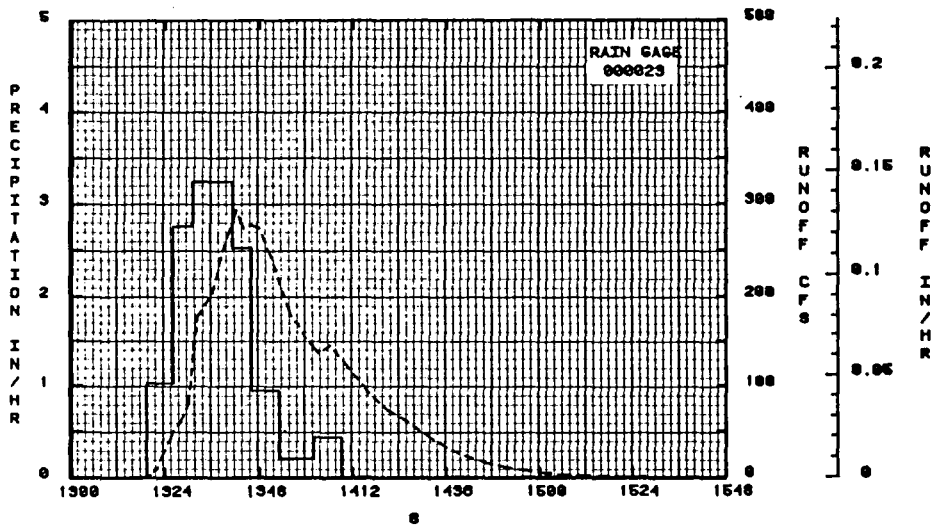
1970 SELECTED RUNOFF EVENT — TOMBSTONE, ARIZONA [redacted]

EVENT OF [redacted] 1970

ANTECEDENT CONDITIONS Date Mo-Day	Rainfall (inches)	Runoff (inches)	RAINFALL Date Mo-Day	Time of Day	Intensity (in/hr)	Acc. (inches)	RUNOFF Date Mo-Day	Time of Day	Rate (cfs)	Acc. (inches)
	RG 000023			RG 000023						
9- 8	0.0	0.0	9- 8	1319	0.0	0.0	9- 8	1317	0.0	0.0
				1326	1.0286	0.12		1318	0.530	0.0
				1331	2.7600	0.35		1319	0.745	0.0
				1336	3.2400	0.62		1320	2.276	0.0
				1341	3.2400	0.89		1321	5.895	0.0
				1346	2.5200	1.10		1322	11.499	0.0001
				1353	0.9429	1.21		1323	21.511	0.0002
				1402	9.2000	1.24		1324	29.985	0.0004
				1409	0.4286	1.29		1325	40.026	0.0006
								1326	50.443	0.0009
								1328	60.824	0.0018
								1330	81.638	0.0029
								1332	177.827	0.0047
								1334	190.832	0.0076
								1336	204.354	0.0104
								1338	241.965	0.0139
								1340	266.895	0.0175
								1342	293.205	0.0219
								1344	273.342	0.0259
								1346	276.596	0.0302
								1348	273.342	0.0340
								1351	241.965	0.0398
								1356	177.827	0.0475
								1401	146.404	0.0537
								1403	135.224	0.0557
								1406	144.128	0.0589
								1411	118.365	0.0637
								1416	91.856	0.0677
								1421	72.283	0.0707
								1426	59.468	0.0731
								1431	44.493	0.0751
								1436	31.866	0.0765
								1441	22.289	0.0775
								1446	15.098	0.0782
								1451	10.420	0.0787
								1456	6.686	0.0790
								1501	3.849	0.0792
								1506	2.058	0.0793
								1511	0.867	0.0794
								1516	0.354	0.0794
								1521	0.077	0.0794
								1527	0.0	0.0794

WATERSHED CONDITIONS:
Vegetative cover: Desert shrubs (whitethorn, creosote-bush, and tarbrush) with a crown spread approximately 30% and grasses with basal area of approximately 0.8% cover, occupy 55% of the area. Grasses (black grass, curly mesquite, tobosa) with a basal area of 2.6% cover and shrub cover of 2% occupy the remaining 45% of the area.

NOTES: To convert runoff in CFS to IN/HR, multiply by 0.000447.



EVENT OF [redacted] 1970

TOMBSTONE, ARIZONA [redacted]

Flood Reconstitution for Walnut Gulch 63.004 4-1

Storm Event 10 August 1971

Runoff: depth = .36 inches, Q_p = 401 cfs at t_p = 1.17 hours

$R_{recession}$ = .18-.26 hrs

INPUT (1) Area acres	(2) Eff. Imp. Area %	(3) Rain in.	(4) Comp. Inter. min.	(5) Time-Area	(6)	Results (7) Q_p cfs	(8) t_p hr.	(9) T_c hr.	(10) R hr.	(11) STRTL in.	(12) CNSTL in/hr	(13) Output File	(14) Comment
560	0	1.25	2	D		373	1.13	.58	.22	.70	.40	Ø1	← selected
"	"	"	"	N-2		398	1.07	.53	.31	.70	.34	Ø2	
"	"	"	"	N-5		411	1.10	.44	.30	.72	.30	Ø3	

All runs are about equal.

Flood Reconstitution for Walnut Gulch 63.004 4-2

Storm Event 17-18 Aug 61

Runoff: depth = .44 inches, Q_p = 355 cfs at t_p = .90 hours

$R_{recession}$ = .17 hrs

INPUT (1) Area acres	(2) Eff. Imp. Area %	(3) Rain in.	(4) Comp. Inter. min.	(5) Time-Area	(6)	Results (7) Q_p cfs	(8) t_p hr.	(9) T_c hr.	(10) R hr.	(11) STRTL in.	(12) CNSTL in/hr	(13) Output File	(14) Comment
560	0	1.80	2	N-2		376	.73	.55	.42	1.11	.73	Ø1	
"	"	"	"	D		358	.83	.61	.32	1.13	.76	Ø2	← best

TOMBSTONE, ARIZONA WALNUT GULCH WATERSHED W-4 (63.004)

LOCATION: Cochise County; 2 miles north of Tombstone; Walnut Gulch, San Pedro River, Gila River, Colorado River Basin.

AREA: 0.88 sq. mi. (560 ac.) SHAPE: Oval, 1 3/4 miles long by ½ miles wide.

SLOPES: Not available.

SOILS: Tombstone 100%, a gravelly loam, calcareous throughout, with a moderately permeable surface and subsoil.

GEOLOGY: The W-4 subwatershed occupies 25 percent of the northwest portion of subwatershed W-3 (and 1.5 percent of W-1) and is representative of the broad alluvium-filled basins between the isolated mountain blocks of the Basin and Range Province. Quaternary and Tertiary alluvium of the Tombstone pediment occurs on 100 percent of the drainage area. The alluvium is made up of permeable lensed and interbedded sand, gravel, conglomerate, caliche conglomerate, and some clay. Two series of conglomerates are recognized beneath the recent alluvium of the Tombstone Pediment: A younger conglomerate whose bedding is nearly conformable to the pediment surface and probably considerably older than that surface; and an older Tertiary conglomerate lying unconformably beneath that. These conglomerates are known to persist to depths exceeding 1,200 feet. Topographic expression of the alluvium is that of low undulating hills dissected by present stream channels. Caliche conglomerates of the above units are fairly resistant to erosion and form steep cliffs of low relief in some of the present stream channels. See geologic map, page 63.1-2, this publication.

Stratigraphy and Hydrogeology of Walnut Gulch Watershed W-4

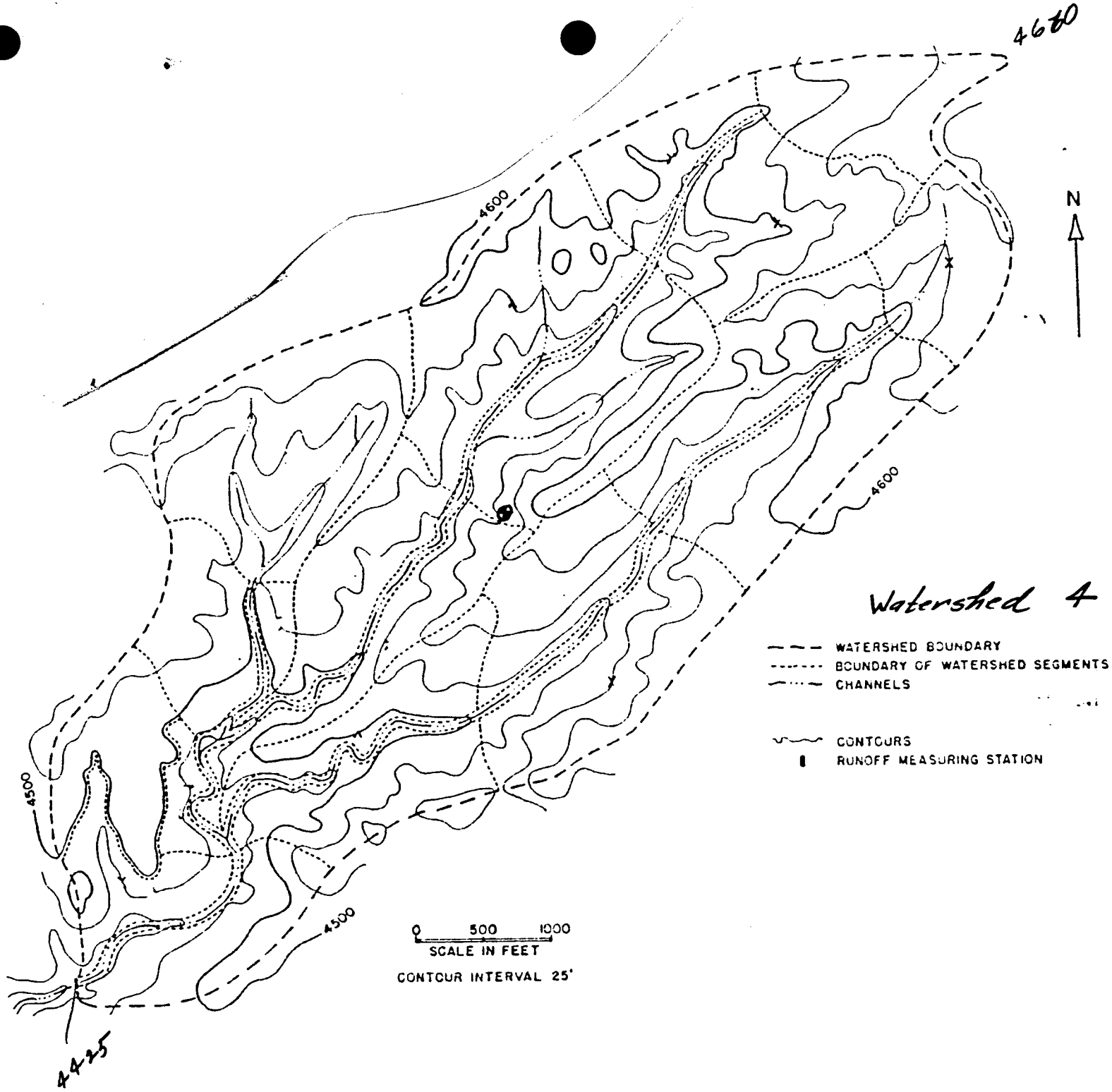
System	Formation and percent of area	Description
Quaternary & Tertiary	Recent alluvium ≈ 96%	Gravel, sand, and clay.
	Younger conglomerate ≈ 3%	Gravel, sand, conglomerate, caliche conglomerate, and clay, some boulders.
	Older conglomerate ≈ 1%	Gravel, sand, conglomerate, caliche conglomerate, and clay, some boulders.

Source of data: General Geology of Cochise County, Arizona, by James Gilluly, U. S. Geological Survey, Professional Paper 281, and extended field studies by project staff.

INSTRUMENTATION: Precipitation: Measured by 3 recording gages with 24-hour charts. Runoff: Runoff data for Watershed W-4 have been re-evaluated and no hydrologic data are being submitted for publication until they have been re-tabulated. Previously reported runoff data for this watershed should be disregarded.

WATERSHED CONDITIONS: (Revision) Vegetative cover: Entire area dominated by desert shrubs (whitethorn, creosote bush, and tarbush) with a crown spread approximating 38 percent and an understory of grasses with approximately 0.6 percent basal cover.

NOTES: NO MONTHLY OR ANNUAL P AND Q, ANNUAL MAXIMUM DISCHARGES AND ANNUAL MAXIMUM VOLUMES, OR SELECTED RUNOFF EVENTS ARE REPORTED FOR 1963. (SEE EXPLANATION UNDER REVISED INSTRUMENTATION ABOVE). FOR WATERSHED TOPOGRAPHIC MAP SEE HYDROLOGIC DATA FOR EXPERIMENTAL AGRICULTURAL WATERSHEDS IN THE UNITED STATES, 1960-61, USDA MISC. PUB., 994, P. 63.1-2. FOR GEOLOGIC AND VEGETATION MAPS, SEE P. 63.1-2 AND 63.1-3 OF THIS VOLUME.


4680
4600
4600
4500
4500
4425
N
Watershed 4
WATERSHED BOUNDARY
BOUNDARY OF WATERSHED SEGMENTS
CHANNELS
CONTOURS
RUNOFF MEASURING STATION
0 500 1000
SCALE IN FEET
CONTOUR INTERVAL 25'

#1070
1962

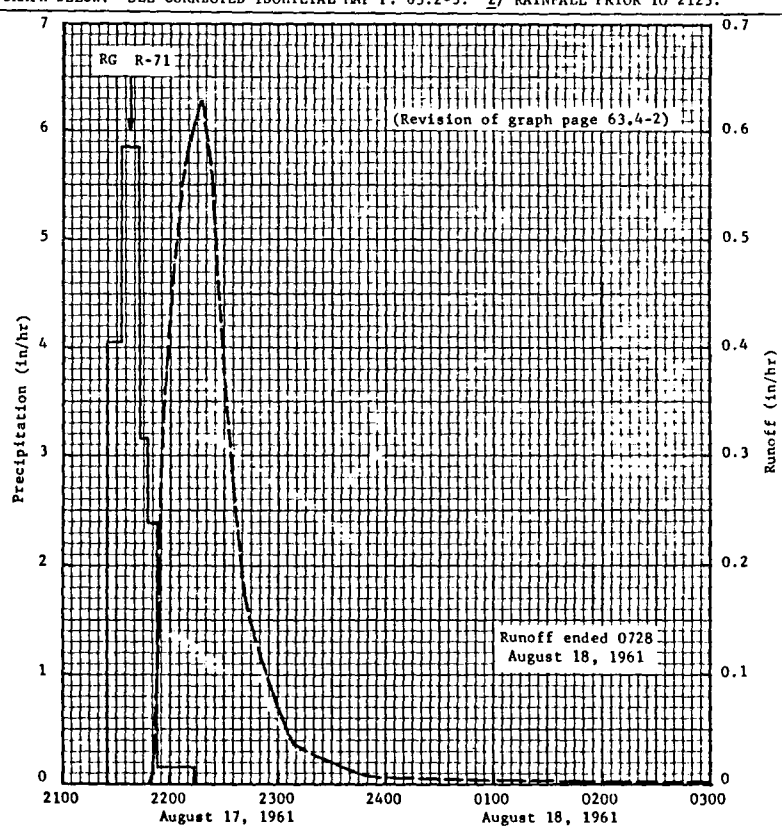
REVISIONS OF PREVIOUSLY PUBLISHED DATA SHEETS

1961 **SELECTED RUNOFF EVENTS** — TOMBSTONE, ARIZONA WATERSHED

ANTECEDENT CONDITIONS			RAINFALL				RUNOFF				
DATE MO-DAY	RAINFALL (inches)	RUNOFF (inches)	DATE MO-DAY	TIME OF DAY	INTENSITY (in/hr)	ACC. (inches)	DATE MO-DAY	TIME OF DAY	RATE (in/hr)	ACC. (inches)	Q cfs
			Event of August 17-18, 1961 (Revision of page 63.4-1)								
	RG R-31		8-17	RG	R-31 1/		8-17				
7-31	.15	.00		2125	.00	.00		2148	.0000	.0000	0
8-2	.17	.00		2128	2.20	.11		2151	.0142	.0004	8
8-13	.13	.00		2132	3.45	.34		2153	.0832	.0020	47
8-15	.06	.00		2136	3.75	.59		2154	.2319	.0046	131
8-17	2/.13	.00		2140	3.60	.83		2158	.3823	.0251	216
				2144	3.15	1.04		2202	.4832	.0539	273
				2148	3.15	1.25		2208	.5699	.1066	322
				2151	2.40	1.37		2213	.6000	.1553	339
				2158	1.11	1.50		2218	.6284	.2065	355
				2210	.15	1.53		2223	.5629	.2561	318
	RG R-71		8-17	RG	R-71 1/			2233	.3229	.3300	182
7-31	.10	.00		2125	.00	.00		2243	.1588	.3702	90
8-2	.12	.00		2132	4.05	.47		2308	.0375	.4111	21
8-13	.05	.00		2142	5.86	1.45		2353	.0081	.4282	4.6
8-14	.02	.00		2147	3.15	1.71	8-18	0053	.0029	.4337	1.6
								0253	.0011	.4377	.6
8-15	.05	.00		2152	2.39	1.91		0453	.0003	.4391	.2
8-17	2/.10	.00		2213	.15	1.96		0728	.0000	.4395	0

Watershed Conditions: 25% of area has shrub cover of white-thorn, creosotebush, and tarbush.

NOTES: TO CONVERT RUNOFF IN IN/HR TO CFS, MULTIPLY BY 565. FOR MAPS OF WATERSHED, SEE HYDROLOGIC DATA FOR EXPERIMENTAL AGRICULTURAL WATERSHEDS IN THE UNITED STATES: USDA MISC. PUB. 945 (1956-59) P. 63.1-5, CULTURAL MAP; AND USDA MISC. PUB. 994 (1960-61) P. 63.1-2, CONTOUR MAP. 1/ PREVIOUSLY PUBLISHED RAINFALL DATA FOR R-31 AND R-71 REVISED AND REPLOTTED ON GRAPH BELOW. SEE CORRECTED ISOHYETAL MAP P. 63.2-3. 2/ RAINFALL PRIOR TO 2125.



TOMBSTONE, ARIZONA WATERSHED W-4

1971 MEAN DAILY DISCHARGE (cfs) TOMBSTONE, ARIZONA W-4

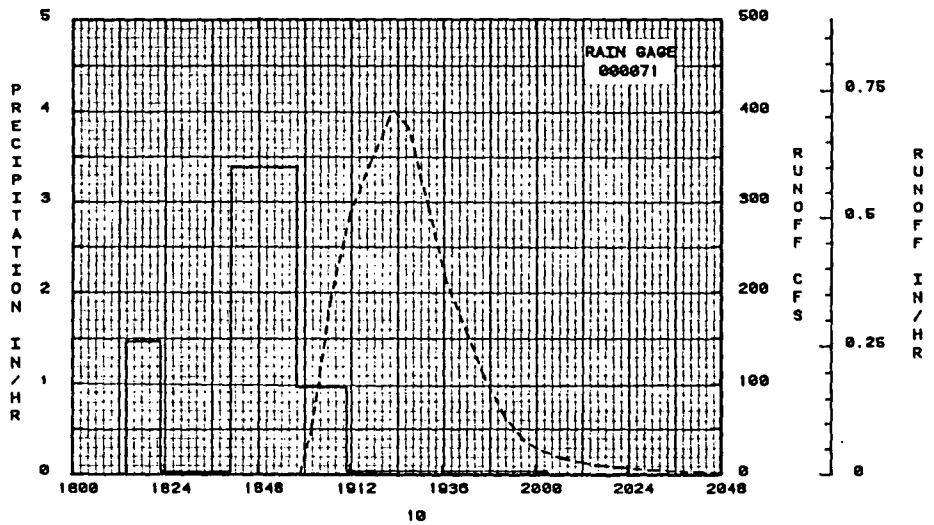
Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.046	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.106	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.087	0.0	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.457E	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.004	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.076	1.195E	0.0	0.0	0.0
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 T	0.0	0.0	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.004	0.0	0.0	0.0	0.0
22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0	0.0	0.0	3.493	0.0	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0	0.0	3.185	0.0	0.0	0.0	0.0	0.0
25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	0.0		0.0		0.0		0.0	0.0		0.0		0.0
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.2154	0.6380	0.0398	0.0	0.0	0.0
INCHES	0.0	0.0	0.0	0.0	0.0	0.0	0.284	0.841	0.051	0.0	0.0	0.0
STA AV	0.0	0.0	0.0	0.0	0.0	0.0	0.371	0.164	0.030	0.0	0.0	0.0

NOTES: To convert mean daily discharge in CFS to IN/DAY, multiply by 0.042503. STA AV based on record period (1955-58) and (1961-71).

1971 SELECTED RUNOFF EVENT [redacted]

ANTECEDENT CONDITIONS Date Mo-Day	Rainfall (inches)	Runoff (inches)	RAINFALL Date Mo-Day	Time of Day	Intensity (in/hr)	Acc. (inches)	RUNOFF Date Mo-Day	Time of Day	Rate (cfs)	Acc. (inches)
			EVENT OF [redacted]							
RG 000071			RG 000071							
8-10	0.0	0.0	8-10	1814	0.0	0.0	8-10	1854	0.0	0.0
				1823	1.4666	0.22		1857	0.275	0.0
				1841	0.0333	0.23		1859	0.692	0.0
				1858	3.3882	1.19		1902	51.396	0.0023
				1911	0.9693	1.40		1907	197.041	0.0203
WATERSHED CONDITIONS: 100% of area dominated by desert shrubs (whitethorn, creosotebush and tarbush) with a crown spread of approximately 33% and an understory of grasses with approximately 0.6% basal cover.				2003	0.0346	1.43		1912	289.415	0.0573
								1917	343.489	0.1033
								1922	394.602	0.1569
								1923	401.414	0.1707
								1927	381.126	0.2167
								1932	293.896	0.2657
								1937	209.874	0.3023
								1942	158.298	0.3303
								1947	105.096	0.3494
								1952	62.674	0.3616
								1957	37.266	0.3692
								2002	25.390	0.3738
								2007	17.168	0.3769
								2012	12.982	0.3792
								2017	9.533	0.3808
								2022	7.000	0.3820
								2032	4.494	0.3837
								2042	2.818	0.3848
								2052	1.342	0.3854
								2107	0.568	0.3858
								2127	0.143	0.3860
								2139	0.029	0.3860
								2159	0.0	0.3860

NOTES: To convert runoff in CFS to IN/HR, multiply by 0.001771.



EVENT OF [redacted]

TO [redacted]

1971 SELECTED RUNOFF EVENT [redacted]

ANTECEDENT CONDITIONS Date Mo-Day	Rainfall (inches)	Runoff (inches)	RAINFALL Date Mo-Day	Time of Day	Intensity (in/hr)	Acc. (inches)	RUNOFF Date Mo-Day	Time of Day	Rate (cfs)	Acc. (inches)
			EVENT OF [redacted]							
RG 000071				RG 000071						
8-18	0.24	0.0	8-18	2050	0.0	0.0	8-18	2058	0.0	0.0
				2057	0.7714	0.09		2110	0.275	0.0
				2106	2.0667	0.40		2112	0.359	0.0
				2118	1.4500	0.69		2115	15.446	0.0007
				2139	0.0857	0.72		2117	45.416	0.0024
				2204	0.1680	0.79		2120	56.230	0.0070
				2230	0.1615	0.86		2123	73.969	0.0129
				2317	0.0383	0.89		2125	85.931	0.0173
								2127	96.816	0.0230
								2130	112.988	0.0324
								2133	126.324	0.0423
								2135	132.689	0.0504
								2137	135.921	0.0578
								2138	138.094	0.0625
								2140	139.186	0.0702
								2145	132.689	0.0909
								2150	123.191	0.1095
								2155	102.198	0.1259
								2200	76.309	0.1395
								2205	50.044	0.1487
								2210	34.878	0.1549
								2215	23.321	0.1593
								2220	18.051	0.1623
								2225	13.787	0.1646
								2230	11.040	0.1665
								2241	6.660	0.1693
								2255	3.122	0.1713
								2310	1.546	0.1723
								2338	0.275	0.1731
								2400	0.057	0.1732

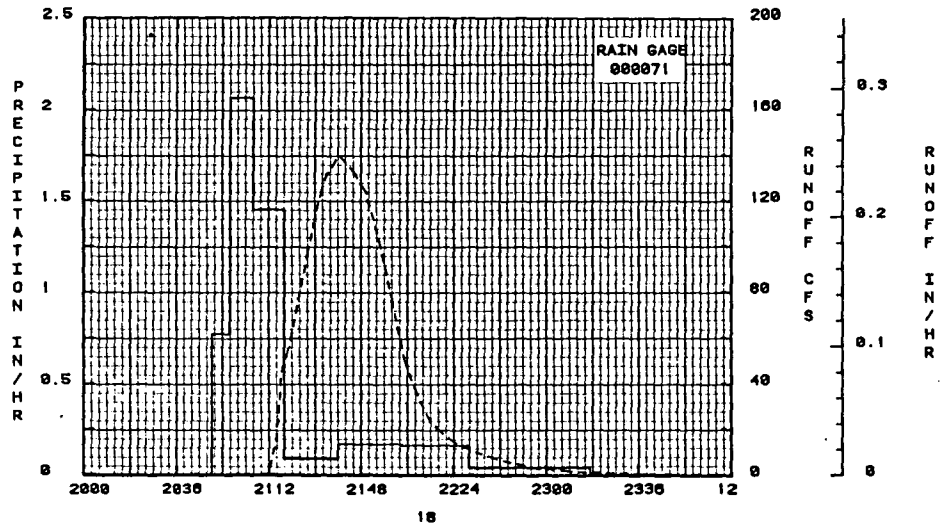
WATERSHED CONDITIONS:
100% of area dominated by desert shrubs (whitethorn, creosotebush and tarbush) with a crown spread of approximately 33% and an understory of grasses with approximately 0.6% basal cover.

NOTES: To convert runoff in CFS to IN/HR, multiply by 0.001771.

1971 SELECTED RUNOFF EVENT TOMBSTONE, ARIZONA B-4

ANTECEDENT CONDITIONS Date Mo-Day	Rainfall (inches)	Runoff (inches)	RAINFALL Date Mo-Day	Time of Day	Intensity (in/hr)	Acc. (inches)	RUNOFF Date Mo-Day	Time of Day	Rate (cfs)	Acc. (inches)
EVENT OF AUGUST 18 - 19, 1971 (CONTINUED)										
							8-19	5	0.012	0.1732
								18	0.0	0.1732

NOTES: To convert runoff in CFS to IN/HR, multiply by 0.001771.



EVENT OF [illegible]

TOMBSTONE, ARIZONA [illegible]

1970 MEAN DAILY DISCHARGE (cfs) TOMBSTONE, ARIZONA W-4

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.466	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.763	0.0	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.006E	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 T	0.0	0.0	0.0	0.0
27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	0.0		0.0		0.0		0.0	0.0		0.0		0.0
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0248	0.1489	0.0	0.0	0.0
INCHES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.033	0.190	0.0	0.0	0.0
STA AV	0.0	0.0	0.0	0.0	0.0	0.0	0.377	0.116	0.029	0.0	0.0	0.0

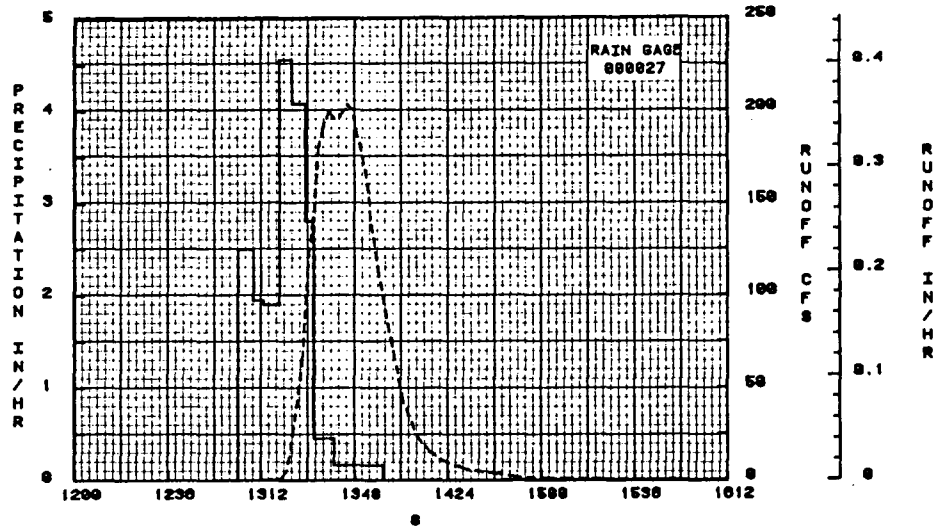
NOTES: To convert mean daily discharge in CFS to IN/DAY, multiply by 0.042503. STA AV based on record period (1955-58) and (1961-70).

1970 SELECTED RUNOFF EVENT [redacted]

ANTECEDENT CONDITIONS Date Mo-Day	Rainfall (inches)	Runoff (inches)	RAINFALL Date Mo-Day	Time of Day	Intensity (in/hr)	Acc. (inches)	RUNOFF Date Mo-Day	Time of Day	Rate (cfs)	Acc. (inches)
			EVENT OF [redacted] 8, 1970							
	RG 000027			RG 000027						
9- 8	0.0	0.0	9- 8	1303	0.0	0.0	9- 8	1314	0.0	0.0
				1309	2.5000	0.25		1316	0.692	0.0
				1313	1.9500	0.38		1318	0.831	0.0
				1319	1.9000	0.57		1319	0.584	0.0
				1324	4.5600	0.95		1320	1.546	0.0
				1329	4.0800	1.29		1322	5.619	0.0002
				1332	2.8000	1.43		1324	24.867	0.0011
				1340	0.4500	1.49		1326	43.484	0.0030
				1359	0.1579	1.54		1328	69.370	0.0065
								1330	118.043	0.0123
								1332	142.483	0.0195
								1334	179.651	0.0295
								1336	193.258	0.0398
								1338	199.580	0.0520
								1340	195.776	0.0629
								1342	197.041	0.0751
								1344	200.855	0.0861
								1345	203.415	0.0931
								1347	200.655	0.1043
								1352	167.648	0.1311
								1357	113.992	0.1525
								1402	76.309	0.1663
								1407	41.582	0.1749
								1412	23.832	0.1799
								1417	15.026	0.1827
								1422	10.665	0.1846
								1427	7.467	0.1860
								1432	5.619	0.1870
								1442	3.122	0.1883
								1452	1.342	0.1889
								1502	0.831	0.1892
								1512	0.359	0.1894
								1537	0.029	0.1895
								1552	0.0	0.1895

WATERSHED CONDITIONS:
100% of area dominated by desert shrubs (whitethorn, creosotebush and tarbush) with a crown spread of approximately 33% and an understory of grasses with approximately 0.6% basal cover.

NOTES: To convert runoff in CFS to IN/HR, multiply by 0.001771.

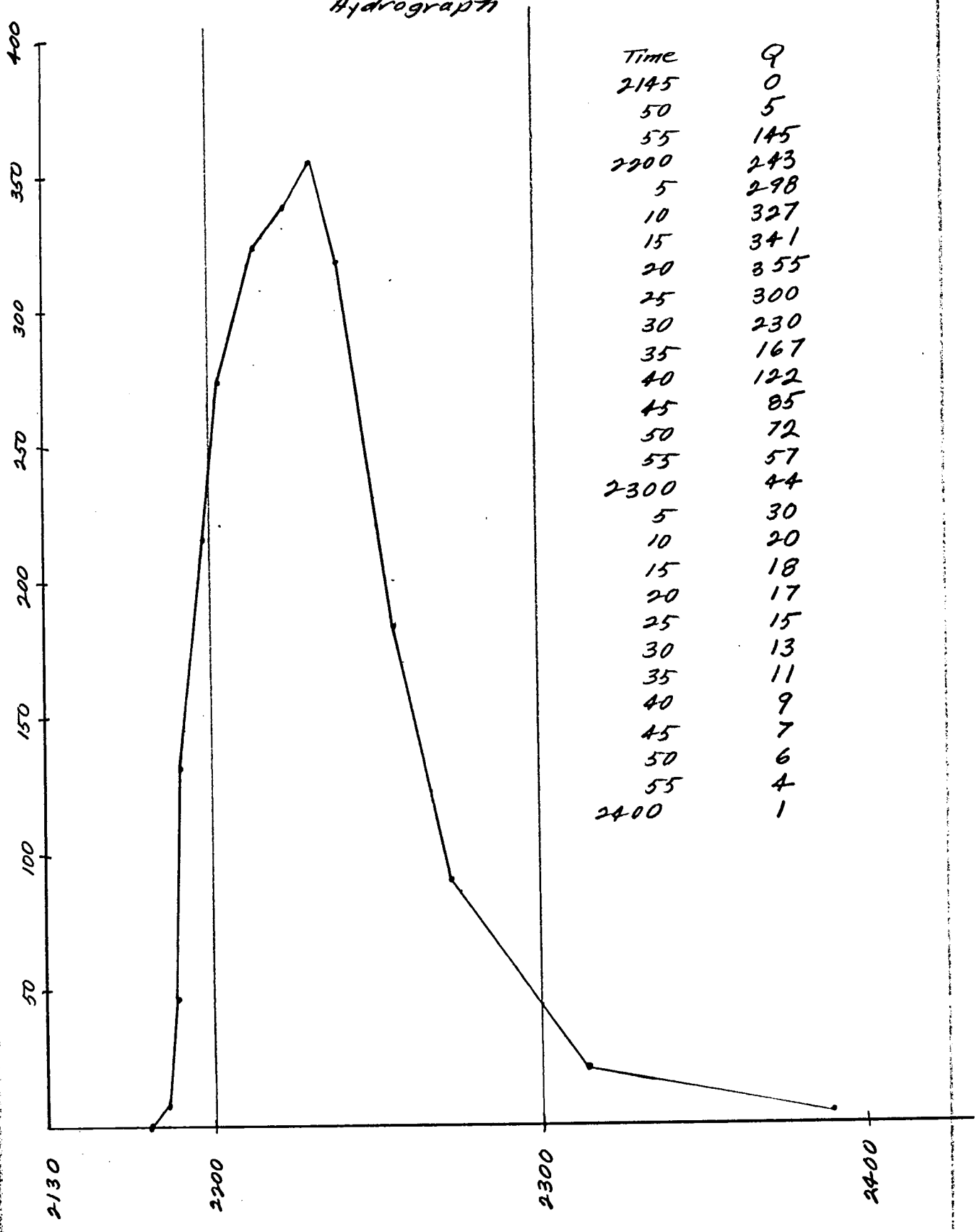


EVENT OF [redacted]

TOMBSTONE, [redacted]

W-4 23 Oct 87

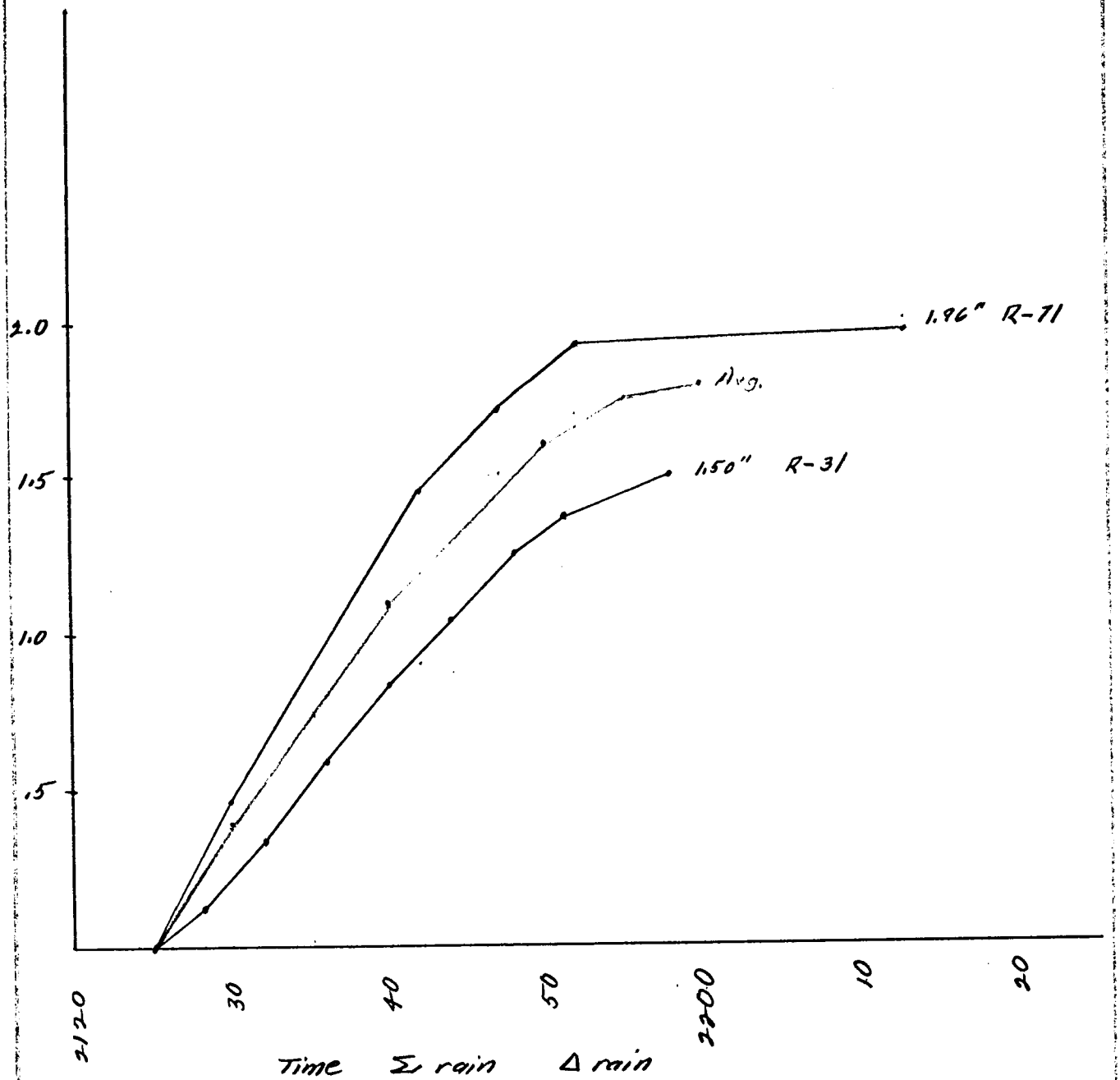
17-18 Aug 61
Hydrograph



Time	Q
2145	0
50	5
55	145
2200	243
5	298
10	327
15	341
20	355
25	300
30	230
35	167
40	122
45	85
50	72
55	57
2300	44
5	30
10	20
15	18
20	17
25	15
30	13
35	11
40	9
45	7
50	6
55	4
2400	1

W-4 23 Oct 87

17-18 Aug 61
Rainfall Dist.



Time	Σ rain	Δ rain
2125	0	0
30	.40	.40
35	.75	.35
40	1.10	.35
45	1.35	.25
50	1.60	.25
55	1.75	.10
2200	1.80	.05

Runoff Data
63.004

C>

163004	8	10	71	1854	0.00	0.000	0.000	0.000	0.0000	0
63004	8	10	71	1857	0.08	0.275	0.001	0.000	0.0000	0
63004	8	10	71	1859	0.12	0.692	0.001	0.000	0.0000	0
63004	8	10	71	1902	1.19	51.396	0.091	0.002	0.0023	0
63004	8	10	71	1907	2.69	197.041	0.349	0.018	0.0203	0
63004	8	10	71	1912	3.36	289.415	0.512	0.037	0.0573	0
63004	8	10	71	1917	3.71	343.489	0.608	0.046	0.1033	0
63004	8	10	71	1922	4.02	394.602	0.699	0.054	0.1569	0
63004	8	10	71	1923	4.06	401.414	0.711	0.014	0.1707	0
63004	8	10	71	1927	3.94	381.126	0.675	0.046	0.2167	0
63004	8	10	71	1932	3.39	293.896	0.521	0.049	0.2657	0
63004	8	10	71	1937	2.79	209.874	0.372	0.037	0.3023	0
63004	8	10	71	1942	2.37	158.298	0.280	0.028	0.3303	0
63004	8	10	71	1947	1.87	105.096	0.186	0.019	0.3494	0
63004	8	10	71	1952	1.35	62.674	0.111	0.012	0.3616	0
63004	8	10	71	1957	0.97	37.266	0.066	0.008	0.3692	0
63004	8	10	71	2002	0.76	25.390	0.045	0.005	0.3738	0
63004	8	10	71	2007	0.59	17.168	0.030	0.003	0.3769	0
63004	8	10	71	2012	0.49	12.982	0.023	0.002	0.3792	0
63004	8	10	71	2017	0.40	9.533	0.017	0.002	0.3808	0
63004	8	10	71	2022	0.34	7.000	0.012	0.001	0.3820	0
63004	8	10	71	2032	0.27	4.494	0.008	0.002	0.3837	0
63004	8	10	71	2042	0.22	2.818	0.005	0.001	0.3848	0
63004	8	10	71	2052	0.16	1.342	0.002	0.001	0.3854	0
63004	8	10	71	2107	0.11	0.568	0.001	0.000	0.3858	0
63004	8	10	71	2127	0.06	0.143	0.000	0.000	0.3860	0
63004	8	10	71	2139	0.03	0.029	0.000	0.000	0.3860	0
63004	8	10	71	2159	0.00	0.000	0.000	0.000	0.3860	0

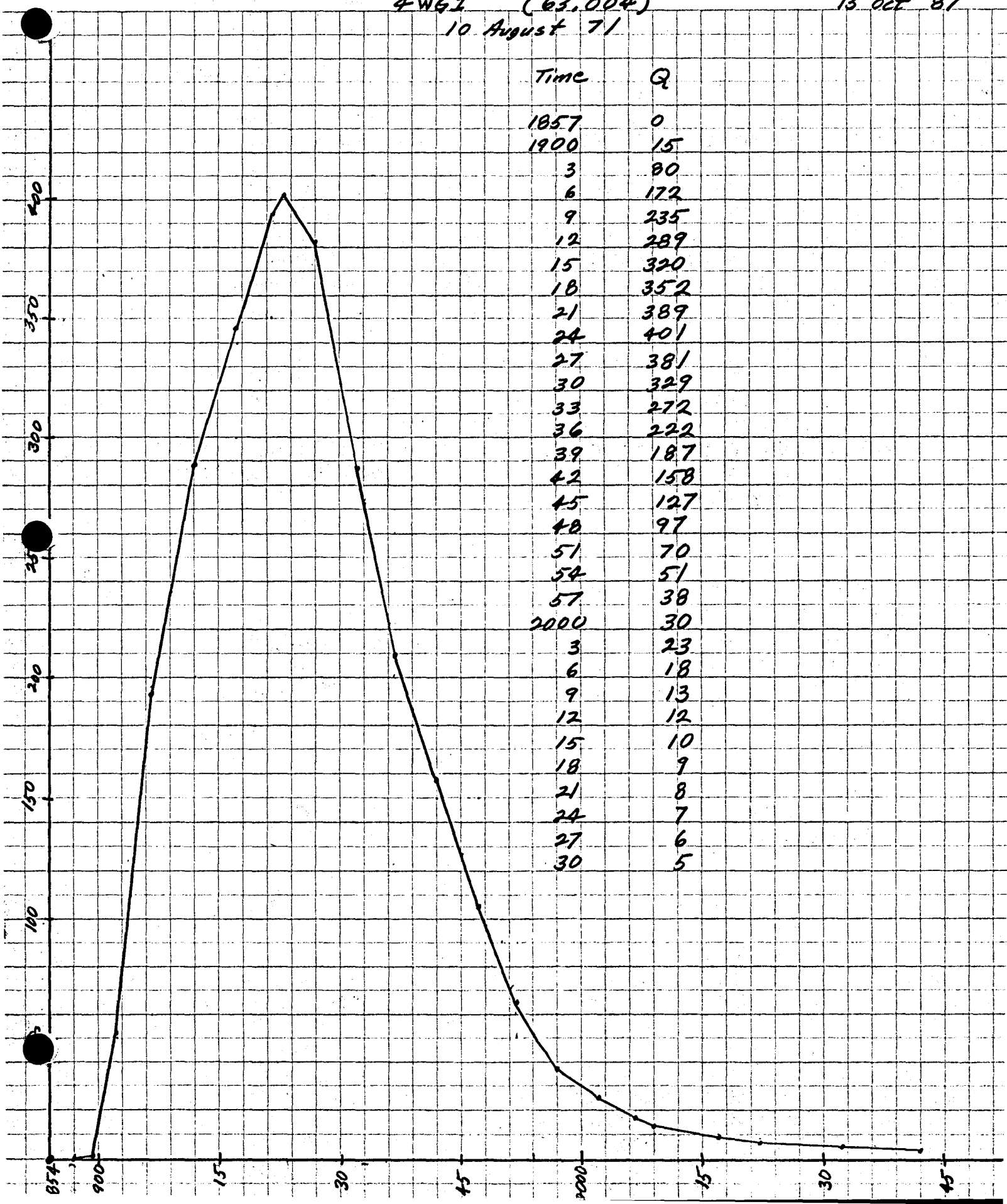
Precipitation Data
63.004

(4) raingages

163000000027	8	10	71	1810	0.0000	0.00	0.00	0
63000000027	8	10	71	1815	1.0799	0.09	0.09	0
63000000027	8	10	71	1828	0.1385	0.03	0.12	0
63000000027	8	10	71	1840	0.2000	0.04	0.16	0
63000000027	8	10	71	1845	2.6397	0.22	0.38	0
63000000027	8	10	71	1849	4.6501	0.31	0.69	0
63000000027	8	10	71	1852	6.2015	0.31	1.00	0
63000000027	8	10	71	1855	5.7996	0.29	1.29	0
63000000027	8	10	71	1901	2.0999	0.21	1.50	0
63000000027	8	10	71	1912	0.2182	0.04	1.54	0
63000000027	8	10	71	1927	0.0400	0.01	1.55	0
63000000027	8	10	71	1939	0.1500	0.03	1.58	0
63000000027	8	10	71	2240	0.0000	0.00	1.58	0
63000000027	8	10	71	2340	0.0900	0.09	1.67	0
163000000031	8	10	71	1820	0.0000	0.00	0.00	0
63000000031	8	10	71	1843	0.1304	0.05	0.05	0
63000000031	8	10	71	1850	4.1142	0.48	0.53	0
63000000031	8	10	71	1854	3.3001	0.22	0.75	0
63000000031	8	10	71	1903	0.8667	0.13	0.88	0
63000000031	8	10	71	1915	0.2000	0.04	0.92	0
63000000031	8	10	71	1923	0.2250	0.03	0.95	0
63000000031	8	10	71	1946	0.0522	0.02	0.97	0
63000000031	8	10	71	2250	0.0000	0.00	0.97	0
63000000031	8	10	71	2400	0.0943	0.11	1.08	0
163000000071	8	10	71	1814	0.0000	0.00	0.00	0
63000000071	8	10	71	1823	1.4666	0.22	0.22	0
63000000071	8	10	71	1841	0.0333	0.01	0.23	0
63000000071	8	10	71	1858	3.3881	0.96	1.19	0
63000000071	8	10	71	1911	0.9693	0.21	1.40	0
63000000071	8	10	71	2003	0.0346	0.03	1.43	0
63000000071	8	10	71	2245	0.0000	0.00	1.43	0
63000000071	8	10	71	2350	0.1015	0.11	1.54	0
163000000074	8	10	71	1840	0.0000	0.00	0.00	0
63000000074	8	10	71	1845	3.5996	0.30	0.30	0
63000000074	8	10	71	1853	2.8500	0.38	0.68	0
63000000074	8	10	71	1900	0.8571	0.10	0.78	0
63000000074	8	10	71	1917	0.2824	0.08	0.86	0
63000000074	8	10	71	1943	0.0462	0.02	0.88	0
63000000074	8	10	71	2245	0.0000	0.00	0.88	0
63000000074	8	10	71	2400	0.1200	0.15	1.03	0

4WG1 (63.004) 13 Oct 87

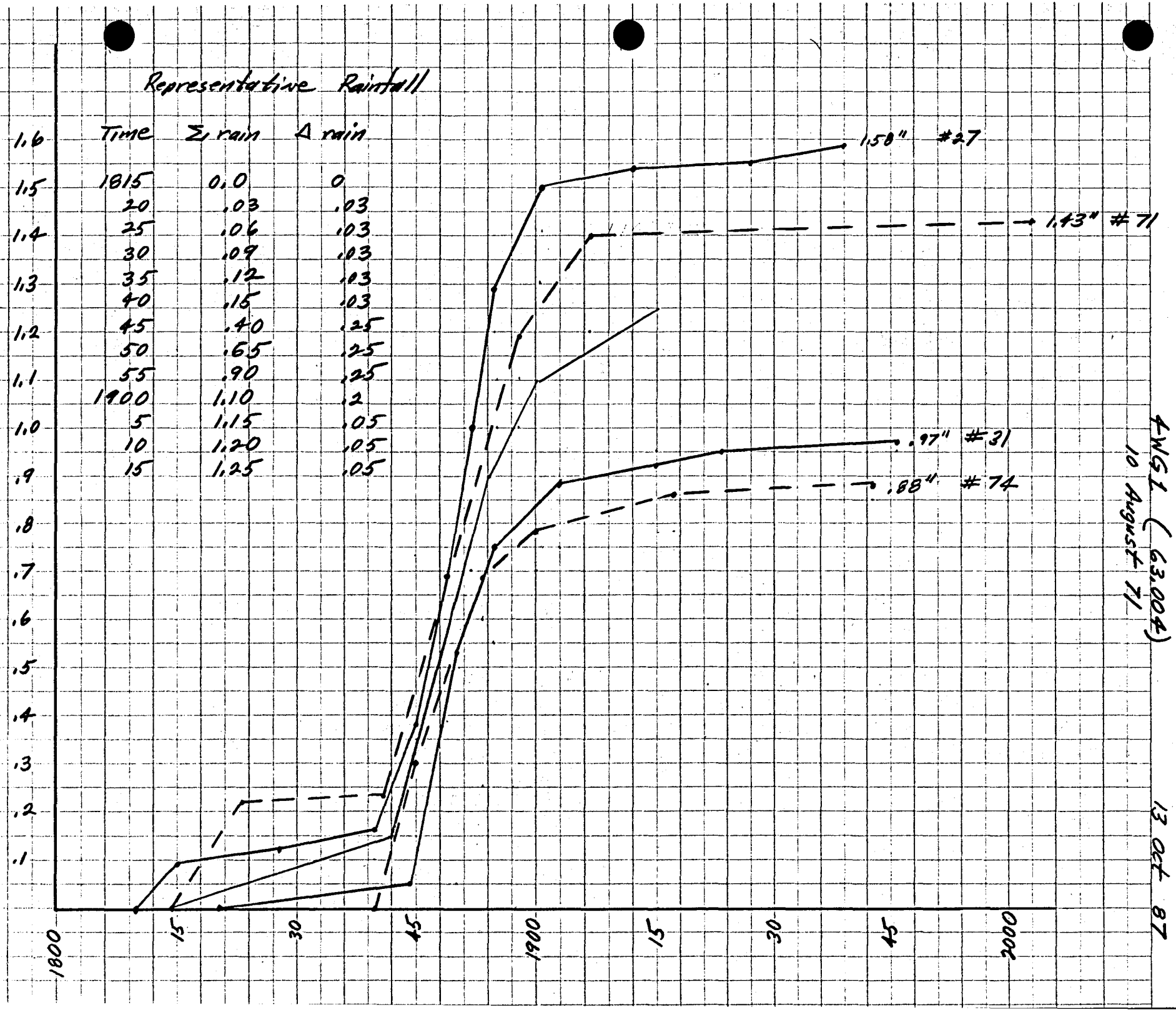
10 August 71



Time	Q
1857	0
1900	15
3	80
6	172
9	235
12	289
15	320
18	352
21	389
24	401
27	381
30	329
33	272
36	222
39	187
42	158
45	127
48	97
51	70
54	51
57	38
2000	30
3	23
6	18
9	13
12	12
15	10
18	9
21	8
24	7
27	6
30	5

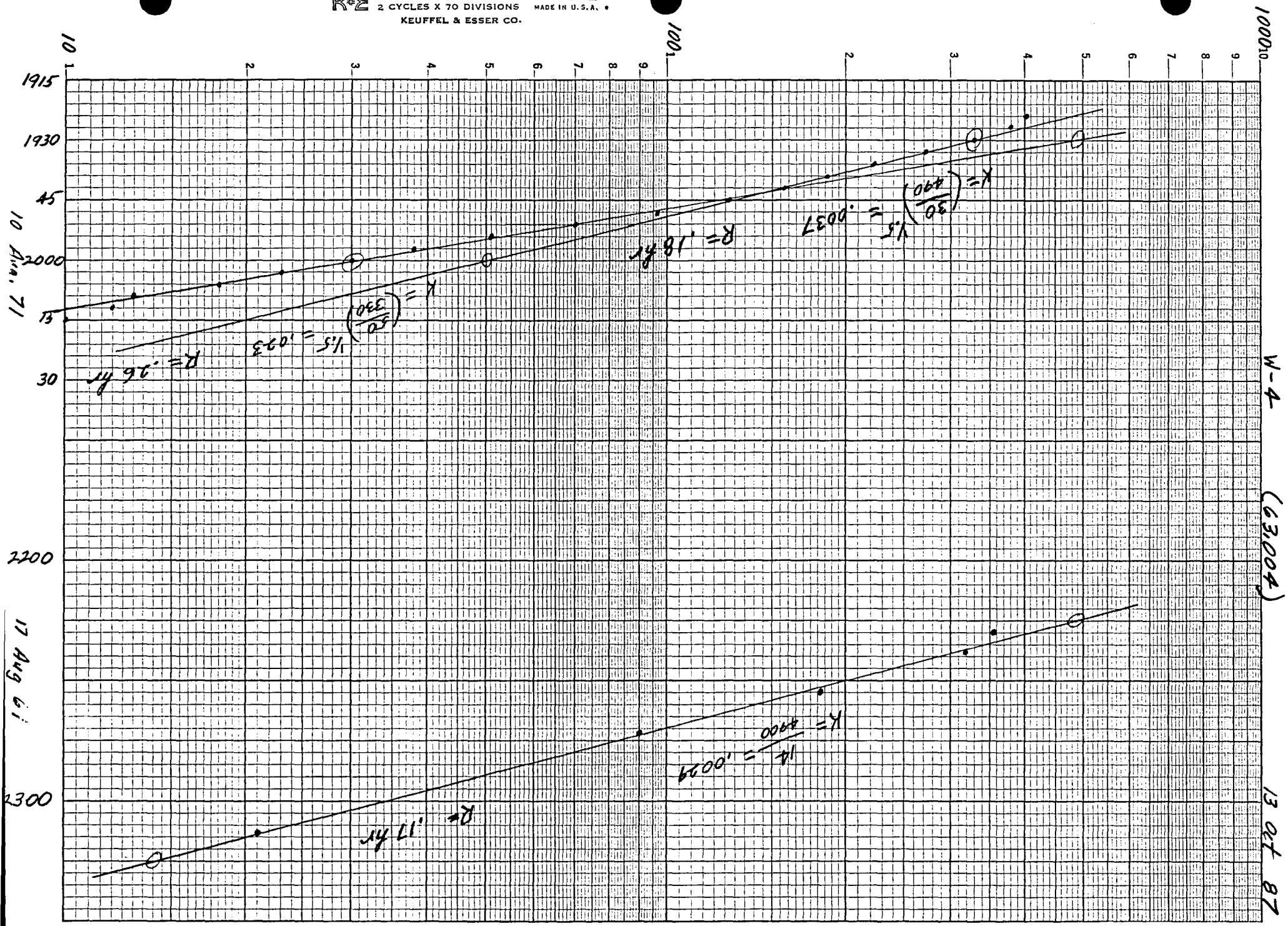
Representative Rainfall

Time	Σ rain	Δ rain
1815	0.0	0
20	.03	.03
25	.06	.03
30	.09	.03
35	.12	.03
40	.15	.03
45	.40	.25
50	.65	.25
55	.90	.25
1900	1.10	.2
5	1.15	.05
10	1.20	.05
15	1.25	.05



AWSL (63.004)
10 August 71
13 Oct 87

K+E SEMI-LOGARITHMIC 46 4972
2 CYCLES X 70 DIVISIONS MADE IN U.S.A.
KEUFFEL & ESSER CO.



10 Aug. 71

17 Aug 71

W-4 (63,004)

13 Oct 87

Flood Reconstitution for Walnut Gulch 63.008 8-1

Storm Event 6 Sept 76

Runoff: depth = .15 inches, Q_p = 588 / 572 cfs at t_p = 1.00 / .70 hours

$R_{recession}$ = .52-.78 hrs

INPUT (1) Area acres	(2) Eff. Imp. Area %	(3) Rain in.	(4) Comp. Inter. min.	(5) Time-Area	(6)	Results (7) Q_p cfs	(8) t_p hr.	(9) T_c hr.	(10) R hr.	(11) STRTL in.	(12) CNSTL in/hr	(13) Output File	(14) Comment
3830	0	.75	6	D		603	.80	.43	.68	.42	.42	Ø3	multiple peak hg. t_p observed is second peak.
"	"	"	"	N-4		565	.80	.63	.71	.42	.41	Ø4	
"	"	"	"	N-2	Changed rain start on IT	629	.80	.35	.70	.43	.41	Ø5	
"	"	"	"	D		567	.80	.32	.79	.43	.41	Ø6	← best

Not very uniform rain.

Flood Reconstitution for Walnut Gulch 63.008 8-2

Storm Event 10 Aug 71

Runoff: depth = .14 inches, Q_p = 1280 cfs at t_p = 1.0 hours

$R_{recession}$ = .23 hrs

INPUT (1) Area acres	(2) Eff. Imp. Area %	(3) Rain in.	(4) Comp. Inter. min.	(5) Time-Area	(6)	Results (7) Q_p cfs	(8) t_p hr.	(9) T_c hr.	(10) R hr.	(11) STRTL in.	(12) CNSTL in/hr	(13) Output File	(14) Comment
3830	0	1.62	5	D		1263	1.0	.18	.29	1.29	1.21	Ø1	

TOMBSTONE, ARIZONA WALNUT GULCH WATERSHED 63.008

LOCATION: Cochise County, Ariz., 1½ miles northeast of Tombstone; Walnut Gulch, San Pedro River, Gila River, Colorado River Basin.

AREA: 3,830 acres (5.98 sq. miles)

SLOPES:

Slope - Percent	0-3	3-10	10-20	20-35
Percent of area 1/	4	56	28	12

1/ Estimated

SOILS: Not available

EROSION:

Erosion Class	1	2
Percent of area	98	2

LAND CAPABILITY:

Class	VI
Percent of area	100

GEOLOGY: One hundred percent of the subwatershed consists of Quaternary and Tertiary alluvium of the Tombstone pediment. The alluvium is made up of permeable lensed and interbedded sand, gravel, conglomerate, caliche conglomerate, and some clay. Two series of conglomerate are recognized beneath the recent alluvium of the Tombstone pediment. A younger conglomerate whose bedding is nearly conformable to the pediment surface and probably considerably older than that surface, and an older Tertiary conglomerate lying unconformably beneath that. These conglomerates are known to persist to depths exceeding 1,200 feet. Topographic expression of the alluvium is that of low undulating hills dissected by present stream channels. Caliche conglomerates of the unit are fairly resistant to erosion and form steep cliffs of low relief in some of the present stream channels. The southeast tip and fluvial outlet of the watershed is underlain by the remnant of a highly fractured intrusive basalt plub. The regional watertable is about 425 feet deep.

Stratigraphy and Hydrogeology of Walnut Gulch Subwatershed 63.008

System	Formation and percent of area		Description
Quaternary & Tertiary	Recent alluvium	99%	Gravel, sand, and clay.
	Younger conglomerate	< 1%	Gravel, sand, conglomerate, caliche conglomerate, and clay, some boulders.
	Older conglomerate	< 1%	Gravel, sand, conglomerate, caliche conglomerate, and clay, some boulders.
	Basalt	< 1%	Intrusive olivine basalt plug, secondary calcite vein filling.

Source of data: General Geology of Central Cochise County, Arizona, by James Gilluly, U. S. Geological Survey, Professional Paper 281, 1956, and extended field studies by project staff.

SURFACE DRAINAGE: Good, length of principal waterway is 8.0 miles with 2 major tributaries; a natural watershed with surface flow in well defined water courses; includes gaged watershed 63.011.

CHARACTER OF FLOW: Ephemeral

INSTRUMENTATION: Precipitation: Measured by 11 24-hour weighing rain gages. Runoff: Critical depth flume (precalibrated), AD-35 analog strip chart water level recorder.

WATERSHED CONDITIONS: (Includes Watershed 63.011) Vegetation cover: Approximately one-third of the area is dominated by desert shrubs (whitethorn, creosotebush, tarbush) with a crown spread of approximately 30 percent and an understory of grasses with less than 1 percent basal area. The remaining two-thirds of the area is dominated by grasses (black grama, curly mesquite grass, sideoats grama), with a basal area of about 2.5 percent, interspersed by desert shrubs with a crown spread of about 5 percent.

GENERALLY REPRESENTS: Desert grassland ranges in the Southeastern Arizona Basin and Rangeland Resources Area (D-41).

#1383

1971

1971 MEAN DAILY DISCHARGE (cfs) [redacted]

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.593E	0.0	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.340	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.474E	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	23.214E	2.770E	0.0	0.0	0.0
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.288E	0.0	0.0	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0	0.0	0.0	4.453E	0.0	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0	0.0	3.832E	4.228E	0.0	0.0	0.0	0.0
25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.275E	0.0	0.0	0.0	0.0
28	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 T	0.0	0.0	0.0	0.0
29	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	0.0		0.0		0.0		0.0	0.0		0.0		0.0
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.2673	2.1423	0.0923	0.0	0.0	0.0
INCHES	0.0	0.0	0.0	0.0	0.0	0.0	0.051	0.413	0.017	0.0	0.0	0.0
STA AV	0.0	0.0	0.0	0.0	0.0	0.0	0.050	0.171	0.015	0.0	0.0	0.0

NOTES: To convert mean daily discharge in CFS to IN/DAY, multiply by 0.006215. STA AV are based on 5 yr only (1966, 1968-71).

1971 SELECTED RUNOFF EVENT [redacted]

ANTECEDENT CONDITIONS Date Mo-Day	Rainfall (inches)	Runoff (inches)	Date Mo-Day	RAINFALL Time of Day	Intensity (in/hr)	Acc. (inches)	Date Mo-Day	RUNOFF Time of Day	Rate (cfs)	Acc. (inches)
EVENT OF [redacted]										
RG 000032				RG 000032						
8-10	0.0	0.0	8-10	1815	0.0	0.0	8-10	1859	0.0	0.0
				1819	3.4501	0.23		1904	150.662	0.0017
				1823	2.1000	0.37		1909	891.032	0.0128
				1843	0.2100	0.44		1911	1220.271	0.0213
				1850	1.5428	0.62		1913	1282.542	0.0327
				1903	4.0617	1.50		1914	1213.448	0.0377
				1910	0.8571	1.60		1915	1275.544	0.0440
				1930	0.0600	1.62		1919	962.392	0.0632
								1924	729.002	0.0812
								1929	496.344	0.0942
								1934	322.693	0.1033
								1936	286.013	0.1058
								1939	331.198	0.1099
								1944	259.271	0.1162
								1949	220.335	0.1215
								1954	182.044	0.1258
								1959	135.000	0.1292
								2003	112.919	0.1313
								2005	110.335	0.1323
								2009	112.919	0.1342
								2014	102.814	0.1365
								2019	91.028	0.1387
								2024	84.395	0.1406
								2034	62.754	0.1438
								2044	43.664	0.1461
								2054	34.000	0.1478
								2104	26.365	0.1491
								2114	21.226	0.1501
								2124	16.560	0.1509
								2134	12.221	0.1515
								2204	4.275	0.1526
								2234	0.608	0.1529
								2300	0.0	0.1529

WATERSHED CONDITIONS:
Vegetative cover: Approximately 33% of the area is dominated by desert shrubs (whitethorn, creosotebush, tarbush) with a crown spread of approximately 30% and an understory of grasses with less than 1% basal area. The remaining 67% of the area is dominated by grasses (black grama, curly mesquite, sideoats grama) with a basal area of about 2.5%, interspersed by desert shrubs with a crown spread of about 5%.

NOTES: To convert runoff in CFS to IN/HR, multiply by 0.000259.

1972 MEAN DAILY DISCHARGE (cfs) TOMBSTONE, ARIZONA W-8

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	4.483	0.0	0.0	0.054	0.260	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.027	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.034	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.029	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.080	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.634	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0	0.0	4.048	0.0	0.0	0.0	0.0	0.0
25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.042	0.0	0.0	0.0	0.0
27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	0.0	0.0	0.0	0.0	0.0	0.0	0.425	0.0	0.0	0.0	0.0	0.0
29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.771	0.0	0.0	0.0	0.0
30	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	0.0		0.0		0.0		0.0	0.232		0.0		0.0
MEAN	0.0	0.0	0.0	0.0	0.0	0.1494	0.1469	0.0358	0.0027	0.0611	0.0	0.0
INCHES	0.0	0.0	0.0	0.0	0.0	0.028	0.028	0.007	0.001	0.012	0.0	0.0
STA AV	0.0	0.0	0.0	0.0	0.0	0.005	0.046	0.144	0.013	0.002	0.0	0.0

NOTES: To convert mean daily discharge in CFS to IN/DAY, multiply by 0.006215. STA AV are based on 6 yr only (1966, 1968-72).

1972 SELECTED RUNOFF EVENT TOMBSTONE, [redacted]

ANTECEDENT CONDITIONS Date Mo-Day	Rainfall (inches)	Runoff (inches)	Date Mo-Day	RAINFALL Time of Day	Intensity (in/hr)	Acc. (inches)	Date Mo-Day	RUNOFF Time of Day	Rate (cfs)	Acc. (inches)
				EVENT OF [redacted]						
	RG 000032			RG 000032						
7-24	0.0	0.0	7-24	1657	0.0	0.0	7-24	1738	0.0	0.0
				1700	1.3999	0.07		1739	84.159	0.0002
				1702	9.0022	0.37		1740	163.339	0.0007
				1705	6.1996	0.68		1742	178.999	0.0023
				1709	0.9000	0.74		1743	191.861	0.0031
				1713	0.9000	0.80		1747	187.127	0.0064
				1717	0.7500	0.85		1750	164.158	0.0087
				1725	0.1500	0.87		1753	143.857	0.0107
				1748	0.0522	0.89		1755	122.225	0.0118
				1755	0.0	0.89		1756	118.314	0.0123
				1807	0.1500	0.92		1758	106.356	0.0133
								1801	84.726	0.0146
								1803	73.953	0.0152
								1807	63.015	0.0164
								1811	49.880	0.0174
								1815	41.418	0.0182
								1817	41.929	0.0185
								1818	46.962	0.0187
								1821	48.340	0.0193
								1824	43.093	0.0199
								1826	37.090	0.0202
								1829	35.433	0.0207
								1831	32.801	0.0210
								1833	30.281	0.0213
								1835	28.077	0.0216
								1840	25.866	0.0222
								1842	25.573	0.0224
								1844	26.261	0.0226
								1847	24.416	0.0229
								1849	24.227	0.0231

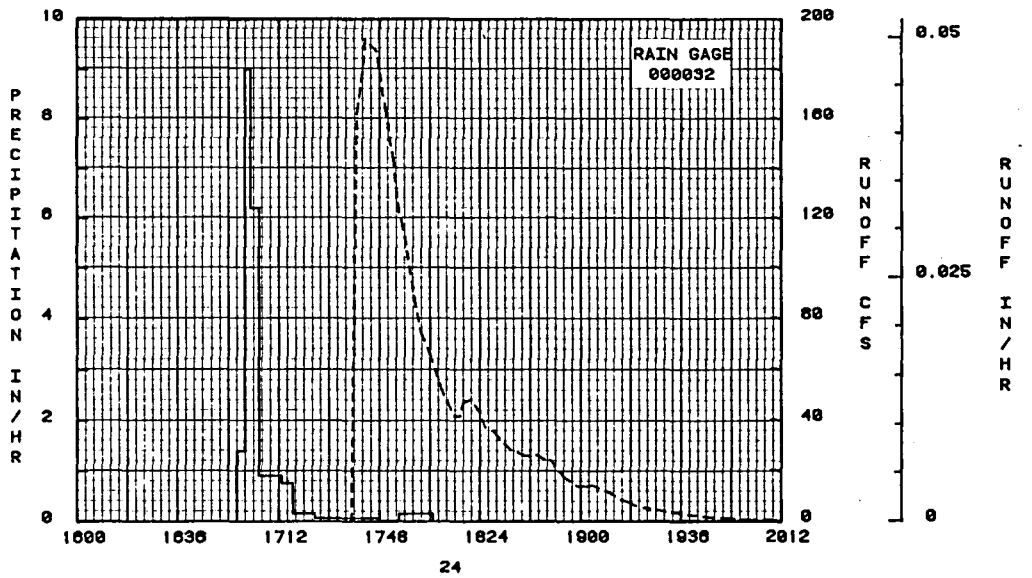
WATERSHED CONDITIONS:
Vegetative cover: Approximately 33% of the area is dominated by desert shrubs (whitethorn, creosotebush, tarbush) with a crown spread of approximately 30% and an understory of grasses with less than 1% basal area. The remaining 67% of the area is dominated by grasses (black grama, curly mesquite, sideoats grama) with a basal area of about 2.5%, interspersed by desert shrubs with a crown spread of about 5%.

NOTES: To convert runoff in CFS to IN/HR, multiply by 0.000259.

1972 SELECTED RUNOFF EVENT TOMBSTONE, ARIZONA W-8

ANTECEDENT CONDITIONS Date Mo-Day	Rainfall (inches)	Runoff (inches)	RAINFALL Date Mo-Day	Time of Day	Intensity (in/hr)	Acc. (inches)	RUNOFF Date Mo-Day	Time of Day	Rate (cfs)	Acc. (inches)
			EVENT OF JULY 24, 1972 (CONTINUED)							
							7-24	1854	17.456	0.0235
								1859	13.614	0.0238
								1903	13.614	0.0240
								1904	14.171	0.0241
								1910	11.260	0.0244
								1916	7.736	0.0246
								1920	5.706	0.0247
								1923	4.918	0.0248
								1925	4.568	0.0248
								1936	2.624	0.0250
								1945	1.335	0.0251
								1955	0.493	0.0251

NOTES: To convert runoff in CFS to IN/HR, multiply by 0.000259.



EVENT OF [redacted]

TOMBSTONE, [redacted]

SWG 1. RUN

63.008
Runoff
6 Sept 76

C>

163008	9	6	76	13	0.13	0.819	0.000	0.000	0.0000	0
63008	9	6	76	27	0.09	0.337	0.000	0.000	0.0000	0
63008	9	6	76	42	0.06	0.130	0.000	0.000	0.0000	0
63008	9	6	76	58	0.03	0.041	0.000	0.000	0.0000	0
63008	9	6	76	120	0.00	0.000	0.000	0.000	0.0000	0
63008	9	6	76	1538	0.00	0.000	0.000	0.000	0.0000	0
63008	9	6	76	1539	0.05	0.106	0.000	0.000	0.0000	0
63008	9	6	76	1542	0.07	0.214	0.000	0.000	0.0000	0
63008	9	6	76	1543	0.13	0.848	0.000	0.000	0.0000	0
63008	9	6	76	1544	0.19	2.050	0.001	0.000	0.0000	0
63008	9	6	76	1547	0.21	2.513	0.001	0.000	0.0000	0
63008	9	6	76	1548	0.33	7.037	0.002	0.000	0.0000	0
63008	9	6	76	1550	0.41	11.635	0.003	0.000	0.0001	0
63008	9	6	76	1552	0.47	15.543	0.004	0.000	0.0002	0
63008	9	6	76	1554	0.44	13.408	0.004	0.000	0.0003	0
63008	9	6	76	1556	0.39	10.000	0.003	0.000	0.0004	0
63008	9	6	76	1558	1.82	325.714	0.084	0.001	0.0018	0
63008	9	6	76	1559	2.00	401.197	0.104	0.002	0.0034	0
63008	9	6	76	1600	2.12	449.669	0.116	0.002	0.0052	0
63008	9	6	76	1602	2.22	492.016	0.127	0.004	0.0093	0
63008	9	6	76	1604	2.35	548.060	0.142	0.005	0.0138	0
63008	9	6	76	1605	2.32	538.458	0.139	0.002	0.0161	0
63008	9	6	76	1606	2.40	571.966	0.148	0.002	0.0185	0
63008	9	6	76	1607	2.31	530.659	0.137	0.002	0.0209	0
63008	9	6	76	1608	2.32	538.022	0.139	0.002	0.0232	0
63008	9	6	76	1611	2.19	478.852	0.124	0.007	0.0298	0
63008	9	6	76	1613	2.30	527.641	0.137	0.004	0.0341	0
63008	9	6	76	1615	2.25	508.008	0.132	0.005	0.0386	0
63008	9	6	76	1617	2.28	519.062	0.134	0.004	0.0430	0
63008	9	6	76	1618	2.32	538.022	0.139	0.002	0.0453	0
63008	9	6	76	1621	2.34	544.559	0.141	0.007	0.0523	0
63008	9	6	76	1623	2.44	588.167	0.152	0.005	0.0572	0
63008	9	6	76	1626	2.34	544.996	0.141	0.007	0.0645	0
63008	9	6	76	1630	2.21	491.133	0.127	0.009	0.0734	0
63008	9	6	76	1632	2.08	432.516	0.112	0.004	0.0774	0
63008	9	6	76	1634	2.00	401.995	0.104	0.004	0.0810	0
63008	9	6	76	1638	1.90	358.153	0.093	0.007	0.0876	0
63008	9	6	76	1643	1.76	299.217	0.077	0.007	0.0947	0
63008	9	6	76	1647	1.65	259.486	0.067	0.005	0.0995	0
63008	9	6	76	1652	1.53	219.303	0.057	0.005	0.1047	0
63008	9	6	76	1658	1.47	201.235	0.052	0.005	0.1101	0
63008	9	6	76	1702	1.38	172.752	0.045	0.003	0.1133	0
63008	9	6	76	1706	1.35	164.705	0.043	0.003	0.1162	0
63008	9	6	76	1710	1.39	176.428	0.046	0.003	0.1191	0
63008	9	6	76	1712	1.38	172.752	0.045	0.002	0.1206	0
63008	9	6	76	1713	1.39	176.713	0.046	0.001	0.1214	0
63008	9	6	76	1715	1.35	165.802	0.043	0.002	0.1229	0
63008	9	6	76	1721	1.25	139.324	0.036	0.004	0.1269	0
63008	9	6	76	1726	1.17	120.376	0.031	0.003	0.1297	0
63008	9	6	76	1731	1.09	101.477	0.026	0.002	0.1321	0

63008	9	6	76	1735	1.01	86.441	0.022	0.002	0.1337	0
63008	9	6	76	1748	0.88	62.694	0.016	0.004	0.1379	0
63008	9	6	76	1753	0.85	58.293	0.015	0.001	0.1392	0
63008	9	6	76	1802	0.78	48.757	0.013	0.002	0.1413	0
63008	9	6	76	1812	0.71	39.780	0.010	0.002	0.1432	0
63008	9	6	76	1828	0.61	27.566	0.007	0.002	0.1455	0
63008	9	6	76	1842	0.51	18.337	0.005	0.001	0.1469	0
63008	9	6	76	1858	0.40	11.075	0.003	0.001	0.1479	0
63008	9	6	76	1913	0.32	6.607	0.002	0.001	0.1485	0
63008	9	6	76	1928	0.24	3.504	0.001	0.000	0.1488	0
63008	9	6	76	1944	0.18	1.815	0.001	0.000	0.1490	0
63008	9	6	76	1958	0.13	0.819	0.000	0.000	0.1491	0
63008	9	6	76	2014	0.09	0.329	0.000	0.000	0.1491	0
63008	9	6	76	2028	0.05	0.089	0.000	0.000	0.1491	0
63008	9	6	76	2053	0.00	0.000	0.000	0.000	0.1491	0

8WG1. PRC

63,008
Precipitation
6 Sept 76

(17) gages

C>E

163000000028	9	6	76	1505	0.0000	0.00	0.00		0
63000000028	9	6	76	1517	0.3000	0.06	0.06		0
63000000028	9	6	76	1524	1.2857	0.15	0.21		0
63000000028	9	6	76	1532	0.6000	0.08	0.29		0
63000000028	9	6	76	1539	0.5143	0.06	0.35		0
63000000028	9	6	76	1553	0.1714	0.04	0.39		0
63000000028	9	6	76	1600	0.2571	0.03	0.42		0
163000000032	9	6	76	1522	0.0000	0.00	0.00		0
63000000032	9	6	76	1529	0.7714	0.09	0.09		0
63000000032	9	6	76	1531	0.9000	0.03	0.12		0
63000000032	9	6	76	1533	0.9000	0.03	0.15		0
63000000032	9	6	76	1535	2.4000	0.08	0.23		0
63000000032	9	6	76	1537	2.1000	0.07	0.30		0
63000000032	9	6	76	1540	2.8000	0.14	0.44		0
63000000032	9	6	76	1542	2.7000	0.09	0.53		0
63000000032	9	6	76	1544	3.3000	0.11	0.64		0
63000000032	9	6	76	1548	0.7500	0.05	0.69		0
63000000032	9	6	76	1552	0.7500	0.05	0.74		0
63000000032	9	6	76	1557	0.6000	0.05	0.79		0
63000000032	9	6	76	1604	0.2571	0.03	0.82		0
63000000032	9	6	76	1611	0.1714	0.02	0.84		0
63000000032	9	6	76	1623	0.1000	0.02	0.86		0
163000000033	9	6	76	1520	0.0000	0.00	0.00		0
63000000033	9	6	76	1531	0.2727	0.05	0.05		0
63000000033	9	6	76	1537	0.4000	0.04	0.09		0
63000000033	9	6	76	1540	1.8000	0.09	0.18		0
63000000033	9	6	76	1543	4.0000	0.20	0.38		0
63000000033	9	6	76	1546	1.4000	0.07	0.45		0
63000000033	9	6	76	1548	3.0000	0.10	0.55		0
63000000033	9	6	76	1551	2.2000	0.11	0.66		0
63000000033	9	6	76	1601	0.3000	0.05	0.71		0
63000000033	9	6	76	1609	0.1500	0.02	0.73		0
63000000033	9	6	76	1618	0.1333	0.02	0.75		0
163000000038	9	6	76	1532	0.0000	0.00	0.00		0
63000000038	9	6	76	1535	2.2000	0.11	0.11		0
63000000038	9	6	76	1543	0.7500	0.10	0.21		0
63000000038	9	6	76	1546	1.4000	0.07	0.28		0
63000000038	9	6	76	1550	3.1500	0.21	0.49		0
63000000038	9	6	76	1553	3.2000	0.16	0.65		0
63000000038	9	6	76	1558	0.7200	0.06	0.71		0
63000000038	9	6	76	1604	0.4000	0.04	0.75		0
63000000038	9	6	76	1609	0.2400	0.02	0.77		0
63000000038	9	6	76	1622	0.0462	0.01	0.78		0
163000000039	9	6	76	1526	0.0000	0.00	0.00	E	0
63000000039	9	6	76	1616	0.9240	0.77	0.77	E	0
163000000044	9	6	76	1522	0.0000	0.00	0.00		0
63000000044	9	6	76	1529	0.6857	0.08	0.08		0
63000000044	9	6	76	1532	0.8000	0.04	0.12		0
63000000044	9	6	76	1535	0.6000	0.03	0.15		0
63000000044	9	6	76	1539	2.2500	0.15	0.30		0

63000000044	9	6	76	1542	1.4000	0.07	0.37		0
63000000044	9	6	76	1546	2.1000	0.14	0.51		0
63000000044	9	6	76	1550	1.2000	0.08	0.59		0
63000000044	9	6	76	1554	1.2000	0.08	0.67		0
63000000044	9	6	76	1557	0.8000	0.04	0.71		0
63000000044	9	6	76	1605	0.1500	0.02	0.73		0
63000000044	9	6	76	1608	0.2000	0.01	0.74		0
63000000044	9	6	76	1613	0.1200	0.01	0.75		0
163000000051	9	6	76	1517	0.0000	0.00	0.00		0
63000000051	9	6	76	1525	0.5250	0.07	0.07		0
63000000051	9	6	76	1531	0.9000	0.09	0.16		0
63000000051	9	6	76	1538	1.1143	0.13	0.29		0
63000000051	9	6	76	1544	2.3000	0.23	0.52		0
63000000051	9	6	76	1554	0.6600	0.11	0.63		0
63000000051	9	6	76	1612	0.2000	0.06	0.69		0
163000000052	9	6	76	1527	0.0000	0.00	0.00		0
63000000052	9	6	76	1537	0.6000	0.10	0.10		0
63000000052	9	6	76	1548	0.9818	0.18	0.28		0
63000000052	9	6	76	1552	0.6000	0.04	0.32		0
63000000052	9	6	76	1558	1.5000	0.15	0.47		0
63000000052	9	6	76	1605	1.2857	0.15	0.62		0
63000000052	9	6	76	1610	0.6000	0.05	0.67		0
63000000052	9	6	76	1617	0.2571	0.03	0.70		0
163000000054	9	6	76	1527	0.0000	0.00	0.00		0
63000000054	9	6	76	1535	0.6000	0.08	0.08		0
63000000054	9	6	76	1539	1.2000	0.08	0.16		0
63000000054	9	6	76	1548	0.4000	0.06	0.22		0
63000000054	9	6	76	1552	0.6000	0.04	0.26		0
63000000054	9	6	76	1559	1.2000	0.14	0.40		0
63000000054	9	6	76	1604	1.0800	0.09	0.49		0
63000000054	9	6	76	1611	0.4286	0.05	0.54		0
63000000054	9	6	76	1619	0.1500	0.02	0.56		0
63000000054	9	6	76	1627	0.0750	0.01	0.57		0
163000000055	9	6	76	1539	0.0000	0.00	0.00		0
63000000055	9	6	76	1545	0.3000	0.03	0.03		0
63000000055	9	6	76	1552	0.0857	0.01	0.04		0
63000000055	9	6	76	1600	0.3000	0.04	0.08		0
63000000055	9	6	76	1605	0.2400	0.02	0.10		0
63000000055	9	6	76	1608	2.6000	0.13	0.23		0
63000000055	9	6	76	1611	2.2000	0.11	0.34		0
63000000055	9	6	76	1614	1.8000	0.09	0.43		0
63000000055	9	6	76	1616	1.8000	0.06	0.49		0
63000000055	9	6	76	1623	0.3429	0.04	0.53		0
163000000056	9	6	76	1522	0.0000	0.00	0.00	E	0
63000000056	9	6	76	1616	0.5556	0.50	0.50	E	0
163000000080	9	6	76	1520	0.0000	0.00	0.00	E	0
63000000080	9	6	76	1640	0.0600	0.08	0.08	E	0
163000000087	9	6	76	1524	0.0000	0.00	0.00		0
63000000087	9	6	76	1531	0.4286	0.05	0.05		0
63000000087	9	6	76	1541	0.9000	0.15	0.20		0
63000000087	9	6	76	1544	3.2000	0.16	0.36		0
63000000087	9	6	76	1550	2.1000	0.21	0.57		0
63000000087	9	6	76	1555	1.9200	0.16	0.73		0
63000000087	9	6	76	1602	0.4286	0.05	0.78		0
63000000087	9	6	76	1607	0.4800	0.04	0.82		0
63000000087	9	6	76	1618	0.1091	0.02	0.84		0
63000000087	9	6	76	1623	0.2400	0.02	0.86		0
163000000088	9	6	76	1523	0.0000	0.00	0.00		0
63000000088	9	6	76	1530	0.5143	0.06	0.06		0
63000000088	9	6	76	1536	0.6000	0.06	0.12		0
63000000088	9	6	76	1545	0.4667	0.07	0.19		0
63000000088	9	6	76	1552	1.2000	0.14	0.33		0
63000000088	9	6	76	1556	1.8000	0.12	0.45		0
63000000088	9	6	76	1601	1.3200	0.11	0.56		0
63000000088	9	6	76	1609	0.3000	0.04	0.60		0

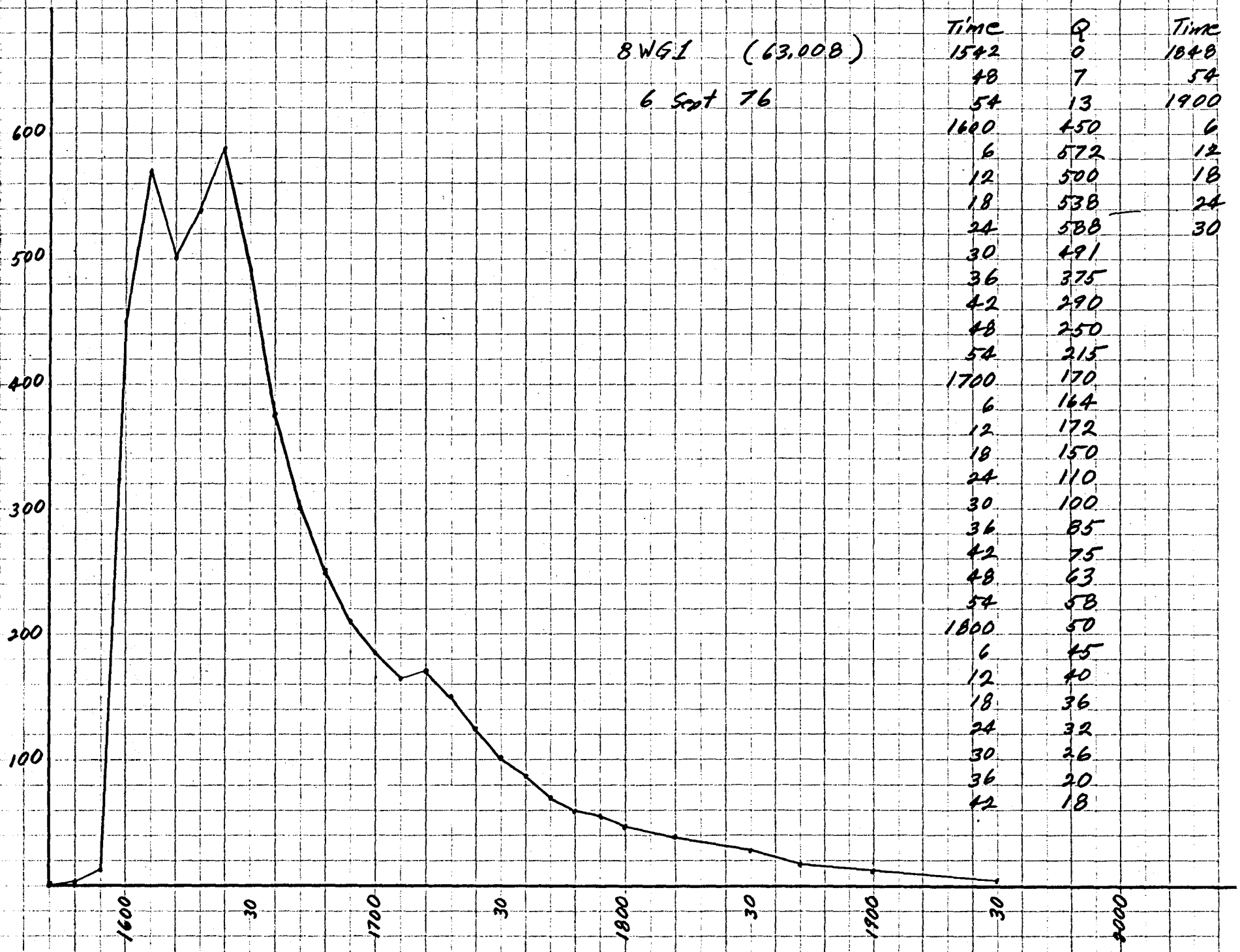
63000000088	9	6	76	1619	0.1800	0.03	0.63	0

163000000089	9	6	76	1527	0.0000	0.00	0.00	0
63000000089	9	6	76	1534	0.4286	0.05	0.05	0
63000000089	9	6	76	1541	0.6857	0.08	0.13	0
63000000089	9	6	76	1546	1.0800	0.09	0.22	0
63000000089	9	6	76	1550	1.5000	0.10	0.32	0
63000000089	9	6	76	1555	1.2000	0.10	0.42	0
63000000089	9	6	76	1603	0.7500	0.10	0.52	0
63000000089	9	6	76	1612	0.0000	0.00	0.52	0
63000000089	9	6	76	1617	0.3600	0.03	0.55	0
63000000089	9	6	76	1627	0.2400	0.04	0.59	0
163000000090	9	6	76	1528	0.0000	0.00	0.00	0
63000000090	9	6	76	1533	0.6000	0.05	0.05	0
63000000090	9	6	76	1537	0.9000	0.06	0.11	0
63000000090	9	6	76	1544	0.6000	0.07	0.18	0
63000000090	9	6	76	1550	0.9000	0.09	0.27	0
63000000090	9	6	76	1558	1.3500	0.18	0.45	0
63000000090	9	6	76	1603	1.4400	0.12	0.57	0
63000000090	9	6	76	1615	0.3500	0.07	0.64	0
63000000090	9	6	76	1623	0.2250	0.03	0.67	0
163000000091	9	6	76	1538	0.0000	0.00	0.00	0
63000000091	9	6	76	1543	0.6000	0.05	0.05	0
63000000091	9	6	76	1552	0.2000	0.03	0.08	0
63000000091	9	6	76	1559	0.5143	0.06	0.14	0
63000000091	9	6	76	1605	0.9000	0.09	0.23	0
63000000091	9	6	76	1611	2.0000	0.20	0.43	0
63000000091	9	6	76	1617	0.5000	0.05	0.48	0
63000000091	9	6	76	1629	0.1500	0.03	0.51	0

15 oct 87

8WG1 (63,008)

6 Sept 76



Time	Q	Time	Q
1542	0	1848	
48	7	54	
54	13	1900	
1600	450	6	
6	572	12	
12	500	18	
18	538	24	
24	588	30	
30	491		
36	375		
42	290		
48	250		
54	215		
1700	170		
6	164		
12	172		
18	150		
24	110		
30	100		
36	85		
42	75		
48	63		
54	58		
1800	50		
6	45		
12	40		
18	36		
24	32		
30	26		
36	20		
42	18		

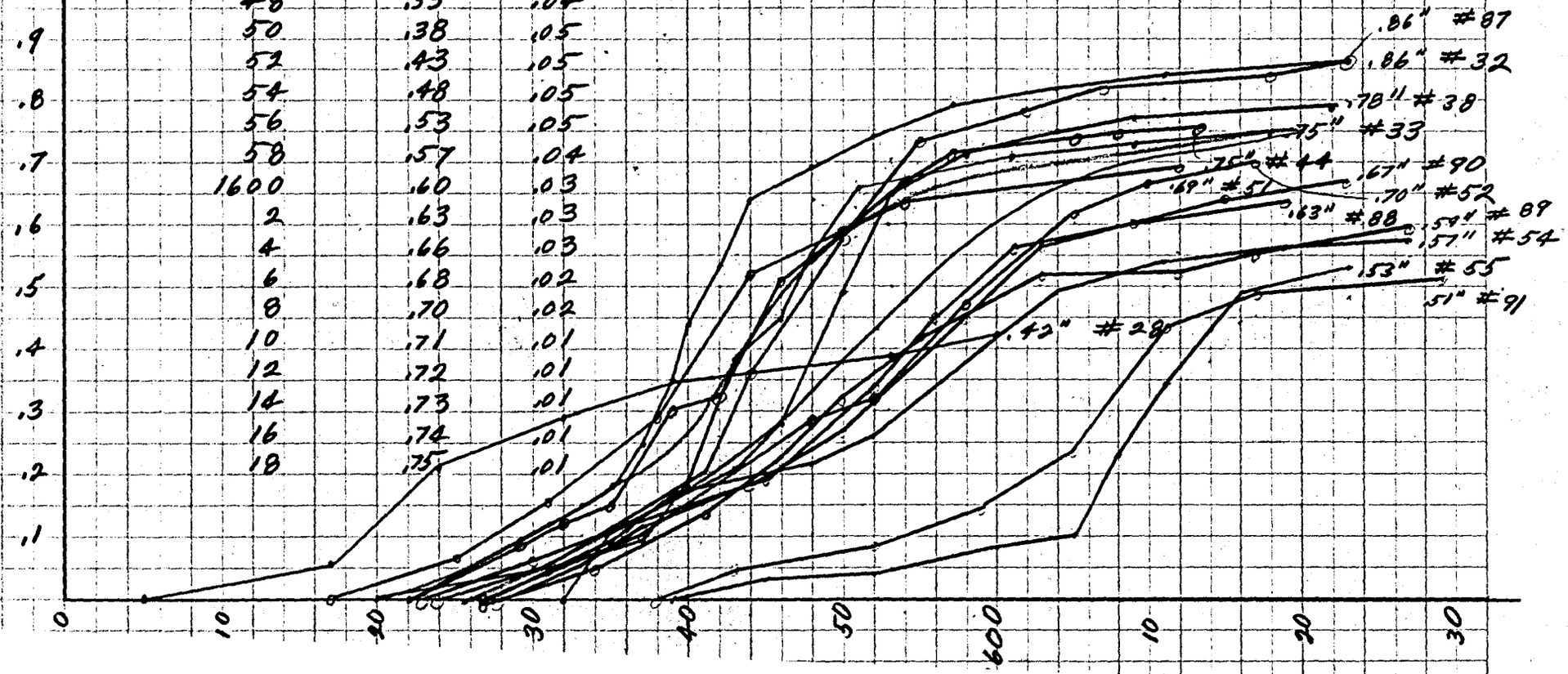
15 Oct 87

5.98

8WG I (63.008)

6 Sept 76

Time	Σ rain	Δ rain (shown in red)
1526	0.0	0
28	.02	.02
30	.04	.02
32	.07	.03
34	.10	.03
36	.13	.03
38	.16	.03
40	.19	.03
42	.22	.03
44	.25	.03
46	.29	.04
48	.33	.04
50	.38	.05
52	.43	.05
54	.48	.05
56	.53	.05
58	.57	.04
1600	.60	.03
2	.63	.03
4	.66	.03
6	.68	.02
8	.70	.02
10	.71	.01
12	.72	.01
14	.73	.01
16	.74	.01
18	.75	.01

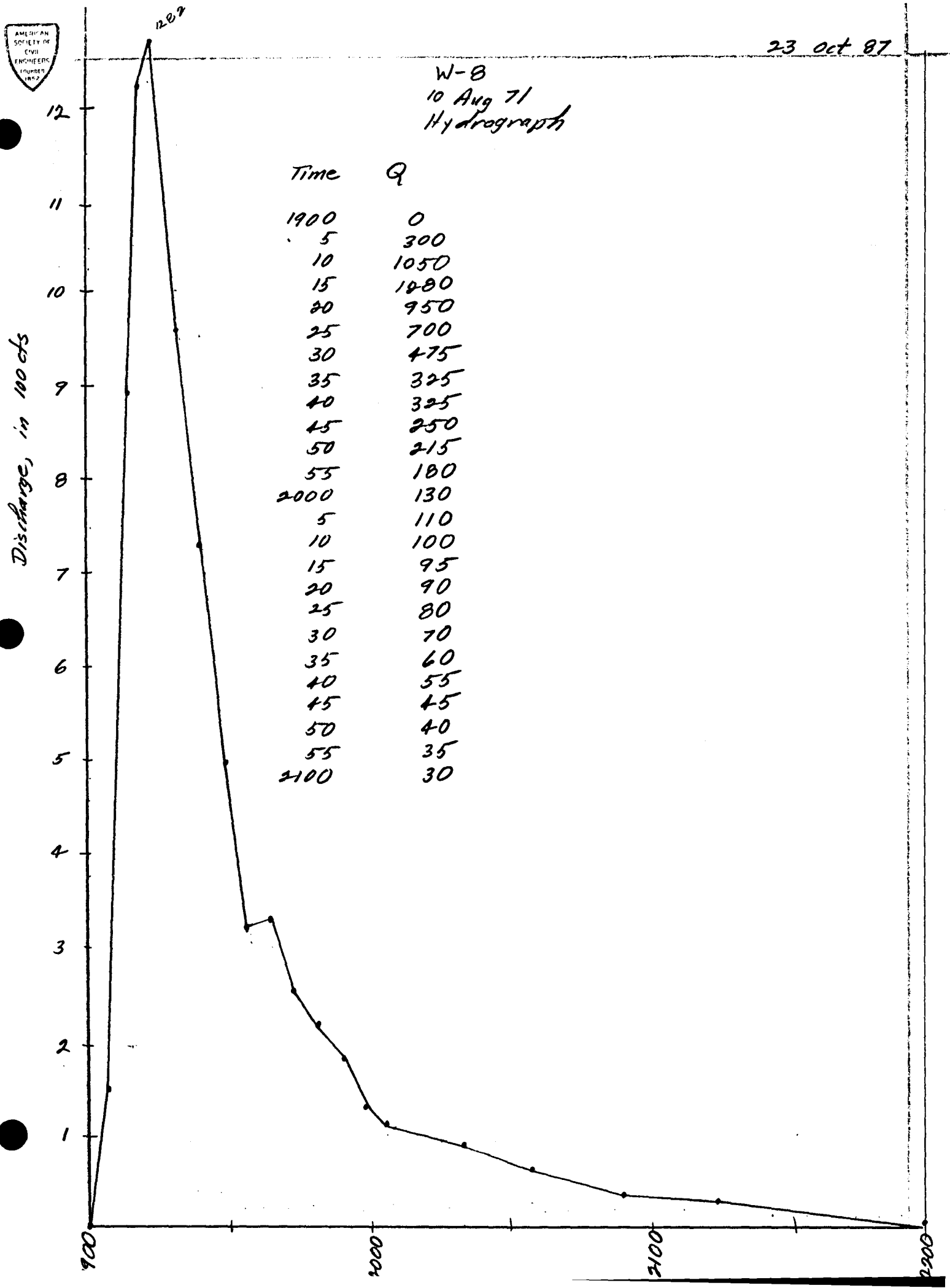


Time	Σ rain	Δ rain
1520	0.0	
22	.02	.02
24	.04	.02
26	.06	.02
28	.08	.02
30	.11	.03
32	.14	.03
34	.17	.03
36	.20	.03
38	.23	.03
40	.27	.04
42	.34	.07
44	.42	.08
46	.48	.06
48	.54	.06
50	.58	.04
52	.62	.04
54	.64	.02
56	.66	.02
58	.67	.01
1600	.68	.01
2	.69	.01
4	.70	.01
6	.71	.01
8	.72	.01
10	.73	.01
12	.74	.01
14	.75	.01

(shown in green)

23 Oct 87

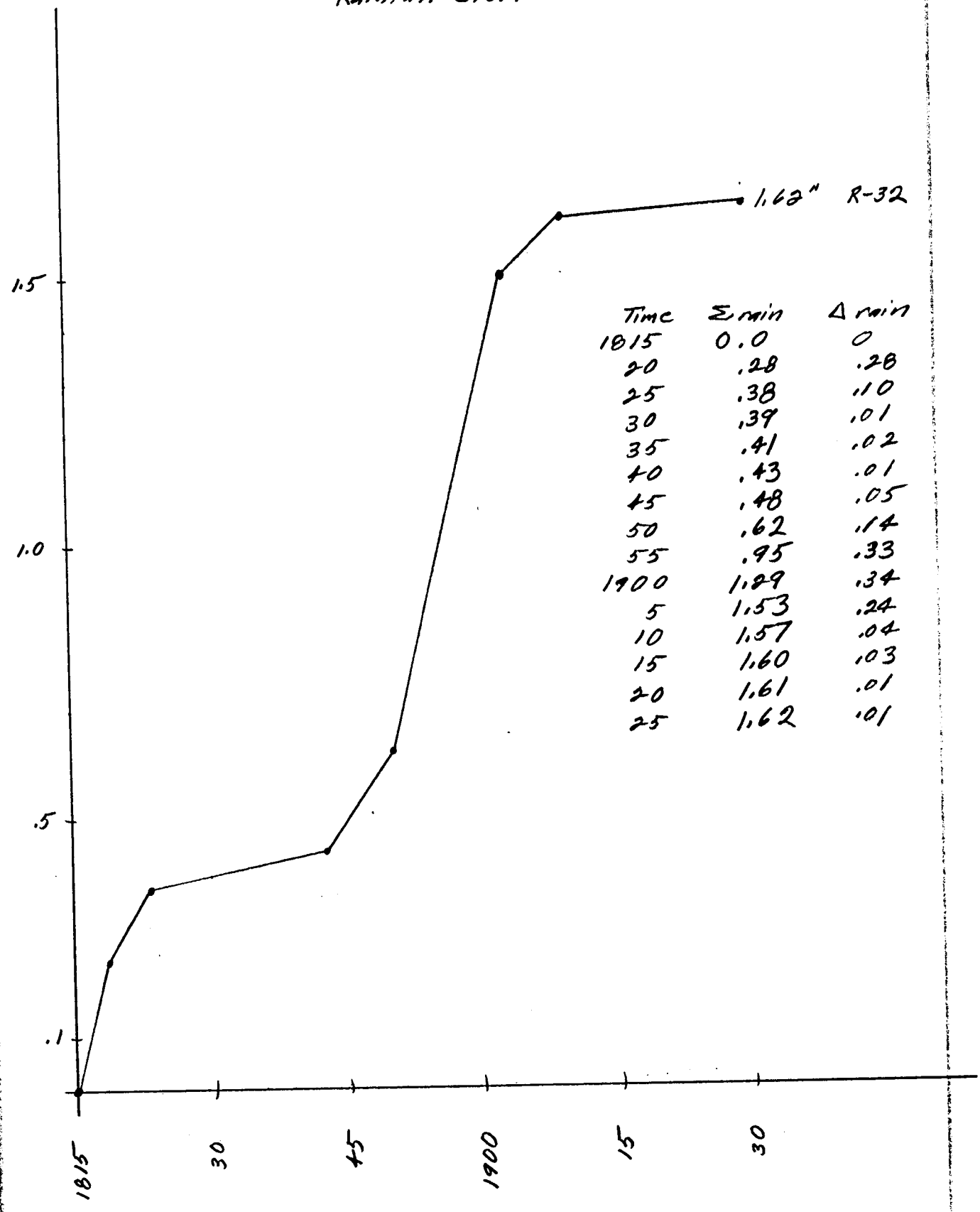
W-8
10 Aug 71
Hydrograph



Time	Q
1900	0
5	300
10	1050
15	1280
20	950
25	700
30	475
35	325
40	325
45	250
50	215
55	180
2000	130
5	110
10	100
15	95
20	90
25	80
30	70
35	60
40	55
45	45
50	40
55	35
2100	30

23 Oct 87

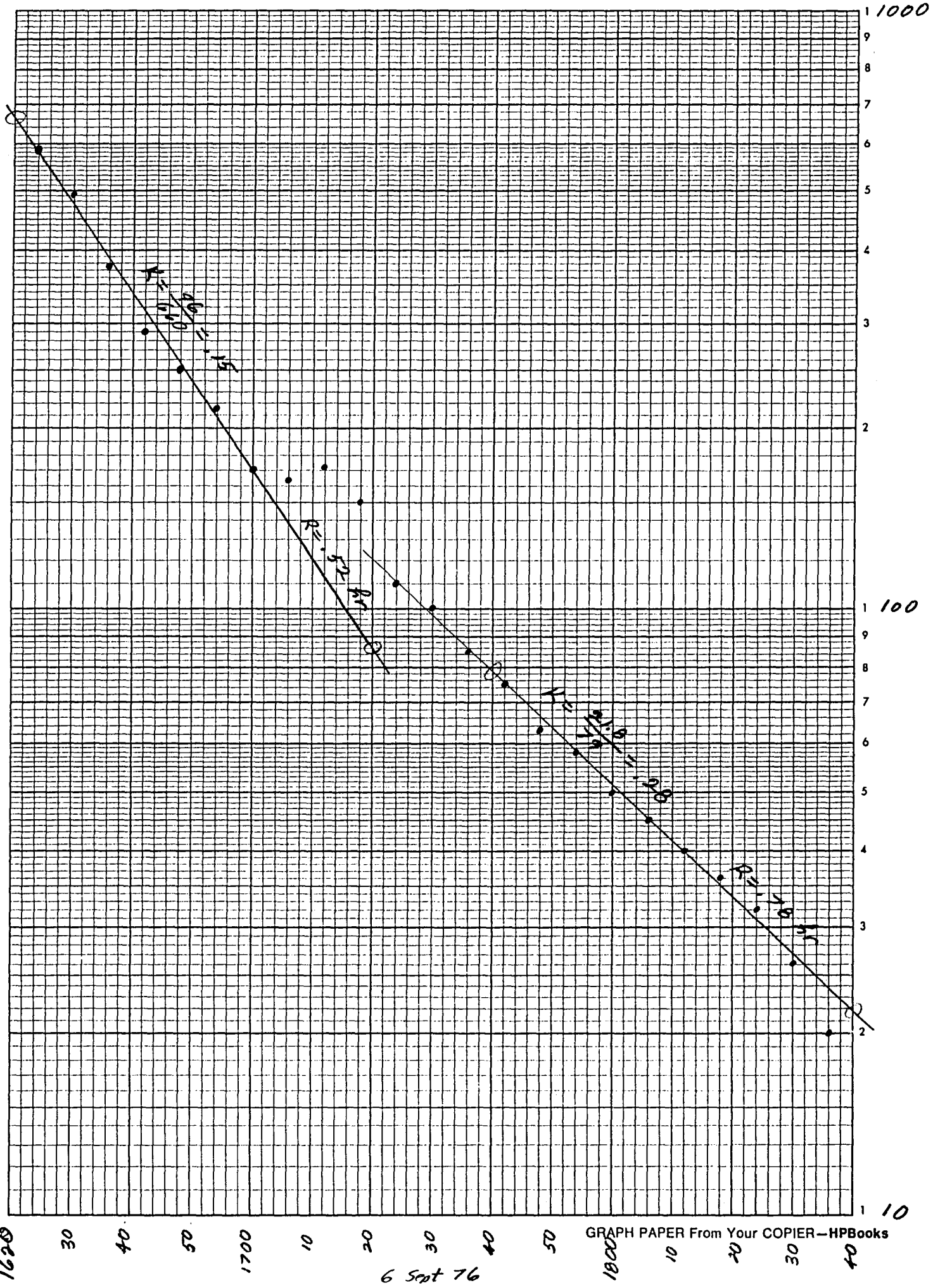
W-8
10 Aug 71
Rainfall Dist.



Time	Σ rain	Δ rain
1815	0.0	0
20	.28	.28
25	.38	.10
30	.39	.01
35	.41	.02
40	.43	.01
45	.48	.05
50	.62	.14
55	.95	.33
1900	1.29	.34
5	1.53	.24
10	1.57	.04
15	1.60	.03
20	1.61	.01
25	1.62	.01

70 Divisions 5th, 10th Accent by 2 Cycle Semi-Log

8WG 1

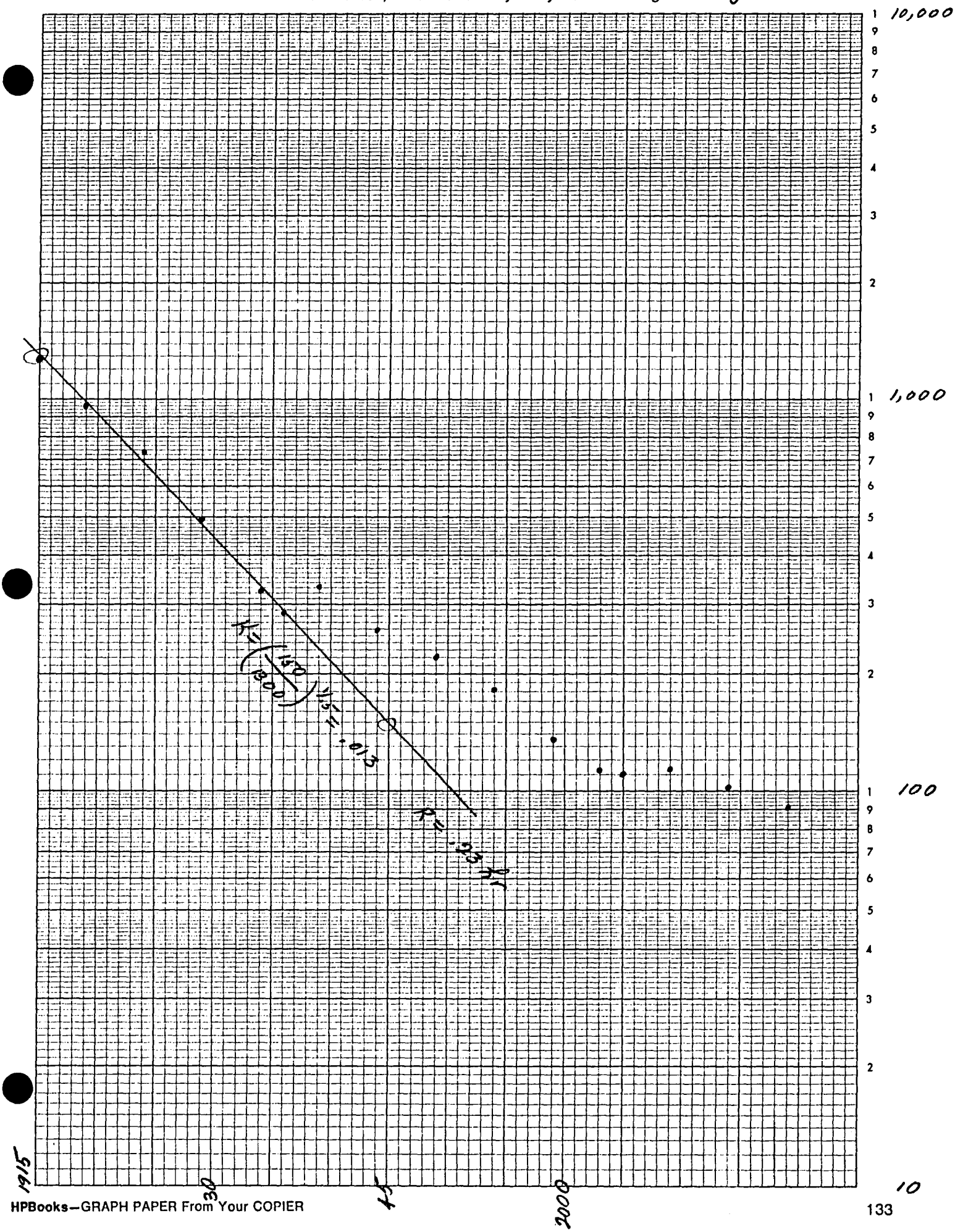


6 Sept 76

GRAPH PAPER From Your COPIER—HPBooks

W-8

70 Divisions 5th, 10th Accent by 3 Cycle Semi-Log 10 Aug 71



Flood Reconstitution for Walnut Gulch 63.011 11-1

Storm Event 13 Sept 75

Runoff: depth = .21 inches, Q_p = 698 cfs at t_p = .63 hours

$R_{recession}$ = .18 hrs

INPUT (1) Area acres	(2) Eff. Imp. Area %	(3) Rain in.	(4) Comp. Inter. min.	(5) Time-Area	(6)	Results (7) Q_p cfs	(8) t_p hr.	(9) T_c hr.	(10) R hr.	(11) STRTL in.	(12) CNSTL in/hr	(13) Output File	(14) Comment
2035	0	.90	2	D		780	.70	.37	.37	.48	.54	ϕ1	flat peak hg.
"	"	"	"	N-2		805	.63	.35	.41	.50	.46	ϕ2	
"	"	"	"	U-3		722	.60	.52	.33	.50	.50	ϕ4	← best
"	"	"	"	N-4		774	.63	.55	.39	.49	.48	ϕ5	

Flood Reconstitution for Walnut Gulch 63.011 11-2

Storm Event 22 July 64

Runoff: depth = .97 inches, Q_p = 4420 cfs at t_p = .75 hours

$R_{recession}$ = .16 hrs

INPUT (1) Area acres	(2) Eff. Imp. Area %	(3) Rain in.	(4) Comp. Inter. min.	(5) Time-Area	(6)	Results (7) Q_p cfs	(8) t_p hr.	(9) T_c hr.	(10) R hr.	(11) STRTL in.	(12) CNSTL in/hr	(13) Output File	(14) Comment
2035	0	1.80	5	D		2930	.83	.73	.22	.72	.30	Ø1	error w/ rainfall input
"	"	"	"	U-3		2339	.67	.75	.40	.72	.30	Ø2	
"	"	"	"	D	changed to 5-min. rainfall dist.	4188	.83	.46	.16	.72	.56	Ø3	error in data (rainfall)
"	"	"	"	D		3210	.75	.67	.20	.67	.54	Ø4	
"	"	"	"	U-3		2524	.58	.77	.33	.77	.22	Ø5	
"	"	2.06	"	"		2451	.67	.72	.34	1.02	.26	Ø6	
"	"	"	"	D		3131	.75	.68	.20	.82	.85	Ø7	
"	"	"	"	N-2		4151	.75	.79	.14	.90	.62	Ø8	← best

TOMBSTONE, ARIZONA WALNUT GULCH WATERSHED 63.011

LOCATION: Cochise County, Ariz.; 4 1/3 miles northeast of Tombstone; Walnut Gulch, San Pedro River, Gila River, Colorado River Basin.

AREA: 2,035 acres (3.18 sq. miles)

SLOPES:

Slope - Percent	0-3	3-10	10-20	20-35
Percent of area 1/	4	52	28	16

1/ Estimated

SOILS: Not available

EROSION:

Erosion Class	1	2
Percent of area	98	2

LAND CAPABILITY:

Class	VI
Percent of area	100

GEOLOGY: One hundred percent of the subwatershed consists of Quaternary and Tertiary alluvium of the Tombstone pediment. The alluvium is made up of permeable lensed and interbedded sand, gravel, conglomerate, caliche conglomerate, and some clay. Two series of conglomerate are recognized beneath the recent alluvium of the Tombstone pediment. A younger conglomerate whose bedding is nearly conformable to the pediment surface and probably older than that surface, and an older Tertiary conglomerate lying unconformably beneath that. These conglomerates are known to persist to depths exceeding 1,200 feet. Topographic expression of the alluvium is that of low undulating hills dissected by present stream channels. Caliche conglomerates of this unit are fairly resistant to erosion and form steep cliffs of low relief in some of the present stream channels. The regional watertable is about 425 feet deep.

Stratigraphy and Hydrogeology of Walnut Gulch Subwatershed 63.011

System	Formation and percent of area	Description
Quaternary & Tertiary	Recent alluvium 99%	Gravel, sand, and clay.
	Younger conglomerate < 1%	Gravel, sand, conglomerate, caliche conglomerate, and clay, some boulders.
	Older conglomerate < 1%	Gravel, sand, conglomerate, caliche conglomerate, and clay, some boulders.

Source of data: General Geology of Central Cochise County, Arizona, by James Gilluly, U. S. Geological Survey, Professional Paper 281, 1956 and extended field studies by project staff.

SURFACE DRAINAGE: Good, length of principal waterway is 4.0 miles with 2 major tributaries; a natural watershed with surface flow in well defined water courses.

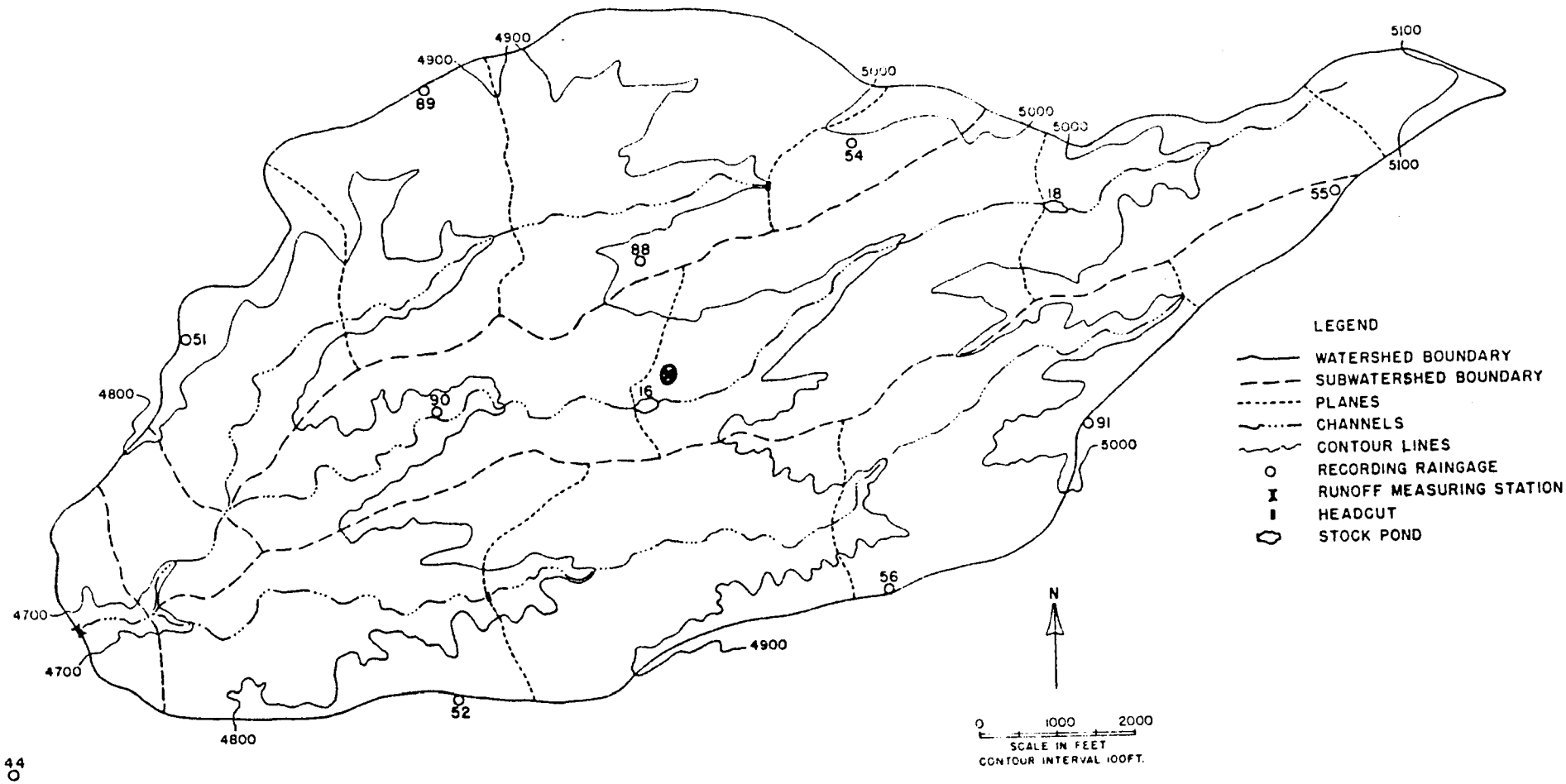
CHARACTER OF FLOW: Ephemeral.

INSTRUMENTATION: Precipitation: Measured by 5 24-hour weighing rain gages. Runoff: Critical depth flume (precalibrated) AD-35 analog strip chart water level recorder.

WATERSHED CONDITIONS: Vegetation cover: Approximately 20 percent of the area dominated by desert shrubs (whitethorn, creosotebush, tarbush) with a crown spread of approximately 30 percent cover and an understory of grasses with basal area of less than 1 percent. The remaining 80 percent of the area supports a grass cover (black grama, curly mesquite grass, sideoats grama) with a basal cover of about 2.5 percent interspersed with desert shrubs averaging less than 5 percent crown cover.

GENERALLY REPRESENTS: Desert grassland ranges in the Southeastern Arizona Basin and Rangeland resources area (D-41).

Watershed 11



MONTHLY PRECIPITATION AND RUNOFF (inches)

TOMBSTONE, ARIZONA WATERSHED 63.011
AREA - 2035 ACRES (3.18 SQ. MILES)

63.11

YEAR \ MONTH		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	ANNUAL
1963	P 1/	.16	.37	.03	.12	.00	.00	2.78	3.64	.64	.36	1.41	.26	9.77
	Q							.01	.31	.00	.00	.00	.00	
1964	P 1/	.24	.02	.33	.28	.00	.02	5.16	2.36	5.50	.59	.69	.35	15.54
	Q	.00	.00	.00	.00	.00	.00	.09	.29	1.71	.00	.00	.00	2.99
STA AVG	P 2/	.20	.20	.18	.20	.00	.01	3.97	3.00	3.07	.47	1.05	.30	12.65
	Q	.00	.00	.00	.00	.00	.00	.50	.30	.85	.00	.00	.00	1.65
MEAN 68 YR	P 3/	.84	.78	.62	.28	.18	.50	3.64	3.48	1.53	.68	.64	.85	14.02

ANNUAL MAXIMUM DISCHARGES (inches per hour) AND ANNUAL MAXIMUM VOLUMES OF RUNOFF (inches) FOR SELECTED TIME INTERVALS

YEAR	MAXIMUM DISCHARGE		MAXIMUM VOLUME FOR SELECTED TIME INTERVAL													
			1 HOUR		2 HOURS		6 HOURS		12 HOURS		1 DAY		2 DAYS		8 DAYS	
	DATE	RATE	DATE	VOLUME	DATE	VOLUME	DATE	VOLUME	DATE	VOLUME	DATE	VOLUME	DATE	VOLUME	DATE	VOLUME
1964	7-22	2.16	7-22	.91	7-22	.93	7-22	.94	9-9	.97	9-9	.97	9-10	1.46	9-8	1.71
MAXIMUMS FOR PERIOD OF RECORD																
1963 TO 1964	7-22 1964	2.16	7-22 1964	.91	7-22 1964	.93	7-22 1964	.94	9-9 1964	97	9-9 1964	.97	9-10 1964	1.46	9-8 1964	1.71

Notes: 1/ Monthly precipitation is arithmetic average of 4 rain gages on watershed. 2/ Precipitation record began January 1, 1963; runoff record began July 9, 1963 with the completion of the 6000-cfs maximum-capacity flume. 3/ Mean P based on 68-yr (1897-1964) U.S. Weather Bureau record period at Tombstone, Ariz.

1963 SELECTED RUNOFF EVENTS

TOMBSTONE, ARIZONA WATERSHED 63.011

63.11

ANTECEDENT CONDITIONS			RAINFALL				RUNOFF				
DATE MO-DAY	RAINFALL (inches)	RUNOFF (inches)	DATE MO-DAY	TIME OF DAY	INTENSITY (in/hr)	ACC. (inches)	DATE MO-DAY	TIME OF DAY	RATE (in/hr)	ACC. (inches)	Q
			Event of August 19, 1963 6/								
	RG R-52		8-19	RG	R-52		8-19				
7-19	.03	.0000		0900	0.00	0.00		0920	.000	.0000	0
7-22	.35	.0000		0908	3.38	0.45		0925	.002	.0001	2
7-24	.11	.0000		0915	3.26	0.83		0930	.021	.0011	43
7-25	.17	.0000		0930	1.64	1.24		0935	.206	.0105	423
7-26	.12	.0000		0938	1.05	1.38		0940	.292	.0313	599
7-27	.04	.0000		1002	0.23	1.47		0945	.349	.0580	716
7-28	.15	.0000						0950	.383	.0885	786
7-29	.41	.0000						0952	.403	.1016	827
7-31	.39	.0106						0955	.376	.1210	772
8-2	.18	.0274						1000	.302	.1493	620
8-8	.03	.0000						1005	.196	.1700	402
8-10	.35	.0029						1010	.112	.1829	230
								1015	.062	.1901	127
								1020	.039	.1943	80
								1025	.030	.1971	62
								1030	.026	.1994	53
								1040	.020	.2033	41
								1050	.016	.2062	33
								1100	.012	.2085	25
								1110	.009	.2103	18
								1120	.008	.2117	16
								1130	.006	.2128	12
								1145	.004	.2141	8
								1200	.003	.2147	6
								1230	.001	.2159	2
								1300	.000	.2163	0
								1330	.000	.2165	
								1400	.000	.2165	
								1430	.000	.2165	
								1515	.000	.2165	

Watershed conditions: Vegetation cover: Approximately 20 percent of the area dominated by desert shrubs (whitethorn, creosotebush, tarbush) with a crown spread of approximately 30 percent cover and an understory of grasses with basal area of less than 1 percent. The remaining 80 percent of the area supports a grass cover (black grama, curly mesquite grass, sideoats grama) with a basal cover of about 2.5 percent interspersed with desert shrubs averaging less than 5 percent crown cover.

NOTE: TO CONVERT RUNOFF IN IN/HR TO CFS, MULTIPLY BY 2051.9. FOR TOPOGRAPHIC MAP OF WATERSHED, SEE HYDROLOGIC DATA FOR EXPERIMENTAL AGRICULTURAL WATERSHEDS IN THE UNITED STATES 1960-61, USDA MISC. PUB. 994, P. 63.1-2. FOR GEOLOGIC AND VEGETATION MAPS, SEE 1963 USDA MISC. PUB. 1164, P. 63.1-2 AND 63.1-3. 4/ ISOHYETAL MAP ON P. 63.6-9, USDA MISC. PUB. 1164.

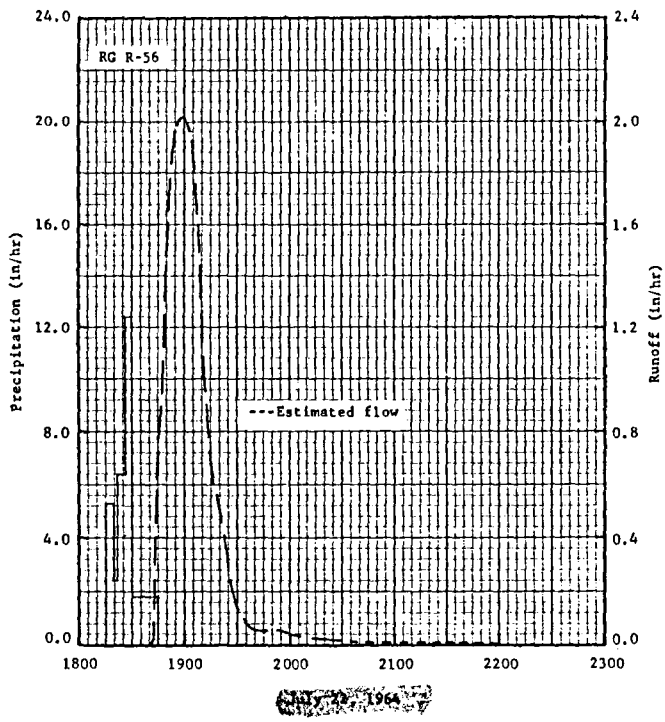
1964 **SELECTED RUNOFF EVENTS** TOMBSTONE, ARIZONA [redacted] 63.11

ANTECEDENT CONDITIONS			RAINFALL				RUNOFF				
DATE MO-DAY	RAINFALL (inches)	RUNOFF (inches)	DATE MO-DAY	TIME OF DAY	INTENSITY (in/hr)	ACC. (inches)	DATE MO-DAY	TIME OF DAY	RATE (in/hr)	ACC. (inches)	Q cfs
				Event of [redacted] 1964 1/							
	RG R-56		7-22	RG	R-56		7-22				
7-7	.05	.0000		1815	.00	.00		1835	.000	.0000	
7-8	.03	.0000		1819	5.25	.35		1837	.000	.0000	0
7-12	.46	.0050		1822	2.40	.47		1840	.002	.0001	4
7-13	.10	.0004		1827	6.36	1.00		1842	.186	.0032	382
7-17	.08	.0000		1830	12.40	1.62		1845	.630	.0236	1292
7-18	.08	T		1845	1.76	2.06		1847	.874	.0487	1793
7-20	.16	.0001						1849	1.198	.0832	2458
7-21	.16	.0000						1852	1.572	.1524	3226
								1855	1.961	.2408	4024
								1858	2.125	.3429	4360
								1900	2.155	.4142	4422
								1901	2.061	.4494	4229
								1903	1.961	.5164	4024
								1905	1.804	.5791	3702
								1908	1.572	.6636	3226
								1910	1.198	.7097	2458
								1913	.874	.7615	1793
								1917	.630	.8117	1293
								1920	.503	.8400	1032
Watershed conditions: Vegetation cover: Approximately 20 percent of the area dominated by desert shrubs (whitethorn, creosotebush, tarbush) with a crown spread of approximately 30 percent cover and an understory of grasses with basal area of less than 1 percent. The remaining 80 percent of the area supports a grass cover (black grama, curly mesquite grass, sideoats grama) with a basal cover of about 2.5 percent interspersed with desert shrubs averaging less than 5 percent crown cover.								1925	.313	.8740	642
								1928	.186	.8865	382
								1930	.141	.8919	289
								1935	.085	.9013	174
								1940	.057	.9072	117
								1945	.049	.9116	101
								1948	.047	.9140	96
								1950	.049	.9156	101
								1955	.043	.9194	88
								2000	.037	.9227	76
								2005	.031	.9256	64
								2015	.021	.9299	43
								2030	.013E	.9342E	
								2045	.009E	.9370E	
								2100	.006E	.9389E	
								2130	.002E	.9410E	
								2200	.000E	.9416E	
								2230	.000E	.9418E	
				Event of September 9-10, 1964 2/							
	RG R-51		9-9	RG	R-51		9-9				
8-9	.07	.0000		1615	.00	.00		1613	.000	.0000	
8-13	.06	.0000		1618	2.20	.11		1615	.002	.0000	
8-20	.13	.0000		1623	2.28	.30		1617	.006	.0002	
8-25	.08	.0000		1627	3.00	.50		1619	.078	.0016	
8-26	.05	.0000		1630	2.60	.63		1621	.250	.0070	
8-27	.66	.0304		1643	.32	.70		1623	.302	.0162	
9-6	.03	.0000		2000	.00	.00		1625	.359	.0273	
9-8	.88	.0000		2115	.10	.10		1627	.383	.0396	
				2350	.00	.00		1629	.397	.0526	
				2358	2.77	.37		1630	.401	.0593	
				2400	1.50	.42		1633	.397	.0793	
			9-10	0005	5.52	.88		1635	.377	.0922	
				0018	1.85	1.28		1637	.324	.1039	
				0029	1.04	1.47		1640	.313	.1198	
				0039	1.08	1.65		1643	.324	.1357	
				0047	2.10	1.93		1645	.331	.1466	
				0333	.06	2.10		1647	.313	.1573	
								1649	.272	.1671	
								1651	.177	.1746	

Continued on next page

NOTE: TO CONVERT RUNOFF IN IN/HR TO CFS, MULTIPLY BY 2051.9. 1/ ISOHYETAL MAP ON P. 63.1-9. 2/ ISOHYETAL MAP ON P. 63.1-10.

#1194
1964



TOMBSTONE, ARIZONA WATERSHED 63.011

MONTHLY PRECIPITATION AND RUNOFF (inches)

TOMBSTONE, ARIZONA WATERSHED 63.011
AREA - 2035 ACRES (3.18 SQ. MILES)

63.11

YEAR \ MONTH		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	ANNUAL
1965	P 1/	.93	.09	.26	.00	.02	.14	4.10	2.34	2.67	.00	.34	3.34	14.23
	Q	.00	.00	.00	.00	.00	.00	.13	.01	.34	.00	.00	.00	.48
STA AVG (63-65)	P 2/	.44	.16	.21	.13	.01	.05	4.01	2.78	2.93	.32	.81	1.31	13.16
	Q	.00	.00	.00	.00	.00	.00	.38	.20	.68	.00	.00	.00	1.26
MEAN 68 YR	P 3/	.84	.78	.62	.28	.18	.50	3.64	3.48	1.53	.68	.64	.85	14.02

ANNUAL MAXIMUM DISCHARGES (inches per hour) AND ANNUAL MAXIMUM VOLUMES OF RUNOFF (inches) FOR SELECTED TIME INTERVALS

YEAR	MAXIMUM DISCHARGE		MAXIMUM VOLUME FOR SELECTED TIME INTERVAL													
			1 HOUR		2 HOURS		6 HOURS		12 HOURS		1 DAY		2 DAYS		6 DAYS	
	DATE	RATE	DATE	VOLUME	DATE	VOLUME	DATE	VOLUME	DATE	VOLUME	DATE	VOLUME	DATE	VOLUME	DATE	VOLUME
1965	9-4	.56	9-4	.27	9-4	.29	9-4	.30	9-4	.30	9-4	.30	9-4	.34	9-4	.34
MAXIMUMS FOR PERIOD OF RECORD																
1963 TO 1965	9-11 1964	.83	9-10 1964	.62	9-9 1964	.75	9-9 1964	.77	9-9 1964	.97	9-9 1964	.97	9-10 1964	1.46	9-8 1964	1.70

Notes: For watershed conditions see information below and vegetative cover map, page 63.1-4. 1/ Monthly precipitation is arithmetic average of 4 rain gages on watershed. 2/ Precipitation and runoff records began July 9, 1963. 3/ Mean P based on 68-yr. (1897-1964) U.S. Weather Bureau record period at Tombstone, Ariz.

1965 SELECTED RUNOFF EVENT

TOMBSTONE, ARIZONA WATERSHED 63.011

63.11

Event of July 17-18, 1965 4/

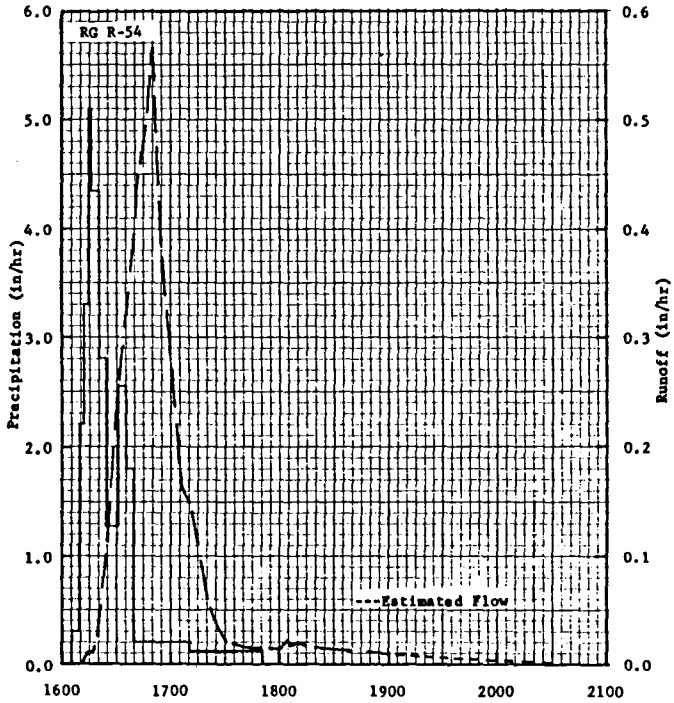
ANTECEDENT CONDITIONS			RAINFALL				RUNOFF			
DATE MO-DAY	RAINFALL (inches)	RUNOFF (inches)	DATE MO-DAY	TIME OF DAY	INTENSITY (in/hr)	ACC. (inches)	DATE MO-DAY	TIME OF DAY	RATE (in/hr)	ACC. (inches)
	RG R-55		7-17	RG	R-55		7-17			
6-23	.02	.0000		2350	0.00	0.00		2351	.000E	.0000
7-9	.49	.0000		2355	4.08	0.34		2356	.001E	.0000E
7-10	.05	.0000		2400	4.44	0.71	7-18	0001	.015E	.0007E
7-11	.03	.0000	7-18	0002	7.50	0.96		0006	.101E	.0055E
7-13	.21	.0000		0008	2.20	1.18		0011	.268E	.0209E
7-14	.43	.0220		0032	0.03	1.19		0016	.354E	.0468E
7-16	.58	.0000		0044	0.25	1.24		0021	.141E	.0674E
								0024	.114E	.0738E
								0028	.083E	.0803E
								0033	.053	.0860
								0038	.032	.0896
								0043	.018	.0916
								0053	.009	.0939
								0056	.008	.0943
								0100	.007	.0948
								0110	.007	.0960
								0112	.011E	.0962E
								0117	.013E	.0972E
								0127	.012E	.0992E
								0137	.009E	.1009E
								0142	.011E	.1018E
								0157	.004E	.1036E
								0227	.001E	.1047E
								0327	TE	.1052E
								0447	.000E	.1052E

Watershed conditions: Vegetation cover: Approximately 20 percent of the area dominated by desert shrubs (whitethorn, creosotebush, tarbush) with a crown spread of approximately 30 percent cover and an understory of grasses with basal area of less than 1 percent. The remaining 80 percent of the area supports a grass cover (black grama, curly mesquite grass, sideoats grama) with a basal cover of about 2.5 percent interspersed with desert shrubs averaging less than 5 percent crown cover.

NOTES: TO CONVERT RUNOFF IN IN/HR TO CFS, MULTIPLY BY 2051.9. FOR TOPOGRAPHIC MAP OF WATERSHED, SEE HYDROLOGIC DATA FOR EXPERIMENTAL AGRICULTURAL WATERSHEDS IN THE U. S. 1960-61, USDA MISC. PUB. 994, P. 63.1-2. FOR GEOLOGIC AND VEGETATION MAPS SEE P. 63.1-3 AND P. 63.1-4, THIS VOLUME. 4/ ISOHYETAL MAP ON P. 63.1-5.

#1216
1965

July 17-18, 1965



September 4, 1965

TOMBSTONE, ARIZONA WATERSHED 63.011

MONTHLY PRECIPITATION AND RUNOFF (inches)

TOMBSTONE, ARIZONA WATERSHED 63.011
AREA — 2035 ACRES (3.18 SQ. MILES) 63.11

YEAR \ MONTH		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	ANNUAL
1966	P 1/													
	Q	.00	.00	.00	.00	.00	.00	.31	.06	T	.00	.00	.00	.37
STA AV 2/ (63-66)	P													
	Q													
MEAN 70 YR	P 3/	.84	.77	.61	.28	.18	.49	3.65	3.50	1.52	.66	.63	.88	14.01

ANNUAL MAXIMUM DISCHARGES (inches per hour) AND ANNUAL MAXIMUM VOLUMES OF RUNOFF (inches) FOR SELECTED TIME INTERVALS

YEAR	MAXIMUM DISCHARGE		MAXIMUM VOLUME FOR SELECTED TIME INTERVAL													
			1 HOUR		2 HOURS		6 HOURS		12 HOURS		1 DAY		2 DAYS		8 DAYS	
	DATE	RATE	DATE	VOLUME	DATE	VOLUME	DATE	VOLUME	DATE	VOLUME	DATE	VOLUME	DATE	VOLUME	DATE	VOLUME
1966	7-30	.52	7-30	.24	7-30	.26E	7-30	.26E	7-30	.26E	7-30	.26E	7-30	.26E	7-28	.31E
MAXIMUMS FOR PERIOD OF RECORD																
1963 TO 1966	9-11 1964	.83	9-10 1964	.62	9-9 1964	.75	9-9 1964	.77	9-9 1964	.97	9-9 1964	.97	9-10 1964	1.46	9-8 1964	1.70

Notes: Watershed conditions: Same as for Selected Events, see below. 1/ Not available, data are being reevaluated. 2/ Precipitation and runoff records began in 1963. 3/ Mean P based on 70-yr (1897-1966) U.S. Weather Bureau record period at Tombstone, Ariz.

1966 SELECTED RUNOFF EVENT

TOMBSTONE, ARIZONA WATERSHED 63.011 63.11

Event of July 30, 1966 4/

ANTECEDENT CONDITIONS			RAINFALL				RUNOFF			
DATE MO-DAY	RAINFALL (inches)	RUNOFF (inches)	DATE MO-DAY	TIME OF DAY	INTENSITY (in/hr)	ACC. (inches)	DATE MO-DAY	TIME OF DAY	RATE (in/hr)	ACC. (inches)
	RG R-55		7-30	RG	R-55		7-30			
7-8	.09	.0000		1532	.00	.00		1643	.000	.0000
7-16	.21	.0000		1537	.48	.04		1644	.001	.0000
7-18	.09	.0000		1539	1.50	.09		1645	.004	.0000
7-19	.12	.0000		1543	1.95	.22		1646	.013	.0002
7-20	1.36	.0033		1545	2.70	.31		1647	.038	.0006
7-22	.11	.0000		1553	.30	.35		1648	.057	.0014
7-24	.27	.0000		1557	1.50	.45		1649	.079	.0025
7-26	.07	.0000		1559	1.50	.50		1650	.116	.0041
7-27	.28	.0000		1603	.75	.55		1651	.161	.0065
7-28	2.88	.0443		1605	2.10	.62		1652	.223	.0097
7-29	.65	.0050E		1611	.70	.69		1653	.266	.0137
				1615	1.80	.81		1654	.296	.0184
				1621	.40	.85		1655	.317	.0235
				1623	3.00	.95		1656	.349	.0291
				1625	6.30	1.16		1657	.390	.0352
				1627	2.40	1.24		1659	.431	.0489
				1631	2.25	1.39		1701	.469	.0639
				1636	1.68	1.53		1703	.507	.0801
				1639	4.40	1.75		1706	.523	.1059
				1641	6.30	1.96		1708	.509	.1231
				1647	.50	2.01		1710	.489	.1398
				1651	1.50	2.11		1711	.467	.1477
				1655	1.05	2.18		1712	.431	.1552
				1702	.26	2.21		1713	.399	.1621
					.26					
				1719	.00	2.21		1714	.376	.1686
				1731	.40	2.29		1715	.358	.1747
								1716	.327	.1804
								1717	.300	.1856
								1718	.264	.1903
								1820	.243	.1988
								1722	.196	.2061
								1724	.169	.2122
								1726	.136	.2173
								1728	.112	.2214

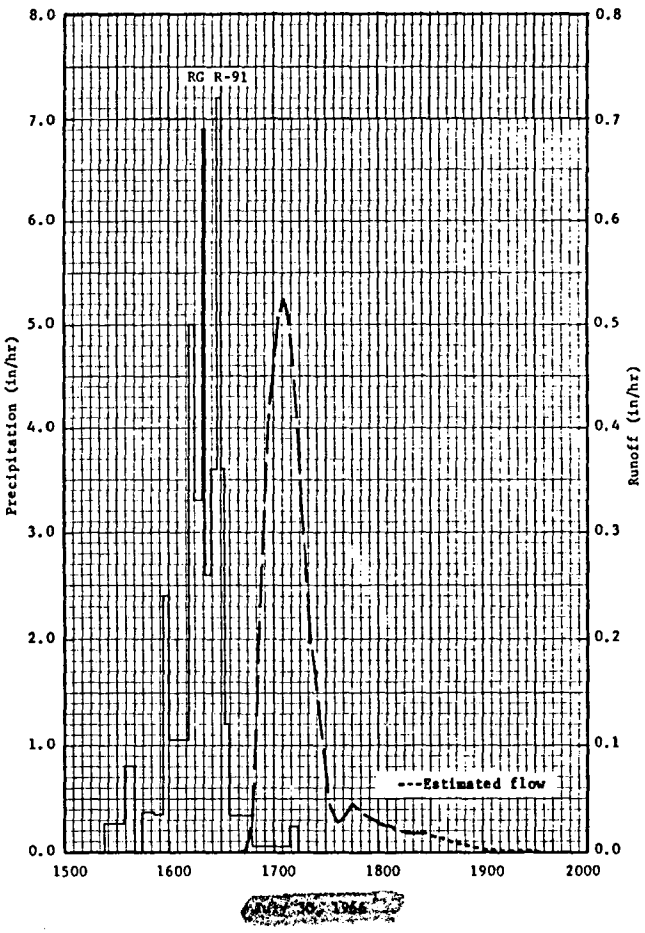
Watershed conditions: Vegetation cover: Approximately 20% of the area dominated by desert shrubs (whitethorn, creosotebush, tarbush) with a crown spread of approximately 30% cover and an understory of grasses with basal area of less than 1%. The remaining 80% of the area supports a grass cover (black grama, curly mesquite grass, sideoats grama) with a basal cover of about 2.5% interspersed with desert shrubs averaging less than 5% crown cover.

Continued on next page

NOTES: TO CONVERT RUNOFF IN IN/HR TO CFS, MULTIPLY BY 2051.9. FOR TOPOGRAPHIC MAP OF WATERSHED, SEE P. 63.1-3, THIS VOLUME. GEOLOGIC AND VEGETATION MAPS ON P. 63.1-4 AND P. 63.1-5. 4/ ISOHYETAL MAP ON P. 63.1-8.

1966 SELECTED RUNOFF EVENT					TOMBSTONE, ARIZONA WATERSHED 63.011					63.11
ANTECEDENT CONDITIONS			RAINFALL				RUNOFF			
DATE MO-DAY	RAINFALL (inches)	RUNOFF (inches)	DATE MO-DAY	TIME OF DAY	INTENSITY (in/hr)	ACC. (inches)	DATE MO-DAY	TIME OF DAY	RATE (in/hr)	ACC. (inches)
			Event of July 30, 1966 - Continued							
	RG R-91		7-30	RG	R-91		7-30	1730	.089	.2247
7-8	.10	.0000		1523	.00	.00		1732	.054	.2271
7-16	.28	.0000		1534	.27	.05		1734	.035	.2286
7-18	.17	.0000		1540	.80	.13		1737	.027	.2302
7-19	.08	.0000		1544	.00	.13		1742	.036	.2328
7-20	1.50	.0033		1552	.38	.18		1746	.044	.2355
7-22	.15	.0000		1557	.36	.21		1748	.039	.2369
7-24	.23	.0000		1600	2.40	.33		1752	.035	.2393
7-26	.07	.0000		1604	1.05	.40		1757	.030	.2420
7-27	.34	.0000		1612	1.05	.54		1802	.025	.2443
7-28	2.70	.0443		1615	5.00	.79		1807	.024	.2463
7-29	.51	.0050E		1619	3.30	1.01		1812	.020	.2481
				1621	6.90	1.24		1817	.017	.2497
				1624	2.60	1.37		1822	.018	.2511
				1628	3.60	1.61		1827	.017	.2526
				1630	7.20	1.85		1832	.014E	.2539E
				1632	3.60	1.97		1837	.012E	.2549E
				1634	1.20	2.01		1842	.009E	.2558E
				1648	.34	2.09		1847	.007E	.2565E
				1709	.06	2.11		1852	.005E	.2570E
				1714	.24	2.13		1857	.003E	.2573E
								1902	.002E	.2575E
								1912	.001E	.2578E
								1922	.001E	.2579E
								1932	.000E	.2580E
								1947	.000E	.2580E
								2002	.000E	.2581E
								2032	.000E	.2581E
								2102	.000E	.2581E
							7-31	0002	.000E	.2581E
								0300E	.000E	.2581E

NOTES: TO CONVERT RUNOFF IN IN/HR TO CFS, MULTIPLY BY 2051.9.



TOMBSTONE, ARIZONA WATERSHED 63.011

1970 MEAN DAILY DISCHARGE (cfs) TOMBSTONE, ARIZONA W-11

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.752	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 T	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 T	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.002	0.0 T	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.111E	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.845E	0.0	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.898	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 T	0.0	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0	0.0	10.952E	0.0	0.0	0.0	0.0	0.0
21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0	0.0	0.939	0.0	0.0	0.0	0.0	0.0
25	0.0	0.0	0.0	0.0	0.0	0.0	0.236E	0.0	0.0	0.0	0.0	0.0
26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 T	0.0	0.0	0.0	0.0
27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	0.0	0.0	0.0	0.0	0.0	0.0	0.236	0.0	0.0	0.0	0.0	0.0
29	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	0.0		0.0	0.0	0.0	0.0	0.001	0.0	0.0	0.0	0.0	0.0
31	0.0		0.0		0.0		2.315	0.0		0.0		0.0
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.4735	0.5680	0.0	0.0	0.0	0.0
INCHES	0.0	0.0	0.0	0.0	0.0	0.0	0.172	0.206	0.0	0.0	0.0	0.0
STA AV	0.0	0.0	0.0	0.0	0.0	0.0	0.120	0.144	0.019	0.0	0.0	0.0

NOTES: To convert mean daily discharge values in CFS to IN/ DAY, multiply by 0.011696. STA AV values are for 4 yr only (1966, 1968-70).

1970 SELECTED RUNOFF EVENT TOMBSTONE, ARIZONA W-11

ANTECEDENT CONDITIONS Date No-Day	Rainfall (inches)	Runoff (inches)	RAINFALL Date No-Day	Time of Day	Intensity (in/hr)	Acc. (inches)	RUNOFF Date No-Day	Time of Day	Rate (cfs)	Acc. (inches)
			EVENT OF JULY 20, 1970							
RG 000091				RG 000091						
7-20	0.0	0.0	7-20	1730	0.0	0.0	7-20	1802	0.0	0.0
				1734	1.9500	0.13		1803	0.288	0.0
				1737	3.6009	0.31		1805	2.851	0.0
				1741	3.9001	0.57		1810	5.800	0.0002
				1745	3.2993	0.79		1811	126.756	0.0007
				1750	1.4401	0.91		1812	178.713	0.0022
				1754	2.5500	1.08		1813	270.147	0.0039
				1757	5.5997	1.36		1814	394.969	0.0064
				1802	1.8001	1.51		1815	446.081	0.0104
				1807	1.0801	1.60		1816	469.298	0.0139
				1818	0.1636	1.63		1817	472.656	0.0175
				1924	0.0091	1.64		1818	479.406	0.0211
				1931	0.5143	1.70		1819	493.031	0.0257
				1935	0.9000	1.76		1820	479.406	0.0294
				1952	0.1412	1.80		1821	469.298	0.0330
				2052	0.0100	1.81		1823	479.406	0.0411
				2056	0.4500	1.84		1824	482.798	0.0448
				2141	0.0533	1.88		1825	465.948	0.0484
								1827	416.995	0.0560
								1830	388.774	0.0660
								1835	302.708	0.0798
								1840	250.379	0.0909
								1845	185.823	0.1000
								1850	143.101	0.1066
								1855	111.389	0.1117
								1900	85.865	0.1158
								1905	65.185	0.1188
								1910	51.787	0.1211
								1915	41.375	0.1231
								1920	31.405	0.1246
								1925	19.792	0.1256
								1930	13.282	0.1263
								1940	7.513	0.1271
								1950	4.804	0.1276
								2000	2.851	0.1279

WATERSHED CONDITIONS:
Vegetative cover: Approximately 20% of the area is dominated by desert shrubs (whitethorn, creosotbush, tarbush) with a crown spread of approximately 30% cover and an understory of grasses with basal area of less than 1%. The remaining 80% of the area supports a grass cover (black grass, curly mesquite, sideoats grama) with basal cover of about 2.5% interspersed with desert shrubs averaging less than 5% crown cover.

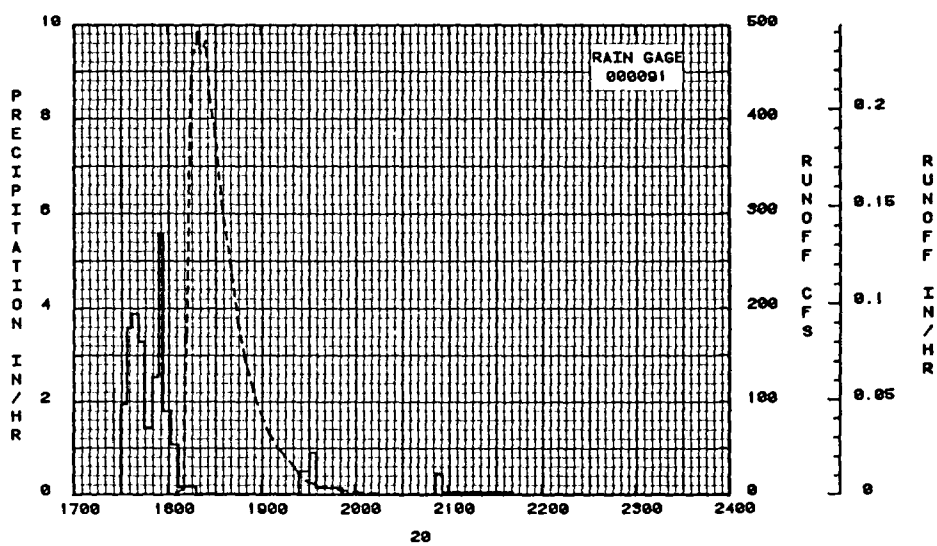
NOTES: To convert runoff in CFS to IN/HR, multiply by 0.000487.

1380
1970

1970 SELECTED RUNOFF EVENT TOMBSTONE, ARIZONA W-11

ANTECEDENT CONDITIONS Date Mo-Day	Rainfall (inches)	Runoff (inches)	RAINFALL Date Mo-Day	Time of Day	Intensity (in/hr)	Acc. (inches)	RUNOFF Date Mo-Day	Time of Day	Rate (cfs)	Acc. (inches)
			EVENT OF JULY 20, 1970 (CONTINUED)							
							7-20	2010	0.709	0.1280
								2020	0.151	0.1280
								2030	0.0	0.1280

NOTES: To convert runoff in CFS to IN/HR, multiply by 0.000487.



EVENT OF JULY 20, 1970
TOMBSTONE, ARIZONA W-11

11 WG 1. RUN

63,011
Runoff
13 Sept 75

C>

163011	9	13	75	1618	0.00	0.000	0.000	0.000	0.0000	0
63011	9	13	75	1620	0.13	0.908	0.000	0.000	0.0000	0
63011	9	13	75	1623	0.36	8.311	0.004	0.000	0.0001	0
63011	9	13	75	1626	1.00	84.187	0.041	0.001	0.0012	0
63011	9	13	75	1629	1.32	156.353	0.076	0.003	0.0041	0
63011	9	13	75	1631	1.69	263.882	0.129	0.003	0.0075	0
63011	9	13	75	1634	2.00	363.878	0.177	0.008	0.0151	0
63011	9	13	75	1636	2.32	477.652	0.233	0.007	0.0219	0
63011	9	13	75	1639	2.60	588.136	0.287	0.013	0.0349	0
63011	9	13	75	1642	2.77	655.071	0.319	0.015	0.0500	0
63011	9	13	75	1645	2.87	698.248	0.340	0.016	0.0665	0
63011	9	13	75	1649	2.79	666.607	0.325	0.022	0.0887	0
63011	9	13	75	1651	2.77	655.922	0.320	0.011	0.0994	0
63011	9	13	75	1653	2.81	674.349	0.329	0.011	0.1102	0
63011	9	13	75	1656	2.76	652.944	0.318	0.016	0.1264	0
63011	9	13	75	1701	2.60	584.490	0.285	0.025	0.1515	0
63011	9	13	75	1703	2.46	530.610	0.259	0.009	0.1606	0
63011	9	13	75	1706	2.23	445.177	0.217	0.012	0.1725	0
63011	9	13	75	1709	2.00	364.210	0.178	0.010	0.1824	0
63011	9	13	75	1711	1.70	267.674	0.130	0.005	0.1875	0
63011	9	13	75	1715	1.38	172.200	0.084	0.007	0.1946	0
63011	9	13	75	1720	1.17	119.940	0.058	0.006	0.2005	0
63011	9	13	75	1724	1.00	84.376	0.041	0.003	0.2038	0
63011	9	13	75	1727	0.93	71.889	0.035	0.002	0.2057	0
63011	9	13	75	1729	0.89	64.989	0.032	0.001	0.2068	0
63011	9	13	75	1732	0.83	55.431	0.027	0.002	0.2083	0
63011	9	13	75	1734	0.78	48.497	0.024	0.001	0.2091	0
63011	9	13	75	1736	0.77	46.436	0.023	0.001	0.2099	0
63011	9	13	75	1740	0.79	49.759	0.024	0.002	0.2115	0
63011	9	13	75	1744	0.80	50.467	0.025	0.002	0.2131	0
63011	9	13	75	1745	0.81	52.190	0.025	0.000	0.2135	0
63011	9	13	75	1748	0.78	48.081	0.023	0.001	0.2147	0
63011	9	13	75	1751	0.81	52.480	0.026	0.001	0.2159	0
63011	9	13	75	1753	0.78	48.497	0.024	0.001	0.2167	0
63011	9	13	75	1755	0.78	48.220	0.023	0.001	0.2175	0
63011	9	13	75	1756	0.81	52.045	0.025	0.000	0.2179	0
63011	9	13	75	1800	0.86	60.027	0.029	0.002	0.2197	0
63011	9	13	75	1808	0.81	52.625	0.026	0.004	0.2234	0
63011	9	13	75	1813	0.78	48.916	0.024	0.002	0.2255	0
63011	9	13	75	1819	0.76	45.625	0.022	0.002	0.2278	0
63011	9	13	75	1822	0.74	42.978	0.021	0.001	0.2289	0
63011	9	13	75	1827	0.69	36.150	0.018	0.002	0.2305	0
63011	9	13	75	1832	0.58	24.900	0.012	0.001	0.2317	0
63011	9	13	75	1842	0.45	14.102	0.007	0.002	0.2333	0
63011	9	13	75	1852	0.35	7.994	0.004	0.001	0.2342	0
63011	9	13	75	1902	0.25	3.704	0.002	0.001	0.2347	0
63011	9	13	75	1912	0.17	1.534	0.001	0.000	0.2349	0
63011	9	13	75	1922	0.12	0.699	0.000	0.000	0.2350	0
63011	9	13	75	1932	0.08	0.284	0.000	0.000	0.2350	0
63011	9	13	75	1942	0.05	0.079	0.000	0.000	0.2350	0
63011	9	13	75	2002	0.00	0.000	0.000	0.000	0.2350	0

11WG1. PRC

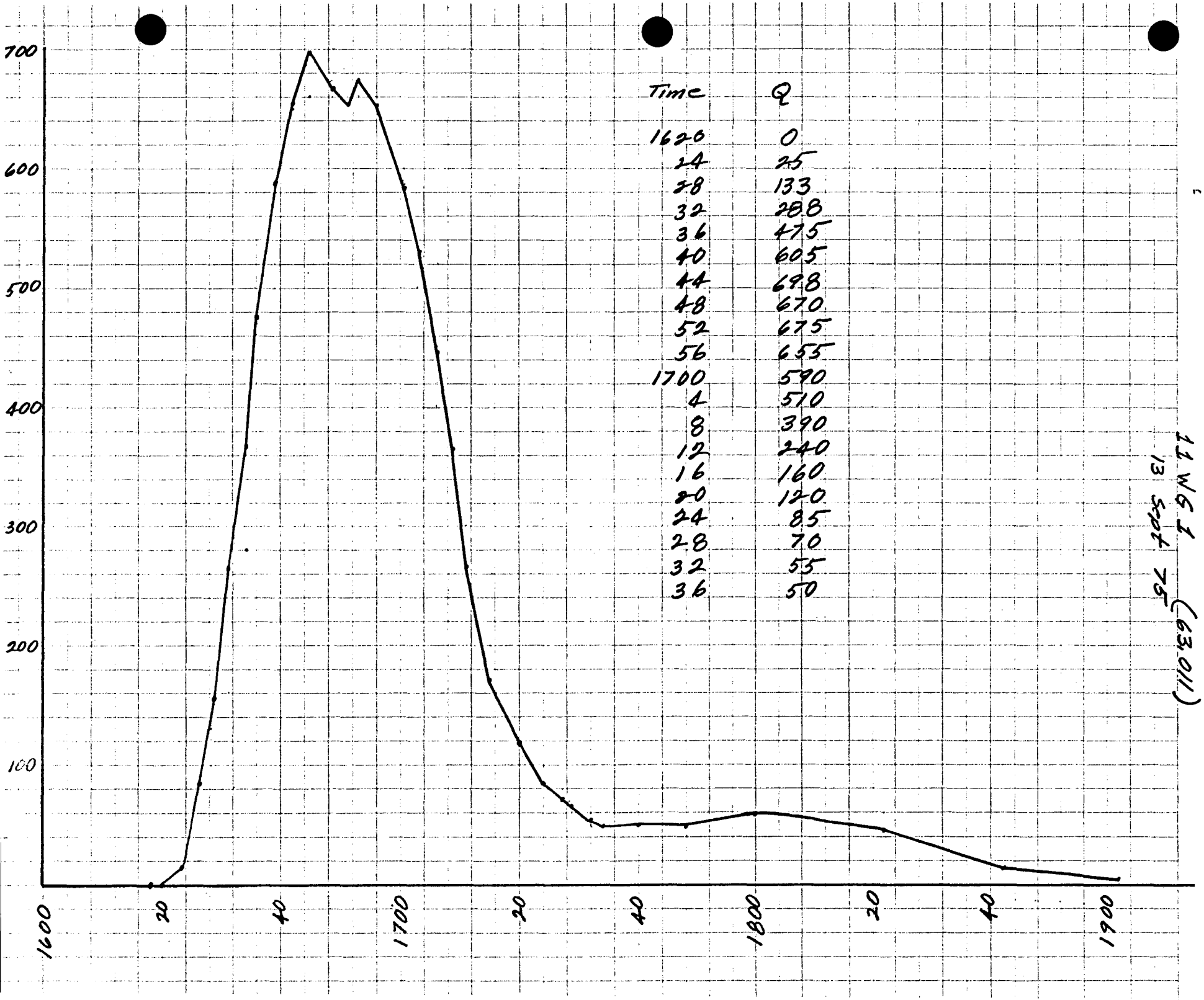
63.011
Precipitation
13 Sept 75

(10) gages

163000000044	9	13	75	1605	0.0000	0.00	0.00	0
63000000044	9	13	75	1608	0.6000	0.03	0.03	0
63000000044	9	13	75	1611	3.0007	0.15	0.18	0
63000000044	9	13	75	1615	3.7492	0.25	0.43	0
63000000044	9	13	75	1619	3.0000	0.20	0.63	0
63000000044	9	13	75	1624	1.8001	0.15	0.78	0
63000000044	9	13	75	1627	3.9998	0.20	0.98	0
63000000044	9	13	75	1629	3.0007	0.10	1.08	0
63000000044	9	13	75	1632	2.9998	0.15	1.23	0
63000000044	9	13	75	1638	0.2000	0.02	1.25	0
63000000044	9	13	75	1651	0.1385	0.03	1.28	0
63000000044	9	13	75	1703	0.1500	0.03	1.31	0
63000000044	9	13	75	1726	0.0261	0.01	1.32	0
63000000044	9	13	75	1824	0.0103	0.01	1.33	0
63000000044	9	13	75	2047	0.0000	0.00	1.33	0
63000000044	9	13	75	2123	0.0167	0.01	1.34	0
163000000051	9	13	75	1600	0.0000	0.00	0.00	0
63000000051	9	13	75	1604	0.9000	0.06	0.06	0
63000000051	9	13	75	1607	0.8002	0.04	0.10	0
63000000051	9	13	75	1611	3.1500	0.21	0.31	0
63000000051	9	13	75	1618	2.9142	0.34	0.65	0
63000000051	9	13	75	1622	2.8500	0.19	0.84	0
63000000051	9	13	75	1627	2.0398	0.17	1.01	0
63000000051	9	13	75	1632	0.6000	0.05	1.06	0
63000000051	9	13	75	1642	0.1200	0.02	1.08	0
63000000051	9	13	75	1658	0.1125	0.03	1.11	0
63000000051	9	13	75	1710	0.0500	0.01	1.12	0
63000000051	9	13	75	1835	0.0071	0.01	1.13	0
63000000051	9	13	75	2046	0.0000	0.00	1.13	0
63000000051	9	13	75	2106	0.0300	0.01	1.14	0
163000000052	9	13	75	1608	0.0000	0.00	0.00	0
63000000052	9	13	75	1614	0.3000	0.03	0.03	0
63000000052	9	13	75	1618	2.2500	0.15	0.18	0
63000000052	9	13	75	1621	4.9997	0.25	0.43	0
63000000052	9	13	75	1626	3.0002	0.25	0.68	0
63000000052	9	13	75	1630	2.2495	0.15	0.83	0
63000000052	9	13	75	1635	2.4002	0.20	1.03	0
63000000052	9	13	75	1643	0.0750	0.01	1.04	0
63000000052	9	13	75	1653	0.2400	0.04	1.08	0
63000000052	9	13	75	1706	0.0462	0.01	1.09	0
63000000052	9	13	75	1746	0.0300	0.02	1.11	0
63000000052	9	13	75	1829	0.0140	0.01	1.12	0
63000000052	9	13	75	1937	0.0088	0.01	1.13	0
63000000052	9	13	75	2053	0.0000	0.00	1.13	0
63000000052	9	13	75	2116	0.0261	0.01	1.14	0
163000000054	9	13	75	1605	0.0000	0.00	0.00	0
63000000054	9	13	75	1613	0.1500	0.02	0.02	0
63000000054	9	13	75	1617	0.6000	0.04	0.06	0
63000000054	9	13	75	1622	0.7200	0.06	0.12	0
63000000054	9	13	75	1625	1.9999	0.10	0.22	0
63000000054	9	13	75	1628	1.9999	0.10	0.32	0

63000000054	9	13	75	1630	2.9994	0.10	0.42	0
63000000054	9	13	75	1632	1.5004	0.05	0.47	0
63000000054	9	13	75	1636	0.7500	0.05	0.52	0
63000000054	9	13	75	1640	1.5000	0.10	0.62	0
63000000054	9	13	75	1644	1.0500	0.07	0.69	0
63000000054	9	13	75	1649	0.1200	0.01	0.70	0
63000000054	9	13	75	1656	0.1714	0.02	0.72	0
63000000054	9	13	75	1704	0.2250	0.03	0.75	0
63000000054	9	13	75	1709	0.0000	0.00	0.75	0
63000000054	9	13	75	1718	0.0667	0.01	0.76	0
63000000054	9	13	75	1825	0.0090	0.01	0.77	0
63000000054	9	13	75	2019	0.0000	0.00	0.77	0
63000000054	9	13	75	2112	0.0113	0.01	0.78	0
16300000055	9	13	75	1608	0.0000	0.00	0.00	0
63000000055	9	13	75	1615	0.0857	0.01	0.01	0
63000000055	9	13	75	1620	0.4800	0.04	0.05	0
63000000055	9	13	75	1623	0.9999	0.05	0.10	0
63000000055	9	13	75	1627	1.5000	0.10	0.20	0
63000000055	9	13	75	1630	2.9998	0.15	0.35	0
63000000055	9	13	75	1635	1.8001	0.15	0.50	0
63000000055	9	13	75	1639	1.8000	0.12	0.62	0
63000000055	9	13	75	1642	0.6000	0.03	0.65	0
63000000055	9	13	75	1646	0.7500	0.05	0.70	0
63000000055	9	13	75	1649	0.9999	0.05	0.75	0
63000000055	9	13	75	1659	0.1800	0.03	0.78	0
63000000055	9	13	75	1707	0.1500	0.02	0.80	0
63000000055	9	13	75	1718	0.0545	0.01	0.81	0
63000000055	9	13	75	1918	0.0000	0.00	0.81	0
63000000055	9	13	75	2029	0.0085	0.01	0.82	0
63000000055	9	13	75	2114	0.0133	0.01	0.83	0
16300000056	9	13	75	1612	0.0000	0.00	0.00	0
63000000056	9	13	75	1616	0.4500	0.03	0.03	0
63000000056	9	13	75	1620	1.0500	0.07	0.10	0
63000000056	9	13	75	1622	6.0015	0.20	0.30	0
63000000056	9	13	75	1626	1.8000	0.12	0.42	0
63000000056	9	13	75	1630	2.3995	0.16	0.58	0
63000000056	9	13	75	1634	1.2000	0.08	0.66	0
63000000056	9	13	75	1640	1.5001	0.15	0.81	0
63000000056	9	13	75	1647	0.1714	0.02	0.83	0
63000000056	9	13	75	1656	0.1333	0.02	0.85	0
63000000056	9	13	75	1707	0.1091	0.02	0.87	0
63000000056	9	13	75	1722	0.0400	0.01	0.88	0
63000000056	9	13	75	1828	0.0091	0.01	0.89	0
63000000056	9	13	75	2052	0.0000	0.00	0.89	0
63000000056	9	13	75	2108	0.0375	0.01	0.90	0
63000000056	9	13	75	2117	0.0667	0.01	0.91	0
16300000088	9	13	75	1608	0.0000	0.00	0.00	0
63000000088	9	13	75	1614	0.1000	0.01	0.01	0
63000000088	9	13	75	1619	0.5999	0.05	0.06	0
63000000088	9	13	75	1622	2.0005	0.10	0.16	0
63000000088	9	13	75	1627	2.9996	0.25	0.41	0
63000000088	9	13	75	1630	1.9999	0.10	0.51	0
63000000088	9	13	75	1633	2.6006	0.13	0.64	0
63000000088	9	13	75	1640	1.0286	0.12	0.76	0
63000000088	9	13	75	1646	0.3000	0.03	0.79	0
63000000088	9	13	75	1651	0.2400	0.02	0.81	0
63000000088	9	13	75	1659	0.1500	0.02	0.83	0
63000000088	9	13	75	1707	0.0750	0.01	0.84	0
63000000088	9	13	75	1716	0.0667	0.01	0.85	0
63000000088	9	13	75	1731	0.0400	0.01	0.86	0
63000000088	9	13	75	2056	0.0000	0.00	0.86	0
63000000088	9	13	75	2112	0.0375	0.01	0.87	0
16300000089	9	13	75	1600	0.0000	0.00	0.00	0
63000000089	9	13	75	1602	0.6001	0.02	0.02	0
63000000089	9	13	75	1605	2.3999	0.12	0.14	0

63000000089	9	13	75	1610	1.2001	0.10	0.24	0
63000000089	9	13	75	1614	3.0000	0.20	0.44	0
63000000089	9	13	75	1617	1.9999	0.10	0.54	0
63000000089	9	13	75	1620	1.7999	0.09	0.63	0
63000000089	9	13	75	1623	1.7999	0.09	0.72	0
63000000089	9	13	75	1626	0.8002	0.04	0.76	0
63000000089	9	13	75	1633	0.2571	0.03	0.79	0
63000000089	9	13	75	1640	0.1714	0.02	0.81	0
63000000089	9	13	75	1647	0.1714	0.02	0.83	0
63000000089	9	13	75	1655	0.0750	0.01	0.84	0
63000000089	9	13	75	2035	0.0000	0.00	0.84	0
63000000089	9	13	75	2058	0.0261	0.01	0.85	0
163000000090	9	13	75	1557	0.0000	0.00	0.00	0
63000000090	9	13	75	1602	0.3600	0.03	0.03	0
63000000090	9	13	75	1605	0.8000	0.04	0.07	0
63000000090	9	13	75	1609	1.3500	0.09	0.16	0
63000000090	9	13	75	1614	2.5202	0.21	0.37	0
63000000090	9	13	75	1617	4.9997	0.25	0.62	0
63000000090	9	13	75	1621	1.5000	0.10	0.72	0
63000000090	9	13	75	1627	1.2999	0.13	0.85	0
63000000090	9	13	75	1631	0.4500	0.03	0.88	0
63000000090	9	13	75	1639	0.1500	0.02	0.90	0
63000000090	9	13	75	1647	0.0750	0.01	0.91	0
63000000090	9	13	75	1659	0.1500	0.03	0.94	0
63000000090	9	13	75	1716	0.0353	0.01	0.95	0
63000000090	9	13	75	1824	0.0000	0.00	0.95	0
63000000090	9	13	75	2011	0.0056	0.01	0.96	0
63000000090	9	13	75	2057	0.0130	0.01	0.97	0
163000000091	9	13	75	1611	0.0000	0.00	0.00	0
63000000091	9	13	75	1615	0.4499	0.03	0.03	0
63000000091	9	13	75	1617	0.6001	0.02	0.05	0
63000000091	9	13	75	1622	1.3201	0.11	0.16	0
63000000091	9	13	75	1625	2.3999	0.12	0.28	0
63000000091	9	13	75	1629	3.0000	0.20	0.48	0
63000000091	9	13	75	1632	1.9999	0.10	0.58	0
63000000091	9	13	75	1637	1.2001	0.10	0.68	0
63000000091	9	13	75	1643	0.9999	0.10	0.78	0
63000000091	9	13	75	1648	0.1200	0.01	0.79	0
63000000091	9	13	75	1655	0.1714	0.02	0.81	0
63000000091	9	13	75	1706	0.1091	0.02	0.83	0
63000000091	9	13	75	1720	0.0429	0.01	0.84	0
63000000091	9	13	75	1912	0.0054	0.01	0.85	0
63000000091	9	13	75	2051	0.0000	0.00	0.85	0
63000000091	9	13	75	2110	0.0316	0.01	0.86	0



Time	Q
1620	0
24	25
28	133
32	288
36	475
40	605
44	698
48	670
52	675
56	655
1700	590
4	510
8	390
12	240
16	160
20	120
24	85
28	70
32	55
36	50

11 MGT
13 Sept 75 (63 011)

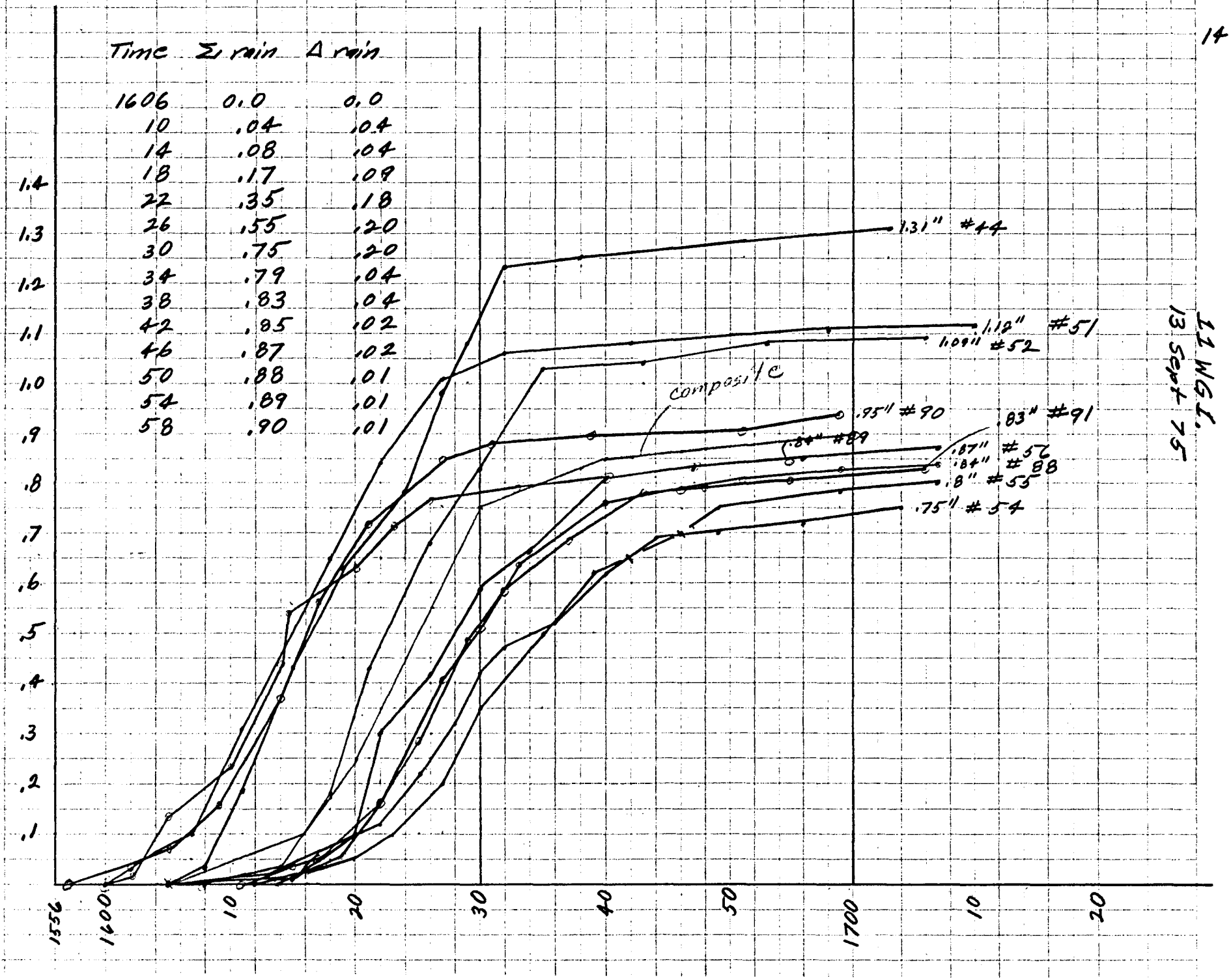
14 Oct 87

14 Oct 87

13 Sept 75

11 MST

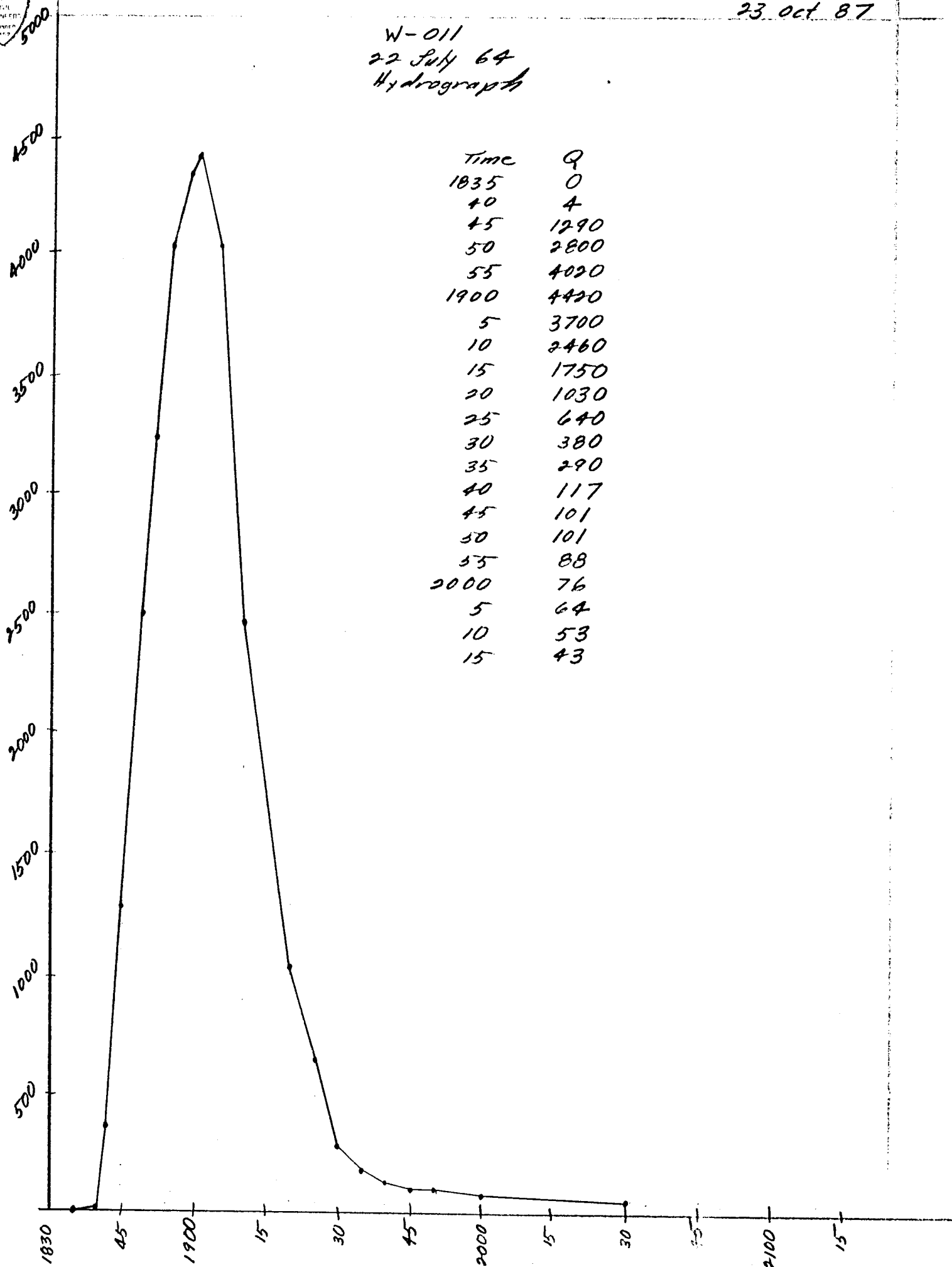
Time	Σ rain	Δ rain
1606	0.0	0.0
10	.04	.04
14	.08	.04
18	.17	.09
22	.35	.18
26	.55	.20
30	.75	.20
34	.79	.04
38	.83	.04
42	.85	.02
46	.87	.02
50	.88	.01
54	.89	.01
58	.90	.01



11-2

23 Oct 87

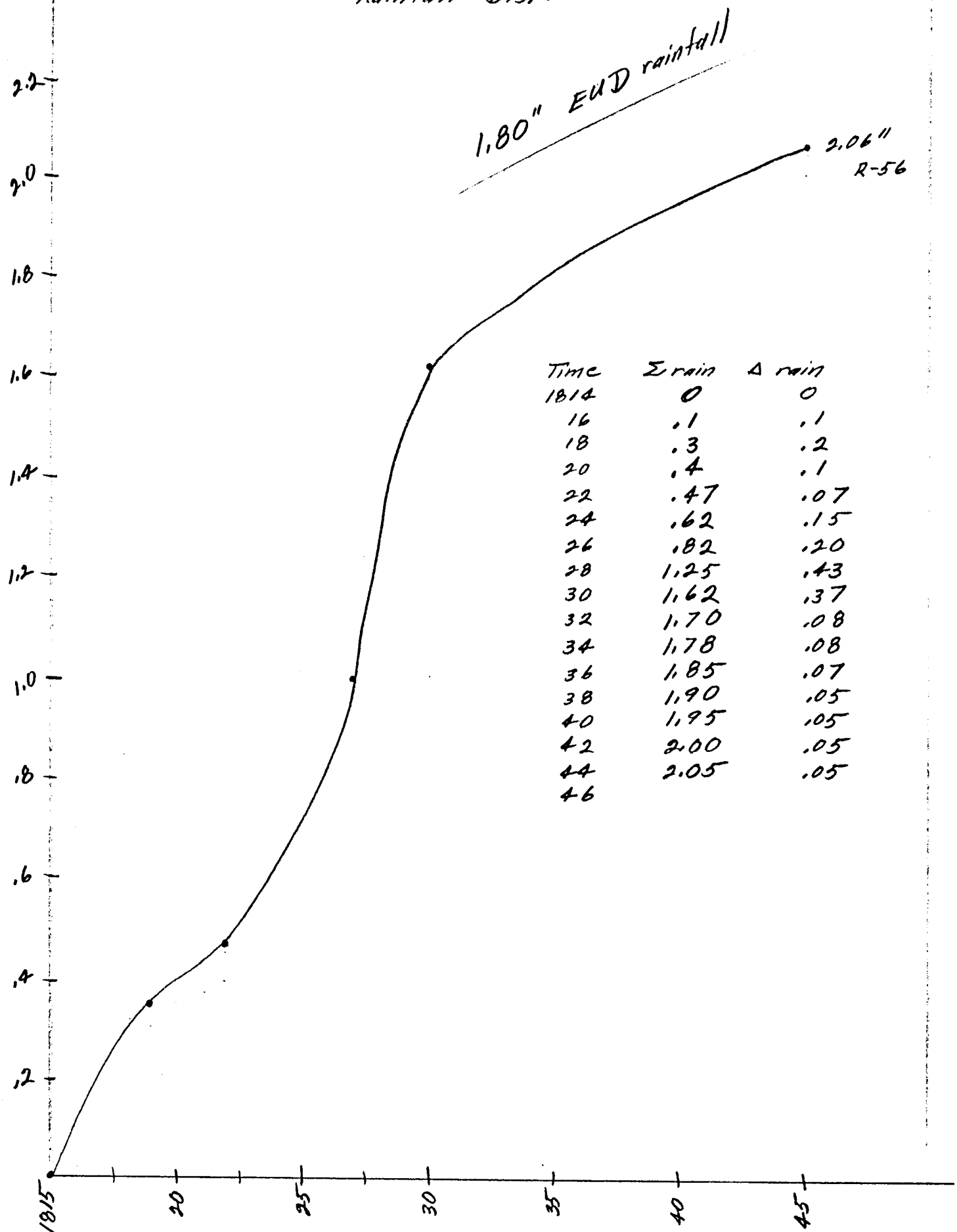
W-011
22 July 64
Hydrograph



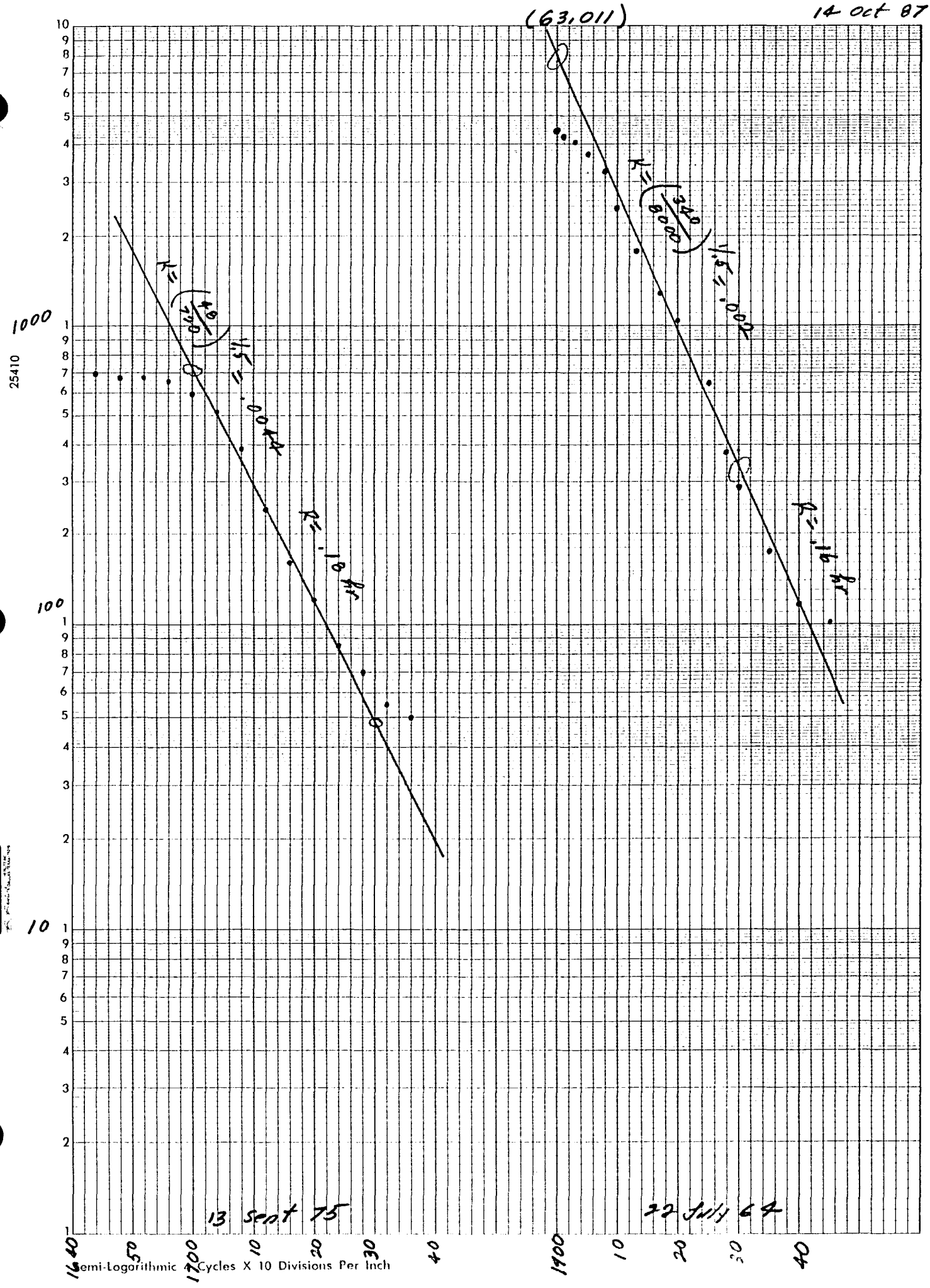
Time	Q
1835	0
40	4
45	1290
50	2800
55	4020
1900	4420
5	3700
10	2460
15	1750
20	1030
25	640
30	380
35	290
40	117
45	101
50	101
55	88
2000	76
5	64
10	53
15	43

23 Oct 87

W-011
22 July 64
Raintall Dist.



Time	Σ rain	Δ rain
1814	0	0
16	.1	.1
18	.3	.2
20	.4	.1
22	.47	.07
24	.62	.15
26	.82	.20
28	1.25	.43
30	1.62	.37
32	1.70	.08
34	1.78	.08
36	1.85	.07
38	1.90	.05
40	1.95	.05
42	2.00	.05
44	2.05	.05
46		


(63,011)
14 Oct 87
1000
100
10
25410
13 Sept 75
22 July 64
Semi-Logarithmic 4 Cycles X 10 Divisions Per Inch

Flood Reconstitution for Walnut Gulch 63.015 15-1

Storm Event 6 Sept 76

Runoff: depth = .08 inches, Q_p = 543 cfs at t_p = 1.40 hours

$R_{recession}$ = .36 hrs

INPUT (1) Area acres	(2) Eff. Imp. Area %	(3) Rain in.	(4) Comp. Inter. min.	(5) Time-Area	(6)	Results (7) Q_p cfs	(8) t_p hr.	(9) T_c hr.	(10) R hr.	(11) STRTL in.	(12) CNSTL in/hr	(13) Output File	(14) Comment
5912	0	.70	4	D		404	1.40	1.25	.51	.57	.56	ϕ 1	
"	"	"	"	N-4		510	1.40	2.51	.36	.57	.49	ϕ 2	← best

TOMBSTONE, ARIZONA WALNUT GULCH WATERSHED 63.015

LOCATION: Cochise County; three fourths of a mile east of Tombstone; Walnut Gulch, San Pedro River, Gila River, Colorado River Basin.

AREA: 9.24 sq. mi. (5912 ac.) SHAPE: Roughly circular, diameter of 3.5 miles.

SLOPES: Not available.

SOILS: Boothill, a stony clay loam developed on andesite extrusions; calcareous throughout the profile; moderately permeable -- 15%. Cave, a gravelly sandy loam developed on outwash material from andesite extrusions; calcareous throughout the profile; moderately permeable -- 15%. Tombstone, a gravelly loam, calcareous throughout, moderately permeable surface and subsoil -- 43%. Tortgas, developed on limestone; calcareous surface horizon underlain by consolidated caliche -- 8%. The remaining 19% is made up of small bodies of five other moderately permeable soils.

GEOLOGY: This watershed is representative of the Basin and Range Province and is located in south part of 63.001 occupying 16.02 percent of its area. Quaternary and Tertiary alluvium of the Tombstone pediment occurs on 83 percent of the subarea (63.015). The alluvium is made up of permeable lensed and interbedded sand, gravel, conglomerate, caliche conglomerate, and some clay. Two series of conglomerate are recognized beneath the recent alluvium of the Tombstone pediment: A younger conglomerate whose bedding is nearly conformable to the pediment surface and probably considerably older than that surface, and an older Tertiary conglomerate lying unconformably beneath that. These conglomerates are known to persist to depths exceeding 1,200 feet. Topographic expression of the alluvium is that of low undulating hills dissected by present stream channels. Caliche conglomerates of this unit are fairly resistant to erosion and form steep cliffs of low relief in some of the present stream channels. In the east 13 percent of the watershed is made up of highly faulted and fractured Tertiary intrusive and extrusive igneous rocks, mostly volcanics. Extensive folded tuff beds are found underlying andesite-rhyolite flow material. Topographic expression is that of low rolling hills interrupted in places by dike-like ridges. In the south and southwest, thick sections of permian and carboniferous age limestones form low hills and cover 4 percent of the watershed. Numerous intrusive rhyolite dikes and sills invade the limestones and affect surface and subsurface drainage. See geologic map on page 63.1-4 of this volume.

Stratigraphy and Hydrogeology of Walnut Gulch Watershed 63.015

System	Formation and percent of area	Description
Quaternary & Tertiary	Recent alluvium 79%	Gravel, sand, and clay. This, and underlying conglomerates, are important water producers.
	Younger conglomerate ≈ 3%	Gravel, sand, conglomerate, caliche conglomerate, and clay, some boulders.
	Older conglomerate ≈ 1%	Gravel, sand, conglomerate, caliche conglomerate, and clay, some boulders.
Tertiary	S. O. volcanics 13%	Interbedded quartz latite tuffs, andesite-rhyolite flow, pyroclastic sandstone mudstones, and conglomerates. Not important as a water producer.
Permian Carboniferous	Naco limestone 4%	Light-tan to dark-blue limestone. Silica blebs in upper layers. Important water producer.

Source of data: General Geology of Central Cochise County, Arizona, by James Gilluly, U. S. Geological Survey, Professional Paper 281, 1956, and extended field studies by project staff.

INSTRUMENTATION: Precipitation: Measured by 11 recording gages with 24-hour charts.

RUNOFF: Critical depth flume (precalibrated), AD-35 analog strip chart water level recorder.

WATERSHED CONDITIONS: (Revision) Vegetation cover: Desert shrubs (whitethorn, creosote bush, tarbush) occupy 78 percent of the area with a crown spread of approximately 30 percent and an understory of grasses of less than 1 percent basal area. The remaining 22 percent of the area supports a grass cover (black grama, tobosa grass, blue grama, sideoats grama, and curly mesquite grass) of approximately 2 percent basal area.

NOTES: FOR WATERSHED TOPOGRAPHIC MAP SEE HYDROLOGIC DATA FOR EXPERIMENTAL AGRICULTURAL WATERSHEDS IN THE UNITED STATES, 1960-61, USDA MISC. PUB., 994, P. 63.1-2. FOR GEOLOGIC AND VEGETATION MAPS, SEE P. 63.1-4 AND 63.1-5 OF THIS VOLUME. WATERSHED 63.015, ACTIVATED JUNE 15, 1965, REPLACES WATERSHED 63.005. FLUME 63.015 WAS PLACED APPROXIMATELY 0.7 MILE DOWNSTREAM FROM FLUME 63.005 AND MEASURES RUNOFF FROM ESSENTIALLY THE SAME WATERSHED AS 63.005.

15 WG I. RUN

63.015
Runoff
6 Sept 76

C>

163015	9	6	76	11	0.25	3.841	0.001	0.000	0.0000	0
63015	9	6	76	31	0.20	2.327	0.000	0.000	0.0002	0
63015	9	6	76	52	0.18	1.660	0.000	0.000	0.0003	0
63015	9	6	76	106	0.15	1.187	0.000	0.000	0.0004	0
63015	9	6	76	137	0.10	0.504	0.000	0.000	0.0005	0
63015	9	6	76	151	0.09	0.329	0.000	0.000	0.0005	0
63015	9	6	76	206	0.07	0.194	0.000	0.000	0.0005	0
63015	9	6	76	222	0.06	0.125	0.000	0.000	0.0005	0
63015	9	6	76	251	0.03	0.031	0.000	0.000	0.0005	0
63015	9	6	76	314	0.00	0.000	0.000	0.000	0.0005	0
63015	9	6	76	1525	0.00	0.000	0.000	0.000	0.0005	0
63015	9	6	76	1527	0.02	0.017	0.000	0.000	0.0005	0
63015	9	6	76	1531	0.02	0.017	0.000	0.000	0.0005	0
63015	9	6	76	1535	0.05	0.085	0.000	0.000	0.0005	0
63015	9	6	76	1538	0.08	0.249	0.000	0.000	0.0005	0
63015	9	6	76	1540	0.09	0.337	0.000	0.000	0.0005	0
63015	9	6	76	1542	0.09	0.337	0.000	0.000	0.0005	0
63015	9	6	76	1545	0.08	0.264	0.000	0.000	0.0005	0
63015	9	6	76	1548	0.09	0.373	0.000	0.000	0.0005	0
63015	9	6	76	1551	0.10	0.421	0.000	0.000	0.0005	0
63015	9	6	76	1554	0.10	0.483	0.000	0.000	0.0005	0
63015	9	6	76	1600	0.10	0.483	0.000	0.000	0.0005	0
63015	9	6	76	1603	0.09	0.346	0.000	0.000	0.0005	0
63015	9	6	76	1611	0.07	0.181	0.000	0.000	0.0005	0
63015	9	6	76	1613	1.33	159.279	0.027	0.000	0.0009	0
63015	9	6	76	1615	1.57	232.166	0.039	0.001	0.0020	0
63015	9	6	76	1617	1.75	298.445	0.050	0.002	0.0035	0
63015	9	6	76	1622	2.00	401.197	0.067	0.005	0.0084	0
63015	9	6	76	1624	2.07	429.621	0.072	0.002	0.0107	0
63015	9	6	76	1629	2.13	455.177	0.076	0.006	0.0169	0
63015	9	6	76	1630	2.19	483.219	0.081	0.001	0.0182	0
63015	9	6	76	1633	2.25	508.007	0.085	0.004	0.0224	0
63015	9	6	76	1636	2.30	528.502	0.089	0.004	0.0267	0
63015	9	6	76	1637	2.34	546.308	0.092	0.002	0.0282	0
63015	9	6	76	1639	2.35	550.693	0.092	0.003	0.0313	0
63015	9	6	76	1641	2.35	548.936	0.092	0.003	0.0344	0
63015	9	6	76	1643	2.28	521.628	0.087	0.003	0.0374	0
63015	9	6	76	1646	2.22	494.228	0.083	0.004	0.0417	0
63015	9	6	76	1647	2.14	460.292	0.077	0.001	0.0430	0
63015	9	6	76	1649	2.11	445.456	0.075	0.002	0.0455	0
63015	9	6	76	1653	2.00	402.395	0.067	0.005	0.0502	0
63015	9	6	76	1656	1.89	351.781	0.059	0.003	0.0534	0
63015	9	6	76	1658	1.81	322.483	0.054	0.002	0.0553	0
63015	9	6	76	1702	1.75	297.674	0.050	0.004	0.0588	0
63015	9	6	76	1705	1.67	265.586	0.045	0.002	0.0612	0
63015	9	6	76	1709	1.60	240.628	0.040	0.003	0.0640	0
63015	9	6	76	1711	1.51	210.954	0.035	0.001	0.0653	0
63015	9	6	76	1714	1.42	186.246	0.031	0.002	0.0670	0
63015	9	6	76	1718	1.31	154.746	0.026	0.002	0.0689	0
63015	9	6	76	1722	1.21	128.581	0.022	0.002	0.0705	0

63015	9	6	76	1726	1.11	107.650	0.018	0.001	0.0718	0
63015	9	6	76	1731	1.05	94.093	0.016	0.001	0.0732	0
63015	9	6	76	1738	0.99	81.910	0.014	0.002	0.0749	0
63015	9	6	76	1742	0.94	73.251	0.012	0.001	0.0758	0
63015	9	6	76	1752	0.85	58.910	0.010	0.002	0.0776	0
63015	9	6	76	1801	0.79	50.021	0.008	0.001	0.0790	0
63015	9	6	76	1818	0.72	40.910	0.007	0.002	0.0812	0
63015	9	6	76	1828	0.68	35.667	0.006	0.001	0.0823	0
63015	9	6	76	1838	0.66	32.913	0.005	0.001	0.0833	0
63015	9	6	76	1848	0.63	29.641	0.005	0.001	0.0842	0
63015	9	6	76	1902	0.57	23.943	0.004	0.001	0.0852	0
63015	9	6	76	1919	0.51	18.581	0.003	0.001	0.0862	0
63015	9	6	76	1933	0.46	14.597	0.002	0.001	0.0868	0
63015	9	6	76	1948	0.41	11.198	0.002	0.001	0.0873	0
63015	9	6	76	2003	0.35	8.205	0.001	0.000	0.0877	0
63015	9	6	76	2018	0.29	5.119	0.001	0.000	0.0880	0
63015	9	6	76	2033	0.23	3.122	0.001	0.000	0.0882	0
63015	9	6	76	2043	0.20	2.123	0.000	0.000	0.0883	0
63015	9	6	76	2053	0.17	1.575	0.000	0.000	0.0884	0
63015	9	6	76	2114	0.15	1.205	0.000	0.000	0.0885	0
63015	9	6	76	2134	0.15	1.205	0.000	0.000	0.0886	0
63015	9	6	76	2159	0.14	1.033	0.000	0.000	0.0887	0
63015	9	6	76	2229	0.12	0.749	0.000	0.000	0.0888	0
63015	9	6	76	2259	0.11	0.515	0.000	0.000	0.0889	0
63015	9	6	76	2330	0.09	0.364	0.000	0.000	0.0889	0
63015	9	6	76	2400	0.09	0.364	0.000	0.000	0.0889	0

1600-2100

15 WG I. PRC

63.015
Precipitation
6 Sept 76

(15) gages

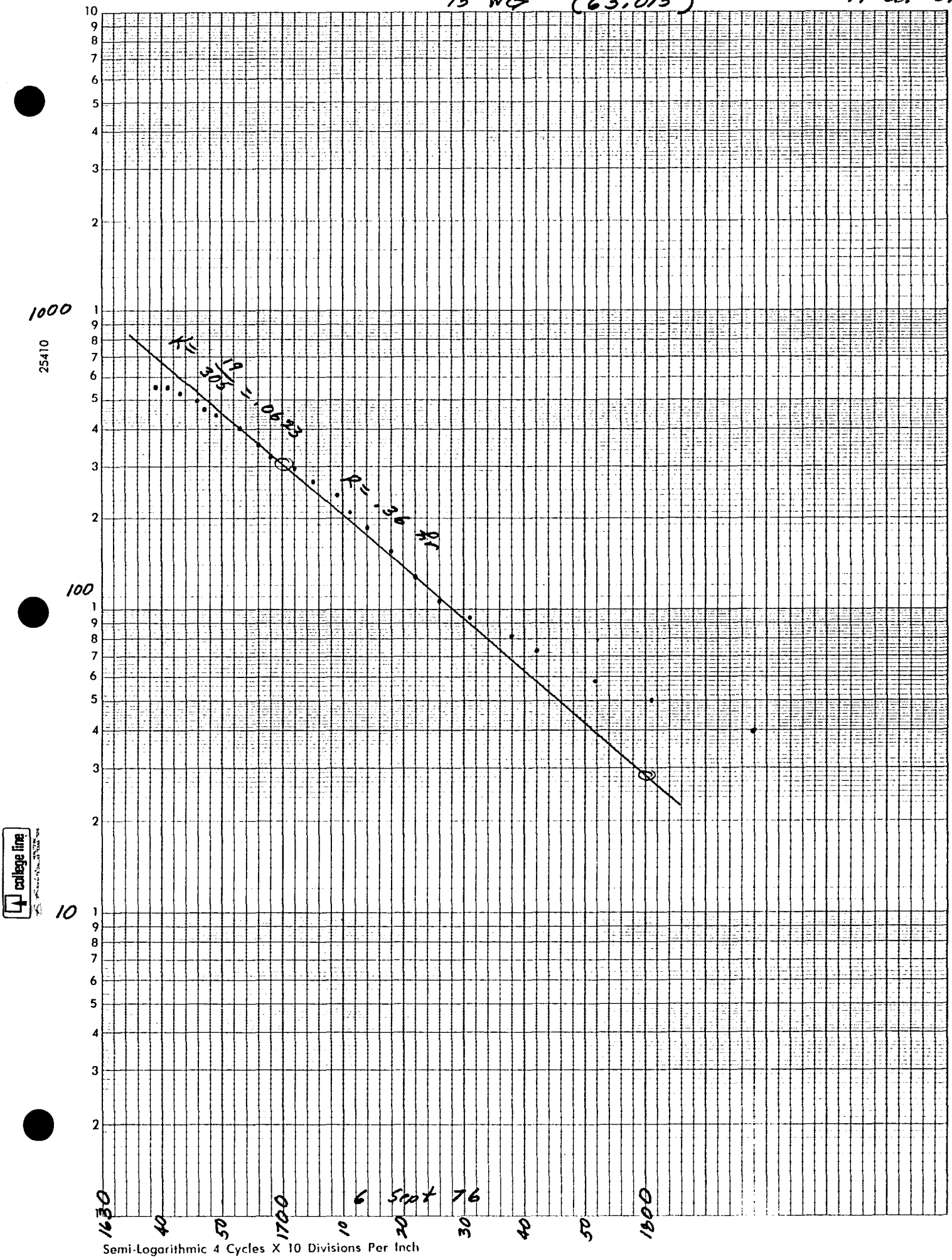
C>

163000000029	9	6	76	1522	0.0000	0.00	0.00	0
63000000029	9	6	76	1528	0.3000	0.03	0.03	0
63000000029	9	6	76	1533	0.1200	0.01	0.04	0
63000000029	9	6	76	1535	2.1000	0.07	0.11	0
63000000029	9	6	76	1538	1.0000	0.05	0.16	0
63000000029	9	6	76	1541	2.4000	0.12	0.28	0
63000000029	9	6	76	1545	0.4500	0.03	0.31	0
63000000029	9	6	76	1556	0.1091	0.02	0.33	0
63000000029	9	6	76	1603	0.0000	0.00	0.33	0
63000000029	9	6	76	1607	0.3000	0.02	0.35	0
163000000030	9	6	76	1519	0.0000	0.00	0.00	0
63000000030	9	6	76	1523	1.0500	0.07	0.07	0
63000000030	9	6	76	1528	0.4800	0.04	0.11	0
63000000030	9	6	76	1530	1.5000	0.05	0.16	0
63000000030	9	6	76	1532	1.5000	0.05	0.21	0
63000000030	9	6	76	1535	1.6000	0.08	0.29	0
63000000030	9	6	76	1546	0.1636	0.03	0.32	0
163000000034	9	6	76	1524	0.0000	0.00	0.00	0
63000000034	9	6	76	1531	0.4286	0.05	0.05	0
63000000034	9	6	76	1534	1.0000	0.05	0.10	0
63000000034	9	6	76	1539	0.4800	0.04	0.14	0
63000000034	9	6	76	1541	2.1000	0.07	0.21	0
63000000034	9	6	76	1544	1.4000	0.07	0.28	0
63000000034	9	6	76	1551	0.2571	0.03	0.31	0
163000000035	9	6	76	1521	0.0000	0.00	0.00	0
63000000035	9	6	76	1528	0.3429	0.04	0.04	0
63000000035	9	6	76	1535	0.8571	0.10	0.14	0
63000000035	9	6	76	1540	0.8400	0.07	0.21	0
63000000035	9	6	76	1544	0.7500	0.05	0.26	0
63000000035	9	6	76	1548	0.4500	0.03	0.29	0
163000000036	9	6	76	1513	0.0000	0.00	0.00	0
63000000036	9	6	76	1519	0.7000	0.07	0.07	0
63000000036	9	6	76	1524	0.8400	0.07	0.14	0
63000000036	9	6	76	1526	1.8000	0.06	0.20	0
63000000036	9	6	76	1529	2.0000	0.10	0.30	0
63000000036	9	6	76	1535	0.3000	0.03	0.33	0
63000000036	9	6	76	1546	0.0545	0.01	0.34	0
163000000037	9	6	76	1508	0.0000	0.00	0.00	0
63000000037	9	6	76	1514	0.3000	0.03	0.03	0
63000000037	9	6	76	1518	1.5000	0.10	0.13	0
63000000037	9	6	76	1521	1.6000	0.08	0.21	0
63000000037	9	6	76	1523	3.3000	0.11	0.32	0
63000000037	9	6	76	1525	4.2000	0.14	0.46	0
63000000037	9	6	76	1527	4.2000	0.14	0.60	0
63000000037	9	6	76	1529	2.4000	0.08	0.68	0
63000000037	9	6	76	1532	2.0000	0.10	0.78	0
63000000037	9	6	76	1535	2.0000	0.10	0.88	0
63000000037	9	6	76	1545	0.0000	0.00	0.88	0
63000000037	9	6	76	1622	0.0162	0.01	0.89	0
163000000041	9	6	76	1522	0.0000	0.00	0.00	0

63000000041	9	6	76	1525	2.6000	0.13	0.13	0
63000000041	9	6	76	1532	1.8000	0.21	0.34	0
63000000041	9	6	76	1534	7.2000	0.24	0.58	0
63000000041	9	6	76	1543	1.0667	0.16	0.74	0
63000000041	9	6	76	1547	0.9000	0.06	0.80	0
163000000042	9	6	76	1504	0.0000	0.00	0.00	0
63000000042	9	6	76	1510	0.3000	0.03	0.03	0
63000000042	9	6	76	1521	1.2545	0.23	0.26	0
63000000042	9	6	76	1523	3.9000	0.13	0.39	0
63000000042	9	6	76	1525	4.2000	0.14	0.53	0
63000000042	9	6	76	1530	1.8000	0.15	0.68	0
63000000042	9	6	76	1535	0.2400	0.02	0.70	0
163000000046	9	6	76	1518	0.0000	0.00	0.00	0
63000000046	9	6	76	1524	0.9000	0.09	0.09	0
63000000046	9	6	76	1528	0.7500	0.05	0.14	0
63000000046	9	6	76	1533	2.6400	0.22	0.36	0
63000000046	9	6	76	1543	1.3200	0.22	0.58	0
63000000046	9	6	76	1551	1.6500	0.22	0.80	0
63000000046	9	6	76	1555	2.5500	0.17	0.97	0
63000000046	9	6	76	1558	2.0000	0.10	1.07	0
63000000046	9	6	76	1604	0.3000	0.03	1.10	0
163000000047	9	6	76	1523	0.0000	0.00	0.00	0
63000000047	9	6	76	1531	1.1250	0.15	0.15	0
63000000047	9	6	76	1536	2.0400	0.17	0.32	0
63000000047	9	6	76	1538	3.0000	0.10	0.42	0
63000000047	9	6	76	1540	7.2000	0.24	0.66	0
63000000047	9	6	76	1542	4.5000	0.15	0.81	0
63000000047	9	6	76	1546	1.3500	0.09	0.90	0
63000000047	9	6	76	1554	1.6500	0.22	1.12	0
163000000048	9	6	76	1505	0.0000	0.00	0.00	0
63000000048	9	6	76	1510	0.4800	0.04	0.04	0
63000000048	9	6	76	1514	2.1000	0.14	0.18	0
63000000048	9	6	76	1520	1.3000	0.13	0.31	0
63000000048	9	6	76	1524	0.1500	0.01	0.32	0
63000000048	9	6	76	1530	1.0000	0.10	0.42	0
63000000048	9	6	76	1537	0.6000	0.07	0.49	0
63000000048	9	6	76	1541	0.1500	0.01	0.50	0
63000000048	9	6	76	1544	1.4000	0.07	0.57	0
63000000048	9	6	76	1547	1.0000	0.05	0.62	0
63000000048	9	6	76	1552	0.6000	0.05	0.67	0
63000000048	9	6	76	1621	0.0414	0.02	0.69	0
163000000049	9	6	76	1504	0.0000	0.00	0.00	0
63000000049	9	6	76	1512	0.9000	0.12	0.12	0
63000000049	9	6	76	1516	1.3500	0.09	0.21	0
63000000049	9	6	76	1522	0.9000	0.09	0.30	0
63000000049	9	6	76	1524	3.9000	0.13	0.43	0
63000000049	9	6	76	1527	1.8000	0.09	0.52	0
63000000049	9	6	76	1531	0.6000	0.04	0.56	0
63000000049	9	6	76	1534	1.0000	0.05	0.61	0
63000000049	9	6	76	1538	0.0000	0.00	0.61	0
63000000049	9	6	76	1543	0.1200	0.01	0.62	0
63000000049	9	6	76	1548	0.2400	0.02	0.64	0
163000000053	9	6	76	1524	0.0000	0.00	0.00	0
63000000053	9	6	76	1531	0.5143	0.06	0.06	0
63000000053	9	6	76	1540	1.2000	0.18	0.24	0
63000000053	9	6	76	1546	1.1000	0.11	0.35	0
63000000053	9	6	76	1552	1.2000	0.12	0.47	0
63000000053	9	6	76	1558	0.9000	0.09	0.56	0
63000000053	9	6	76	1603	1.6800	0.14	0.70	0
63000000053	9	6	76	1609	0.3000	0.03	0.73	0
163000000077	9	6	76	1502	0.0000	0.00	0.00 E	0
63000000077	9	6	76	1547	0.6000	0.45	0.45 E	0
163000000078	9	6	76	1500	0.0000	0.00	0.00	0
63000000078	9	6	76	1510	0.4200	0.07	0.07	0
63000000078	9	6	76	1513	1.0000	0.05	0.12	0

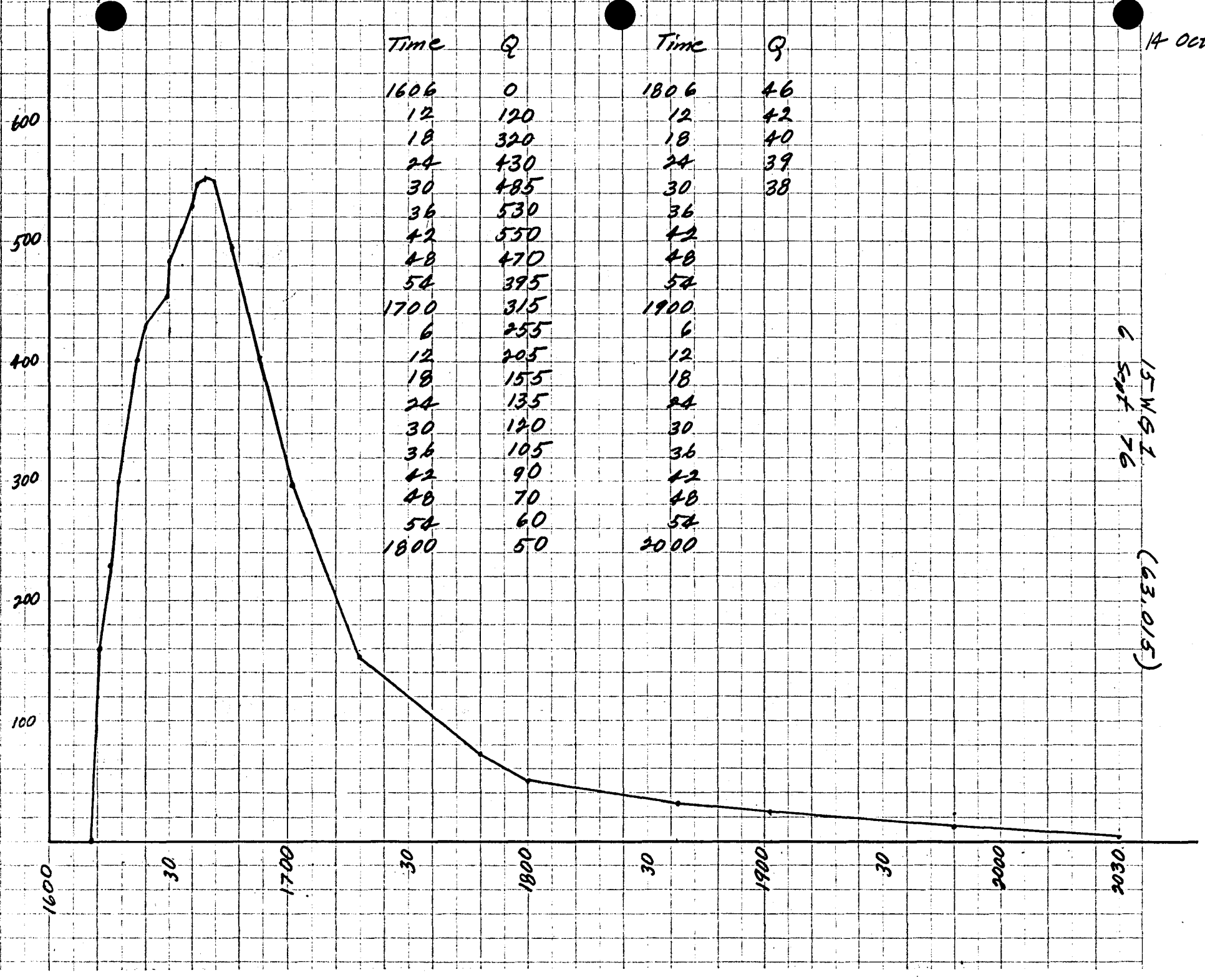
63000000078	9	6	76	1519	0.2000	0.02	0.14	0
63000000078	9	6	76	1541	0.0000	0.00	0.14	0
63000000078	9	6	76	1543	0.6000	0.02	0.16	0
63000000078	9	6	76	1552	0.1333	0.02	0.18	0

15 WG (63,015) 14 oct 87



14 Oct 87

Time	Q	Time	Q
1606	0	1806	46
12	120	12	42
18	320	18	40
24	430	24	39
30	485	30	38
36	530	36	
42	550	42	
48	470	48	
54	395	54	
1700	315	1900	
6	255	6	
12	205	12	
18	155	18	
24	135	24	
30	120	30	
36	105	36	
42	90	42	
48	70	48	
54	60	54	
1800	50	2000	



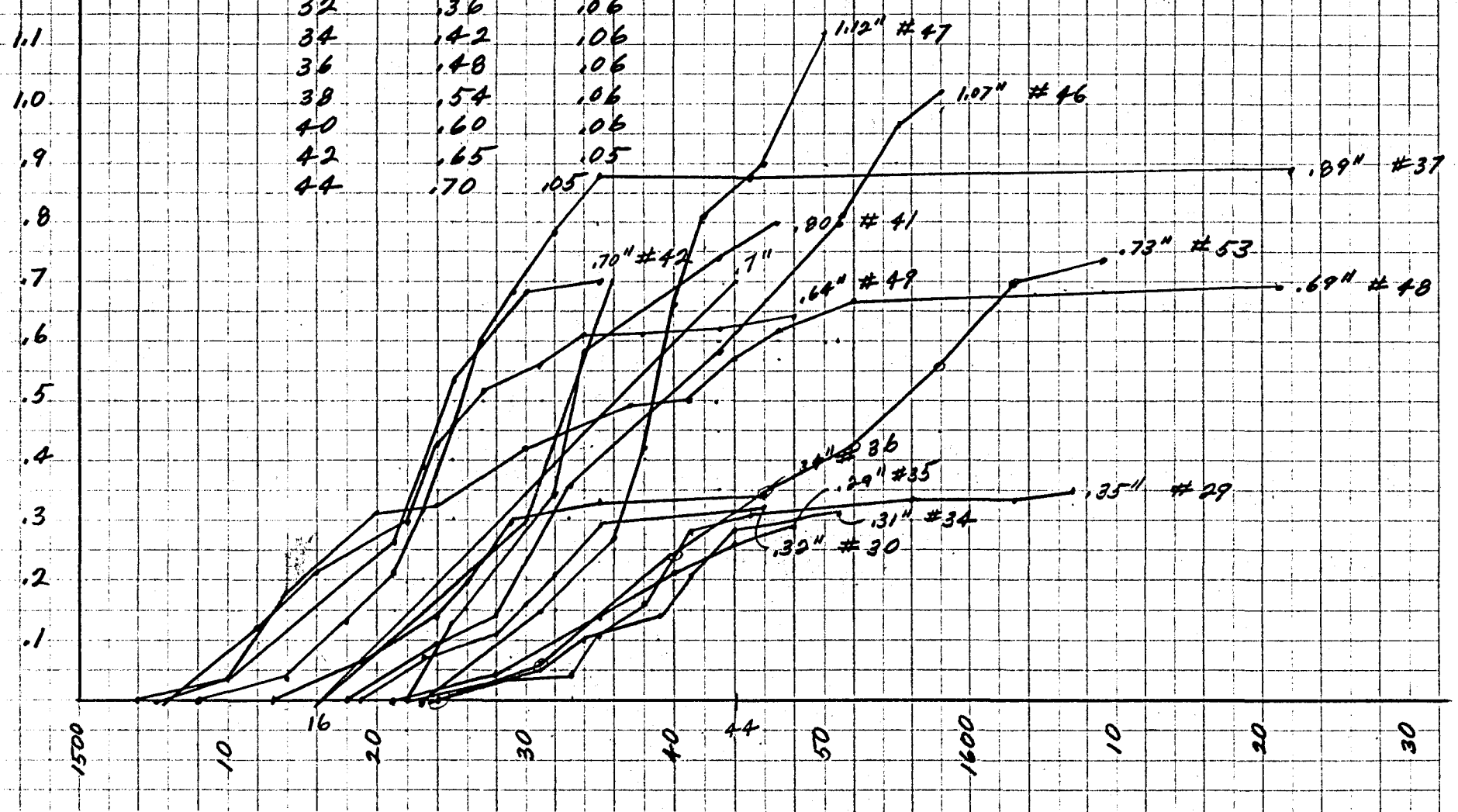
15 MAY 76

(63.015)

14 oct 87

Time	Σ rain	Δ rain
1516	0.0	
18	.04	.04
20	.08	.04
22	.12	.04
24	.16	.04
26	.20	.04
28	.25	.05
30	.30	.05
32	.36	.06
34	.42	.06
36	.48	.06
38	.54	.06
40	.60	.06
42	.65	.05
44	.70	.05

(shown in green)



15 MSL
6 sept 76

Flood Reconstitution for Walnut Gulch 63.103 103-1

Storm Event 10 Aug 71

Runoff: depth = .48 inches, Q_p = 19 cfs at t_p = .23 hours

$R_{recession}$ = .15 hrs

INPUT (1) Area acres	(2) Eff. Imp. Area %	(3) Rain in.	(4) Comp. Inter. min.	(5) Time-Area	(6)	Results (7) Q_p cfs	(8) t_p hr.	(9) T_c hr.	(10) R hr.	(11) STRTL in.	(12) CNSTL in/hr	(13) Output File	(14) Comment
8.3	0	1.04	1	D		19	.23	.02	.11	.17	1.08	Ø1	← best
"	"	"	"	U-3		19	.22	.02	.11	.14	1.14	Ø2	
													T_c is too short & changing T-A will have no effect.

Flood Reconstitution for Walnut Gulch 63.103 103-2

Storm Event 8 Sept 70

Runoff: depth = .67 inches, Q_p = 17 cfs at t_p = .30 hours

$R_{recession}$ = .16 hrs

INPUT (1) Area acres	(2) Eff. Imp. Area %	(3) Rain in.	(4) Comp. Inter. min.	(5) Time-Area	(6)	Results (7) Q_p cfs	(8) t_p hr.	(9) T_c hr.	(10) R hr.	(11) STRTL in.	(12) CNSTL in/hr	(13) Output File	(14) Comment
8.3	0	1.41	1	D		17	.32	.02	.09	.09	1.12	Ø1	← best

TOMBSTONE, ARIZONA WATERSHED 63.103

LOCATION: Cochise County; 2 miles north of Tombstone; Walnut Gulch, tributary of San Pedro River.

AREA: 8.3 acres. SHAPE: Fan shape - 500 feet wide by 1150 feet long.

SLOPES:

Slope - percent	0-3	3-8	8-15	15-30
Percent of area	0	90	10	0

SOIL: Nickel gravelly loam. An arid soil, typic Calciorthid, loamy-skeletal, mixed, thermic.

EROSION:

Erosion Class	2
Percent of area	100

LAND CAPABILITY:

Class	VII
Percent of area	100

GEOLOGY: One hundred percent alluvium, with an erosional gravel cover. Particle size ranges from sand grain size to boulders. Topographic expression is that of low, rolling hills dissected by the present day drainage system. The predominant rock types of the erosional gravels are chert, quartzite, limestones, and andesite. Lesser amounts of rhyolite, breccia, mudstone, tuff, and sandstones are also present. Caliche conglomerates are exposed in many stream channels. The alluvium is made up of disconnected sand, gravel, and clay layers and lenses and is known to exist in depths of more than 1200 feet in this area.

Source of data: General Geology of Central Cochise County, Arizona, by James Gilluly, U. S. Geological Survey, Professional Paper 281, 1956 and extended field studies by project staff.

SURFACE DRAINAGE: Good; length of principal drainage 700 feet.

CHARACTER OF FLOW: Ephemeral, continuous.

INSTRUMENTATION: Precipitation: Measured by one 24-hour weighing rain gage (scales on chart: 1 in. = 1 in. rain; 1 in. = 125 minutes) and 6-hour rain gage (1 in. = .333 in. rain; 1 in. = 31.25 minutes). Runoff: Measured by 2:1 broad-crested V-notch weir with a FW-1 stage recorder (scales on chart 1 in. = .20 ft. of stage and 1 in. = 25 min.).

WATERSHED CONDITIONS: Vegetation cover: Entire area dominated by desert shrubs (whitethorn, creosote bush, and tarbush) with a crown spread approximating 25 percent and an understory of grasses with approximately 0.6 percent basal cover.

GENERALLY REPRESENTS: Desert grassland ranges in the Southeastern Arizona Basin and Range land resource area (D-41).

MONTHLY PRECIPITATION AND RUNOFF (Inches)

TOMBSTONE, ARIZONA WATERSHED 63.103
AREA—8.3 ACRES

63.103

YEAR \ MONTH		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	ANNUAL
1965	P 1/	.63	.07	.26	.04	.06	.22	3.22	2.06	1.32	.00	.26	3.71	11.85
	Q							.00	.54	T	.00	.00	.04	.58
1966	P 1/	.50	1.08	.00	.10	.00	.00	3.86	4.95	1.65	.00	.30	.15	12.59
	Q	.00	.00	.00	.00	.00	.00	.15E	.16	.05	.00	.00	.00	.36
STA AV 2/ (65-66)	P	.56	.58	.13	.07	.03	.11	3.54	3.51	1.49	.00	.28	1.93	12.23
	Q	.00	.00	.00	.00	.00	.00	.08	.35	.03	.00	.00	.02	.48
MEAN 70 YR	P 3/	.84	.77	.61	.28	.18	.49	3.65	3.50	1.52	.66	.63	.88	14.01

ANNUAL MAXIMUM DISCHARGES (inches per hour) AND ANNUAL MAXIMUM VOLUMES OF RUNOFF (Inches) FOR SELECTED TIME INTERVALS

YEAR	MAXIMUM DISCHARGE		MAXIMUM VOLUME FOR SELECTED TIME INTERVAL													
			1 HOUR		2 HOURS		6 HOURS		12 HOURS		1 DAY		2 DAYS		6 DAYS	
	DATE	RATE	DATE	VOLUME	DATE	VOLUME	DATE	VOLUME	DATE	VOLUME	DATE	VOLUME	DATE	VOLUME	DATE	VOLUME
1965	8-13	2.07	8-13	.53	8-13	.53	8-13	.53	8-13	.53	8-13	.53	8-13	.53	8-13	.53
1966	8-31	.36	8-31	.09	8-31	.09	8-31	.09	8-31	.09	8-31	.09	8-31	.09	8-31	.09
MAXIMUMS FOR PERIOD OF RECORD																
1965 TO 1966	8-13 1965	2.07	8-13 1965	.53	8-13 1965	.53	8-13 1965	.53	8-13 1965	.53	8-13 1965	.53	8-13 1965	.53	8-13 1965	.53

Notes: Watershed condition same as described under WATERSHED CONDITIONS. 1/ Monthly precipitation is the record of 1 rain gage. 2/ Precipitation record began January 1965 and runoff record began July 1965. 3/ Mean P based on 70-yr (1897-1966) U.S. Weather Bureau record period at Tombstone, Ariz.

1965 SELECTED RUNOFF EVENT

TOMBSTONE, ARIZONA WATERSHED 63.103

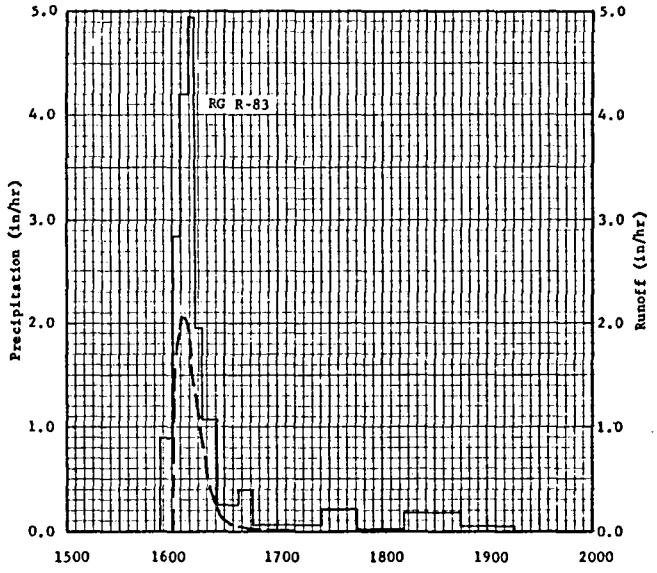
63.103

Event of August 13, 1965

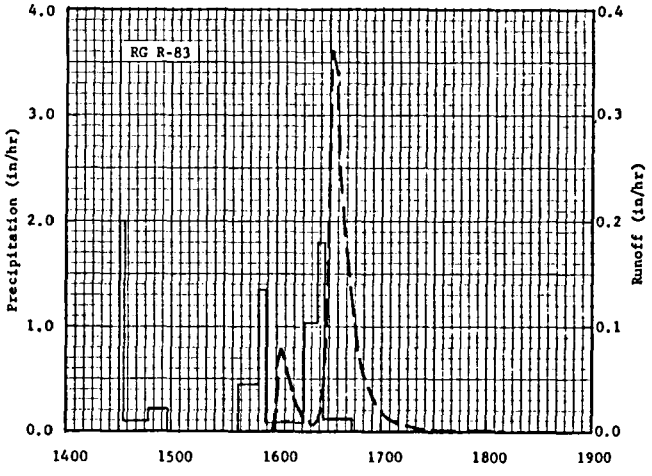
ANTECEDENT CONDITIONS			RAINFALL				RUNOFF			
DATE MO-DAY	RAINFALL (inches)	RUNOFF (inches)	DATE MO-DAY	TIME OF DAY	INTENSITY (in/hr)	ACC. (inches)	DATE MO-DAY	TIME OF DAY	RATE (in/hr)	ACC. (inches)
	RG R-83		8-13	RG	R-83		8-13			
7-13	.14	.00		1553	.00	.00		1600	.000	.0000
7-16	.44	.00		1601	.90	.12		1601	.277	.0023
7-17	.26	.00		1605	2.85	.31		1602	1.123	.0140
7-21	.22	.00		1609	4.20	.59		1603	1.768	.0381
7-22	.14	.00		1613	4.95	.92		1604	1.900	.0686
7-23	.06	.00		1617	1.95	1.05		1606	2.067	.1348
7-25	.44	.00		1626	1.07	1.21		1608	2.031	.2031
7-27	.95	.00		1638	.25	1.26		1610	1.924	.2690
7-28	.05	.00		1647	.40	1.32		1612	1.589	.3275
8-5	.05	.00		1726	.05	1.35		1614	1.267	.3751
8-8	.22	.00		1746	.21	1.42		1616	1.099	.4146
				1813	.02	1.43		1618	.820	.4465
				1845	.18	1.53		1620	.580	.4699
				1916	.04	1.55		1622	.410	.4863
								1624	.308	.4983
								1626	.220	.5071
								1628	.151	.5133
								1630	.114	.5177
								1635	.061	.5250
								1640	.035	.5290
								1645	.021	.5314
								1650	.013	.5328
								1700	.005	.5342
								1710	.001	.5347
								1720	.000	.5348
								1730	.000	.5349
								1740	.000	.5349

Watershed conditions: Vegetation cover: Entire area dominated by desert shrubs (whitethorn, creosote bush, and tarbush) with a crown spread approximating 25% and an understory of grasses with approximately 0.6% basal cover.

NOTES: TO CONVERT RUNOFF IN IN/HR TO CFS, MULTIPLY BY 8.37. FOR TOPOGRAPHIC MAP OF WATERSHED, SEE P. 63.1-3, THIS VOLUME. GEOLOGIC AND VEGETATION MAPS ON P. 63.1-4 AND P. 63.1-5



[illegible] 13, 1965



August 31, 1966

TOMBSTONE, ARIZONA WATERSHED 63.103

1972	MEAN DAILY DISCHARGE (cfs)							TOMBSTONE, ARIZONA WATERSHED 63.103				
Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.001	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.039	0.0	0.0	0.126E	0.057E	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.002E	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.018E	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.001	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.001	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.025	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0	0.0	0.003	0.0	0.0	0.0	0.0	0.0
25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.001E	0.0	0.0	0.0	0.0
27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	0.0	0.0	0.0	0.0	0.0	0.0	0.016E	0.0	0.0	0.0	0.0	0.0
29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.070E	0.0	0.0	0.0	0.0
30	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	0.0		0.0		0.0		0.0	0.0		0.0		0.0
MEAN	0.0	0.0	0.0	0.0	0.0	0.0013	0.0007	0.0014	0.0042	0.0027	0.0	0.0
INCHES	0.0	0.0	0.0	0.0	0.0	0.101	0.053	0.112	0.330	0.216	0.0	0.0
STA AV	0.0	0.0	0.0	0.0	0.0	0.014	0.111	0.357	0.166	0.027	0.0	0.007

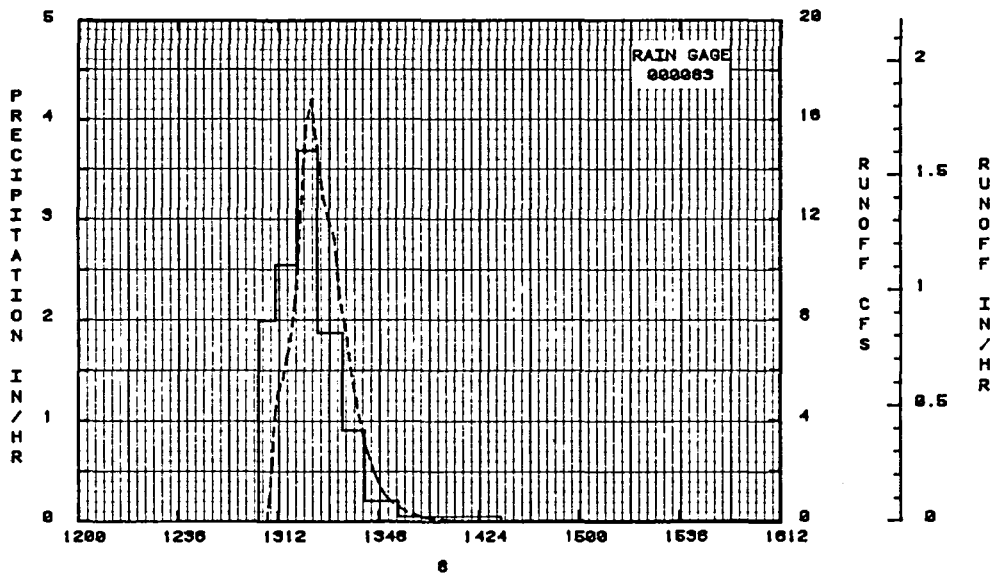
NOTES: To convert mean daily discharge in CFS to IN/DAY, multiply by 2.615566. STA AV based on record period 1965-72.

1970	SELECTED RUNOFF EVENT						TOMBSTONE, ARIZONA [redacted]			
ANTECEDENT CONDITIONS				RAINFALL				RUNOFF		
Date Mo-Day	Rainfall (inches)	Runoff (inches)	Date Mo-Day	Time of Day	Intensity (in/hr)	Acc. (inches)	Date Mo-Day	Time of Day	Rate (cfs)	Acc. (inches)
EVENT OF [redacted]										
	RG 000083			RG 000083						
9- 8	0.0	0.0	9- 8	1305	0.0	0.0	9- 8	1308	0.0	0.0
				1311	2.0000	0.20		1309	1.111	0.0009
				1319	2.5500	0.54		1310	2.237	0.0038
				1326	3.6857	0.97		1311	4.326	0.0094
				1335	1.8667	1.25		1312	5.051	0.0154
WATERSHED CONDITIONS: Vegetative cover: Entire area dominated by desert shrubs (Whitethorn, creosotebush, and tarbush) with a crown spread of about 25% and an understory of grasses with about 0.6% basal cover.				1343	0.9000	1.37		1313	5.459	0.0283
				1355	0.2000	1.41		1314	5.674	0.0378
				1432	0.0486	1.44		1315	6.517	0.0508
								1316	6.873	0.0622
								1317	7.790	0.0747
								1318	8.661	0.0887
								1319	10.075	0.1086
								1320	12.039	0.1274
								1321	14.103	0.1497
								1322	15.773	0.1751
								1324	16.819	0.2375
								1325	15.535	0.2650
								1326	14.837	0.2909
								1327	13.751	0.3214
								1328	12.819	0.3441
								1330	12.020	0.3917
								1332	11.277	0.4314
								1333	10.158	0.4497
								1334	8.867	0.4699
								1336	7.564	0.4979
								1338	6.074	0.5240
								1340	4.804	0.5425
								1342	3.594	0.5586
								1344	2.749	0.5654
								1346	2.038	0.5786

NOTES: To convert runoff in CFS to IN/HR, multiply by 0.108582.

ANTECEDENT CONDITIONS Date Mo-Day	Rainfall (inches)	Runoff (inches)	RAINFALL Date Mo-Day	Time of Day	Intensity (in/hr)	Acc. (inches)	RUNOFF Date Mo-Day	Time of Day	Rate (cfs)	Acc. (inches)
EVENT OF SEPTEMBER 8, 1970 (CONTINUED)										
							9- 8	1348	1.512	0.5846
								1350	1.068	0.5895
								1353	0.725	0.5945
								1358	0.370	0.5994
								1403	0.172	0.6018
								1408	0.091	0.6030
								1413	0.031	0.6035
								1418	0.003	0.6037
								1428	0.0	0.6037
								1438	0.0	0.6037
								1458	0.0	0.6037

NOTES: To convert runoff in CFS to IN/HR, multiply by 0.108982.



EVENT OF SEPTEMBER 8, 1970

TOMBSTONE, ARIZONA WATERSHED 63.103

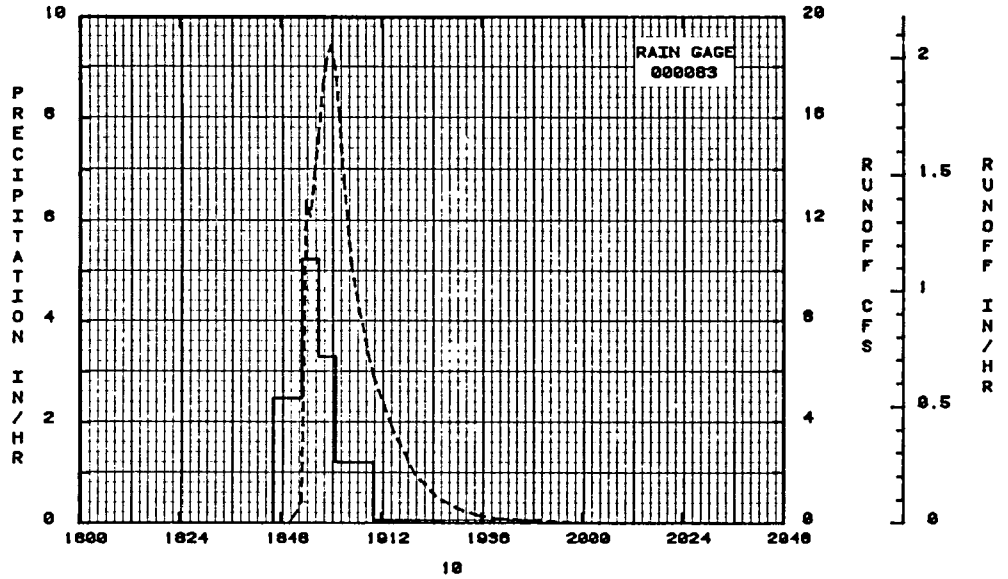
1971 SELECTED RUNOFF EVENT TOMBSTONE, ARIZONA [illegible]

EVENT OF [illegible] 10, 1971

ANTECEDENT CONDITIONS Date Mo-Day	Rainfall (inches)	Runoff (inches)	RAINFALL Date Mo-Day	Time of Day	Intensity (in/hr)	Acc. (inches)	RUNOFF Date Mo-Day	Time of Day	Rate (cfs)	Acc. (inches)
	RG 000083			RG 000083						
8-10	0.0	0.0	8-10	1846	0.0	0.0	8-10	1850	0.0	0.0
				1853	2.4857	0.29		1852	0.487	0.0008
				1857	5.2501	0.64		1853	0.883	0.0023
				1901	3.3000	0.86		1854	12.782	0.0139
				1910	1.2001	1.04		1855	12.167	0.0351
				1950	0.0600	1.08		1856	13.828	0.0572
								1857	15.287	0.0882
								1858	17.287	0.1159
								1859	18.342	0.1462
								1900	18.875	0.1858
								1901	17.884	0.2171
								1902	15.837	0.2458
								1903	13.562	0.2708
								1904	11.718	0.2977
								1905	9.983	0.3162
								1907	8.160	0.3471
								1910	5.817	0.3858
								1915	3.580	0.4298
								1920	1.938	0.4545
								1925	1.074	0.4680
								1930	0.595	0.4758
								1935	0.298	0.4798
								1940	0.158	0.4818
								1950	0.066	0.4839
								2000	0.0	0.4845

WATERSHED CONDITIONS:
Vegetative cover: Entire area dominated by desert shrubs (Whitethorn, creosotebush, and tarbush) with a crown spead of about 25% and an understory of grasses with about 0.6% basal cover.

NOTES: To convert runoff in CFS to IN/HR, multiply by 0.108982.



EVENT OF [illegible] 10, 1971

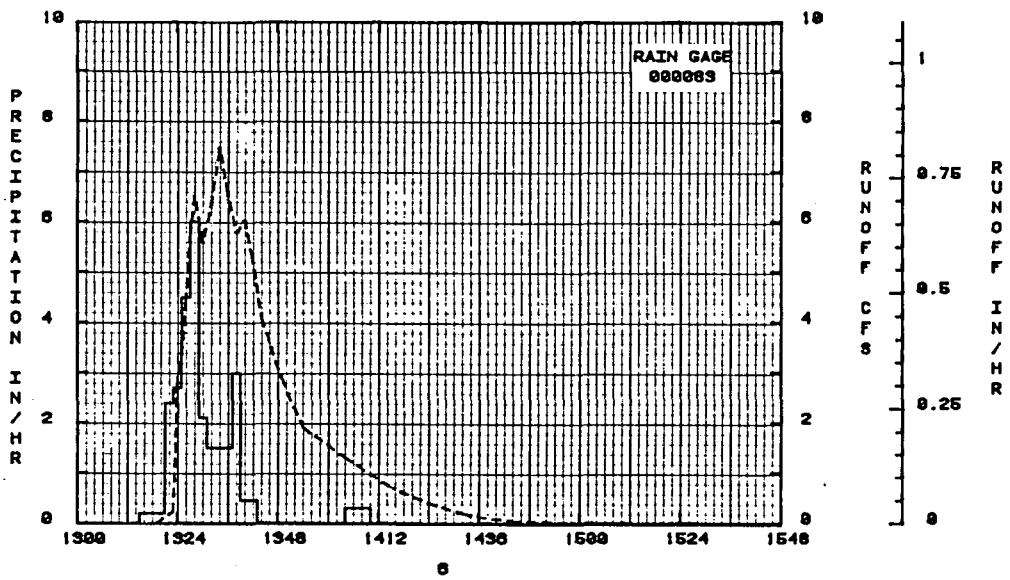
TOMBSTONE, ARIZONA [illegible]

#1412

1972

ANTECEDENT CONDITIONS Date Mo-Day	Rainfall (inches)	Runoff (inches)	RAINFALL Date Mo-Day	Time of Day	Intensity (in/hr)	Acc. (inches)	RUNOFF Date Mo-Day	Time of Day	Rate (cfs)	Acc. (inches)
			EVENT OF [redacted] 6, 1972							
	RG 000083			RG 000083						
9- 6	0.0	0.0	9- 6	1315	0.0	0.0	9- 6	1319	0.0	0.0
				1321	0.2000	0.02		1323	0.238	0.0009
				1323	2.4000	0.10		1324	2.911	0.0036
				1325	2.7000	0.19		1325	3.374	0.0090
				1327	4.5000	0.34		1326	4.558	0.0158
WATERSHED CONDITIONS: Vegetative cover: Entire area dominated by desert shrubs (Whitethorn, creosotebush, and tarbush) with a crown spread of about 25% and an understory of grasses with about 0.6% basal cover.				1329	6.0001	0.54		1327	5.750	0.0268
				1331	2.1000	0.61		1328	6.533	0.0373
				1335	1.5000	0.71		1330	5.566	0.0605
				1337	1.5000	0.76		1332	6.352	0.0808
				1339	2.9999	0.86		1334	7.481	0.1073
				1343	0.4500	0.89		1336	6.533	0.1312
				1404	0.0	0.89		1338	5.771	0.1548
				1410	0.3000	0.92		1340	6.026	0.1749
								1342	5.180	0.1964
								1344	4.060	0.2121
								1349	2.860	0.2445
								1354	1.900	0.2658
								1404	1.303	0.2951
								1414	0.751	0.3135
								1424	0.387	0.3239
								1434	0.139	0.3287
								1444	0.027	0.3302
								1459	0.0	0.3306

NOTES: To convert runoff in CFS to IN/HR, multiply by 0.108982.



EVENT OF [redacted] 6, 1972

TOMBSTONE, ARIZONA [redacted]

Runoff Data

for 63.103

C>TYPE A:W103.RBN

163103	9	24	67	1552	1.00	0.000	0.000	0.000	0.0000	i
63103	9	24	67	1602	3.00	0.586	0.064	0.011	0.0107	i
63103	9	24	67	1603	3.61	6.635	0.723	0.012	0.0228	i
63103	9	24	67	1604	3.89	6.305	0.687	0.012	0.0343	i
63103	9	24	67	1605	3.98	5.823	0.635	0.011	0.0449	i
63103	9	24	67	1606	3.95	4.489	0.489	0.008	0.0531	i
63103	9	24	67	1607	3.90	3.717	0.405	0.007	0.0599	i
63103	9	24	67	1608	3.83	2.778	0.303	0.005	0.0649	i
63103	9	24	67	1609	3.76	2.092	0.228	0.004	0.0687	i
63103	9	24	67	1610	3.71	1.824	0.199	0.003	0.0720	i
63103	9	24	67	1612	3.63	1.452	0.158	0.005	0.0773	i
63103	9	24	67	1614	3.57	1.099	0.120	0.004	0.0813	i
63103	9	24	67	1616	3.51	0.770	0.084	0.003	0.0841	i
63103	9	24	67	1618	3.46	0.569	0.062	0.002	0.0862	i
63103	9	24	67	1620	3.41	0.376	0.041	0.001	0.0876	i
63103	9	24	67	1623	3.35	0.255	0.028	0.001	0.0890	i
63103	9	24	67	1627	3.29	0.154	0.017	0.001	0.0901	i
63103	9	24	67	1632	3.23	0.071	0.008	0.001	0.0907	i
63103	9	24	67	1637	3.18	0.013	0.001	0.000	0.0908	i
63103	9	24	67	1642	3.15	0.007	0.001	0.000	0.0909	i
63103	9	24	67	1647	3.12	0.000	0.000	0.000	0.0909	i
63103	9	24	67	1657	3.08	0.000	0.000	0.000	0.0909	i
63103	9	24	67	1707	3.05	0.000	0.000	0.000	0.0909	i
63103	9	24	67	1717	3.03	0.000	0.000	0.000	0.0909	i
63103	9	24	67	1727	3.02	0.000	0.000	0.000	0.0909	i
63103	9	24	67	1738	3.00	0.000	0.000	0.000	0.0909	i
163103	8	10	71	1850	1.00	0.000	0.000	0.000	0.0000	i
63103	8	10	71	1852	2.69	0.487	0.053	0.002	0.0018	i
63103	8	10	71	1853	3.00	0.883	0.096	0.002	0.0034	i
63103	8	10	71	1854	4.20	12.782	1.393	0.023	0.0266	i
63103	8	10	71	1855	4.36	12.167	1.326	0.022	0.0487	i
63103	8	10	71	1856	4.44	13.828	1.507	0.025	0.0738	i
63103	8	10	71	1857	4.50	15.287	1.666	0.028	0.1016	i
63103	8	10	71	1858	4.57	17.287	1.884	0.031	0.1330	i
63103	8	10	71	1859	4.61	18.342	1.999	0.033	0.1663	i
63103	8	10	71	1900	4.63	18.875	2.057	0.034	0.2006	i
63103	8	10	71	1901	4.60	17.884	1.949	0.032	0.2331	i
63103	8	10	71	1902	4.53	15.837	1.726	0.029	0.2619	i
63103	8	10	71	1903	4.44	13.562	1.478	0.025	0.2865	i
63103	8	10	71	1904	4.36	11.718	1.277	0.021	0.3078	i
63103	8	10	71	1905	4.28	9.983	1.088	0.018	0.3259	i
63103	8	10	71	1907	4.15	8.160	0.889	0.030	0.3555	i
63103	8	10	71	1910	3.98	5.817	0.634	0.032	0.3872	i
63103	8	10	71	1915	3.77	3.580	0.390	0.032	0.4197	i
63103	8	10	71	1920	3.62	1.938	0.211	0.018	0.4373	E1
63103	8	10	71	1925	3.50	1.074	0.117	0.010	0.4470	E1
63103	8	10	71	1930	3.40	0.595	0.065	0.005	0.4524	E1
63103	8	10	71	1935	3.31	0.298	0.032	0.003	0.4551	E1
63103	8	10	71	1940	3.25	0.158	0.017	0.001	0.4565	E1
63103	8	10	71	1950	3.16	0.066	0.007	0.001	0.4577	E1

.49 inch
5 1/2 hr duration
4.5 in/hr

1.18 in
5 hr duration
5.2 in/hr

63103	8	10	71	2000	3.08	0.000	0.000	0.000	0.4577	E1
63103	8	10	71	2010	3.04	0.000	0.000	0.000	0.4577	E1
63103	8	10	71	2020	3.00	0.000	0.000	0.000	0.4577	E1
163103	9	8	70	1308	1.00	0.000	0.000	0.000	0.0000	1
63103	9	8	70	1309	3.00	1.111	0.121	0.002	0.0020	1
63103	9	8	70	1310	3.40	2.237	0.244	0.004	0.0061	1
63103	9	8	70	1311	3.75	4.326	0.471	0.008	0.0140	1
63103	9	8	70	1312	3.91	5.051	0.550	0.009	0.0232	1
63103	9	8	70	1313	3.98	5.459	0.595	0.010	0.0331	1
63103	9	8	70	1314	4.01	5.674	0.618	0.010	0.0434	1
63103	9	8	70	1315	4.06	6.517	0.710	0.012	0.0552	1
63103	9	8	70	1316	4.09	6.873	0.749	0.012	0.0677	1
63103	9	8	70	1317	4.14	7.790	0.849	0.014	0.0818	1
63103	9	8	70	1318	4.19	8.661	0.944	0.016	0.0975	1
63103	9	8	70	1319	4.26	10.075	1.098	0.018	0.1158	1
63103	9	8	70	1320	4.35	12.039	1.312	0.022	0.1377	1
63103	9	8	70	1321	4.44	14.103	1.537	0.026	0.1633	1
63103	9	8	70	1322	4.51	15.773	1.719	0.029	0.1919	1
63103	9	8	70	1324	4.57	16.819	1.833	0.061	0.2530	1
63103	9	8	70	1325	4.52	15.535	1.693	0.028	0.2812	1
63103	9	8	70	1326	4.49	14.837	1.617	0.027	0.3081	1
63103	9	8	70	1327	4.45	13.791	1.503	0.025	0.3332	1
63103	9	8	70	1328	4.41	12.819	1.397	0.023	0.3565	1
63103	9	8	70	1330	4.36	12.020	1.310	0.044	0.4002	1
63103	9	8	70	1332	4.33	11.277	1.229	0.041	0.4412	1
63103	9	8	70	1333	4.29	10.158	1.107	0.019	0.4597	1
63103	9	8	70	1334	4.23	8.867	0.966	0.016	0.4758	1
63103	9	8	70	1336	4.13	7.564	0.824	0.027	0.5033	1
63103	9	8	70	1338	4.04	6.074	0.662	0.022	0.5254	1
63103	9	8	70	1340	3.95	4.804	0.524	0.017	0.5429	1
63103	9	8	70	1342	3.85	3.594	0.392	0.013	0.5560	1
63103	9	8	70	1344	3.77	2.749	0.300	0.010	0.5660	1
63103	9	8	70	1346	3.69	2.038	0.222	0.007	0.5734	1
63103	9	8	70	1348	3.62	1.512	0.165	0.005	0.5789	1
63103	9	8	70	1350	3.55	1.068	0.116	0.004	0.5828	1
63103	9	8	70	1353	3.46	0.725	0.079	0.004	0.5868	1
63103	9	8	70	1358	3.33	0.370	0.040	0.003	0.5902	1
63103	9	8	70	1403	3.26	0.172	0.019	0.002	0.5918	1
63103	9	8	70	1408	3.21	0.091	0.010	0.001	0.5926	1
63103	9	8	70	1413	3.16	0.031	0.003	0.000	0.5929	1
63103	9	8	70	1418	3.12	0.003	0.000	0.000	0.5929	1
63103	9	8	70	1428	3.07	0.000	0.000	0.000	0.5929	1
63103	9	8	70	1438	3.04	0.000	0.000	0.000	0.5929	1
63103	9	8	70	1458	3.00	0.000	0.000	0.000	0.5929	1
163103	7	27	73	1304	2.50	0.000	0.000	0.000	0.0000	1
63103	7	27	73	1319	3.36	0.080	0.009	0.002	0.0022	1
63103	7	27	73	1320	4.06	3.648	0.398	0.007	0.0088	1
63103	7	27	73	1321	4.62	8.634	0.941	0.016	0.0245	1
63103	7	27	73	1322	4.80	10.791	1.176	0.020	0.0441	1
63103	7	27	73	1323	4.94	13.773	1.501	0.025	0.0691	1
63103	7	27	73	1324	5.05	16.627	1.812	0.030	0.0993	1
63103	7	27	73	1325	5.00	15.140	1.650	0.027	0.1268	1
63103	7	27	73	1326	4.98	14.709	1.603	0.027	0.1535	1
63103	7	27	73	1328	4.88	12.892	1.405	0.047	0.2003	1
63103	7	27	73	1330	4.78	10.644	1.160	0.039	0.2390	1
63103	7	27	73	1335	4.70	9.194	1.002	0.084	0.3225	1
63103	7	27	73	1340	4.61	7.631	0.832	0.069	0.3918	1
63103	7	27	73	1342	4.50	5.685	0.620	0.021	0.4125	1
63103	7	27	73	1344	4.35	3.850	0.420	0.014	0.4265	1
63103	7	27	73	1346	4.24	2.607	0.284	0.010	0.4360	1
63103	7	27	73	1350	4.06	1.544	0.168	0.011	0.4472	1
63103	7	27	73	1351	4.00	0.687	0.075	0.001	0.4484	1
63103	7	27	73	1352	3.99	0.823	0.090	0.002	0.4499	1
63103	7	27	73	1354	3.95	0.662	0.072	0.002	0.4523	1
63103	7	27	73	1356	3.92	0.554	0.060	0.002	0.4543	1

1.44 in

1 1/2 hr duration

3.7 in/hr

1.57 in

1+ hr duration

4.8 in/hr

63103	7	27	73	1358	3.93	0.626	0.068	0.002	0.4566	1
63103	7	27	73	1400	4.00	0.955	0.104	0.004	0.4601	1
63103	7	27	73	1405	4.06	1.127	0.123	0.010	0.4703	1
63103	7	27	73	1406	4.05	1.115	0.122	0.002	0.4723	1
63103	7	27	73	1408	4.06	1.208	0.132	0.004	0.4767	1
63103	7	27	73	1410	4.04	1.089	0.119	0.004	0.4807	1
63103	7	27	73	1412	4.00	0.879	0.096	0.003	0.4839	1
63103	7	27	73	1413	3.98	0.745	0.081	0.001	0.4853	1
63103	7	27	73	1415	3.96	0.716	0.078	0.003	0.4879	1
63103	7	27	73	1420	3.93	0.641	0.070	0.006	0.4937	1
63103	7	27	73	1425	3.89	0.507	0.055	0.005	0.4983	1
63103	7	27	73	1430	3.86	0.408	0.044	0.004	0.5020	1
63103	7	27	73	1435	3.82	0.305	0.033	0.003	0.5048	1
63103	7	27	73	1440	3.70	0.083	0.009	0.001	0.5056	1
63103	7	27	73	1445	3.62	0.000	0.000	0.000	0.5056	1
63103	7	27	73	1505	3.51	0.000	0.000	0.000	0.5056	1
63103	7	27	73	1507	3.50	0.000	0.000	0.000	0.5056	1
163103	7	28	74	2014	3.16	0.000	0.000	0.000	0.0000	1
63103	7	28	74	2017	3.18	0.016	0.002	0.000	0.0001	1
63103	7	28	74	2018	4.25	5.566	0.607	0.010	0.0102	1
63103	7	28	74	2019	4.44	4.868	0.530	0.009	0.0190	1
63103	7	28	74	2020	4.47	5.004	0.545	0.009	0.0281	1
63103	7	28	74	2021	4.49	5.261	0.573	0.010	0.0377	1
63103	7	28	74	2022	4.50	5.391	0.587	0.010	0.0475	1
63103	7	28	74	2023	4.46	4.827	0.526	0.009	0.0563	1
63103	7	28	74	2026	4.37	4.100	0.447	0.022	0.0786	1
63103	7	28	74	2027	4.35	3.525	0.384	0.006	0.0850	1
63103	7	28	74	2029	4.34	3.465	0.378	0.013	0.0976	1
63103	7	28	74	2032	4.23	2.687	0.293	0.015	0.1122	1
63103	7	28	74	2034	4.13	1.714	0.187	0.006	0.1184	1
63103	7	28	74	2037	4.00	1.022	0.111	0.006	0.1240	1
63103	7	28	74	2042	3.86	0.527	0.058	0.005	0.1288	1
63103	7	28	74	2047	3.77	0.222	0.024	0.002	0.1308	1
63103	7	28	74	2052	3.69	0.077	0.008	0.001	0.1315	1
63103	7	28	74	2102	3.60	0.016	0.002	0.000	0.1318	1
63103	7	28	74	2112	3.56	0.000	0.000	0.000	0.1318	1
63103	7	28	74	2157	3.50	0.000	0.000	0.000	0.1318	1

.77 in

4 hr duration

4.5 in/hr

Precipitation Data
for 63.103

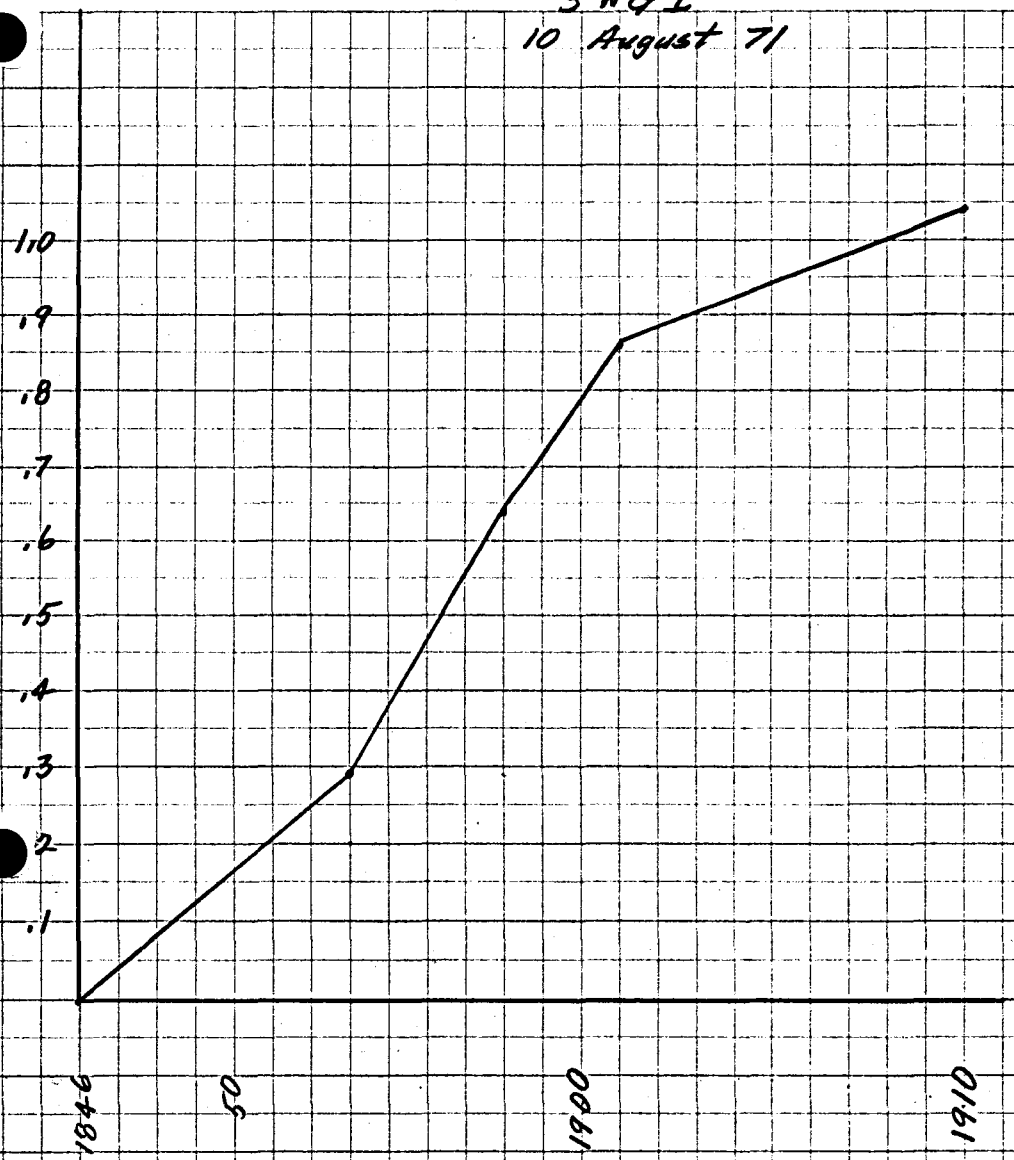
ID	Date			Time	Interval Rain	Rain	Total Rain	
163000000386	9	24	67	1552	0.0000	0.00	0.00	0
63000000386	9	24	67	1554	0.9000	0.03	0.03	0
63000000386	9	24	67	1556	1.5000	0.05	0.08	0
63000000386	9	24	67	1558	2.1000	0.07	0.15	0
63000000386	9	24	67	1600	4.4999	0.15	0.30	0
63000000386	9	24	67	1602	1.8004	0.06	0.36	0
63000000386	9	24	67	1604	0.5999	0.02	0.38	0
63000000386	9	24	67	1646	0.0143	0.01	0.39	0
63000000386	9	24	67	2020	0.0000	0.00	0.39	0
63000000386	9	24	67	2022	0.6001	0.02	0.41	0
63000000386	9	24	67	2024	0.2999	0.01	0.42	0
63000000386	9	24	67	2026	0.3001	0.01	0.43	0
63000000386	9	24	67	2028	0.0000	0.00	0.43	0
63000000386	9	24	67	2030	0.5999	0.02	0.45	0
63000000386	9	24	67	2046	0.0000	0.00	0.45	0
63000000386	9	24	67	2048	0.3001	0.01	0.46	0
63000000386	9	24	67	2122	0.0000	0.00	0.46	0
63000000386	9	24	67	2124	0.5999	0.02	0.48	0
63000000386	9	24	67	2126	0.3001	0.01	0.49	0
163000000083	8	10	71	1846	0.0000	0.00	0.00	0
63000000083	8	10	71	1853	2.4857	0.29	0.29	0
63000000083	8	10	71	1857	5.2501	0.35	0.64	0
63000000083	8	10	71	1901	3.3000	0.22	0.86	0
63000000083	8	10	71	1910	1.2000	0.18	1.04	0
63000000083	8	10	71	1950	0.0600	0.04	1.08	0
63000000083	8	10	71	2247	0.0000	0.00	1.08	0
63000000083	8	10	71	2355	0.0882	0.10	1.18	0
163000000083	9	8	70	1305	0.0000	0.00	0.00	0
63000000083	9	8	70	1311	2.0000	0.20	0.20	0
63000000083	9	8	70	1319	2.5500	0.34	0.54	0
63000000083	9	8	70	1326	3.6857	0.43	0.97	0
63000000083	9	8	70	1335	1.8667	0.28	1.25	0
63000000083	9	8	70	1343	0.9000	0.12	1.37	0
63000000083	9	8	70	1355	0.2000	0.04	1.41	0
63000000083	9	8	70	1432	0.0486	0.03	1.44	0
163000000083	7	27	73	1304	0.0000	0.00	0.00	0
63000000083	7	27	73	1310	0.3000	0.03	0.03	0
63000000083	7	27	73	1315	1.5600	0.13	0.16	0
63000000083	7	27	73	1321	4.8000	0.48	0.64	0
63000000083	7	27	73	1325	2.4000	0.16	0.80	0
63000000083	7	27	73	1331	2.4000	0.24	1.04	0
63000000083	7	27	73	1338	2.1429	0.25	1.29	0
63000000083	7	27	73	1347	0.2667	0.04	1.33	0
63000000083	7	27	73	1355	0.3000	0.04	1.37	0
63000000083	7	27	73	1400	1.0800	0.09	1.46	0
63000000083	7	27	73	1404	1.2000	0.08	1.54	0
63000000083	7	27	73	1412	0.2250	0.03	1.57	0
163000000083	7	28	74	2009	0.0000	0.00	0.00	0
63000000083	7	28	74	2013	0.6000	0.04	0.04	0

63000000083	7	28	74	2016	3.1998	0.16	0.20	0
63000000083	7	28	74	2018	4.5011	0.15	0.35	0
63000000083	7	28	74	2021	2.1999	0.11	0.46	0
63000000083	7	28	74	2023	2.3995	0.08	0.54	0
63000000083	7	28	74	2027	1.2000	0.08	0.62	0
63000000083	7	28	74	2032	0.7200	0.06	0.68	0
63000000083	7	28	74	2100	0.0429	0.02	0.70	0
63000000083	7	28	74	2108	0.2250	0.03	0.73	0
63000000083	7	28	74	2300	0.0000	0.00	0.73	0
63000000083	7	28	74	2307	0.1714	0.02	0.75	0
63000000083	7	28	74	2341	0.0000	0.00	0.75	0
63000000083	7	28	74	2400	0.0632	0.02	0.77	0

3 WG 1

12 oct 87

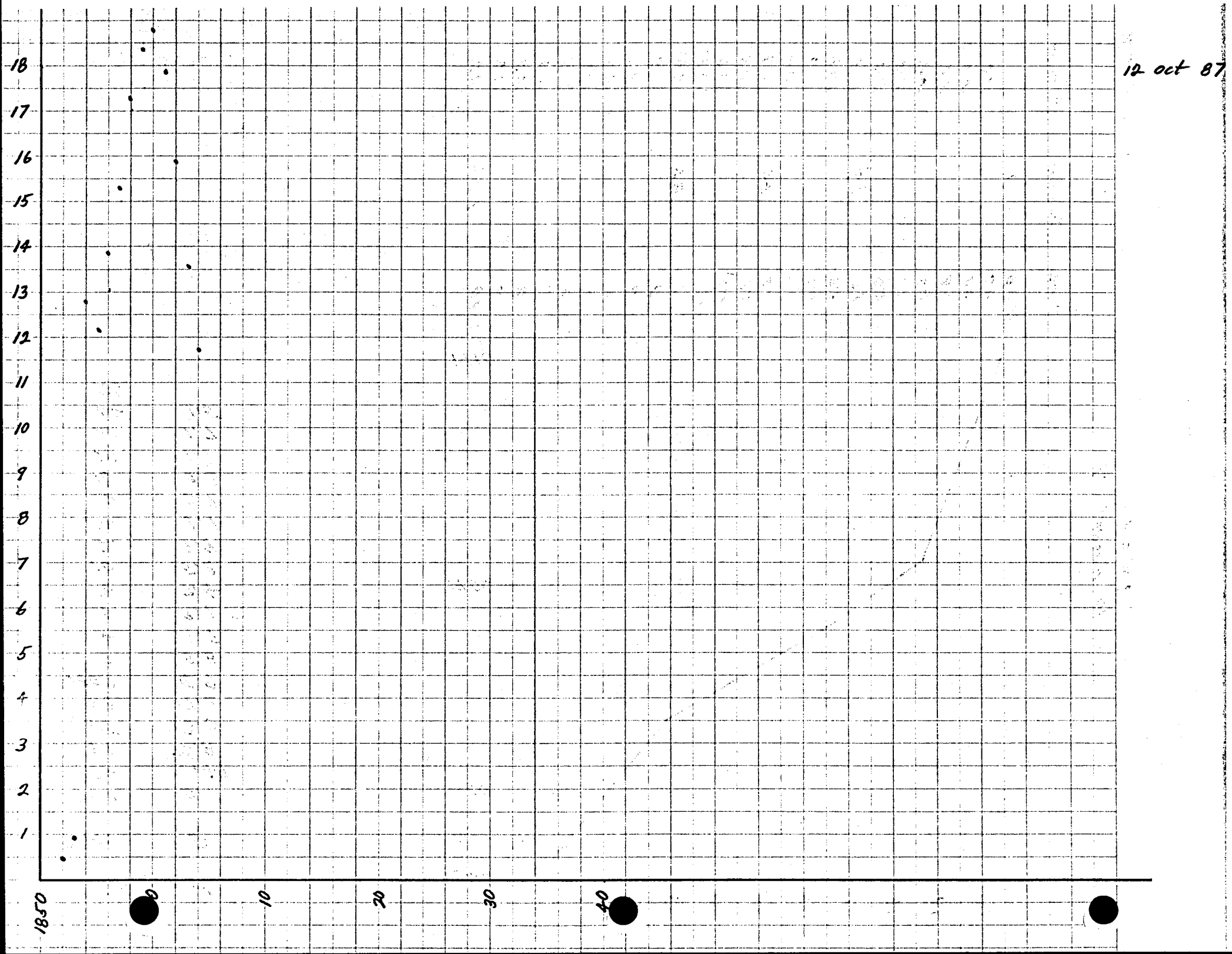
10 August 71



Time	Σ rain	Δ rain
1846	0.0	
47		.04
48		.04
49		.04
50		.04
51		.04
52		.04
53	.29	.05
54		.08
55		.09
56		.09
57	.64	.09
58		.06
59		.06
1900		.05
1	.86	.05
2		.02
3		.02
4		.02
5		.02
6		.02
7		.02
8		.02
9		.02
10	1.04	.02

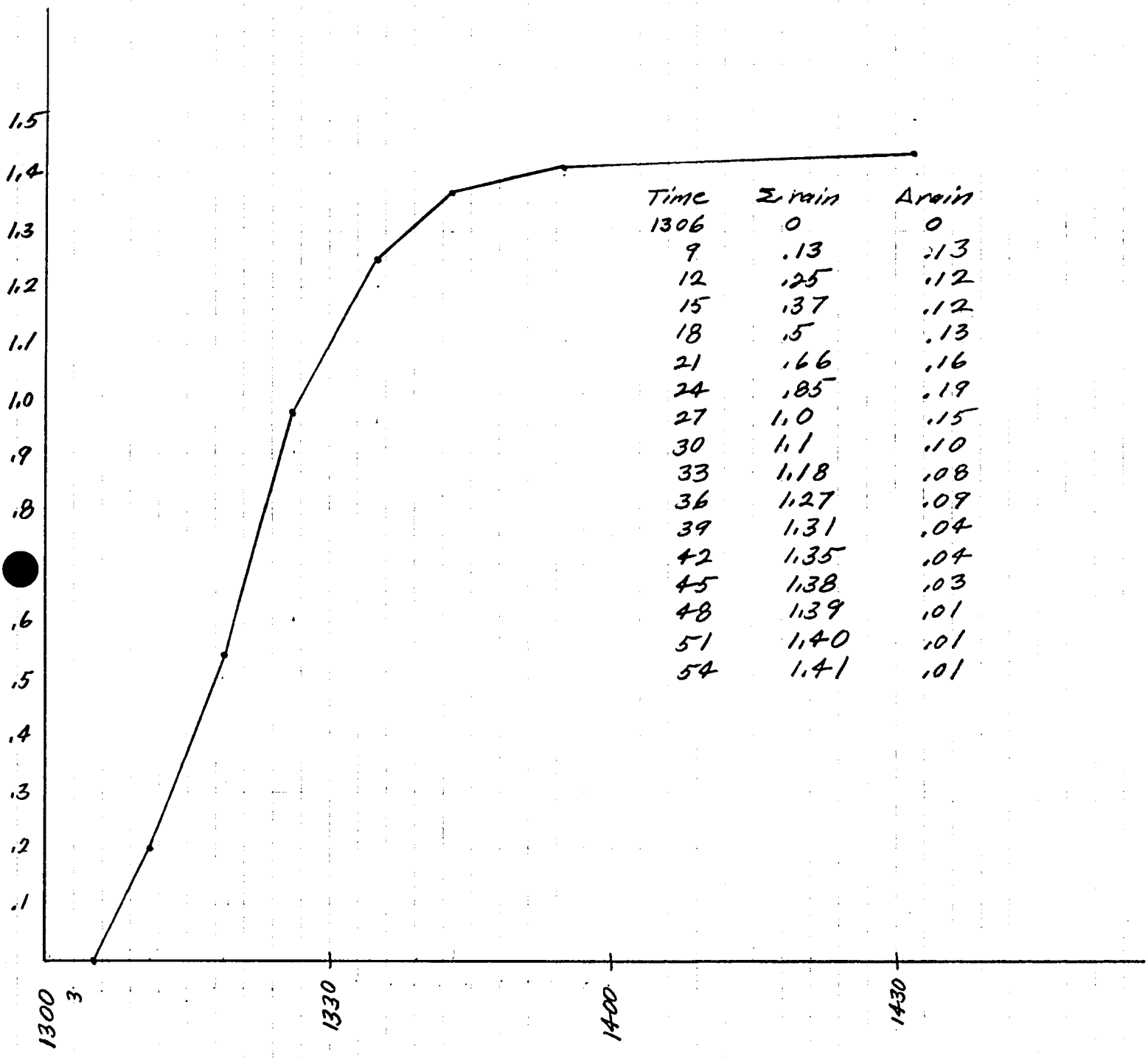
Hydrograph

Time	Q
1850	0.0
52	.49
54	12.8
56	13.8
58	17.3
1900	18.9
2	15.8
4	11.7
6	9.1
8	7.4
10	5.8
12	4.9
14	3.1
16	2.7
18	2.3
20	1.9
22	1.7
24	1.5
26	


12 oct 87
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
1850
00
10
20
30
40

3WG2
8 Sept 70

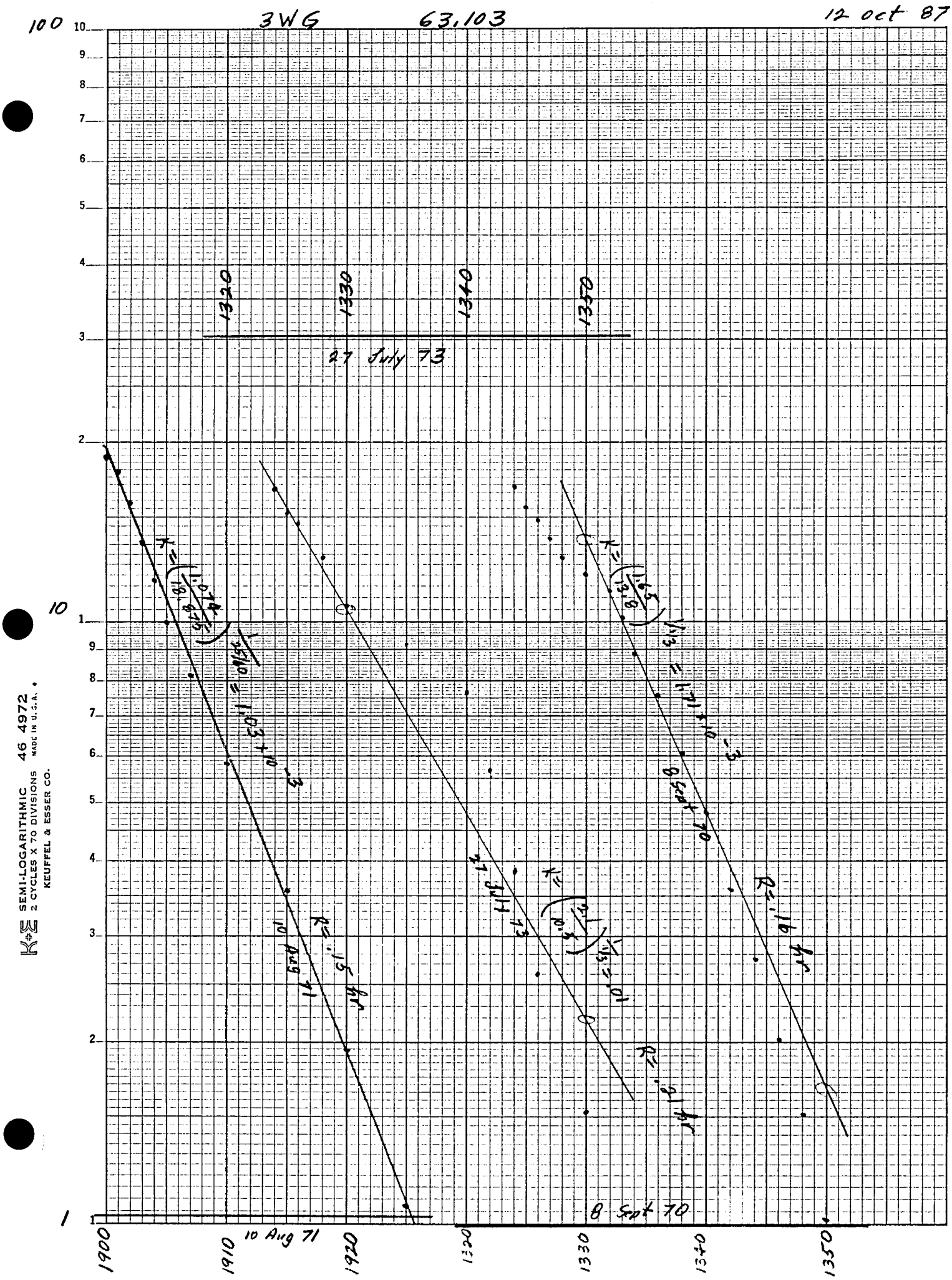
12 Oct 87



Time	Σ rain	Δ rain
1306	0	0
9	.13	.13
12	.25	.12
15	.37	.12
18	.5	.13
21	.66	.16
24	.85	.19
27	1.0	.15
30	1.1	.10
33	1.18	.08
36	1.27	.09
39	1.31	.04
42	1.35	.04
45	1.38	.03
48	1.39	.01
51	1.40	.01
54	1.41	.01

Hydrograph on back side.

Time	Q
1306	0
9	1.1
12	5.0
15	6.5
18	8.7
21	14.1
24	16.8
27	13.8
30	12.0
33	10.2
36	6.8
39	5.4
42	3.2
45	2.5
48	1.5
51	.9
54	.6
57	.4
1400	.2
3	
6	
9	
12	
15	
18	
21	
24	
27	
30	
33	
36	
39	
42	
45	
48	
51	
54	
57	
1500	


3WG
63,103
12 oct 87
1320
1330
1340
1350
27 July 73
10 Aug 71
8 Sept 70
1900
1910
1920
1330
1340
1350
SEMI-LOGARITHMIC 46 4972
2 CYCLES X 70 DIVISIONS MADE IN U.S.A.
KEUFFEL & ESSER CO.

Flood Reconstitution for Walnut Gulch 63.111 111-1

Storm Event 19 August 1963

Runoff: depth = .47 inches, Q_p = 264 cfs at t_p = .43 hours

$R_{recession}$ = .11 hrs

INPUT (1) Area acres	(2) Eff. Imp. Area %	(3) Rain in.	(4) Comp. Inter. min.	(5) Time-Area	(6)	Results (7) Q_p cfs	(8) t_p hr.	(9) T_c hr.	(10) R hr.	(11) STRTL in.	(12) CNSTL in/hr	(13) Output File	(14) Comment
143	0	1.19	2	D		208	.47	.03	.03	.64	.33	Ø1	

Flood Reconstitution for Walnut Gulch 63:111 111-2

Storm Event 11 Sept 64

Runoff: depth = .83 inches, Q_p = 284 cfs at t_p = .73 hours

$R_{recession}$ = .12 hrs

INPUT (1) Area acres	(2) Eff. Imp. Area %	(3) Rain in.	(4) Comp. Inter. min.	(5) Time-Area	(6)	Results (7) Q_p cfs	(8) t_p hr.	(9) T_c hr.	(10) R hr.	(11) STRTL in.	(12) CNSTL in/hr	(13) Output File	(14) Comment
143	0	1.95	2	D		273	.73	.16	.18	.93	.30	ϕ1	

Flood Reconstitution for Walnut Gulch 63.111 111-3

Storm Event 4 Sept 65

Runoff: depth = .22 inches, Q_p = 88 cfs at t_p = .43 hours

$R_{recession}$ = .13 hrs

INPUT (1) Area acres	(2) Eff. Imp. Area %	(3) Rain in.	(4) Comp. Inter. min.	(5) Time-Area	(6)	Results (7) Q_p cfs	(8) t_p hr.	(9) T_c hr.	(10) R hr.	(11) STRTL in.	(12) CNSTL in/hr	(13) Output File	(14) Comment
143	0	.75	2	D		90	.40	.18	.14	.41	.27	ϕ1	

TOMBSTONE, ARIZONA WATERSHED 63.111

LOCATION: Cochise County; 6½ miles NW of Tombstone; Walnut Gulch, tributary of San Pedro River.

AREA: 143 Acres SHAPE: Oblong

SLOPES:

Slope - Percent	0-3	3-10	10-20	20-35
Percent of area	0	25	75	0

SOILS: Are mapped as complexes. Bernadino (Aridisol, Mollic Haplarid) - Hathaway and comprises 74%. Hathaway (Mollisol Typic Calcuistoll)-Bernadino comprises 22% of area. The remainder is sandy and loamy alluvium.

EROSION:

Erosion Class	2
Percent of area	100

LAND CAPABILITY:

Class	VI
Percent of area	100

GEOLOGY: The watershed lies wholly within the Tombstone pediment. It is typified by low, rounded hills with few rock outcrops present. An erosional remnant cover blankets the area with particle sizes ranging from sand grain size to boulders. Predominant rock types are tuffs, breccia, hornblende andesite, sandstones, and conglomerates. Disconnected sand, gravel, and clay layers make up the subsurface alluvium, which extends to unknown depths in this area.

Stratigraphy and Hydrogeology of Walnut Gulch Watershed 63.111

System	Formation and percent of area	Description
Quaternary	Recent alluvium, 100%	Sand, silt, gravel, cobbles, boulders. Surface gravels consist mainly of andesite, rhyolite, quartz, and tuff from surrounding hills. Outer surface of gravel and cobbles weathered to reddish-brown to brown.

Source of data: General Geology of Central Cochise County, Arizona, by James Gilluly, U. S. Geological Survey, Professional Paper 281, 1956, and extended field studies by project staff.

SURFACE DRAINAGE: Good; length of principal drainage .97 mi.

CHARACTER OF FLOW: Ephemeral, continuous.

INSTRUMENTATION: Precipitation: Measured by two 24-hour (scales on chart: 1 in., = 1 in. rain; 1 in. = 125 minutes) and one 6-hour weighing rain gage (1 in. = .333 in. rain; 1 in. = 31.25 minutes). Runoff: Measured by 3:1 broad-crested V-notch weir with FW-1 recorder (scales on chart 1 in. = .20 ft. of stage and 1 in. = 25 minutes).

WATERSHED CONDITIONS: Representative of desert grassland. Vegetation dominated by short grasses (blue, sideoats, black and hairy grama, curly mesquite); also, present shrubs include (soapweed, mesquite, burroweed), basal cover of grasses approximately 2.5 percent. Canopy approximately 20 percent.

GENERALLY REPRESENTS: Desert grassland ranges in the Southeastern Arizona Basin and Range land resource area (D-41).

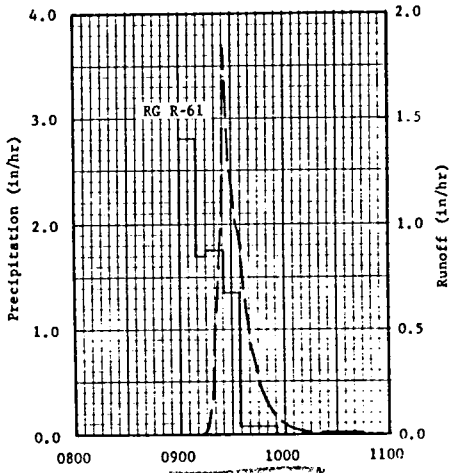
1963 **SELECTED RUNOFF EVENT** — TOMBSTONE, ARIZONA — WATERSHED 63.111 — 63.111

Event of August 19, 1963

ANTECEDENT CONDITIONS			RAINFALL				RUNOFF				
DATE MO-DAY	RAINFALL (inches)	RUNOFF (inches)	DATE MO-DAY	TIME OF DAY	INTENSITY (in/hr)	ACC. (inches)	DATE MO-DAY	TIME OF DAY	RATE (in/hr)	ACC. (inches)	Q
	RG R-61		8-19	RG	R-61		8-19				
				0900	.00	.00		0913	.000	.0000	0
7-19	.10	.00		0909	2.80	.42		0914	.003	.0000	.4
7-22	.12	.00		0915	1.70	.59		0915	.008	.0001	1.2
7-24	.08	.00		0926	1.75	.91		0916	.020	.0003	2.9
7-25	.12	.00									6.8
				0934	1.35	1.09		0917	.047	.0009	17
7-26	.05	.00		0956	.08	1.12		0918	.117	.0023	34
7-27	.13	.00						0919	.234	.0052	51
7-28	.63	.08						0920	.352	.0101	73
7-29	.56	.15						0921	.506	.0172	95
7-31	.60	.13									115
								0922	.657	.0269	141
8-2	.36	T						0923	.798	.0390	168
8-12	.11	.00						0924	.978	.0538	264 — max
								0925	1.165	.0717	197
								0926	1.831	.0967	188
	RG R-82			RG	R-82						
				0900	.00	.00		0927	1.366	.1233	174
7-19	.05	.00		0907	.69	.08		0928	1.304	.1456	149
7-22	.15	.00		0911	.75	.13		0930	1.207	.1874	134
7-24	.21	.00		0922	2.78	.64		0932	1.033	.2247	111
7-25	.14	.00						0934	.929	.2574	93
				0939	1.59	1.09		0936	.770	.2858	75
7-26	.11	.00		0949	.54	1.18		0938	.643	.3093	55
7-27	.18	.00		1015	.12	1.23		0940	.518	.3287	42
7-28	.95	.08						0942	.380	.3436	36
7-29	.84	.15						0944	.293	.3549	27
7-31	.81	.13									22
								0946	.248	.3639	12
8-2	.43	T						0948	.188	.3711	6.8
8-12	.10	.00						0950	.150	.3768	3.6
								0955	.083	.3865	2.3
								1000	.047	.3919	1.4
								1005	.025	.3950	.9
								1010	.016	.3967	.4
								1015	.010E	.3977E	.3
								1020	.006E	.3984E	.1
								1025	.003E	.3988E	.1
								1030	.002E	.3990E	0
								1035	.001E	.3992E	
								1040	.001E	.3992E	
								1045	.000E	.3993E	
								1055	T	.3993E	
								1125	.000E	.3993E	

Watershed conditions: Representative of desert grassland. Vegetation dominated by short grasses (blue, sideoats, black and hairy grama, curly mesquite); also, present shrubs include (soapweed, mesquite, burroweed), basal cover of grasses approximately 2.5%. Canopy approximately 20%.

NOTE: TO CONVERT RUNOFF IN IN/HR TO CFS, MULTIPLY BY 144.19.



August 19, 1963

TOMBSTONE, ARIZONA — WATERSHED 63.111

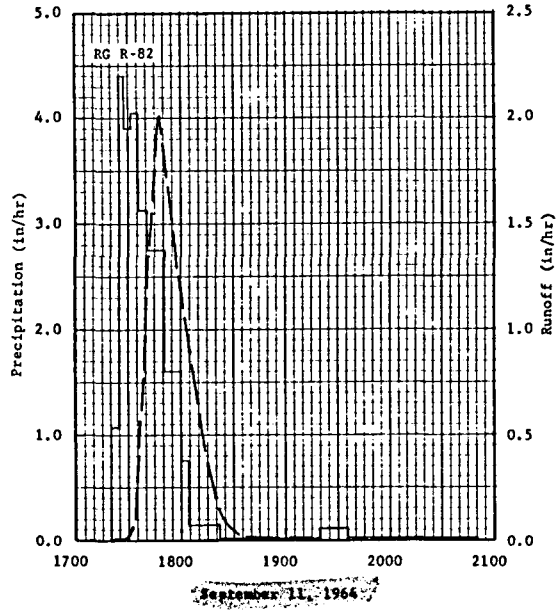
1964 **SELECTED RUNOFF EVENT** — TOMBSTONE, ARIZONA WATERSHED 63.111 — 63.111

Event of September 11, 1964

ANTECEDENT CONDITIONS			RAINFALL				RUNOFF			
DATE MO-DAY	RAINFALL (inches)	RUNOFF (inches)	DATE MO-DAY	TIME OF DAY	INTENSITY (in/hr)	ACC. (inches)	DATE MO-DAY	TIME OF DAY	RATE (in/hr)	ACC. (inches)
	RG R-61		9-11	RG	R-61		9-11			
8-12	.15	.00		1705	.00	.00		1720	.000	.0000
8-19	.15	.00		1707	1.50	.05		1721	.000	.0000
8-20	.11	.00		1712	.48	.09		1723	.001	.0000
8-25	.06	.00		1717	1.92	.25		1724	.001	.0000
8-27	.32	.00		1726	3.53	.78		1727	.002	.0001
9-6	.31	.00		1731	3.12	1.04		1728	.002	.0001
9-8	.86	.10		1735	3.15	1.25		1729	.005	.0002
9-9	1.80	.54		1742	3.08	1.61		1730	.013	.0003
				1749	1.54	1.79		1731	.033	.0007
				1802	.65	1.93		1732	.059	.0015
				1808	.30	1.96		1733	.072	.0026
				1830	.05	1.98		1734	.170	.0046
				1928	.02	2.00		1735	.270	.0083
				1949	.09	2.03		1736	.352	.0134
	RG R-82			RG	R-82			1737	.535	.0208
8-12	.22	.00		1720	.00	.00		1738	.630	.0305
8-19	.09	.00		1725	1.08	.09		1739	.770	.0422
8-20	.05	.00		1728	4.40	.31		1740	1.013	.0571
8-26	.05	.00		1732	3.90	.57		1741	1.144	.0750
8-27	.28	.00		1736	4.05	.84		1742	1.359	.0959
9-6	.31	.00		1741	3.12	1.10		1743	1.526	.1199
9-8	1.14	.10		1751	2.76	1.56		1744	1.637	.1463
9-9	1.35	.54		1800	1.60	1.80		1745	1.762	.1746
				1804	.75	1.85		1746	1.824	.2045
				1822	.13	1.89		1748	2.018	.2685
				1919	.01	1.90		1750	1.859	.3331
				1936	.11	1.93		1752	1.734	.3930
				2050	.02	1.96		1754	1.595	.4485
								1756	1.436	.4990
								1758	1.304	.5447
								1800	1.207	.5865
								1802	1.068	.6244
								1803	1.013	.6418
								1805	.888	.6734
								1807	.798	.7015
								1808	.721	.7142
								1809	.650	.7256
								1810	.598	.7360
								1811	.535	.7454
								1812	.495	.7540
								1813	.424	.7617
								1815	.352	.7746
								1816	.309	.7802
								1817	.270	.7850
								1818	.234	.7892
								1819	.200	.7928
								1820	.176	.7959
								1821	.155	.7987
								1822	.132	.8011
								1823	.117	.8032
								1825	.085	.8065
								1827	.059	.8089
								1830	.041	.8114
								1832	.031	.8126
								1834	.023	.8135
								1837	.017	.8145
								1840	.013	.8153
								1845	.009	.8162
								1850	.005	.8167
								1855	.003	.8171
								1900	.002	.8173
								1905	.001	.8174
								1910	.001	.8175
								1915	T	.8175
								2010	.000	.8175

Watershed conditions: Representative of desert grassland. Vegetation dominated by short grasses (blue, sideoats, black and hairy grama, curly mesquite); also, present shrubs include (soapweed, mesquite, burroweed), basal cover of grasses approximately 2.5%. Canopy approximately 20%.

NOTE: TO CONVERT RUNOFF IN IN/HR TO CFS, MULTIPLY BY 144.19.



TOMBSTONE, ARIZONA WATERSHED 63.111

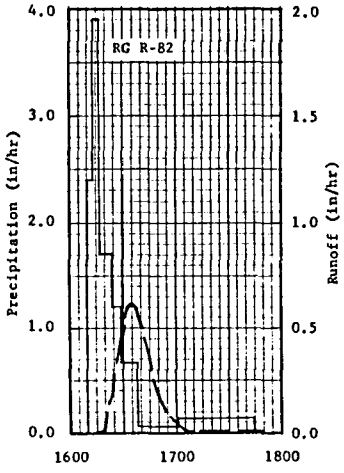
1965 **SELECTED RUNOFF EVENT** — TOMBSTONE, ARIZONA — WATERSHED 63.111-5 — 63.111

Event of September 4, 1965

ANTECEDENT CONDITIONS			RAINFALL				RUNOFF				
DATE MO-DAY	RAINFALL (inches)	RUNOFF (inches)	DATE MO-DAY	TIME OF DAY	INTENSITY (in/hr)	ACC. (inches)	DATE MO-DAY	TIME OF DAY	RATE (in/hr)	ACC. (inches)	
	RG R-61		9-4	RG	R-61		9-4				
8-5	.05	.00		1605	.00	.00		1614	.000	.0000	0
8-8	.66	.00		1611	.50	.05		1615	.001	.0000	.1
8-9	.08	.00		1616	3.84	.37		1616	.001	.0000	.1
8-13	.39	.00		1622	1.10	.48		1617	.002	.0000	.3
											.9
8-15	.15	.00		1630	.98	.61		1618	.006	.0001	1.3
8-16	.02	.00		1639	.47	.68		1619	.009	.0002	2.5
8-17	.02	.00		1708	.06	.71		1620	.017	.0005	6.3
8-18	.69	T		1748	.12	.79		1621	.044	.0010	12.
8-20	.10	.00						1622	.083	.0020	19
8-21	.05	.00						1623	.132	.0038	25
8-22	.16	.00						1624	.176	.0064	32
8-26	.04	.00						1625	.220	.0097	39
9-1	.10	.00						1626	.270	.0138	47
9-2	1.13	.13						1627	.326	.0187	58
9-3	.40	.06						1628	.399	.0248	68
								1629	.473	.0321	75
								1630	.518	.0403	82
								1631	.566	.0493	85
								1632	.591	.0590	88
	RG R-82			RG	R-82			1633	.610	.0690	89
8-5	.07	.00		1610	.00	.00		1634	.617	.0792	90 — max
8-8	.58	.00		1613	2.40	.12		1635	.623	.0896	89
8-9	.10	.00		1617	3.90	.38		1636	.617	.0999	88
8-13	.35	.00		1624	1.71	.58		1637	.610	.1101	85
8-15	.04	.00		1629	1.20	.68		1638	.590	.1201	82
8-16	.02	.00		1638	.67	.78		1639	.566	.1298	78
8-17	.03	.00		1701	.05	.80		1640	.542	.1390	73
8-18	.59	T		1744	.13	.89		1641	.506	.1477	67
8-20	.22	.00						1642	.467	.1558	61
8-22	.05	.00						1643	.424	.1633	55
8-26	.10	.00						1644	.380	.1700	48
8-29	.07	.00						1645	.335	.1759	43
9-2	.83	.13						1646	.300	.1812	39
9-3	.58	.06						1647	.270	.1860	34
								1648	.237	.1902	30
								1649	.210	.1939	26
								1650	.182	.1972	23
								1651	.159	.2000	20
								1652	.137	.2025	18
								1653	.125	.2047	16
								1654	.112	.2067	14
								1655	.100	.2084	13
								1656	.089	.2100	11
								1657	.078	.2114	9.7
								1658	.067	.2126	8.2
								1659	.057	.2136	7.1
								1700	.049	.2145	5.2
								1702	.036	.2159	4.0
								1704	.028	.2170	3.2
								1706	.022	.2178	2.7
								1708	.019	.2185	2.2
								1710	.015	.2191	1.9
								1712	.013	.2195	1.6
								1714	.010	.2199	1.3
								1716	.009	.2202	1.0
								1718	.007	.2205	.9
								1720	.006	.2207	.6
								1725	.004	.2212	.3
								1730	.002	.2214	.3
								1735	.002E	.2216E	.1
								1740	.001E	.2217E	.1
								1745	.001E	.2218E	0
								1750	T	.2218E	
								1825	.000E	.2218E	

Watershed conditions: Representative of desert grassland. Vegetation dominated by short grasses (blue, sideoats, black and hairy grama, curly mesquite); also present shrubs include (soapweed, mesquite, burroweed), basal cover of grasses approximately 2.5%. Canopy approximately 20%.

NOTE: TO CONVERT RUNOFF IN IN/HR TO CFS, MULTIPLY BY 144.19.



September 4, 1965

TOMBSTONE, ARIZONA — WATERSHED 63.111

1966 **SELECTED RUNOFF EVENT** — TOMBSTONE, ARIZONA — WATERSHED 63.111 — 63.111

Event of July 28, 1966

ANTECEDENT CONDITIONS			RAINFALL				RUNOFF			
DATE MO-DAY	RAINFALL (inches)	RUNOFF (inches)	DATE MO-DAY	TIME OF DAY	INTENSITY (in/hr)	ACC. (inches)	DATE MO-DAY	TIME OF DAY	RATE (in/hr)	ACC. (inches)
	RG R-61		7-28	RG	R-61		7-28			
7-16	.06	.00		1830	.00	.00		1834	.000	.0000
7-17	.07	.00		1837	3.69	.43		1835	.000	.0000
7-18	.20	.00		1851	.73	.60		1836	.000	.0000 0
7-19	.24	.00		1855	2.85	.79		1837	.004	.0000 1
7-20	1.31	.19		1903	1.95	1.05		1838	.022	.0003 3
7-22	.15	.00		1908	.96	1.13		1839	.059	.0009 9
7-24	.19	.00		1911	1.60	1.21		1840	.112	.0024 16
7-26	.11	.00		1915	2.85	1.40		1841	.129	.0044 19
7-27	.39	.00		1919	2.85	1.59		1842	.159	.0068 23
7-28	1/ .49	2/.02		1927	1.50	1.79		1843	.176	.0096 25
				1931	.75	1.84		1845	.191	.0157 28
				2001	.22	1.95		1851	.200	.0353 29
				2031	.06	1.98		1853	.214	.0422 31
				2051	.09	2.01		1855	.241	.0497 35
	RG R-82			RG	R-82			1857	.277	.0584 40
7-8	.06	.00		1825	.00	.00		1858	.309	.0633 45
7-16	.20	.00		1829	1.20	.08		1859	.339	.0687 49
7-18	.10	.00		1832	3.60	.26		1900	.371	.0746 53
7-19	.21	.00		1834	3.60	.38		1901	.404	.0810 58
7-20	1.60	.19		1842	1.05	.52		1902	.430	.0880 62
7-22	.15	.00		1848	1.00	.62		1903	.456	.0954 66
7-24	.23	.00		1850	1.50	.67		1904	.484	.1032 79
7-26	.12	.00		1852	1.20	.71		1906	.560	.1206 81
7-27	.42	.00		1858	1.90	.90		1908	.610	.1401 88
7-28	1/ .56	2/.02		1904	1.90	1.09		1910	.637	.1609 92
				1906	.90	1.12		1916	.657	.2256 95
				1914	1.13	1.27		1920	.721	.2715 104
				1917	3.00	1.42		1922	.791	.2967 114
				1922	2.64	1.64		1924	.902	.3249 130
				1926	2.70	1.82		1926	.999	.3566 144
				1930	1.80	1.94		1928	1.151	.3924 166
				1943	.37	2.02		1930	1.234	.4322 178
				2002	.26	2.10		1932	1.283	.4741 185
				2028	.05	2.12		1934	1.234	.5161 178
				2058	.12	2.18		1936	1.144	.5557 165
								1938	.978	.5911 141
								1940	.860	.6217 124
								1941	.763	.6353 110
								1942	.657	.6471 95

Continued on next page

Watershed conditions: Representative of desert grassland. Vegetation dominated by short grasses grama, curly mesquite); also, present shrubs include (soapweed, mesquite, burroweed), basal cover of grasses approximately 2.5%. Canopy approximately 20%.

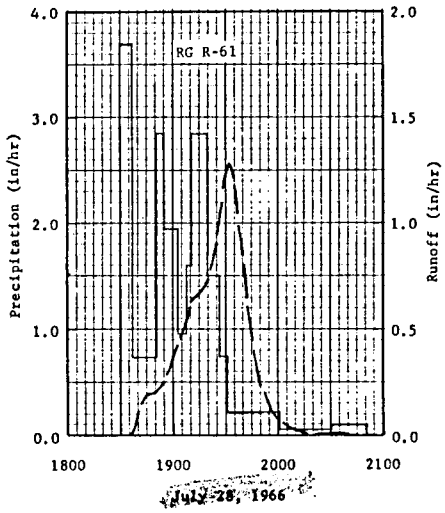
NOTES: TO CONVERT RUNOFF IN IN/HR TO CFS, MULTIPLY BY 144.19. 1/ OCCURRED BETWEEN 1310 AND 1355. 2/ PRIOR TO 1834.

#1226
1966

1966 SELECTED RUNOFF EVENT — TOMBSTONE, ARIZONA WATERSHED 63.111 — 63.111

ANTECEDENT CONDITIONS			RAINFALL				RUNOFF				
DATE MO-DAY	RAINFALL (inches)	RUNOFF (inches)	DATE MO-DAY	TIME OF DAY	INTENSITY (in/hr)	ACC. (inches)	DATE MO-DAY	TIME OF DAY	RATE (in/hr)	ACC. (inches)	
			Event of July 28, 1966-Continued								
							7-28	1943	.604	.6576	87
								1944	.542	.6671	78
								1945	.484	.6757	70
								1946	.424	.6833	61
								1947	.361	.6898	52
								1948	.318	.6955	46
								1949	.277	.7004	40
								1950	.241	.7047	35
								1951	.200	.7084	27
								1952	.170	.7115	25
								1953	.148	.7142	21
								1954	.125	.7164	18
								1956	.103	.7202	15
								1958	.091	.7235	13
								2000	.079	.7263	11
								2002	.059	.7286	9
								2004	.047	.7304	7
								2006	.040	.7318	6
								2008	.027	.7329	4
								2010	.022	.7337	3
								2013	.015	.7346	
								2016	.011	.7353	
								2019	.008	.7358	
								2022	.006	.7361	
								2025	.004	.7364	
								2030	.003	.7367	
								2035	.002	.7368	
								2040	.001	.7369	
								2045	.000	.7370	
								2055	.000E	.7370E	
								2105	.000E	.7370E	
								2115	.000E	.7370E	

NOTE: TO CONVERT RUNOFF IN IN/HR TO CFS, MULTIPLY BY 144.19.



TOMBSTONE, ARIZONA WATERSHED 63.111

MONTHLY PRECIPITATION AND RUNOFF (inches)

TOMBSTONE, ARIZONA [redacted] 63.111
AREA—143 ACRES

YEAR \ MONTH		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	ANNUAL
1967	P1/	.00	.32	.02	.01	.25	.50	2.91	.00	4.85	.13	.15	2.32	11.46
	Q	.00	.00	.00	.00	.00	.00	T	.02	.22	.00	.00	.00	.24
STA AVG (62-67)	P2/	.54	.27	.19	.11	.04	.17	4.12	2.07	2.87	.19	.60	1.06	12.23
	Q	.00	.00	.00	.00	.00	.00	.49	.18	.42	.00	.00	.00	1.09
MEAN 71 YR	P3/	.83	.77	.61	.28	.18	.49	3.64	3.49	1.52	.66	.63	.89	13.99

ANNUAL MAXIMUM DISCHARGES (Inches per hour) AND ANNUAL MAXIMUM VOLUMES OF RUNOFF (inches) FOR SELECTED TIME INTERVALS

YEAR	MAXIMUM DISCHARGE		MAXIMUM VOLUME FOR SELECTED TIME INTERVAL													
			1 HOUR		2 HOURS		6 HOURS		12 HOURS		1 DAY		2 DAYS		8 DAYS	
	DATE	RATE	DATE	VOLUME	DATE	VOLUME	DATE	VOLUME	DATE	VOLUME	DATE	VOLUME	DATE	VOLUME	DATE	VOLUME
1967	9-10	.38	9-10	.21	9-10	.22	9-10	.22	9-10	.22	9-10	.22	9-10	.22	9-10	.22
MAXIMUMS FOR PERIOD OF RECORD																
19 62 TO 19 67	7-22 1964	2.90	7-22 1964	.83	7-22 1964	.83	7-22 1964	.83	7-22 1964	.83	7-22 1964	.84	9-10 1964	1.34	9-8 1964	1.45

NOTES: 1/ Monthly precipitation is arithmetic average of 2 rain gages. 2/ Precipitation and runoff record began in 1962. 3/ Mean P based on 71-yr (1897-1967) U.S. Weather Bureau record period at Tombstone, Ariz.

1967 SELECTED RUNOFF EVENT

TOMBSTONE, ARIZONA [redacted] 63.111

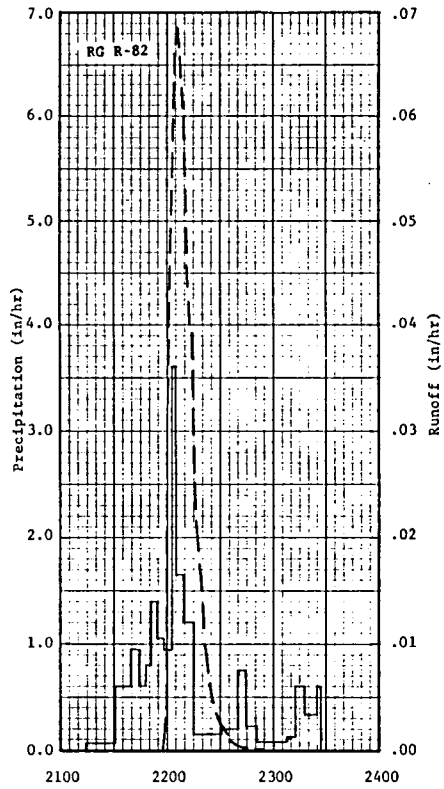
Event of [redacted]

ANTECEDENT CONDITIONS			RAINFALL				RUNOFF			
DATE MO-DAY	RAINFALL (inches)	RUNOFF (inches)	DATE MO-DAY	TIME OF DAY	INTENSITY (in/hr)	ACC. (inches)	DATE MO-DAY	TIME OF DAY	RATE (in/hr)	ACC. (inches)
	RG R-82		8-11	RG	R-82		8-11			
7-11	.21	.00		2114	.00	.00		2158	.0000	.0000
7-12	.04	.00		2131	.07	.02		2159	.0031	.0000
7-13	.10	.00		2135	.60	.06		2200	.0157	.0002
7-15	.05	.00		2139	.60	.10		2201	.0327	.0006
7-16	.46	.00		2144	.96	.18		2202	.0472	.0013
7-17	.67	.001		2148	.60	.22		2203	.0587	.0021
7-19	.07	.00		2151	.80	.26		2204	.0654	.0032
7-25	.10	.00		2154	1.40	.33		2205	.0671	.0043
7-26	.10	.00		2158	1.05	.40		2206	.0687	.0054
7-27	.27	.00		2203	.96	.48		2207	.0671	.0065
7-31	.12	.00		2205	3.60	.60		2208	.0637	.0076
8-2	.10	.00		2209	1.65	.71		2209	.0603	.0087
8-3	.11	.00		2212	1.20	.77		2210	.0558	.0096
8-4	.04	.00		2215	1.20	.83		2211	.0514	.0105
8-5	.18	.00		2231	.15	.87		2212	.0458	.0113
8-9	.11	.00		2240	.20	.90		2213	.0409	.0121
8-10	.09	.00		2244	.75	.95		2214	.0362	.0127
				2252	.22	.98		2215	.0298	.0132
				2308	.08	1.00		2216	.0261	.0137
				2313	.12	1.01		2217	.0224	.0141
				2318	.60	1.06		2218	.0192	.0145
				2325	.34	1.10		2219	.0163	.0148
				2327	.60	1.12		2220	.0137	.0150
								2222	.0098	.0154
								2224	.0062	.0157
								2226	.0048	.0159
								2228	.0036	.0160
								2230	.0026	.0161
								2232	.0020	.0162
								2234	.0014	.0162
								2236	.0008	.0163
								2238	.0005	.0163
								2240	.0003	.0163E
								2245	.0001	.0163E
								2255	.0000	.0163E

Watershed conditions: Representative of desert grassland. Vegetation dominated by short grasses (blue, sideoats, black and hairy grama, curly mesquite); also, present shrubs include (soapweed, mesquite, burroweed), basal cover of grasses approximately 2.5 percent. Canopy approximately 20 percent.

NOTE: TO CONVERT RUNOFF IN IN/HR TO CFS, MULTIPLY BY 144.19. FOR TOPOGRAPHIC, GEOLOGIC, AND VEGETATION MAP OF WATERSHED, SEE HYDROLOGIC DATA FOR EXPERIMENTAL AGRICULTURAL WATERSHEDS IN THE UNITED STATES, 1966, USDA MISC. PUB. 1226, P. 63.1-3, AND 63.1-4, 63.1-5.

#1262
1967

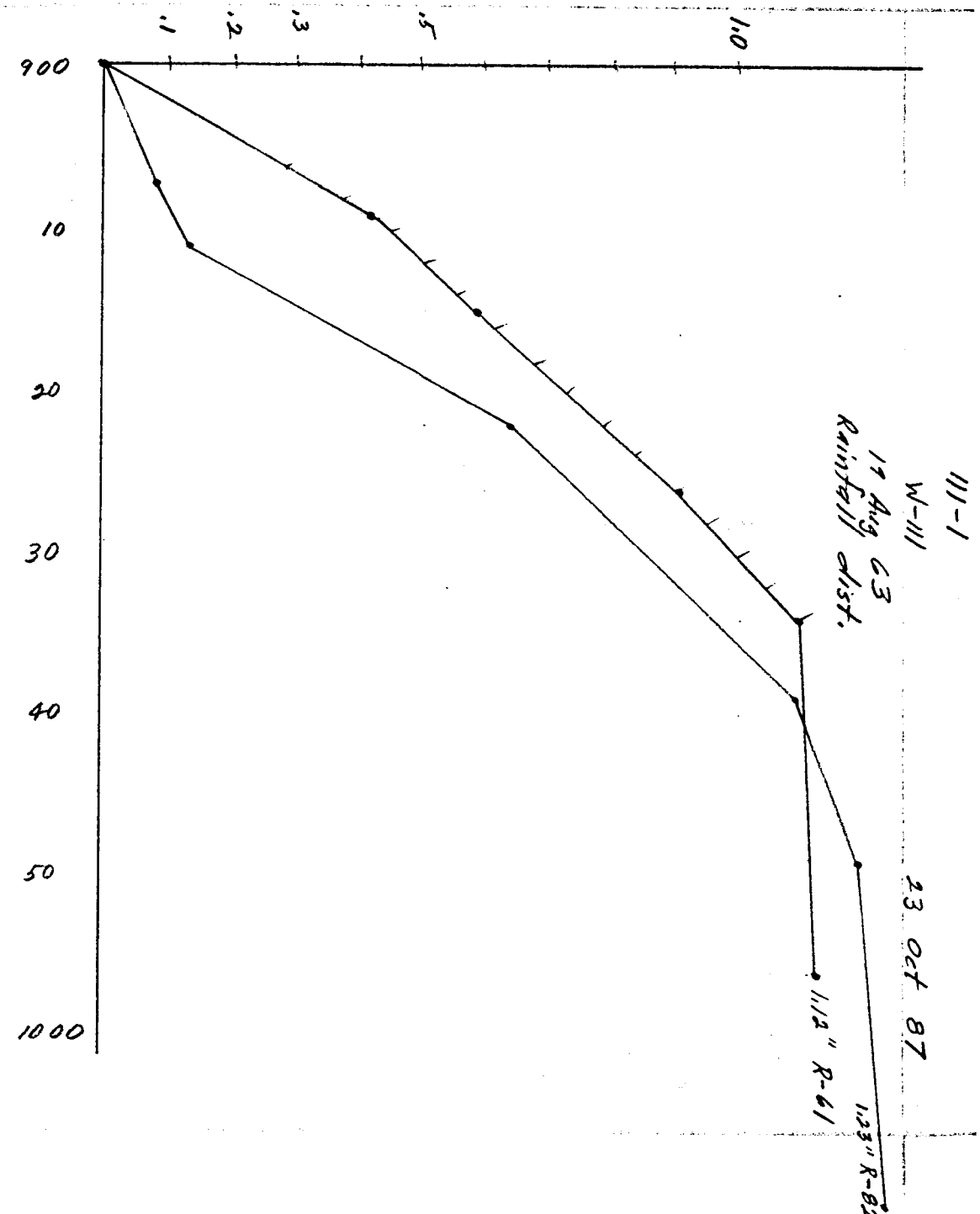


AUGUST 11, 1967

TOMBSTONE, ARIZONA WATERSHED 63.111

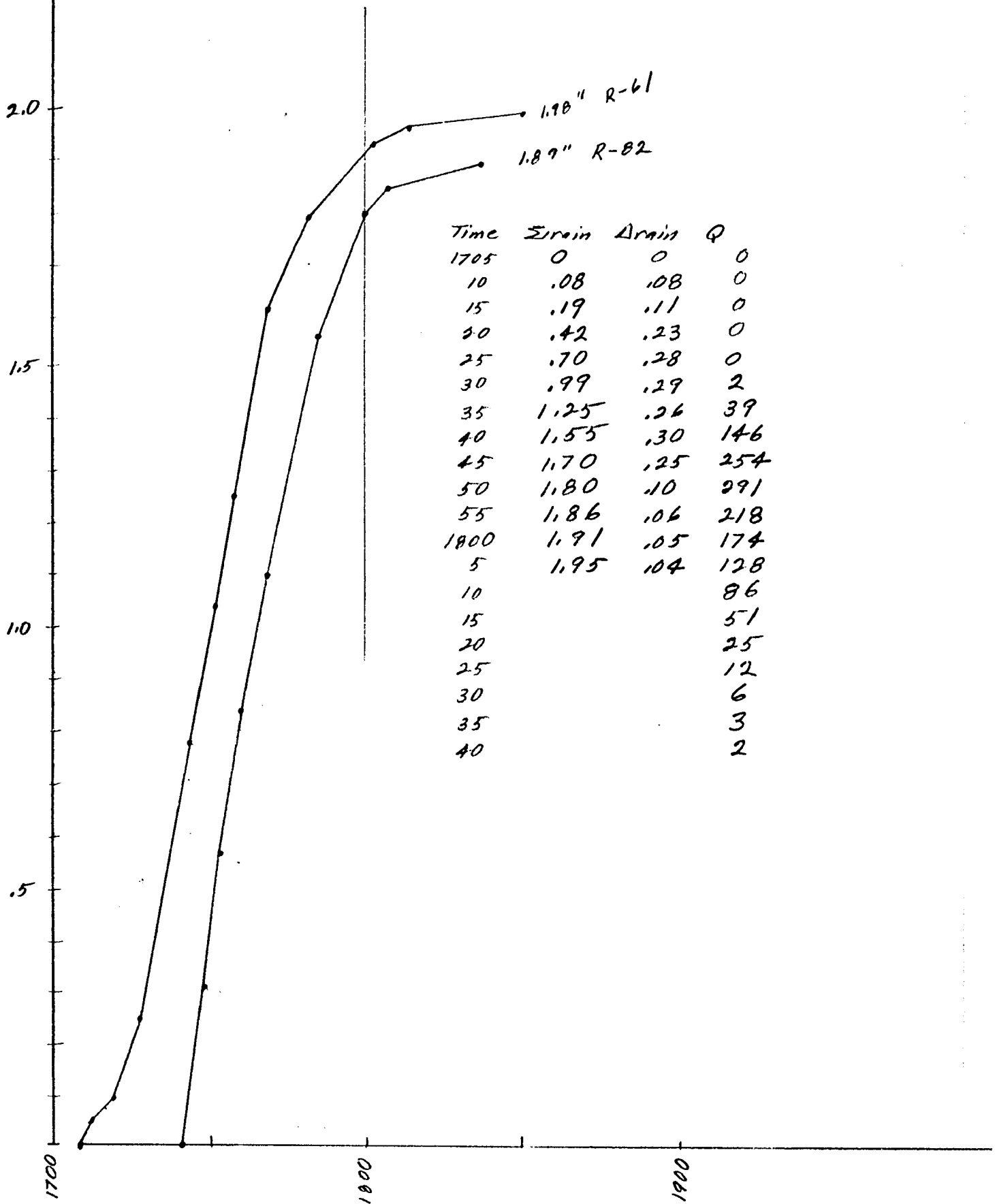
A= .223

Time	Σrain	Δrain	Q	Time	Q
900	0	0		1000	7
2	.1	.1		2	6
4	.19	.09		4	5
6	.28	.09		6	4
8	.37	.09		8	3
10	.45	.08		10	2
12	.5	.05	0		
14	.55	.05	.4		
16	.62	.07	2.9		
18	.67	.05	17		
20	.72	.05	51		
22	.78	.06	95		
24	.83	.05	141		
26	.9	.07	264		
28	.95	.05	188		
30	.99	.04	174		
32	1.04	.05	149		
34	1.09	.05	134		
36	1.12	.03	111		
38	1.15	.03	93		
40	1.17	.02	75		
42	1.19	.02	55		
44			42		
46			36		
48			27		
50			22		
52			18		
54			14		
56			11		
58			9		



111-2 23 Oct 87

11 Sept. 64
Rainfall Dist.

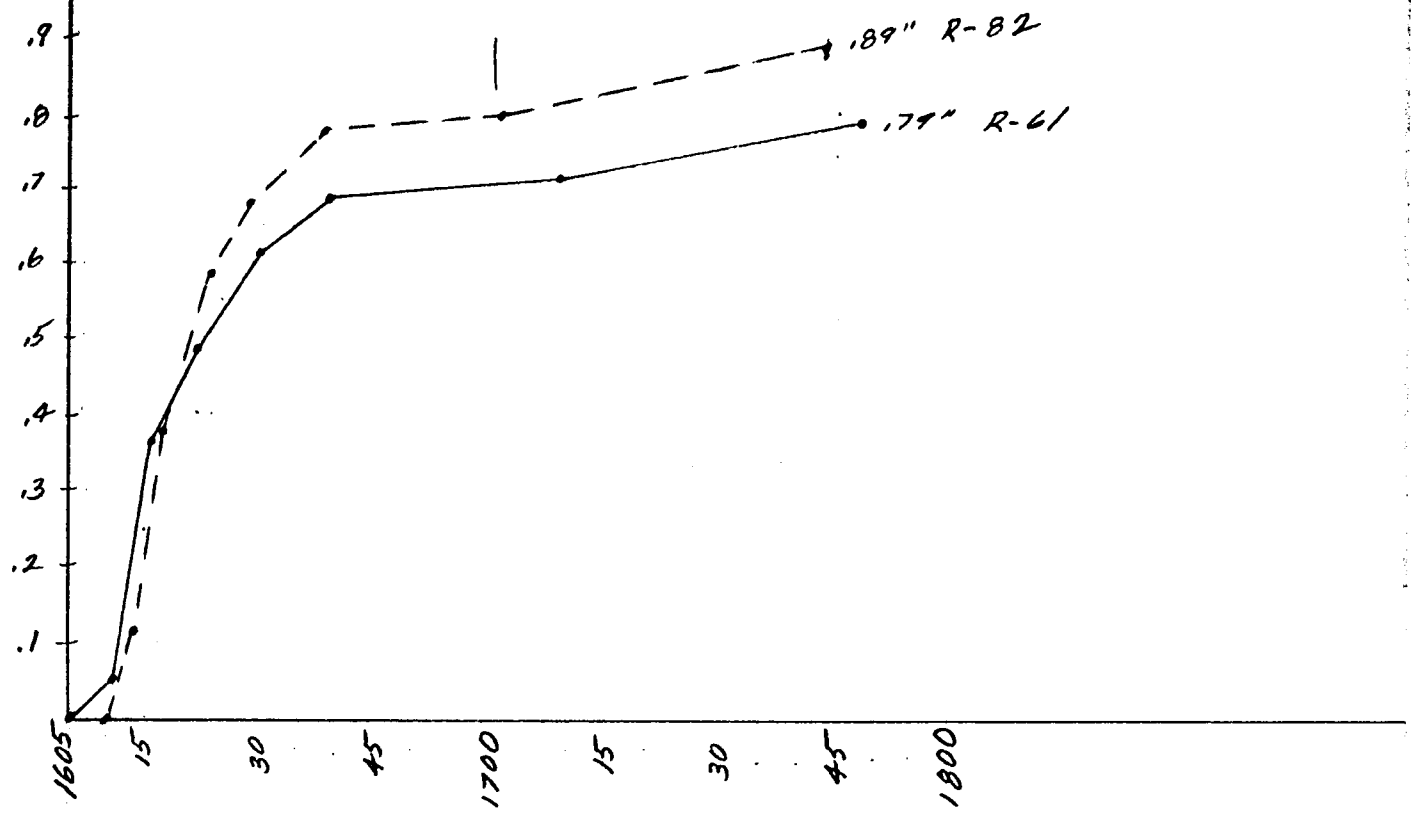


Time	Σrain	Δrain	Q
1705	0	0	0
10	.08	.08	0
15	.19	.11	0
20	.42	.23	0
25	.70	.28	0
30	.99	.29	2
35	1.25	.26	39
40	1.55	.30	146
45	1.70	.25	254
50	1.80	.10	291
55	1.86	.06	218
1800	1.91	.05	174
5	1.95	.04	128
10			86
15			51
20			25
25			12
30			6
35			3
40			2

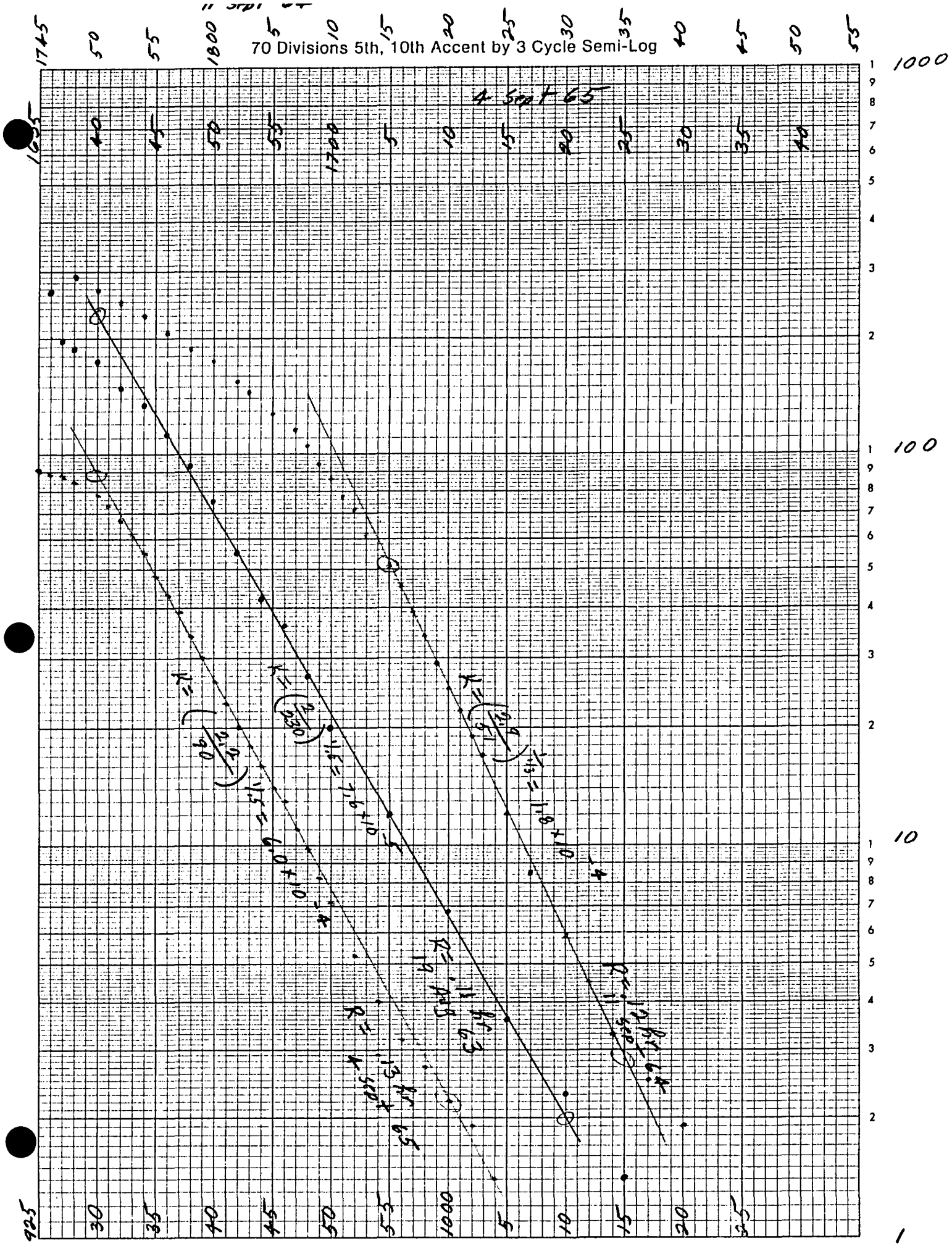
111-3 23 Oct 87

4 Sept 65

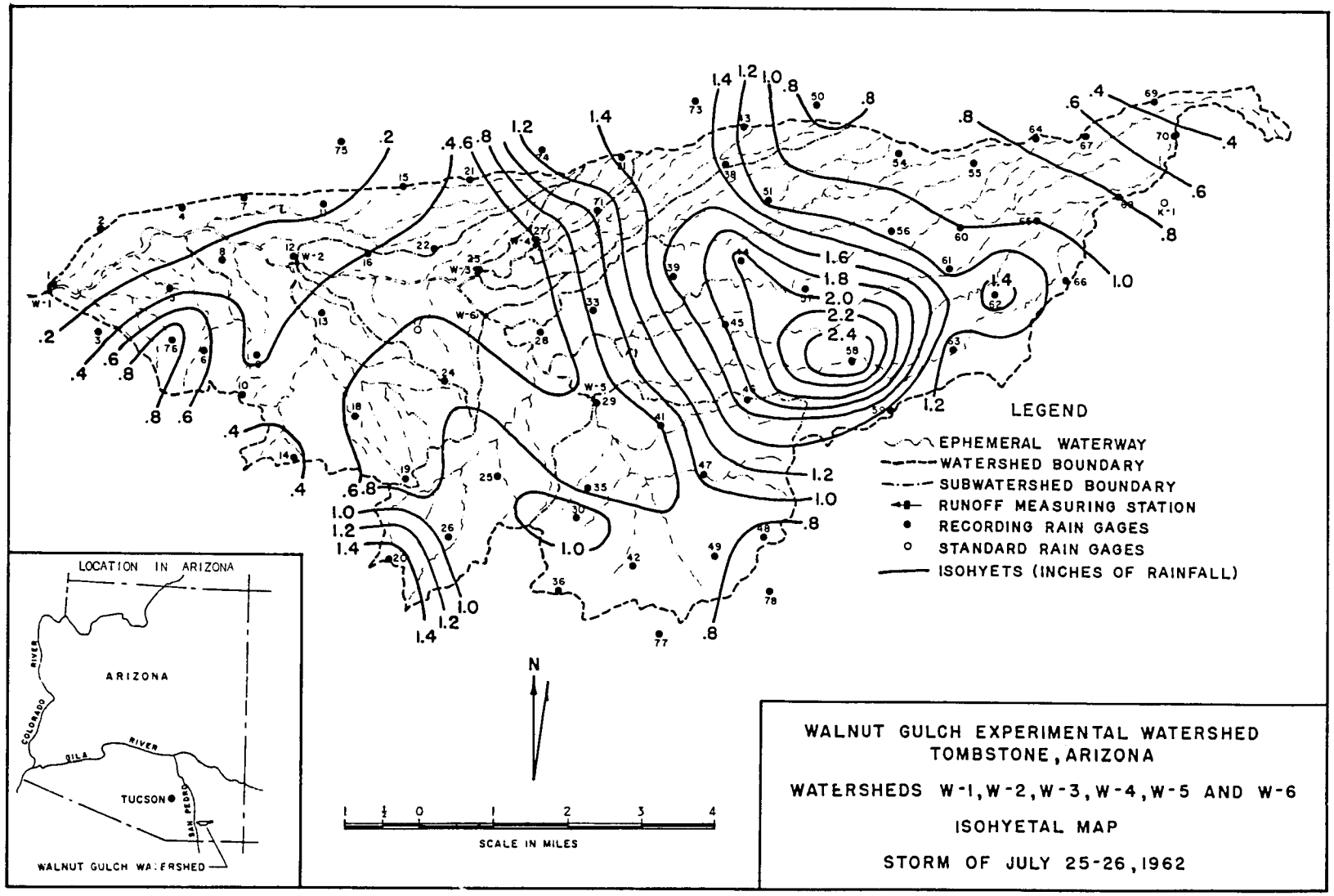
Rainfall Dist.

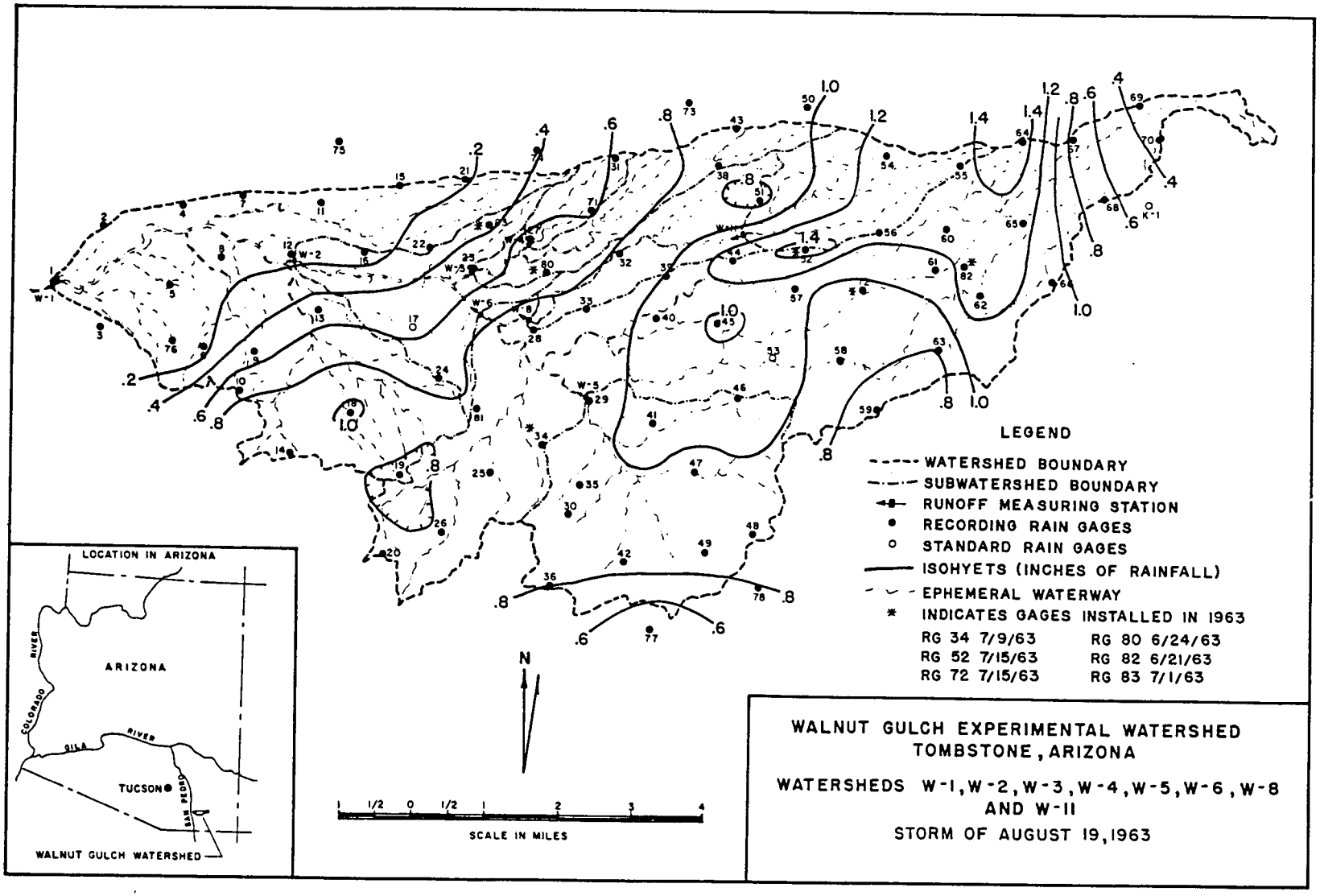


Time	Σrain	Δrain	Q
1610	0	0	0
15	.25	.25	0
20	.45	.20	2
25	.57	.12	32
30	.65	.08	75
35	.70	.05	90
40	.73	.03	78
45	.75	.02	48
50			26
55			14
1700			7
5			3.6
10			2.2
15			1.3
20			.9
25			.6
30			.3


70 Divisions 5th, 10th Accent by 3 Cycle Semi-Log
4 Sept 65
1000
100
10
1

19 August 63


LEGEND
EPHEMERAL WATERWAY
WATERSHED BOUNDARY
SUBWATERSHED BOUNDARY
RUNOFF MEASURING STATION
RECORDING RAIN GAGES
STANDARD RAIN GAGES
ISOHYETS (INCHES OF RAINFALL)
LOCATION IN ARIZONA
ARIZONA
COLORADO RIVER
GILA RIVER
TUCSON
SAN PEDRO RIVER
WALNUT GULCH WATERSHED
N
SCALE IN MILES
WALNUT GULCH EXPERIMENTAL WATERSHED
TOMBSTONE, ARIZONA
WATERSHEDS W-1, W-2, W-3, W-4, W-5 AND W-6
ISOHYETAL MAP
STORM OF JULY 25-26, 1962



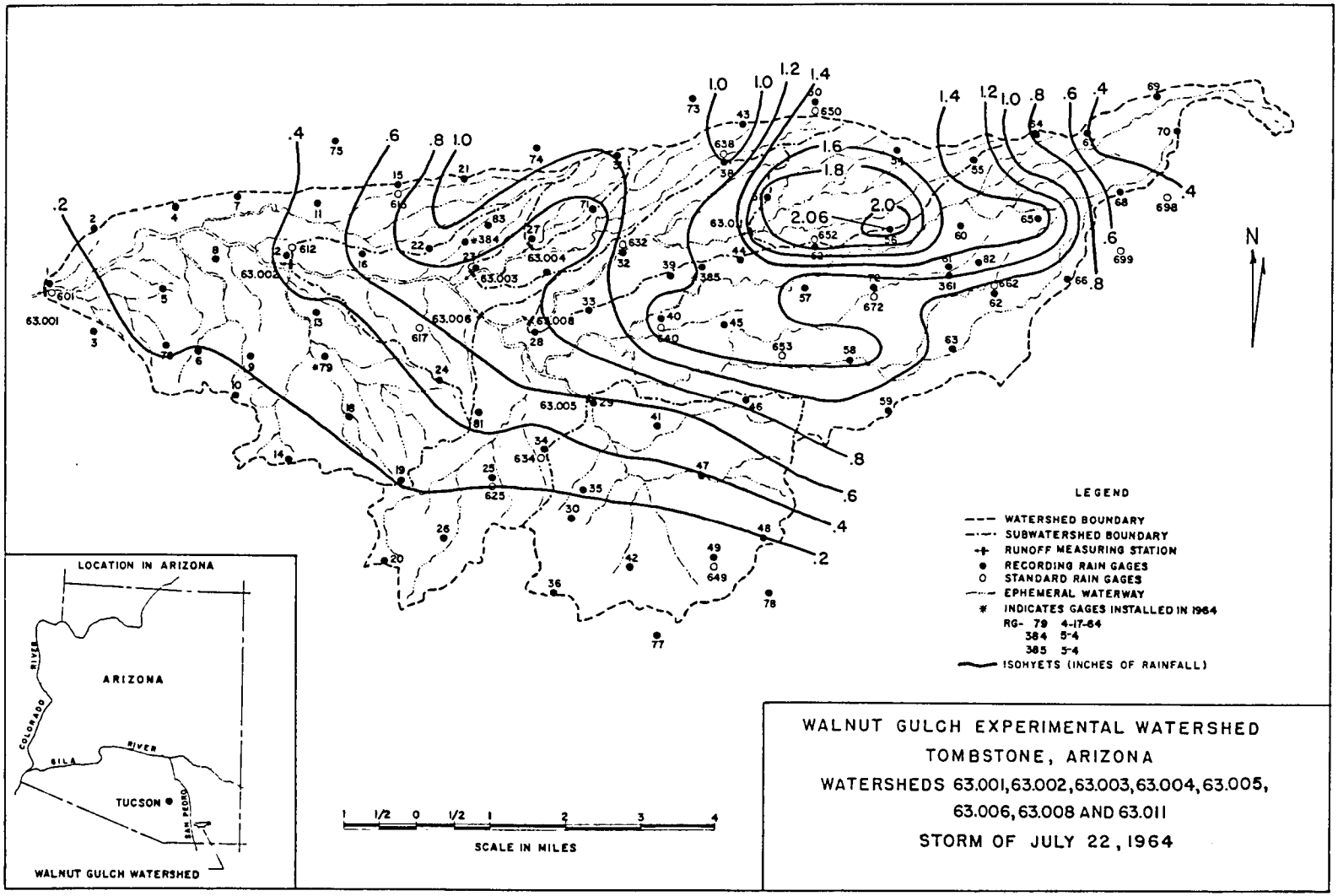
WALNUT GULCH EXPERIMENTAL WATERSHED
TOMBSTONE, ARIZONA

WATERSHEDS W-1, W-2, W-3, W-4, W-5, W-6, W-8 AND W-11

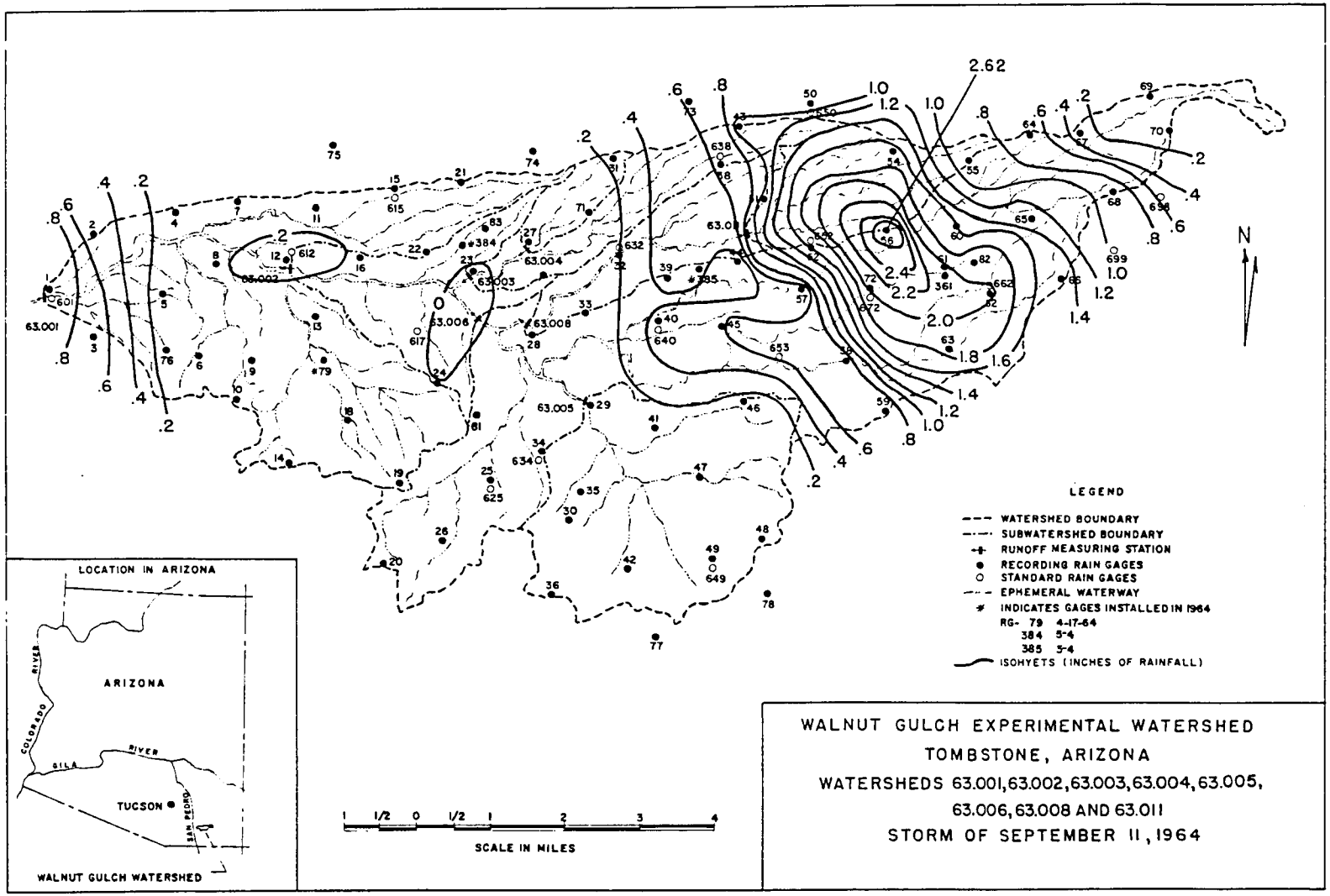
STORM OF AUGUST 19, 1963

63-6-9

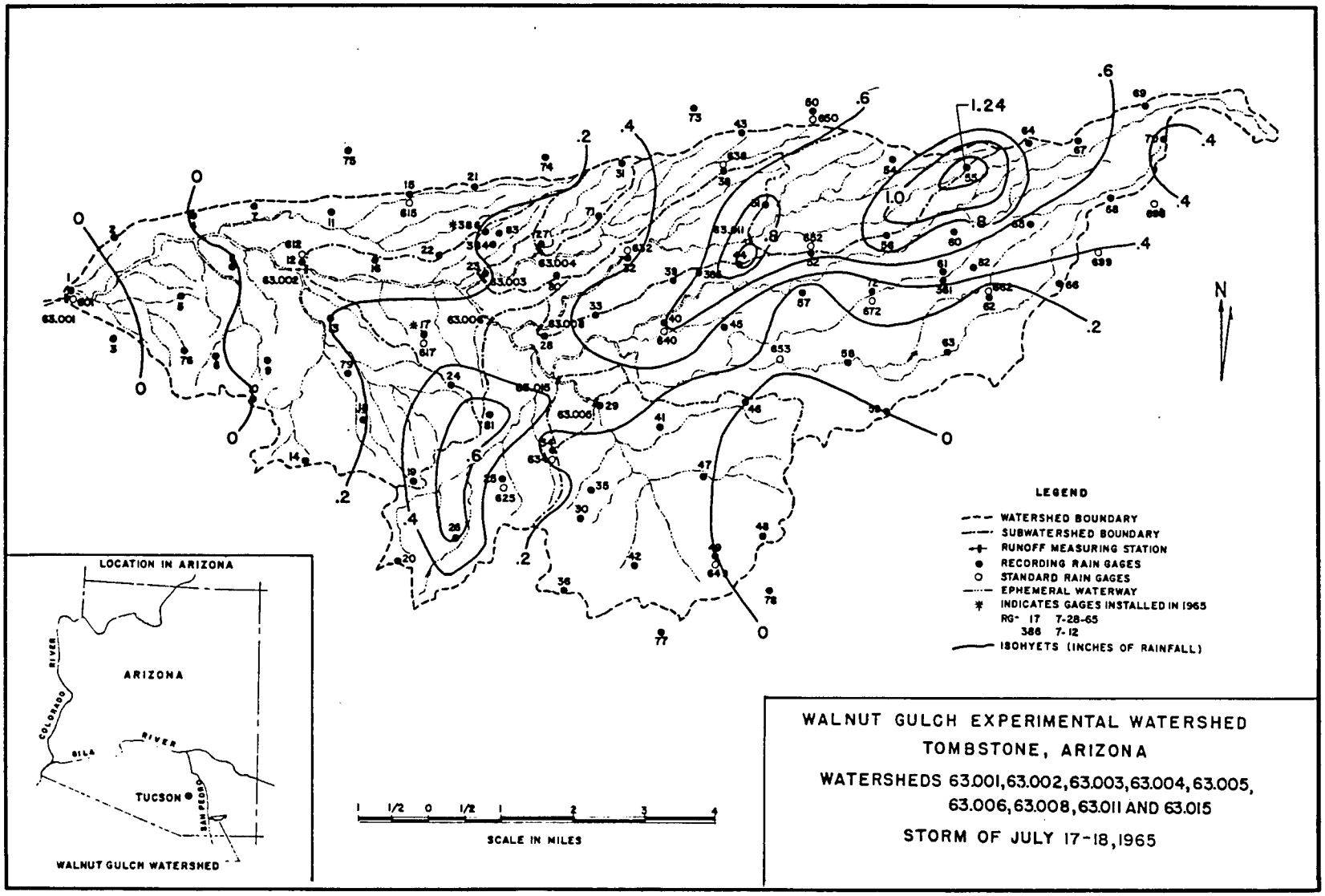
#1164
1963



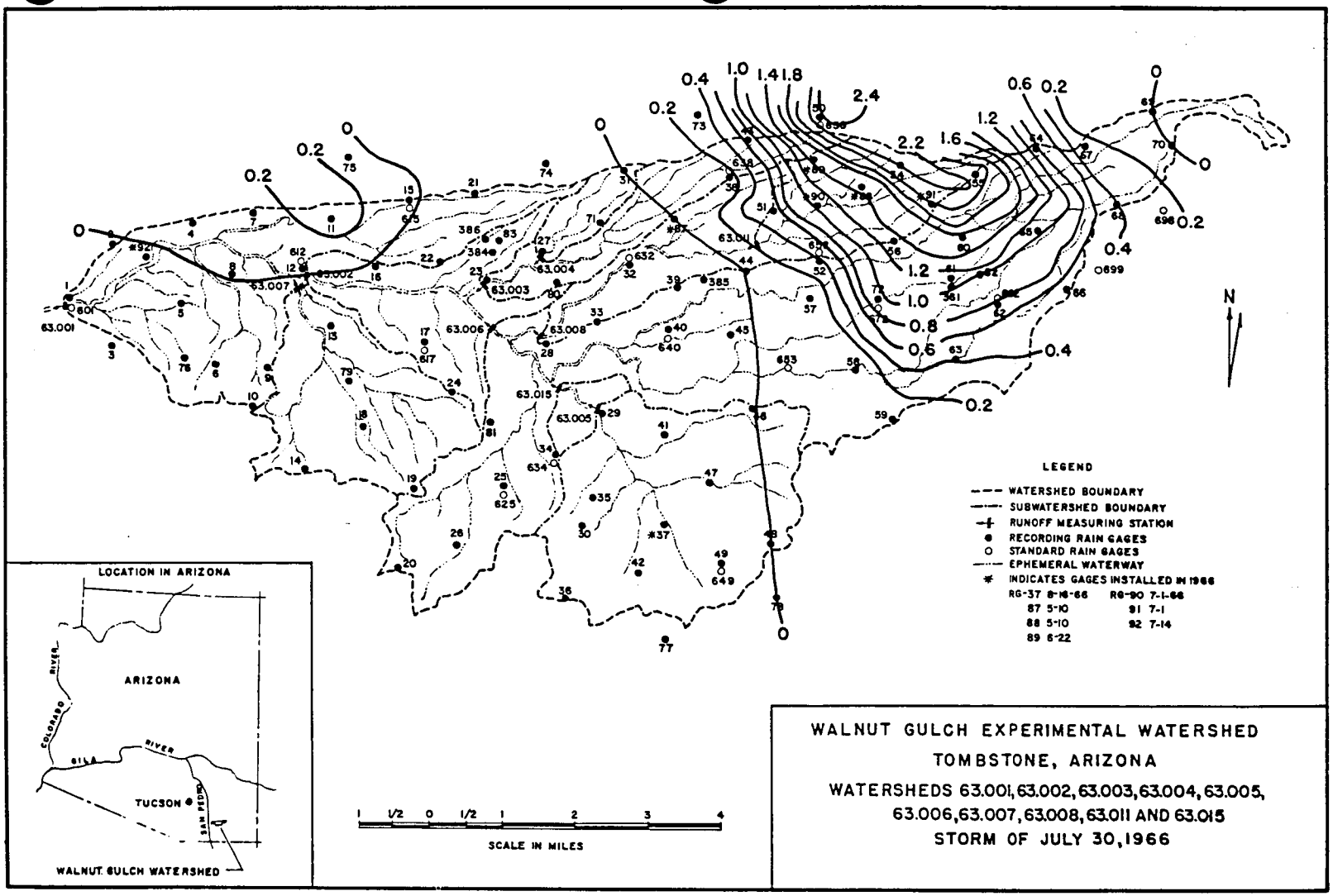
WALNUT GULCH EXPERIMENTAL WATERSHED
TOMBSTONE, ARIZONA
WATERSHEDS 63.001, 63.002, 63.003, 63.004, 63.005, 63.006, 63.008 AND 63.011
STORM OF JULY 22, 1964

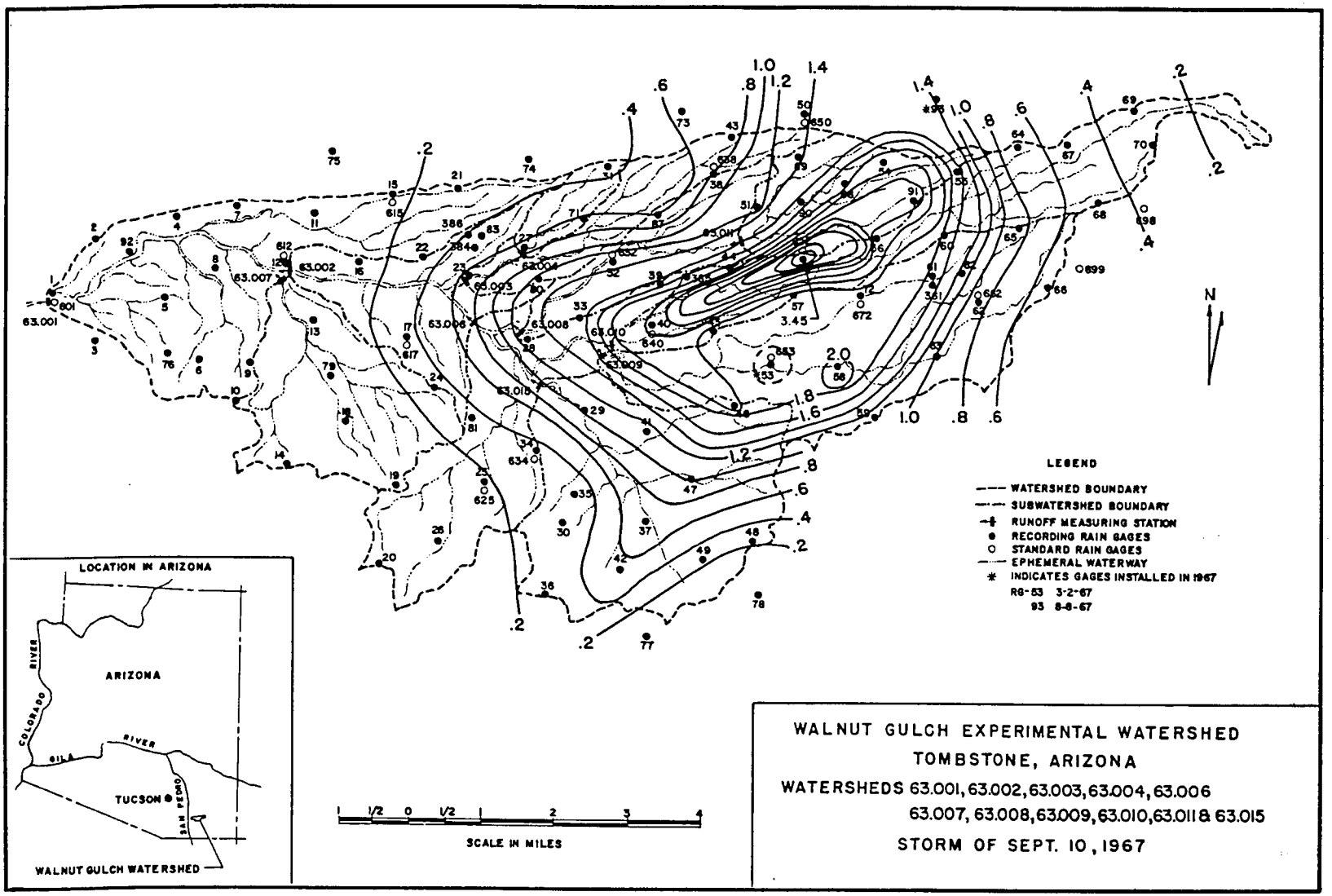

LEGEND
WATERSHED BOUNDARY
SUBWATERSHED BOUNDARY
RUNOFF MEASURING STATION
RECORDING RAIN GAGES
STANDARD RAIN GAGES
EPHEMERAL WATERWAY
INDICATES GAGES INSTALLED IN 1964
RG- 79 4-17-64
384 5-4
385 5-4
ISOHYETS (INCHES OF RAINFALL)
N
SCALE IN MILES
LOCATION IN ARIZONA
ARIZONA
COLORADO RIVER
GILA RIVER
TUCSON
SAN PEDRO
WALNUT GULCH WATERSHED
WALNUT GULCH EXPERIMENTAL WATERSHED
TOMBSTONE, ARIZONA
WATERSHEDS 63.001, 63.002, 63.003, 63.004, 63.005,
63.006, 63.008 AND 63.011
STORM OF SEPTEMBER 11, 1964

#1194

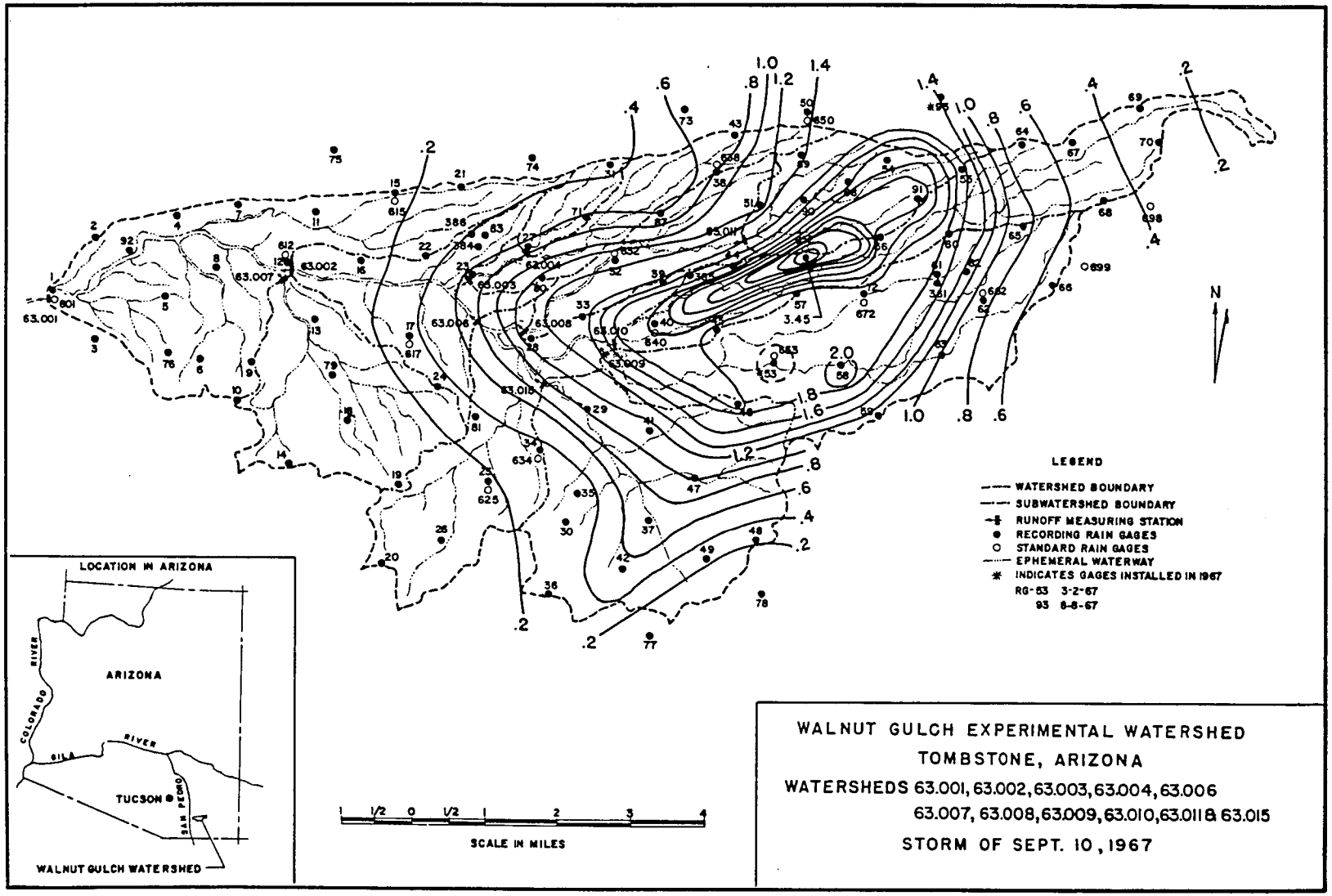


WALNUT GULCH EXPERIMENTAL WATERSHED
TOMBSTONE, ARIZONA
WATERSHEDS 63.001, 63.002, 63.003, 63.004, 63.005, 63.006, 63.008, 63.011 AND 63.015
STORM OF JULY 17-18, 1965


LEGEND
WATERSHED BOUNDARY
SUBWATERSHED BOUNDARY
RUNOFF MEASURING STATION
RECORDING RAIN GAGES
STANDARD RAIN GAGES
EPHEMERAL WATERWAY
INDICATES GAGES INSTALLED IN 1966
RG-37 8-16-66
87 5-10
88 5-10
89 6-22
RG-90 7-1-66
91 7-1
92 7-14
N
LOCATION IN ARIZONA
ARIZONA
COLORADO RIVER
GILA RIVER
TUCSON
SAN PEDRO
WALNUT GULCH WATERSHED
SCALE IN MILES
WALNUT GULCH EXPERIMENTAL WATERSHED
TOMBSTONE, ARIZONA
WATERSHEDS 63.001, 63.002, 63.003, 63.004, 63.005,
63.006, 63.007, 63.008, 63.011 AND 63.015
STORM OF JULY 30, 1966


LEGEND
WATERSHED BOUNDARY
SUBWATERSHED BOUNDARY
RUNOFF MEASURING STATION
RECORDING RAIN GAGES
STANDARD RAIN GAGES
EPHEMERAL WATERWAY
INDICATES GAGES INSTALLED IN 1967
RG-53 3-2-67
93 8-8-67
N
SCALE IN MILES
LOCATION IN ARIZONA
ARIZONA
COLORADO RIVER
GILA RIVER
TUCSON
SAN PEDRO
WALNUT GULCH WATERSHED
WALNUT GULCH EXPERIMENTAL WATERSHED
TOMBSTONE, ARIZONA
WATERSHEDS 63.001, 63.002, 63.003, 63.004, 63.006
63.007, 63.008, 63.009, 63.010, 63.011 & 63.015
STORM OF SEPT. 10, 1967

#1262


LEGEND
WATERSHED BOUNDARY
SUBWATERSHED BOUNDARY
RUNOFF MEASURING STATION
RECORDING RAIN GAGES
STANDARD RAIN GAGES
EPHEMERAL WATERWAY
INDICATES GAGES INSTALLED IN 1967
RG-53 3-2-67
93 8-8-67
N
LOCATION IN ARIZONA
ARIZONA
COLORADO RIVER
GILA RIVER
TUCSON
SAN PEDRO
WALNUT GULCH WATERSHED
SCALE IN MILES
WALNUT GULCH EXPERIMENTAL WATERSHED
TOMBSTONE, ARIZONA
WATERSHEDS 63.001, 63.002, 63.003, 63.004, 63.006
63.007, 63.008, 63.009, 63.010, 63.011 & 63.015
STORM OF SEPT. 10, 1967

TOMBSTONE, ARIZONA WALNUT GULCH WATERSHED W-1 (63.001)

LOCATION: (Revision) Cochise County, Ariz.; 5.6 miles W. of Tombstone; Walnut Gulch, San Pedro River, Gila River, Colorado River Basin.

AREA: 36,900 ac. (57.7 sq. miles).

SLOPES: Not yet available.

SOILS, EROSION, AND LAND CAPABILITY: Detailed descriptions not yet available; see general notes in Hydrologic Data for Experimental Agricultural Watersheds in the United States 1956-59, USDA Misc. Pub. 945, 1963, p. 63.1-1.

GEOLOGY: Basin and Range Province; isolated mountain blocks separated by broad alluvium-filled basins. The watershed is bounded on the east by the lower Dragoon Mountains which are predominantly Triassic and Jurassic quartz monzonite. In the south central part, isolated volcanic hills form the perimeter of the study area. Andesite-rhyolite beds have been thrust over the underlying complex, resulting in a highly fractured region. In the southwestern portion of the watershed, major granitic intrusions have uplifted and exposed a thick sequence of limestone and shale beds. These fractured units form the Tombstone Hills and are cut by numerous faults and rhyolite dikes. Various intrusive rocks in this portion of the watershed have much local influence on drainage patterns. The majority of the watershed is covered by the Tombstone pediment, a deep Quaternary and Tertiary alluvial fill of disconnected lenses and layers of sands, gravel, and conglomerate up to depths of more than 1,200 feet. Some of the pediment conglomerates are resistant enough to form steep cliffs and affect drainage patterns. The northern boundary of the watershed is low alluvium hills. See geologic map on next page.

Stratigraphy and Hydrogeology of Walnut Gulch Watershed W-1

System	Formation and percent of area	Description
Quaternary and Tertiary	Alluvium (Tombstone pediment) 74%	Deep alluvial fill area, lensed and interbedded sand, gravel, conglomerate, caliche conglomerate, and some clay. A major water producer of the area.
	Basalt <1%	Intrusive olivine basalt plug, secondary calcite vein filling. Not important as a water producer.
Tertiary	S.O. volcanics 6%	Interbedded quartz latite tuffs, breccia, minor obsidian flows, hornblende andesite, some pyroclastic sandstones, mudstones, and conglomerates. Highly shattered. Not important as a water producer.
	Schieffelin granodiorite 6%	Intrusive fine-grained light grey biotite-hornblende granodiorite, easily altered. Contact metamorphism at limestone granite contacts. Highly fractured and jointed with secondary carbonate vein filling. Some small local water tables formed on granodiorite. Not a major water producer in this area.
	Intrusive rhyolite <1%	Intrusive fine to medium-grained cream to red-brown dikes and sills. Not included on geologic map because limited areal distribution. Not important as a water producer.
	Uncle Sam porphyry 3%	Quartz latite porphyry, small pheoncrysts of feldspar, quartz, biotite, and hornblende, uneven texture, glassy matrix. Also includes volcanic breccia and flows. Not important as a water producer.
Cretaceous	Bisbee group 5%	Limestone, quartzite, sandstone, and mudstone. Area of low relief, some areas highly faulted and fractured. Some areas important as water producers.
Jurassic Triassic	Gleeson quartz monzonite 1%	Intrusive coarse-grained quartz monzonite. Has highly resistant alaskite phase which forms high ridges and cliffs. Not important as a water producer.
Permian Carboniferous	Naco limestone (Naco group) 4%	Thick sectionof thin to thick-bedded light-tan to dark-blue limestone, dolomitic in some areas. Characteristic silica blebs in most upper layers. Cut by faults of major proportions in many areas. An important water producer in lower areas.
Carboniferous	Escabrosa limestone <1% <1%	Light-grey coarse granular limestone. Dolomite and chert nodules common in most parts of the formation. Not important as a water producer.
Devonian	Martin limestone <1%	Light-grey to dark-blue limestone. Shale beds and chert common in the formation. Not important as a water producer.
Cambrian	Abrigo limestone <1%	Sandy impure limestone with some shale beds. Not important as a water producer.
	Bolsa quartzite <1%	Medium-grained light-pink quartzite. Surface weathers to reddish brown. Very erosion resistant formation. Not important as a water producer.

Source of data: General Geology of Central Cochise County, Arizona, by James Gilluly, U. S. Geological Survey, Professional Paper 281, 1956, and extended field studies by project staff. For additional details see geologic description for watersheds: W-3, 4, 5, and 6.

INSTRUMENTATION: (Revision) Precipitation: Measured with 81 recording gages, of which 77 gages operated with 24-hour charts and 4 gages with 6-hour charts. Six of these gages were installed between 6-21 and 7-15-63. Runoff: The cutoff wall installed in the natural channel in 1957 was replaced by a laboratory-rated flume of 22,500 cfs capacity in April 1964. Field ratings used to determine water yields and peak discharge amounts for the period of 1957-62, were unsatisfactory, therefore, the previously published values for this period should not be used until a re-evaluation of the records has been completed.

WATERSHED CONDITIONS: (Revision) Includes 2 subwatersheds, W-2 and W-6 on main waterway and 3 subwatersheds, W-3, W-4, and W-5, on tributaries. Vegetation cover: Oak woodland and desert shrubs (whitethorn, creosote bush, tarbush, and mortonia) occupy approximately 63 percent of the area, with a crown spread approximating 26 percent and a basal cover of grass of less than 1 percent. The remaining 37 percent supports a grass cover averaging 2.4 percent basal area and a shrub cover of 6 percent crown spread. Dominant grasses are black gramma, curly mesquite grass, sideoats gramma, blue grama, and tobosa grass. See vegetation map on page 63.1-3.

NOTES: NO MONTHLY OR ANNUAL P AND Q, ANNUAL MAXIMUM DISCHARGES AND ANNUAL MAXIMUM VOLUMES, OR SELECTED RUNOFF EVENTS ARE REPORTED FOR 1963 FOR W-1 OR W-2. (SEE EXPLANATION UNDER REVISED INSTRUMENTATION ABOVE). FOR TOPOGRAPHIC MAP OF WATERSHEDS, SEE HYDROLOGIC DATA FOR EXPERIMENTAL AGRICULTURAL WATERSHEDS IN THE UNITED STATES 1960-61, USDA MISC. PUB. 994, P. 63.1-2. FOR GEOLOGIC AND VEGETATION MAPS, SEE NEXT TWO PAGES.

TOMBSTONE, ARIZONA WALNUT GULCH WATERSHED W-2 (63.002)

LOCATION: (Revision) Cochise County, Ariz.; 2 3/4 miles NW of Tombstone; Walnut Gulch, San Pedro River, Gila River, Colorado River Basin.

AREA: 43.9 sq. mi. (28,100 ac.) SHAPE: Butterfly, approximately 13 miles long by 6 miles wide.

SLOPES: Not available.

SOILS, EROSION, AND LAND CAPABILITY: Detailed descriptions not yet available; see general notes in Hydrologic Data for Experimental Agricultural Watersheds in the United States 1956-59, USDA Misc. Pub. 945, 1963, p. 63.1-1.

GEOLOGY: The W-2 subwatershed occupies 76 percent of the eastern part of W-1 and is in the Basin and Range Province, isolated mountain blocks, separated by broad alluvium-filled basins. The subwatershed is 85 percent Quaternary and Tertiary alluvium of the Tombstone pediment. The alluvium is made up of permeable lensed and interbedded sand, gravel, conglomerate, caliche conglomerate, and some clay. Two series of conglomerates are recognized beneath the recent alluvium of the Tombstone pediment: A younger conglomerate whose bedding is nearly conformable to the pediment surface and probably considerably older than that surface; and an older Tertiary conglomerate lying unconformably beneath that. The younger conglomerate is known to persist to depth of 700 feet in places, and the older conglomerate to depths exceeding 1,200 feet. A few outcrops of the older conglomerate occur in recent stream channels near the city of Tombstone. Topographic expression of the alluvium is that of low undulating hills dissected by present stream channels. Caliche conglomerates of this unit are fairly resistant to erosion and form steep cliffs of low relief in some of the present stream channels. The alluvium reaches unknown depths on the east and lenses out at a probable fault contact as it abuts the Schieffelin granodiorite on the southwest. A considerable portion of the alluvium in the lower reaches of the watershed is underlain at shallow depth by the relatively impermeable Schieffelin granodiorite causing groundwater to accumulate and at times return to the surface as streamflow. The Schieffelin granodiorite borders the subwatershed on the southwest where it occupies an area of about 1 percent. It is Tertiary in age and is the major intrusive igneous rock in Walnut Gulch. The granodiorite forms the eastern foothills of the Tombstone Hills and has been reduced by physical and chemical weathering to remnant hills that are rapidly being converted to alluvium and residual soils. A small patch of Permian Naco limestone is found as a protective cap over the Schieffelin granodiorite and forms the highest hill in this area. Further south, uplifted and much faulted sedimentary beds occupy about 7 percent of the watershed. These beds range from Cambrian Abrigo limestone and Bolsa quartzite through Devonian Martin limestone and Carboniferous-Permian Escabrosa and Naco limestones overlain in places by the Cretaceous Bisbee formation. A small patch of pre-Cambrian granite is also found here. These rocks form the relatively high relief lower Tombstone Hills. This area has been much affected by east-west trending high angle faults and Intrusive rhyolite dikes and deep granitic intrusions. Surface and subsurface irregularities, caused by faulting and intrusive bodies, noticeably affect the drainage of this area. An intrusive olivine basalt plug of small areal extent and Quaternary or late Tertiary age occurs just below Flume W-8. The plug is jointed and fractured making a highly permeable formation. Eight percent of the watershed in the southeast portion is highly faulted and fractured Tertiary intrusive and extrusive igneous rocks, mostly volcanics. Extensive folded tuff beds are found underlying andesite-rhyolite flow material. Topographic expression is that of low rolling hills interrupted in places by dike-like ridges. In the upper and eastern tip of the watershed, intrusive igneous rocks form high cliffs of the lower Dragoon Mountains. These rocks consist of Triassic or Jurassic Quartz monzonite and lesser amounts of pre-Cambrian granite. The quartz monzonite is erosion resistant and forms the highest peaks of the watershed at over 6000 feet while the less resistant granite makes up the lower foothills. These rocks make up about 1 percent of the watershed. Regional watertable depth near the west center of the watershed is about 425 feet. See Geologic map, P. 63.1-2, this volume.

Stratigraphy and Hydrogeology of Walnut Gulch Subwatershed W-2

System	Formation		Description
Quaternary & Tertiary	Recent Alluvium	≈ 80%	Gravel, sand, and clay. A major water producer of the area.
	Younger conglomerate	≈ 3%	Gravel, sand, conglomerate, caliche conglomerate, and clay, some boulders.
	Older conglomerate	≈ 1%	Gravel, sand, conglomerate, caliche conglomerate, and clay, some boulders.
	Basalt	< 1%	Intrusive olivine basalt plug, secondary calcite vein filling. 1/
Tertiary	S. O. volcanics	9%	Interbedded quartz latite tuffs, andesite-rhyolite flows, pyroclastic sandstones, mudstones, and conglomerates. 1/
	Schieffelin granodiorite	< 1%	Intrusive fine-grained light grey biotite-hornblende granodiorite. 1/
Cretaceous	Bisbee group	1%	Limestone, quartzite, sandstone, and mudstone. Some areas important as water producer.
Jurassic Triassic	Gleeson quartz monzonite	1%	Intrusive coarse-grained quartz monzonite. 1/
Permian Carboniferous	Naco limestone	4%	Light-tan to dark-blue limestone. Silica blebs in upper layers. An important water producer in lower areas.
Carboniferous	Escabrosa limestone	< 1%	Light-grey coarse granular limestone, dolomite and chert nodules common. 1/
Devonian	Martin limestone	< 1%	Light-grey to dark-blue limestone, shale beds and chert common. 1/
Cambrian	Abrigo limestone	< 1%	Sandy impure limestone with some shale beds. 1/
	Bolsa quartzite	< 1%	Medium-grained light-pink quartzite, weathers to reddish brown. 1/

1/ Not important as water producers.

Source of data: General Geology of Central Cochise County, Arizona, by James Gilluly, U. S. Geological Survey, Professional Paper 281, 1956, and extended field studies by project staff.

INSTRUMENTATION: (Revision) Precipitation: Measured with 56 recording gages of which 54 operated with 24-hour charts and 2 with 6-hour charts. Six of these gages were installed between 6-21 and 7-15-63. Runoff: Previously reported runoff data should be disregarded.

WATERSHED CONDITIONS: (Revision) Includes subwatersheds W-3, W-4, W-5 and W-6. Vegetation cover: Oak woodland and desert shrubs (whitethorn, creosote bush, tarbush, mortonia), with a crown spread of 25 percent cover, occupy 55 percent of the area. The remaining 45 percent supports grass (black grama, curly mesquite grass, tobosa grass, blue grama and sideoats grama), with a basal area of 2.5 percent cover, and a shrub cover of approximately 6 percent crown spread. See vegetative map, p. 63.1-3, this publication.

TOMBSTONE, ARIZONA WALNUT GULCH WATERSHED W-5 (63.005)

LOCATION: Cochise County; 1 3/4 miles east of Tombstone; Walnut Gulch, San Pedro River, Gila River, Colorado River Basin.

AREA: 8.61 sq. mi. (5510 ac.) SHAPE: Roughly circular, diameter of 3½ miles.

SLOPES: Not available.

SOILS: Boothill, a stony clay loam developed on andesite extrusions; calcareous throughout the profile; moderately permeable -- 15%. Cave, a gravelly sandy loam developed on outwash material from andesite extrusions; calcareous throughout the profile; moderately permeable -- 15%. Tombstone (see description under W-2) 43%. Tortugas (see W-2) 8%. The remaining 19% is made up of small bodies of five other moderately permeable soils.

GEOLOGY: This subwatershed is representative of the Basin and Range Province and is located in south part of W-1, occupying 14.9 percent of its area. Quaternary and Tertiary alluvium of the Tombstone pediment occurs on 82 percent of the subarea (W-5). The alluvium is made up of permeable lensed and interbedded sand, gravel, conglomerate, caliche conglomerate, and some clay. Two series of conglomerate are recognized beneath the recent alluvium of the Tombstone pediment: A younger conglomerate whose bedding is nearly conformable to the pediment surface and probably considerably older than that surface, and an older Tertiary conglomerate lying unconformably beneath that. These conglomerates are known to persist to depths exceeding 1,200 feet. Topographic expression of the alluvium is that of low undulating hills dissected by present stream channels. Caliche conglomerates of this unit are fairly resistant to erosion and form steep cliffs of low relief in some of the present stream channels. In the east, 13 percent of the watershed is made up of highly faulted and fractured Tertiary intrusive and extrusive igneous rocks, mostly volcanics. Extensive folded tuff beds are found underlying andesite-rhyolite flow material. Topographic expression is that of low rolling hills interrupted in places by dike-like ridges. In the south and southwest, thick sections of permian and carboniferous age limestones form low hills and cover 5 percent of the watershed. Numerous intrusive rhyolite dikes and sills invade the limestones and affect surface and subsurface drainage. See geologic map on page 63.1-2 of this volume.

Stratigraphy and Hydrogeology of Walnut Gulch Subwatershed W-5

System	Formation and percent of area	Description
Quaternary & Tertiary	Recent alluvium 78%	Gravel, sand, and clay. This, and underlying conglomerates, are important water producers.
	Younger conglomerate ≈ 3%	Gravel, sand, conglomerate, caliche conglomerate, and clay, some boulders.
	Older conglomerate ≈ 1%	Gravel, sand, conglomerate, caliche conglomerate, and clay, some boulders.
Tertiary	S. O. volcanics 15%	Interbedded quartz latite tuffs, andesite-rhyolite flow, pyroclastic sandstone mudstones, and conglomerates. Not important as a water producer.
Permian Carboniferous	Naco limestone 4%	Light-tan to dark-blue limestone. Silica blebs in upper layers. Important water producer.

Source of data: General Geology of Central Cochise County, Arizona, by James Gilluly, U. S. Geological Survey, Professional Paper 281, 1956, and extended field studies by project staff.

INSTRUMENTATION: (Revision) Precipitation: Measured by 11 recording gages, 10 with 24-hour charts and 1 with a 6-hour chart. Runoff: Runoff data for W-5 have been re-evaluated and no hydrologic data are being submitted for publication until they have been retabulated. Previously reported runoff data for this watershed should be disregarded.

WATERSHED CONDITIONS: (Revision) Vegetation cover: Desert shrubs (Whitethorn, creosote bush, tarbush) occupy 78 percent of the area with a crown spread of approximately 30 percent and an understory of grasses of less than 1 percent basal area. The remaining 22 percent of the area supports a grass cover (black grama, tobosa grass, blue grama, sideoats grama, and curly mesquite grass) of approximately 2 percent basal area.

NOTES: NO MONTHLY OR ANNUAL P AND Q, ANNUAL MAXIMUM DISCHARGES AND ANNUAL MAXIMUM VOLUMES, OR SELECTED RUNOFF EVENTS ARE REPORTED FOR 1963. (SEE EXPLANATION UNDER REVISED INSTRUMENTATION ABOVE). FOR WATERSHED TOPOGRAPHIC MAP SEE HYDROLOGIC DATA FOR EXPERIMENTAL AGRICULTURAL WATERSHEDS IN THE UNITED STATES, 1960-61, USDA MISC. PUB., 994, P. 63.1-2. FOR GEOLOGIC AND VEGETATION MAPS, SEE P. 63.1-2 AND 63.1-3 OF THIS VOLUME.

Cooperative Research Project of USDA and Arizona Agricultural Experiment Station

TOMBSTONE, ARIZONA WALNUT GULCH WATERSHED W-6 (63.006)

LOCATIONS: Cochise County, Arizona; 3/4 mile north of Tombstone; Walnut Gulch, San Pedro River, Gila River, Colorado River Basin.

AREA: 23,500 acres (36.7 Sq. miles)

SLOPES:

Slope - Percent	0-3	3-10	10-20	20-35
Percent of area	3	59	29	9

SOILS: Not yet available.

EROSION:

Erosion Class	1	2
Percent of area	98	2

LAND CAPABILITY:

Class	VI
Percent of area	100

GEOLOGY: This subwatershed, typical of the Basin and Range Province, occupies 63.7 percent of the eastern and south central parts of Watershed W-1. Quaternary and Tertiary alluvium of the Tombstone pediment covers 81 percent of the subarea. The alluvium is made up of permeable lensed and interbedded sand, gravel, conglomerate, caliche conglomerate, and some clay. Two series of conglomerate are recognized beneath the Recent alluvium of the Tombstone Pediment: A younger conglomerate whose bedding is nearly conformable to the pediment surface and probably considerably older than that surface; and an older Tertiary conglomerate lying unconformably beneath that. These conglomerates are known to persist to depths exceeding 1,200 feet. Topographic expression of the alluvium is that of low undulating hills dissected by present stream channels. Caliche conglomerates of this unit are fairly resistant to erosion and form steep cliffs of low relief in some of the present stream channels. In the upper and eastern tip of the watershed, intrusive igneous rocks form high cliffs of the lower Dragoon Mountains. These rocks consist of Triassic or Jurassic quartz monzonite and lesser amounts of Precambrian granite. The quartz monzonite is erosion resistant and forms the highest peaks of the watershed at over 6,000 feet elevation, while the less resistant granite makes up the lower foothills. These rocks make up about 2 percent of the subwatershed. In the southeast portion, 9 percent of the area is made up of highly faulted and fractured Tertiary intrusive and extrusive igneous rocks, mostly volcanics. Extensive folded tuff beds are found and underlying andesite-rhyolite flow material. Topographic expression is that of low rolling hills interrupted in places by dike-like ridges. In the southwest, uplifted and much faulted sedimentary beds occupy about 7 percent of the drainage area. These beds range from Cambrian Abrigo limestone and Bolsa quartzite through Devonian Martin limestone and Carboniferous-Permian Escabrosa and Naco limestones overlain in places by the Cretaceous Bisbee formation. These rocks from the relatively high relief on the lower Tombstone Hills. This area has been much affected by east-west trending high angle faults and rhyolite intrusive dikes and sills and deep granitic intrusions. Surface and subsurface irregularities caused by faulting and intrusive bodies noticeably affect the drainage of this area. An intrusive olivine basalt plug of small areal extent and Quaternary or Late Tertiary age occurs just below runoff flume W-8. The plug is jointed and fractured, making a highly permeable formation. See geologic map, page 63.1-2 of this volume.

Stratigraphy and Hydrogeology of Walnut Gulch Subwatershed W-6

System	Formation and percent of area		Description
Quaternary & Tertiary	Alluvium (Tombstone pediment)	80%	Deep alluvial fill area, lensed and interbedded sand, gravel, conglomerate, caliche conglomerate, and some clay. A major water producer of the area.
	Basalt	< 1%	Intrusive olivine basalt plug, secondary calcite vein filling. 1/
Tertiary	S. O. volcanics	11%	Interbedded quartz latite tuffs, andesite-rhyolite flows, pyroclastic sandstones, mudstones, and conglomerates. 1/
	Intrusive rhyolite	< 1%	Intrusive fine to medium-grained cream to red-brown dikes and sills. Not included on geologic map because limited areal distribution. Not important as a water producer.
Cretaceous	Bisbee group	1%	Limestone, quartzite, sandstone, and mudstone. Some areas produce water.
Jurassic Triassic	Gleeson quartz monzonite	2%	Intrusive coarse-grained quartz monzonite. 1/
Permian Carboniferous	Naco limestone	5%	Light-tan to dark-blue limestone. Silica blebs in upper layers. Important water producer in lower areas.
Carboniferous	Escabrosa limestone	< 1%	Light-grey coarse granular limestone, dolomite and chert nodules common. 1/
Devonian	Martin limestone	< 1%	Light-grey to dark-blue limestone, shale beds and chert common. 1/
Cambrian	Abrigo limestone	< 1%	Sandy impure limestone with some shale beds. 1/
	Bolsa quartzite	< 1%	Medium-grained light-pink quartzite, weathers to reddish brown. 1/

1/ Not important as water producers.

Source of data: General Geology of Central Cochise County, Arizona, by James Gilluly, U.S. Geological Survey, Professional Paper 281, 1956, and extended field studies by project staff.

SURFACE DRAINAGE: Good, length of principal waterway is 13.3 miles with 4 major tributaries; a natural watershed with surface flow to well defined water courses; includes gaged watersheds W-5, W-8, and W-11.

CHARACTER OF FLOW: Ephemeral

INSTRUMENTATION: Precipitation: Measured with 45 recording gages of which 43 operate with 24-hour charts and 2 with 6-hour charts. Four of these gages were installed between 6-21 and 7-15-63. Runoff: Critical depth flume (Precalibrated), AD-35 analog strip chart water level recorder.

WATERSHED CONDITIONS: Includes subwatersheds W-5, W-8 and W-11. Vegetation cover: Oak woodland and desert shrubs (Whitethorn, creosote bush, tarbush, mortonia) occupy approximately 45 percent of the area, with a crown spread of 25 percent cover. The remaining 55 percent of the area supports a grass cover (black grama, curly mesquite grass, tobosa grass, blue grama, and sideoats grama) with a basal area of 2.5 percent cover and a shrub cover of approximately 6 percent crown spread.

GENERALLY REPRESENTS: Desert grassland ranges in the Southeastern Arizona Basin and Range land resource area (D-41).

TOMBSTONE, ARIZONA WATERSHED 63.007

LOCATION: Cochise County, Ariz.; 2 3/4 miles NW of Tombstone; Walnut Gulch, San Pedro River, Gila River, Colorado River Basin.

AREA: 3340 acres (5.22 sq. mi.). SHAPE: Rectangular, about 2 miles wide by 3 miles long.

SLOPES:

Slope - percent	0-3	3-8	8-15	15-30
Percent of area	2	25	54	19

SOILS: Celler rocky sandy loam and House Mountain very rocky loam (Entisols) comprise 24% of the area; Sonoita sandy loam, Chiricahua very gravelly clay loam. Cave-Rillito gravelly loam, Laveen loam, and Nickel gravelly loam (Aridisols) comprise 33% and Tortugas rocky loam and Comoro sandy loam (Mollisols) comprise 43% of the area.

EROSION:

Erosion Class	4
Percent of area	100

LAND CAPABILITY:

Class	VI
Percent of area	100

GEOLOGY: The major rock types of this area are the Schieffelin granodiorite (Tertiary) and the Bisbee Group (Cretaceous). The Schieffelin granodiorite occupies the northern portion of the watershed and is expressed as low, rounded, boulder-covered hills. The intrusion extends to unknown depths in this particular area. The granodiorite is easily eroded and is rapidly being reduced to alluvium and residual soil. Small natural lysimeters formed by alluvium filling depressions in the undulating granodiorite surface are used as local water supplies. The Bisbee Group (Cretaceous) is present in the southern portion of the watershed as sharp peaks and ridges of limestone and quartzite, as well as low, gently sloping alluvial plains. Portions of this area are mineralized and have been extensively mined in past years. The formations have been folded and shattered, with large-scale faulting and intrusion of igneous dikes further complicating the structural geology. Massive Naco Group limestones appear as high ridges on the southern boundary of the watershed, with the western boundary of the area formed by the Uncle Sam Porphyry. The porphyry is a fine grained, highly resistant, intrusive rock which forms steep slopes and sharp peaks along the southwestern boundary of the watershed. The Abrigo limestone (Cambrian), an impure limestone with some shale beds, occupies a small portion of the southern boundary of the watershed.

Stratigraphy and Hydrogeology of Walnut Gulch Watershed 63.007

System	Formation and percent of area		Description
Quaternary	Alluvium	10%	Interbedded sand, clay, gravel, conglomerate, some caliche, minor water producer.
Tertiary	Schieffelin granodiorite	45%	Intrusive, light grey biotite-hornblende granodiorite, much surface alteration, highly fractured and jointed, secondary carbonate in many fractures.
	Uncle Sam porphyry	4%	Quartz-latite prophyry, phenocrysts of feldspar, quartz, biotite, hornblende, augite, uneven texture, glassy matrix, contains some volcanic breccia and flows. Not important as a water producer.
Cretaceous	Bisbee Group	32%	Limestone, quartzite, sandstone, and mudstone. Some portions highly folded, fractured, and faulted. Some areas important as water producers.
Cm	Naco limestone (Naco Group)	7%	Thin to thick-bedded light-tan to dark-blue limestone, dolomitic in some areas. Characteristic silica blebs in most upper layers. Faulting of major proportions in many areas. An important water producer in some areas.
Ꞓa	Abrigo limestone	2%	Sandy impure limestone with some shale beds. Not important as a water producer.

Source of data: General Geology of Central Cochise County, Arizona, by James Gilluly, U. S. Geological Survey, Professional Paper 281, 1956, and extended field studies by project staff.

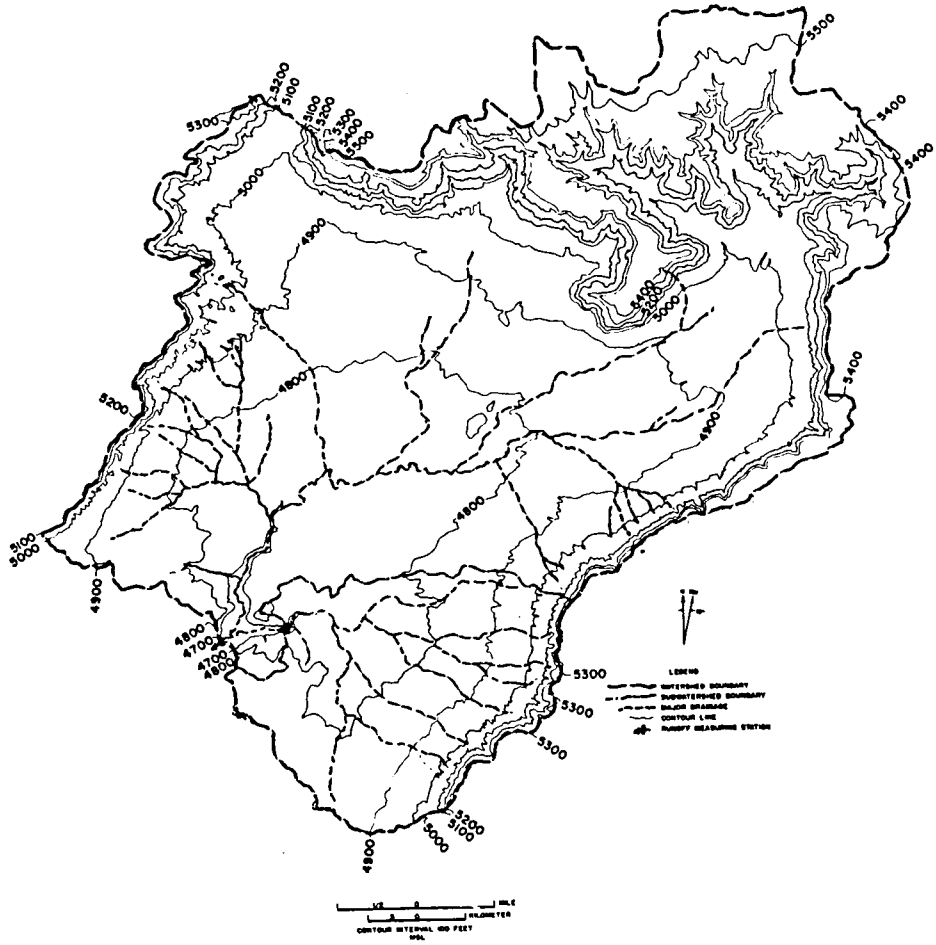
SURFACE DRAINAGE: Excellent except in SE ¼ where many old roads, mine shafts, and tailing dumps slow, divert, and often entrap runoff. Principle channel 3.8 miles in length over relatively steep clean channels.

CHARACTER OF FLOW: Ephemeral, Continuous.

INSTRUMENTATION: PRECIPITATION: Measured by two 6-in., 24-hour weighing rain gages (scales on chart: 1 in. = 1 in. rain; 125 minutes), and nine 4.5-in., 24-hour weighing rain gages (scales on chart: 1 in. = .333 in. rain; 1 in. = 125 minutes). RUNOFF: Measured by a precalibrated, super-critical depth flume, AD-35 analog strip chart, water level recorder (scale on chart: 1 in. = .10 ft. of stage; 1 in. = 50 minutes).

WATERSHED CONDITIONS: Vegetation: Desert shrubs (whitethorn, creosotebush, tarbush, and mortonia) occupy approximately 75 percent of the watershed. The remaining 25 percent of the area is grass. Most prevelent grasses are black grama, curly mesquite sideoats grama, blue grama, and tobosa grass.

GENERALLY REPRESENTS: Desert grassland ranges in the Southeastern Arizona Basin and Rangeland resources area (D-41).

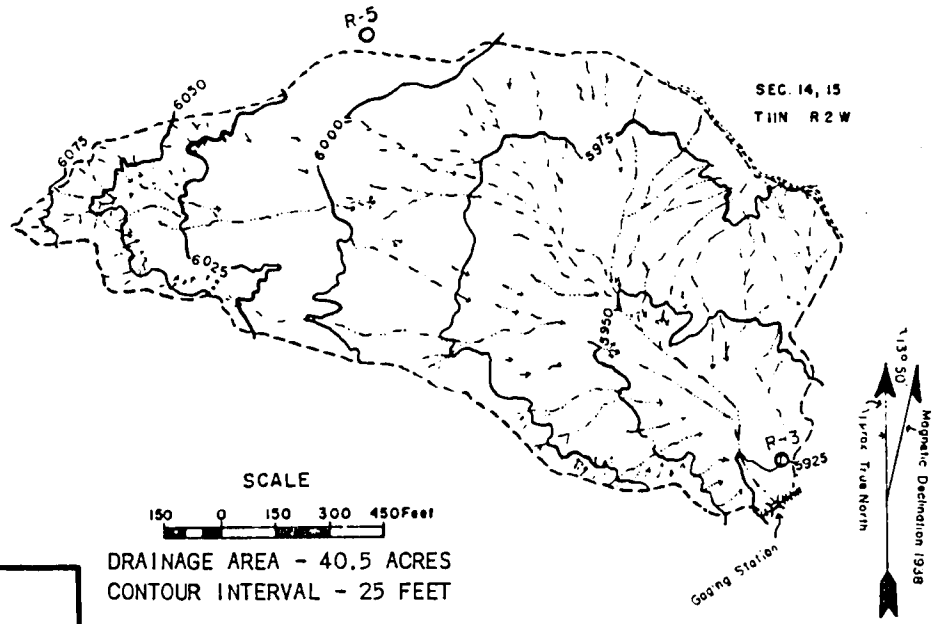


WATERSHED AREA

67 SQUARE MILES 42,880 ACRES

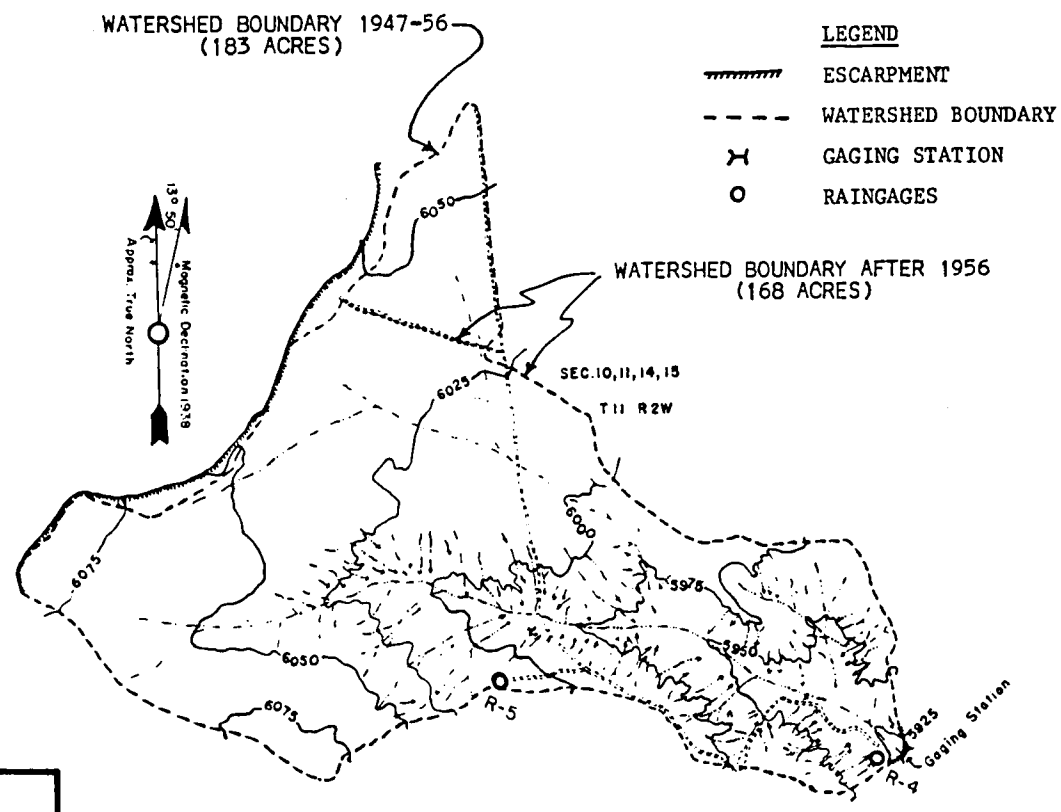
173.53 SQUARE KILOMETERS 17,353 HECTARES

64.001
CONTOUR MAP OF
ALAMOGORDO CREEK
EXPERIMENTAL WATERSHED



DRAINAGE AREA - 40.5 ACRES
CONTOUR INTERVAL - 25 FEET

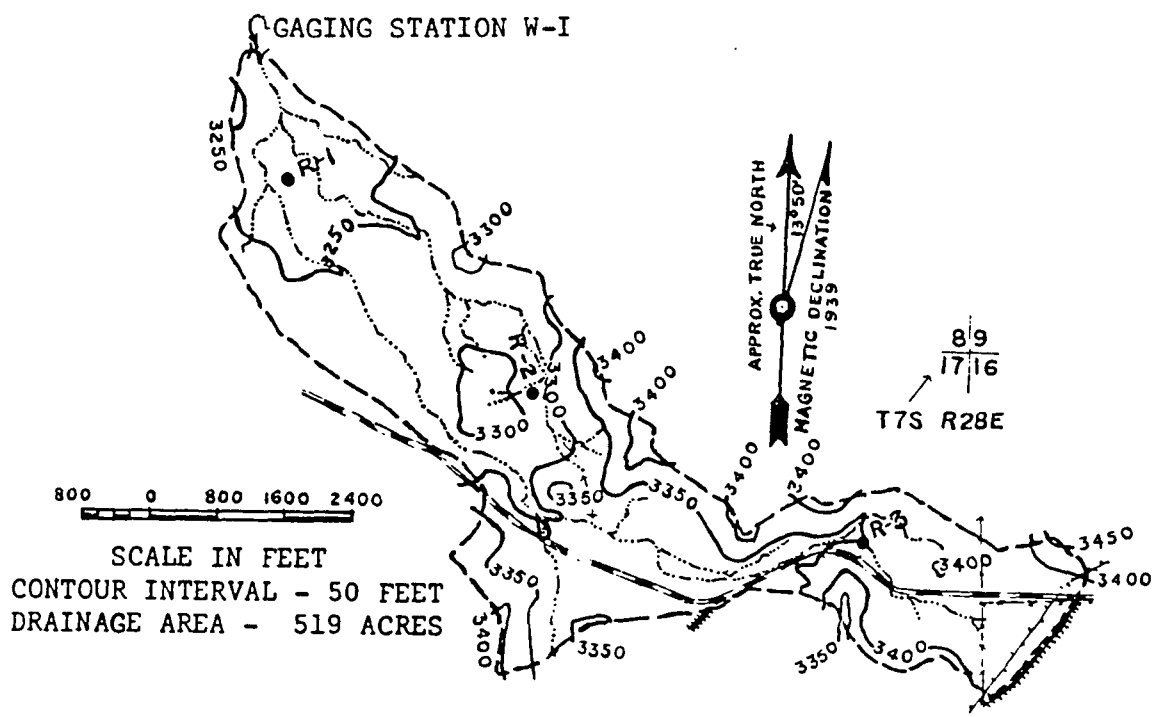
ALBUQUERQUE, NEW MEXICO
WATERSHED W-II



ALBUQUERQUE, NEW MEXICO
WATERSHED W-III

SCALE
300 0 300 600 900 Feet

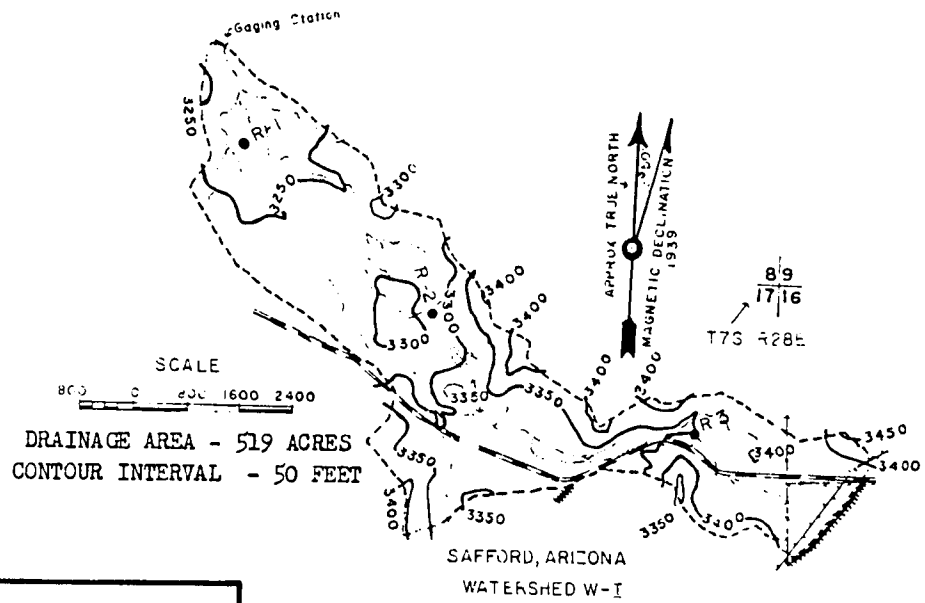
DRAINAGE AREA - 183 ACRES (1947-56)
DRAINAGE AREA - 168 ACRES (1957-59)
CONTOUR INTERVAL - 25 FEET



SAFFORD, ARIZONA

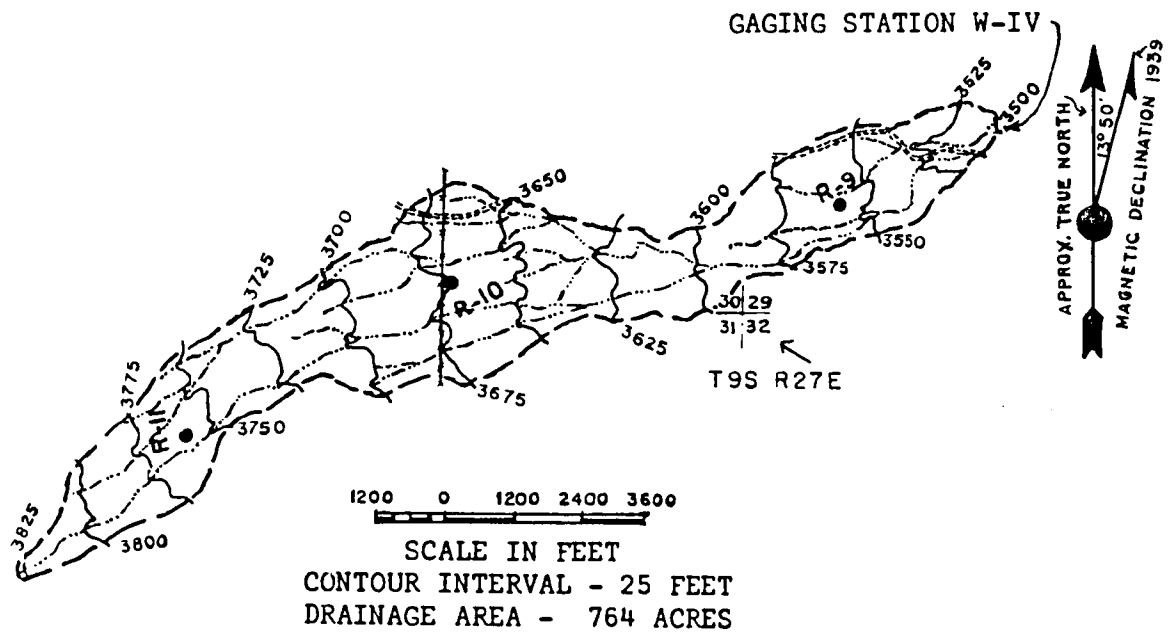
WATERSHED W-I

This map was not clearly reproduced in Reference 4: Hydrologic Data for Experimental Agricultural Watersheds in the United States, 1956-69, USDA Misc. Pub. 945. It is hereby reprinted.



SAFFORD, ARIZONA

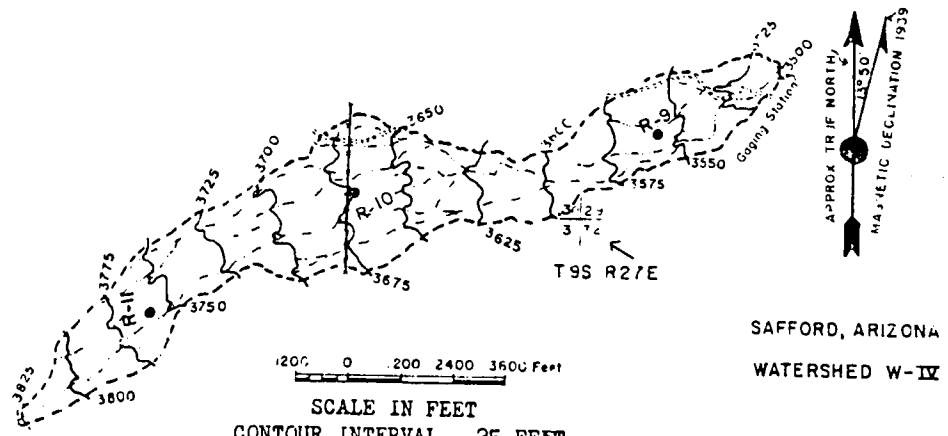
WATERSHED W-I



SAFFORD, ARIZONA

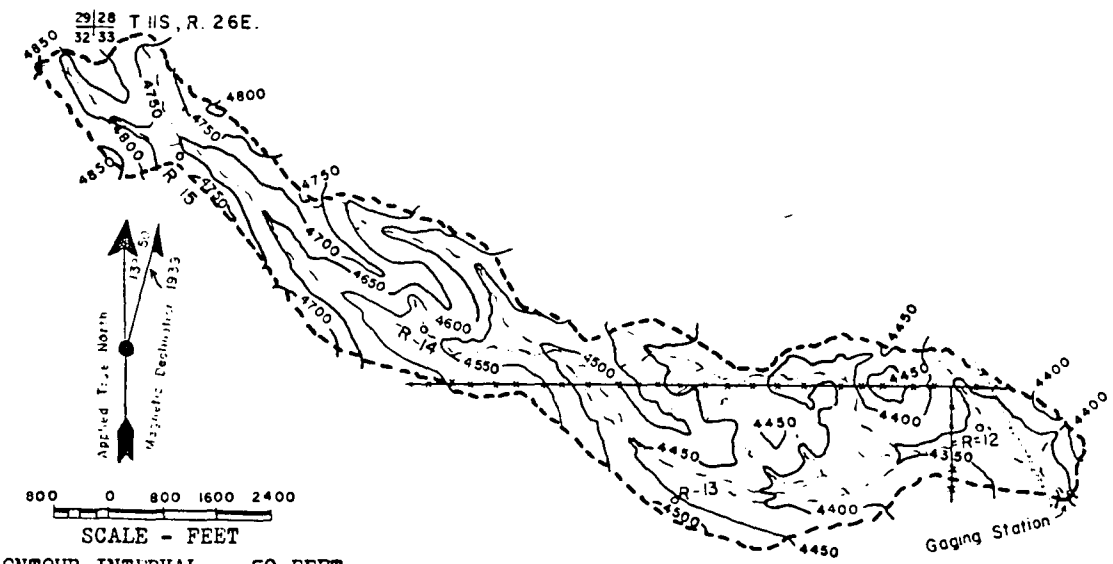
WATERSHED W-IV

This map was not clearly reproduced in Reference 4: Hydrologic Data for Experimental Agricultural Watersheds in the United States, 1956-69, USDA Misc. Pub. 945. It is hereby reprinted.



SAFFORD, ARIZONA

WATERSHED W-IV



CONTOUR INTERVAL - 50 FEET

DRAINAGE AREA - 723 ACRES

SAFFORD, ARIZONA

WATERSHED W-V

APPENDIX 3-E

Flood reconstitutions and worksheets, Tucson.

C)

Volume in drive A is TUCSON#1
Directory of A:\

THS1	I5	487	10-16-87	2:46p
THS1	O5	25049	10-16-87	2:48p
THS2	I2	388	9-30-87	4:21p
THS2	O2	20427	9-30-87	4:22p
TAR1	I7	486	10-16-87	3:28p
TAR1	O7	20642	10-16-87	3:29p
TAR2	I3	385	10-16-87	3:46p
TAR2	O3	18447	10-16-87	3:47p
TAR3	I4	445	10-16-87	7:29p
TAR3	O4	25448	10-16-87	7:31p
TAR4	I3	439	10-16-87	7:55p
TAR4	O3	21877	10-16-87	7:57p
TRR1	I7	473	10-11-87	10:17a
TRR1	O7	23722	10-11-87	10:21a
TRR2	I4	415	10-11-87	5:15p
TRR2	O4	19170	10-11-87	5:16p
TAT1	O1	20211	10-12-87	10:58a
TAT1	I1	488	10-12-87	10:57a
TAT1	BAK	488	10-27-87	7:34a
TAT1	O2	20655	10-27-87	7:36a
TAT2	I1	383	10-27-87	8:48a
TAT2	O1	19394	10-27-87	8:50a
TAT3	O1	26872	10-27-87	8:42p
TAT3	I1	475	10-27-87	8:41p
TAT1	I2	492	10-27-87	9:05p
TAT1	O3	27291	10-27-87	9:08p

26 File(s) 53248 bytes free

Table 4.- Storm events that have been selected for further inspection and possible unit-hydrograph analysis.

Station	Storm Date	Rainfall Depth inches	Rainfall Max Intensity in/hr	Rainfall Duration hr-min	Runoff Peak Discharge cfs	Runoff Depth inches
(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Tucson				
THS High School	10 Aug 68	1.32			486.	.61
	1 Aug 69	.93			341.	.44
	19 Jul 70	.71			255.	.37
	20 Jul 70	.95			243.	.36
	11 Aug 70	1.08			409.	.39
	8 Aug 71	1.43			664.	.57
	12 Aug 72	1.67			652	.44
	13 Aug 80	1.76	THS1		360.	.63
	25 Jul 82	.65			464.	.38
	11 Sep 82	1.83	THS2		331.	.61
TAR Arcadia	14 Nov 68	1.29			310.	.59
	20 Jul 70	.74			195.	.23
	11 Aug 70	.68			592.	.26
	3 Aug 71	1.04			450.	.27
	17 Aug 71	1.45			1,207.	.53
	1 Sep 71	1.40	TAR1		980.	.45
	12 Aug 72	1.28			940.	.37
	10 Sep 77	1.00			634.	.28
	25 Jul 78	.73			595.	.14
	12 Aug 79	1.84			647.	.48
	2 Aug 82	1.53			521.	.39
	12 Aug 82	.64			526.	.27
	23 Aug 82	1.11	TAR 2		360.	.26
	19 Sep 82	.86			337.	.29
	11 Sep 82	2.43	TAR3,	TAR4	867.	.95
TRR Railroad	20 Jul 70	1.42			642.	.56
	19 Aug 71	1.29			557.	.65
	12 Aug 72	1.35			1,277.	1.05
	19 Oct 72	1.07			239.	.81
	19 Oct 72	.55			246.	.45
	18 Jul 74	.89			479.	.59
	2 Aug 82	1.03	TRR 2		349.	.31
	11 Sep 82	1.32	TRR1		420.	.62
TAT Atterbury	12 Aug 57	.45			251.	.21
	29 Jul 58	1.80			612.	1.33
	22 Aug 61	1.60			349.	.26
	16 Jul 65	1.31			263.	.24
	25 Sep 76	1.75			341.	.56
	19 Jul 81	1.06			237.	.27
	11 Sep 82	1.95			326.	.60
	23 Jul 84	.58			415.	.27
	26 Sep 84	1.56	TAT1		179.	.31

GEORGE V. SABOL Ph.D., P.E.
1351 EAST 141st AVENUE
BRIGHTON, COLORADO 80601
(303) 457-0989

21 August 1987

Mr. Phillip Guertin
University of Arizona
School of Renewable Natural Resources
325 Biological Sciences East
Tucson, Arizona 85721

Dear Mr. Guertin:

I am conducting a study for the Flood Control District of Maricopa County. The purpose of the study is to develop unit-hydrograph procedures to be used for flood control planning and design in Maricopa County. As previously discussed with you, I would like to use rainfall and runoff data that has been collected at the experimental watersheds in Tucson that are monitored by the University of Arizona. I am requesting the following data and supporting information as described below:

A. Stage recorder charts for the storm events listed in Table 1.
B. Stage-discharge rating curves and/or tables for the measuring flumes at:
   a. High School,
   b. Arcadia,
   c. Railroad, and
   d. Atterbury (W-1A) watersheds.
C. Appropriate rainfall recorder charts for each of the watersheds and events listed in Table 1. It is my understanding that each of the watersheds has rainfall measured at several gages, and the rainfall data for each gage is requested.
   a. Raingages for the High School Watershed

      R-50
      R-51
      R-52
      R-53
      R-54 (non-recording)

b. Raingages for the Arcadia Watershed
   R-60
   R-61
   R-62
   R-63
   R-64
   R-65
   R-66 (non-recording)
   R-67
   R-68 (non-recording)
   R-69
c. Raingages for the Railraoad Watershed
   R-70
   R-71
   R-72
   R-73
   R-74 (non-recording)
   R-75 (non-recording)
   R-76 (non-recording)
d. Raingages for the Atterbury (subcatchment W-1A) Watershed
   R-1 (non-recording)
   R-2
   R-3 (non-recording)
   R-4 (non-recording)
   R-5 (non-recording)
   R-6 (non-recording)
   R-8 (non-recording)
   R-9 (non-recording)
   R-10
   R-12 (non-recording)
   R-13 (non0recording)
   R-14
   R-16 (non-recording)

Please call me if you have any questions concerning this data request.

I will also need documentation on the watershed characteristics during each of the storm events. I would appreciate any advice that you can provide me on obtaining such documentation. Historic aerial photographs of the watersheds would provide a good record on the extent of urbanization. Do you know of such photographs for the watersheds?

I will come to Tucson to pick-up the data and would like to have time to visit with you to discuss the project. I would be interested in your suggestions and comments. I have tentatively planned to be in Tucson on 2 September 1987. I will call you to arrange a meeting.

Sincerely yours,

George V. Sabol

Enclosure - Table 1

Copy - Mr. Tim Sutko, Hydrologist, Flood Control District of Maricopa County

Table 1.- List of requested rainfall-runoff data for storm events for the Experimental Watersheds.

High School	10 Aug 68
	1 Aug 69
	19 Jul 70
	20 Jul 70
	11 Aug 70
	8 Aug 71
	12 Aug 72
	13 Aug 80
	25 Jul 82
	11 Sep 82
Arcadia	14 Nov 68
	20 Jul 70
	11 Aug 70
	3 Aug 71
	17 Aug 71
	1 Sep 71
	12 Aug 72
	10 Sep 77
	25 Jul 78
	12 Aug 79 ✗
	2 Aug 82
	12 Aug 82
	23 Aug 82
	19 Sep 82 ✗
	11 Sep 82
Railroad	20 Jul 70
	19 Aug 71
	12 Aug 72
	19 Oct 72
	19 Oct 72
	18 Jul 74 ✗
	2 Aug 82
	11 Sep 82
Atterbury	12 Aug 57 ✗
	29 Jul 58 ✗
	22 Aug 61 ✗
	16 Jul 65 ✗
	25 Sep 76
	19 Jul 81
	11 Sep 82
	23 Jul 84
	26 Sep 84

D. Phillip Guertin
University of Arizona
325 Biological Sciences East
Tucson, Arizona 85721
(602) 621-1723

September 10, 1987

George V. Sabol
1351 East 141st Avenue
Brighton, Colorado 80601

Dear George:

Enclosed are the data files we reviewed on September 2, 1987. The data from the other watersheds will be along shortly. If you have any questions, or need more information, please contact me.

Sincerely yours,

Phil Guertin

D. Phillip Guertin
Watershed Hydrologist

Enclosures

High School Wash watershed

Rec'd 26 Sept 87

D. Phillip Guertin
University of Arizona
325 Biological Sciences East
Tucson, Arizona 85721
(602) 621-1723

September 21, 1987

George V. Sabol
1351 East 141st Avenue
Brighton, Colorado 80601

Dear George:

Enclosed are the rest of the data files we reviewed on September 2, 1987. The missing precipitation charts take a little long to organize and reproduce. If you have any questions, or need more information, please contact me.

Sincerely yours,

Phil Guertin

D. Phillip Guertin
Watershed Hydrologist

Enclosures

Arcadia
Railroad
Atterbury

Rec'd 28 Sept 87

GEORGE V. SABOL Ph.D., P.E.
1351 EAST 141st AVENUE
BRIGHTON, COLORADO 80601
(303) 457-0989

9 October 1987

Dr. Phillip Guertin
University of Arizona
School of Renewable Natural Resources
325 Biological Sciences East
Tucson, Arizona 85721

Dear Phil:

I have received two packages of data from you; the High School Watershed data under transmittal letter of 10 September 1977, and the Arcadia, Railroad, and Atterbury Watershed data under transmittal letter of 21 September 1987. I have reviewed the data and have previously talked to you about some of the data, and I understand that some of the rainfall data has yet to be compiled and will be sent when available. I have several questions and requests concerning the data and these will be best conveyed by letter rather than telephone. Forgive me if I am requesting data that you are presently compiling.

High School Watershed

1. Storm event for 12 August 1972 has data for raingage R-55. Where is this raingage located?
2. No rainfall recorder charts have been received for
   10 August 1968
   1 August 1969
   19 July 1970
   20 July 1970
   11 August 1970
   8 August 1971.

Arcadia Watershed

1. No rainfall or runoff data have been received for
   12 August 1979
   10 ~~19~~ September 1982.
2. No rainfall recorder charts have been received for
   14 November 1968
   20 July 1970
   11 August 1970.
3. Some of the data refers to raingage R-67A. Is this different than R-67? If so, what is its location?

4. My watershed map does not show the location of raingages R-64, R-65, and TMC. Can you locate these for me?

Railraod Watershed

1. No rainfall or runoff data have been received for
   18 July 1974.
2. No rainfall recorder charts have been received for
   20 July 1970
   11 August 1970.
3. I cannot read the rainfall recorder charts (R-70, R-71, R-72, R-73) for
   12 August 1972
   19 October 1972.
   Can clearer copies be obtained?
4. My watershed map does not show the location of raingages R-72 and R-75. Can you locate these for me?

Atterbury Watershed W-1A

1. No rainfall or runoff data have been received for
   12 August 1957
   29 August 1958
   22 August 1961
   16 July 1965.
2. No rainfall recorder charts have been received for
   19 July 1981.
3. Raingage R-30 is indicated as a recorder gage, and is within the watershed. The only other recorder gage in the watershed is R-2. No data from R-30 has been received for any of the events. It would help define the rainfall pattern if the R-30 recorder charts were available. Please advise.

I am getting good results from much of the data that I am working with, including the Tucson data. I will share my results with you.

Thank you for your continued help.

Sincerely yours,

George V. Sabol

GVS/jr

4 September 1987

Ms. Francine Romero
Cooper Aerial Survey Company
1692 W. Grant Road
Tucson, Arizona 85745

602-884 7580

Dear Ms. Romero:

I talked to you on the telephone on 4 September 1987 concerning the availability of aerial photographs for the City of Tucson.

1. Please advise me as to the availability and cost for aerial photographs of the following land sections for the indicated years:

Land Description	Year
T.14S., R.14E., Sections 7 and 8	1968
	~~1982~~
T.14S., R.14E., Sections 2, 11, 12, 13, 14 and 24	1968 1969
	1982
T.14S., R.14E., Sections 16, 17, 18, 19, 20, 21, 28 and 29	1970
	~~1982~~
T.14S., R.15E., Sections 28, 29, 32 and 33	1957
	~~1984~~
T.15S., R.15E., Sections 4, 5, 8 and 9	1957
	~~1984~~

2. Please send a black line print of the 1 inch = 200 feet, 2-foot contour interval ortho-photo maps for the following:
   T.14S., R.14E., Sections 7 and 8

I will call you on 10 or 11 September to discuss this request with you. Please call me before then if you have any questions.

Sincerely yours,

George V. Sabol

GVS/jr

11 Sept.

Ordered from Cooper on 14 Sept 87

		Rec'd	
High School			
1.	1969 photo @ 1" = 2000'	OK	(1)
2.	1983 ~~ortho~~ photo-topo	OK	(2)
Arcadia			
1.	1969 photo @ 1" = 2000'	OK	(3)
2.	1982 blackline @ 1" = 400'	OK	(2)
Railroad			
1.	1969 photo @ 1" = 2000'	OK	(3)
2.	1982 blackline @ 1" = 400'	OK	(4)
Atterbury			
1.	1960 photo @ 1" = 800'	OK	(8)
2.	1985 blackline @ 1" = 400'	OK	(4)

photos (15)	12. + 8 + 6(4) + 7(3)	=	$65.00
ortho-photo (2)		=	30.00
blackline (10)	4.75 + 9(1.50)	=	18.25
			$113.25

11 Sept 87

High School T14, R14, Sec 7 & 8

✓ 1. 1969 photo @ 1" = 2000' (1)
2. 1982 black line @ 1" = 400' (6) or (1) ?
✓ 3. 1983 ortho-photo @ 1" = 200' (2)

Arcadia T 14, R 14, Sec ~~16, 17, 18, 19, 20, 21, 28 & 29~~ 2, 11, 12, 13, 14 & 24

✓ 1. 1969 photo @ 1" = 2000' (3)
✓ 2. 1982 black line @ 1" = 400' (2) ?
3. 1983 ortho-photo @ 1" = 200' (~~8~~ 6)

Railroad T 14, R 14, Sec. 16, 17, 18, 19, 20, 21, 28 & 29

✓ 1. 1969 photo @ 1" = 2,000' (3)
2. 1971 photo @ 1" = 1,000' (8)
✓ 3. 1982 black line @ 1" = 400' (4)
4. 1983 ortho-photo @ 1" = 200' (8)

Atterbury T 14, R 15, Sec 28, 29, 32 & 33

1. 1953 photo @ 1" = 800' (4)
✓ 2. 1960 photo @ 1" = 800' (4)
3. 1983 black line @ 1" = 200' (4)
✓ 4. 1985 black line @ 1" = 400' (2)
5. 1983 ortho-photo @ 1" = 200' (4)

Atterbury T ~~14~~ 15, R 15, Sec 4, 5, 8 & 9

✓ 1. 1960 photo @ 1" = 800' (4)
2. 1982 black line @ 1" = 400' (2)
✓ 3. 1985 black line @ 1" = 400' (2)

11 Sept. 87

Cost of photos & maps from Cooper:

Contact prints of photos (9"x9")

1st	$12.00	
2nd	8.00	
3rd – 8th	4.00	each
9th →	3.00	each

Ortho-photos of sections

$15. each

Blackline prints

1st	$4.75
each additional	$1.50

Francine Romero 9" 11 Sept 1987
Cooper Aerial Survey Co.

4,14,
7,8

1969 1" = 2,000' $12.00
1982 - black line 1" = 400' 4.75

each additional 1982 @ $1.50 each

(6) 1982 black lines

1969 (3) prints 9"x9" photos
1982 (2) black lines

1971 1" = 1,000 (8) 9"x9" photos
1969 1" = 2,000 (3)

1982 (4) black lines

1953 (4) 1" = 800'
1960 (4) 1" = 800'

1983 black line (4) 1" = 200'
1985 black line (2) 1" = 400'

1960 (4) 1" = 800'

1985 blackline (2) 1 = 400'
1982 blackline (2) 1" = 400'

$15 / sec for ortho photo } 1983

12,00	(1)
8.	(2)
4.	(3-8)
$3.	(9-17)

4 Sept. 87

Cooper Air Photo 602- 8847580

back to 1953
9"x9" $12
$4 after (5)
1"=800'-1000'

'83-'84 Ortho Photo maps 1"=200' 2' contour
$15/sec + tax

Ms. Francine Romero
Cooper Aerial Survey Co
1692 W. Grant Rd.
Tucson, AZ 85745

1" = 200'

Cooper Ortho-Photo maps

High School — T.14, R.14, sec 7 & 8

Arcadia — T14S, R14E, Sec. 2, 11, 12, 13, 14, 24

~~14, 19, Sec 11~~

Railroad — 18, 17, 16, 19, 20, 21, 29, 28 — T 14, R 14

(Kinneson) Atterbury — 29, 28, 33, 32 — 14, 15

5, 4, 8, 9, — 15, 15

not available

City of Tucson Maps

1" = 400'

$1.30 each

Tash is to have copies of these sent.

High School — 1, 2, 3

Railroad — 3, 14

Arcadia — 10, 11, 12, 29

Atterbury

Kinneson — 29, 30, 55, ~~56~~, ~~57~~, ~~31~~, ~~32~~

Cooper Air Photo Service

1"=200' Ortho-photo maps

T. 14S R. 14E Sec. 2, 7, 8, 11, 12, 13, 14
16, 17, 18, 19, 20, 21
24, 28, 29

14S 15E sec. 28, 29, 32, 33

What is cost of prints of these?

I need aerial photos for these areas for past years (since 1957) what is available? How do I get?

Yash 7914251

Landis Aerial Surveys, Inc. $20/page
3816 N. 7 St.
Phoenix, AZ 85014
248 8989

		photo/map	1"=1200 ft
57, 58, 61, 65, 76, 81, 82, 84	Atterbury	K-14/13	photo 22 Sept. 85
70, 71, 72, 74 82	Railroad	J-12/11 & K-12/11	
68, 70, 71, 72, 77, 78, 79, 82	Arcadia Wash	J-13/12	
68, 69, 70, 71, 72, 80, 82	High School	J-12/11	

photo & maps	K - 11, 12, 13, 14 J - 11, 12, 13	7
photo only	K - 12, 14 J - 12	3

(Yash Desai)

Rod ~~Rushe~~ Roeske, USGS, Tucson
Rainfall-runoff data

Cooper Air Photo – will have old records

SLA model Mike Zeller
area reduction factor

Eichner data

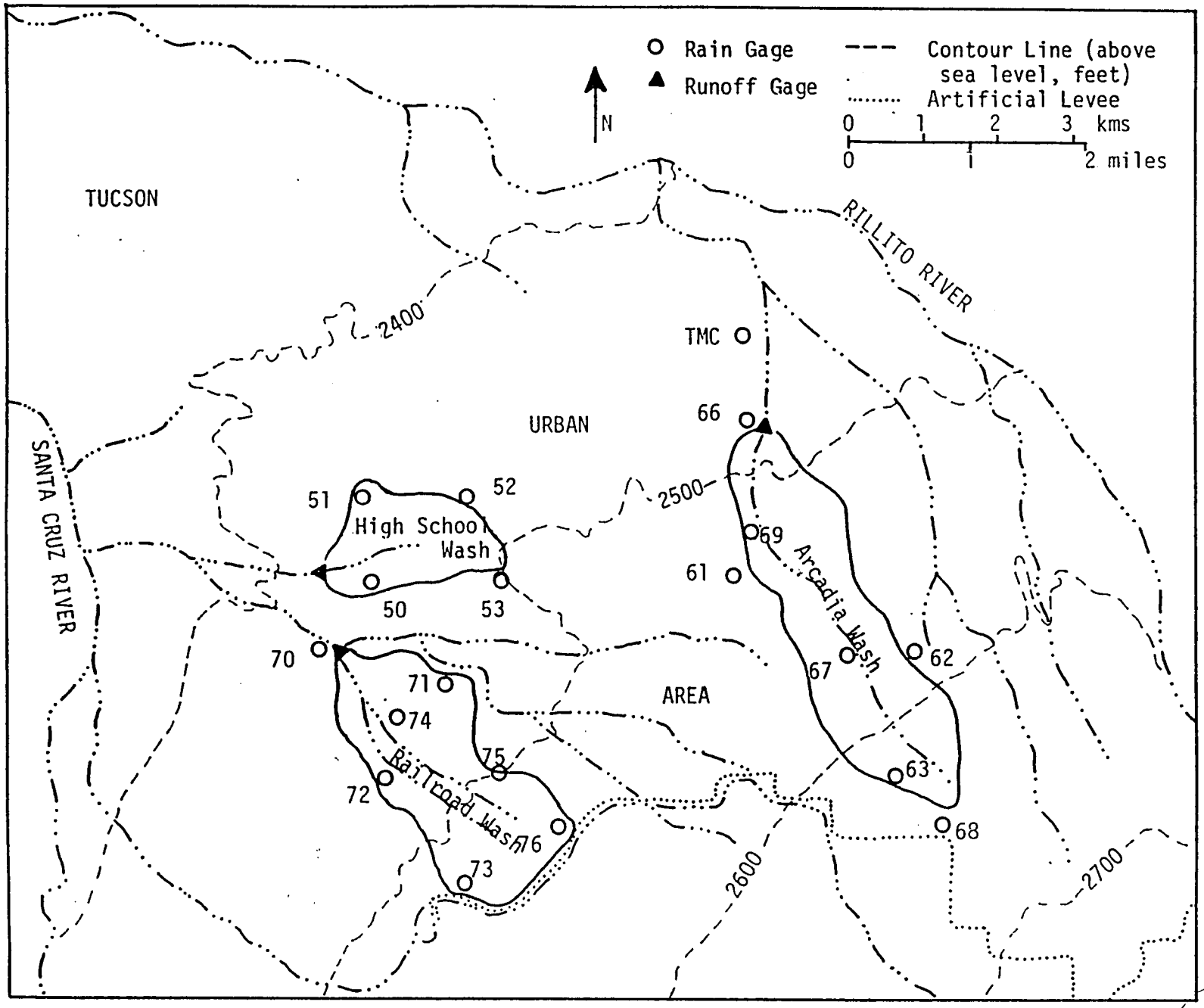


FIGURE 1. Experimental Urban Watershedsin the City of Tucson, Arizona, 1971.

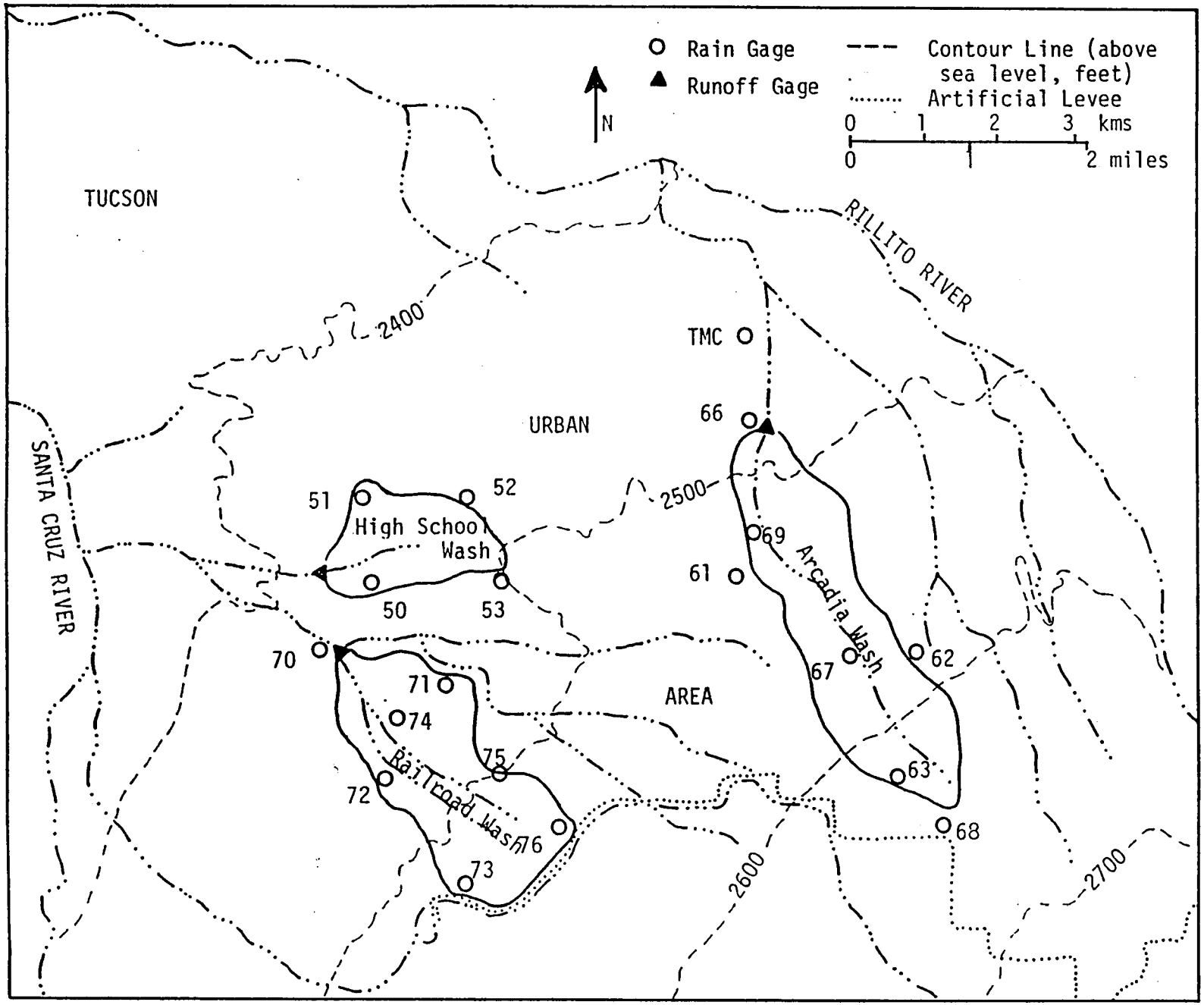


FIGURE 1. Experimental Urban Watershedsin the City of Tucson, Arizona, 1971.

Flood Reconstitution for Tucson High School Wash THS 1

Storm Event 13 Aug 80

Runoff: depth = .67 inches, Q_p = 360 / 270 cfs at t_p = .83 / 1.33 hours

$R_{recession}$ = .43 hrs

INPUT (1) Area acres	(2) Eff. Imp. Area %	(3) Rain in.	(4) Comp. Inter. min.	(5) Time-Area	(6)	Results (7) Q_p cfs	(8) t_p hr.	(9) T_c hr.	(10) R hr.	(11) STRTL in.	(12) CNSTL in/hr	(13) Output File	(14) Comment
576	11.3	1.9	5	D		329	1.0	.10	.68	.39	.46	Ø1	multiple peak hg.
"	"	"	10	D		314	1.0	.17	.54	.39	.40	Ø2	
"	"	"	5	U-6		327	1.08	.12	.73	.35	.44	Ø3	
"	"	"	2	D		321	1.0	.06	.57	.49	.56	Ø4	
"	"	"	"	U-1		323	1.03	.17	.55	.48	.57	Ø5	
608	10.9	"	"	"		322	1.00	.14	.57	.49	.60	Ø6	← best

Flood Reconstitution for Tucson High School Wash THS 2

Storm Event 11-12 Sept 82

Runoff: depth = .38 inches, Q_p = 331 cfs at t_p = .50 hours

$R_{recession}$ = .30 hrs

INPUT (1) Area acres	(2) Eff. Imp. Area %	(3) Rain in.	(4) Comp. Inter. min.	(5) Time-Area	(6)	Results (7) Q_p cfs	(8) t_p hr.	(9) T_c hr.	(10) R hr.	(11) STRTL in.	(12) CNSTL in/hr	(13) Output File	(14) Comment
576	11.3	.87	5	U-4		336	.50	.20	.35	.40	.35	Ø1	
"	"	"	"	U-1		342	.50	.28	.32	.45	.23	Ø2	
"	"	"	"	U-6		322	.50	.13	.39	.41	.33	Ø3	
608	10.9	"	"	"		348	.50	.28	.32	.46	.25	Ø4	← best

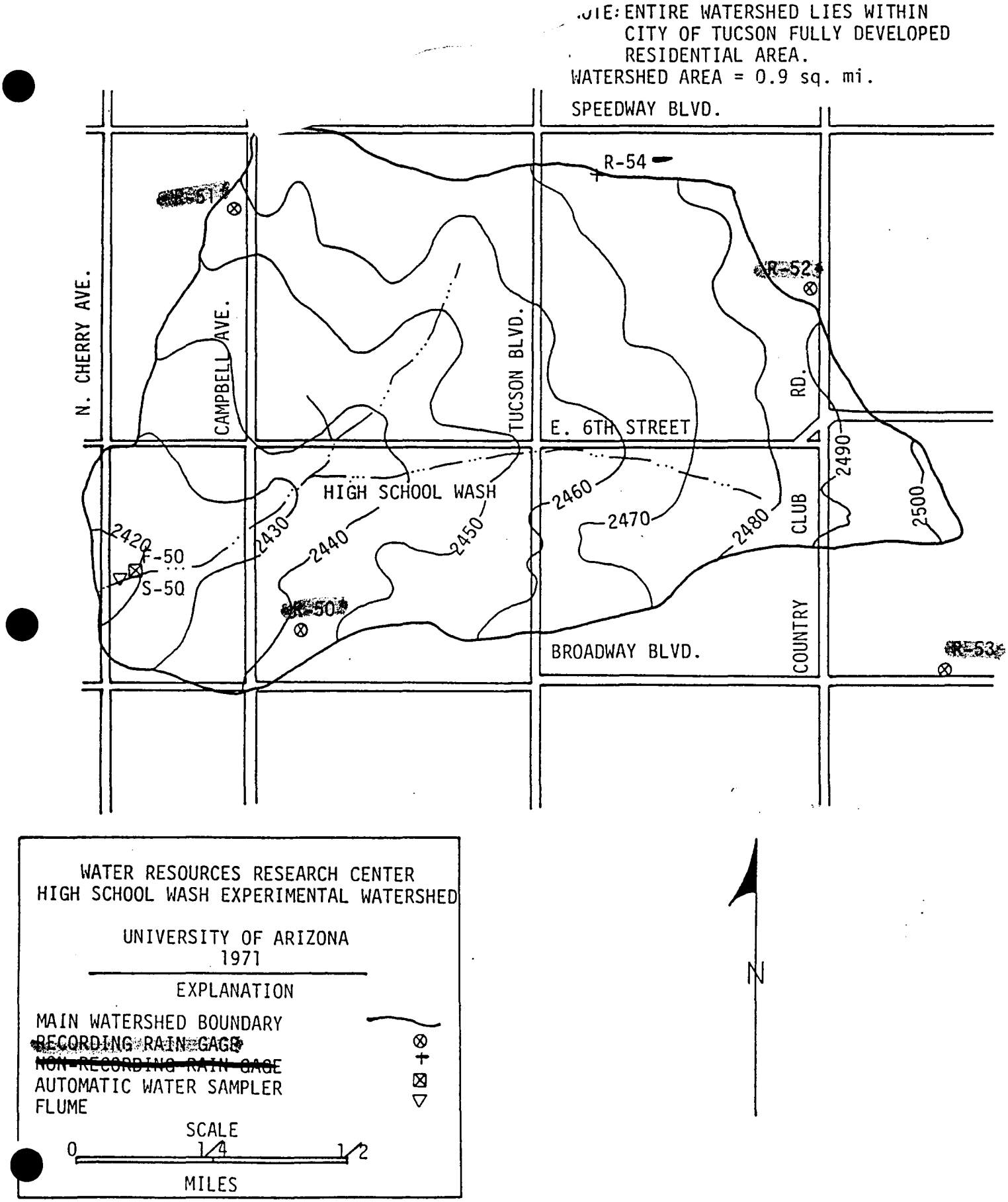


FIGURE 3. High School Wash Experimental Watershed.

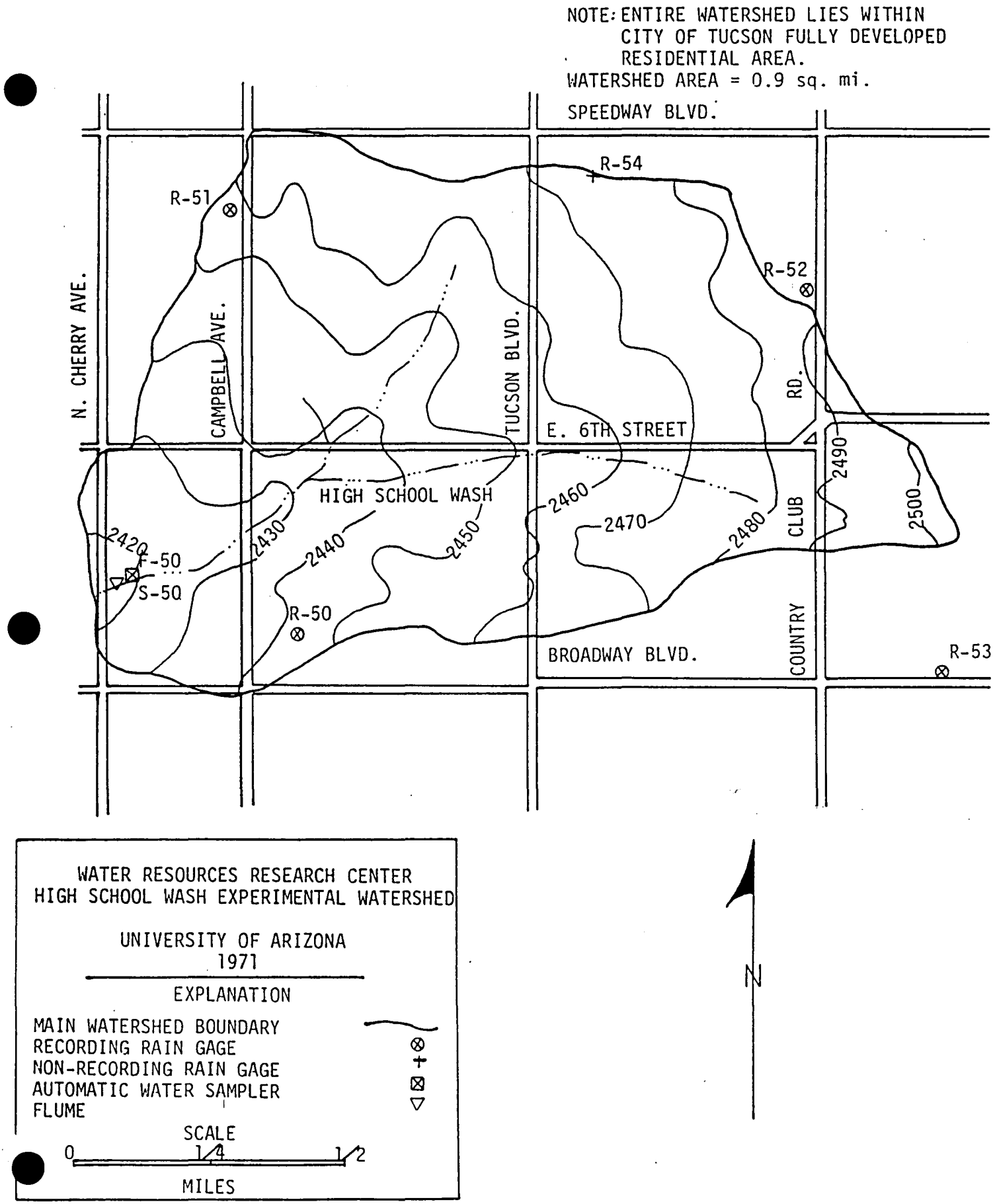
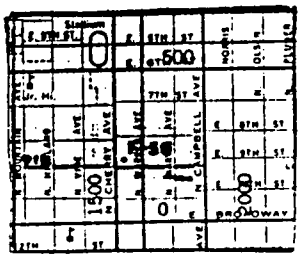
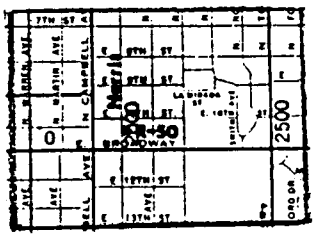
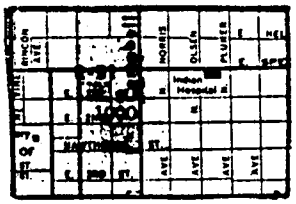
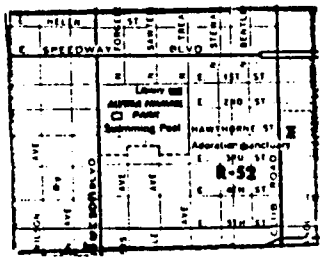


FIGURE 3. High School Wash Experimental Watershed.

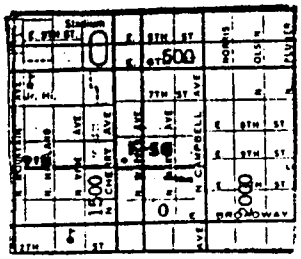
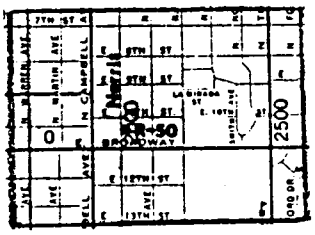
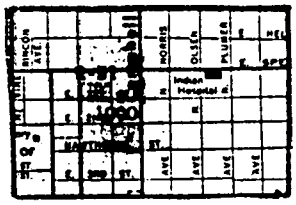
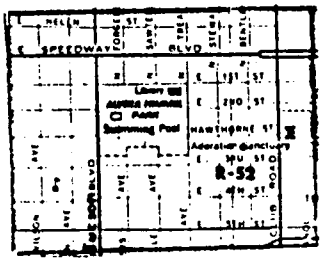
Flume & Raingage Locations

High School Watershed

Number	Location
F-50 (Flume	Flume is on High School Wash., 175 feet up stream from Cherry Ave. culvert.
	
R-50 (Recording Raingage)	City of Tucson Fire Station, 10th Street and Plumer Avenue.
	
R-51 (Recording Raingage)	Well site B-1, 2nd Street and Campbell Ave.
	
R-52 (Recording Raingage)	Well Site B-5 in an alley half block West of Country Club Rd. between Hawthorne and 3rd Streets.
	

Flume & Raingage Locations

High School Watershed

Number	Location
F-50 (Flume	Flume is on High School Wash., 175 feet up stream from Cherry Ave. culvert.
	
R-50 (Recording Raingage)	City of Tucson Fire Station, 10th Street and Plumer Avenue.
	
R-51 (Recording Raingage)	Well site B-1, 2nd Street and Campbell Ave.
	
R-52 (Recording Raingage)	Well Site B-5 in an alley half block West of Country Club Rd. between Hawthorne and 3rd Streets.
	

9 Oct 87

High School Watershed

Storm Event	Hydrograph Type*	Peak cfs	Rainfall recorder gages (✓ if records available) R-50	R-51	R-52	R-53	Nonrecorder Gages R-54	Data comments	Analyzed? Comment
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)		
10 Aug 68	S	486	1.40	1.52		.83		* no rainfall charts	
1 Aug 69	S	341	1.15	.68		1.03	.85	* no rainfall charts	
19 July 70	S	255	.26			.46		* no rainfall charts	
20 July 70	S	243	.49			.84		* no rainfall charts	
11 Aug 70	S	408	.58	1.17		1.45		* no rainfall charts possible hydrograph error	
8 Aug 71	S	663	1.20	1.40	1.65	1.32	1.70	* no rainfall charts	
12 Aug 72	S	790	1.93 ✓	1.87 ✓	1.25 ✓	1.52	1.83 @ R-55	R-53 chart missing possible hydrograph error	
13 Aug 80	S	360	1.72	1.75 ✓	2.15 ✓	1.40 ✓		R-50 chart missing	Yes
25 July 82	S	464	.96	.93 ✓	.50 ✓	.20 ✓		R-50 chart missing	partial area rainfall
11 Sept 82	S	331	2.00	1.60 ✓	1.93 ✓	1.80 ✓		R-50 chart missing	Yes

Type – Single peak (S)
multiple peak (M)
Flat peak (F)

4 Oct 87

Analysis of Effective Impervious Area
High School Watershed

Storm Date	Rainfall Avg. inches	Rainfall Max. inches	Runoff Volume ac-ft	Runoff Qp cfs	Runoff % of rainfall	A_e acres
(1)	(2)	(3)	(4)	(5)	(6)	(7)
10 April 68	.163	.21	.659	7.5	8.0	48.5
20 April 68	.127	.14	.198	3.3	3.2	18.7
26 July 68	.187	.25	1.454	33.0	15.5	93.3
30 July 68	.282	.36	1.454	21.0	10.3	61.9
31 July 68	.157	.18	1.637	39.5	20.4	125.1
14 Nov 68	.762	.79	3.283	21.0	8.5	51.7
14 Nov 68	.437	.51	5.426	73.5	24.5	144.1
26 Dec 68	.450	.46	1.459	8.4	6.4	38.9
14 Jan 69	.623	.65	1.175	3.3	3.7	22.6
5 May 69	.570	.55	3.597	40.0	13.6	83.0
9 Nov 69	.543	.55	2.001	15.5	7.4	44.2
10 Nov 69	.291	.36	1.966	36.0	13.4	81.1
28 June 70	.498	.53	2.087	33.0	8.2	50.3
4 Sept 70	1.270	1.40	8.654	34.6	13.5	81.8
15 April 71	.397	.45	.939	16.5	4.8	28.4
29-30 July 71	.593	.75	5.056	72.3	16.9	102.3
12 Aug 71	.223	.26	1.657	6.2	14.8	89.2
30 Sept 71	.220	.26	.286	2.6	2.7	15.6
17 Oct 71	.983	1.05	6.047	28.6	12.1	73.8
15 Nov 71	.276	.35	.526	9.0	3.6	22.9
16 Nov 71	.494	.53	3.317	23.5	13.2	80.6
4 Dec 71	.636	.66	5.207	37.5	16.2	98.2
7 Dec 71	.780	.82	3.389	11.8	8.6	52.1
30 May 72	.420	.56	2.007	39.6	9.5	57.3
21 June 72	.435	.50	3.080	80.9	14.0	85.0
15 July 72	.328	.40	1.331	27.5	7.9	48.7
17 July 72	.188	.20	.703	5.3	7.5	44.9
5 Aug 72	.620	.80	3.523	39.6	11.3	68.2
11 Aug 72	.454	.60	3.309	77.3	14.3	87.5
7 Sept 72	.266	.34	2.023	44.5	15.0	91.3
18 Sept 72	.318	.35	2.205	44.9	13.8	83.2
3 Oct 72	.503	.53	1.921	11.4	7.6	45.8
4 Oct 72	.452	.57	4.000	42.7	17.7	106.2
5 Oct 72	.365	.42	2.326	19.5	12.6	76.5
19 Oct 72	.180	.18	.788	5.7	8.9	52.5
11 Nov 72	.649	.67	4.750	51.7	14.5	87.8
17 Nov 72	.651	.66	3.445	17.2	10.5	63.5
28 Dec 72	.260	.37	.788	19.0	7.6	45.3

continued - High School

4 Oct 87

(1)	(2)	(3)	(4)	(5)	(6)	(7)
7 Mar 73	.445	.45	2.999	30.8	13.3	80.9
12 Mar 73	.466	.58	2.214	5.1	9.4	57.0
14 Mar 73	.609	.62	5.810	33.6	18.9	114.5
12 June 73	.342	.35	1.148	18.4	6.7	40.3
30 June 73	.360	.45	2.197	32.7	11.9	73.2
8 Mar 74	.362	.40	.866	8.1	4.7	28.7
18 July 74	.490	.60	2.238	43.3	9.0	54.8
29 Oct 74	.710	.80	6.365	44.9	17.7	107.6
29 Jan 75	.407	.45	1.454	10.3	7.1	42.9
8 Mar 75	.217	.25	.989	20.1	9.0	54.7
11-12 Mar 75	.557	.65	3.013	21.2	10.7	64.9
7-8 Apr 75	.300	.34	.399	3.4	2.6	16.0
2 July 75	.390	.45	1.676	25.4	8.5	51.6
7 July 75	.217	.25	1.240	32.7	11.2	68.6
7 July 75	.198	.24	1.137	7.0	11.3	68.9
28-29 Nov 75	.345	.37	1.711	26.1	9.8	59.5
23 Dec 75	.325	.38	1.934	11.3	11.7	71.9
20 May 76	.300	.35	2.824	61.6	18.6	113.0
9 July 76	.205	.25	.729	13.8	7.0	42.7
24 Aug 76	.310	.35	1.256	28.6	8.0	48.6
21 Oct 76	.480	.58	2.086	44.5	8.6	52.2
13-14 Nov 76	.320	.35	.907	5.3	5.5	34.0
31 Dec 76	.950	1.02	6.650	17.9	13.8	84.0
8 Jan 77	.45	.49	2.052	9.0	9.0	54.7
21-22 Jan 77	.56	.65	3.303	27.4	11.6	70.8
29-30 Jan 77	.47	.50	3.455	20.0	14.0	88.2
26-27 Mar 77	.67	.76	3.243	24.8	9.0	58.1
2 Apr 77	.21	.25	.370	4.4	3.4	21.1
9 Oct 77	.43	.50	4.717	87.7	21.6	131.6
6-7 Nov 77	.40	.50	1.647	7.8	8.1	49.4

continued- High School

4 oct 87

(1)	(2)	(3)	(4)	(5)	(6)	(7)
10 Jan 78	.67	.80	5.85	43.8	16.7	101.7
15-16 Jan 78	.80	.83	6.780	25.4	16.6	101.7
17 Jan 78	.53	.60	3.724	18.4	13.9	84.3
1 Feb 78	.38	.40	4.83	86.9	25.0	152.5
11-12 Feb 78	1.05	1.12	7.758	19.5	14.6	88.7
13-14 Feb 78	.35	.40	.887	2.5	4.9	30.4
27 Feb-2 Mar 78	.81	.92	3.165	15.1	7.7	46.9
5-6 Mar 78	.18	.20	.295	2.1	3.2	19.7
14-15 Nov 78	.36	.45	2.45	37.5	13.3	81.7
23-25 Nov 78	1.35	1.45	9.73	32.7	14.2	86.5
6 Dec 78	.25	.30	.53	6.7	4.0	25.4
17-18 Dec 78	1.57	1.70	11.43	49.4	14.3	87.4
29-31 Dec 78	1.55	1.75	9.697	29.01	12.3	75.1
5-7 Jan 79	.68	.75	3.112	14.2	9.0	54.9
16-17 Jan 79	1.09	1.18	10.88	50.6	19.6	119.8
24-25 Jan 79	.72	.75	2.97	15.9	8.3	49.5
4-5 Feb 79	.48	.58	3.42	21.2	14.6	85.5
20-21 Mar 79	.51	.57	3.64	34.1	13.7	85.6
8 Nov 79	.18	.20	.75	16.5	7.8	50.0
13-17 Feb 80	1.69	1.80	15.159	48.3	17.7	107.6
12-13 July 80	.57	.65	2.440	17.0	8.4	51.4
25 July 80	.23	.26	.787	21.2	6.5	41.1
25-26 Sept 80	1.12	1.20	9.291	80.2	16.3	99.5
15-16 Oct 80	.40	.47	1.358	16.9	6.8	40.7
11-12 Jan 81	.548	.62	2.609	15.1	9.4	57.1
8-10 Feb 81	.995	1.02	3.57	14.2	7.0	43.1
1-4 Mar 81	1.08	1.50	5.56	28.6	10.2	61.8
5-6 Mar 81	.44	.50	3.097	22.3	13.9	84.5
30 Apr 81	.255	.30	1.100	35.1	8.5	51.8
11-12 July 81	.223	.27	.63	12.5	5.5	33.9
29 July 81	.295	.38	1.409	21.2	9.4	57.3
29 Nov 81	.743	.83	3.280	35.1	8.7	53.0

continued- High School

4 oct 87

(1)	(2)	(3)	(4)	(5)	(6)	(7)
1-2 Jan 82	.488	.56	1.461	16.0	5.9	35.9
10-12 Jan 82	.365	.45	1.591	26.8	8.5	52.3
21 Jan 82	.400	.52	1.918	18.5	9.5	57.5
29 Jan 82	.303	.35	.473	6.0	3.0	18.7
12-15 Mar 82	.80	.95	4.383	46.0	10.9	65.7
4-5 May 82	.310	.35	1.108	24.2	7.1	42.9
23 July 82	.240	.28	1.497	33.2	12.1	74.9
24 July 82	.330	.38	1.998	38.6	11.8	72.7
8-9 Nov 82	.380	.40	.426	2.2	2.1	13.5
16-17 Nov 82	.330	.45	1.723	28.6	10.3	62.7
30 Nov-2 Dec 82	.790	.90	7.699	62.2	19.2	116.9
9-10 Dec 82	.770	.78	6.183	28.1	15.8	96.4
23 Dec 82	.230	.26	1.776	28.6	15.2	92.7
30-31 Dec 82	.190	.25	.271	.8	2.6	17.1
19-20 Jan 83	.35	.42	1.614	1.0	9.1	55.3
2-3 Feb 83	.24	.27	.209	.9	1.7	10.5
3-4 Mar 83	.98	1.20	9.788	32.2	19.7	119.9
18-19 Mar 83	.53	.70	2.383	8.4	8.9	54.0
13 Sept 83	.30	.36	.842	16.5	6.0	33.7
28 Sept 83	.33	.40	3.003	52.3	18.0	109.2
29-30 Sept 83	1.85	2.00	16.625	62.2	18.0	107.8
1-2 oct 83	3.94	4.08	7.699	91.6	4.0	23.4
3-4 Nov 83	.64	.68	3.128	17.0	10.0	58.7
21 Nov 83	.78	.79	3.234	15.1	8.0	49.8
2 Dec 83	.31	.32	.370	1.8	2.2	14.3
26 Dec 83	.51	.67	3.427	42.7	13.1	80.6

$A = .95\ mi.^2$

# of events = 12.6 10.7 %

Mean = 65.1 acres = ~~11.3~~ %

Std. Dev. = 29.9

Analysis of effective impervious area for High School Wash.

29 Sept. 87

Avg. Rainfall	A_c	Year			
~~.95~~	~~126.5~~	1977	.31	27.1	1979
.45	54.7		.42	109.7	
.56	70.8		~~.77~~	~~224.9~~	
.47	88.2		.18	50.0	
.67	58.1		~~1.69~~	~~107.6~~	1980
.21	21.1		.30	7.0	
.14	33.9		.24	6.0	
.61	60.3		.45	84.1	
.11	22.7		.57	51.4	
~~2.14~~	~~102.1~~		.23	41.1	
.43	131.6		~~1.76~~	~~218.9~~	
.17	34.7		.58	152.4	
.40	49.4		~~.70~~	~~125.2~~	
~~1.21~~	~~288.0~~		.56	196.2	
.69	101.7	1978	~~1.12~~	~~99.5~~	
.11	4.1		.40	40.7	
~~.80~~	~~101.7~~		.548	57.1	1981
.53	84.3		~~1.95~~	~~43.1~~	
.38	152.5		.44	84.5	
~~1.05~~	~~88.7~~		.255	51.8	
.35	30.4		.50	152.0	
~~.81~~	~~46.9~~		.255	12.4	
.18	19.7		.223	33.9	
.41	59.6		.48	101.7	
.36	40.3		.295	57.3	
~~1.55~~	~~131.9~~		~~.743~~	~~53.0~~	
.44	150.8		.488	35.9	1982
.36	81.7		.365	52.3	
~~1.35~~	~~86.5~~		.400	57.5	
.25	25.4		.303	18.7	
~~1.57~~	~~87.4~~		~~.800~~	~~65.7~~	
~~1.55~~	~~75.1~~		.310	42.9	
~~1.55~~	~~131.9~~		.330	4.9	
.44	150.8		.240	74.9	
.36	81.7		.330	72.7	
~~1.35~~	~~86.5~~		~~1.110~~	~~153.2~~	
.25	25.4		~~1.50~~	~~143.4~~	
~~1.57~~	~~87.4~~		.86	~~171.5~~	
~~1.55~~	~~75.1~~		1.00	~~98.1~~	
.68	54.9	1979	~~1.83~~	~~202.6~~	
~~1.09~~	~~119.8~~		.38	13.5	
~~.72~~	~~49.5~~		~~.79~~	~~116.9~~	
.48	85.5		~~.77~~	~~96.4~~	
.29	55.0		.23	92.7	
.51	85.6		.19	17.1	
.56	122.6				

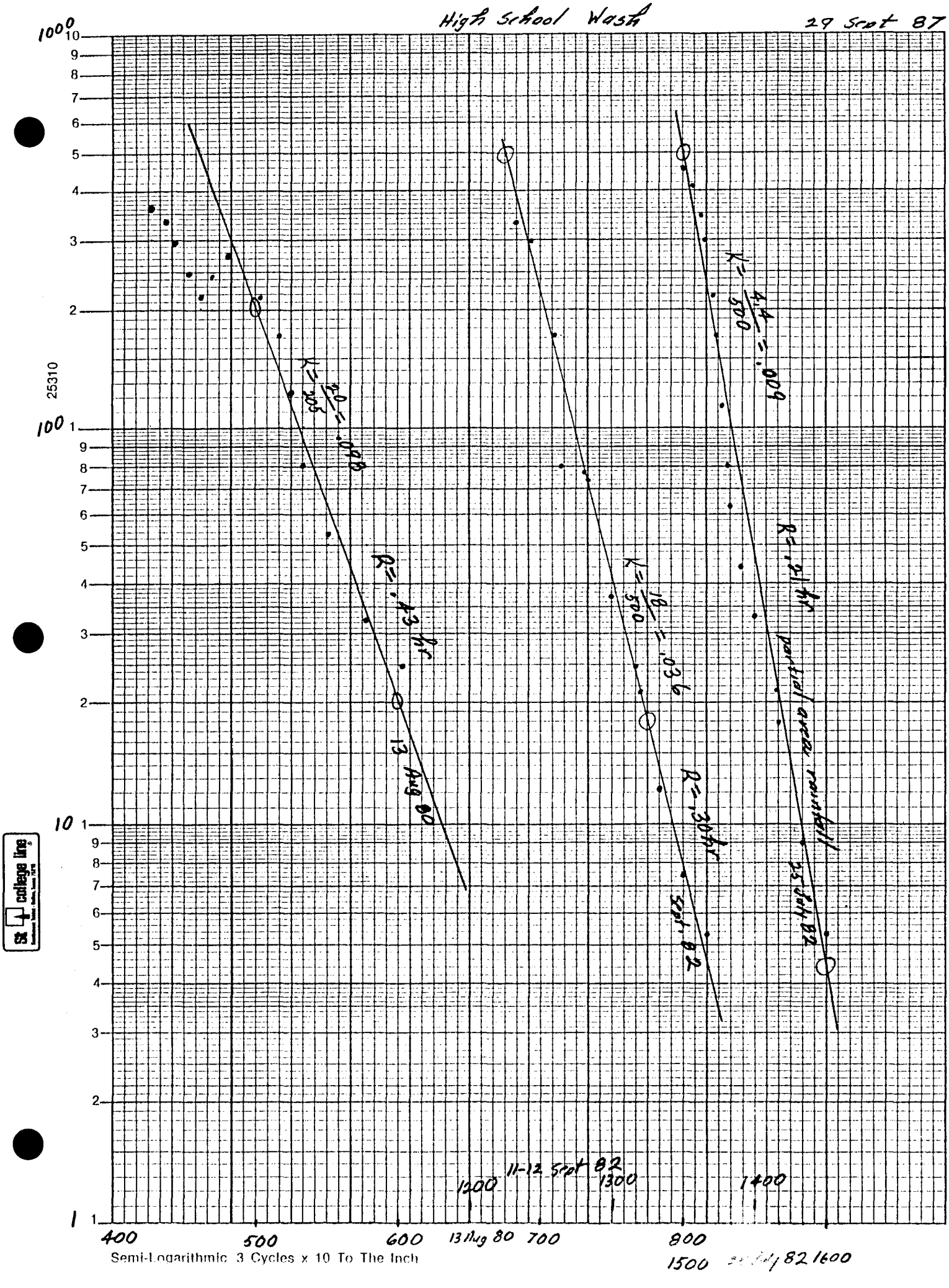
Avg. Rainfall inches	A_e acres	Year
.163	48.5	1968
.127	18.7	
.187	93.3	
.282	61.9	
.157	125.1	
~~1.32~~	~~131.0~~	
~~.762~~	~~51.7~~	
.450	38.9	
.623	22.6	1969
.52	83.0	
.192	58.3	
.576	179.2	
.167	31.0	
.324	139.8	
.543	44.2	
.291	81.1	
.498	50.3	1970
~~1.270~~	~~81.8~~	
.397	28.4	1971
.593	102.3	
~~.849~~	~~134.3~~	
~~1.426~~	~~243.9~~	
.223	89.2	
.542	137.0	
~~1.012~~	~~132.0~~	
~~.857~~	~~112.0~~	
.220	15.6	
~~.983~~	~~73.8~~	
.636	98.2	
~~.780~~	~~52.1~~	
.296	62.2	
.420	57.3	1972
.435	85.0	
.328	48.7	
.188	44.9	
.620	68.2	
.454	87.5	
~~1.665~~	~~159.6~~	
.266	91.3	
.318	83.2	
.503	45.8	
.687	125.9	
.452	106.2	
.365	76.5	
.200	15.4	

.425	123.0	1972
.180	52.5	
~~1.095~~	~~193.3~~	
.505	184.4	
.649	87.8	
.651	63.5	
.262	45.3	
~~1.132~~	~~103.9~~	1973
.192	27.8	
.445	80.9	
.466	57.0	
.609	114.5	
.342	40.3	
.360	73.2	
~~.800~~	~~135.6~~	
.197	54.4	
.362	28.7	1974
.265	40.7	
.490	54.8	
~~.710~~	~~107.6~~	
.407	42.9	1975
.217	54.7	
.557	64.9	
.300	16.0	
.135	14.2	
.390	51.6	
.217	68.6	
.198	68.9	
~~1.040~~	~~155.2~~	
.300	113.0	1976
.205	42.7	
.310	48.6	
.550	116.6	
.480	52.2	
.320	34.0	
~~.950~~	~~84.0~~	

Avg. Rainfall	A_c	Year
.35	55.3	1983
~~1.33~~	~~112.5~~	
.24	10.5	
~~.98~~	~~119.9~~	
.53	54.0	
~~.74~~	~~93.5~~	
.17	11.2	
~~1.09~~	~~109.0~~	
.19	27.6	
.30	33.7	
.33	109.2	
~~1.85~~	~~107.8~~	
~~3.94~~	~~23.4~~	
.64	58.7	
~~.78~~	~~49.8~~	
.31	14.3	

	# event	Avg. A_e	std. dev.
< .30	46	44.2	27.6
.30 – .499	56	64.8	37.5
.50 – .599	19	104.4	50.1
.60 – .699	11	74.2	—

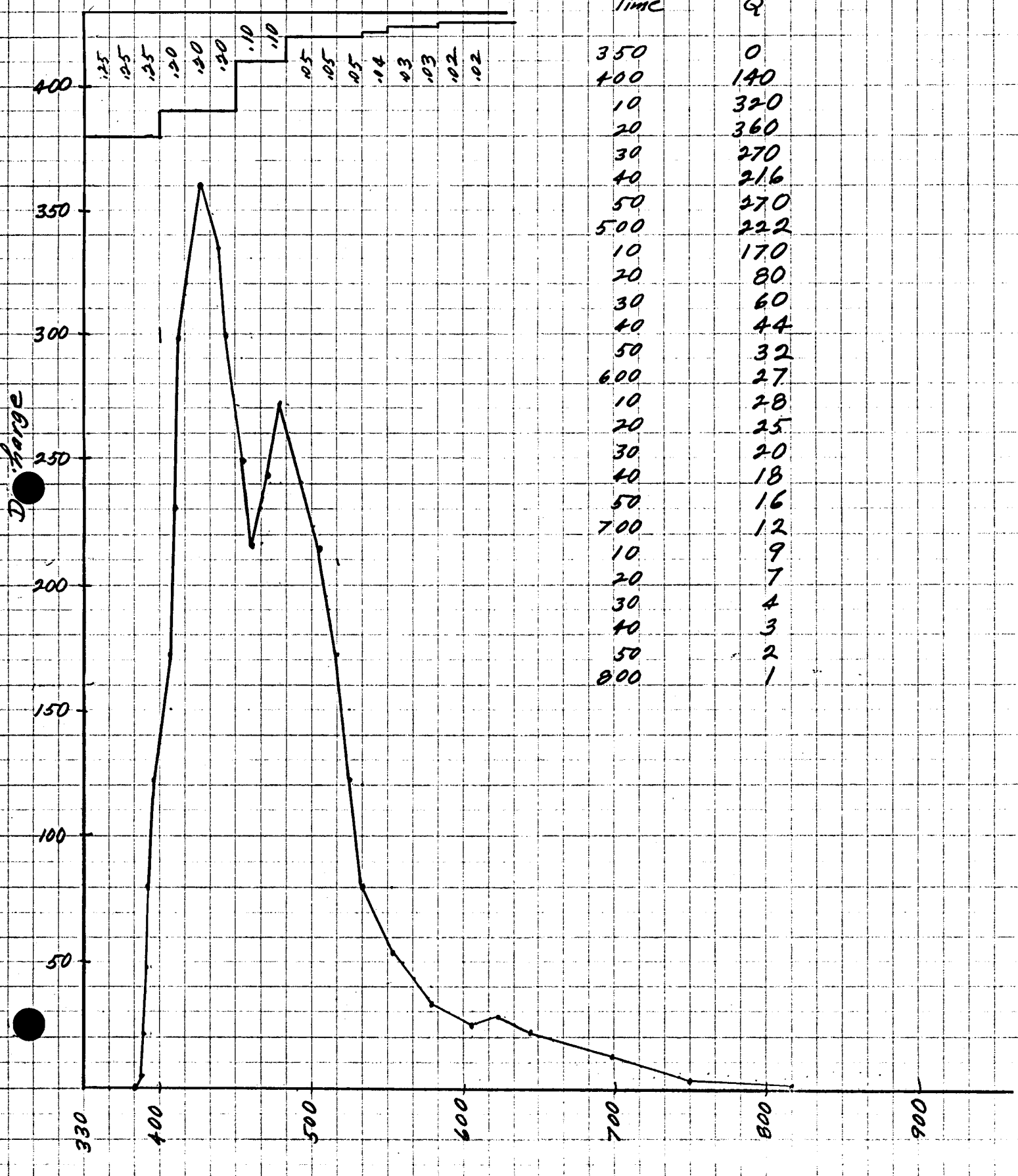
use A_e = 64.8 acres


High School Wash
29 Sept 87
K = 4.4/500 = .009
R = .41 hr
partial area rainfall
5-7 Aug 82
K = 18/500 = .036
R = .30 hr
Sept 82
K = 20/500 = .040
R = .43 hr
13 Aug 80
11-12 Sept 82
13 Aug 80
Semi-Logarithmic 3 Cycles x 10 To The Inch
25310

THS1

29 Sept 87

High School Wash
13 Aug 1980

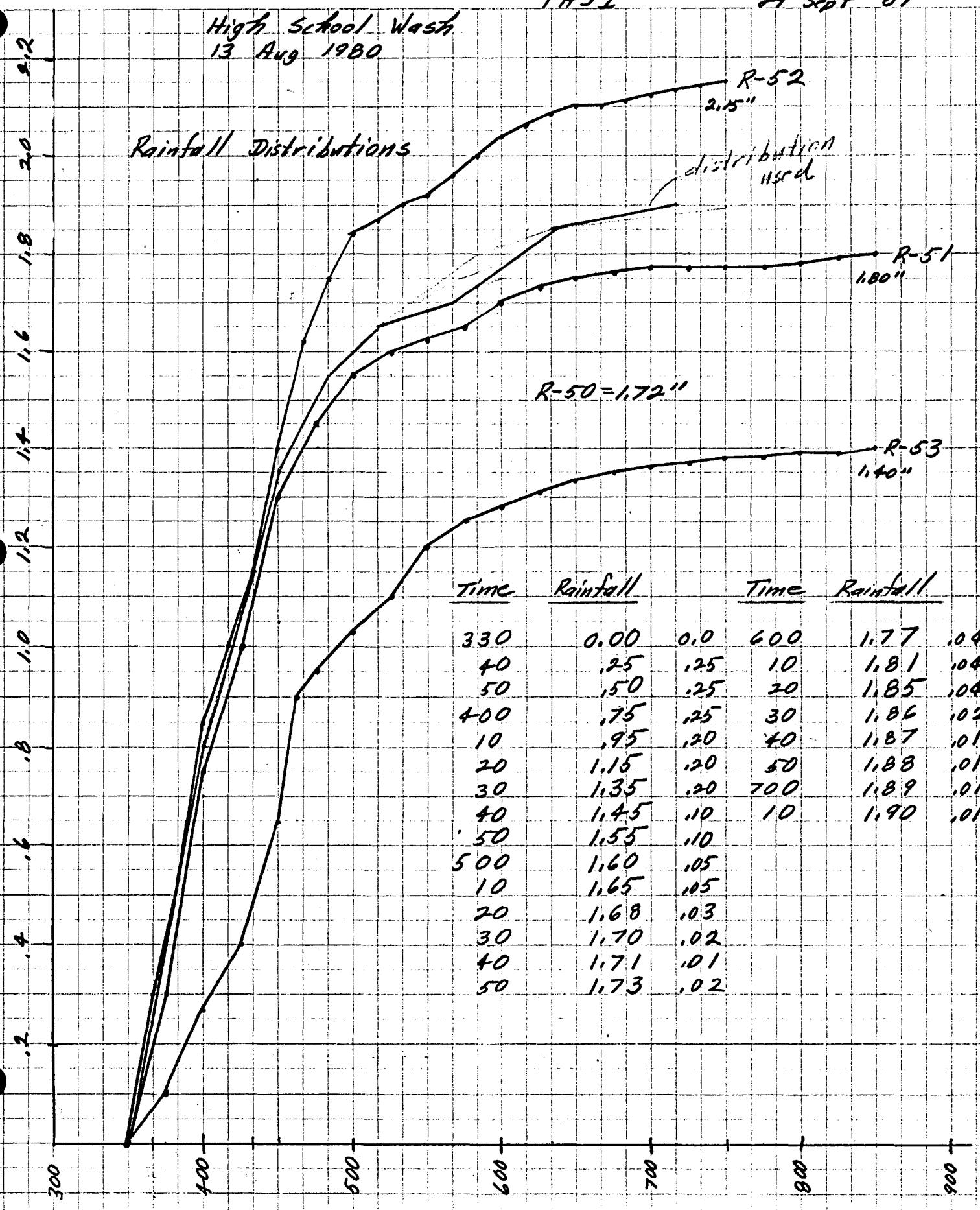


Time	Q
350	0
400	140
10	320
20	360
30	270
40	216
50	270
500	222
10	170
20	80
30	60
40	44
50	32
600	27
10	28
20	25
30	20
40	18
50	16
700	12
10	9
20	7
30	4
40	3
50	2
800	1

THS 1 29 Sept 87

High School Wash
13 Aug 1980

Rainfall Distributions



Time	Rainfall		Time	Rainfall	
330	0.00	0.0	600	1.77	.04
40	.25	.25	10	1.81	.04
50	.50	.25	20	1.85	.04
400	.75	.25	30	1.86	.02
10	.95	.20	40	1.87	.01
20	1.15	.20	50	1.88	.01
30	1.35	.20	700	1.89	.01
40	1.45	.10	10	1.90	.01
50	1.55	.10			
500	1.60	.05			
10	1.65	.05			
20	1.68	.03			
30	1.70	.02			
40	1.71	.01			
50	1.73	.02			

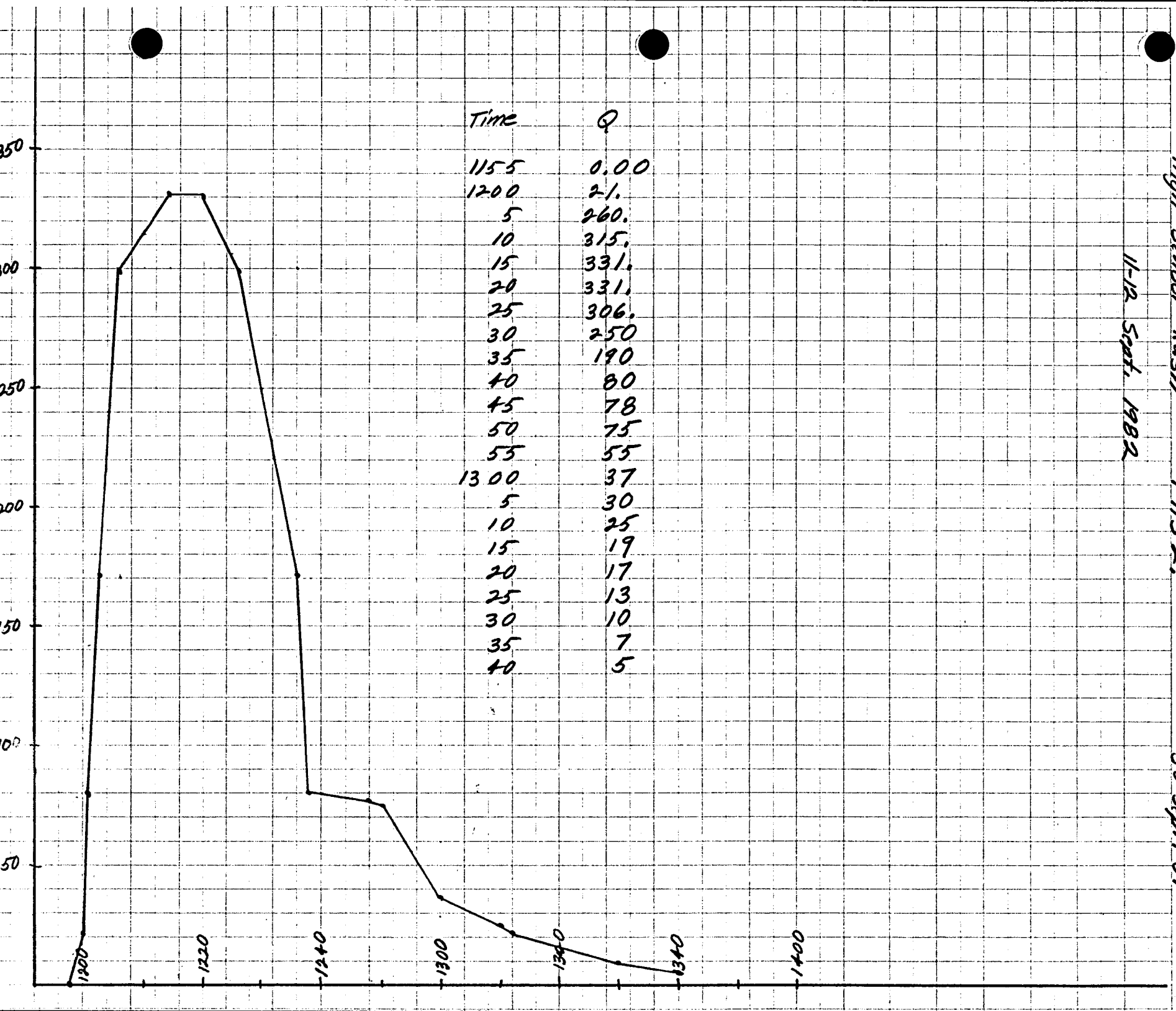
Rainfall Distribution THS1 29 Sept. 87
High School Wash

13 August 1980

Time	R-51	R-53	Time	R-52
0330	0.00	0.00	0330	0.00
345	.30	.10	40	.30
400	.75	.27	50	.53
415	1.00	.40	400	.85
430	1.30	.65	10	1.00
445	1.45	.98 — 437.5	20	1.15
500	1.55	.95	30	1.40
515	1.60	1.03	40	1.62
530	1.62	1.10	50	1.75
545	1.65	1.20	500	1.84
600	1.70	1.25	10	1.87
615	1.73	1.28	20	1.90
630	1.75	1.31	30	1.92
645	1.76	1.33	40	1.96
700	1.77	1.35	50	2.00
715	1.77	1.36	600	2.04
730	1.77	1.37	10	2.06
745	1.77	1.38	20	2.08
800	1.78	1.38	30	2.10
815	1.79	1.39	40	2.10
830	1.80	1.40	50	2.11
			700	2.12
			10	2.13
			20	2.14
			30	2.15

High School Wash THS 2.

11-12 Sept. 1982 30 Sept. 87



Time	Q
1155	0.00
1200	21.
5	260.
10	315.
15	331.
20	331.
25	306.
30	250
35	190
40	80
45	78
50	75
55	55
1300	37
5	30
10	25
15	19
20	17
25	13
30	10
35	7
40	5

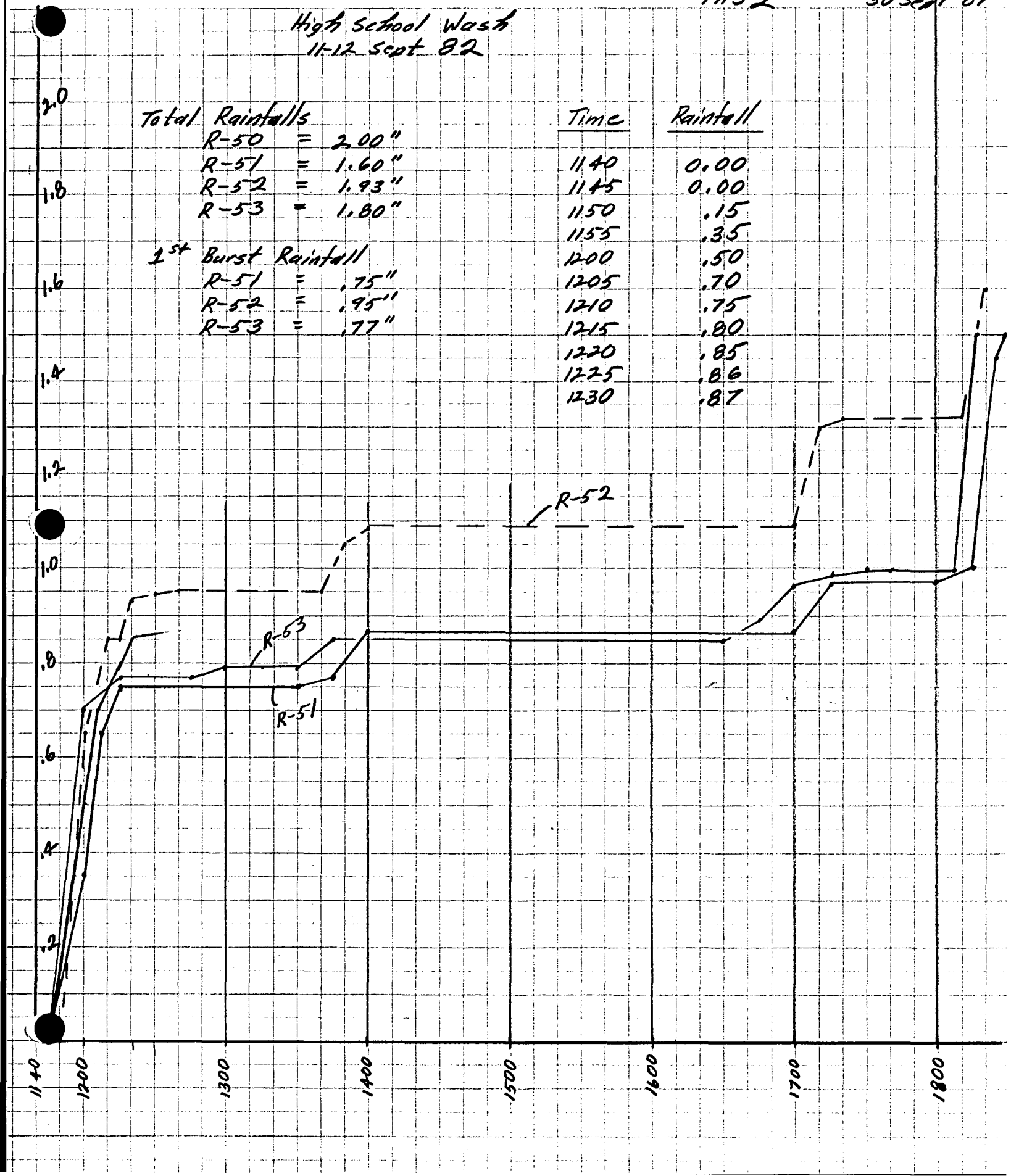
THS 2 30 Sept 87

High School Wash
11-12 Sept 82

Total Rainfalls
R-50 = 2.00"
R-51 = 1.60"
R-52 = 1.93"
R-53 = 1.80"

1st Burst Rainfall
R-51 = .75"
R-52 = .95"
R-53 = .77"

Time	Rainfall
1140	0.00
1145	0.00
1150	.15
1155	.35
1200	.50
1205	.70
1210	.75
1215	.80
1220	.85
1225	.86
1230	.87



High School Wash — THS 2 — 30 Sept 87

11-12 Sept 82

Time	R-51	R-53
1145	0.0	0.0
1200	.35	.70
15	1207.5 .65 / .75	.77
30		
45		
1300		.79
15		
30		
45	.77	.85
1400	.87	
15		
30		
45		
1500		
15		
30		
45		
1600		
15		
30		.85
45		.89
1700	.87	.96
15	.97	.98
30		.99
45		
1800		1807.5 .99 / 1.5
15	1822.5 1.00 1.45 / 1.50	
30		
45		
1900		1.6
15	1.55	1.65
30	1.55	1.75
45	1.57	1.79
2000	1.58	1.80

Time	R-52
1150	0.00
1200	.65
10	.85
20	1215 .85 / .93
30	.94
40	.95
50	
1300	
10	
20	
30	
40	.95
50	1.05
1400	1.08
10	
20	
30	
40	
50	
1500	
10	
20	
30	
40	
50	
1600	
10	
20	
30	
40	
50	
1700	1.08
10	1.30
20	1.32
30	
40	
50	
1800	
10	1.32
20	1.60
30	1825 1.75 / 1.78
40	1.79
50	1.80
1900	
2000	1.88

Flood Reconstitution for Tucson Arcadia Watershed TAR 1

Storm Event 1 Sept 71

Runoff: depth = .41 inches, Q_p = 1430 cfs at t_p = 1.25 hours

$R_{recession}$ = .39 hrs

INPUT (1) Area acres	(2) Eff. Imp. Area %	(3) Rain in.	(4) Comp. Inter. min.	(5) Time-Area	(6)	Results (7) Q_p cfs	(8) t_p hr.	(9) T_c hr.	(10) R hr.	(11) STRTL in.	(12) CNSTL in/hr	(13) Output File	(14) Comment
2240	10.9	1.45	5	D		847	1.25	1.12	.41	.94	.63	Ø1	The peak of the hg. was estimated at 1430 cfs. 980 cfs was recorded peak.
"	"	1.60	"	"		846	1.25	1.12	.41	1.09	.68	Ø2	
"	"	1.45	"	U-1		925	1.33	2.76	.30	.96	.33	Ø3	
"	"	"	"	U-4		1098	1.25	2.07	.18	.97	.36	Ø4	
"	"	"	"	U-5		1172	1.25	1.67	.16	.96	.44	Ø5	
"	"	"	"	U-6		932	1.17	1.38	.23	.95	.57	Ø6	
"	"	"	"	U-7		1265	1.25	1.48	.14	.96	.47	Ø7	
1741	13.9	"	"	"		1231	1.25	1.49	.15	.91	.42	Ø8	← selected

Flood Reconstitution for Tucson Arcadia Watershed TAR 2

Storm Event 23 Aug 82

Runoff: depth = .12 inches, Q_p = 360 cfs at t_p = .92 hours

$R_{recession}$ = .35 hrs

INPUT (1) Area acres	(2) Eff. Imp. Area %	(3) Rain in.	(4) Comp. Inter. min.	(5) Time-Area	(6)	Results (7) Q_p cfs	(8) t_p hr.	(9) T_c hr.	(10) R hr.	(11) STRTL in.	(12) CNSTL in/hr	(13) Output File	(14) Comment
2240	10.9	1.20	5	D		313	.92	.93	.33	1.35	.70	Ø1	
"	"	1.10	"	U-6		324	.92	.96	.29	1.01	.50	Ø2	
"	"	"	"	U-7		357	.92	1.03	.26	1.00	.56	Ø3	
1741	13.9	"	"	"		357	.92	1.04	.25	1.00	.52	Ø4	← best

Flood Reconstitution for Tucson Arcadia Watershed TAR3

Storm Event 11 Sept 82 Part 1

Runoff: depth = .25 inches, Q_p = 461 cfs at t_p = 1.50 hours

$R_{recession}$ = .43 hrs

INPUT (1) Area acres	(2) Eff. Imp. Area %	(3) Rain in.	(4) Comp. Inter. min.	(5) Time-Area	(6)	Results (7) Q_p cfs	(8) t_p hr.	(9) T_c hr.	(10) R hr.	(11) STRTL in.	(12) CNSTL in/hr	(13) Output File	(14) Comment
2240	10.9	1.0	5	D		503	1.5	.33	.60	.88	.30	Ø1	
"	"	"	"	U-6		504	1.5	.30	.64	.87	.36	Ø2	
"	"	"	"	"	changed rainfall dist. ↓	421	1.58	.83	.52	.88	.46	Ø3	
"	"	"	"	U-7		442	1.50	.80	.58	.87	.46	Ø4	
1741	13.9	"	"	"		443	1.50	.80	.58	.83	.44	Ø5	

Flood Reconstitution for Tucson Arcadia Watershed TAR4

Storm Event 11 Sept 82 Part 2

Runoff: depth = .40 inches, Q_p = 867 cfs at t_p = .83 hours

$R_{recession}$ = .54 hrs

INPUT (1) Area acres	(2) Eff. Imp. Area %	(3) Rain in.	(4) Comp. Inter. min.	(5) Time-Area	(6)	Results (7) Q_p cfs	(8) t_p hr.	(9) T_c hr.	(10) R hr.	(11) STRTL in.	(12) CNSTL in/hr	(13) Output File	(14) Comment
2240	10.9	1.30	5	D		795	.83	.67	.62	.72	.34	Ø1	
"	"	"	"	U-6		837	.83	.67	.57	.74	.31	Ø2	
"	"	"	"	U-7		824	.83	.71	.61	.69	.38	Ø3	
"	"	"	"	U-7	changed optimization range	816	.83	.89	.24	.83	.42	Ø4	
1741	13.9	"	"	"	DU, 4, 17	823	.83	.71	.60	.62	.32	Ø5	← selected

Oct 87

Arcadia Watershed

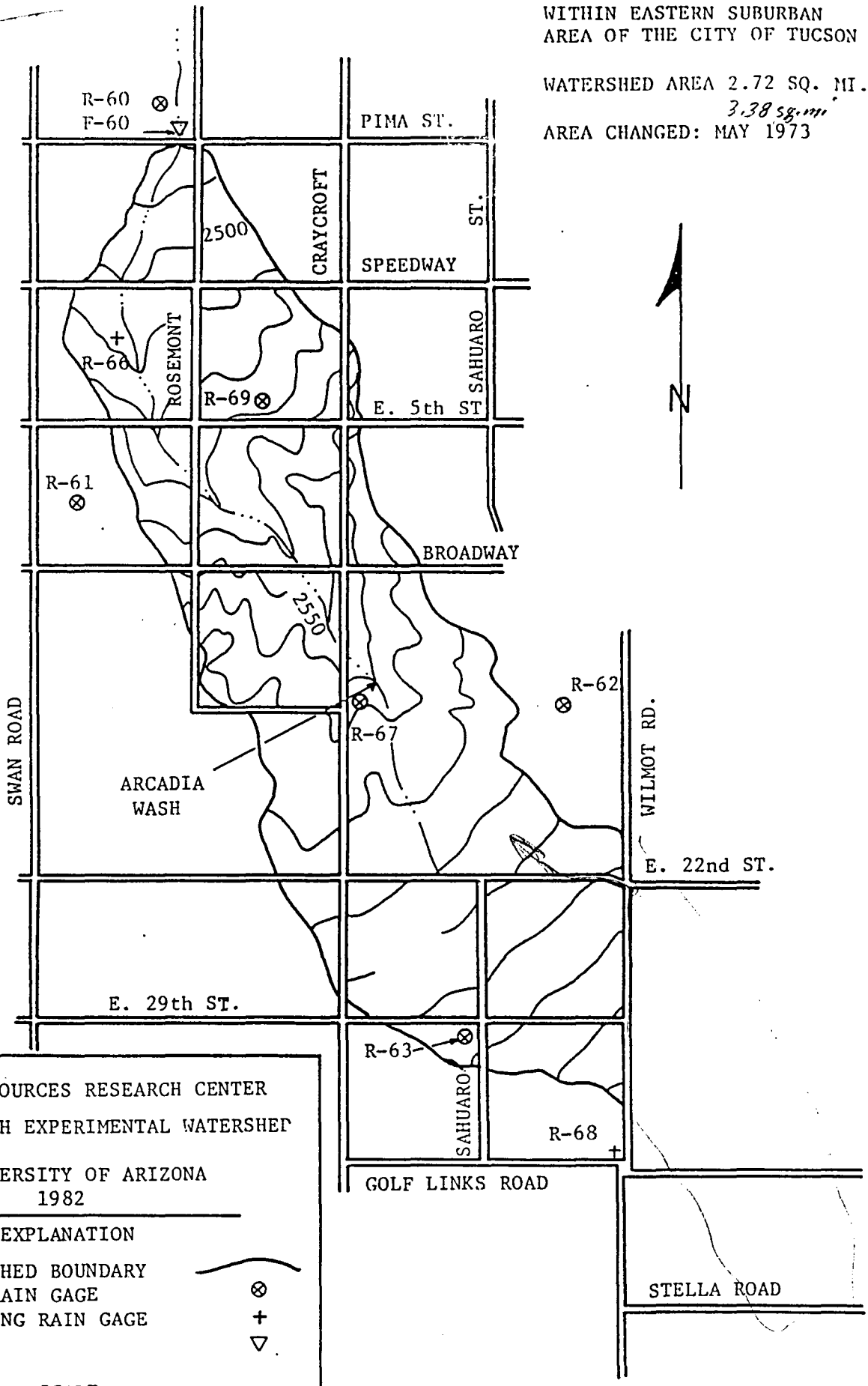
Storm Event	Hydrograph Type	Hydrograph Peak cfs	Raingages (✓ for recorder charts) R-60	R-61	R-62	R-63	R-64 where?	R-65 where?	R-66	R-67A	R-68	R-69	Data Comment	Analyzed
14 Nov 68	S	310		1.20		1.46		.95					*no rainfall charts	
20 July 70	S	195											*no rainfall data	
11 Aug 70	S	592	.65	.85	.85	.25		.30	1.28		0		*no rainfall charts	
3 Aug 71	S	450	1.53 ✓	.86	1.05 ✓	.99 ✓	1.05 ✓	.35	1.10	1.02 ✓	.78	1.49 ✓	tabulated rain & hg	
17 Aug 71	S	1207	1.11 ✓	.68	1.65 ✓	2.12 ✓	1.77 ✓	.35	.62	1.65 ✓	1.25	1.37	tabulated rain & hg	
1 Sept 71	S	979	1.18 ✓	.88	1.60 ✓	1.35 ✓	1.70 ✓	1.25	1.70	1.30 ✓	1.45	1.43 ✓	tabulated rain & hg	Yes
12 Aug 72	S	940	.65 ✓	1.34 ✓	1.85 ✓	1.17 ✓	.84 ✓	.42	1.25	1.60 ✓	.84	1.10 ✓	tabulated hg	
10 Sept 77	S	633	.27 ✓	1.12 ✓	1.11 ✓	1.82 ✓			1.25	.96 ✓	1.35	.75 ✓	TMC .40 tabulated hg	
25 July 78	S	595	.51 ✓	.90 ✓	.55 ✓	.80 ✓			.85	.80 ✓	.97	.80	.40 ✓ tabulated hg	
2 Aug 82	M	521	1.64 ✓	1.42	2.00 ✓	1.38 ✓	.72		1.90	2.17	.58	1.85 ✓	1.67 ✓ tabulated hg	
6 Aug 82	S	525	.38 ✓	.45 ✓	.85 ✓	1.05 ✓	.73		.45	.67 ✓	.98	.52 ✓	.35 ✓ tabulated hg	
23 Aug 82	M	360	.97 ✓	1.05 ✓	1.25 ✓	1.25 ✓	1.13		1.05	1.20 ✓	.89	1.25 ✓	1.07 ✓ tabulated hg	Yes
12-13 Aug 82	M	288	1.85 ✓	1.57 ✓	.70 ✓	.95	.65		2.14	1.19 ✓	.70	1.88 ✓	1.63 ✓ tabulated hg	
10 Sept 82	S	337	.95 ✓	.80 ✓	.72 ✓	.70 ✓	.70		.90	.83 ✓		.89 ✓	1.23 ✓ tabulated hg	
11 Sept 82	M	421 / 866	2.02 ✓	2.09 ✓	2.58 ✓	3.00 ✓	2.42		2.00	2.92 ✓	3.25	2.35 ✓	1.65 ✓ tabulated hg	Yes, both parts

• TMC

NOTE: ENTIRE WATERSHED LIES WITHIN EASTERN SUBURBAN AREA OF THE CITY OF TUCSON

WATERSHED AREA 2.72 SQ. MI.
3.38 sq. mi

AREA CHANGED: MAY 1973



WATER RESOURCES RESEARCH CENTER

ARCADIA WASH EXPERIMENTAL WATERSHED

UNIVERSITY OF ARIZONA
1982

EXPLANATION

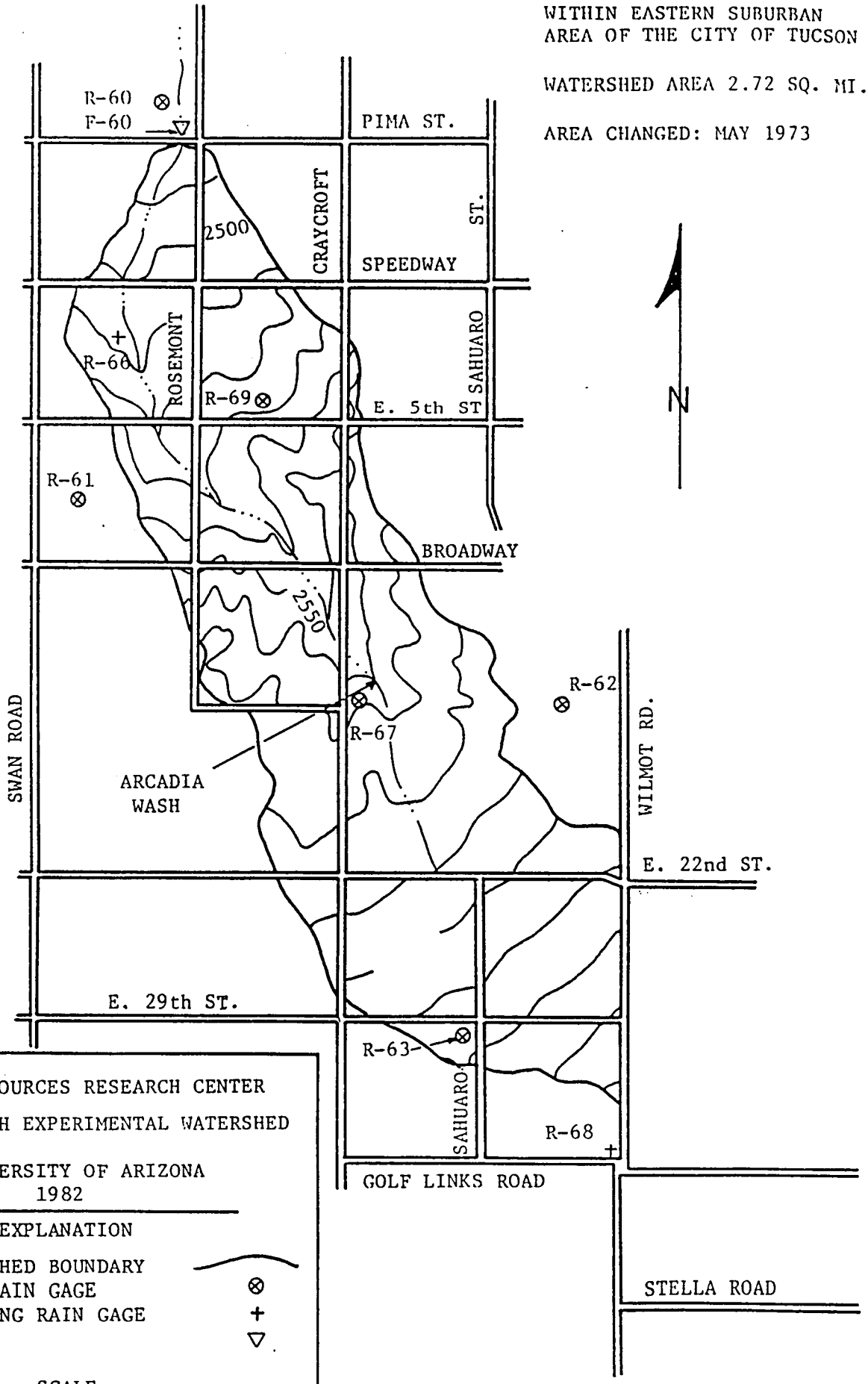
MAIN WATERSHED BOUNDARY
RECORDING RAIN GAGE ⊗
NON-RECORDING RAIN GAGE +
FLUME ▽

SCALE
0 1/2 1
MILES

NOTE: ENTIRE WATERSHED LIES WITHIN EASTERN SUBURBAN AREA OF THE CITY OF TUCSON

WATERSHED AREA 2.72 SQ. MI.

AREA CHANGED: MAY 1973



WATER RESOURCES RESEARCH CENTER

ARCADIA WASH EXPERIMENTAL WATERSHED

UNIVERSITY OF ARIZONA
1982

EXPLANATION

MAIN WATERSHED BOUNDARY
RECORDING RAIN GAGE ⊗
NON-RECORDING RAIN GAGE +
FLUME ▽

SCALE
0 1/2 1
MILES

1 Oct 87

Analysis of Effective Impervious Area
Arcadia Watershed

Storm Date	Rainfall Avg. inches	Rainfall Max. inches	Runoff Volume ac-ft	Runoff Q_p cfs	Runoff % of rainfall	A_e acres	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	
3 Dec 69	.287	.35	11.648	93	24.4	487	
1 Mar 70	.458	.56	8.419	78	11.1	221	
2 Mar 70	.502	.55	8.643	124	10.4	207	
17 Oct 71	1.025	1.25	20.607	82	12.0	241	
16 Nov 71	.457	.48	8.070	44	10.5	212	
4 Dec 71	.742	.80	20.499	130	16.6	332	
30 May 72	.517	.58	9.092	53	10.4	211	
9 Sept 72	.443	.58	7.789	105	10.6	211	
3 Oct 72	.569	.60	6.949	36	7.4	147	
18 Oct 72	.335	.36	6.944	72	12.2	249	
[illegible] Oct 72	.577	.65	26.835	250	27.9	558	× high intensity
17 Nov 72	.741	.80	15.925	52	12.8	258	
21 Feb 73	1.218	1.58	26.475	54	13.0	261	
14 Mar 73	.575	.64	15.896	74	16.5	332	
29 Oct 74	.852	.93	17.760	104	14.3	250	
9 Nov 74	.686	.72	18.67	91	18.8	327	
31 Dec 76	1.158	1.25	12.367	37	7.3	128	
26-27 Mar 77	.752	.87	1.640	14	1.5	26	× very low ?
6-8 Oct 77	1.572	1.75	5.730	30	2.5	44	× intensity ?
25-29 Dec 77	1.221	1.35	19.150	191	10.8	188	
10 Jan 78	.623	.70	12.270	84	13.6	236	
15-16 Jan 78	.978	1.18	21.280	71	15.0	261	
17 Jan 78	.471	.56	4.630	32	6.8	118	
11-12 Feb 78	1.076	1.25	19.270	46	12.4	215	
27 Feb-2 Mar 78	.941	1.24	5.120	40	3.7	65	× very low ?
10-12 Mar 78	.550	.66	4.240	47	5.3	93	× intensity ?
22-25 Nov 78	1.412	1.60	19.980	50	9.8	170	
[illegible]8 Dec 78	1.513	1.75	25.240	66	11.5	200	
29-31 Dec 78	1.533	1.73	16.92	36	7.6	132	

continued - Arcadia Watershed

1 Oct 87

(1)	(2)	(3)	(4)	(5)	(6)	(7)	
5-7 Jan 79	.783	.91	8,310	22	7.3	127	
16-17 Jan 79	.994	1.25	16,920	70	11.8	204	
28-29 Jan 79	.509	.60	2,370	9	3.1	56	× very low
4-5 Feb 79	.399	.50	1,660	9	3.8	50	× intensity
20-21 Mar 79	.452	.57	4,280	21	6.4	114	
18-21 Jan 80	.672	.76	3,403	19	3.4	61	× low intensity
8 Feb 80	.770	.85	22,27	89	20.0	347	
13-17 Feb 80	1.934	2.09	64,506	79	23.0	400	
10-11 Mar 80	.376	.44	5,526	11	10.1	176	
19 Mar 80	.248	.30	4,459	10	12.5	216	
26-27 Mar 80	.737	.80	16,613	33	13.6	271	
25-26 Sept 80	.824	1.04	11,750	49	9.8	171	
16 Oct 80	.417	.50	4,220	26	7.0	121	
11 Jan 81	.539	.64	41,045	69	53.3	913	?
8 Feb 81	1.103	1.25	146.97	205	92.0	1,600	?
1 Mar 81	1.170	1.30	16,174	56	9.6	166	
5 Mar 81	.578	.62	24,025	64	28.7	499	
30 Apr 81	.259	.32	5,889	75	15.8	273	
28-29 Nov 81	.883	1.10	15.42	77	12.0	210	
21 Jan 82	.414	.52	8,017	51	11.8	232	
29 Jan 82	.370	.45	3,608	40	6.0	117	
12-13 Mar 82	.920	1.05	23,111	142	17.3	301	
8-9 Nov 82	.360	.40	13,458	29	25.8	449	
16-17 Nov 82	.260	.34	3,386	19	8.8	156	
30 Nov - 2 Dec 82	.930	1.00	10,305	157	7.6	133	
9-10 Dec 82	.810	1.00	9,415	25	8.0	139	
23 Dec 82	.180	.23	3,384	28	12.8	226	
30-31 Dec 82	.160	.19	3,587	5	21.2	269	
29-30 Jan 83	1.50	1.65	51,652	131	23.7	413	× high
3-6 Feb 83	1.45	1.60	52,802	116	25.1	437	× intensity
3-4 Mar 83	1.00	1.25	43,798	110	30.2	525	×
18-19 Mar 83	.59	.75	24,614	63	29.0	501	
21 Mar 83	.131	.40	11,867	56	26.4	459	
3-4 Nov 83	.71	.78	27,796	105	27.0	470	× high
21 Nov 83	.86	1.02	35,084	110	28.1	490	× intensity

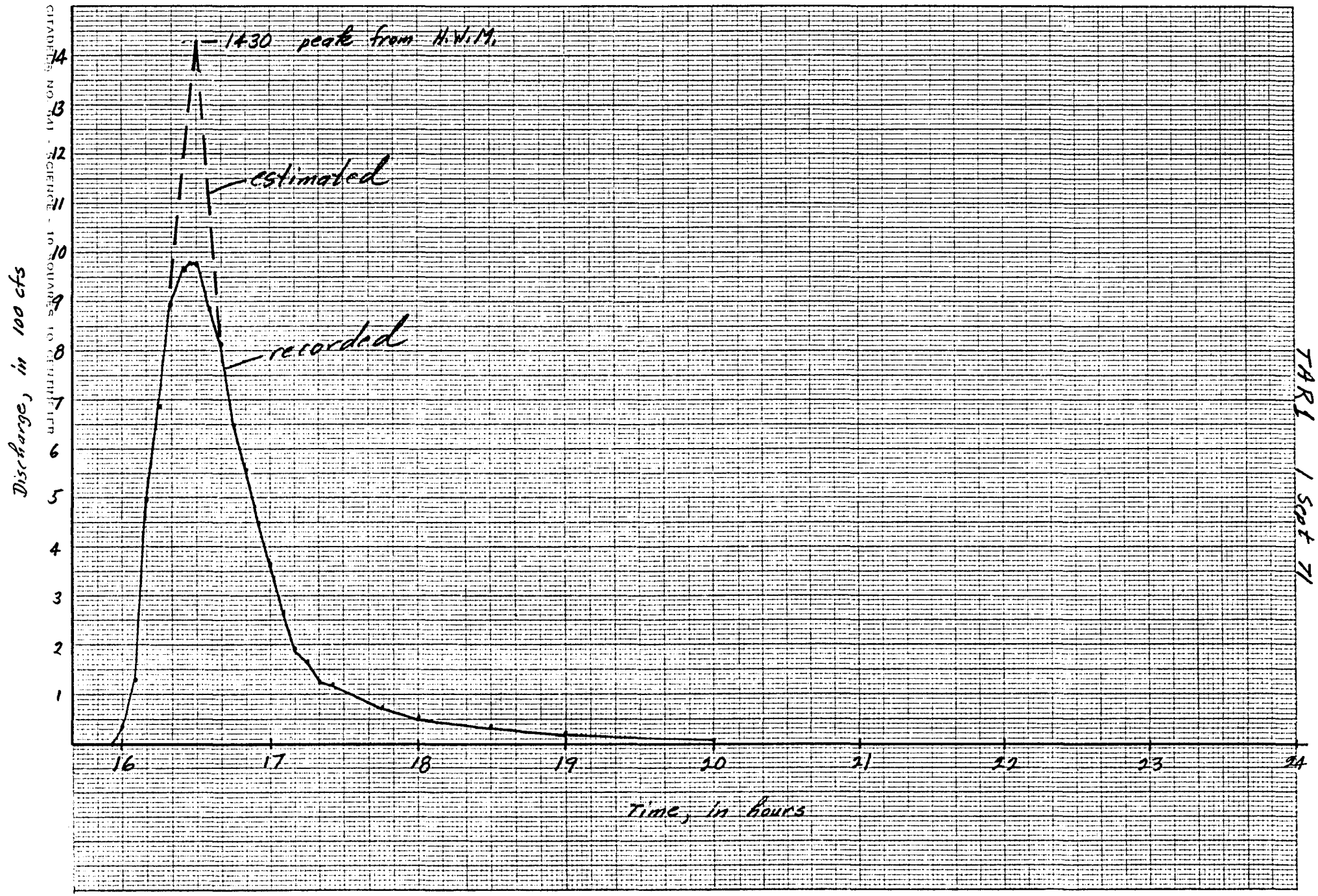
A = 2.72 mi

# of events = 49

mean = 242 acres = .38 mi²

13.9 %

~~10.8%~~



TARS 1 Sept 71

1 Oct 87

TAR 1 1 Oct 87

1 Sept 71

Flood Hydrograph

Time	Q		
1555	0		
1600	36		
5	132		
10	498		
15	688		
20	895		
25	~~963~~	1200	corrected values
30	~~977~~	1430	
35	~~956~~	1100	
40	886		
45	812		
50	647		
55	555		
1700	448		
5	361		
10	263		
15	194		
20	168		
25	132		
30	121		
35	106		
40	93		
45	76		
50	72		
55	64		
1800	58		
5	52		
10	49		
15	45		
20	42		
25	38		
30	33		
35	32		
40	29		
45	26		
50	25		
55	24		
1900	22		

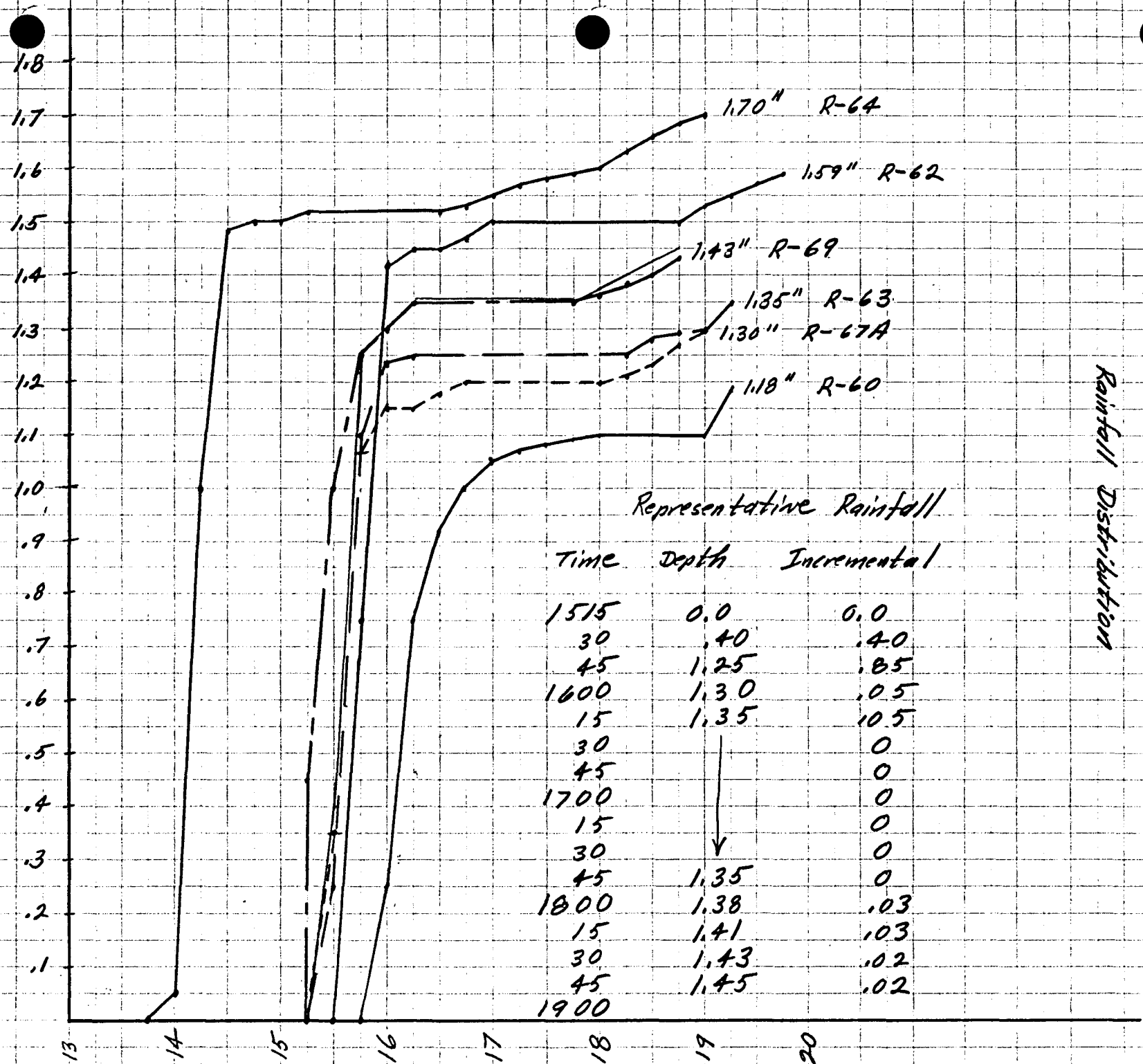
TAR 1 1 Oct 87

1 Sept 71

Rainfall

Time	R-60	R-62	R-63	R-67A	R-69
1500	0	0	0	0	0
15	0	0	0	0	.45
30	0	0	.25	.35	1.00
45	0	.75	1.10	1.07	1.25
1600	.25	1.42	1.23	1.15	1.30
15	.75	1.45	1.25	1.15	1.35
30	.92	1.45	↓	1.18	↓
45	1.00	1.47	↓	1.20	↓
1700	1.05	1.50	↓	↓	↓
15	1.07	↓	↓	↓	↓
30	1.08	↓	↓	↓	↓
45	1.09	↓	↓	↓	1.35
1800	1.10	↓	↓	1.20	1.36
15	↓	↓	1.25	1.21	1.38
30	↓	↓	1.28	1.23	1.40
45	↓	1.50	1.29	1.27	1.43
1900	1.10	1.53	1.30	1.30	
15	1.18	1.55	1.35		
30		1.57			
45		1.59			
2000					

	R-64
1345	0
1400	.05
15	1.00
30	1.48
45	1.50
1500	1.50
15	1.52
30	↓
45	↓
1600	↓
15	↓
30	1.52
45	1.53
1700	1.55
15	1.57
30	1.58
45	1.59
1800	1.60
15	1.63
30	1.66
45	1.68
1900	1.70



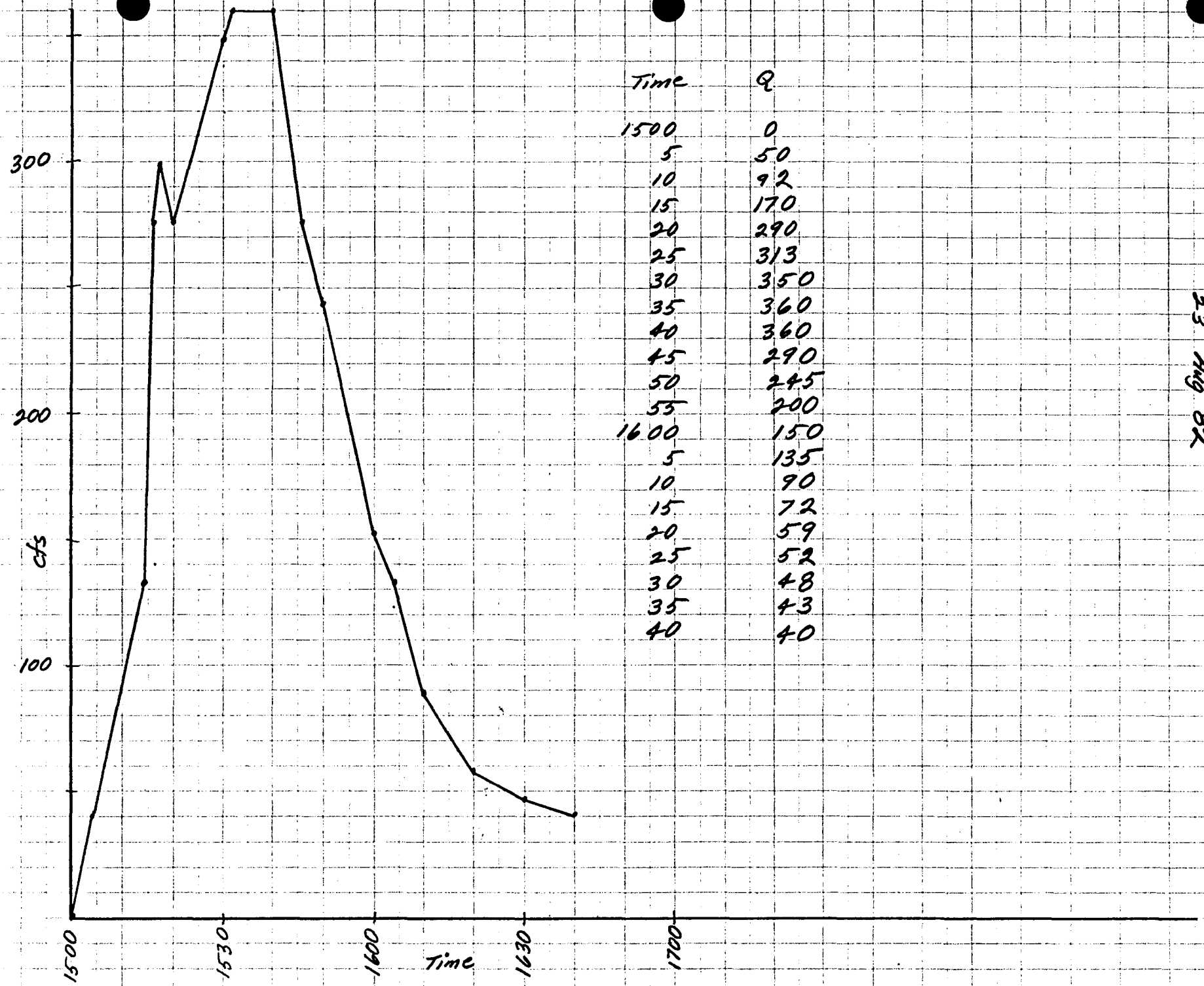
Representative Rainfall

Time	Depth	Incremental
1515	0.0	0.0
30	.40	.40
45	1.25	.85
1600	1.30	.05
15	1.35	.05
30	↓	0
45		0
1700		0
15		0
30		0
45	1.35	0
1800	1.38	.03
15	1.41	.03
30	1.43	.02
45	1.45	.02
1900		

TAR I 1 Sept 71

Rainfall Distribution

1 Oct 87



Time	Q
1500	0
5	50
10	92
15	170
20	290
25	313
30	350
35	360
40	360
45	290
50	245
55	200
1600	150
5	135
10	90
15	72
20	59
25	52
30	48
35	43
40	40

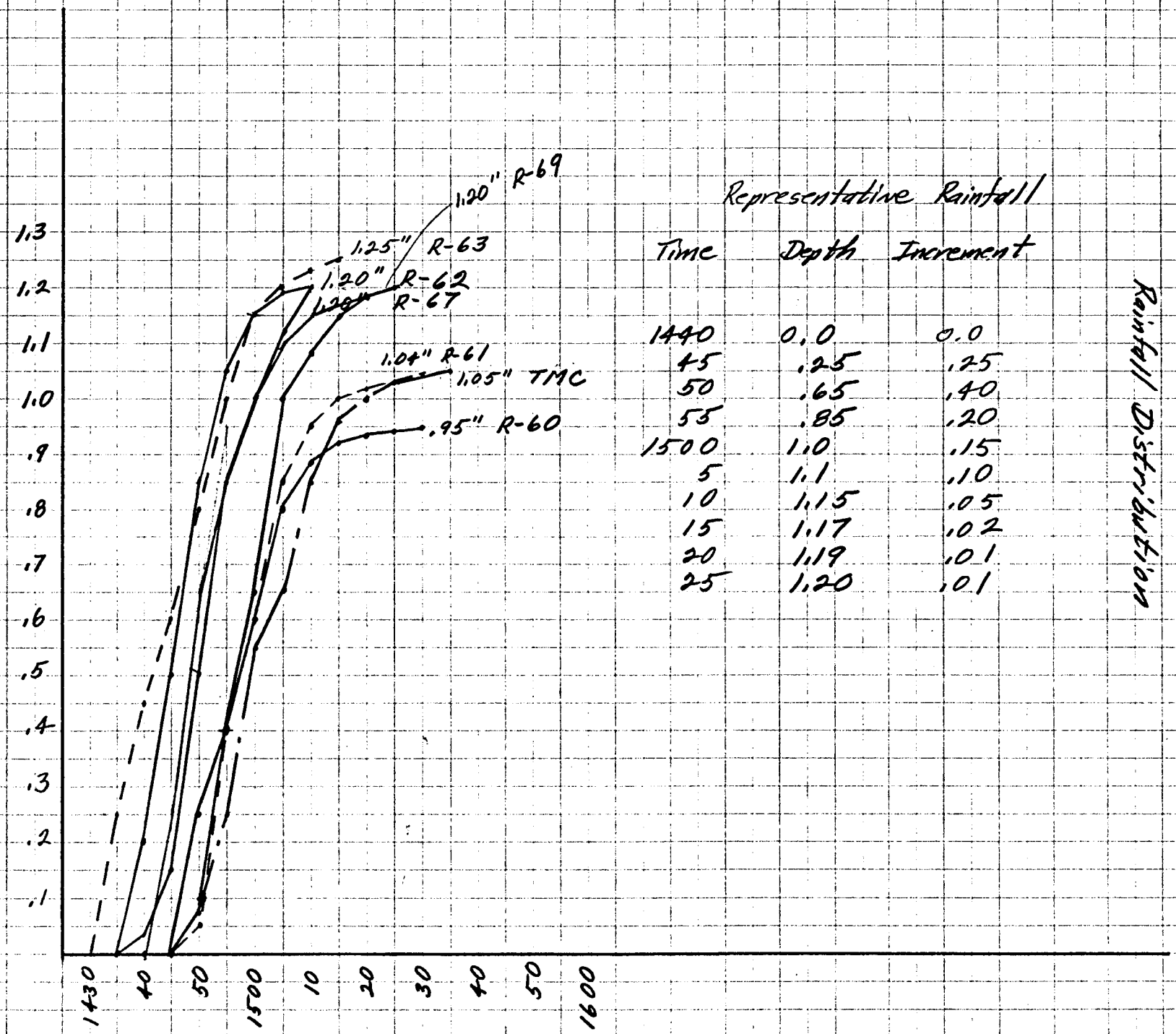
TAR 2
23 Aug 87

2 Oct 87

Time	R-60	R-61	R-62	R-63	R-67	R-69	TMC	Avg.
1425								
30				0.0				0.0
35			0.0	.25	0.0			.04
40			.2	.45	.03			.10
45	0.0	0.0	.5	.6	.15	0.0		.18
50	.25	.05	.85	.8	.5	.1	0.0	.36
55	.4	.40	1.05	1.0	.85	.4	.07	.60
1500	.6	.60	1.15	1.15	1.0	.65	.25	.77
5	.8	.85	1.19	1.20	1.12	1.0	.55	.96
10	.88	.95	1.20	1.23	1.2	1.08	.65	1.03
15	.92	1.0		1.25		1.15	.85	
20	.93	1.02				1.18	.96	
25	.94	1.03				1.2	1.0	
30	.95	1.04					1.03	
35							1.04	
40							1.05	
45								
50								
55								
1600								

THR 2

2 Oct 87



Representative Rainfall

Time	Depth	Increment
1440	0.0	0.0
45	.25	.25
50	.65	.40
55	.85	.20
1500	1.0	.15
5	1.1	.10
10	1.15	.05
15	1.17	.02
20	1.19	.01
25	1.20	.01

Rainfall Distribution

THR 2
23 Aug 82

2 Oct 87

Hydrograph

2 oct 87

TAR3 — 11 Sept 82

Time	Q
1120	0
30	18
40	28
50	33
1200	40
10	132
20	330
30	461
40	381
50	277
1300	270
10	260
20	84
30	59
40	132
50	110
1400	104
10	88
20	78
30	66
40	55
50	47
1500	44
10	40
20	40
30	36
40	33
50	30
1600	27
10	26
20	26
30	25
40	29
50	26
1700	32
10	35
20	33
30	31
40	31
50	31

TAR4

Time	Q	Adjusted
1800	38	0
10	39	0
20	68	40
30	132	110
40	753	740
50	867	
1900	730	
10	498	
20	369	
30	317	
40	294	
50	303	
2000	266	
10	198	
20	145	
30	110	
40	90	
50	69	
2100	52	
10	42	
20	40	
30	30	
40	27	
50	23	
2200	18	
10	14	
20	9	
30	2	
40	0	
50		
2300		

TAR3 & TAR4 2 Oct 87

Time	R-60		R-62		R-63		
					.67	0.0	
1100	0.0		0.0		.75	.08	
15	.18		.07		.85	.18	
30	.19		.1		↓	↓	
45	.25		↓		.85	.18	Part 1
1200	.85		.1		1.2	.53	
15	.95		.2		2.0	1.33	
30	↓		.53		2.04	1.37	
45			.6		2.12	1.45	
1300			.62		2.13	1.46	
15			↓		↓	↓	
30	.95		.62				
45	1.0		.64				
1400	↓		↓		↓	↓	
15							
30							
45							
1500							
15							
30							
45							
1600							
15	1.0	0.0					
30	1.05	.05	↓		2.13	1.46	0.0
45	1.15	.15	.64	0.0	2.28	1.61	.15
1700	1.25	.25	.72	.08	2.33	1.66	.21
15	↓	↓	.74	.10	↓	↓	↓ Part 2
30	↓	↓	.75	.11	↓	↓	↓
45	1.25	.25	↓	↓	2.33	1.66	.21
1800	1.50	.50	.75	.11	2.55	1.88	.42
15	1.77	.77	1.6	.96	3.20	2.53	1.07
30	↓	↓	2.16	1.52	3.27	2.60	1.14
45	1.77	.77	↓	↓	3.27	2.60	1.14
1900	1.90	.90	2.16	1.52	3.40	2.73	1.27
15	1.95	.95	2.35	1.71	3.55	2.88	1.42
30	2.0	1.0	2.5	1.86	3.60	3.03	1.57
45	2.02	1.02	2.55	1.91	3.65	3.08	1.62
2000			2.6	1.96			

Part 1

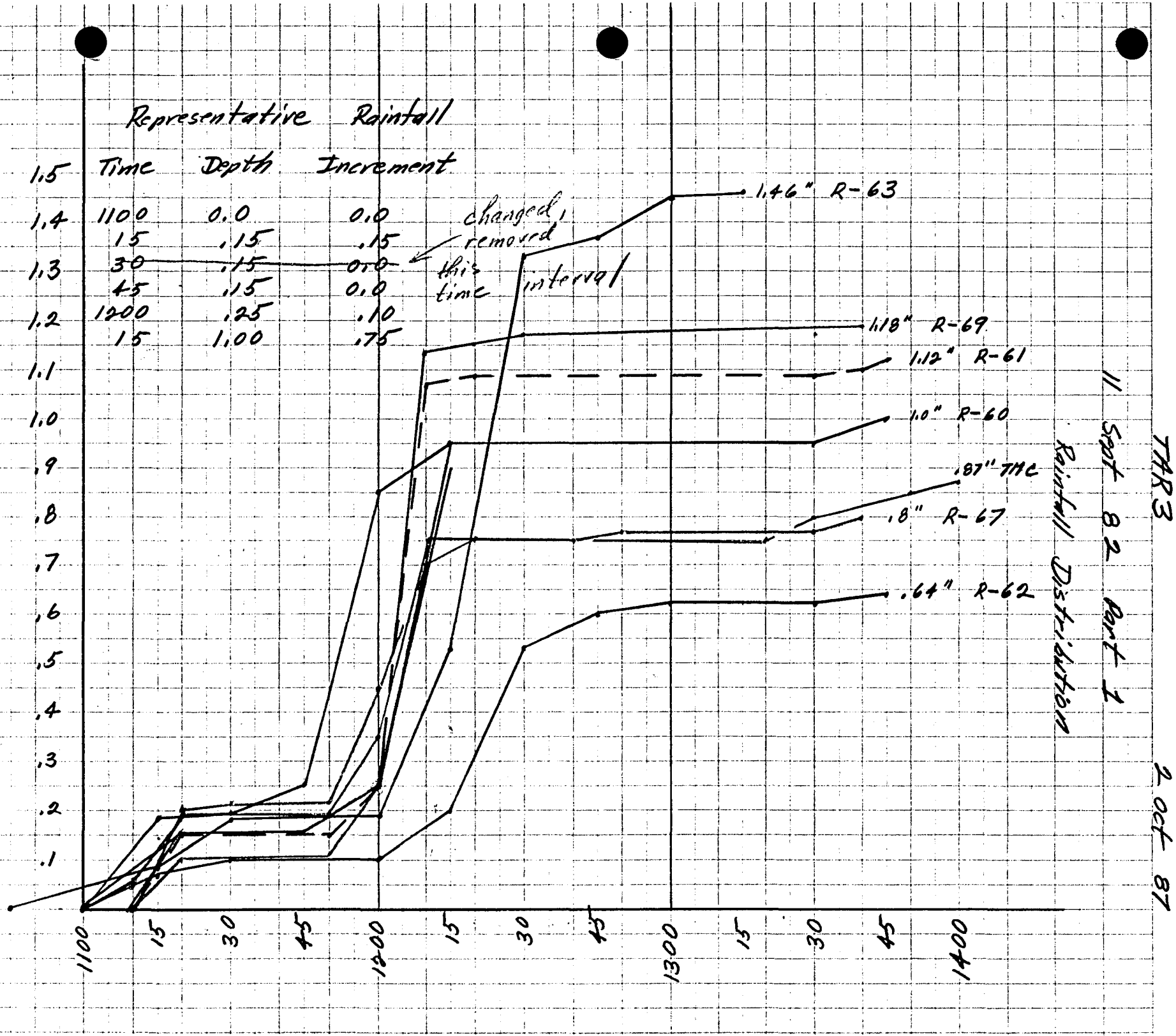
TAR 3 & TAR 4 2 oct 87

Time	R-61	R-67	R-69	TMC
1100		0.0		
10	0.0	.05	0.0	0.0
20	.15	.19	.10	.2
30	↓	↓	↓	.22
40				↓
50	.15	.19	.10	.22
1200	.25	.35	.25	.45
10	1.07	.75	1.13	.70
20	1.08	↓	1.15	.75
30	↓		1.17	↓
40		.75	↓	
50		.77		
1300		↓		
10				
20				.75
30	1.08	.77	1.17	.80
40	1.10	.80	1.18	.80
50	1.12			.85
1400				.87
10				
20				
30				
40				
50				
1500				
10				
20				
30				
40				
50				
1600				

Part 2

TAR3 & TAR 4 — 2 Oct 87

Time	R-61		R-67		R-69		TMC	
1600								
10								
20								
30	1.12	0.0						
40	1.15	.03			1.18	0.0		
50	1.15	.03	.80	0.0	1.20	.02	.87	0.0
1700	1.19	.07	.86	.06	1.24	.06	.94	.07
10	1.21	.09	.88	.08	1.27	.09	1.05	.18
20	1.22	.10	↓	↓	↓	↓	↓	↓
30	1.22	↓	.88	.08				
40	1.22	.10	.89	.09				
50	1.23	.11	↓	↓	1.27	.09		
1800	1.24	.12	.89	.09	1.29	.11	1.05	.18
10	1.25	.13	1.55	.75	1.30	.12	1.06	.19
20	1.40	.28	2.05	1.25	1.46	.28	1.45	.58
30	1.67	.55	2.33	1.53	1.71	.53	1.51	.64
40	↓	↓	2.34	1.54	1.73	.55	1.52	.65
50			2.35	1.55	1.74	.56	1.52	.65
1900			2.35	1.55	1.75	.57	1.53	.66
10	1.67	.55	2.65	1.85	2.00	.82	1.58	.71
20	1.92	.80	2.70	1.95	2.05	.87	1.62	.75
30	1.96	.84	2.85	2.05	2.14	.96	1.64	.77
40	2.13	1.01	2.90	2.10	2.29	1.11	1.65	.78
50	2.15	1.03	2.90	2.10	2.30	1.12		
2000			2.95	2.15				

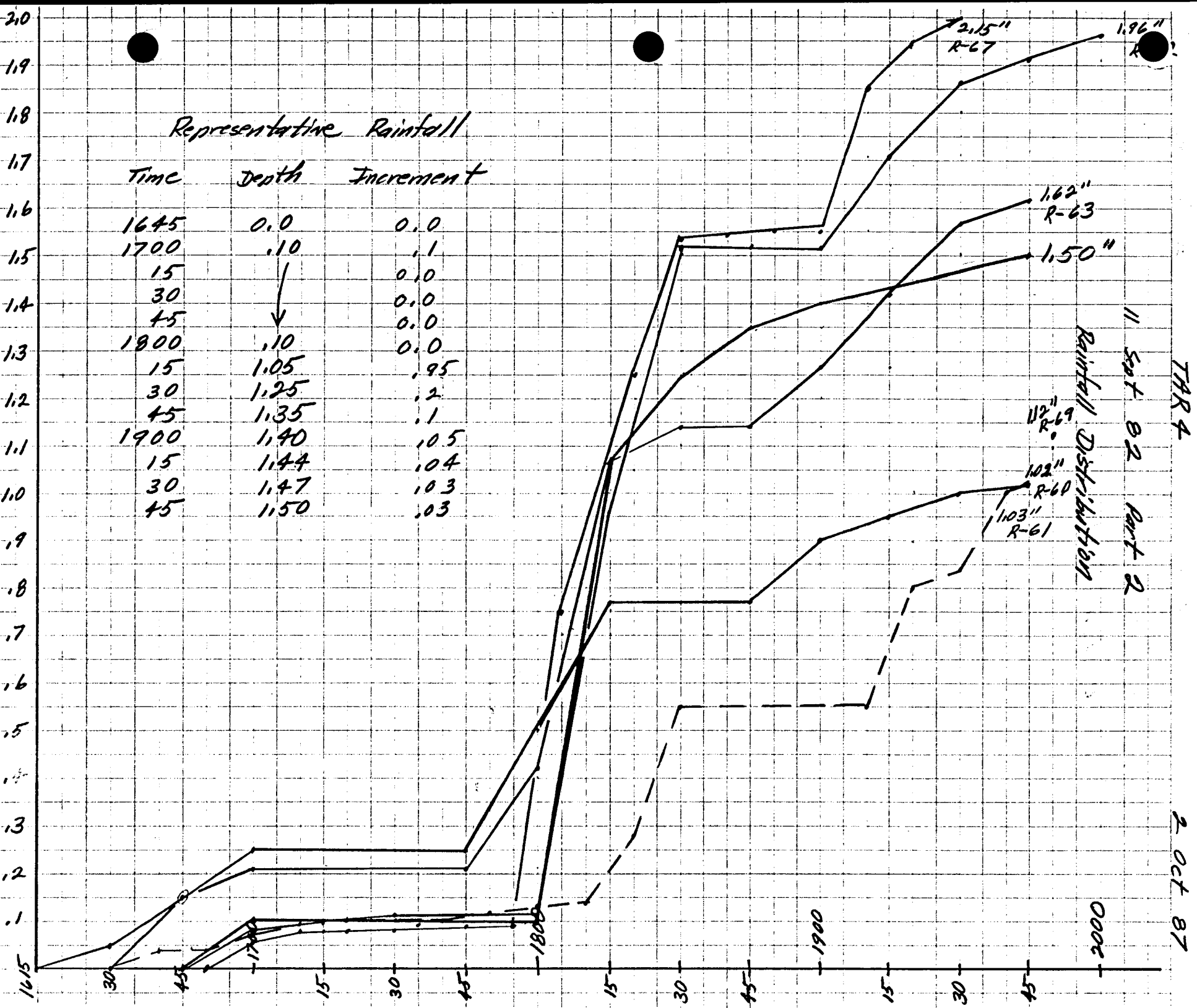


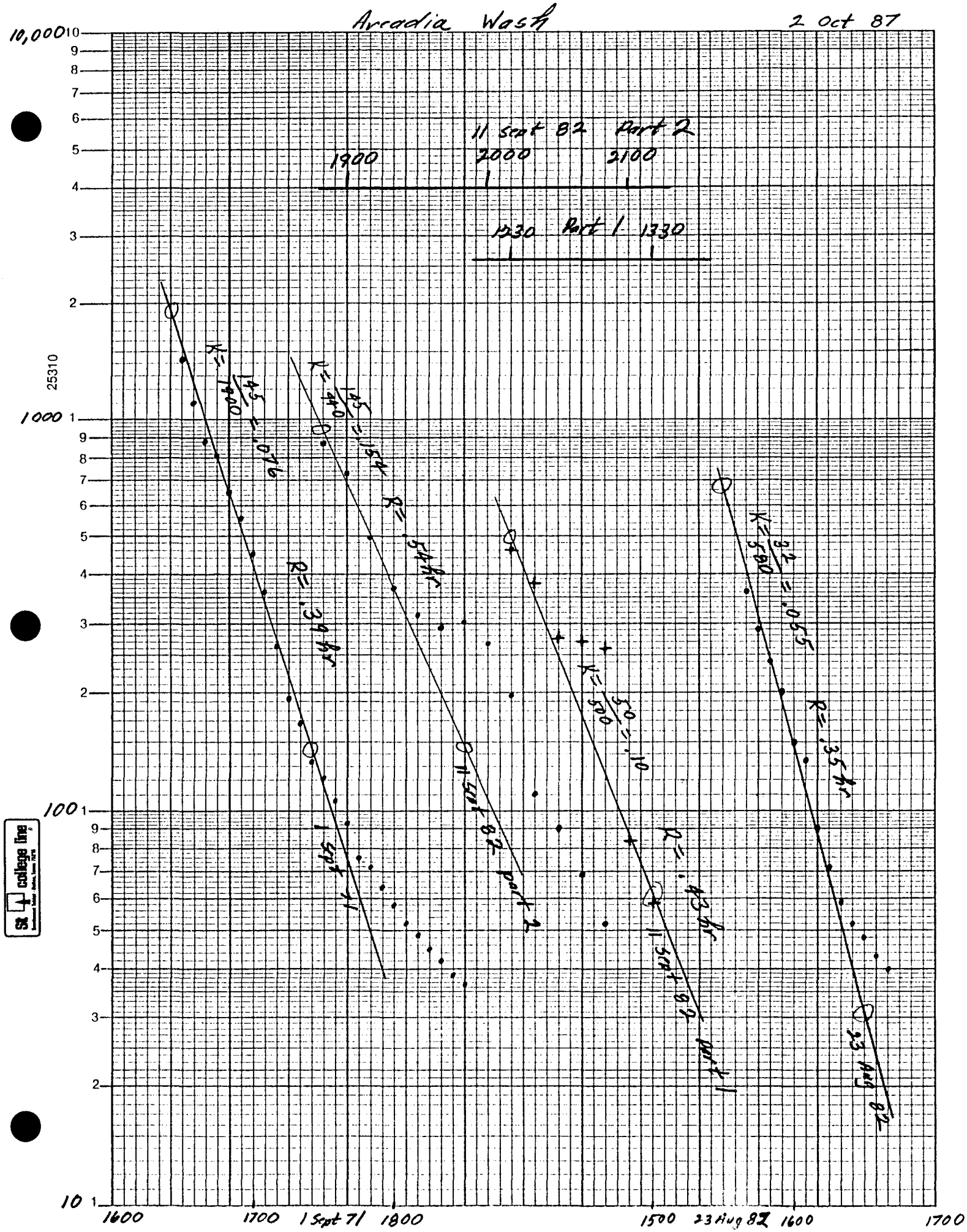
Rainfall Distribution

11 Sept 82 Part I

THR3

2 Oct 87


Representative Rainfall
Time Depth Increment
1645 0.0 0.0
1700 .10 .1
15 0.0
30 0.0
45 0.0
1800 .10 0.0
15 1.05 .95
30 1.25 .2
45 1.35 .1
1900 1.40 .05
15 1.44 .04
30 1.47 .03
45 1.50 .03
2.15" R-67
1.96"
1.62" R-63
1.50"
1.12" R-69
1.02" R-60
1.03" R-61
Rainfall Distribution
THR 4
11 Sept 82 Part 2
2 Oct 87
2.0
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1.0
.9
.8
.7
.6
.5
.3
.2
.1
1615
30
45
1700
15
30
45
1800
15
30
45
1900
15
30
45
2000


Arcadia Wash
2 Oct 87
11 Sept 82 Part 2
1900
2000
2100
1230 Part 1 1330
K = 1/1000 = .076
R = .39 hr
1 Sept 71
K = 1/640 = .154
R = .54 hr
11 Sept 82 part 2
K = 1/500 = .10
R = .43 hr
11 Sept 82 part 1
K = 1/560 = .055
R = .35 hr
23 Aug 82
10,000
1000
100
10
1600
1700
1 Sept 71
1800
1500
23 Aug 82
1600
1700
25310
Semi-Logarithmic 3 Cycles x 10 To The Inch

Flood Reconstitution for Tucson Railroad Watershed TRR1

Storm Event 11-12 Sept 82

Runoff: depth = .41 inches, Q_p = 515 cfs at t_p = 2.00 hours

$R_{recession}$ = .43 hrs

INPUT (1) Area acres	(2) Eff. Imp. Area %	(3) Rain in.	(4) Comp. Inter. min.	(5) Time-Area	(6)	Results (7) Q_p cfs	(8) t_p hr.	(9) T_c hr.	(10) R hr.	(11) STRTL in.	(12) CNSTL in/hr	(13) Output File	(14) Comment
1472	17.0	.75	5	D		489	2.08	1.19	.57	.28	0.0	Ø1	.6" antecedent rainfall
"	"	"	"	U-5		504	1.92	1.46	.51	.24	.05	Ø7	← best
"	"	"	"	U-3		479	1.92	2.08	.62	.19	.01	Ø8	

Flood Reconstitution for Tucson Railroad Watershed TRR 2

Storm Event 2 Aug 82

Runoff: depth = .30 inches, Q_p = 350 cfs at t_p = 2.50 hours

$R_{recession}$ = .61 hrs

INPUT (1) Area acres	(2) Eff. Imp. Area %	(3) Rain in.	(4) Comp. Inter. min.	(5) Time-Area	(6)	Results (7) Q_p cfs	(8) t_p hr.	(9) T_c hr.	(10) R hr.	(11) STRTL in.	(12) CNSTL in/hr	(13) Output File	(14) Comment
1472	17.0	.95	10	D		305	2.67	1.40	.16	.63	.42	Ø1	
"	"	"	"	U-1		284	2.50	1.89	.53	.63	.40	Ø2	
"	"	"	"	U-3		293	2.50	1.33	.49	.61	.44	Ø3	
"	"	"	"	U-5		341	2.50	1.07	.48	.57	.52	Ø4	← best

Oct 87

Railroad Watershed

Storm Event	Hydrograph Type	Peak cfs	R-70	R-71	R-72 where	R-73	R-74	R-75 where	R-76	Data Comment	Analyzed
			Raingages (✓ for recorder charts)								
20 July 70	S	641	1.03	1.00	1.45	1.70				tabulated hg, *no rainfall charts	
19 Aug 71	S	557								tabulated hg, *no rainfall	
12 Aug 72	S	1277	✓ 1.65	✓ 1.60	✓ 1.24	✓ 1.12	1.50	1.28	1.85	tabulated hg } *need clearer rainfall charts	
19 Oct 72	M, F	235	✓ .56	✓ .56	✓ .53	✓ .53				tabulated hg } *need clearer rainfall charts	
	S	245	1.01	1.05	1.06	1.10				(S) } *need clearer rainfall charts	
2 Aug 82	S	349	✓ .79	✓ 1.12		✓ 1.00	1.21	1.20	.86	tabulated hg, rainfall charts	yes
11 Sept 82	M	574	✓ 1.69	✓ 1.13		✓ 1.30	1.27	1.30	1.25	tabulated hg, rainfall charts	yes

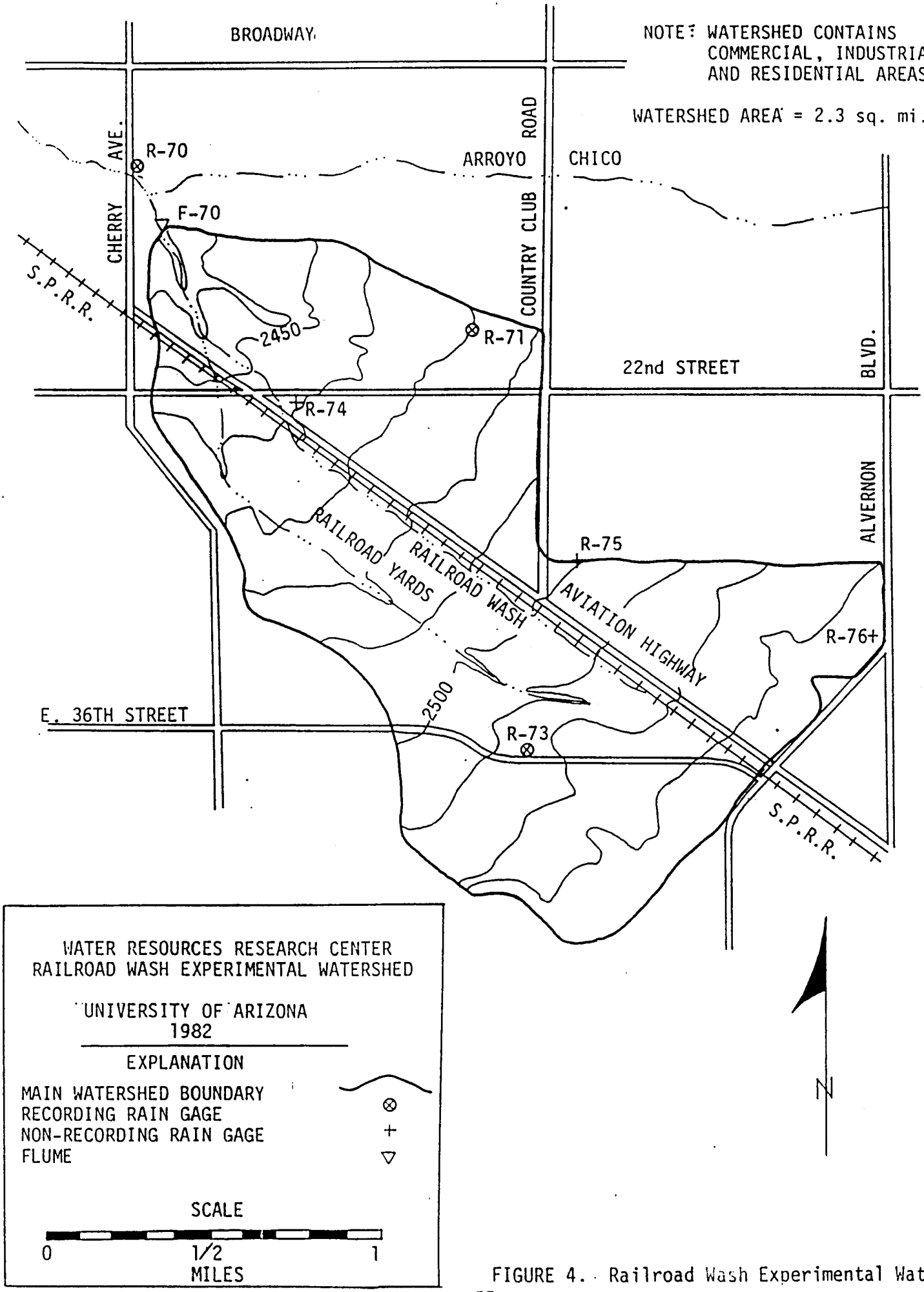
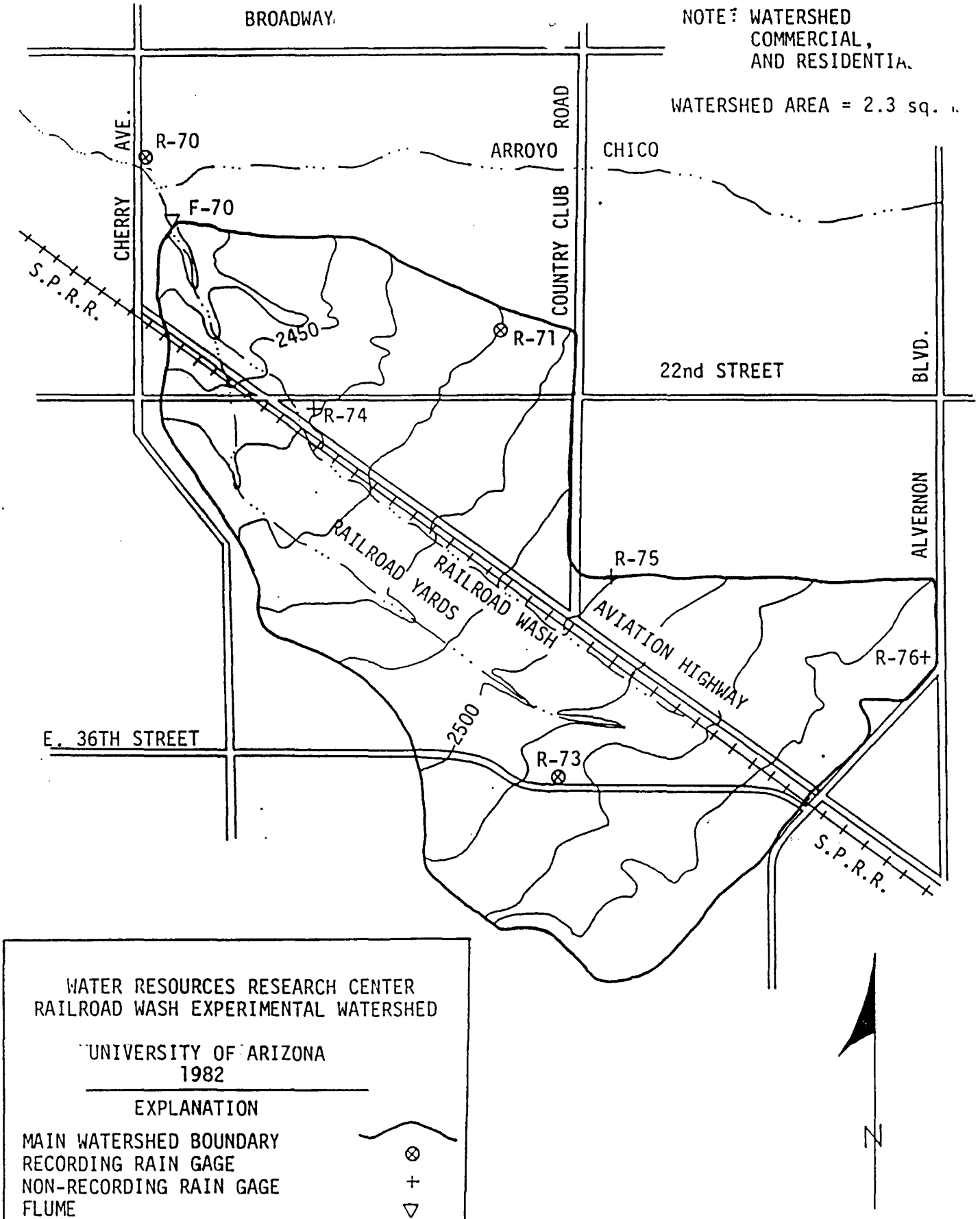


FIGURE 4. Railroad Wash Experimental Watershed



WATER RESOURCES RESEARCH CENTER
RAILROAD WASH EXPERIMENTAL WATERSHED

UNIVERSITY OF ARIZONA
1982

EXPLANATION

MAIN WATERSHED BOUNDARY
RECORDING RAIN GAGE ⊗
NON-RECORDING RAIN GAGE +
FLUME ▽

SCALE

0 1/2 1
MILES

FIGURE 4. Railroad Wash Experimental Watershe

Oct → Mar
$Q_p < 100$ cfs

10 Oct 87

Analysis of Effective Impervious Area
Railroad Wash

Storm Date (1)	Rainfall Avg. inches (2)	Rainfall Max. inches (3)	Runoff Volume ac-ft (4)	Runoff Q_p cfs (5)	Runoff % of rainfall (6)	A_e acres (7)	
22 July 70	.267	.30	4,053	44.1	12.4	182.2	X
1 Aug 70	.348	.39	5,168	39.0	12.1	178.2	X
6 Sept 70	.517	.56	8,208	38.3	15.7	190.5	X
17 Feb 71	.280	.32	.902	9.9	2.5	38.7	X
15 April 71	.363	.38	1,733	19.3	3.9	57.3	X
30 July 71	.382	.49	7,691	67.9	16.5	241.6	X
18 Aug 71	.177	.20	6,323	40.4	29.4	428.7	X
15-16 Nov 71	.828	.87	30,907	75.5	28.1	447.9	high intensit
4 Dec 71	.644	.73	24,016	108.3	30.4	447.5	
7-8 Dec 71	.800	.94	14,006	18.8	14.2	210.1	
13 Dec 71	.338	.38	9,029	24.2	21.9	320.6	
16-17 July 72	.413	.54	16,97	64.2	33.5	493.1	X
8 Aug 72	.135	.15	1,915	10.1	11.8	170.2	X
18 Sept 72	.329	.40	16.66	116.7	41.3	607.7	X
3 Oct 72	.507	.50	18.87	48.0	30.4	446.6	
4 Oct 72	.280	.33	17.03	38.3	49.6	729.9	
5 Oct 72	.400	.43	30.99	92.3	63.3	929.7	
18 Oct 72	.276	.35	19.36	75.6	57.2	841.7	X
28 Dec 72	.249	.25	19.60	54.6	64.3	944.58	
9 Mar 73	.332	.35	8,917	58.0	22.0	322.3	
12 Mar 73	.472	.50	2.03	4.9	.42 ← ?	51.6	X
14 Mar 73	.570	.63	17,295	70.8	24.7	364.1	
22 Mar 73	.165	.18	.618	22.5	3.0	45.0	X
8 Jan 74	.150	.18	13,616	41.2	74.0 ?	1089.3	X
9 Jan 74	.275	.40	6,376	42.6	18.9	278.2	
9 Mar 74	.323	.36	26.050	30.2	67.2	976.8	
11 Oct 74	.270	.33	26.476	79.6	80.0 ?	1176.6	X
31 Dec 76	.818	.92	28.18	26.3	28.12	413.4	
29-30 Jan 77	.480	.54	17.40	26.3	29.6	435.0	
5-26 Mar 77	.657	.72	4.40	18.3	5.5	80.4	
9 Oct 77	.430	.60	13.72	127.3	26.05	382.9	

Railroad – continued

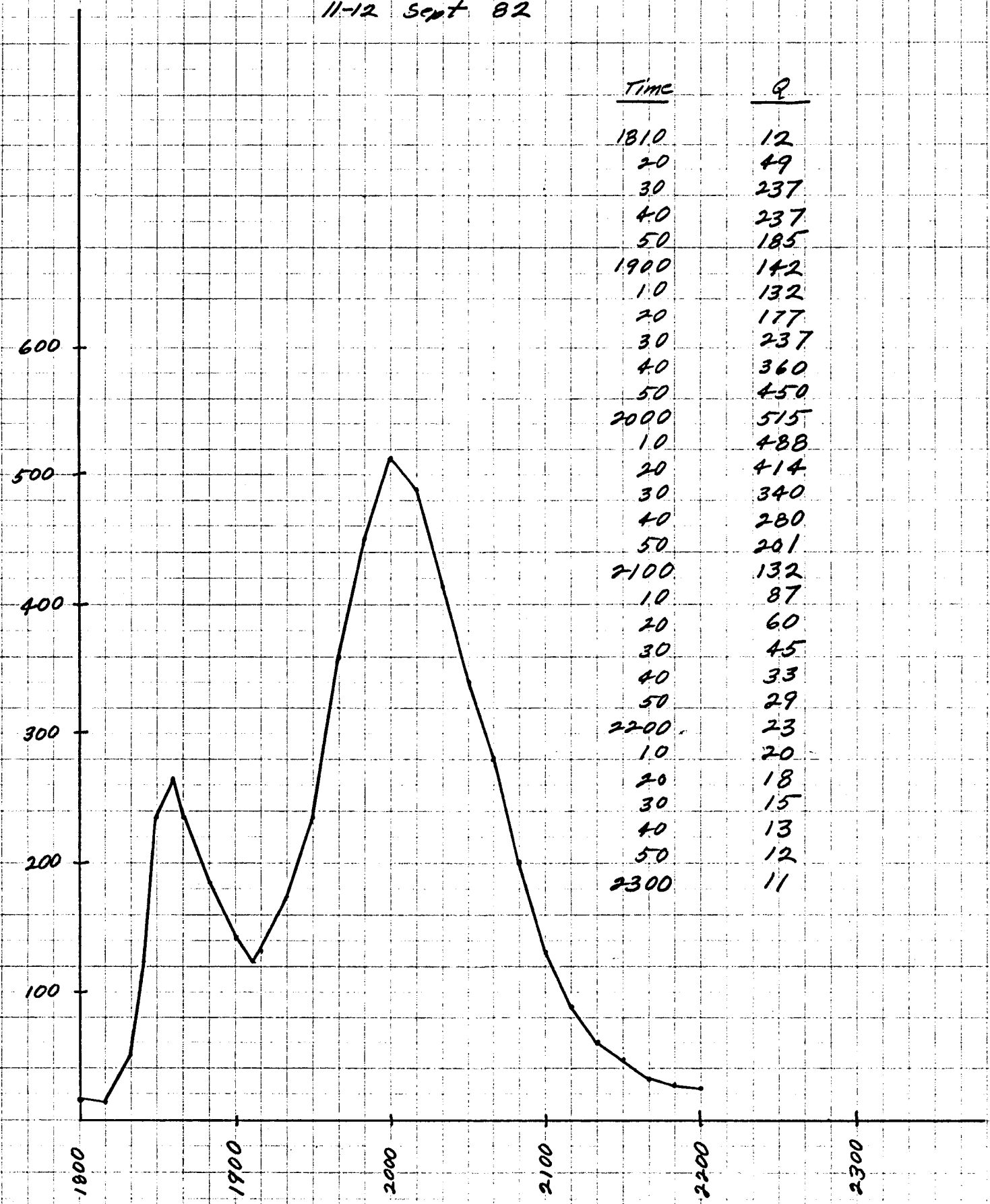
(1)	(2)	(3)	(4)	(5)	(6)	(7)	
15-16 Jan 78	.95	1.12	26.95	65.0	23.2	340.4	
17 Jan 78	.44	.55	5.39	15.3	10.0	147.0	
20 Jan 78	.26	.32	.61	3.1	1.9	28.1	×
11-12 Feb 78	.84	.95	15.93	38.4	15.5	227.6	
13-14 Feb 78	.37	.42	.98	7.0	2.2	31.8	
27 Feb-2 Mar 78	.70	.85	3.43	17.1	4.0	58.8	
10-12 Mar 78	.43	.56	2.70	19.6	5.1	75.4	
23-24 Oct 78	.57	.65	12.37	70.4	17.7	260.5	
14-15 Nov 78	.35	.42	2.08	14.7	4.9	71.4	
23-25 Nov 78	1.17	1.35	23.40	19.5	16.3	240.0	
17-18 Dec 78	1.41	1.60	20.34	67.7	11.8	173.1	
29-31 Dec 78	1.43	1.63	15.80	25.0	9.0	132.6	
5-7 Jan 79	.64	.78	4.086	14.2	5.2	76.6	
16-17 Jan 79	.97	1.15	12.587	35.0	10.6	155.7	
28-29 Jan 79	.44	.50	1.815	10.3	3.4	49.5	
4-5 Feb 79	.49	.65	2.117	11.0	3.4	51.8	
18-21 Jan 80	.57	.66	2.262	13.5	3.2	47.6	
8 Feb 80	.59	.69	5.885	35.0	8.1	119.7	
13-17 Feb 80	1.81	1.97	27.063	45.0	12.21	179.4	
19 Mar 80	.20	.25	.365	4.4	1.5	21.9	×
26-27 Mar 80	.53	.58	3.402	13.4	5.7	77.0	
11 Jan 81	.60	.75	2.008	6.3	2.7	40.2	
8 Feb 81	1.17	1.25	6.189	27.5	4.3	63.5	
2 Mar 81	.94	1.00	0	0	0	0	←
5 Mar 81	.46	.52	1.704	4.1	3.0	44.5	
28-29 Nov 81	.677	.76	4.67	29.5	5.6	82.8	
1-2 Jan 82	.392	.45	2.202	12.2	4.6	67.4	
10-12 Jan 82	.274	.34	.868	5.9	3.3	38.0	×
21 Jan 82	.394	.45	3.959	17.8	9.9	120.6	
29 Jan 82	.505	.60	8.553	32.1	16.6	203.2	
13-15 Mar 82	.860	.90	11.143	51.5	10.6	155.5	
7-10 Dec 82	.720	.78	14.729	32.1	16.7	245.5	
29-30 Jan 83	1.383	1.48	37.789	105.7	22.3	327.9	
3-6 Feb 83	1.102	1.23	22.475	59.2	16.6	244.7	
3-4 Mar 83	.952	1.10	10.486	56.7	9.0	132.2	
18-19 Mar 83	.427	.50	1.119	7.0	2.1	31.4	

n = 48
mean = 250.1 acres (17.0%)

TRR1

Railroad Watershed
11-12 Sept 82

11 oct 87

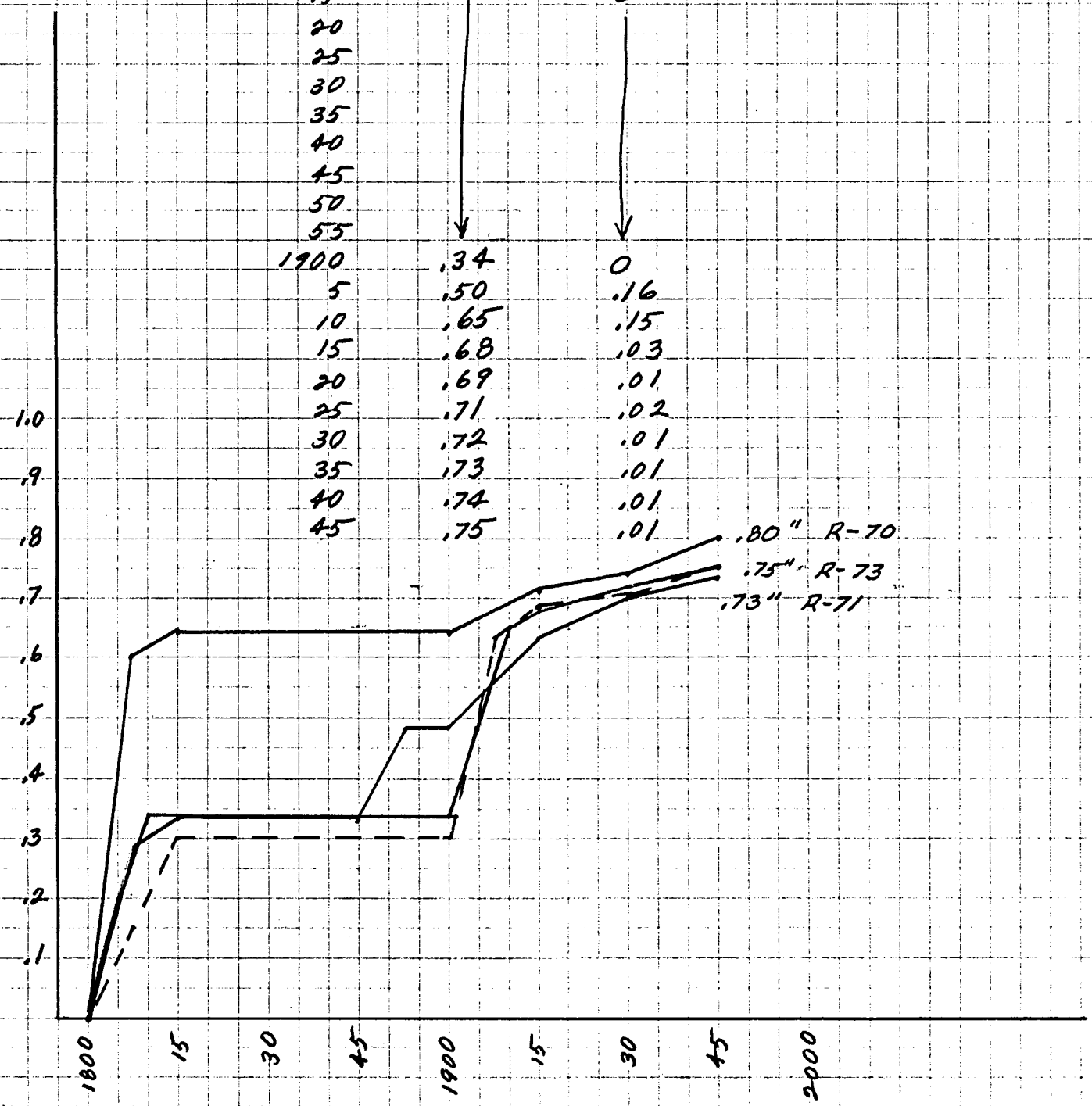


Time	Q
1810	12
20	49
30	237
40	237
50	185
1900	142
10	132
20	177
30	237
40	360
50	450
2000	515
10	488
20	414
30	340
40	280
50	201
2100	132
10	87
20	60
30	45
40	33
50	29
2200	23
10	20
20	18
30	15
40	13
50	12
2300	11

TRR1 11 Oct 87

Rainfall Distribution

Time	Accum Rain	Increm Rain
1800	0.0	
5	.20	.20
10	.33	.13
15		0
20		
25		
30		
35		
40		
45		
50		
55		
1900	.34	0
5	.50	.16
10	.65	.15
15	.68	.03
20	.69	.01
25	.71	.02
30	.72	.01
35	.73	.01
40	.74	.01
45	.75	.01



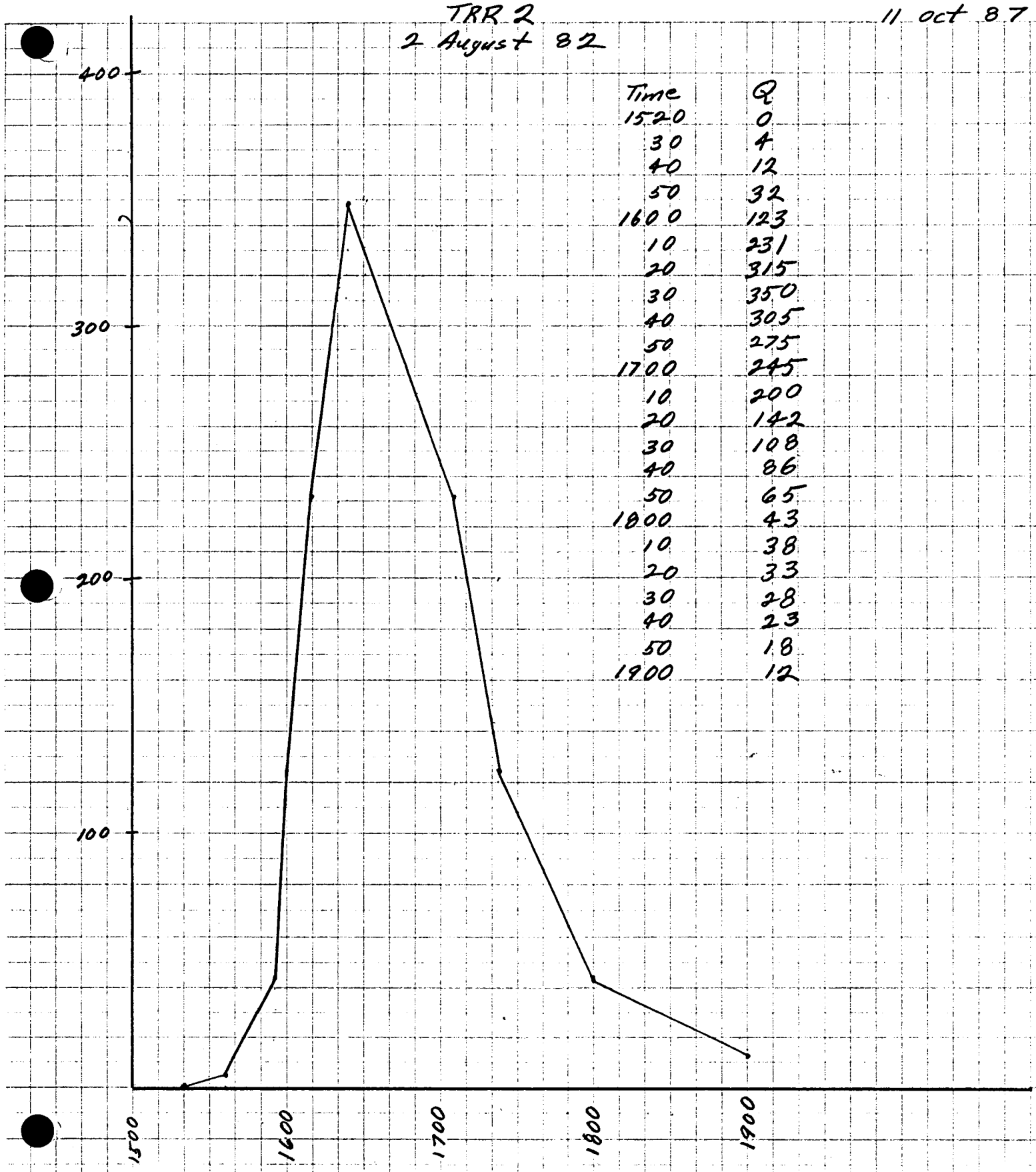
TRR 1 — 11 Oct 87

Rainfall data

Time	R-70		R-71		R-73		
1100						0.0	
1115						.15	
1130	.02						
45	.05	<.4	0.0				
1200	.50		.20				
15							
30							
45							
1300							
15			.20				
30	.50	<.72	.22			.15	
45	.72		.27			.35	
1400							
15							
30							
45							
1500							
15							
30							
45							
1600							
15							
30			.27				
45	.72		.30			.35	
1700	.90		.30			.50	
15			.37				
30							
45							
1800	.90	<1.5	.37	<.65	.28 > 0.0	.50	0.0
15	1.54	.40 > .64	.70		.33	.65	<.80 .30 > .15
30						.80	.30
45			.70	<.85	.48 > .33		
1900	1.54	.64	.85		.48	.80	<1.13 .63 > .30
15	1.61	.71	1.00		.63	1.18	.68
30	1.64	.74	1.07		.70	1.20	.70
45	1.70	.80	1.10		.73	1.25	.75
2000							

TRR 2
2 August 82

11 oct 87



Time	Q
1520	0
30	4
40	12
50	32
1600	123
10	231
20	315
30	350
40	305
50	275
1700	245
10	200
20	142
30	108
40	86
50	65
1800	43
10	38
20	33
30	28
40	23
50	18
1900	12

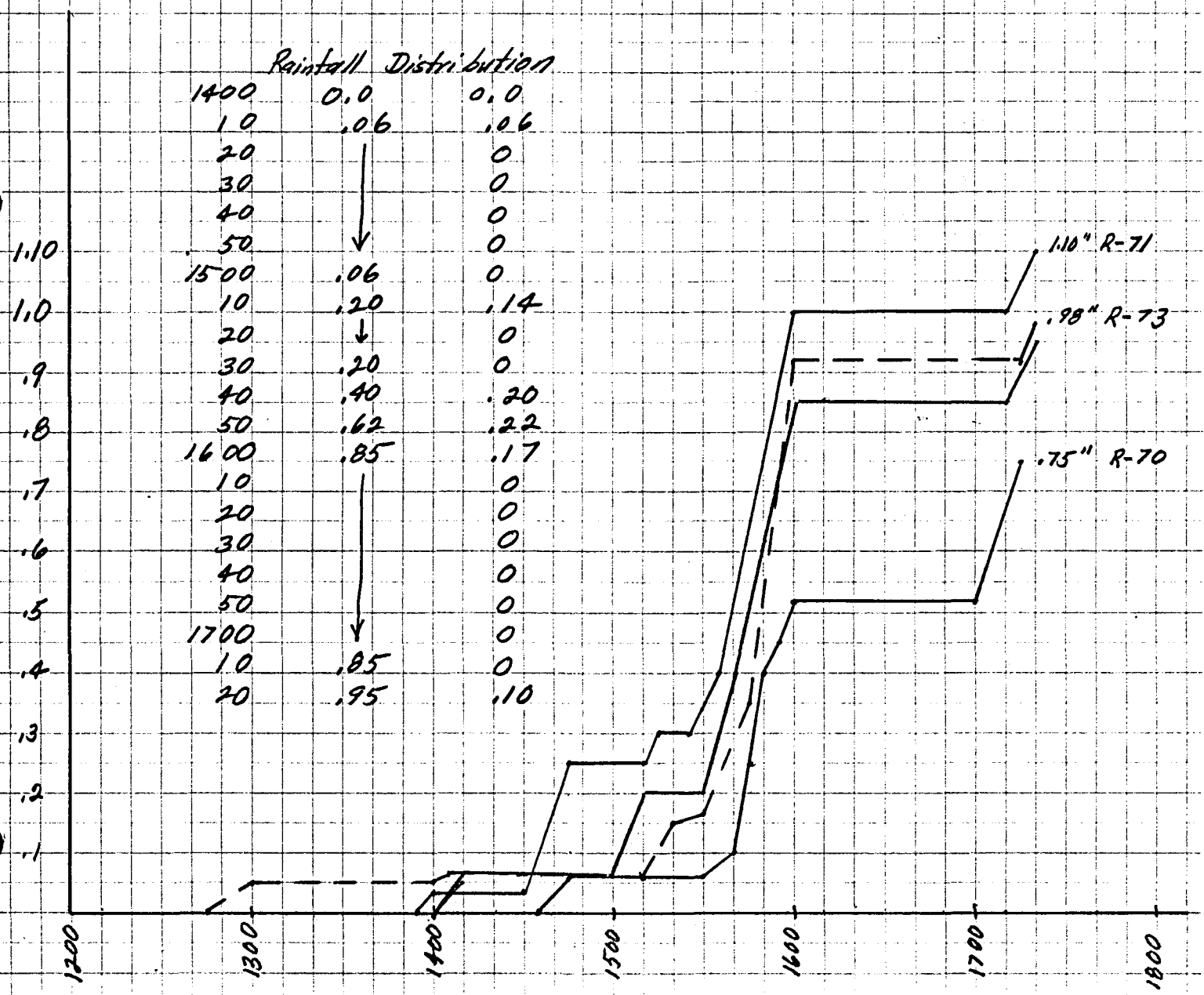
TRR 2 11 Oct 87

Rainfall data

R-70		R-71		R-73	
1435	0.0	1355	0.0	1245	0.0
1445	.06	1400	.03	1300	.05
1530	.06	1430	.03	1400	.05
1540	.10	1445	.25	1405	.06
1545	.25	1510	.25	1510	.06
1550	.40	1515	.30	1520	.15
1555	.45	1525	.30	1530	.17
1600	.52	1535	.40	1545	.35
1700	.52	1600	1.00	1600	.92
1715	.75	1710	1.00	1715	.92
		1720	1.10	1720	.98

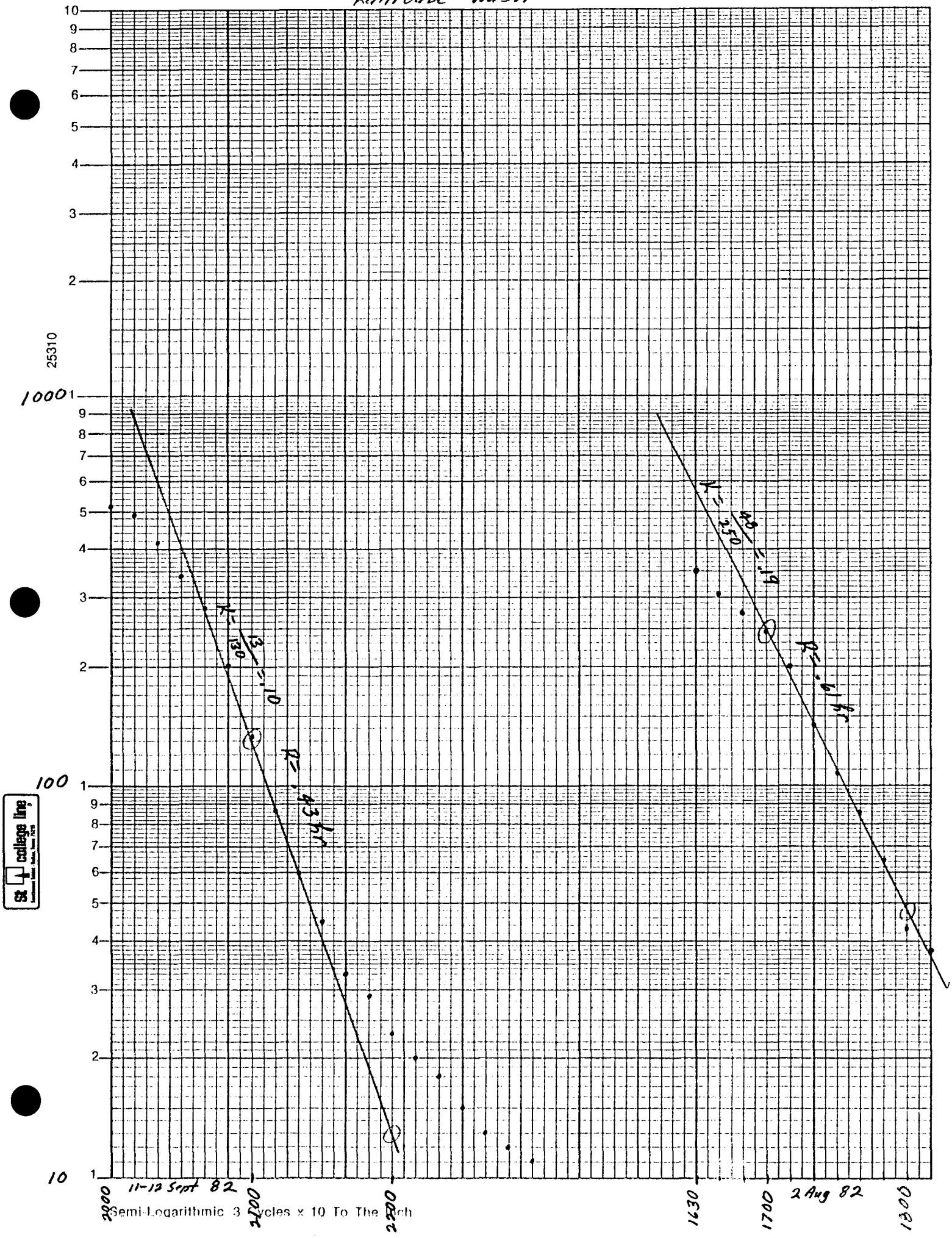
Rainfall Distribution

1400	0.0	0.0
10	.06	.06
20	↓	0
30		0
40		0
50		0
1500	.06	0
10	.20	.14
20	↓	0
30	.20	0
40	.40	.20
50	.62	.22
1600	.85	.17
10	↓	0
20		0
30		0
40		0
50		0
1700		0
10	.85	0
20	.95	.10



Railroad Wash

11 oct 87



Flood Reconstitution for Tucson Atterbury Watershed W-1A TAT1

Storm Event 26 Sept 84

Runoff: depth = .27 inches, Q_p = 178 cfs at t_p = 5.0 hours

$R_{recession}$ = 2.1 hrs

INPUT (1) Area acres	(2) Eff. Imp. Area %	(3) Rain in.	(4) Comp. Inter. min.	(5) Time-Area	(6)	Results (7) Q_p cfs	(8) t_p hr.	(9) T_c hr.	(10) R hr.	(11) STRTL in.	(12) CNSTL in/hr	(13) Output File	(14) Comment
3181.	4.1	1.40	15	D		200	4.75	2.37	3.07	.15	.34	Ø1	
"	3.0	"	"			200	4.75	2.36	3.18	.17	.33	Ø2 Ø3	← selected graphed output

Flood Reconstitution for Tucson Atterbury Watershed W-1A TAT2

Storm Event 11 Sept 82

Runoff: depth = .135 inches, Q_p = 325 cfs at t_p = 1.75 hours

$R_{recession}$ = 1.8 hrs

INPUT (1) Area acres	(2) Eff. Imp. Area %	(3) Rain in.	(4) Comp. Inter. min.	(5) Time-Area	(6)	Results (7) Q_p cfs	(8) t_p hr.	(9) T_c hr.	(10) R hr.	(11) STRTL in.	(12) CNSTL in/hr	(13) Output File	(14) Comment
3181	3.0	1.42	15	D		392	2.00	.26	2.71	.48	1.06	Ø1	← selected
"	"	"	"	U-1		366	2.00	.26	3.07	.42	1.08	Ø2	The rainfall dist. was probably not uniform over the watershed.
				N-1		513	2.00	.26	1.78	.61	.88	Ø3	

Flood Reconstitution for Tucson Atterbury Watershed TAT3

Storm Event 25-26 Sept 1976

Runoff: depth = .51 inches, Q_p = 340 cfs at t_p = 2.25 hours

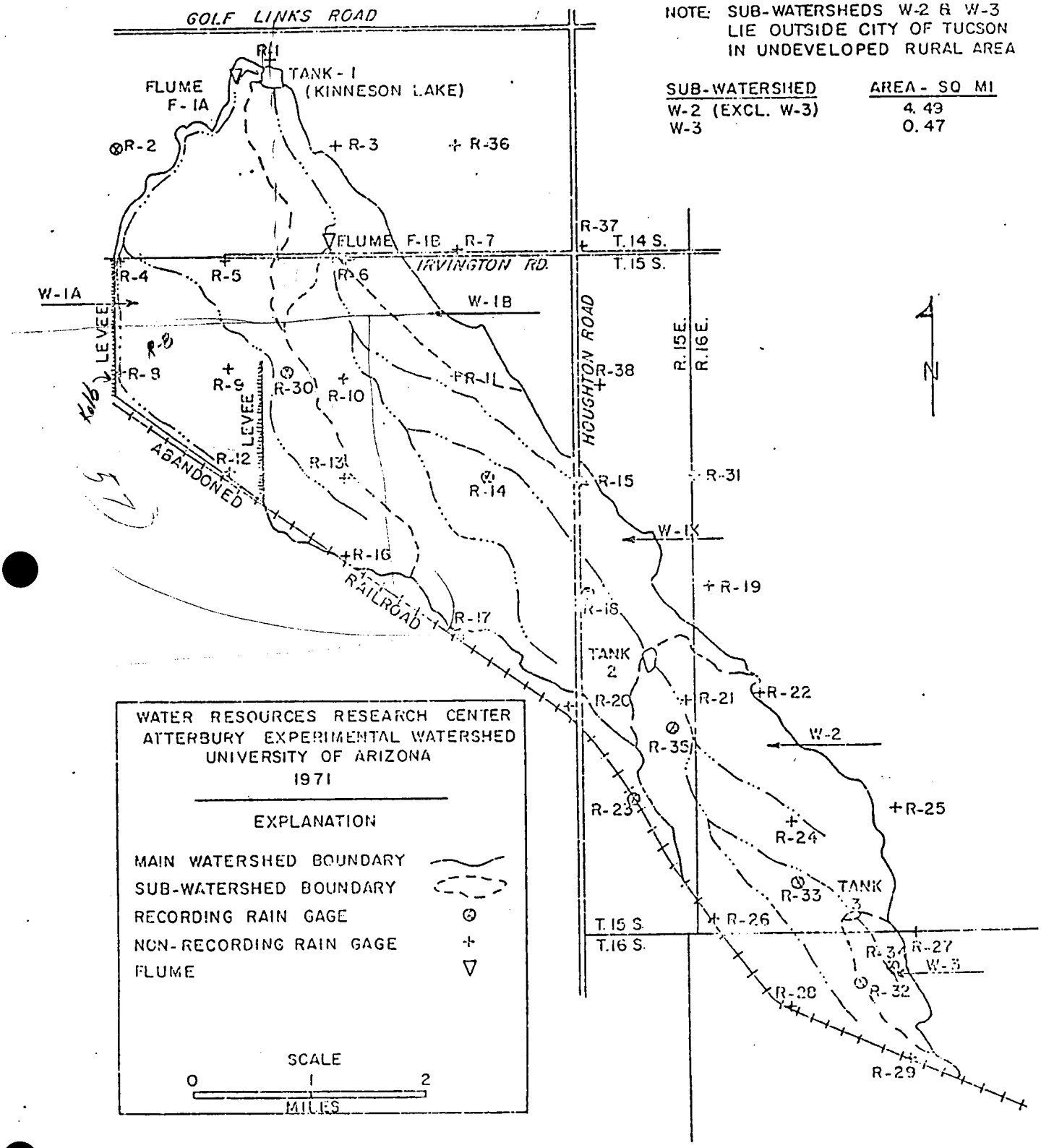
$R_{recession}$ = 1.83 hrs

INPUT (1) Area acres	(2) Eff. Imp. Area %	(3) Rain in.	(4) Comp. Inter. min.	(5) Time-Area	(6)	Results (7) Q_p cfs	(8) t_p hr.	(9) T_c hr.	(10) R hr.	(11) STRTL in.	(12) CNSTL in/hr	(13) Output File	(14) Comment
3181	3.0	1.70	15	D		296	4.00	2.74	3.48	.10	.96	Ø1	

9 Oct 87

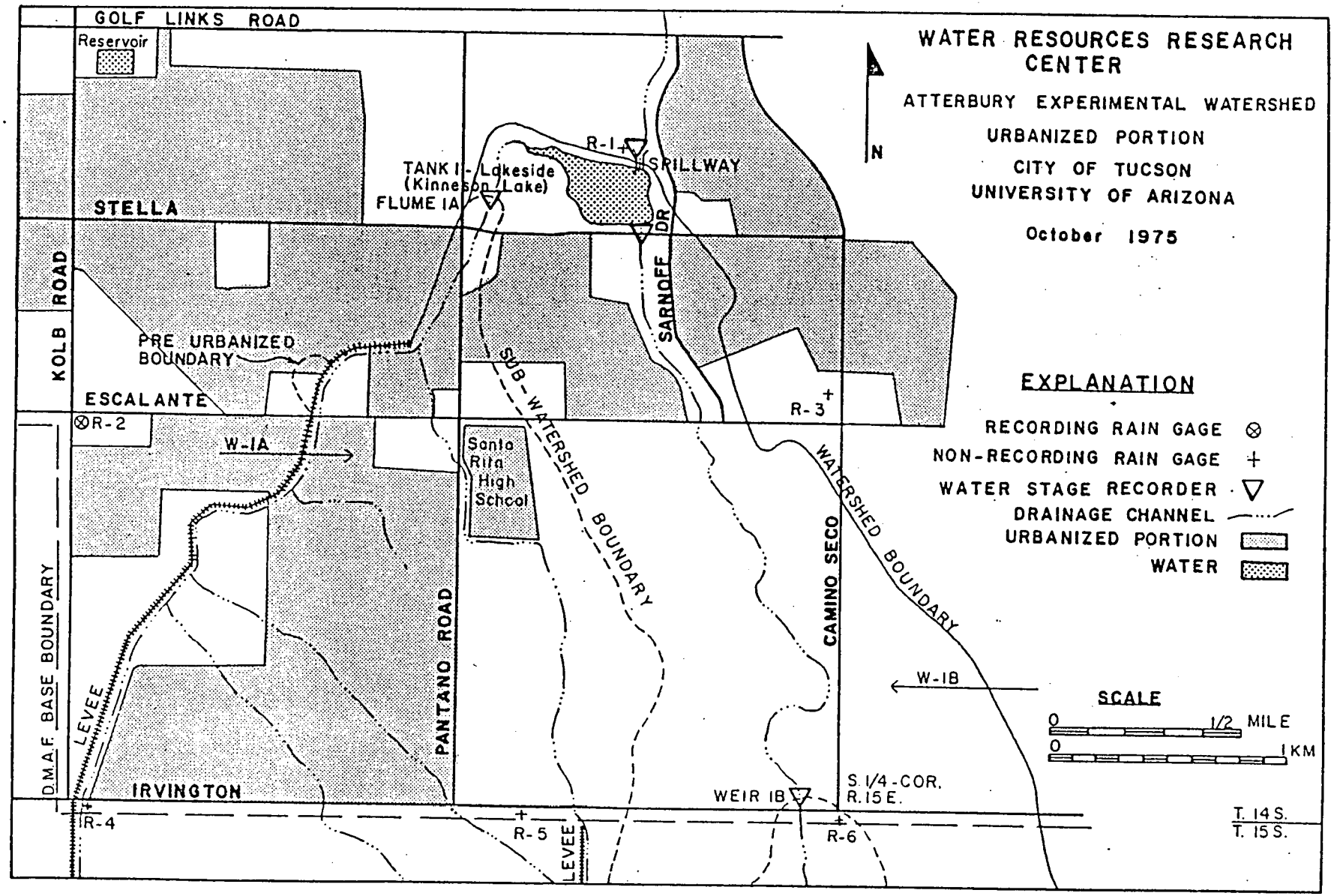
Atterbury Watershed W-1A

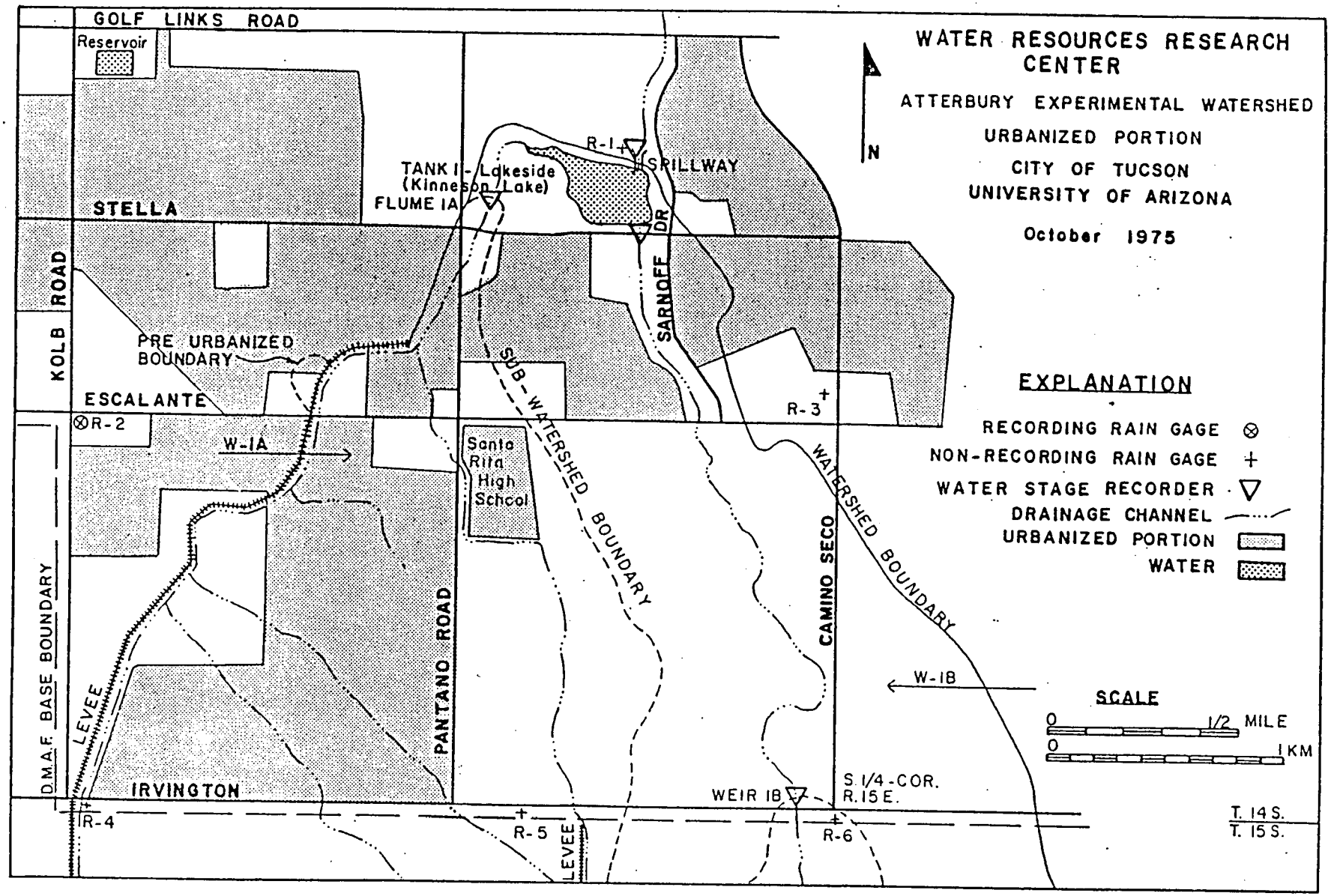
Storm Event	Hydrograph Type	Hydrograph Peak cfs	Raingages (✓ for recorder charts) R-1	R-2	R-4	R-5	R-8	R-9	R-12	R-13	R-16	Data Comment	Analyzed
25 Sept 76	M,F	341	1.35	✓ 1.75	1.98	1.60	1.83	2.02	1.87	1.70	1.63	tabulated hg	
19 July 81	S	40	.56	.32	.40	.60	.45	.38	.34	.22	.27	tabulated hg *no rainfall chart	
11 Sept 82	M	326	1.51	✓ 2.15	1.79	2.02	2.63	2.20	1.83	1.60	1.86	tabulated hg	yes
23 July 84	M	414	.51	✓ 1.14	.84	1.01	.76	.63	.18	.08	.06	tabulated hg	
26 Sept 84	S	178	1.35	✓ 1.44	1.34	1.62	1.56	1.71	1.72	1.77	1.55	tabulated hg	yes

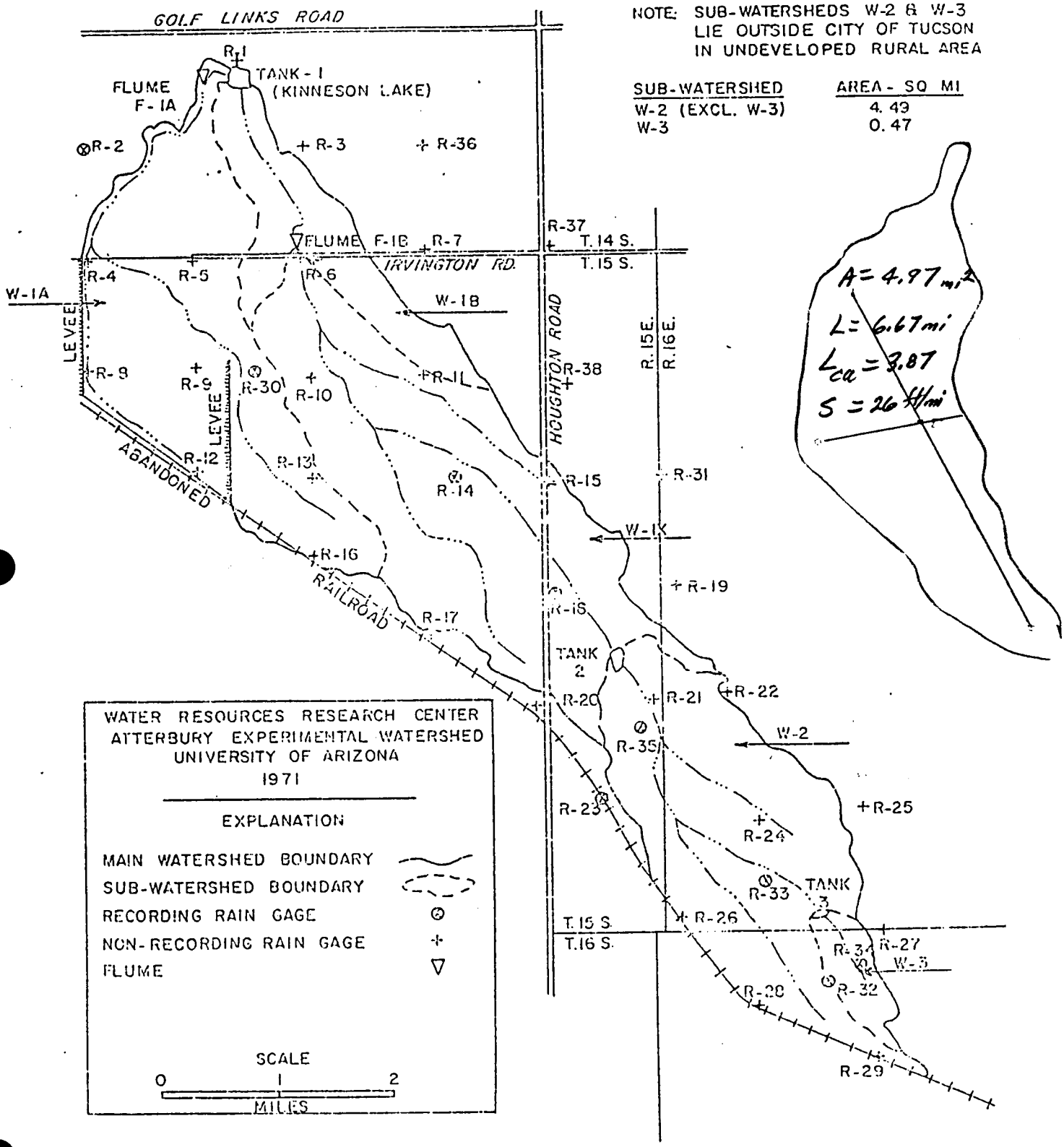


NOTE: SUB-WATERSHEDS W-2 & W-3 LIE OUTSIDE CITY OF TUCSON IN UNDEVELOPED RURAL AREA

SUB-WATERSHED	AREA - SQ MI
W-2 (EXCL. W-3)	4.49
W-3	0.47


WATER RESOURCES RESEARCH CENTER
ATTERBURY EXPERIMENTAL WATERSHED
URBANIZED PORTION
CITY OF TUCSON
UNIVERSITY OF ARIZONA
October 1975
N
EXPLANATION
RECORDING RAIN GAGE
NON-RECORDING RAIN GAGE
WATER STAGE RECORDER
DRAINAGE CHANNEL
URBANIZED PORTION
WATER
SCALE
0 1/2 MILE
0 1 KM
GOLF LINKS ROAD
Reservoir
STELLA
KOLB ROAD
ESCALANTE
IRVINGTON
D.M.A.F. BASE BOUNDARY
LEVEE
PANTANO ROAD
CAMINO SECO
SARNOFF DR
TANK I - Lakeside (Kinnelon Lake)
FLUME IA
R-1
SPILLWAY
PRE URBANIZED BOUNDARY
SUB-WATERSHED BOUNDARY
WATERSHED BOUNDARY
Santa Rita High School
R-2
R-3
R-4
R-5
R-6
W-IA
W-IB
WEIR IB
S.1/4-COR. R.15 E.
T. 14 S.
T. 15 S.

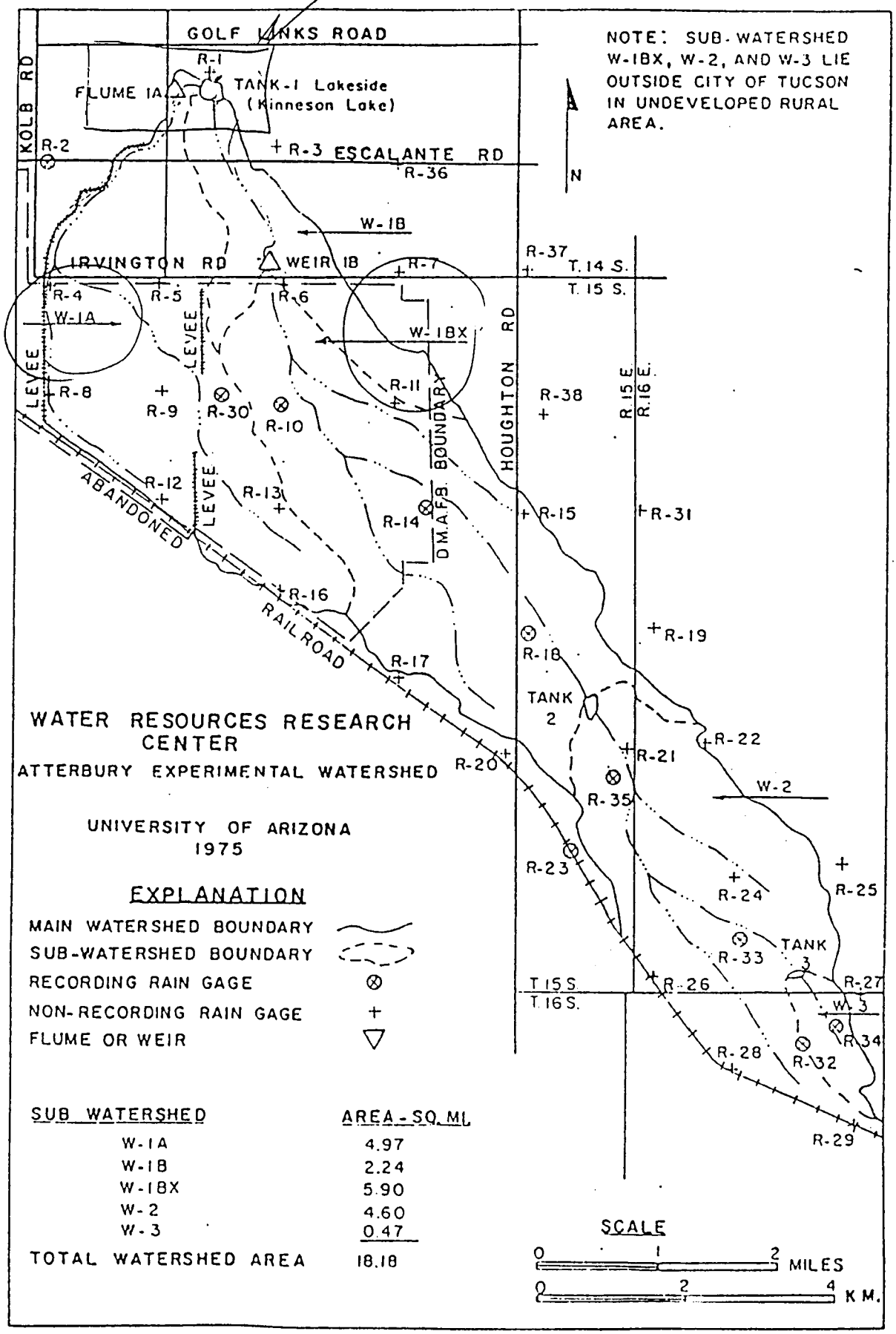

WATER RESOURCES RESEARCH CENTER
ATTERBURY EXPERIMENTAL WATERSHED
URBANIZED PORTION
CITY OF TUCSON
UNIVERSITY OF ARIZONA
October 1975
N
EXPLANATION
RECORDING RAIN GAGE
NON-RECORDING RAIN GAGE
WATER STAGE RECORDER
DRAINAGE CHANNEL
URBANIZED PORTION
WATER
SCALE
0 1/2 MILE
0 1 KM
GOLF LINKS ROAD
Reservoir
STELLA
KOLB ROAD
PRE URBANIZED BOUNDARY
ESCALANTE
R-2
W-1A
TANK 1 - Lakeside (Kinnelon Lake)
FLUME 1A
R-1
SPILLWAY
SARNOFF DR
SUB-WATERSHED BOUNDARY
Santa Rita High School
R-3
WATERSHED BOUNDARY
CAMINO SECO
PANTANO ROAD
W-1B
D.M.A.F. BASE BOUNDARY
LEVEE
IRVINGTON
R-4
R-5
LEVEE
WEIR 1B
S. 1/4-COR. R.15 E.
R-6
T. 14 S.
T. 15 S.



NOTE: SUB-WATERSHEDS W-2 & W-3 LIE OUTSIDE CITY OF TUCSON IN UNDEVELOPED RURAL AREA

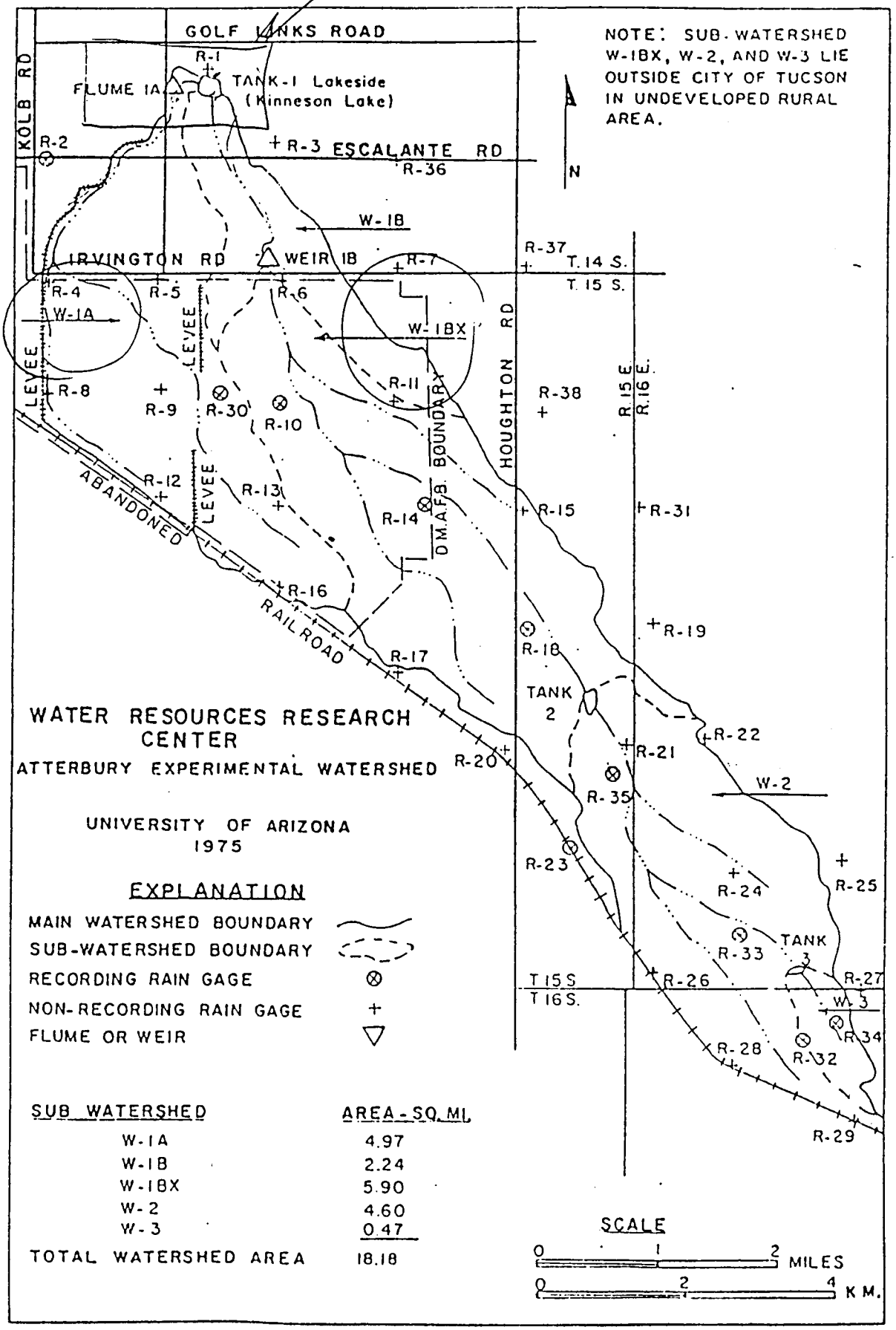
SUB-WATERSHED	AREA - SQ MI
W-2 (EXCL. W-3)	4.49
W-3	0.47

No N exist



SUB WATERSHED	AREA - SQ. MI.
W-1A	4.97
W-1B	2.24
W-1BX	5.90
W-2	4.60
W-3	0.47
TOTAL WATERSHED AREA	18.18

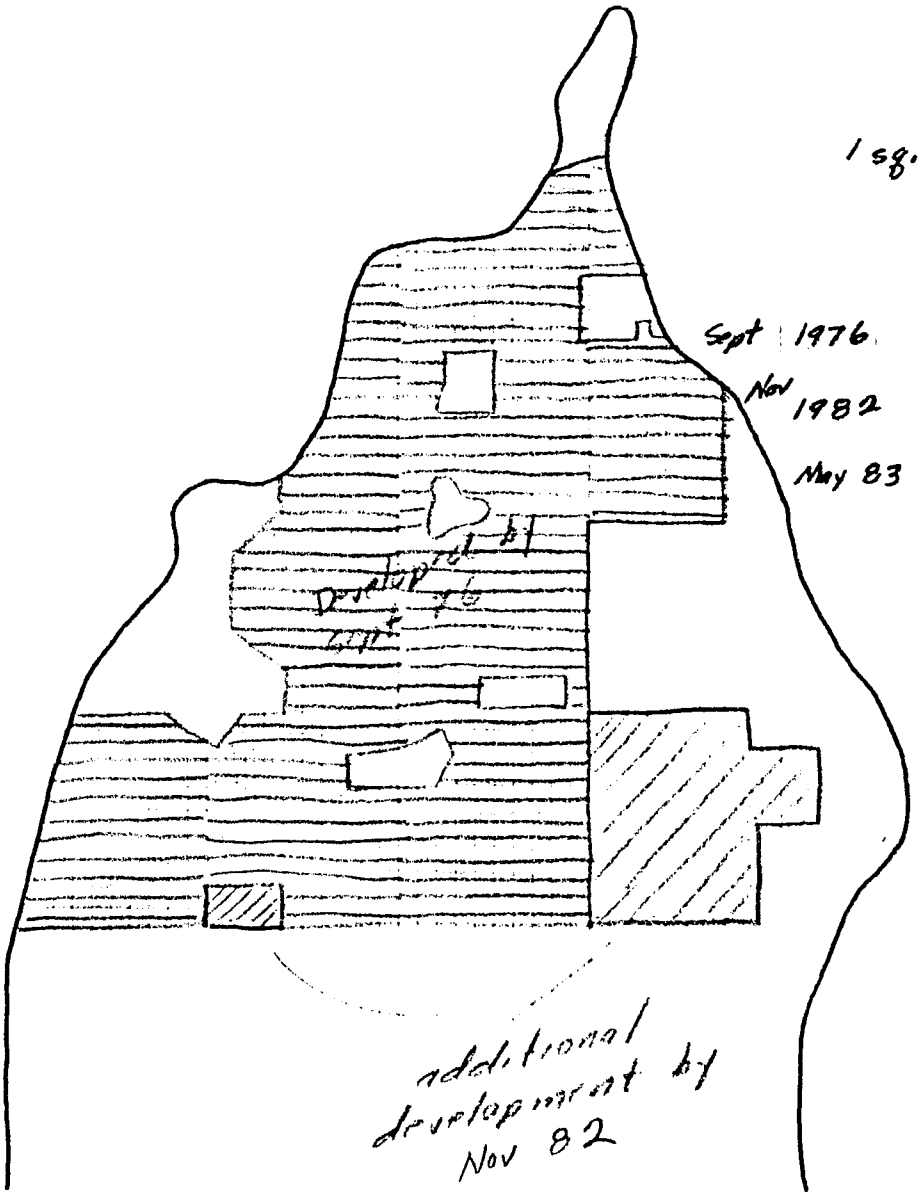
No N exist



SUB WATERSHED	AREA - SQ. MI.
W-1A	4.97
W-1B	2.24
W-1BX	5.90
W-2	4.60
W-3	0.47
TOTAL WATERSHED AREA	18.18

Atterbury Watershed

overlay for 1976 aerial photo 1" = 1820'



1 sq. in. = 76 acres

Sept 1976 7.39 in² = 562 acres

Nov 1982 8.60 in² = 652 acres

May 83 652 acres

12 oct 87

Analysis of Effective Impervious Area
Atterbury W-14 Watershed

Storm Date	Rainfall Avg. inches	Rainfall Max. inches	Runoff Volume ac-ft	Runoff Qp cfs	Runoff % of rainfall	Runoff Ae acres	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	
84							
5 Jan	.370	.40	4.053	7.6	4.1	131	
6-7 April	.512	.62	3.077	9.5	2.3	72	low int.
20-21 Oct	.371	.47	1.632	7.1	1.6	53	low int.
22-23 Nov	.770	.90	19.152	24.8	9.4	298	×
25 Nov	.220	.29	5.768	11.4	10.0	315	×
10-11 Dec	.450	.53	1.299	5.0	1.1	35	low int.
83							
3-4 Mar	.940	1.36	12.751	21.9	5.1	163	
18-19 Mar	.610	.68	7.499	24.3	4.6	148	
21 Mar	.180	.24	1.793	4.6	3.9	120	
24-25 Mar	.440	.51	7.447	23.8	6.4	203	
3-4 Nov	.760	.81	10.145	25.3	5.	400	very wet
21 Nov	1.050	1.22	15.612	25.3	6.	178	wet
25 Nov	.300	.45	3.223	8.38	3.	129	
26 Dec	.370	.41	1.748	7.0	2	57	
82							
1-2 Jan	.580	.67	4.15	15.4	2.8	86	
10-12 Jan	.455	.55	1.878	9.2	1.5	50	
21 Jan	.365	.39	2.217	10.5	2.2	73	
12-15 Mar	1.12	1.28	12.921	24.3	4.4	138	wet
18 Mar	.23	.29	1.396	5.0	2.2	73	
8-10 Dec	.66	.73	7.876	13.1	4.4	143	
81							
11 Jan	.666	.78	2.679	8.7	1.5	48	
8 Feb	1.36	1.56	10.978	26.9	3.0	97	
28 Feb	1.57	1.68	20.865	25.3	5.0	159	high int.
5 Mar	.694	.78	15.25	40.1	8.2	264	wet
28-30 Nov	.754	.80	7.236	15.8	3.6	115	
80							
18-21 Jan	.380	.46	.597	3.3	.61	19	low int.
8 Feb	1.181	1.31	6.742	32.5	2.3	72	
16-18 Feb	.444	.50	2.436	2.3	2.1	66	
10-11 Mar	.483	.53	1.592	7.8	1.2	40	
26-27 Mar	.850	.99	5.420	13.8	2.4	77	

12 oct 87

(1)	(2)	(3)	(4)	(5)	(6)	(7)	
79							
5-7 Jan	.952	1.10	5.070	5.6	2.0	64.	
16-17 Jan	.851	1.00	8.357	11.4	3.7	118	
24-25 Jan	.924	1.05	5.490	5.2	2.2	71	
21 oct	.338	.40	.652	10.8	.7	23	low int
78							
10-11 Jan	.818	.88	5.060	7.3	2.3	74	
15-17 Jan	1.672	1.83	27.692	36.2	6.2	199	wet
20 Jan	.272	.33	1.703	3.1	2.4	75	
30 Jan	.311	.44	.697	8.1	.8	27	
11-12 Feb	1.137	1.38	14.139	18.2	4.7	149	
13-14 Feb	.607	.68	5.697	10.1	3.5	113	wet
11-12 Mar	.742	.85	6.454	25.3	3.3	104	
23-25 Nov	1.523	1.61	5.301	4.0	1.3	42	
17-19 Dec	1.581	1.81	18.264	40.8	4.4	139	
29-31 Dec	1.438	1.66	6.875	5.8	1.8	57	
77							
1 Jan	1.276	1.34	17.655	23.8	5.2	166	x wet
8 Jan	.548	.60	5.623	30.2	4.0	129	
21-22 Jan	.783	.90	5.183	19.5	2.5	79	
26-27 Mar	.688	.73	3.192	7.8	1.7	56	
5-7 Oct	1.46	1.80	28.738	65.5	7.4	236	x
25-29 Dec	1.172	1.35	15.226	83.7	4.9	156	x
76							
14-16 April	.836	1.00	2.793	5.2	1.3	40	
75							
11-12 Mar	.618	.70	1.255	1.1	.76	24	
28-29 Nov	.315	.35	.026	.59	.03	1	
23 Dec	.894	1.25	8.123	6.6	3.5	109	
74							
8-10 Jan	.933	1.03	1.240	3.1	.5	16	
8-9 Mar	.439	.50	.156	.8	.14	4	
11-12 Oct	.496	.65	2.02	3.4	1.5	49	
29-30 oct	1.074	1.23	4.918	10.4	1.7	55	
5 Dec	.417	.55	.126	.2	.1	4	
73							
20-23 Feb	1.746	2.30	4.490	4.6	.9	31	
11-14 Mar	1.376	1.58	3.728	2.3	1.0	33	
21-23 Mar	.345	.39	.184	.9	.2	6	

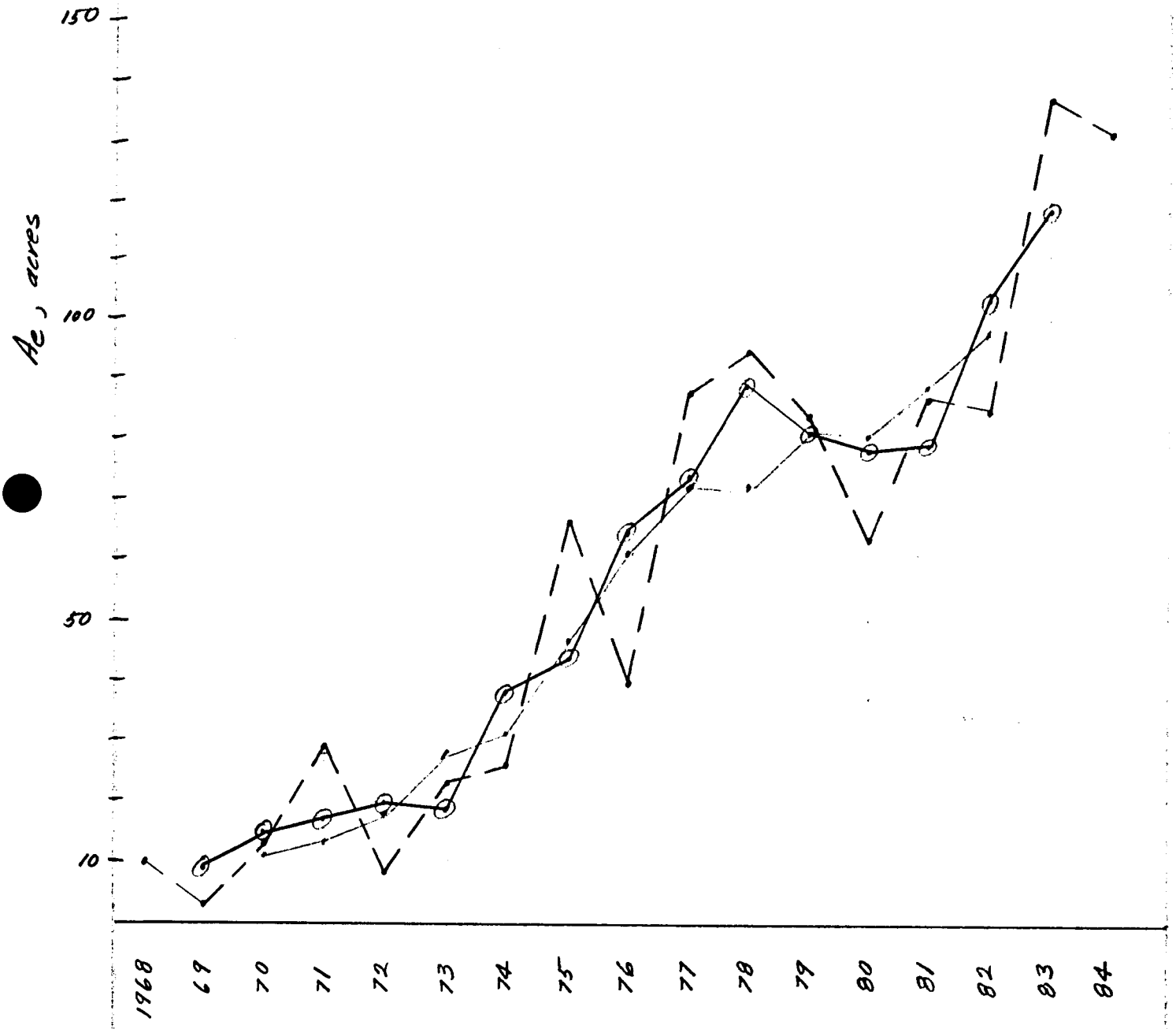
12 oct 87

(1)		(2)	(3)	(4)	(5)	(6)	(7)	
	72							
3-5	Oct	2.352	2.80	28.179	35	4.4	144	high int.
11-12	Nov	.531	.62	.345	1.1	.2	8	
17	Nov	.557	.72	3.56	3.6	2.3	77	wet
	71							
17-18	Oct	1.076	1.14	1.405	2.9	.5	16	
7	Dec	.568	.68	2.029	3.4	1.3	43	
13	Dec	.448	.65	1.089	1.6	.9	29	
	70							
1-2	Mar	1.058	1.32	1.452	11.7	.5	16	
10	Mar	.518	.72	.466	2.3	.8	11	
	69							
15-16	Nov	.77	1.08	.331	4.6	.2	5	
3-4	Dec	.474	.50	.145	1.2	.1	4	
27-29	Dec	.389	.44	.029	.6	.03	1	
	68							
9-12	Feb	1.181	1.34	1.565	10.8	.5	14	
8-10	Mar	1.40	1.51	1.622	2.8	.4	14	
14	oct	1.006	1.09	.338	2.0	.1	4	

26 Oct 87

Atterbury Watershed

Effective Impervious Area



26 oct 87

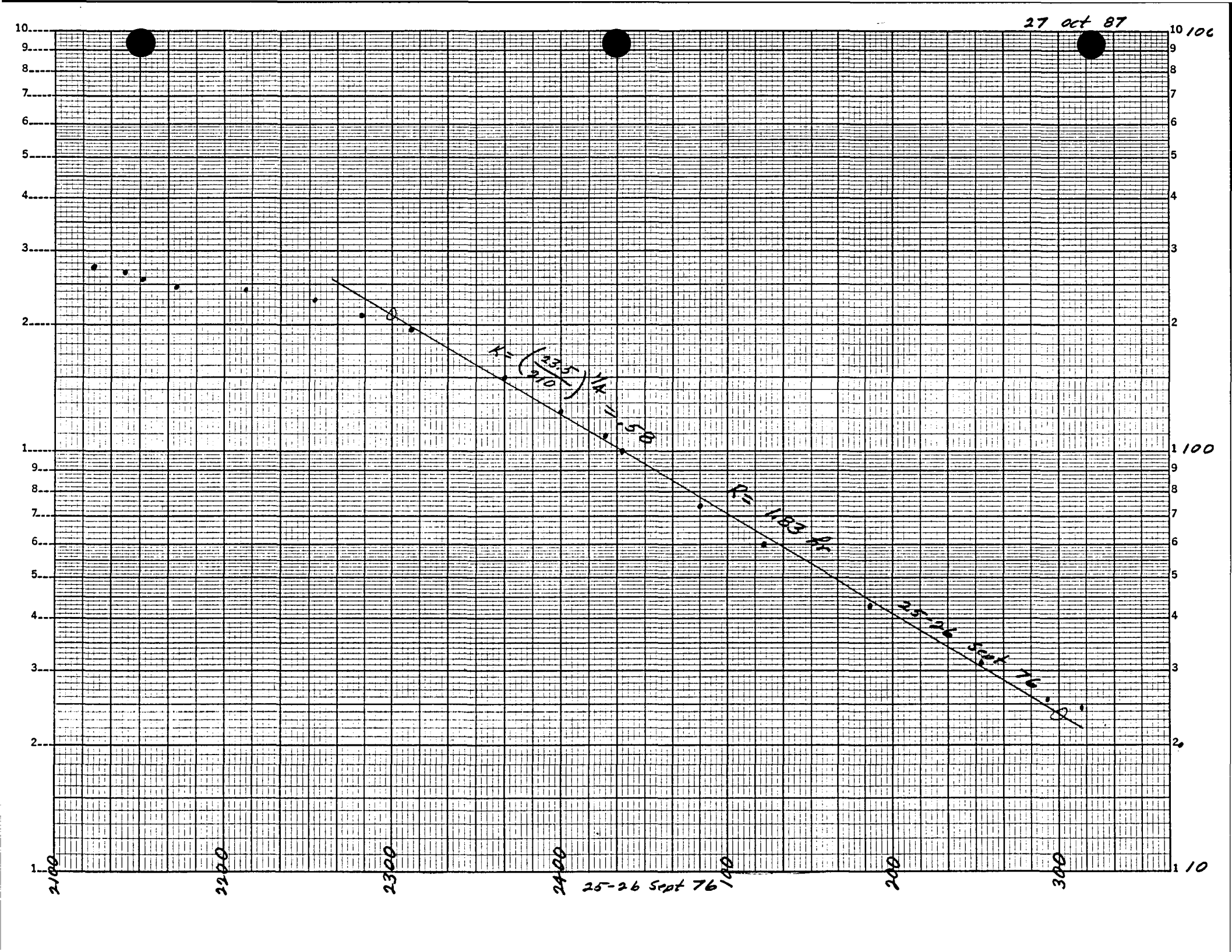
Atterbury Watershed

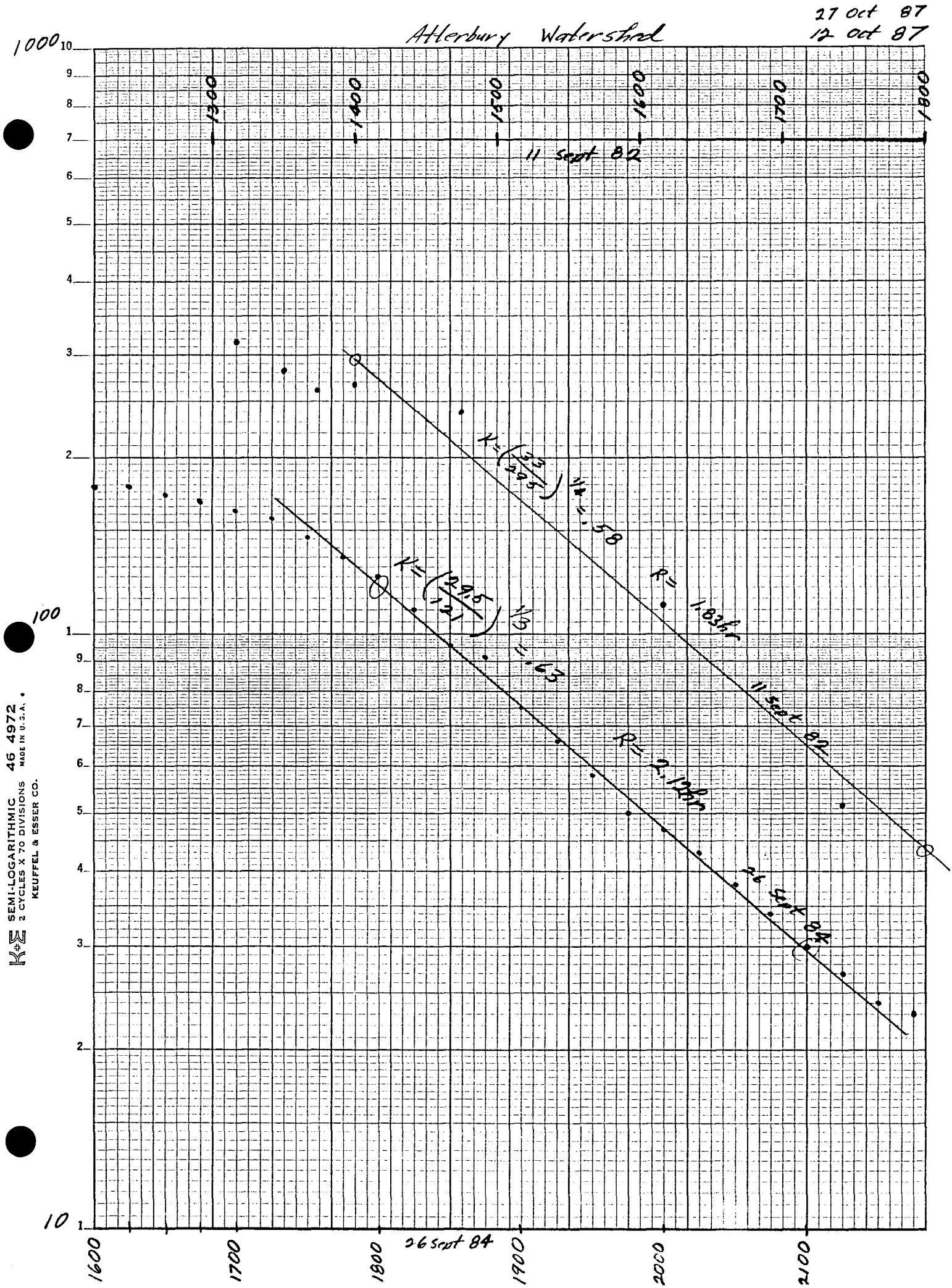
Effective Impervious Area

Year	Ae (acres)	3-yr moving average	5-yr moving average (acres)	Developed Land	% impervious	% Effective imp. area as % of total area
1968	10					
69	3	9				
70	13	15	11			
71	29	17	13			
72	8	20	18			
73	23	19	28			
74	26	38	31			
75	66	44	47	562	8.4	1.5
76	40	65	61	562	10.9	1.9
77	88	74	73	562	13.0	2.3
78	95	89	72	562	12.8	2.3
79	84	81	82	652	12.6	2.6
80	64	78	81	652	12.4	2.5
81	87	79	89	652	13.7	2.8
82	85	103	97	652	14.9	3.0
83	137	118	↑			↑
84	131					

assumed eff. imp. area

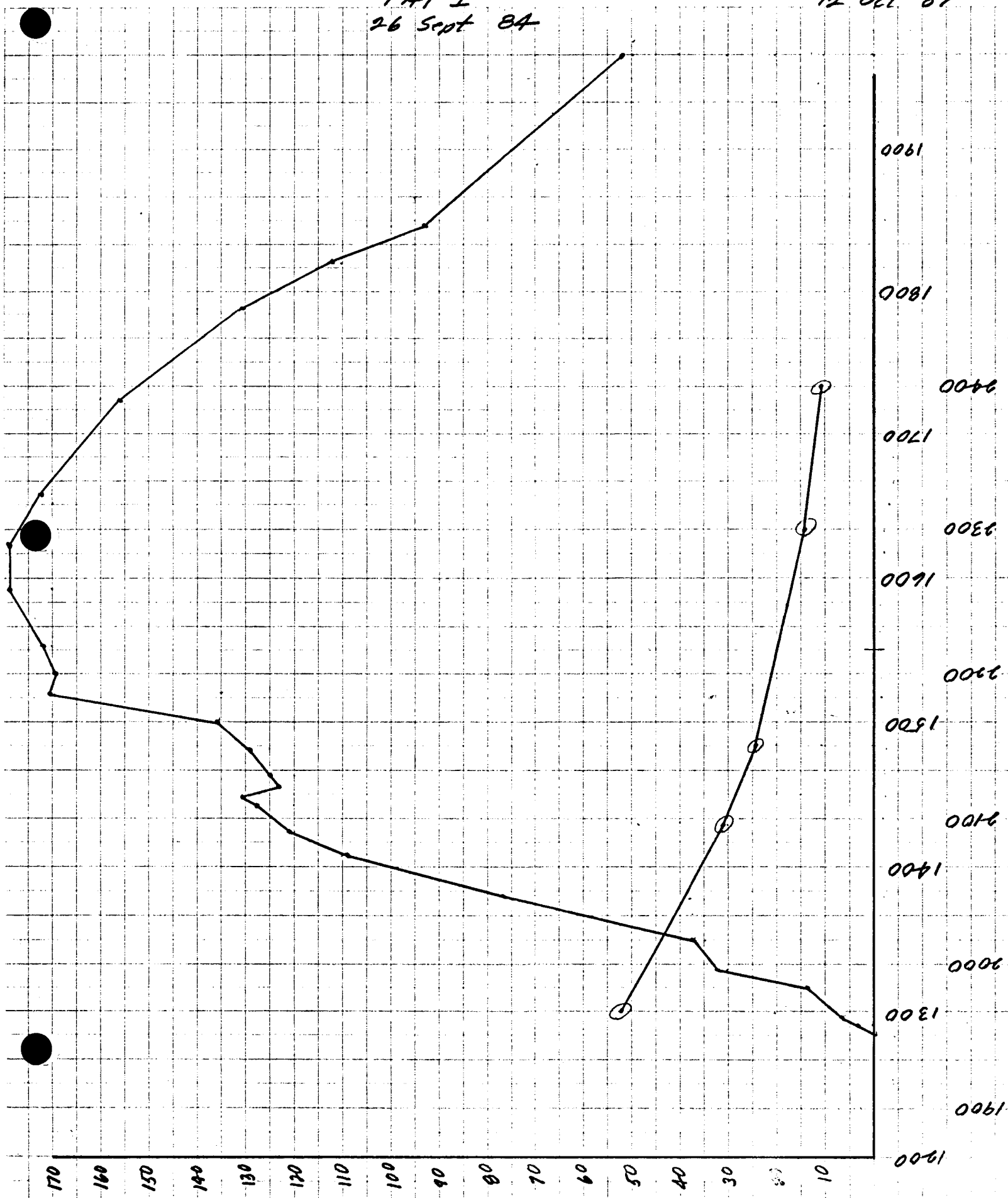
Total Area = 3181 ac


27 oct 87
25-26 Sept 76
2100
2200
2300
2400
100
200
300
10
100
1
2
3
4
5
6
7
8
9
10


27 Oct 87
12 Oct 87
Atterbury Watershed
1000
100
10
1300
1400
1500
1600
1700
1800
11 Sept 82
K = (29.5/1.21)
K = 1.14 = 5/8
R = 1.83 hr
11 Sept 82
K = (29.5/1.21)
K = 1.63 = 8/5
R = 2.10 hr
26 Sept 84
1600
1700
1800
1900
2000
2100
K+E SEMI-LOGARITHMIC 46 4972
2 CYCLES X 70 DIVISIONS MADE IN U.S.A.
KEUFFEL & ESSER CO.

TAT 1
26 Sept 84

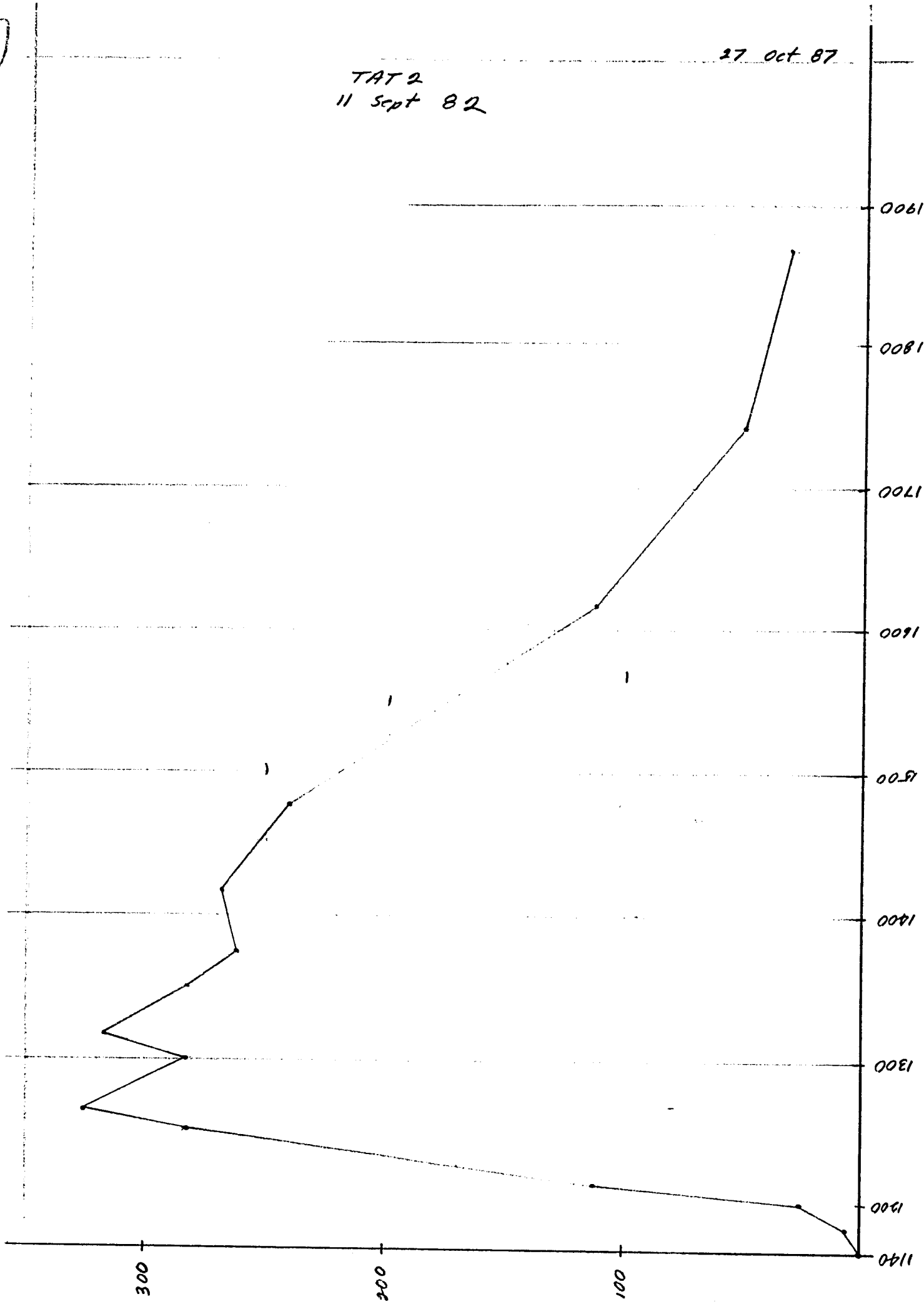
12 Oct 87



TAT 1

12 oct 87

Time	Q	Rain	Δ Rain
1100		0	0
15		.02	.02
30		.04	.02
45		.06	.02
1200		.08	.02
15		.14	.06
30		.20	.06
45	0	.30	.10
1300	8	.39	.09
15	25	.50	.11
30	37	.65	.15
45	70	.82	.17
1400	100	.97	.15
15	122	1.02	.05
30	130	1.07	.05
45	128	1.10	.03
1500	136	1.16	.06
15	170	1.18	.02
30	172	1.26	.08
45	176	1.33	.07
1600	178	1.37	.04
15	178	1.39	.02
30	173	1.40	.01
45	168		
1700	162		
15	157		
30	146		
45	135		
1800	125		
15	110		
30	92		
45	83		
1900	75		
15	66		
30	58		
45	50		
2000	47		
15	43		
30	38		
45	34		
2100	30		
15	27		
30	24		
45	23		
2200	21		

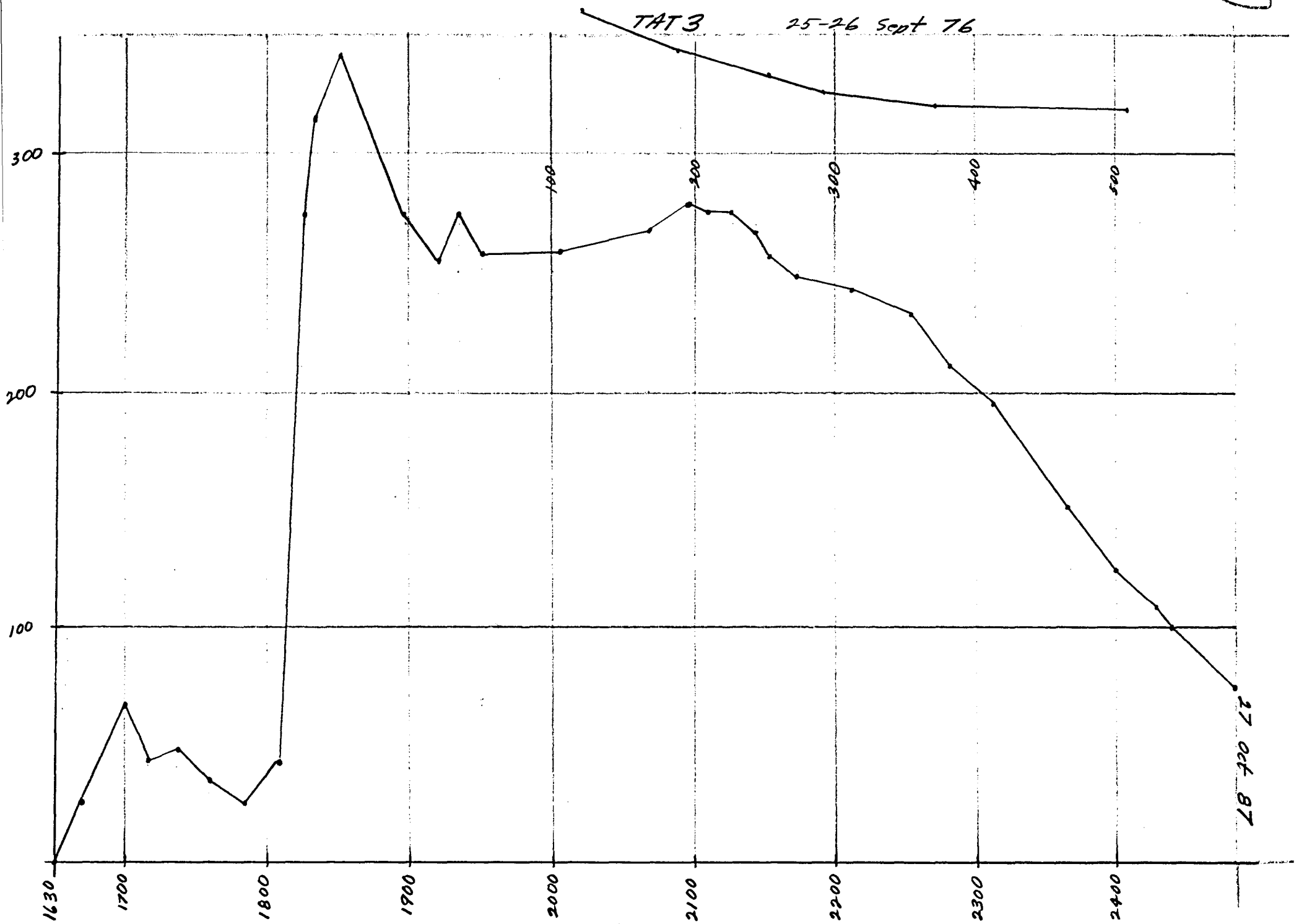

27 Oct 87
TAT 2
11 Sept 82
1900
1800
1700
1600
1500
1400
1300
1200
1100
300
200
100

TAT 2 27 Oct 87

Time	Σrain	Δrain	Q
1100	0	0	
15	.05	.05	
30	.10	.05	0
45	.33	.23	5
1200	.40	.07	25
15	.40	0	170
30	.90	.50	282
45	1.25	.35	325
1300	1.28	.03	285
15	1.42	.04	315
30			285
45			260
1400			265
15			265
30			250
45			240
1500			220
15			200
30			175
45			150
1600			125
15			110
30			95
45			85
1700			70
15			60
30			50
45			45
1800			40

TAT 2 27 Oct 87

Time	Σrain	Δrain	Q
1100	0	0	
15	.05	.05	
30	.10	.05	0
45	.33	.23	5
1200	.40	.07	25
15	.40	0	170
30	.90	.50	282
45	1.25	.35	325
1300	1.28	.03	285
15	1.42	.04	315
30			285
45			260
1400			265
15			265
30			250
45			240
1500			220
15			200
30			175
45			150
1600			125
15			110
30			95
45			85
1700			70
15			60
30			50
45			45
1800			40


TAT 3
25-26 Sept 76
300
200
100
100
200
300
400
500
1630
1700
1800
1900
2000
2100
2200
2300
2400
27 Oct 87

TAT3 27 Oct 87

25-26 Sept 76

Time	Q	Σ rain	Δ rain
1615		0	0
1630		.57	.57
45		↓	0
1700		↓	0
15		↓	0
30		↓	0
45	0	.57	0
1800	35	1.00	.43
15	275	1.30	.30
30	340	1.35	.05
45	305	1.37	.02
1900	270	1.45	.08
15	255	↓	0
30	255	1.45	0
45	255	1.55	.10
2000	255	1.60	.05
15	260	1.65	.05
30	265	1.67	.02
45	275	1.68	.01
2100	280	1.69	.01
15	275	1.70	.01
30	260		
45	245		
2200	245		
15	240		
30	235		
45	215		
2300	205		
15	185		
30	160		
45	140		
2400	125		
15	110		
30	95		
45	80		
100	70		
15	60		
30	55		
45	45		
200	40		
15	35		
30	30		
45	25		
300	25		

APPENDIX 3-F

Flood reconstitutions and worksheets, Albuquerque.

Volume label (11 characters, ENTER for none)?

Volume in drive A is ALBUQUERQUE
Directory of A:\

ANCA2	I5	394	10-20-87	12:23p
ANCA2	O5	20463	10-20-87	12:25p
AVDO1	I3	457	9-15-87	11:17a
AVDO1	O3	21948	9-15-87	11:19a
AVDO2	I2	436	9-15-87	1:31p
AVDO2	O2	21901	9-15-87	1:32p
AAA1	I5	575	10-17-87	7:11a
AAA1	O5	26079	10-17-87	7:13a
AAA2	I2	421	10-17-87	8:22a
AAA2	O2	20002	10-17-87	8:23a
ATR1	I12	474	10-19-87	8:19a
ATR1	O12	22892	10-19-87	8:21a
ALA1	I4	401	10-20-87	9:36a
ALA1	O4	26147	10-20-87	9:38a
ALA2	I2	371	10-20-87	9:53a
ALA2	O2	23422	10-20-87	9:56a
ALA3	I2	383	10-20-87	10:07a
ALA3	O2	24590	10-20-87	10:09a
ACA1	I4	367	10-20-87	11:01a
ACA1	O4	21655	10-20-87	11:03a
ACA2	I3	367	10-20-87	11:22a
ACA2	O3	22366	10-20-87	11:23a
ANCA1	I4	534	10-20-87	12:07p
ANCA1	O4	26524	10-20-87	12:09p

24 File(s) 66560 bytes free

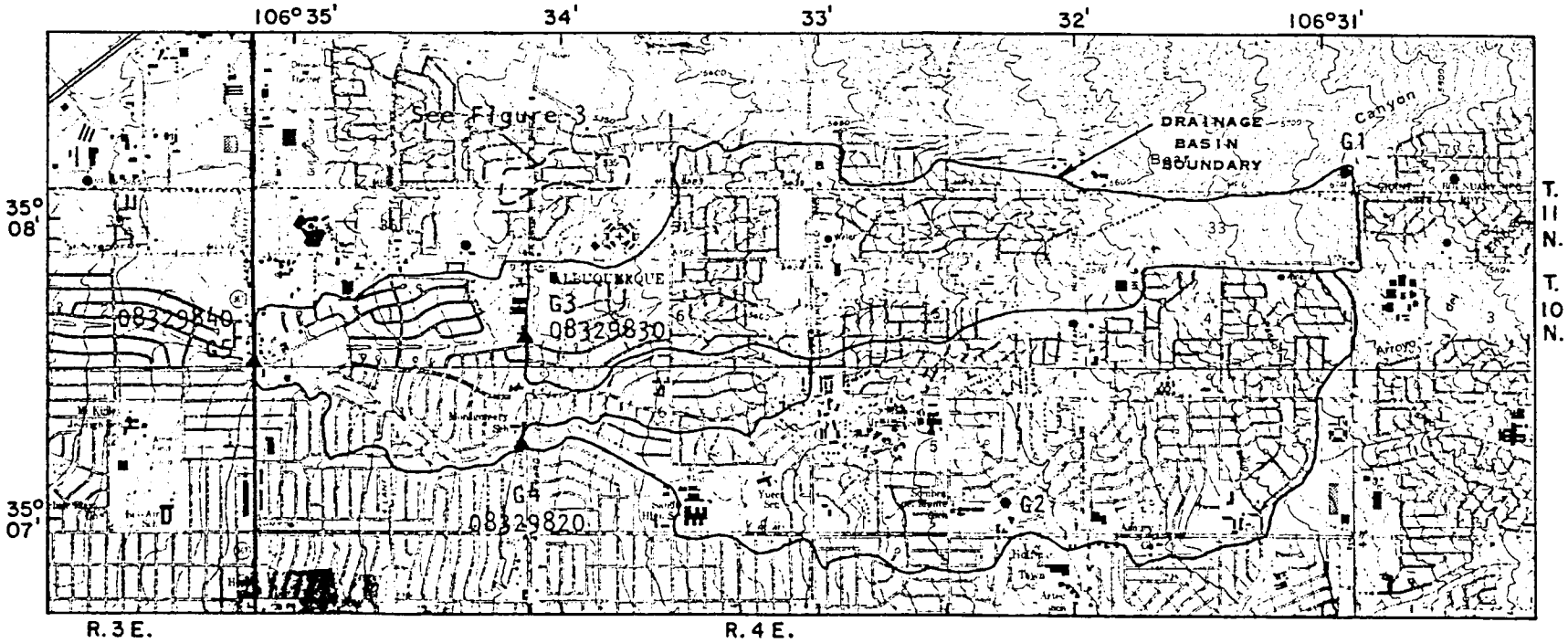
```
C>

 Volume in drive B is ALB#2
 Directory of  B:\

AHA1      I02      1738   8-25-87   5:47p
AHA1      O02     32375   8-25-87   5:49p
AHA1      I04      1737   8-25-87   6:38p
AHA1      O04     32447   8-25-87   6:41p
        4 File(s)    292864 bytes free
```

Albuquerque

Hahn Arroyo HA	14 Aug 80	2.43	5.6	5-0	1,080.	.54
Villa del Oso Drain VDØ	1 Jul 81	.74	4.6	0-25	24.	.18
	1 Aug 82	1.12	5.4	0-30	34.	.38
Academy Acres Drain AA	12 Aug 82	.63	3.8	0-50	37.	.25
LaCueva Arroyo tributary LA	6 Sep 80	1.23	4.8	1-0	37.	.26
	8 Sep 80	.74	3.4	0-45	15.	.11
	7 Jul 81	.99	5.4	0-40	18.	.18
Camino Arroyo tributary CA	6 Sep 80	1.04	5.4	1-5	80.	.39
	7 Jul 81	.98	5.4	0-55	49.	.26
N. Camino Arroyo tributary NCA	14 Aug 80	4.04	6.0	7-0	131.	.43
	7 Jul 81	.98	5.4	1-0	134.	.48
Taylor Ranch Drain TR	29 Jul 83	.58	3.6	0-45	26.	.13

Selection of Albuquerque events for data entry, tabulating and plotting

Station (1)	Date (2)	Start Time (3)	End Time (4)	# of Raingages (5)	Report (6)	pg (7)	File Name (8)
Hahn Arroyo	14 Aug 80	0305	1000	4	84-448	77	AHA1
Villa del Oso Drain	1 Jul 81	1330	1505	1		131	AVDO1
	1 Aug 82	1650	1930	1		139	AVDO2
Academy Heres Drain	12 Aug 82	1750	2230	2		179	AAA1
La Cuerva Arroyo trib.	6 Sep 80	1935	2055	1		200	ALA1
	8 Sep 80	1945	2055	1		200	ALA2
	7 Jul 81	1720	1830	1		203	ALA3
Camino Arroyo trib.	6 Sep 80	1930	2035	1		213	ACA1
	7 Jul 81	1715	1825	1		215	ACA2
N. Camino Arroyo trib.	14 Aug 80	0145	0850	1		222	ANCA1
	7 Jul 81	1715	1835	1		225	ANCA2
Taylor Ranch Drain	29 Jul 83	1400	1710	2		280	ATR1



Base from U.S. Geological Survey Alameda, 1967 and Albuquerque East, 1974, 1:24,000

0 — 1 MILE
0 — 1 KILOMETER

CONTOUR INTERVAL 10 FEET
DATUM IS SEA LEVEL

EXPLANATION

▲ G4 08329820	FLOOD-HYDROGRAPH STATION--Includes streamflow gage (08329820) and raingage (G4)
● G2	RAINGAGE AND NUMBER

Figure 2.--Drainage basins for South Fork Hahn Arroyo (08329820), North Fork Hahn Arroyo (08329830), and Hahn Arroyo (08329840).

1980

Table 5.--Station description, daily mean discharge values, monthly rainfall totals, and selected rainfall-discharge unit-value data for HAHN ARROYO AT ALBUQUERQUE (08329840), 1978-83.

STATION DESCRIPTION

LOCATION.--Lat 35 deg 07 min 31 sec, long 106 deg 35 min 10 sec, in SE1/4 NE1/4 sec. 2, T.10 N., R.3 E., Bernalillo County, Hydrologic Unit 13020203, near center of concrete lined channel on downstream side of San Mateo Blvd bridge, 750 ft (229 m) north of Comanche Rd, and 2,050 ft (625 m) south of Montgomery Blvd, in Albuquerque.

DRAINAGE AREA.--4.35 sq mi (11.3 sq km).

PERIOD OF RECORD.--June 1978 to current year (no winter records).

GAGE.--Water-stage recorder and concrete lined channel. Altitude of gage is 5,190 ft (1,581.91 m), from topographic orthophoto map.

REMARKS.--Records fair. Recording rain gage at station; up to 4 other recording rain gages in drainage basin. Development within basin is predominantly residential with some commercial areas. Most low flows in channel are nuisance flows (not rainfall related).

STAGE-DISCHARGE RELATION.--Rating developed on basis of step-backwater analysis of concrete lined stream channel and 3 discharge measurements at low flows.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,080 cu ft per sec (30.6 cu m per sec) Aug. 14, 1980, gage height 2.54 ft (0.774 m); no flow most of the time.

EXTREMES.--Maximum discharge during period June to December 1978, 819 cu ft per sec (23.2 cu m per sec) Aug. 3, gage height, 2.30 ft (0.701 m); no flow most of the time.

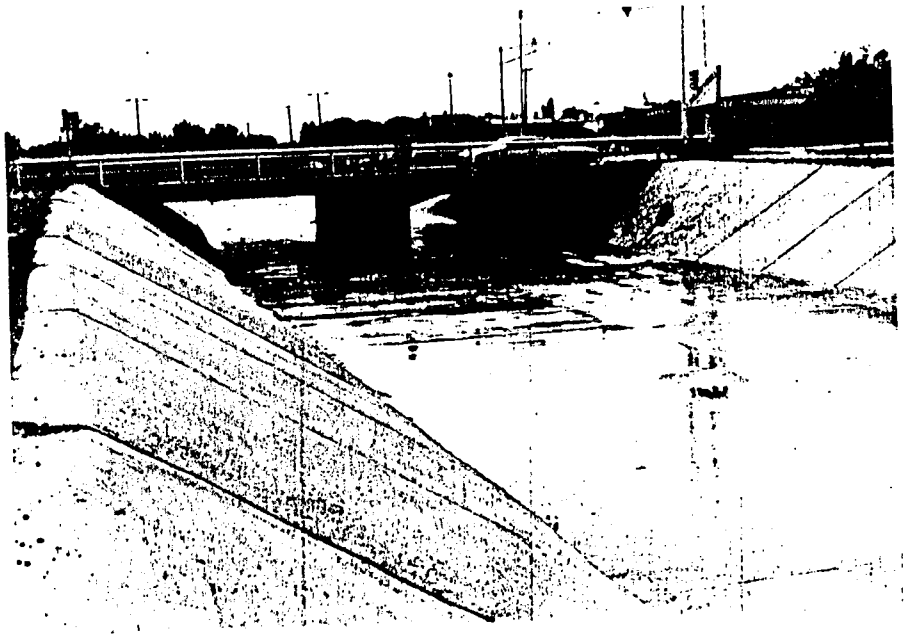
Calendar year 1979: Maximum discharge, 642 cu ft per sec (18.2 cu m per sec) Aug. 15, gage height, 2.12 ft (0.646 m); no flow most of the time.

Calendar year 1980: Maximum discharge, 1,080 cu ft per sec (30.6 cu m per sec) Aug. 14, gage height, 2.54 ft (0.774 m); no flow most of the time.

Calendar year 1981: Maximum discharge, 509 cu ft per sec (14.4 cu m per sec) Aug. 20, gage height, 1.97 ft (0.600 m); no flow most of the time.

Calendar year 1982: Maximum discharge, 892 cu ft per sec (25.3 cu m per sec) Aug. 1, gage height, 2.37 ft (0.722 m); no flow most of the time.

Calendar year 1983: Maximum discharge, 242 cu ft per sec (6.85 cu m per sec) June 25, gage height, 1.61 ft (0.491 m); no flow most of the time.



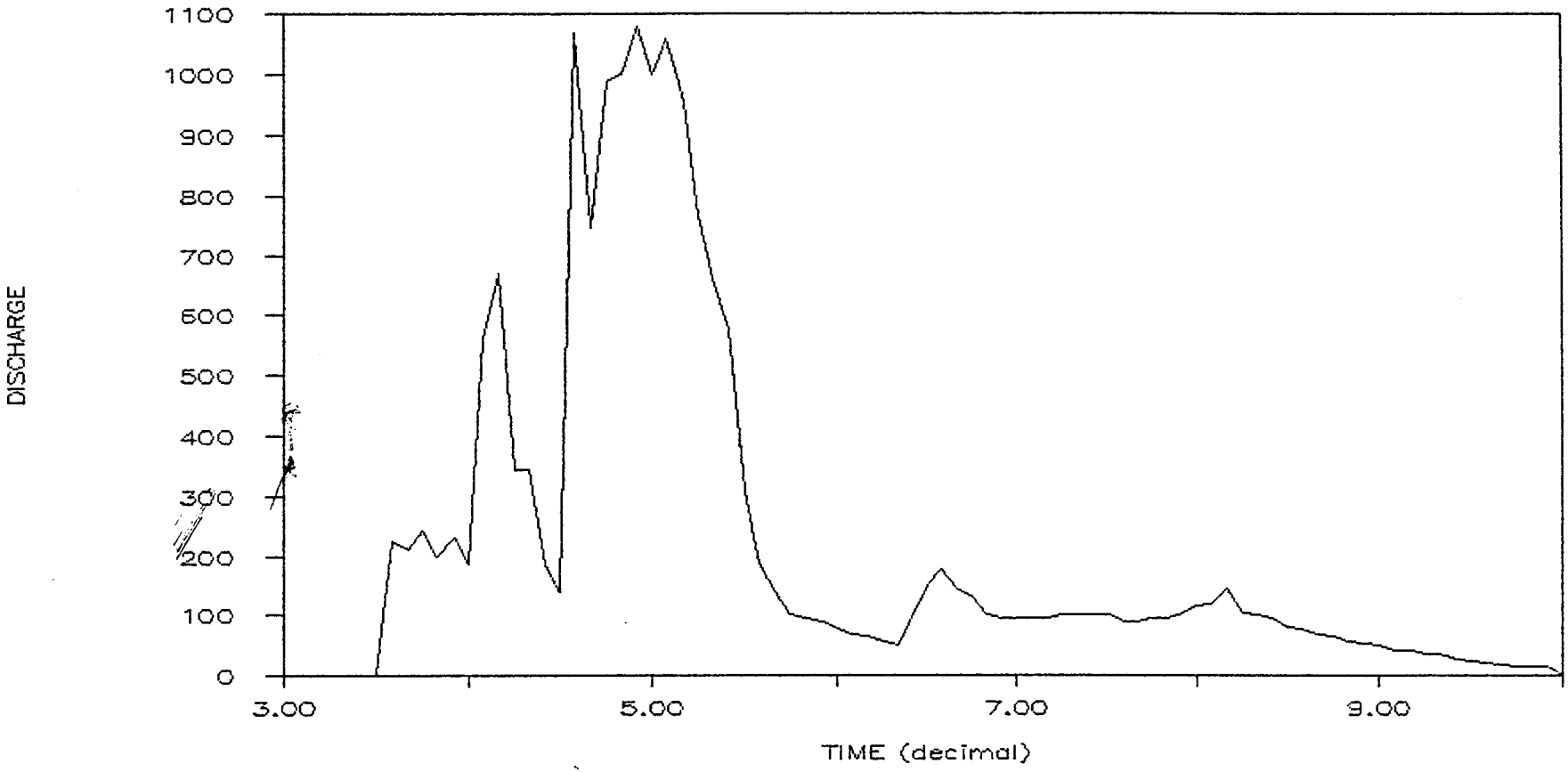
Photograph 6.--Hahn Arroyo (08329840). Direction of view is upstream.

ALBUQUERQUE DATA HAHN ARROYO 14-AUG-80

TIME	Q	P2	SUM P2	P3	SUMP3	P4	SUMP4	P5	SUM P5
305	0.00	0.00	0.00	0	0	0	0	0	0
310	0.00	0.02	0.02	0	0	0	0	0	0
315	0.00	0.09	0.11	0.01	0.01	0	0	0	0
320	0.00	0.16	0.27	0.03	0.04	0	0	0	0
325	0.00	0.02	0.29	0.04	0.08	0	0	0	0
330	0.00	0.04	0.33	0.03	0.11	0.01	0.01	0	0
335	224.00	0.14	0.47	0.01	0.12	0.01	0.02	0	0
340	212.00	0.11	0.58	0	0.12	0.01	0.03	0	0
345	242.00	0.23	0.81	0	0.12	0	0.03	0	0
350	200.00	0.28	1.09	0.06	0.18	0	0.03	0.01	0.01
355	230.00	0.21	1.30	0.12	0.3	0.05	0.08	0.08	0.09
400	188.00	0.11	1.41	0.09	0.39	0.1	0.18	0.1	0.19
405	561.00	0.04	1.45	0.14	0.53	0.06	0.24	0.1	0.29
410	671.00	0.15	1.60	0.16	0.69	0.1	0.34	0.06	0.35
415	343.00	0.26	1.86	0.15	0.84	0.12	0.46	0.05	0.4
420	343.00	0.04	1.90	0.16	1	0.12	0.58	0.07	0.47
425	188.00	0.01	1.91	0.16	1.16	0.16	0.74	0.15	0.62
430	140.00	0.08	1.99	0.13	1.29	0.15	0.89	0.23	0.85
435	1070.00	0.15	2.14	0.11	1.4	0.14	1.03	0.21	1.06
440	748.00	0.14	2.28	0.1	1.5	0.11	1.14	0.15	1.21
445	989.00	0.11	2.39	0.12	1.62	0.11	1.25	0.1	1.31
450	1000.00	0.09	2.48	0.11	1.73	0.11	1.36	0.05	1.36
455	1080.00	0.05	2.53	0.06	1.79	0.12	1.48	0.07	1.43
500	1000.00	0.03	2.56	0.03	1.82	0.06	1.54	0.04	1.47
505	1060.00	0.02	2.58	0.03	1.85	0.04	1.58	0.02	1.49
510	956.00	0.01	2.59	0.02	1.87	0.04	1.62	0.03	1.52
515	768.00	0.02	2.61	0.01	1.88	0.02	1.64	0.02	1.54
520	661.00	0.01	2.62	0.01	1.89	0.01	1.65	0.01	1.55
525	578.00	0.01	2.63	0.01	1.9	0.02	1.67	0.02	1.57
530	307.00	0.01	2.64	0.01	1.91	0.01	1.68	0.01	1.58
535	188.00	0.00	2.64	0.01	1.92	0.01	1.69	0.01	1.59
540	140.00	0.00	2.64	0	1.92	0	1.69	0	1.59
545	100.00	0.00	2.64	0	1.92	0.01	1.7	0	1.59
550	95.00	0.00	2.64	0	1.92	0	1.7	0.01	1.6
555	90.00	0.01	2.65	0.01	1.93	0	1.7	0	1.6
600	78.00	0.01	2.66	0	1.93	0	1.7	0	1.6
605	70.00	0.04	2.70	0	1.93	0	1.7	0.01	1.61
610	66.00	0.06	2.76	0	1.93	0.01	1.71	0	1.61
615	58.00	0.06	2.82	0.01	1.94	0	1.71	0	1.61
620	50.00	0.06	2.88	0.02	1.96	0	1.71	0.01	1.62
625	100.00	0.04	2.92	0.01	1.97	0.01	1.72	0	1.62
630	150.00	0.01	2.93	0.01	1.98	0.01	1.73	0.01	1.63
635	177.00	0.01	2.94	0.02	2	0	1.73	0.01	1.64
640	145.00	0.01	2.95	0.02	2.02	0.01	1.74	0.01	1.65
645	130.00	0.02	2.97	0.03	2.05	0.01	1.75	0.02	1.67
650	100.00	0.03	3.00	0.02	2.07	0.02	1.77	0.01	1.68
655	95.00	0.03	3.03	0.03	2.1	0.02	1.79	0.01	1.69
700	95.00	0.02	3.05	0.03	2.13	0.02	1.81	0.02	1.71
705	95.00	0.01	3.06	0.02	2.15	0.02	1.83	0.02	1.73
710	95.00	0.01	3.07	0.02	2.17	0.02	1.85	0.02	1.75
715	100.00	0.02	3.09	0.02	2.19	0.02	1.87	0	1.75
720	100.00	0.01	3.10	0	2.19	0.01	1.88	0.01	1.76
725	100.00	0.01	3.11	0.01	2.2	0.01	1.89	0	1.76

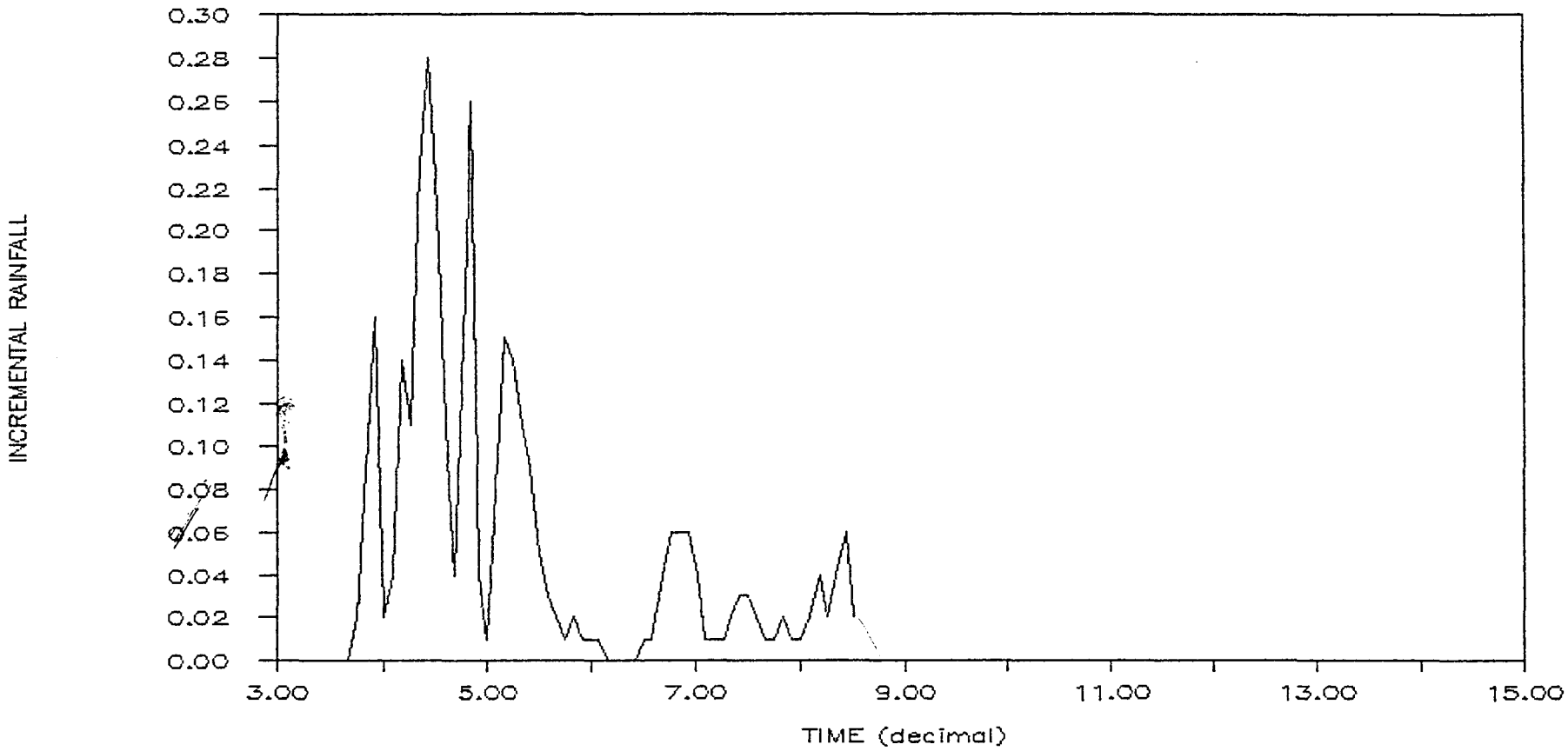
730	100.00	0.02	3.13	0.02	2.22	0.01	1.9	0	1.76
735	90.00	0.04	3.17	0.01	2.23	0.01	1.91	0.01	1.77
740	90.00	0.02	3.19	0.02	2.25	0.02	1.93	0.01	1.78
745	95.00	0.04	3.23	0.01	2.26	0.02	1.95	0.01	1.79
750	95.00	0.06	3.29	0.02	2.28	0.02	1.97	0.01	1.8
755	105.00	0.02	3.31	0.01	2.29	0.01	1.98	0	1.8
800	115.00	0.01	3.32	0.01	2.3	0.02	2	0.01	1.81
805	120.00	0.01	3.33	0.01	2.31	0.01	2.01	0.01	1.82
810	145.00	0.01	3.34	0.01	2.32	0	2.01	0.01	1.83
815	105.00	0.01	3.35	0.01	2.33	0.01	2.02	0	1.83
820	100.00	0.01	3.36	0.01	2.34	0.01	2.03	0.01	1.84
825	95.00	0.01	3.37	0.01	2.35	0	2.03	0	1.84
830	82.00	0.01	3.38	0.01	2.36	0.01	2.04	0	1.84
835	78.00	0.00	3.38	0.01	2.37	0.01	2.05	0	1.84
840	70.00	0.00	3.38	0	2.37	0	2.05	0	1.84
845	66.00	0.01	3.39	0	2.37	0.01	2.06	0	1.84
850	58.00	0.00	3.39	0	2.37	0	2.06	0	1.84
855	54.00	0.00	3.39	0	2.37	0	2.06	0	1.84
900	50.00	0.00	3.39	0	2.37	0	2.06	0	1.84
905	43.00	0.00	3.39	0	2.37	0	2.06	0.01	1.85
910	43.00	0.00	3.39	0	2.37	0	2.06	0	1.85
915	37.00	0.00	3.39	0	2.37	0	2.06	0	1.85
920	37.00	0.00	3.39	0	2.37	0	2.06	0	1.85
925	28.00	0.00	3.39	0.01	2.38	0	2.06	0	1.85
930	25.00	0.00	3.39	0	2.38	0	2.06	0	1.85
935	22.00	0.00	3.39	0	2.38	0	2.06	0	1.85
940	20.00	0.00	3.39	0	2.38	0	2.06	0	1.85
945	17.00	0.00	3.39	0	2.38	0	2.06	0	1.85
950	15.00	0.00	3.39	0	2.38	0	2.06	0	1.85
955	15.00	0.00	3.39	0	2.38	0	2.06	0	1.85
1000	0.00	0.00	3.39	0	2.38	0	2.06	0	1.85

HAHN ARROYO


DISCHARGE
1100
1000
900
800
700
600
500
400
300
200
100
0
3.00
5.00
7.00
9.00
TIME (decimal)

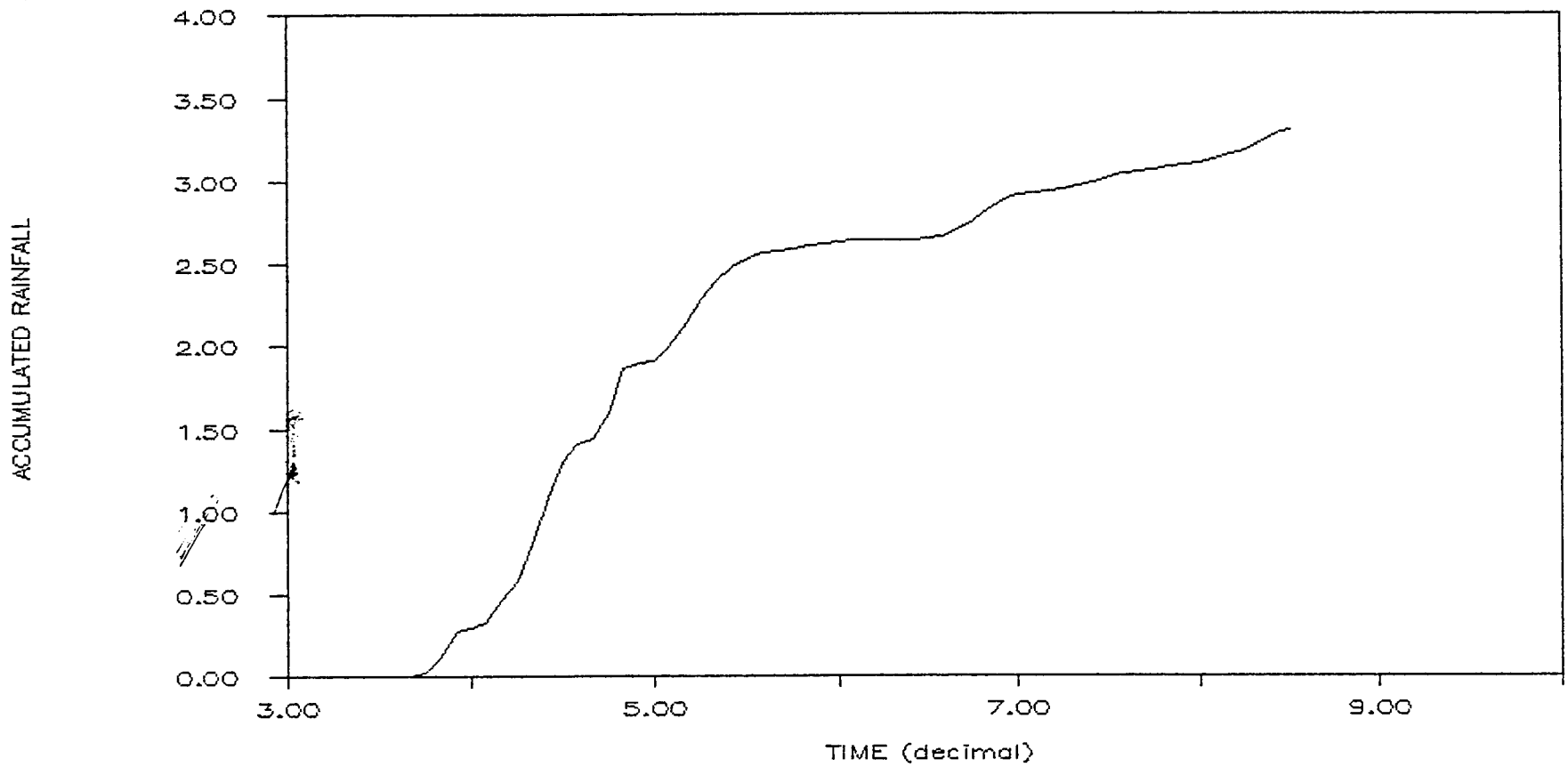
HAHN ARROYO

Gage 2



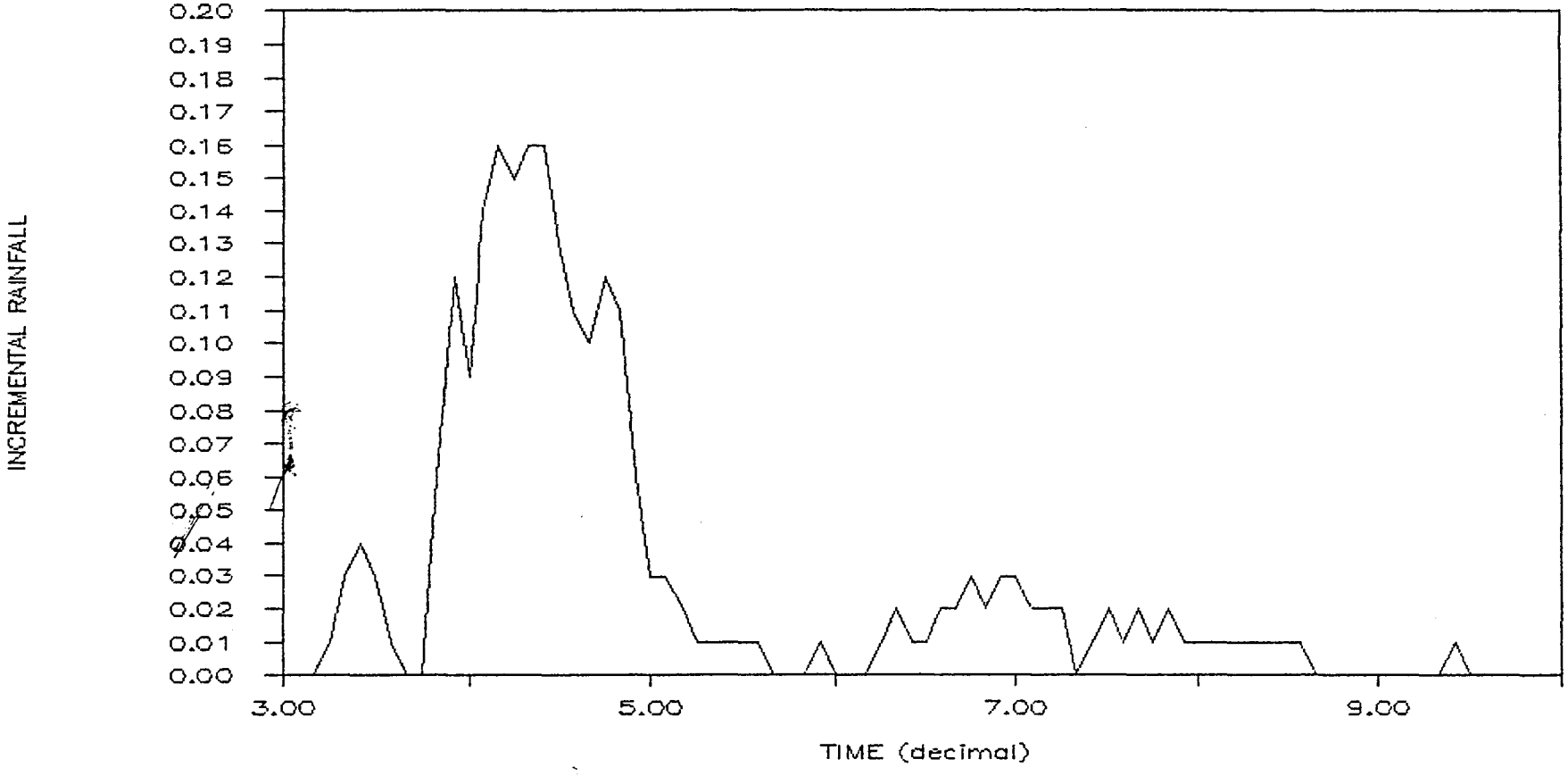
HAHN ARROYO

GAGE 2



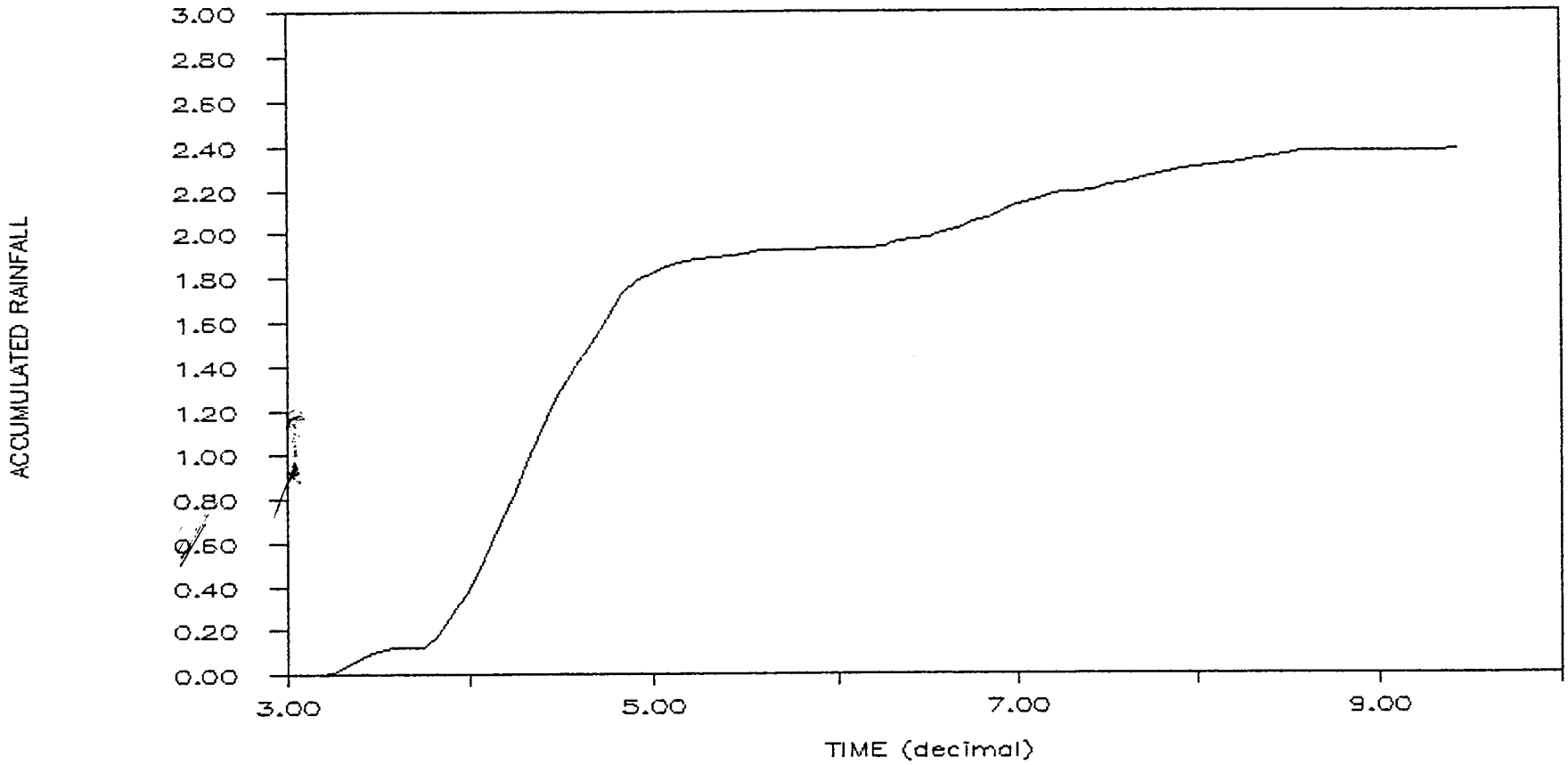
HAHN ARROYO

GAGE 3



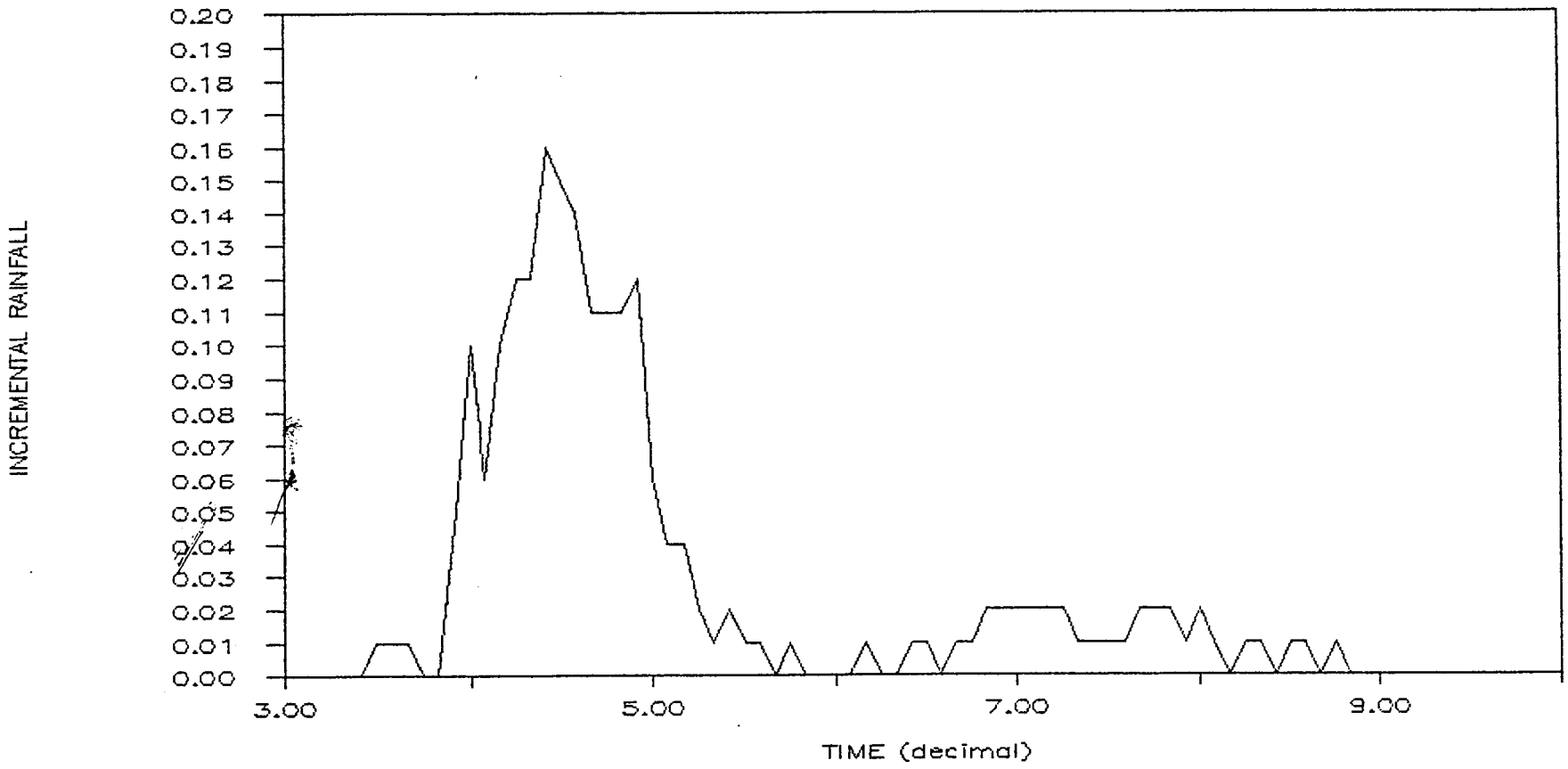
HAHN ARROYO

GAGE 3



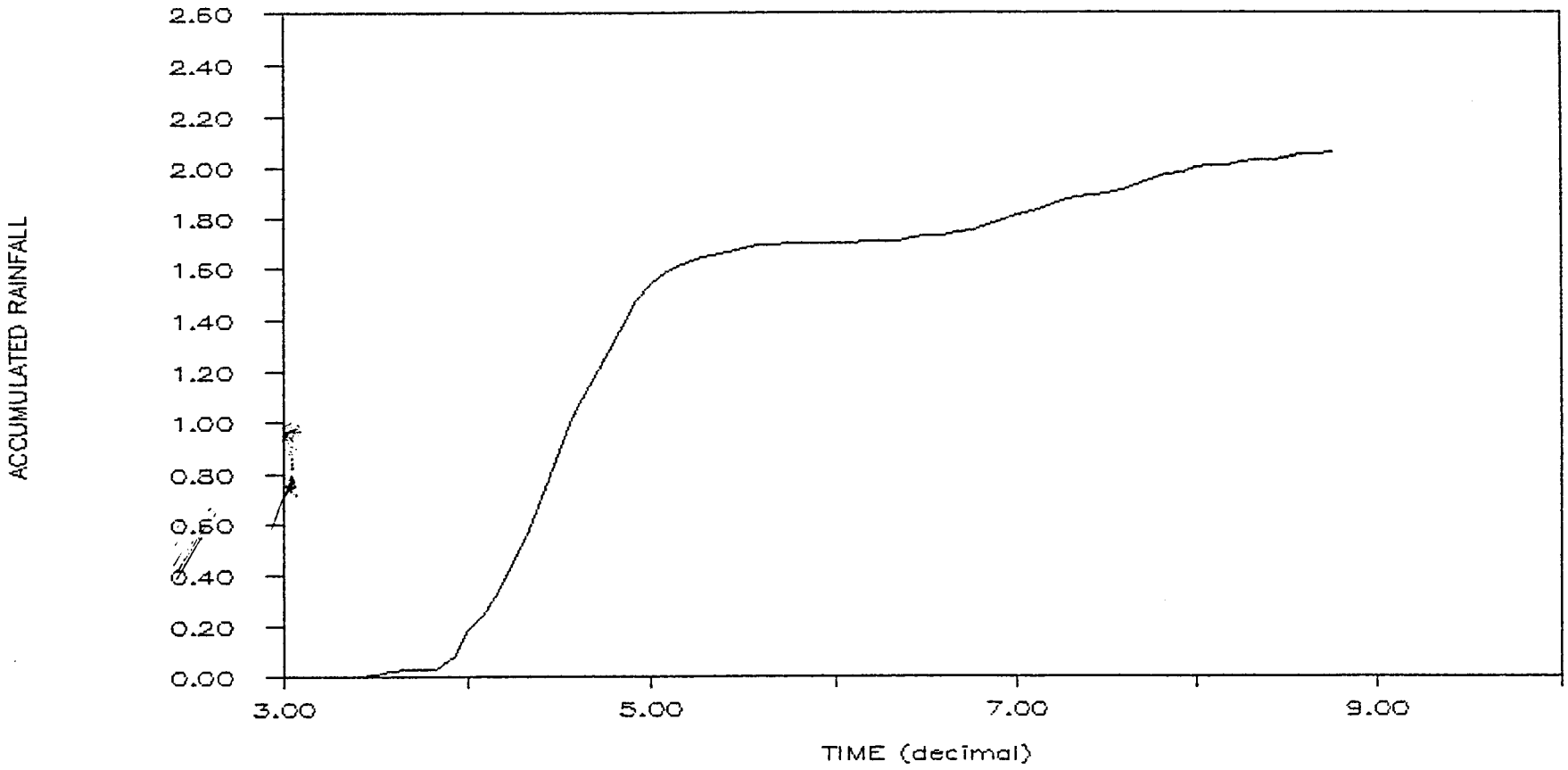
HAHN ARROYO

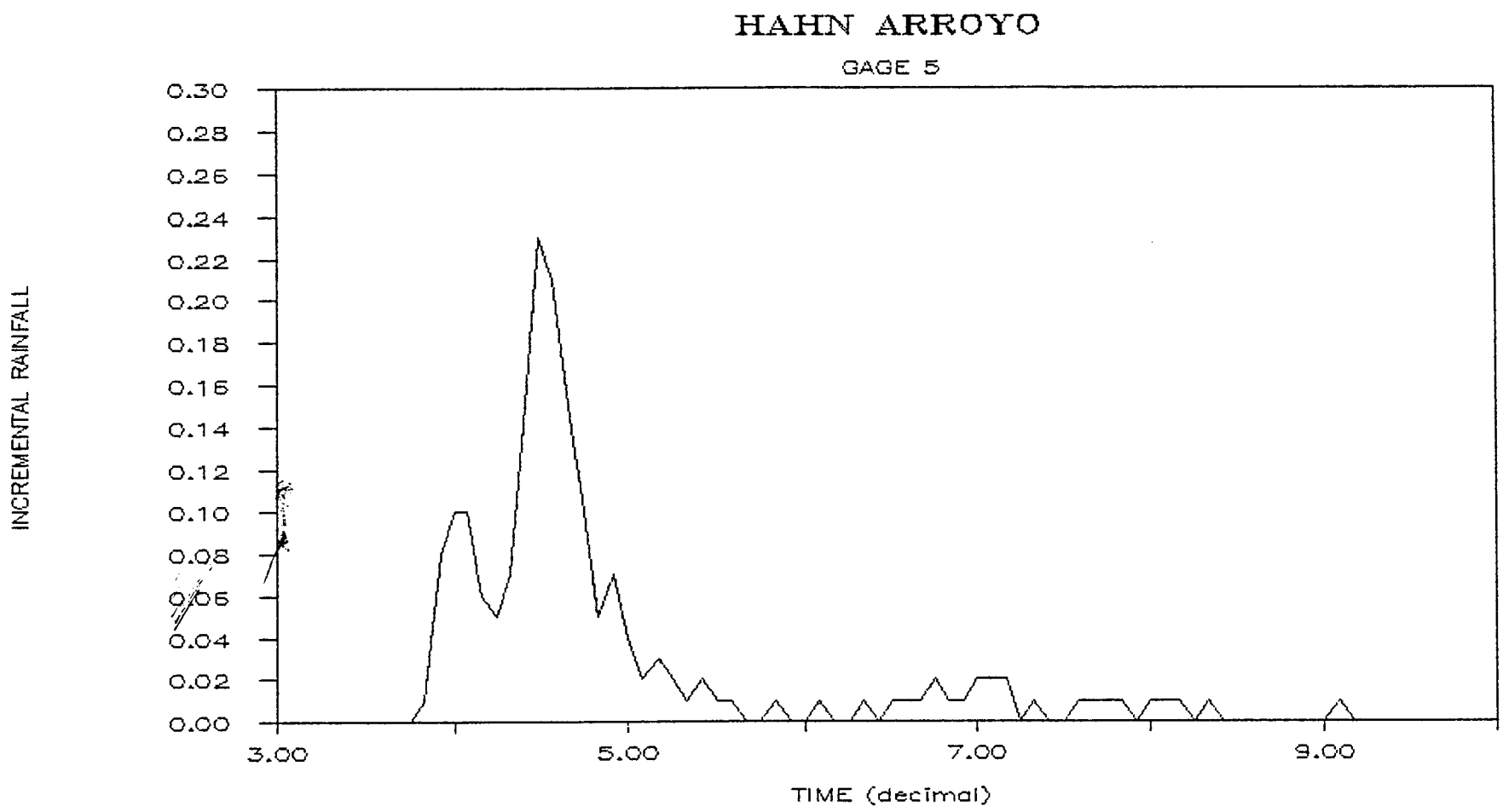
GAGE 4



HAHN ARROYO

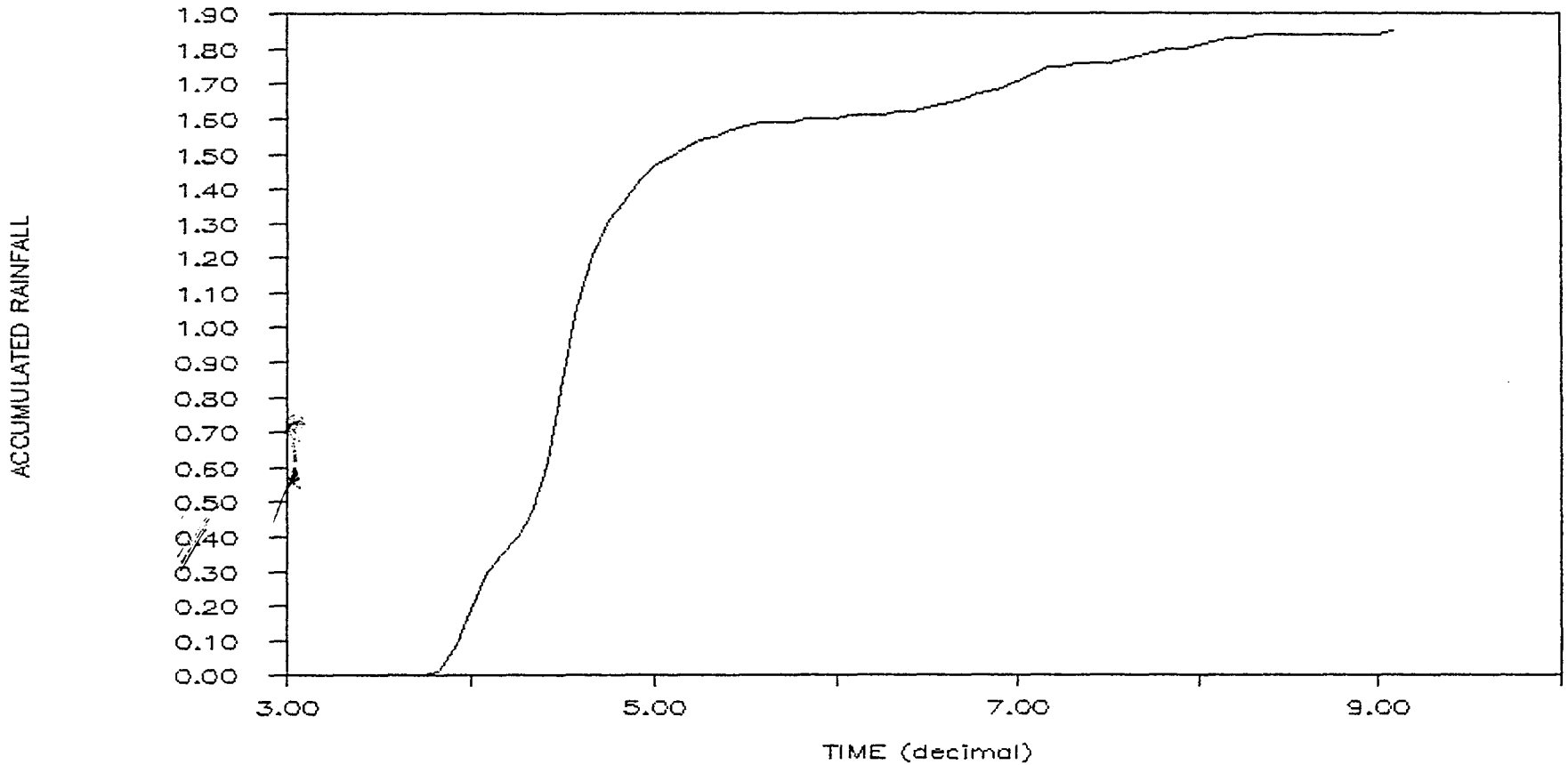
GAGE 4




HAHN ARROYO
GAGE 5
INCREMENTAL RAINFALL
0.30
0.28
0.26
0.24
0.22
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
3.00
5.00
7.00
9.00
TIME (decimal)

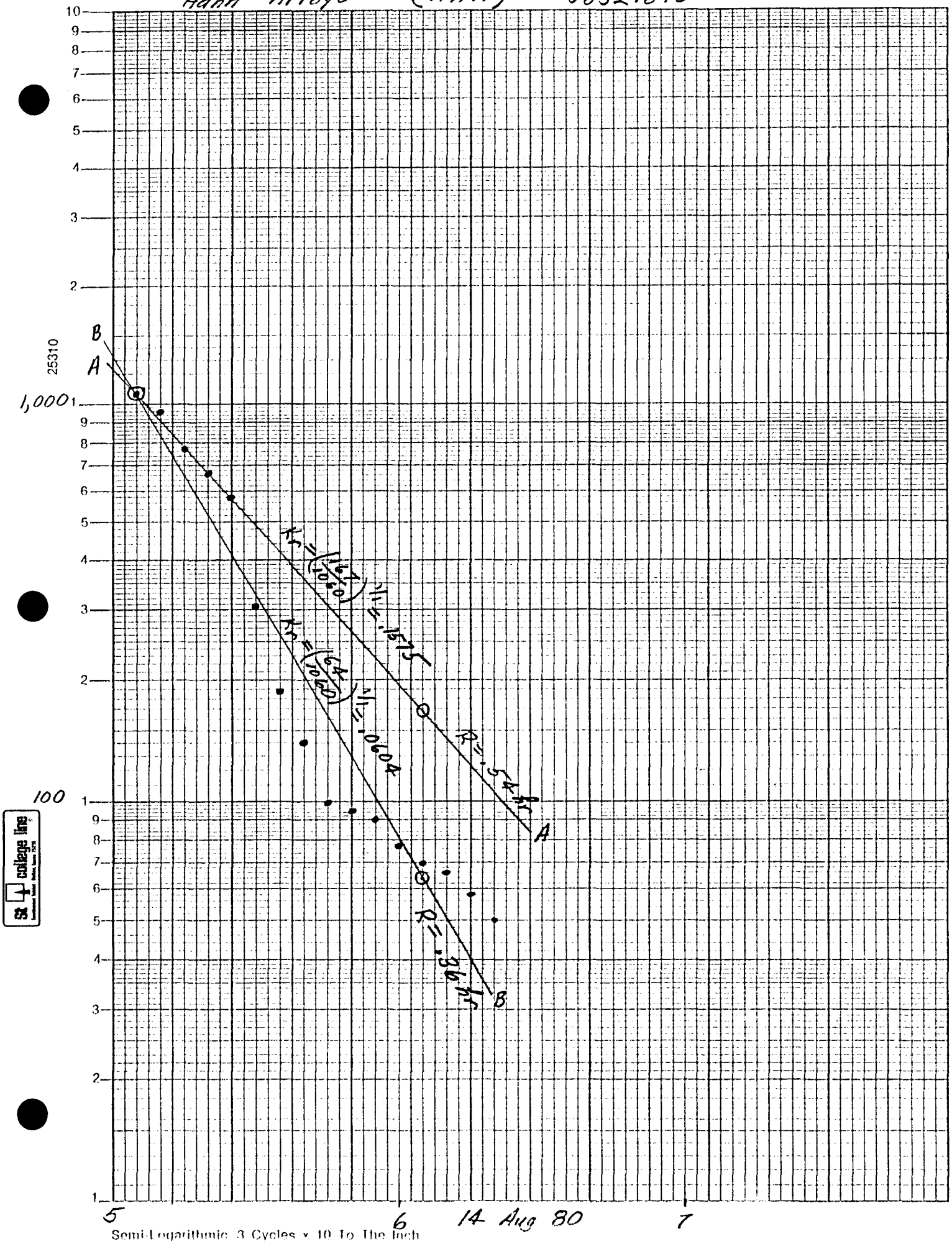
HAHN ARROYO

GAGE 5



Hahn Arroyo (AHA) 08329840

21 Aug 87



Flood Reconstitution for Albuquerque Villa del Oso AVDØ1

Storm Event 1 July 81

Runoff: depth = .18 inches, Q_p = 24 cfs at t_p = .25 hours

$R_{recession}$ = .15 hrs

INPUT (1) Area acres	(2) Eff. Imp. Area %	(3) Rain in.	(4) Comp. Inter. min.	(5) Time-Area	(6)	Results (7) Q_p cfs	(8) t_p hr.	(9) T_c hr.	(10) R hr.	(11) STRTL in.	(12) CNSTL in/hr	(13) Output File	(14) Comment
33.3	40	.50	5	D	runoff = 1.09 x rainfall	24	.25	.09	.11	1.21	.12	Ø1	imp. area too large
"	16.4	"	1	D		27	.25	.02	.12	.33	.27	Ø3	← best
"	"	"	"	U-4		"	"	"	"	"	"	Ø4	no change because of short T_c
"	"	"	"	U-1		"	"	"	"	"	"	Ø5	

Flood Reconstitution for Albuquerque Villa del Oso AVDØ 2

Storm Event 1 Aug 82

Runoff: depth = .39 inches, Q_p = 34 cfs at t_p = .33 hours

$R_{recession}$ = .19 hrs

INPUT (1) Area acres	(2) Eff. Imp. Area %	(3) Rain in.	(4) Comp. Inter. min.	(5) Time-Area	(6)	Results (7) Q_p cfs	(8) t_p hr.	(9) T_c hr.	(10) R hr.	(11) STRTL in.	(12) CNSTL in/hr	(13) Output File	(14) Comment
33.3	40	1.12	5	D	runoff = 1.15 × rainfall	34	.42	.15	.14	1.49	.15	Ø1	
"	16.4	"	2	"		36	.40	.03	.17	.56	1.32	Ø2	changing T-A will not change results because of short T_c ← best

Table 6.--Station description, daily mean discharge values, monthly rainfall totals, and selected rainfall-discharge unit-value data for VILLA DEL OSO DRAIN AT ALBUQUERQUE (08329860), 1976-83.

STATION DESCRIPTION

LOCATION.--Lat 35 deg 08 min 04 sec, long 106 deg 34 min 16 sec, in SE1/4 SE1/4 sec.36, T.11 N., R.3 E., Bernalillo County, Hydrologic Unit 13020203, on left bank 60 ft (18 m) west of northwest corner of parking lot for apartments at 4215 Louisiana Blvd NE and 1,550 ft (472 m) northwest of intersection of Montgomery and Louisiana Blvd, in Albuquerque.

DRAINAGE AREA.--0.052 sq mi (0.135 sq km).

PERIOD OF RECORD.--June 1976 to December 1978, May 1979 to current year (no winter records).

GAGE.--Water-stage recorder and concrete control. Altitude 5,302 ft (1,616.05 m), from topographic orthophoto map.

REMARKS.--Records good. Recording rain gage at station. Basin drains residential area.

STAGE-DISCHARGE RELATION.--Rating developed based on point of zero flow, 17 discharge measurements between discharges 0.17 cu ft per sec (0.005 cu m per sec) and 4.5 cu ft per sec (0.13 cu m per sec) and slope-area measurement at discharge of 30 cu ft per sec (0.85 cu m per sec).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 34 cu ft per sec (0.963 cu m per sec) Aug. 1, 1982, gage height, 2.14 ft (0.652 m), from rating curve extended above 5.0 cu ft per sec (0.14 cu m per sec) on basis of slope-area measurement at gage height 2.06 ft (0.628 m); no flow most of the time.

EXTREMES.--Maximum discharge during period June to December 1976, 17 cu ft per sec (0.481 cu m per sec) Aug. 12, gage height, 1.84 ft (0.561 m); no flow most of the time.

Calendar year 1977: Maximum discharge, 8.1 cu ft per sec (0.229 cu m per sec) Sept. 4, gage height, 1.62 ft (0.494 m); no flow most of the time.

Calendar year 1978: Maximum discharge, 30 cu ft per sec (0.850 cu m per sec) Aug. 3, gage height, 2.06 ft (0.628 m); no flow most of the time.

Calendar year 1979: Maximum discharge, 8.1 cu ft per sec (0.229 cu m per sec) July 17, gage height, 1.62 ft (0.494 m); no flow most of the time.

Calendar year 1980: Maximum discharge, 28 cu ft per sec (0.793 cu m per sec) Aug. 14, gage height, 2.05 ft (0.625 m); no flow most of the time.

Calendar year 1981: Maximum discharge, 24 cu ft per sec (0.680 cu m per sec) July 1, gage height, 1.99 ft (0.607 m); no flow most of the time.

Calendar year 1982: Maximum discharge, 34 cu ft per sec (0.963 cu m per sec) Aug. 1, gage height, 2.14 ft (0.652 m); no flow most of the time.

Calendar year 1983: Maximum discharge, 28 cu ft per sec (0.793 cu m per sec) June 25, gage height, 2.05 ft (0.625 m); no flow most of the time.

Photograph 8.--Villa del Oso Drain (08329860). Direction of view is upstream.

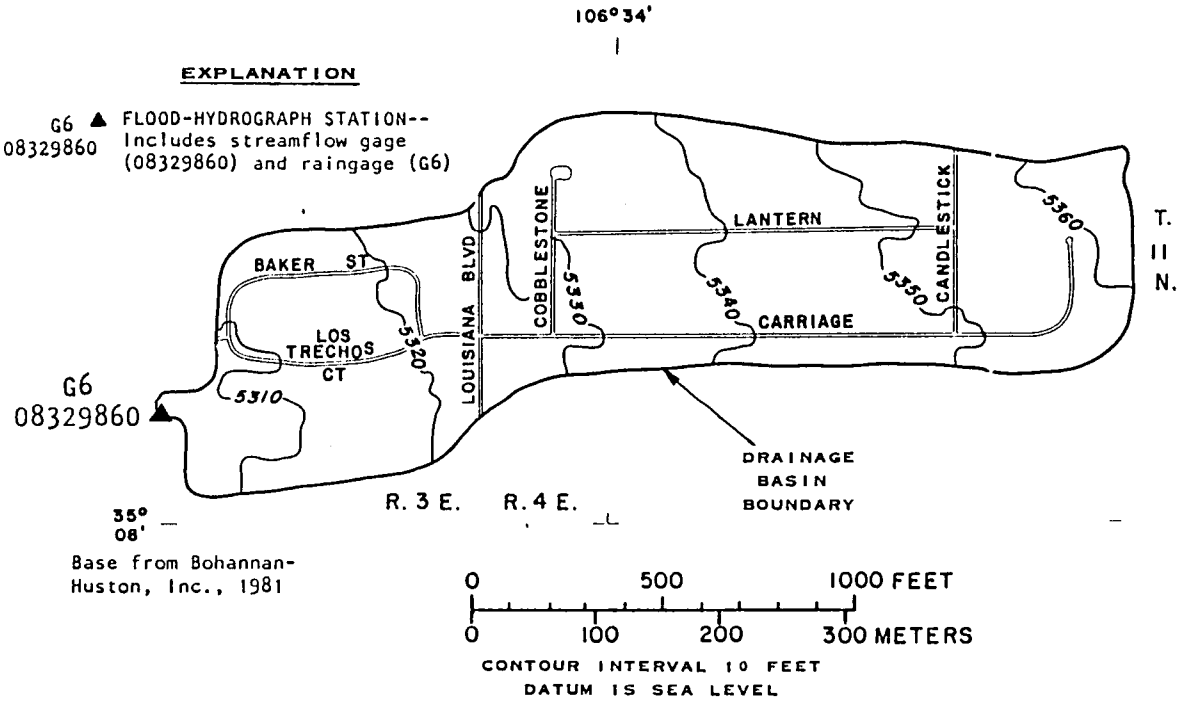


Figure 3.--Drainage basin for Villa del Oso Drain (08329860).

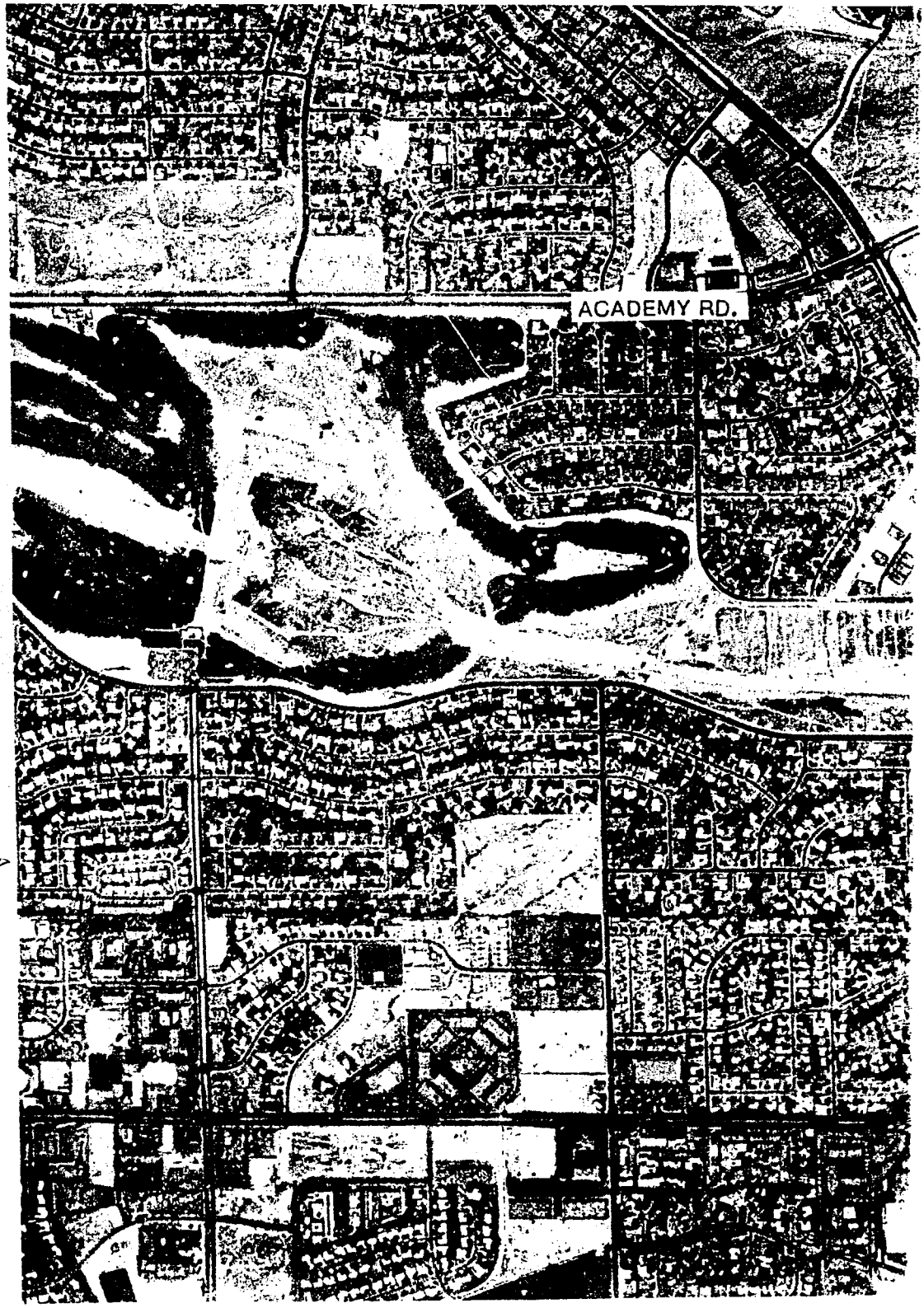
1981
1982

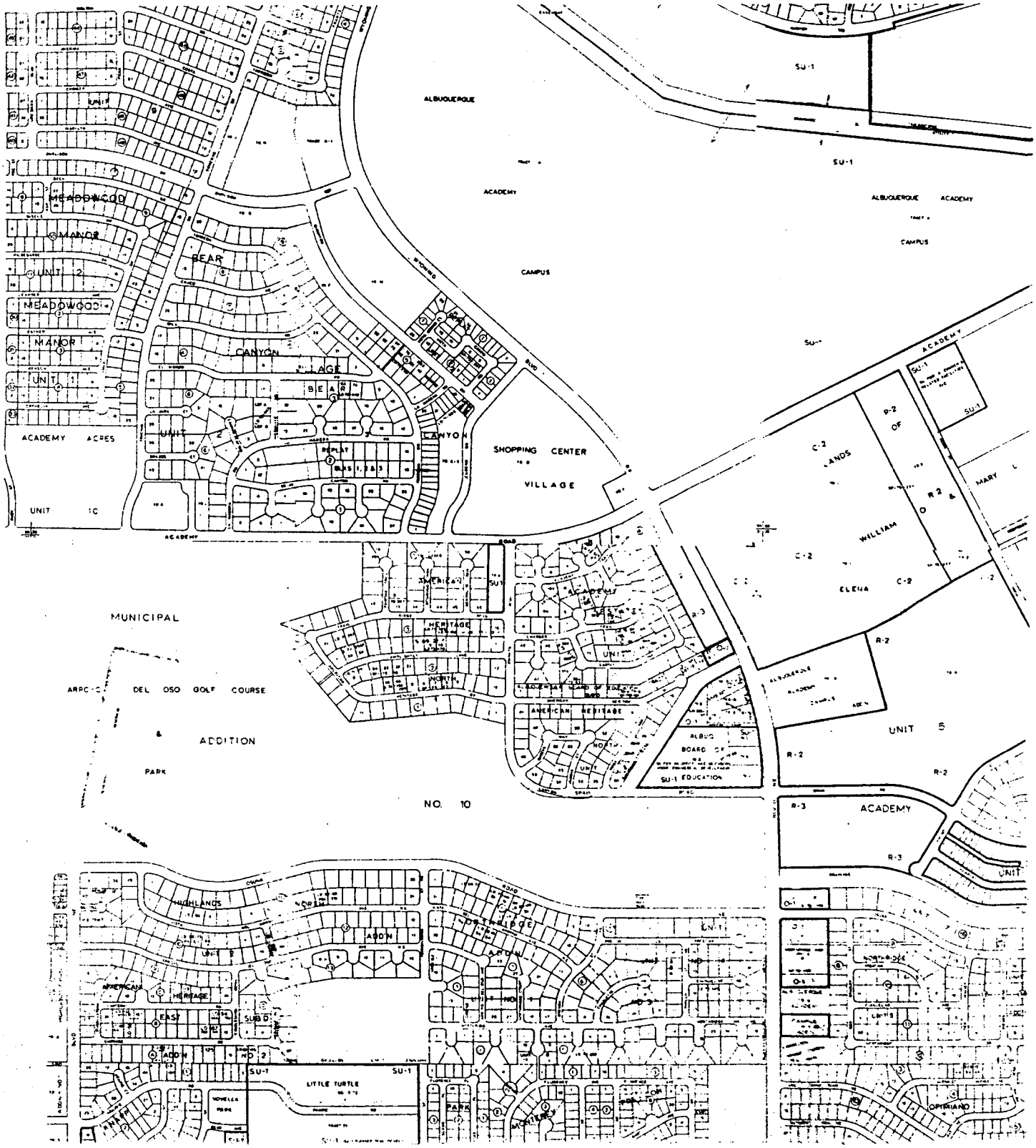
	2	1
0	11	12
5	14	13
2	23	24
7	26	25
4	35	36

R4E

Villa del Oso
1982

17



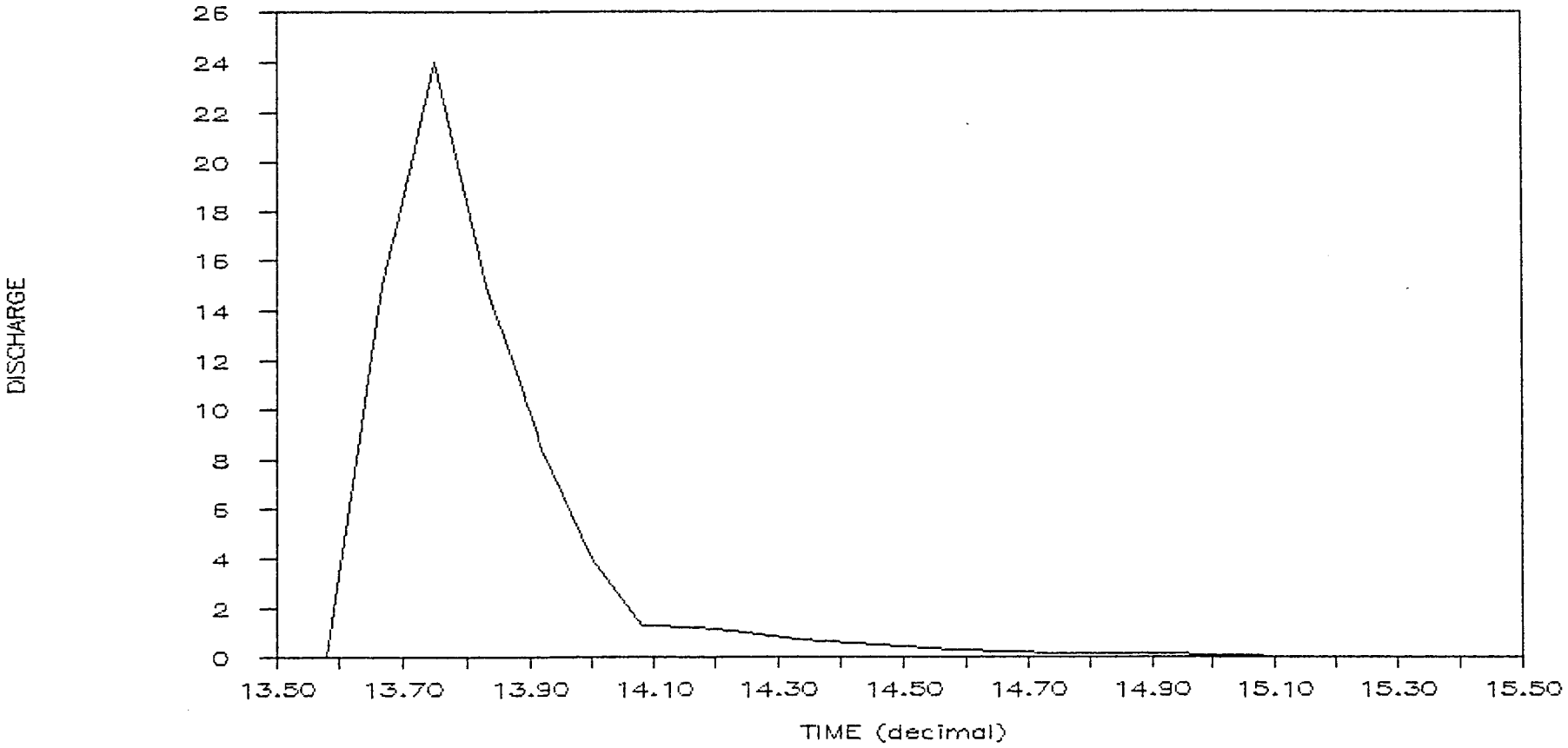

ALBUQUERQUE
ACADEMY
CAMPUS
ALBUQUERQUE ACADEMY
SU-1
MEADOWOOD
MANOR
UNIT 2
BEAR
CANYON
VILLAGE
ACADEMY ACRES
UNIT 1C
SHOPPING CENTER
VILLAGE
ACADEMY
MUNICIPAL
DEL OSO GOLF COURSE
ADDITION
PARK
NO. 10
HERITAGE
NORTH
AMERICAN HERITAGE
ALBUQ BOARD OF EDUCATION
SU-1 EDUCATION
WILLIAM
ELENA
R-2
R-3
C-2
UNIT 5
HIGHLANDS
ADD'N
NORTHRIDGE
EAST
SUBD
LITTLE TURTLE
OPTIMIND

	DATE	TIME	Q	P6	SUM P6
VILLA DEL OSO DRAIN	01-Jul-81	1330	0.00	0.00	0.00
		1335	0.00	0.10	0.10
		1340	15.00	0.23	0.33
		1345	24.00	0.14	0.47
		1350	15.00	0.02	0.49
		1355	8.40	0.01	0.50
		1400	4.00	0.00	0.50
		1405	1.30	0.00	0.50
		1410	1.20	0.00	0.50
		1415	1.00	0.00	0.50
		1420	0.74	0.00	0.50
		1425	0.59	0.00	0.50
		1430	0.47	0.00	0.50
		1435	0.32	0.00	0.50
		1440	0.24	0.00	0.50
		1445	0.18	0.00	0.50
		1450	0.16	0.00	0.50
		1455	0.14	0.00	0.50
		1500	0.12	0.00	0.50
		1505	0.10	0.00	0.50
		1510	0.0		

	DATE	TIME	Q	P6	SUM P6
VILLA DEL OSO DRAIN	01-Aug-82	1650	0.00	0.00	0.00
		1655	0.00	0.07	0.07
		1700	0.00	0.26	0.33
		1705	10.00	0.27	0.60
		1710	34.00	0.22	0.82
		1715	33.00	0.23	1.05
		1720	28.00	0.03	1.08
		1725	17.00	0.00	1.08
		1730	9.40	0.01	1.09
		1735	6.30	0.00	1.09
		1740	4.40	0.00	1.09
		1745	3.10	0.00	1.09
		1750	2.10	0.00	1.09
		1755	1.40	0.01	1.10
		1800	0.91	0.01	1.11
		1805	0.74	0.00	1.11
		1810	0.53	0.01	1.12
		1815	0.41	0.00	1.12
		1820	0.27	0.00	1.12
		1825	0.27	0.00	1.12
		1830	0.16	0.00	1.12
		1835	0.12	0.00	1.12
		1840	0.09	0.00	1.12
		1845	0.08	0.00	1.12
		1850	0.07	0.00	1.12
		1855	0.06	0.00	1.12
		1900	0.05	0.00	1.12
		1905	0.04	0.00	1.12
		1910	0.03	0.00	1.12
		1915	0.03	0.00	1.12
		1920	0.02	0.00	1.12
		1925	0.02	0.00	1.12
		1930	0.00	0.00	1.12

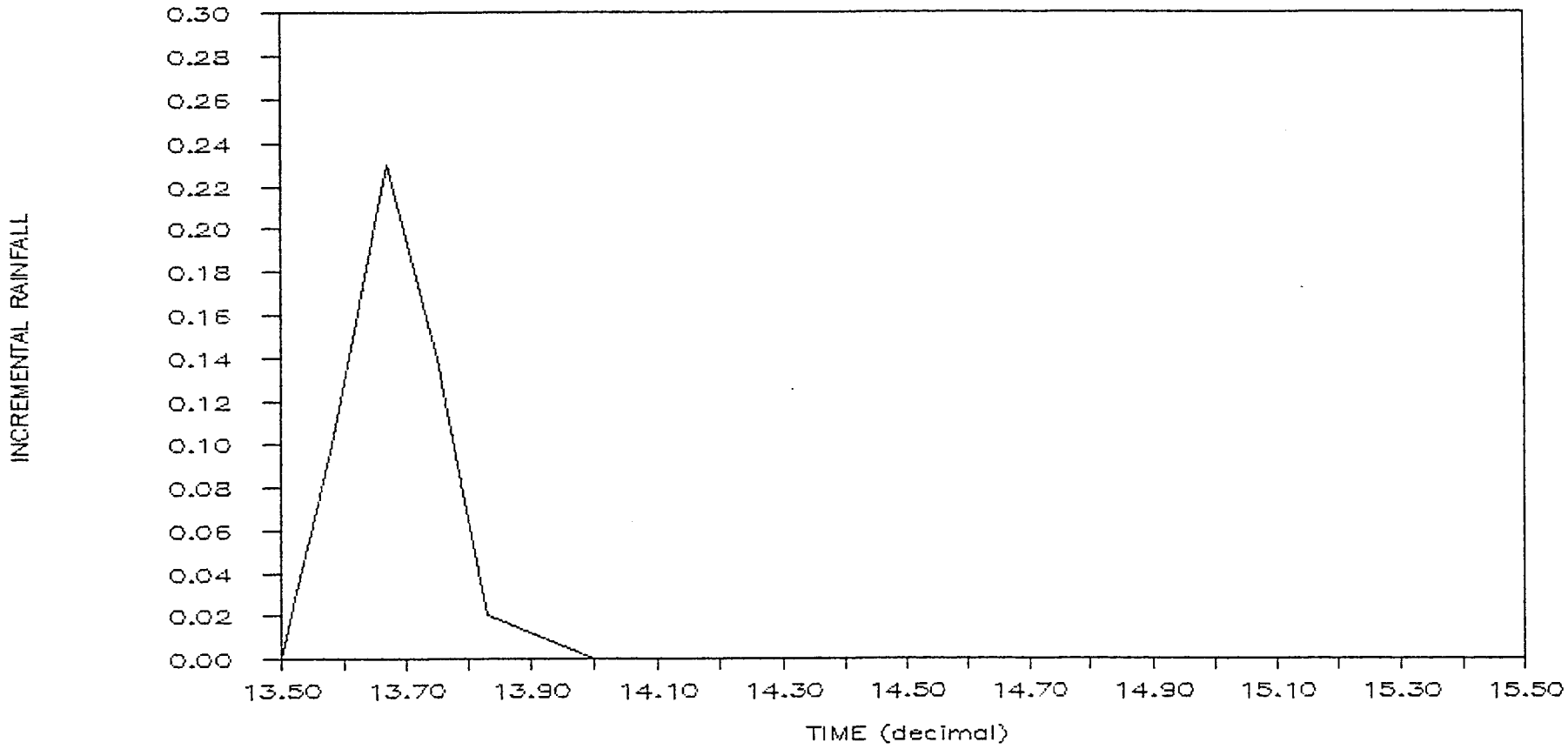
VILLA del OSO DRAIN

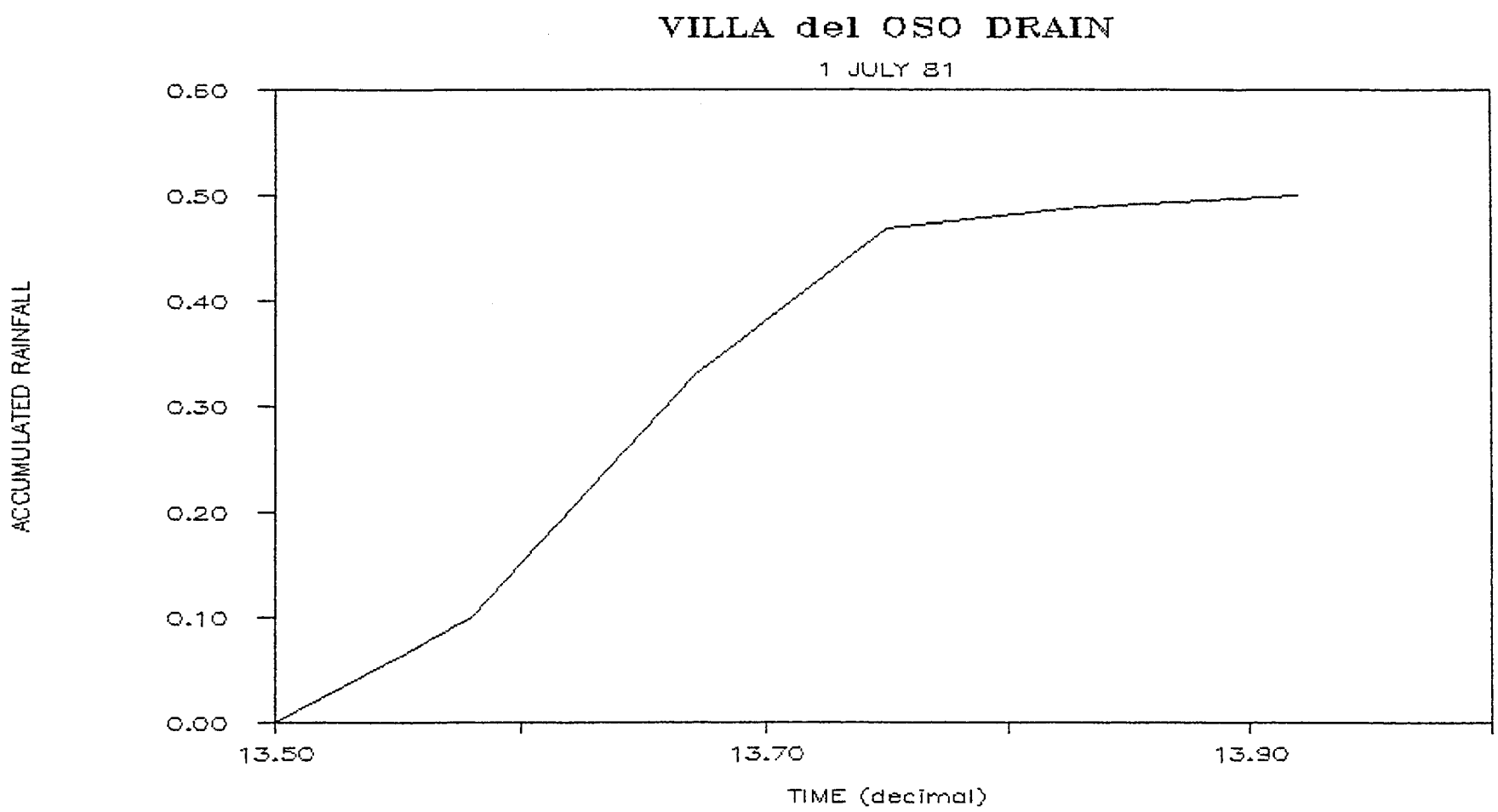
1 JULY 81



VILLA del OSO DRAIN

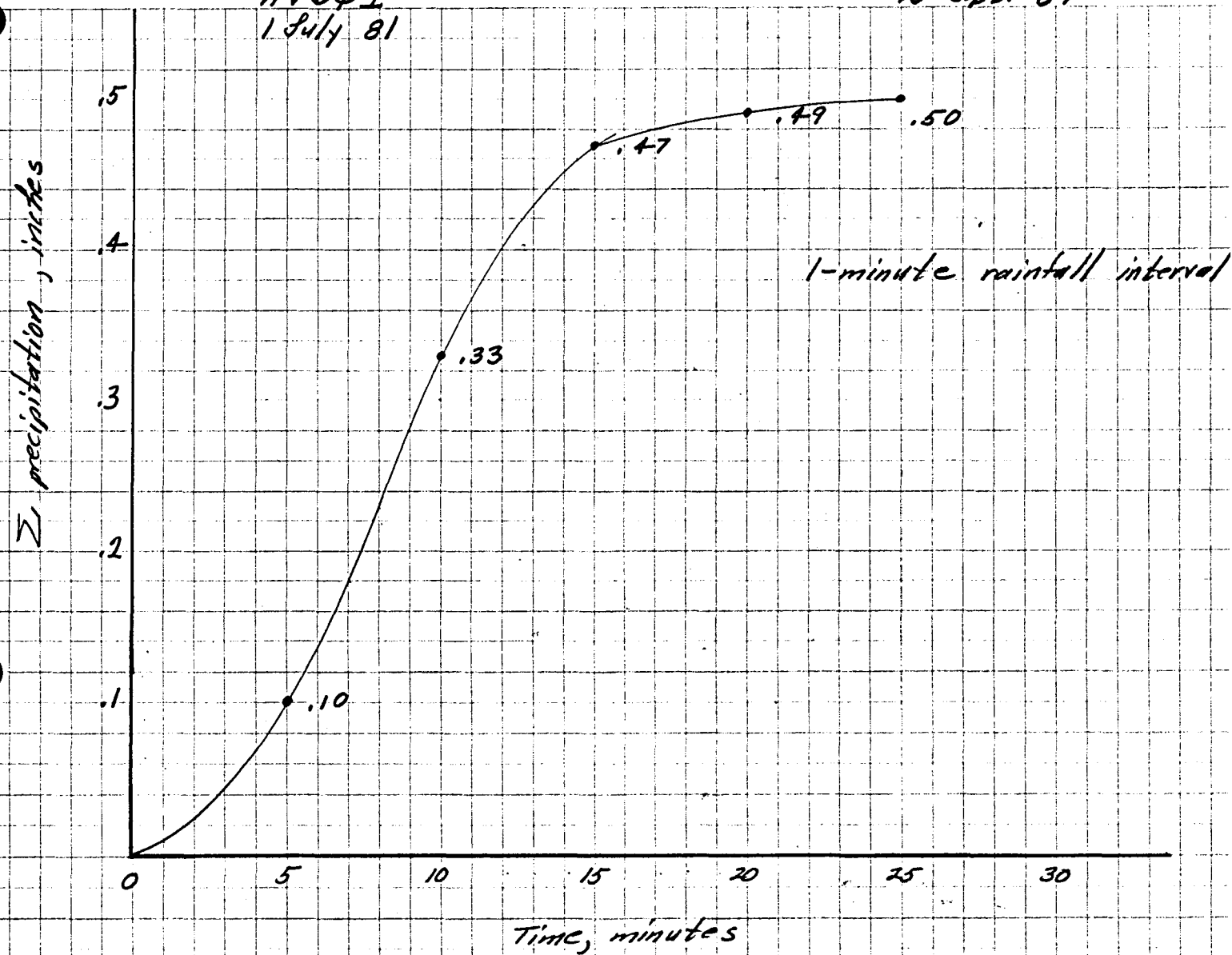
1 JULY 81



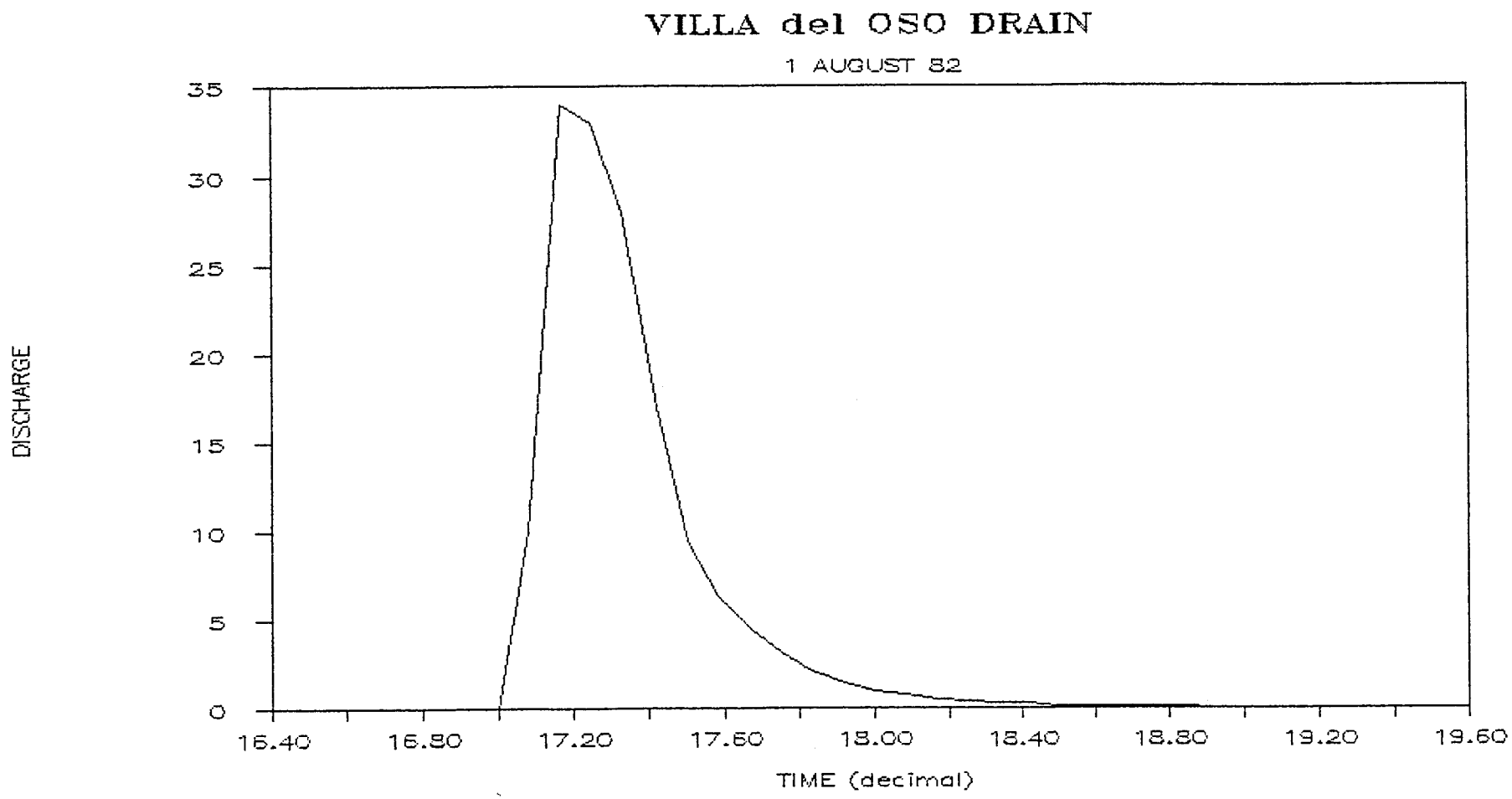

VILLA del OSO DRAIN
1 JULY 81
ACCUMULATED RAINFALL
0.60
0.50
0.40
0.30
0.20
0.10
0.00
13.50
13.70
13.90
TIME (decimal)

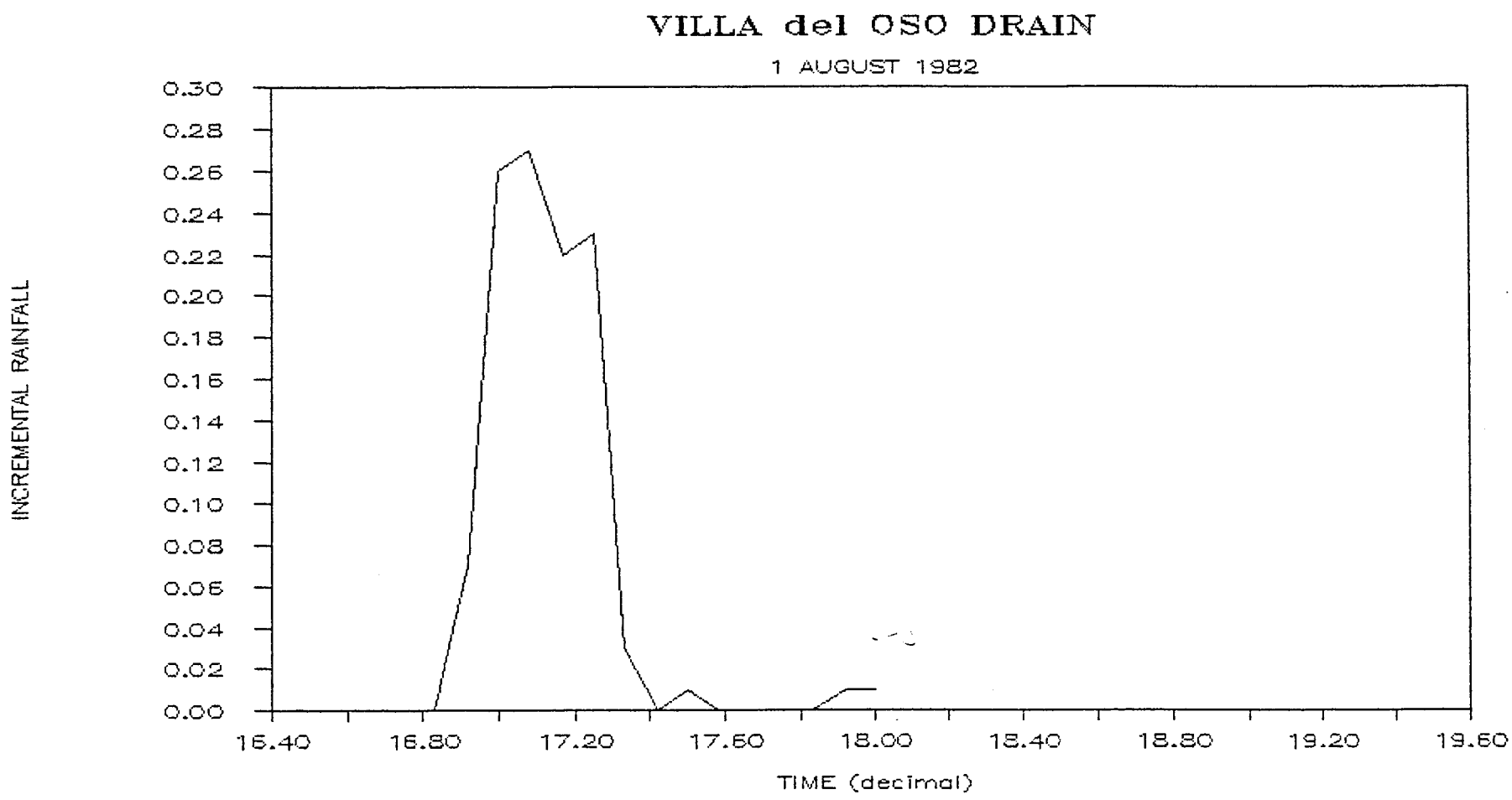
AVDØ1 15 Sept. 87

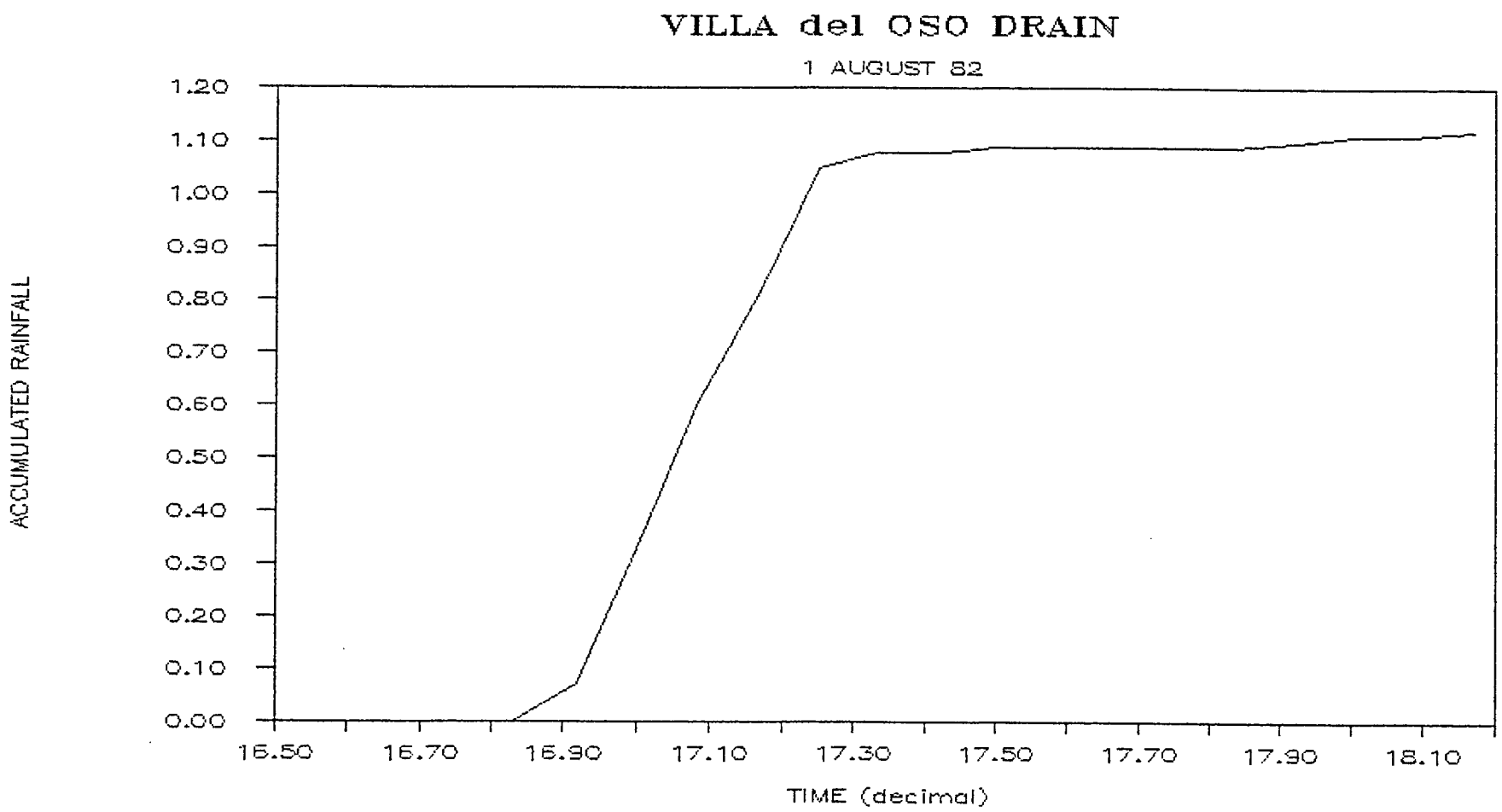
1 July 81



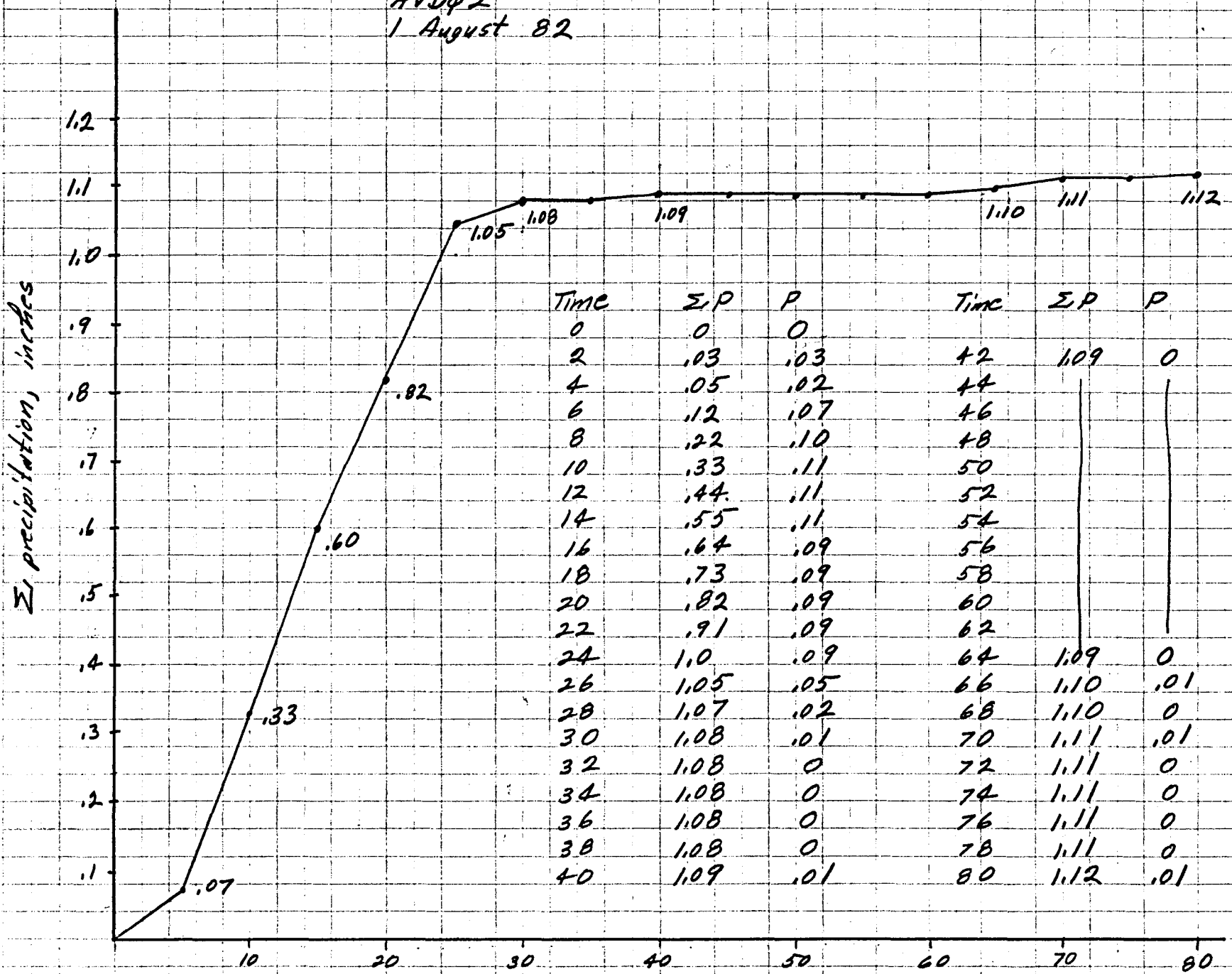
Time	Σ P	P	Time	Σ P	P
0	0.0	0.0			
1	.01	.01	14	.45	.02
2	.025	.015	15	.47	.02
3	.045	.02	16	.475	.005
4	.07	.025	17	.48	.005
5	.10	.03	18	.485	.005
6	.135	.035	19	.488	.003
7	.18	.045	20	.49	.002
8	.23	.05	21	.492	.002
9	.28	.05	22	.494	.002
10	.33	.05	23	.496	.002
11	.37	.04	24	.498	.002
12	.40	.03	25	.50	.002
13	.43	.03			
					.50


VILLA del OSO DRAIN
1 AUGUST 82
DISCHARGE
35
30
25
20
15
10
5
0
16.40
16.80
17.20
17.60
18.00
18.40
18.80
19.20
19.60
TIME (decimal)


VILLA del OSO DRAIN
1 AUGUST 1982
INCREMENTAL RAINFALL
0.30
0.28
0.26
0.24
0.22
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
16.40
16.80
17.20
17.60
18.00
18.40
18.80
19.20
19.60
TIME (decimal)


VILLA del OSO DRAIN
1 AUGUST 82
ACCUMULATED RAINFALL
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
16.50
16.70
16.90
17.10
17.30
17.50
17.70
17.90
18.10
TIME (decimal)

AVDØ2
1 August 82



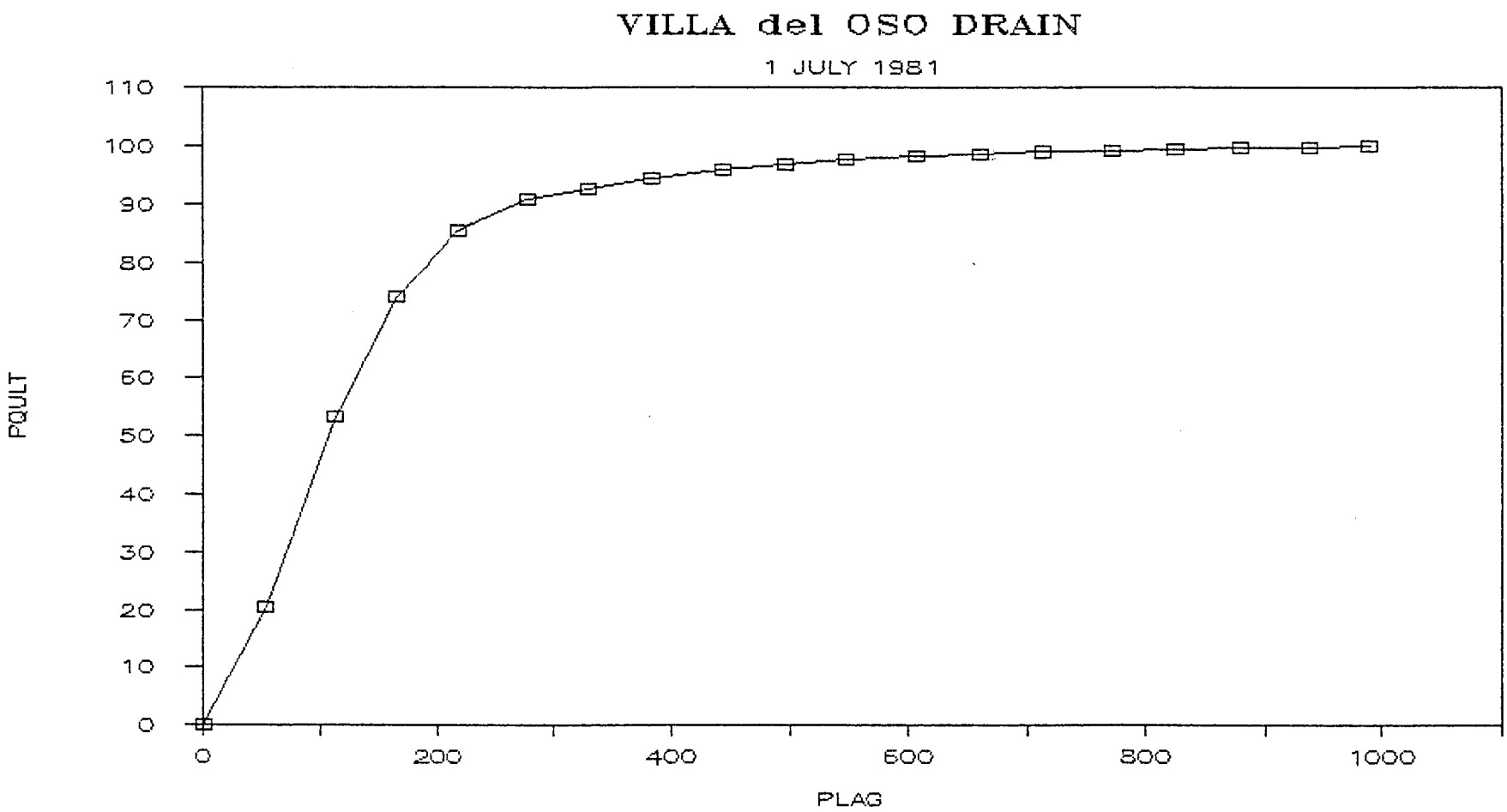
Time	ΣP	P	Time	ΣP	P
0	0	0			
2	.03	.03	42	1.09	0
4	.05	.02	44		
6	.12	.07	46		
8	.22	.10	48		
10	.33	.11	50		
12	.44	.11	52		
14	.55	.11	54		
16	.64	.09	56		
18	.73	.09	58		
20	.82	.09	60		
22	.91	.09	62		
24	1.0	.09	64	1.09	0
26	1.05	.05	66	1.10	.01
28	1.07	.02	68	1.10	0
30	1.08	.01	70	1.11	.01
32	1.08	0	72	1.11	0
34	1.08	0	74	1.11	0
36	1.08	0	76	1.11	0
38	1.08	0	78	1.11	0
40	1.09	.01	80	1.12	.01

15 Sept 87

AVDO.1	SUM Q	EUD	LAG	QULT	A	B	C
	72.96	0.18	0.15	402.69	201.35	132.46	0.08
		E	F	G	H	X	
		215.25	82.79	118.55	0.08	0.07	

ALBUQUERQUE DATA	DATE	TIME	Q	DEC TI	UHG	SUM UHG	~~H~~	PQULT	PLAG
VILLA DEL OSO DRAIN	01-Jul-81	1330	0.00		0.00	0.00		0.00	
		1335	0.00	0.00	0.00	0.00	0	0.00	0.00
		1340	15.00	0.08	82.79	82.79	5	20.56	52.77
		1345	24.00	0.17	132.46	215.25	10	53.45	112.14
		1350	15.00	0.25	82.79	298.04	15	74.01	164.91
		1355	8.40	0.33	46.36	344.40	20	85.53	217.68
		1400	4.00	0.42	22.08	366.48	25	91.01	277.04
		1405	1.30	0.50	7.18	373.66	30	92.79	329.81
		1410	1.20	0.58	6.62	380.28	35	94.44	382.58
		1415	1.00	0.67	5.52	385.80	40	95.81	441.95
		1420	0.74	0.75	4.08	389.88	45	96.82	494.72
		1425	0.59	0.83	3.26	393.14	50	97.63	547.49
		1430	0.47	0.92	2.59	395.73	55	98.27	606.85
		1435	0.32	1.00	1.77	397.50	100	98.71	659.62
		1440	0.24	1.08	1.32	398.83	105	99.04	712.39
		1445	0.18	1.17	0.99	399.82	110	99.29	771.76
		1450	0.16	1.25	0.88	400.70	115	99.51	824.53
		1455	0.14	1.33	0.77	401.47	120	99.70	877.30
		1500	0.12	1.42	0.66	402.14	125	99.86	936.66
		1505	0.10	1.50	0.55	402.69	130	100.00	989.43

U-fig duration = 5 min


VILLA del OSO DRAIN
1 JULY 1981
PQULT
110
100
90
80
70
60
50
40
30
20
10
0
0
200
400
600
800
1000
PLAG

SUM Q	EUD	LAG	QULT	A	B	C
152.6	0.38	0.25	402.69	201.35	87.08	0.08
	E	F	G	H	X	
	203.19	116.11	85.24	0.17	0.08	

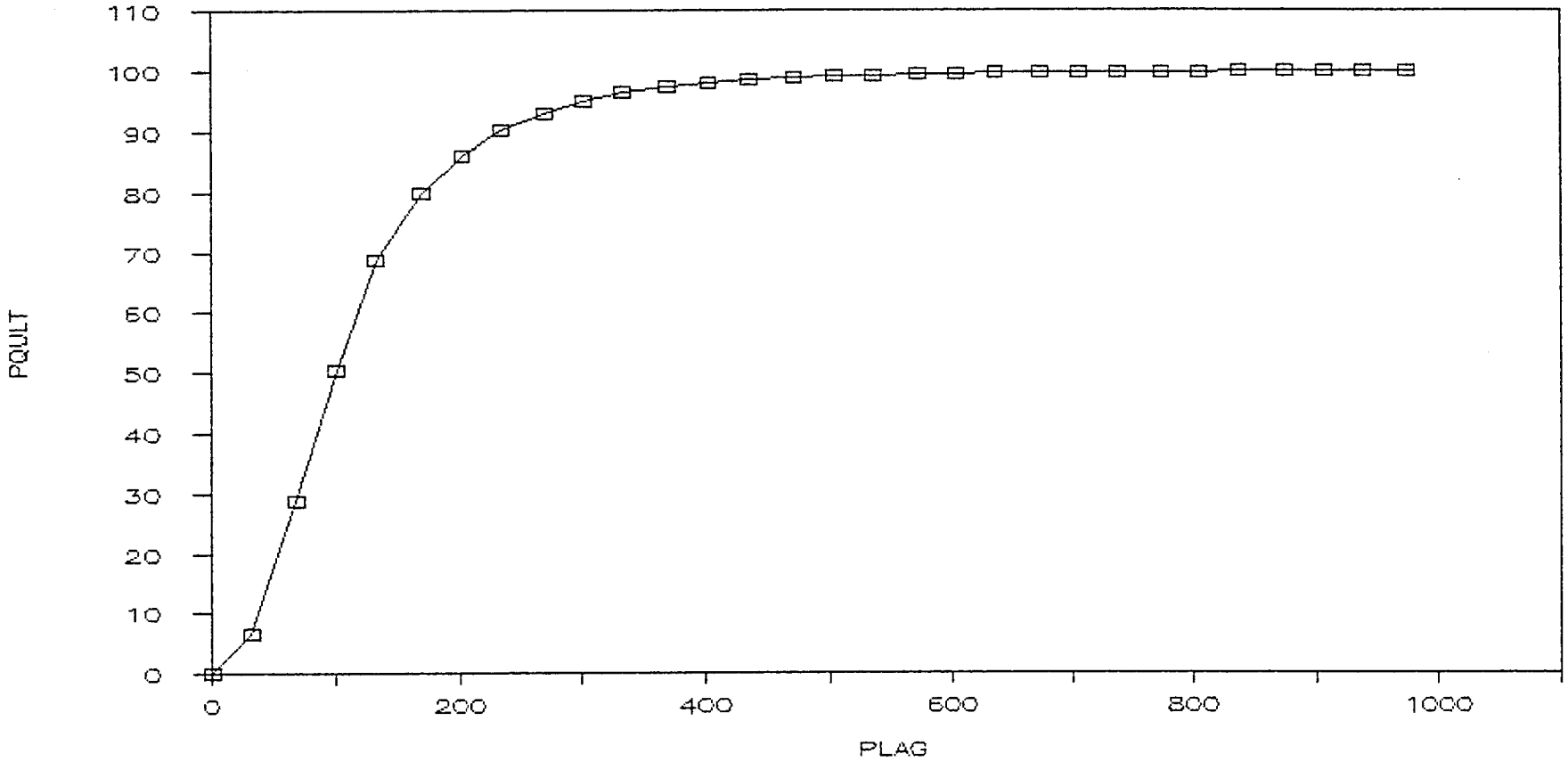
ALBUQUERQUE DATA
VILLA DEL OSO DRAIN

DATE	TIME	Q	DEC TI	UHG	SUM UHG	I	PQULT	PLAG
01-Aug-82	1650	0.00		0.00	0.00		0.00	
	1655	0.00		0.00	0.00		0.00	
	1700	0.00	0.00	0.00	0.00	0	0.00	0.00
	1705	10.00	0.08	26.39	26.39	5	6.55	32.22
	1710	34.00	0.17	89.72	116.11	10	28.83	68.46
	1715	33.00	0.25	87.08	203.19	15	50.46	100.68
	1720	28.00	0.33	73.89	277.08	20	68.81	132.90
	1725	17.00	0.42	44.86	321.94	25	79.95	169.15
	1730	9.40	0.50	24.81	346.75	30	86.11	201.37
	1735	6.30	0.58	16.62	363.37	35	90.24	233.58
	1740	4.40	0.67	11.61	374.98	40	93.12	269.83
	1745	3.10	0.75	8.18	383.16	45	95.15	302.05
	1750	2.10	0.83	5.54	388.70	50	96.53	334.27
	1755	1.40	0.92	3.69	392.40	55	97.44	370.51
	1800	0.91	1.00	2.40	394.80	100	98.04	402.73
	1805	0.74	1.08	1.95	396.75	105	98.53	434.95
	1810	0.53	1.17	1.40	398.15	110	98.87	471.19
	1815	0.41	1.25	1.08	399.23	115	99.14	503.41
	1820	0.27	1.33	0.71	399.94	120	99.32	535.63
	1825	0.27	1.42	0.71	400.66	125	99.50	571.88
	1830	0.16	1.50	0.42	401.08	130	99.60	604.10
	1835	0.12	1.58	0.32	401.40	135	99.68	636.31
	1840	0.09	1.67	0.24	401.63	140	99.74	672.56
	1845	0.08	1.75	0.21	401.84	145	99.79	704.78
	1850	0.07	1.83	0.18	402.03	150	99.84	737.00
	1855	0.06	1.92	0.16	402.19	155	99.88	773.24
	1900	0.05	2.00	0.13	402.32	200	99.91	805.46
	1905	0.04	2.08	0.11	402.42	205	99.93	837.68
	1910	0.03	2.17	0.08	402.50	210	99.95	873.93
	1915	0.03	2.25	0.08	402.58	215	99.97	906.14
	1920	0.02	2.33	0.05	402.64	220	99.99	938.36
	1925	0.02	2.42	0.05	402.69	225	100.00	974.61
	1930	~~0.00~~	~~2.50~~	~~0.00~~	~~402.69~~	~~230~~	~~100.00~~	~~1006.83~~
		152.6						

11 hr duration = 6 min.

VILLA del OSO DRAIN

1 AUGUST 1982



AVDØ 15 Sept. 87

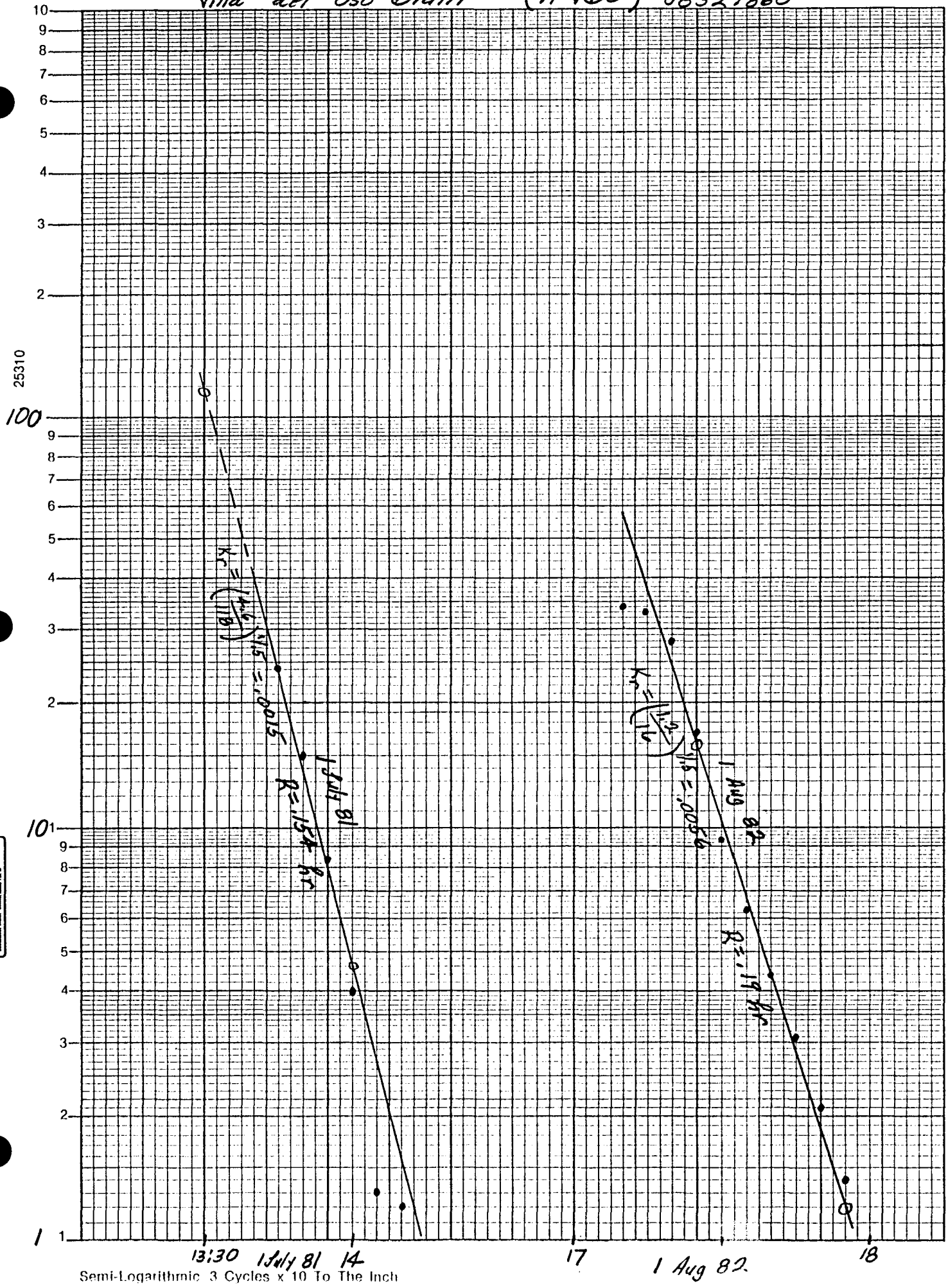
Total area = .052 mi^2 = 33.3 acres

Storm Date	Rainfall Depth inches	Runoff Volume ft^3	Effective Imp. Area acres		Rainfall Duration minutes	
4 Aug 78	.12	2,529	5.81		35	
19 Aug 78	.67	11,607	4.77	✓	575	
20 May 79	.75	18,123	6.66		170	
8 June 79	.66	14,991	6.26	✓	480	
16 July 79	.36	5,346	4.09		165	
15 Aug 79	.69	14,130	5.64	✓	420	
9 Sept 80	.52	9,759	5.17	✓	480	
25 June 81	.44	10,434	6.53		95	(high intensity)
22 May 82	.43	4,452	2.85		120	
31 July 83	.47	7,962	4.67		120	
1 Oct 83	.36	4,758	3.64		150	
20 Oct 83	.38	3,573	2.59		450	(very low intensity)

average of checked values = 5.46 acres

% effective imp. area = $\frac{5.46}{33.3} \times 100 = 16.4$

Villa del Oso Drain (AVDO) 08329860 21 Aug 87



Semi-Logarithmic 3 Cycles x 10 To The Inch

24 Aug 87

Input to CURBAN
for AVDØ 1

Precip @ 5-min. interval
.10, .23, .14, .02, .01

Total area = 33.3 acres
impervious area = 15.5 acres
effective imp. area = 9.6 acres

loss rates

impervious	initial =	.04
	uniform =	.02
pervious	initial =	1.0
	uniform =	.1

T_c = 5 minutes
R = 10 minutes / 6.6 for HEC-1

for AVDØ 2

Precip @ 5-min. interval
.07, .26, .27, .22, .23, .03, 0, .01, 0, 0, 0, .01, .01, 0, .01

T_c = 5 minutes
R = 10 minutes / 8.4 minutes for HEC-1

Flood Reconstitution for Albuquerque Academy Acres AAA1

Storm Event 12 Aug 82

Runoff: depth = .24 inches, Q_p = 37 cfs at t_p = .40 hours

$R_{recession}$ = .29 hrs

INPUT (1) Area acres	(2) Eff. Imp. Area %	(3) Rain in.	(4) Comp. Inter. min.	(5) Time-Area	(6)	Results (7) Q_p cfs	(8) t_p hr.	(9) T_c hr.	(10) R hr.	(11) STRTL in.	(12) CNSTL in/hr	(13) Output File	(14) Comment
79.4	16.3	.63	5	D		38	.42	.21	.11	.66	.13	Ø01	
"	"	"	"	U-1		37	.42	.27	.15	.66	.13	Ø02	
"	"	"	2	U-4		56	.43	.05	.15	.37	.26	Ø04	
"	"	"	1	U-3		38	.35	.17	.31	.44	.11	Ø5	← best
"	"	"	"	U-4		37	.32	.13	.41	.40	.11	Ø6	

Flood Reconstitution for Albuquerque Academy Acres AAA2

Storm Event 25 June 81

Runoff: depth = .22 inches, Q_p = 49 cfs at t_p = .40 hours

$R_{recession}$ = .20 hrs

INPUT (1) Area acres	(2) Eff. Imp. Area %	(3) Rain in.	(4) Comp. Inter. min.	(5) Time-Area	(6)	Results (7) Q_p cfs	(8) t_p hr.	(9) T_c hr.	(10) R hr.	(11) STRTL in.	(12) CNSTL in/hr	(13) Output File	(14) Comment
79.4	16.3	.57	2	D		50	.37	.03	.20	.35	.29	Ø01	
"	"	"	"	U-3		50	.37	.03	.20	.35	.30	Ø2	best no change due to short T_c

A very short T_c, I doubt that rain dist. is uniform for watershed.

Table 7.--Station description, daily mean discharge values, monthly rainfall totals, and selected rainfall-discharge unit-value data for ACADEMY ACRES DRAIN AT ALBUQUERQUE (08329880), 1976-83.

STATION DESCRIPTION

LOCATION.--Lat 35 deg 09 min 02 sec, long 106 deg 34 min 18 sec, in NE1/4 SE1/4 sec.25, T.11 N., R.3 E., Bernalillo County, Hydrologic Unit 13020203, on left bank of concrete lined channel, at intersection of Burlison Dr and Leander Ave, 230 ft (70 m) north of intersection of Esther Ave and Burlison Dr and 0.4 mi (0.6 km) north of Academy Rd, in Albuquerque.

DRAINAGE AREA.--0.124 sq mi (0.321 sq km).

PERIOD OF RECORD.--June 1976 to December 1978, May 1979 to current year (no winter records).

GAGE.--Water-stage recorder and V-notch sharp-crested weir. Prior to May 1, 1978, concrete trapezoidal weir. Altitude of gage is 5,306 ft (1,617.27 m), from topographic orthophoto map.

REMARKS.--Records good except those for June 1976 to October 1979, which are poor. Recording rain gage at station. Additional recording rain gage near upstream end of basin since September, 1981. Basin drains residential area.

STAGE-DISCHARGE RELATION.--Rating developed on basis of weir-flow computations and discharge measurements at discharges of 0.10 cu ft per sec (0.003 cu m per sec), 0.20 cu ft per sec (0.006 cu m per sec), 0.35 cu ft per sec (0.01 cu m per sec), 1.00 cu ft per sec (0.03 cu m per sec), 2.50 cu ft per sec (0.07 cu m per sec) and 5.0 cu ft per sec (0.14 cu m per sec) June 1976 to May 1978. Rating developed on basis of V-notch sharp-crested weir computation and discharge measurements at discharges of 0.10 cu ft per sec (0.003 cu m per sec), 0.60 cu ft per sec (0.02 cu m per sec), 1.85 cu ft per sec (0.05 cu m per sec), 2.08 cu ft per sec (0.06 cu m per sec) and slope-area measurement at discharge of 100 cu ft per sec (2.83 cu m per sec).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 103 cu ft per sec (2.92 cu m per sec) Aug. 3, 1978, gage height, 4.09 ft (1.247 m) from rating curve extended above 2.0 cu ft per sec (0.57 cu m per sec) on basis of slope-area measurement of peak flow; no flow most of the time.

EXTREMES.--Maximum discharge during period June to December 1976, 20 cu ft per sec (0.55 cu m per sec) July 31, gage height, 0.68 ft (0.207 m); no flow most of the time.

Calendar year 1977: Maximum discharge, 15 cu ft per sec (0.42 cu m per sec) Sept. 5, gage height, 0.58 ft (0.177 m); no flow most of the time.

Calendar year 1978: Maximum discharge, 103 cu ft per sec (2.92 cu m per sec) Aug. 3, gage height, 4.09 ft (1.247 m) from rating curve extended above 2.0 cu ft per sec (0.57 cu m per sec) on basis of slope-area measurement of peak flow; no flow most of the time.

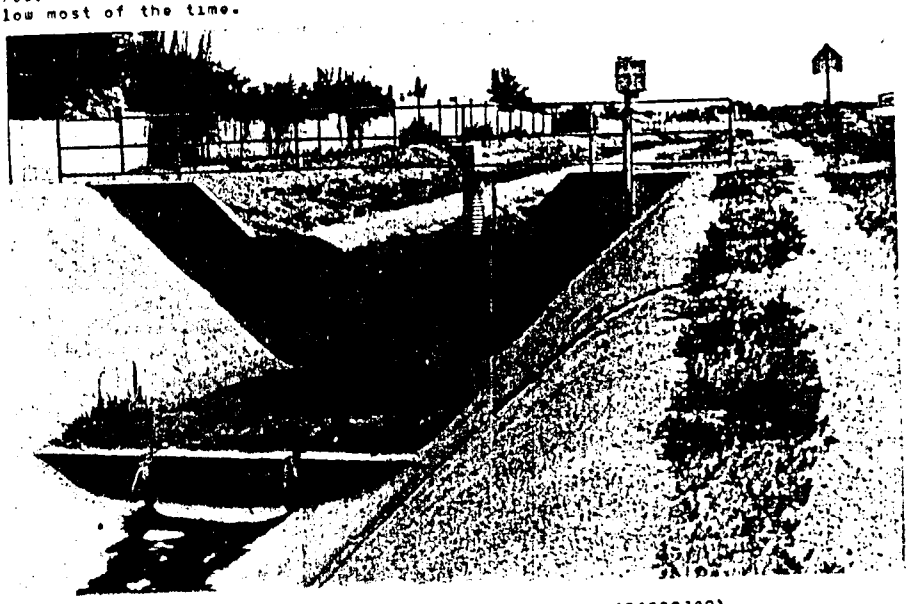
Calendar year 1979: Maximum discharge, 65 cu ft per sec (1.82 cu m per sec) July 16, gage height, 3.68 ft (1.122 m); no flow most of the time.

Calendar year 1980: Maximum discharge, 101 cu ft per sec (2.88 cu m per sec) Aug. 14, gage height, 4.07 ft (1.241 m); no flow most of the time.

Calendar year 1981: Maximum discharge, 59 cu ft per sec (1.67 cu m per sec) July 7, gage height, 3.61 ft (1.100 m); no flow most of the time.

Calendar year 1982: Maximum discharge, 37 cu ft per sec (1.05 cu m per sec) Aug. 12, gage height, 3.25 ft (0.991 m); no flow most of the time.

Calendar year 1983: maximum discharge, 39 cu ft per sec (1.10 cu m per sec) June 25, gage height, 3.29 ft (1.003 m); no flow most of the time.



Photograph 9.--Academy Acres Drain (08329880).

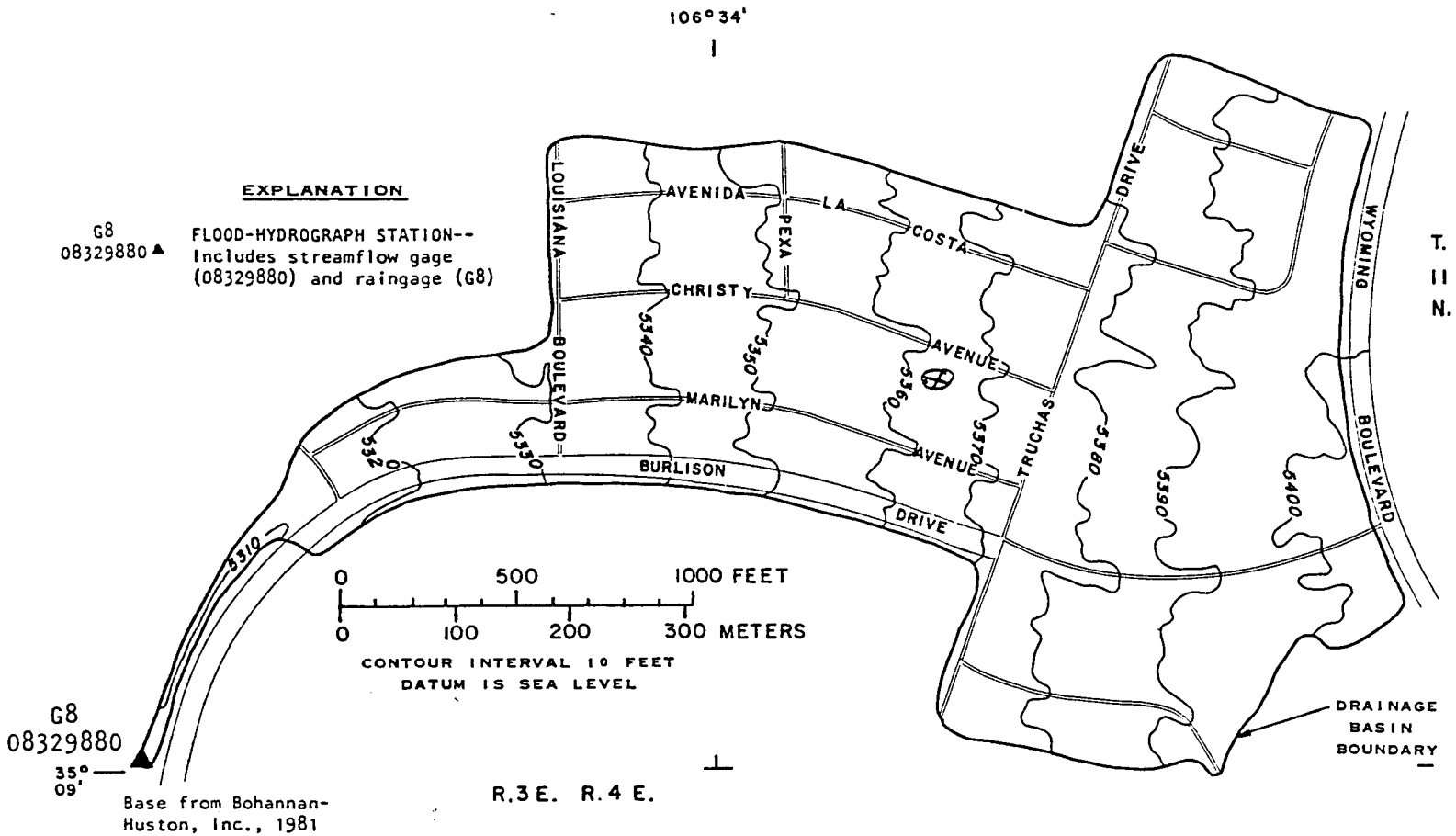
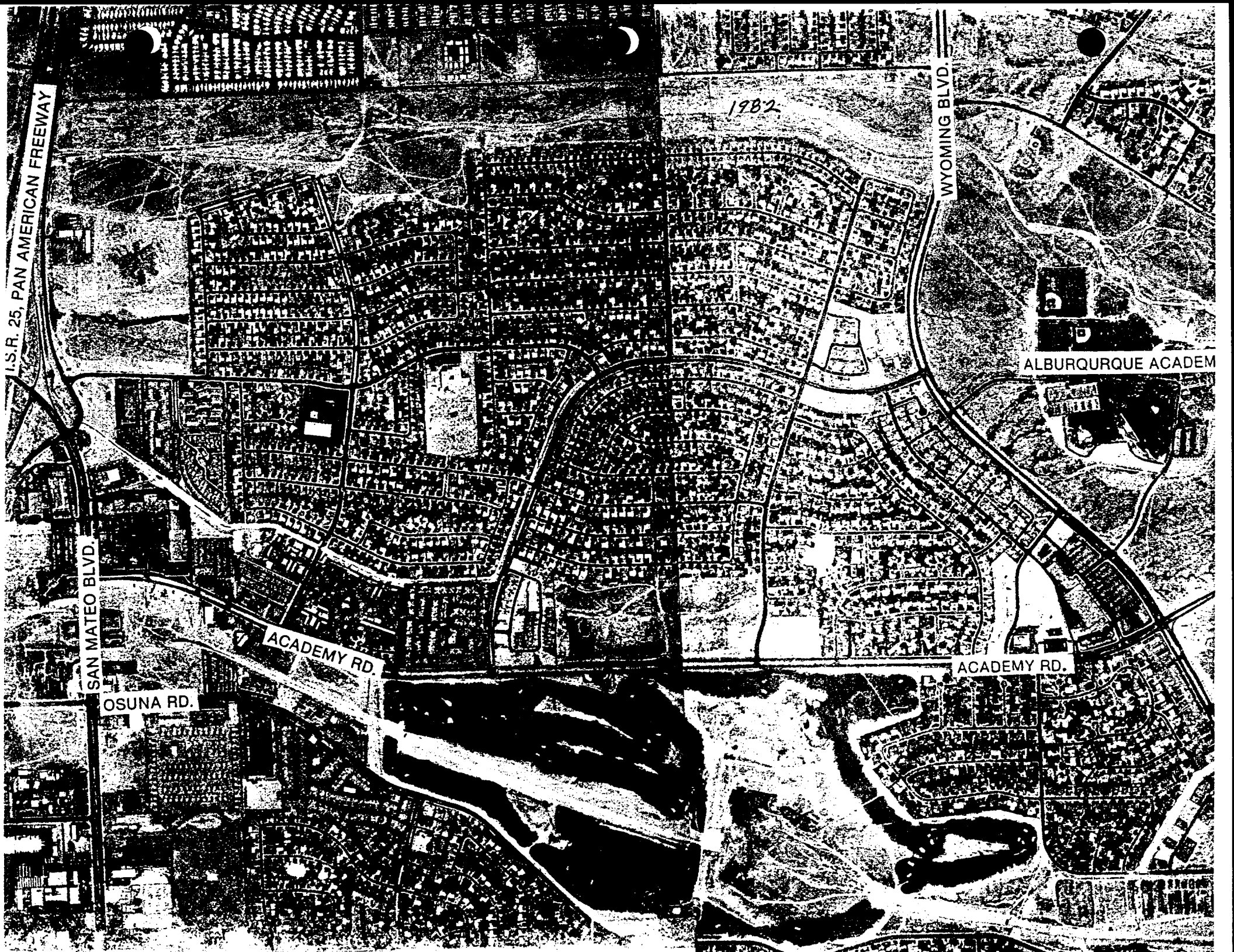


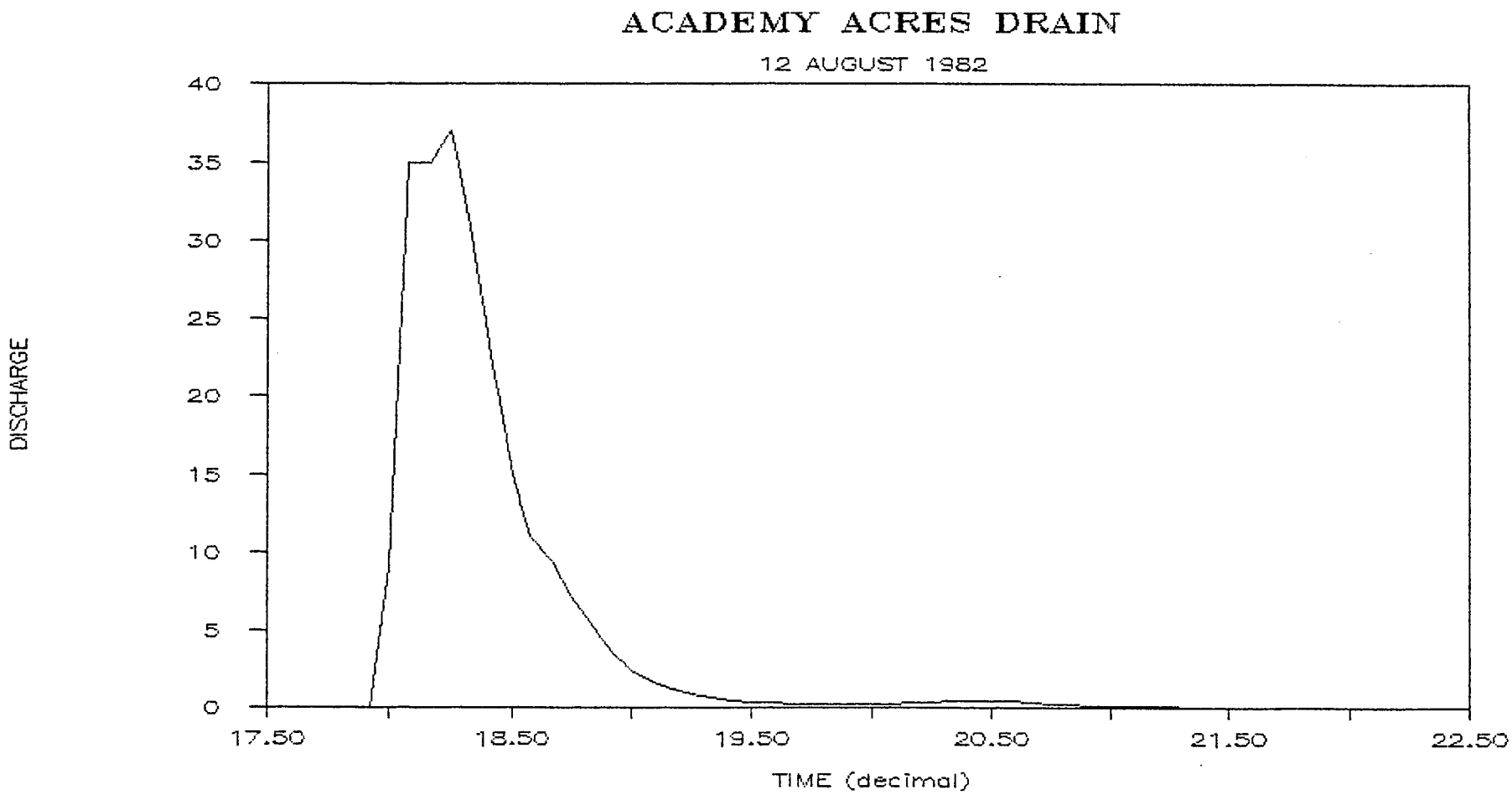
Figure 4.--Drainage basin for Academy Acres Drain (08329880).

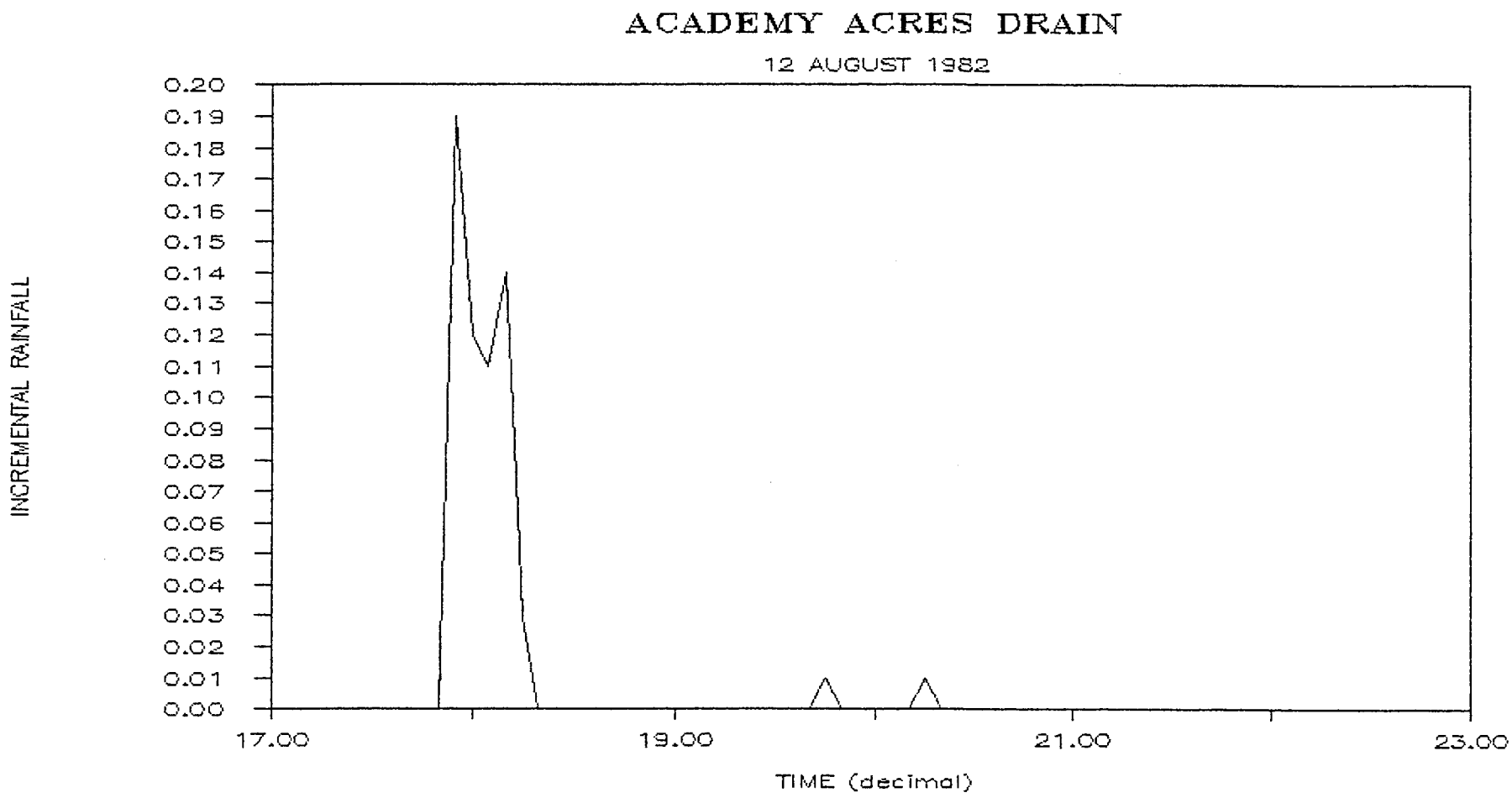
1982

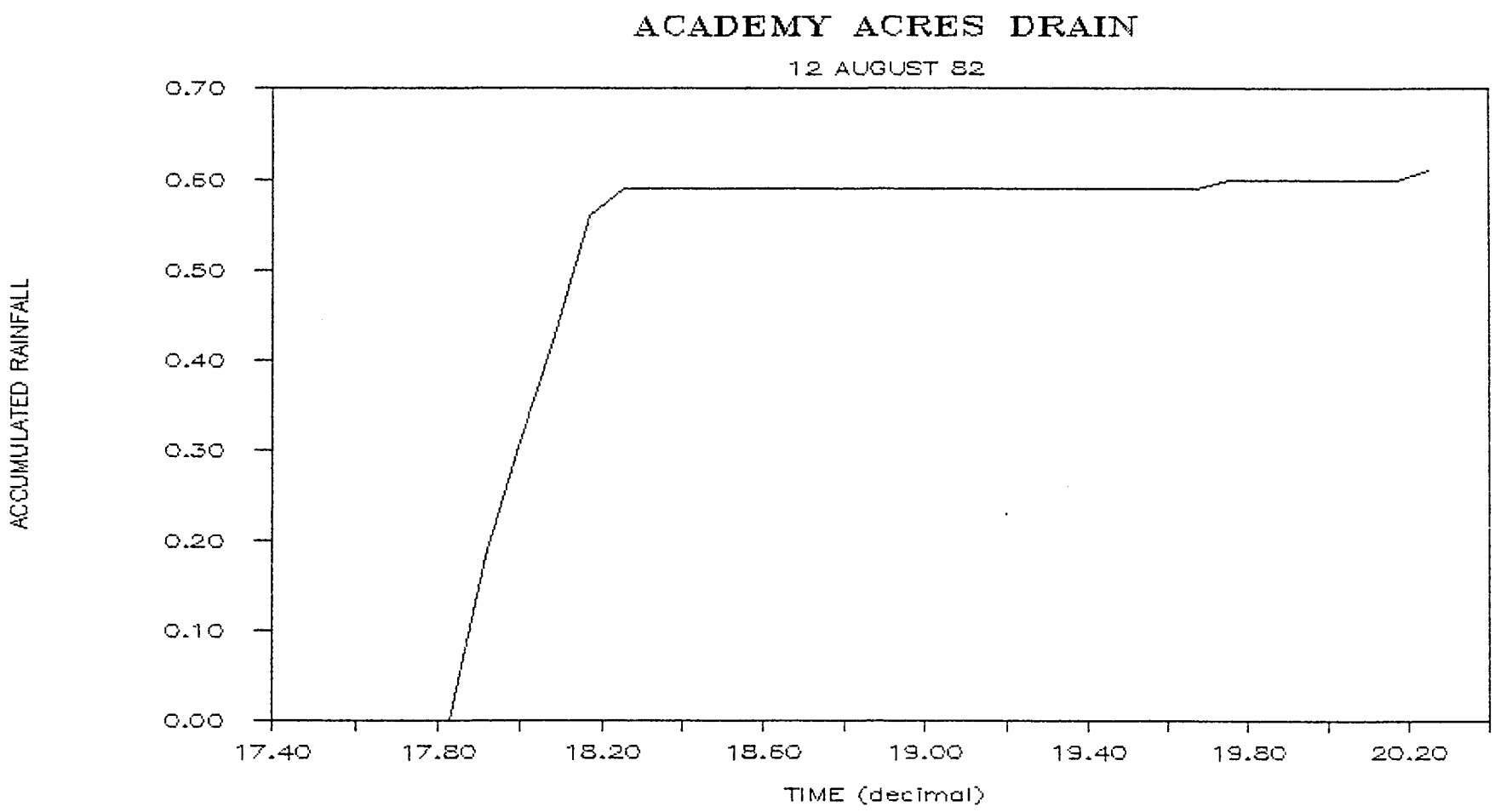

1982
I.S.R. 25, PAN AMERICAN FREEWAY
SAN MATEO BLVD.
OSUNA RD.
ACADEMY RD.
WYOMING BLVD.
ACADEMY RD.
ALBURQURQUE ACADEM

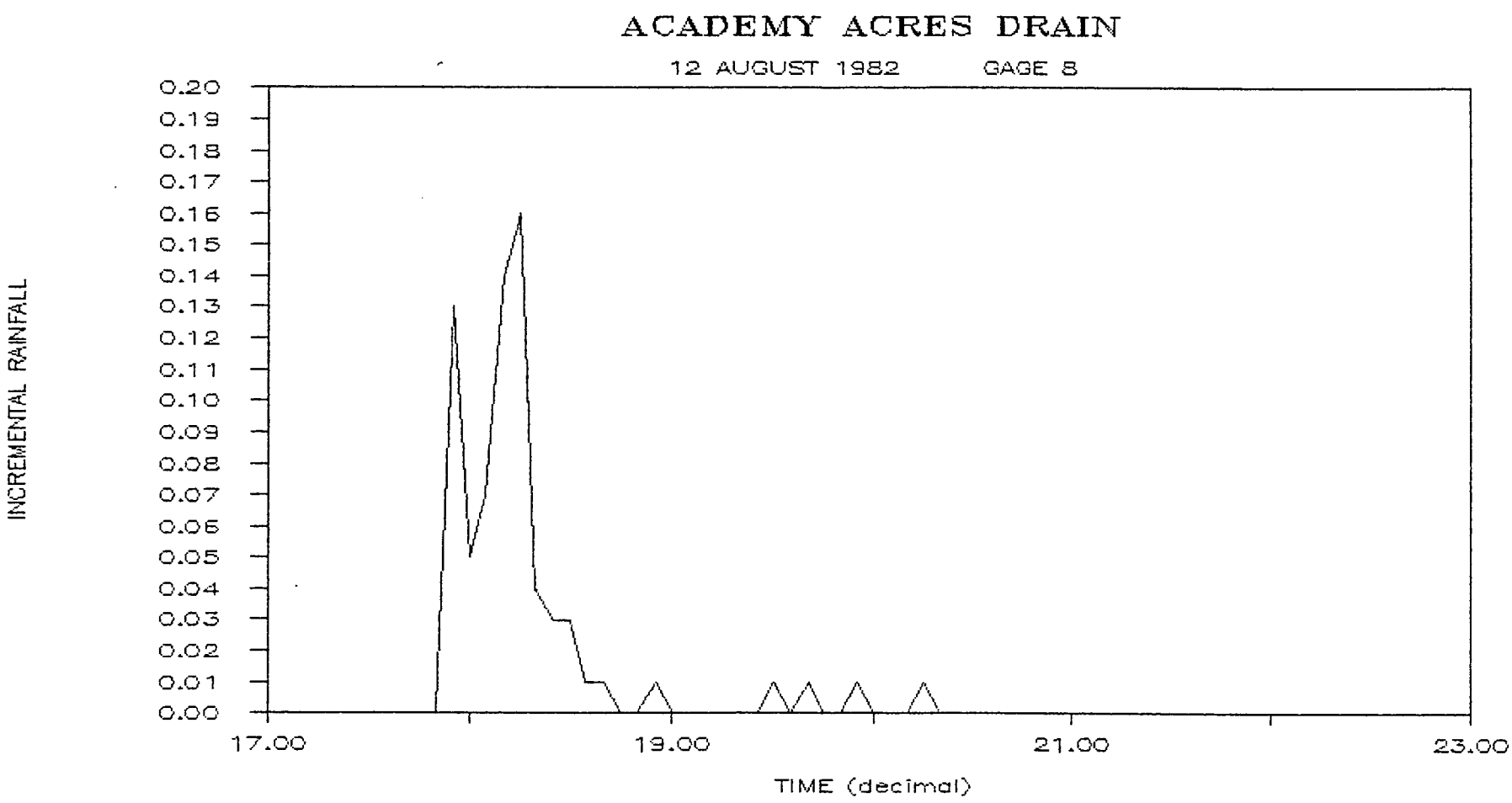
THE MEADOWBROOK
MOBILE HOME
MEADOWS
COMMUNITY
MOBILE HOME
PARK
GROUP ADD'N
ACRES
DEL NORTE ADD'N
UNIT 2
UNIT 3
UNIT 5
UNIT 6
CHERRY HILLS
ALBUQUERQUE ACADEMY
ACADEMY ACRES
UNIT 5
UNIT 14
UNIT 15
UNIT 11
UNIT 12
ACADEMY ACRES
1982
ACADEMY ACRES 7
MEADOWOOD MANOR
UNIT 2
BEAR CANYON VILLAGE
CAMPUS
RUST ADD'N
SUMMARY PLAT
FAR NORTH SHOPPING CENTER
ACADEMY ACRES SUB'D UNIT 2
VILLA ENCANTADA
ACADEMY ACRES UNIT 10
UNIT 1
REPLAT BLKS 1, 2 & 3
SHOPPING CENTER
VILLAGE
MUNICIPAL

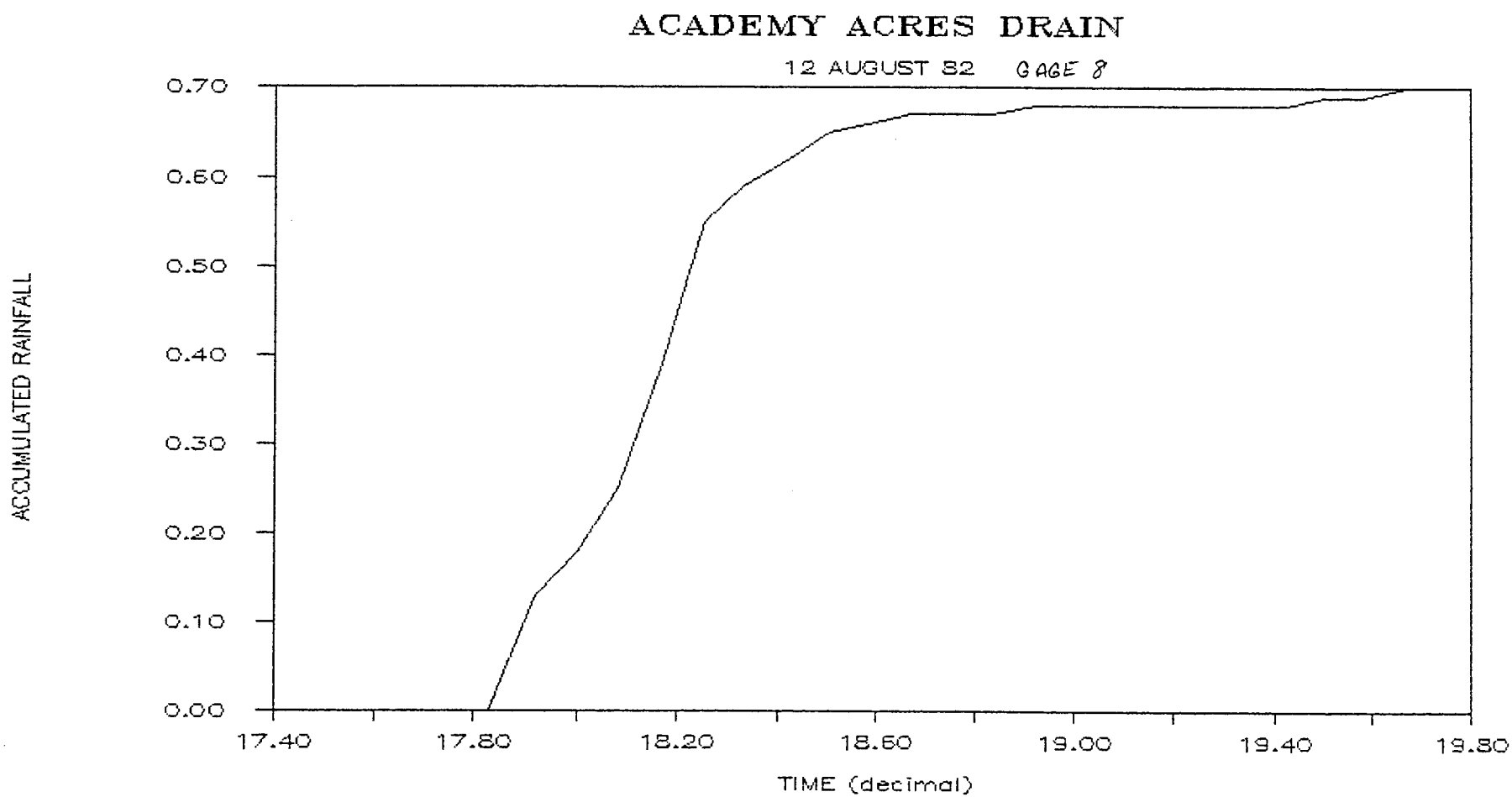
	DATE	TIME	Q	P7	SUM P7	P8	SUMP8
ACADEMY ACRES DRAIN	12-Aug-82	1750	0.00	0.00	0.00	0.00	0
		1755	0.06	0.19	0.19	0.13	0.13
		1800	9.10	0.12	0.31	0.05	0.18
		1805	35.00	0.11	0.42	0.07	0.25
		1810	35.00	0.14	0.56	0.14	0.39
		1815	37.00	0.03	0.59	0.16	0.55
		1820	31.00	0.00	0.59	0.04	0.59
		1825	22.00	0.00	0.59	0.03	0.62
		1830	15.00	0.00	0.59	0.03	0.65
		1835	11.00	0.00	0.59	0.01	0.66
		1840	9.50	0.00	0.59	0.01	0.67
		1845	7.10	0.00	0.59	0.00	0.67
		1850	5.50	0.00	0.59	0.00	0.67
		1855	3.60	0.00	0.59	0.01	0.68
		1900	2.40	0.00	0.59	0.00	0.68
		1905	1.70	0.00	0.59	0.00	0.68
		1910	1.20	0.00	0.59	0.00	0.68
		1915	0.90	0.00	0.59	0.00	0.68
		1920	0.71	0.00	0.59	0.00	0.68
		1925	0.51	0.00	0.59	0.00	0.68
		1930	0.40	0.00	0.59	0.01	0.69
		1935	0.33	0.00	0.59	0.00	0.69
		1940	0.26	0.00	0.59	0.01	0.7
		1945	0.24	0.01	0.60	0.00	0.7
		1950	0.24	0.00	0.60	0.00	0.7
		1955	0.24	0.00	0.60	0.01	0.71
		2000	0.26	0.00	0.60	0.00	0.71
		2005	0.28	0.00	0.60	0.00	0.71
		2010	0.35	0.00	0.60	0.00	0.71
		2015	0.38	0.01	0.61	0.01	0.72
		2020	0.43	0.00	0.61	0.00	0.72
		2025	0.48	0.00	0.61	0.00	0.72
		2030	0.48	0.00	0.61	0.00	0.72
		2035	0.45	0.00	0.61	0.00	0.72
		2040	0.35	0.00	0.61	0.00	0.72
		2045	0.26	0.00	0.61	0.00	0.72
		2050	0.23	0.00	0.61	0.00	0.72
		2055	0.18	0.00	0.61	0.00	0.72
		2100	0.15	0.00	0.61	0.00	0.72
		2105	0.12	0.00	0.61	0.00	0.72
		2110	0.10	0.00	0.61	0.00	0.72
		2115	0.08	0.00	0.61	0.00	0.72
		2120	0.06	0.00	0.61	0.00	0.72
		2125	0.05	0.00	0.61	0.00	0.72
		2130	0.04	0.00	0.61	0.00	0.72
		2135	0.03	0.00	0.61	0.00	0.72
		2140	0.02	0.00	0.61	0.00	0.72
		2145	0.02	0.00	0.61	0.00	0.72
		2150	0.01	0.00	0.61	0.00	0.72
		2155	0.01	0.00	0.61	0.00	0.72
		2200	0.01	0.00	0.61	0.00	0.72
		2205	0.01	0.00	0.61	0.00	0.72
		2210	0.01	0.00	0.61	0.00	0.72
		2215	0.01	0.00	0.61	0.00	0.72
		2220	0.01	0.00	0.61	0.00	0.72
		2225	0.01	0.00	0.61	0.00	0.72
		2230	0.00	0.00	0.61	0.00	0.72

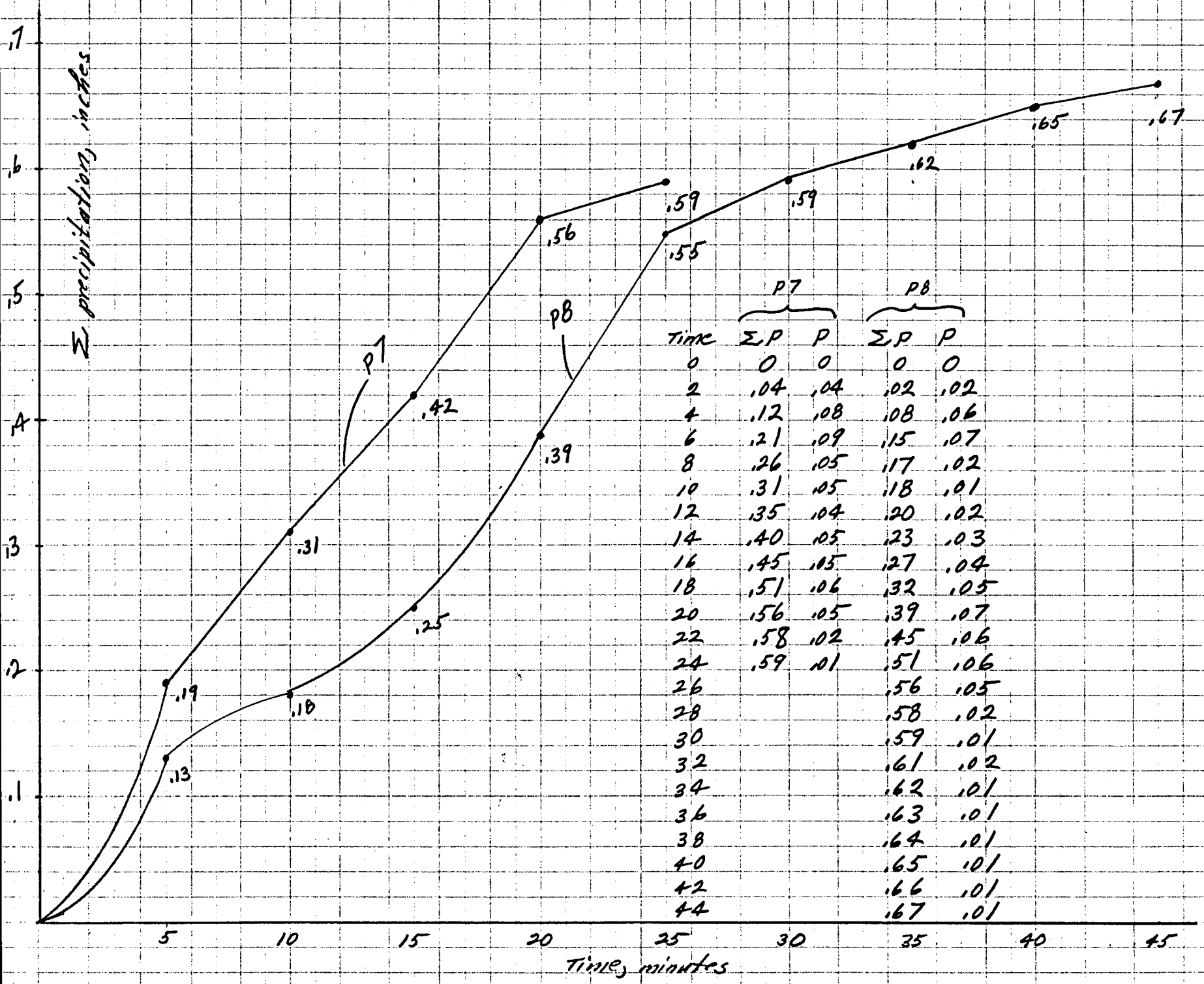

ACADEMY ACRES DRAIN
12 AUGUST 1982
DISCHARGE
40
35
30
25
20
15
10
5
0
17.50
18.50
19.50
20.50
21.50
22.50
TIME (decimal)


ACADEMY ACRES DRAIN
12 AUGUST 1982
INCREMENTAL RAINFALL
0.20
0.19
0.18
0.17
0.16
0.15
0.14
0.13
0.12
0.11
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
17.00
19.00
21.00
23.00
TIME (decimal)


ACADEMY ACRES DRAIN
12 AUGUST 82
ACCUMULATED RAINFALL
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
17.40
17.80
18.20
18.60
19.00
19.40
19.80
20.20
TIME (decimal)


ACADEMY ACRES DRAIN
12 AUGUST 1982 GAGE 8
INCREMENTAL RAINFALL
0.20
0.19
0.18
0.17
0.16
0.15
0.14
0.13
0.12
0.11
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
17.00
19.00
21.00
23.00
TIME (decimal)


ACADEMY ACRES DRAIN
12 AUGUST 82 GAGE 8
ACCUMULATED RAINFALL
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
17.40
17.80
18.20
18.60
19.00
19.40
19.80
TIME (decimal)



	P7		P8	
Time	ΣP	P	ΣP	P
0	0	0	0	0
2	.04	.04	.02	.02
4	.12	.08	.08	.06
6	.21	.09	.15	.07
8	.26	.05	.17	.02
10	.31	.05	.18	.01
12	.35	.04	.20	.02
14	.40	.05	.23	.03
16	.45	.05	.27	.04
18	.51	.06	.32	.05
20	.56	.05	.39	.07
22	.58	.02	.45	.06
24	.59	.01	.51	.06
26			.56	.05
28			.58	.02
30			.59	.01
32			.61	.02
34			.62	.01
36			.63	.01
38			.64	.01
40			.65	.01
42			.66	.01
44			.67	.01

AAA1

15 Sept 87

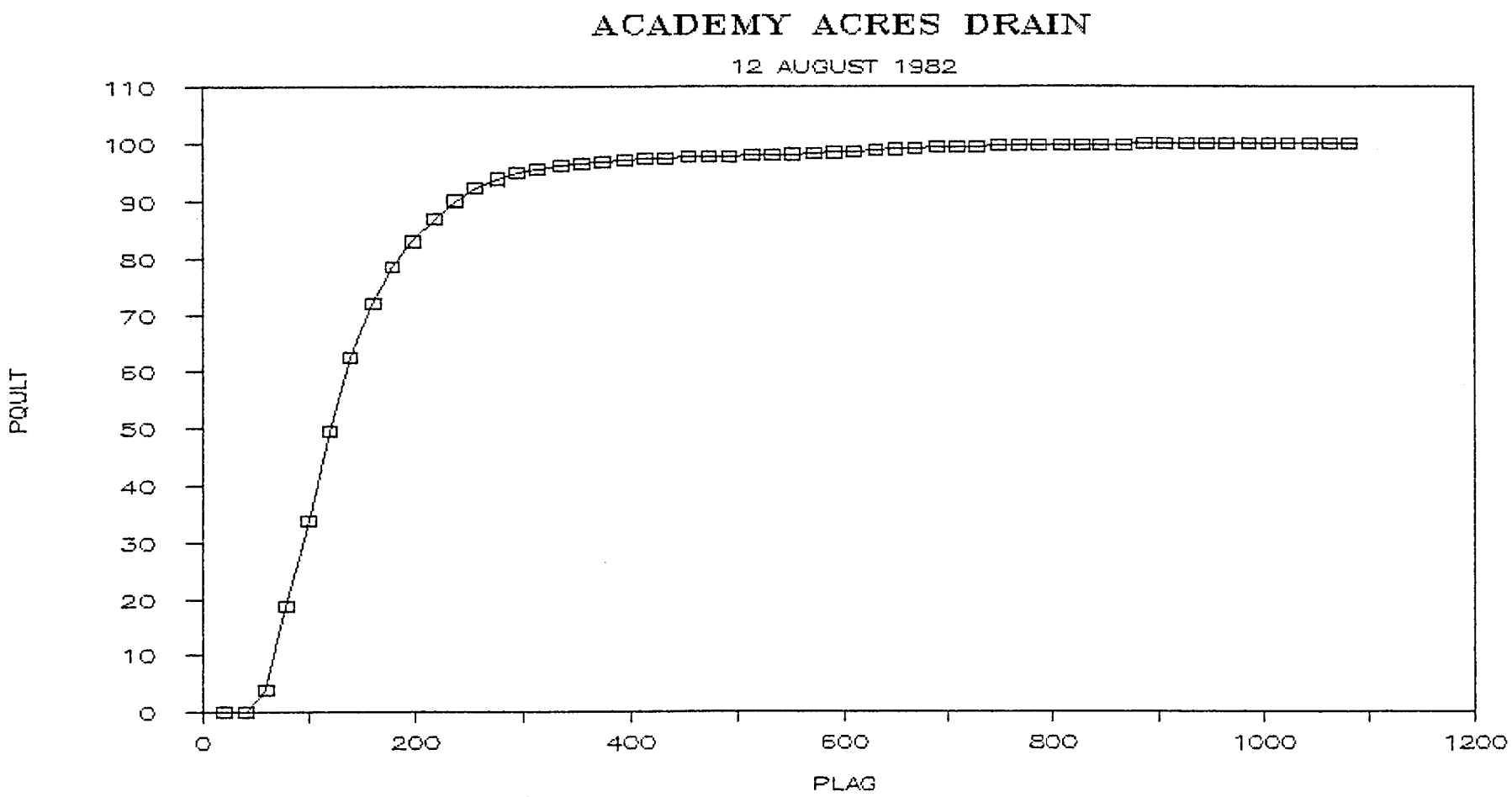
AAA.1	SUM Q	EUD	LAG	QULT	A	B	C
	234.87	0.24	0.42	960.26	480.13	126.74	0.08
		E	F	G	H	X	
		601.66	474.92	5.21	0.42	0.50	

ALBUQUERQUE DATA
ACADEMY ACRES DRAIN

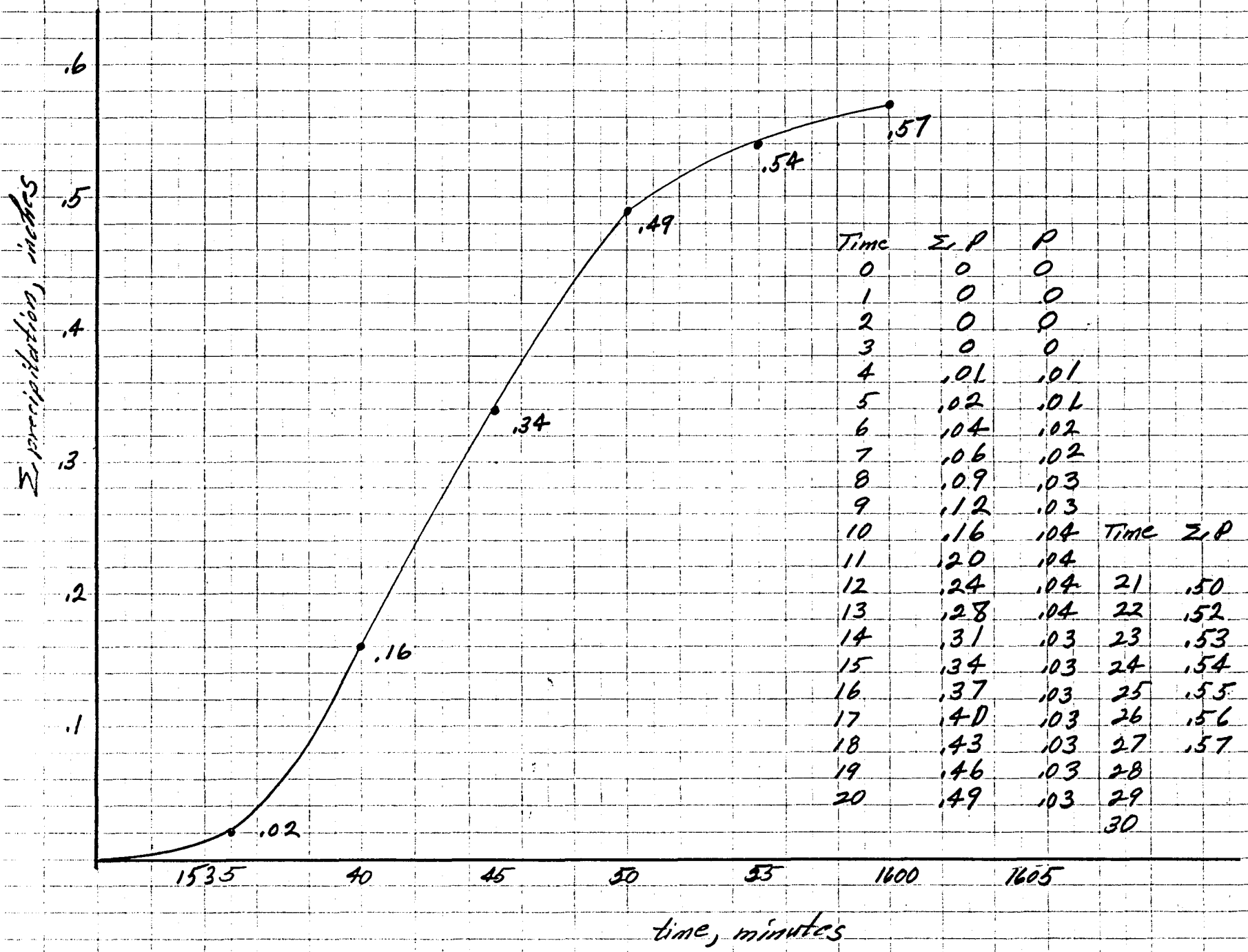
DATE	TIME	Q	DEC TI	UHG	SUM UHG	M	PQULT	PLAG
12-Aug-82	1750	0.00	0.00	0.00	0.00	0	0.00	0.00
	1755	0.06	0.08	0.25	0.25	5	0.03	18.90
	1800	9.10	0.17	37.21	37.45	10	3.90	40.16
	1805	35.00	0.25	143.10	180.55	15	18.80	59.06
	1810	35.00	0.33	143.10	323.64	20	33.70	77.96
	1815	37.00	0.42	151.27	474.92	25	49.46	99.22
	1820	31.00	0.50	126.74	601.66	30	62.66	118.12
	1825	22.00	0.58	89.95	691.60	35	72.02	137.02
	1830	15.00	0.67	61.33	752.93	40	78.41	158.28
	1835	11.00	0.75	44.97	797.90	45	83.09	177.18
	1840	9.50	0.83	38.84	836.75	50	87.14	196.08
	1845	7.10	0.92	29.03	865.77	55	90.16	217.35
	1850	5.50	1.00	22.49	888.26	0	92.50	236.25
	1855	3.60	1.08	14.72	902.98	5	94.03	255.15
	1900	2.40	1.17	9.81	912.79	10	95.06	276.41
	1905	1.70	1.25	6.95	919.74	15	95.78	295.31
	1910	1.20	1.33	4.91	924.65	20	96.29	314.21
	1915	0.90	1.42	3.68	928.33	25	96.67	335.47
	1920	0.71	1.50	2.90	931.23	30	96.98	354.37
	1925	0.51	1.58	2.09	933.31	35	97.19	373.27
	1930	0.40	1.67	1.64	934.95	40	97.36	394.53
	1935	0.33	1.75	1.35	936.30	45	97.50	413.43
	1940	0.26	1.83	1.06	937.36	50	97.62	432.33
	1945	0.24	1.92	0.98	938.34	55	97.72	453.59
end	1950	0.24	2.00	0.98	939.32	0	97.82	472.49
	1955	0.24	2.08	0.98	940.31	5	97.92	491.39
	2000	0.26	2.17	1.06	941.37	10	98.03	512.65
	2005	0.28	2.25	1.14	942.51	15	98.15	531.55
	2010	0.35	2.33	1.43	943.94	20	98.30	550.45
	2015	0.38	2.42	1.55	945.50	25	98.46	571.71
	2020	0.43	2.50	1.76	947.26	30	98.65	590.61
	2025	0.48	2.58	1.96	949.22	35	98.85	609.51
	2030	0.48	2.67	1.96	951.18	40	99.05	630.78
	2035	0.45	2.75	1.84	953.02	45	99.25	649.67
	2040	0.35	2.83	1.43	954.45	50	99.40	668.57
	2045	0.26	2.92	1.06	955.52	55	99.51	689.84
	2050	0.23	3.00	0.94	956.46	0	99.60	708.74
	2055	0.18	3.08	0.74	957.19	5	99.68	727.64
	2100	0.15	3.17	0.61	957.80	10	99.74	748.90
	2105	0.12	3.25	0.49	958.30	15	99.80	767.80
	2110	0.10	3.33	0.41	958.70	20	99.84	786.70
	2115	0.08	3.42	0.33	959.03	25	99.87	807.96
	2120	0.06	3.50	0.25	959.28	30	99.90	826.86
	2125	0.05	3.58	0.20	959.48	35	99.92	845.76
	2130	0.04	3.67	0.16	959.64	40	99.94	867.02
	2135	0.03	3.75	0.12	959.77	45	99.95	885.92
	2140	0.02	3.83	0.08	959.85	50	99.96	904.82
	2145	0.02	3.92	0.08	959.93	55	99.97	926.08
	2150	0.01	4.00	0.04	959.97	0	99.97	944.98
	2155	0.01	4.08	0.04	960.01	5	99.97	963.88

[illegible] = 5-min

2200	0.01	4.17	0.04	960.05	10	99.98	985.14
2205	0.01	4.25	0.04	960.09	15	99.98	1004.04
2210	0.01	4.33	0.04	960.14	20	99.99	1022.94
2215	0.01	4.42	0.04	960.18	25	99.99	1044.20
2220	0.01	4.50	0.04	960.22	30	100.00	1063.10
2225	0.01	4.58	0.04	960.26	35	100.00	1082.00
~~2230~~	~~0.00~~	~~4.67~~	~~0.00~~	~~960.26~~	~~40~~	~~100.00~~	~~1103.27~~


ACADEMY ACRES DRAIN
12 AUGUST 1982
PQULT
110
100
90
80
70
60
50
40
30
20
10
0
0
200
400
600
800
1000
1200
PLAG

AAA2
25 June 81



Time	Σ P	P
0	0	0
1	0	0
2	0	0
3	0	0
4	.01	.01
5	.02	.01
6	.04	.02
7	.06	.02
8	.09	.03
9	.12	.03
10	.16	.04
11	.20	.04
12	.24	.04
13	.28	.04
14	.31	.03
15	.34	.03
16	.37	.03
17	.40	.03
18	.43	.03
19	.46	.03
20	.49	.03

Time	Σ P	P
21	.50	.01
22	.52	.01
23	.53	.01
24	.54	.01
25	.55	.01
26	.56	.01
27	.57	.01
28		
29		
30		

15 Sept. 87

AAA 15 Sept 87

Total area = .124 mi^2 = 79.4 acres

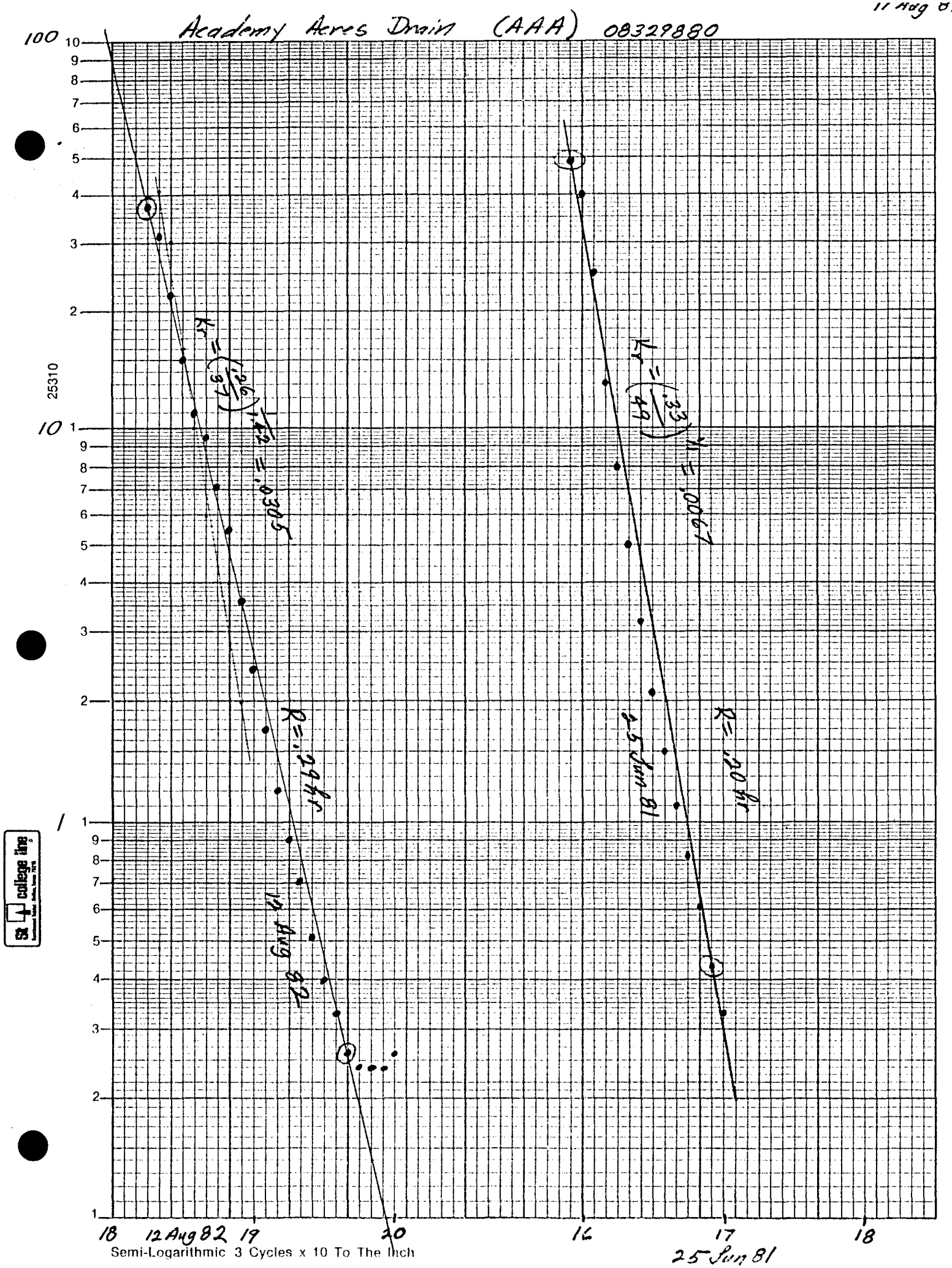
Storm Date	Rainfall Depth inches	Rainfall Duration minutes	Runoff Volume ft^3	Effective Imp. Area acres	
24 April 80	.27	145 -	14,820	15.1	✓
9 Sept 80	.48	480	34,158	19.6	(antecedent rainfall)
1 July 81	.17	160 -	9,369	15.2	✓
15 July 81	.25	150 -	10,341	11.4	✓
5 Sept 81	.14	35	8,751	17.2	high intensity
1 Oct 81	.295	270 -	12,360	11.5	✓
26 July 82	.18	150 -	7,374	11.3	✓
20 Sept 82	.30	210	19,128	17.6	high intensity
21 Sept 82	.135	65	8,679	17.7	non-uniform

Average of checked events = 12.9 acres

% effective imp. area = 16.3 %

impervious area = 38 %

11 Aug 81


Academy Acres Drain (AAA) 08329880
100
10
1
25310
$K_r = \left(\frac{.26}{37}\right)^{1/2} = .0305$
R = .29 hr
12 Aug 82
$K_r = \left(\frac{.33}{49}\right)^{1/2} = .0067$
R = .20 hr
25 Jun 81
18
12 Aug 82
19
20
16
17
18
25 Jun 81
Semi-Logarithmic 3 Cycles x 10 To The Inch

Flood Reconstitution for Albuquerque Camino Arroyo Trib. ACA 1

Storm Event 6 Sept 80

Runoff: depth = .40 inches, Q_p = 80 cfs at t_p = .42 hours

$R_{recession}$ = .22 hrs

INPUT (1) Area acres	(2) Eff. Imp. Area %	(3) Rain in.	(4) Comp. Inter. min.	(5) Time-Area	(6)	Results (7) Q_p cfs	(8) t_p hr.	(9) T_c hr.	(10) R hr.	(11) STRTL in.	(12) CNSTL in/hr	(13) Output File	(14) Comment
57.0	0	1.00	5	D		73	.42	.09	.13	.35	.33	Ø01	
"	"	"	1	"		71	.43	.09	.12	.41	.28	Ø2	
"	"	"	"	N-2		70	.43	.08	.12	.41	.28	Ø3	
"	"	"	"	N-1		70	.43	.07	.14	.36	.35	Ø4	← best
"	"	"	"	N-3		70	.42	.06	.14	.35	.36	Ø5	

Flood Reconstitution for Albuquerque Camino Arroyo Trib. ACA 2

Storm Event 7 July 81

Runoff: depth = .27 inches, Q_p = 49 cfs at t_p = .42 hours

$R_{recession}$ = .23 hrs

INPUT (1) Area acres	(2) Eff. Imp. Area %	(3) Rain in.	(4) Comp. Inter. min.	(5) Time-Area	(6)	Results (7) Q_p cfs	(8) t_p hr.	(9) T_c hr.	(10) R hr.	(11) STRTL in.	(12) CNSTL in/hr	(13) Output File	(14) Comment
57.0	0	.98	5	D		47	.42	.09	.16	.62	.17	Ø01	
"	"	"	"	U-1		"	"	"	"	"	"	Ø02	no change because of 5 min. comp. interva
"	"	"	1	N-1		44	.45	.05	.19	.62	.18	Ø3	← best

Table 9.--Station description, daily mean discharge values, monthly rainfall totals, and selected rainfall-discharge unit-value data for CAMINO ARROYO TRIBUTARY NEAR ALBUQUERQUE (08329910), 1979-83.

STATION DESCRIPTION

LOCATION.--Lat 35 deg 11 min 33 sec, long 106 deg 33 min 58 sec, Bernalillo County, Hydrologic Unit 13020203, in Elena Gallegos Grant, on left bank in right-of-way for extension of Wyoming Blvd, 150 ft (46 m) north of Florence Ave, 370 ft (113 m) south of San Diego Ave, and 1.2 mi (1.9 km) north of intersection of Los Angeles and Wyoming Blvds.

DRAINAGE AREA.--0.089 sq mi (0.231 sq km).

PERIOD OF RECORD.--June 1979 to current year (no winter records).

GAGE.--Water-stage recorder. Altitude of gage is 5,370 ft (1,636.78 m), from topographic orthophoto map.

REMARKS.--Records poor. Recording rain gage at station. Drainage basin is undeveloped semi-desert terrain.

STAGE-DISCHARGE RELATION.--Rating developed on basis of step-backwater analysis of reach of natural stream channel and slope-area measurements at discharges of 63 cu ft per sec (1.78 cu m per sec) and 80 cu ft per sec (2.27 cu m per sec).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 80 cu ft per sec (2.26 cu m per sec) Sept. 6, 1980, gage height, 2.11 ft (0.643 m); no flow most of the time.

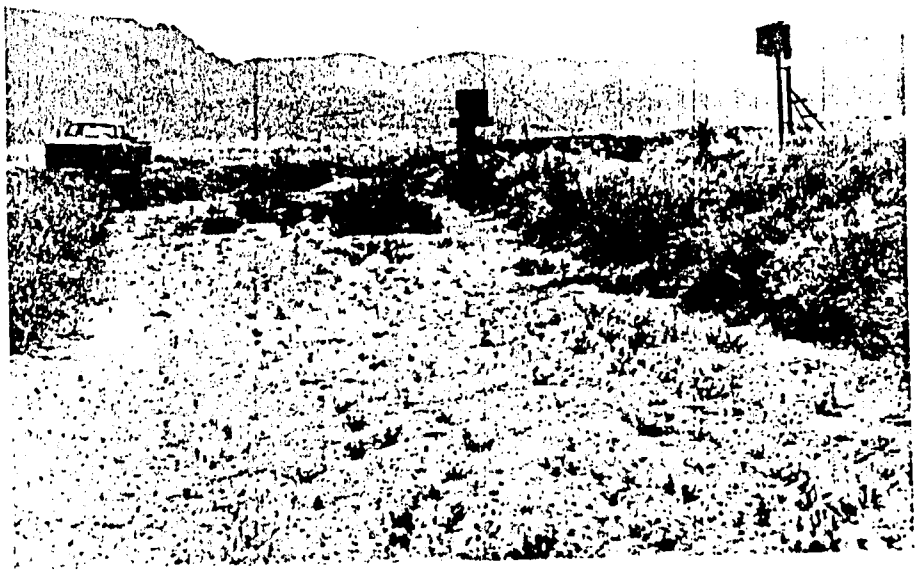
EXTREMES.--Maximum discharge during period June to December 1979, 0.37 cu ft per sec (0.01 cu m per sec) Aug. 15, gage height, 1.02 ft (0.311 m), from slope-area measurement of peak flow; no flow most of the time.

Calendar year 1980: Maximum discharge, 80 cu ft per sec (2.26 cu m per sec) Sept. 6, gage height, 2.11 ft (0.643 m); no flow most of the time.

Calendar year 1981: Maximum discharge, 49 cu ft per sec (1.39 cu m per sec) July 7, gage height, 1.81 ft (0.552 m); no flow most of the time.

Calendar year 1982: Maximum discharge, 5.5 cu ft per sec (0.16 cu m per sec) July 31, gage height, 1.20 ft (0.366 m); no flow most of the time.

Calendar year 1983: No flow recorded.



Photograph 11.--Camino Arroyo Tributary (08329910). Direction of view is downstream.

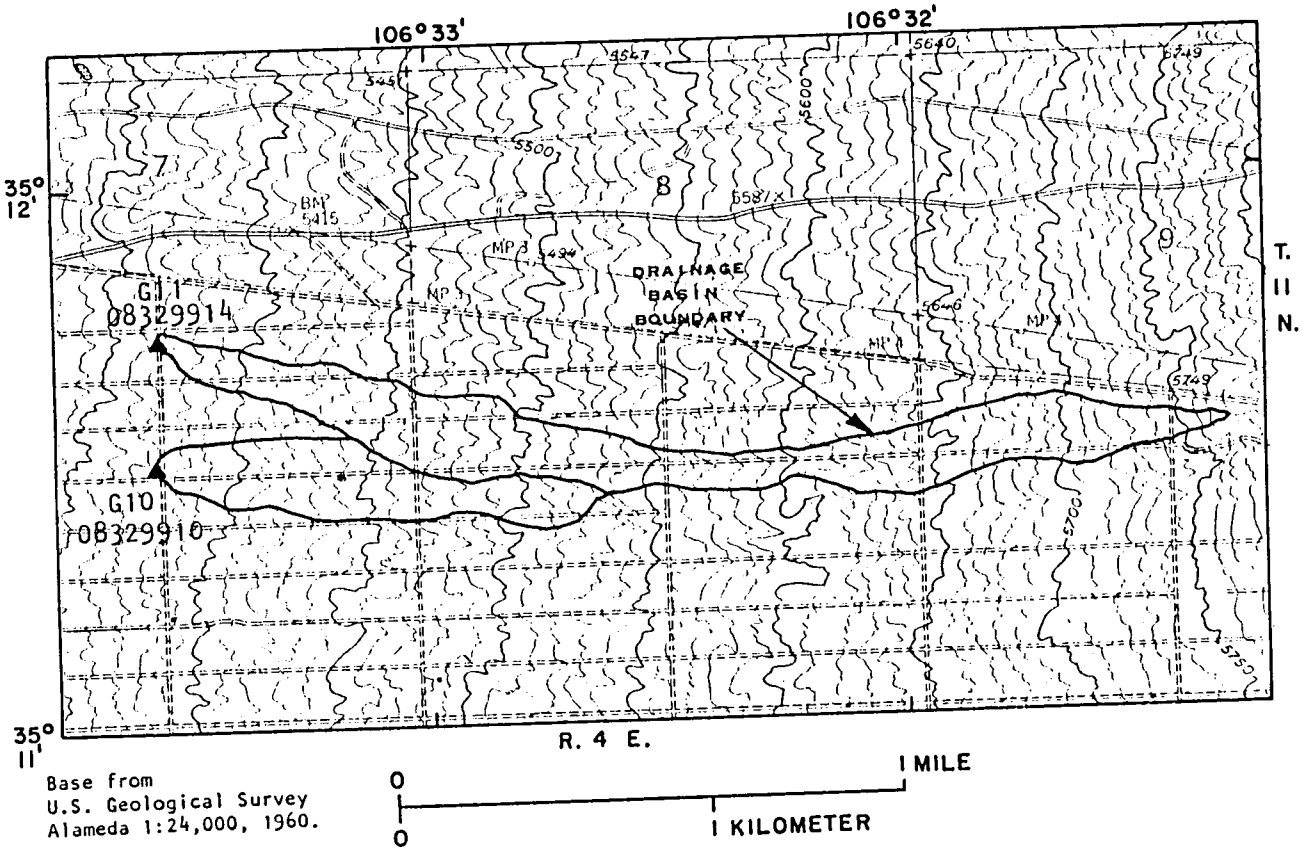


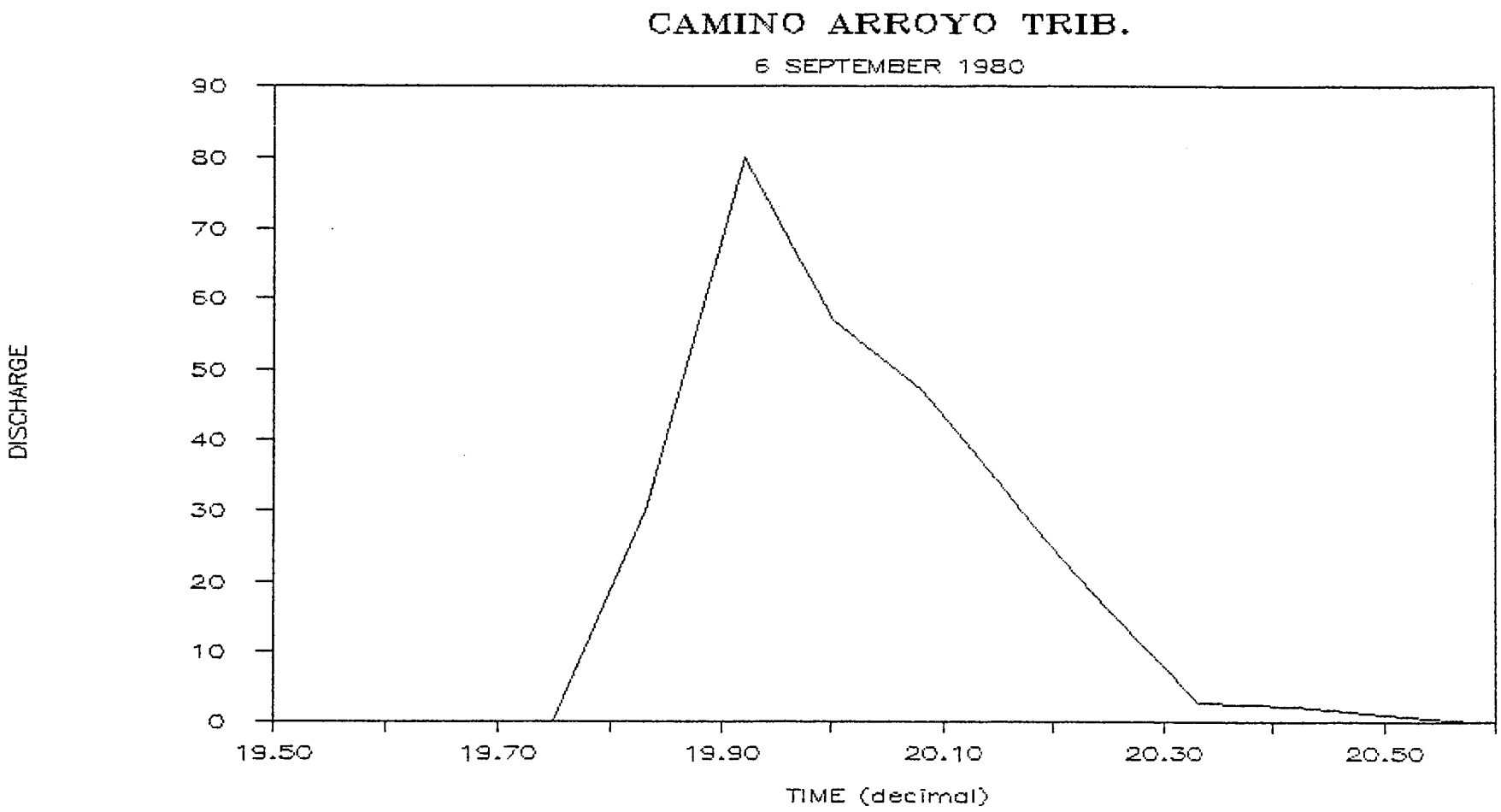
Figure 6.--Drainage basins for Camino Arroyo Tributary (08329910) and North Camino Arroyo Tributary (08329914).

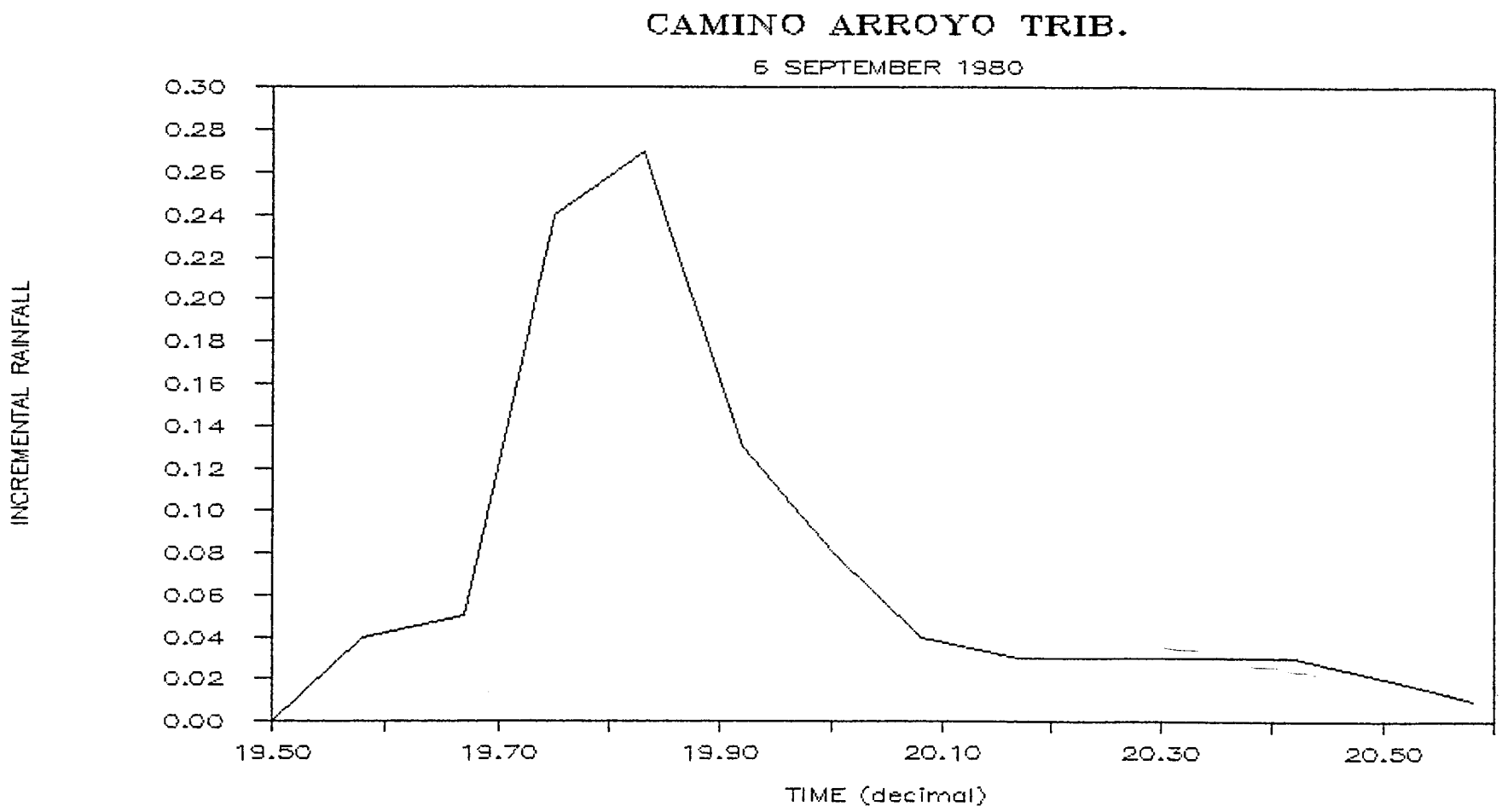
1980
1981

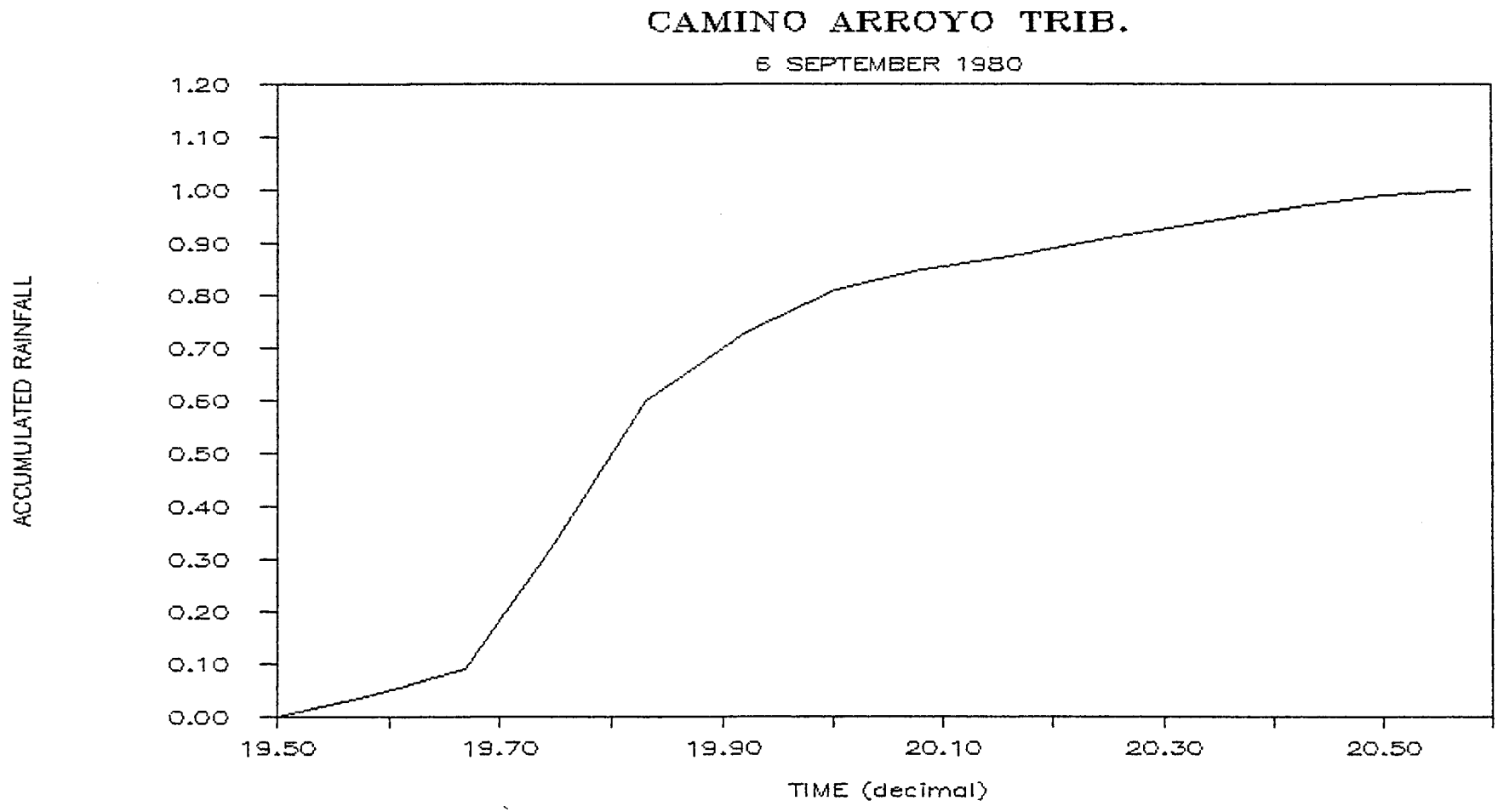
CAMINO ARROYO TRIB.

DATE	TIME	Q	P10	SUM P10
06-Sep-80	1930	0.00	0.00	0.00
	1935	0.00	0.04	0.04
	1940	0.00	0.05	0.09
	1945	0.00	0.24	0.33
	1950	30.00	0.27	0.60
	1955	80.00	0.13	0.73
	2000	57.00	0.08	0.81
	2005	47.00	0.04	0.85
	2010	30.00	0.03	0.88
	2015	16.00	0.03	0.91
	2020	2.80	0.03	0.94
	2025	2.10	0.03	0.97
	2030	1.10	0.02	0.99
	2035	0.00	0.01	1.00

DATE	TIME	Q	P10	SUM P10
07-Jul-81	1715	0.00	0.00	0.00
	1720	0.00	0.15	0.15
	1725	0.00	0.27	0.42
	1730	5.50	0.25	0.67
	1735	24.00	0.15	0.82
	1740	49.00	0.09	0.91
	1745	32.00	0.02	0.93
	1750	29.00	0.00	0.93
	1755	10.00	0.02	0.95
	1800	8.70	0.01	0.96
	1805	7.70	0.00	0.96
	1810	5.90	0.01	0.97
	1815	4.20	0.01	0.98
	1820	1.10	0.00	0.98
	1825	0.00	0.00	0.98


CAMINO ARROYO TRIB.
6 SEPTEMBER 1980
DISCHARGE
90
80
70
60
50
40
30
20
10
0
19.50
19.70
19.90
20.10
20.30
20.50
TIME (decimal)

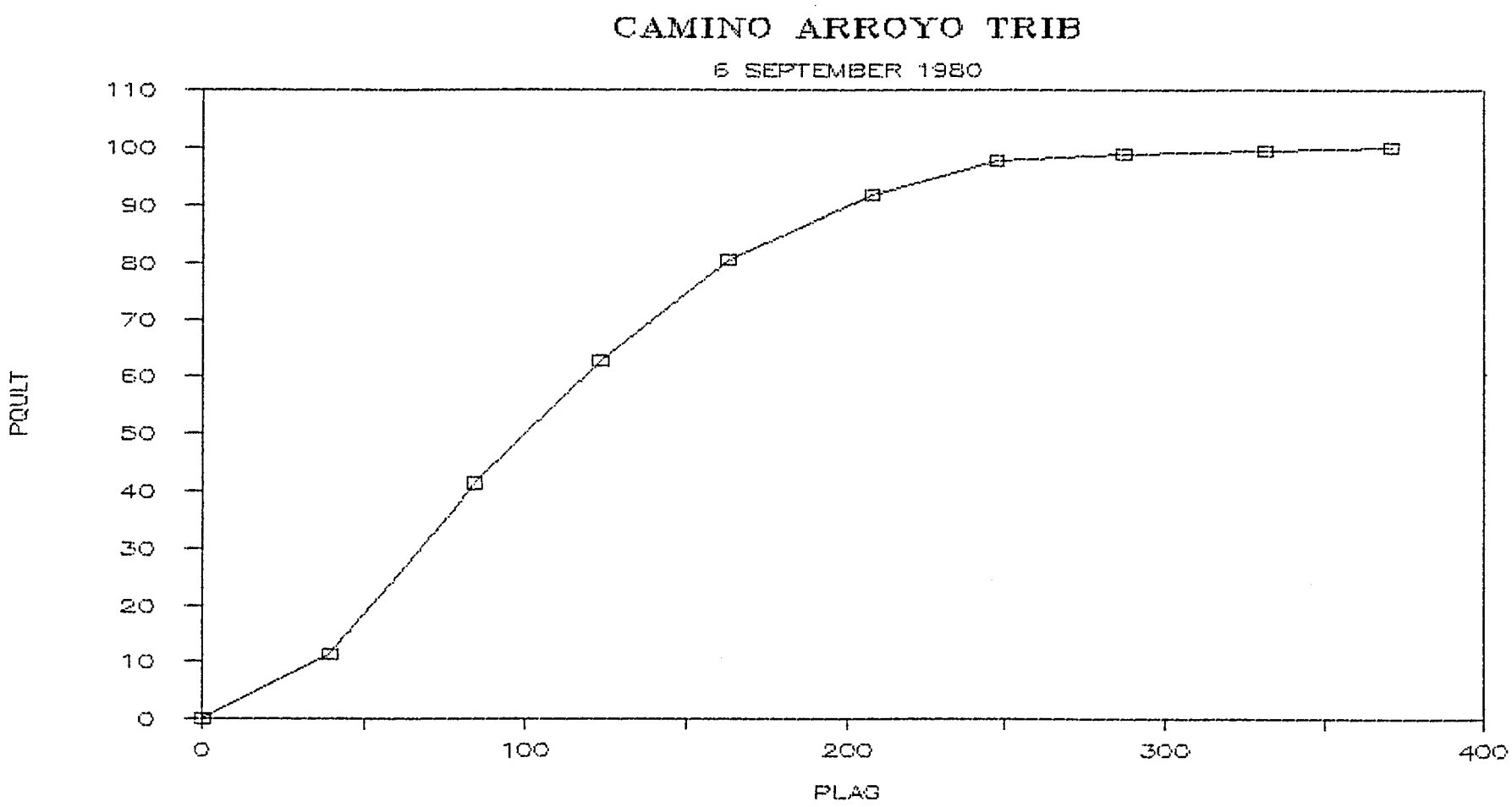

CAMINO ARROYO TRIB.
6 SEPTEMBER 1980
INCREMENTAL RAINFALL
0.30
0.28
0.26
0.24
0.22
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
19.50
19.70
19.90
20.10
20.30
20.50
TIME (decimal)

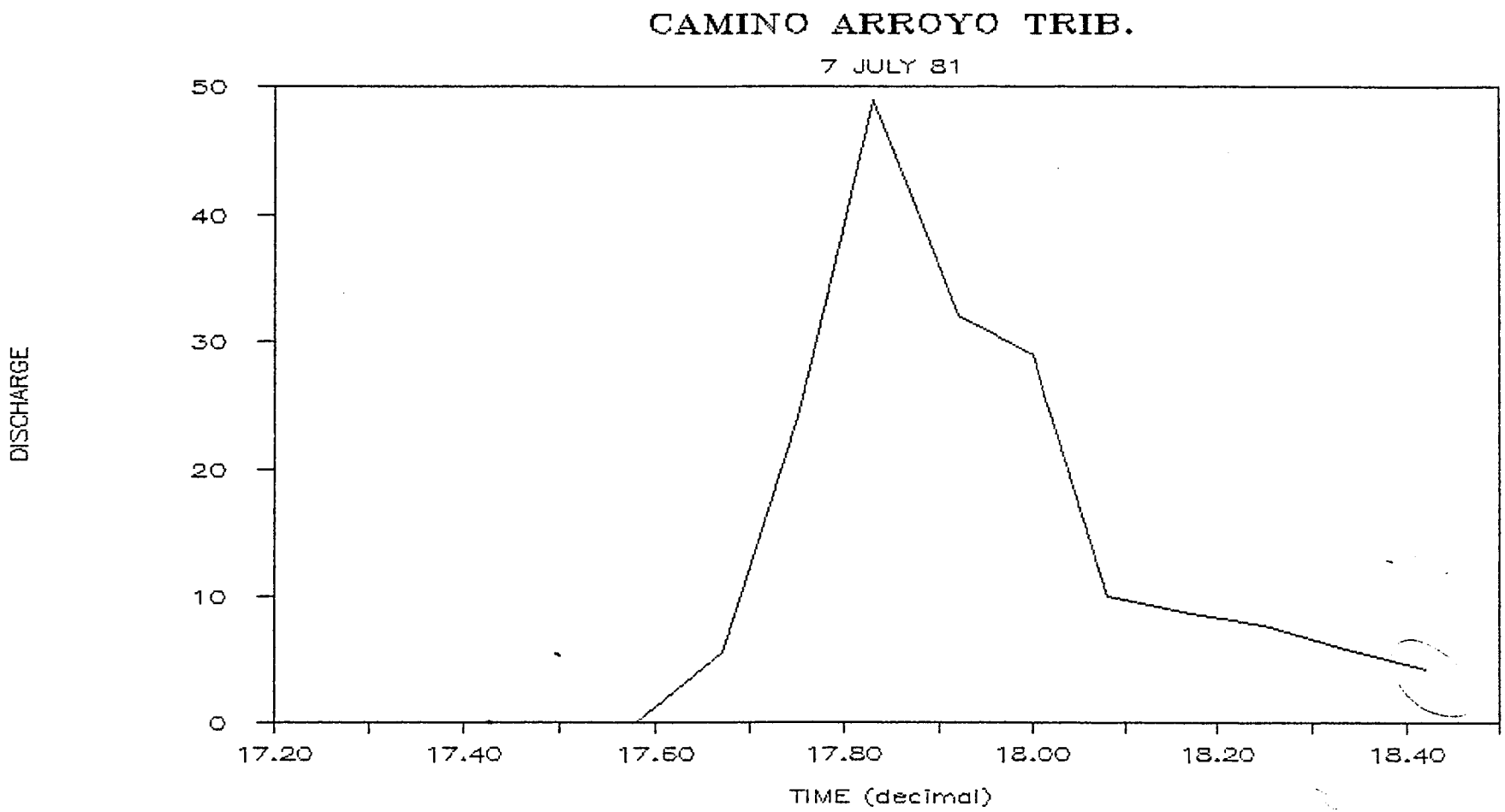

CAMINO ARROYO TRIB.
6 SEPTEMBER 1980
ACCUMULATED RAINFALL
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
19.50
19.70
19.90
20.10
20.30
20.50
TIME (decimal)

ACA.1	SUM Q	EUD	LAG	QULT
	266	0.39	0.20	689.22

ALBUQUERQUE DATA
CAMINO ARROYO TRIB.

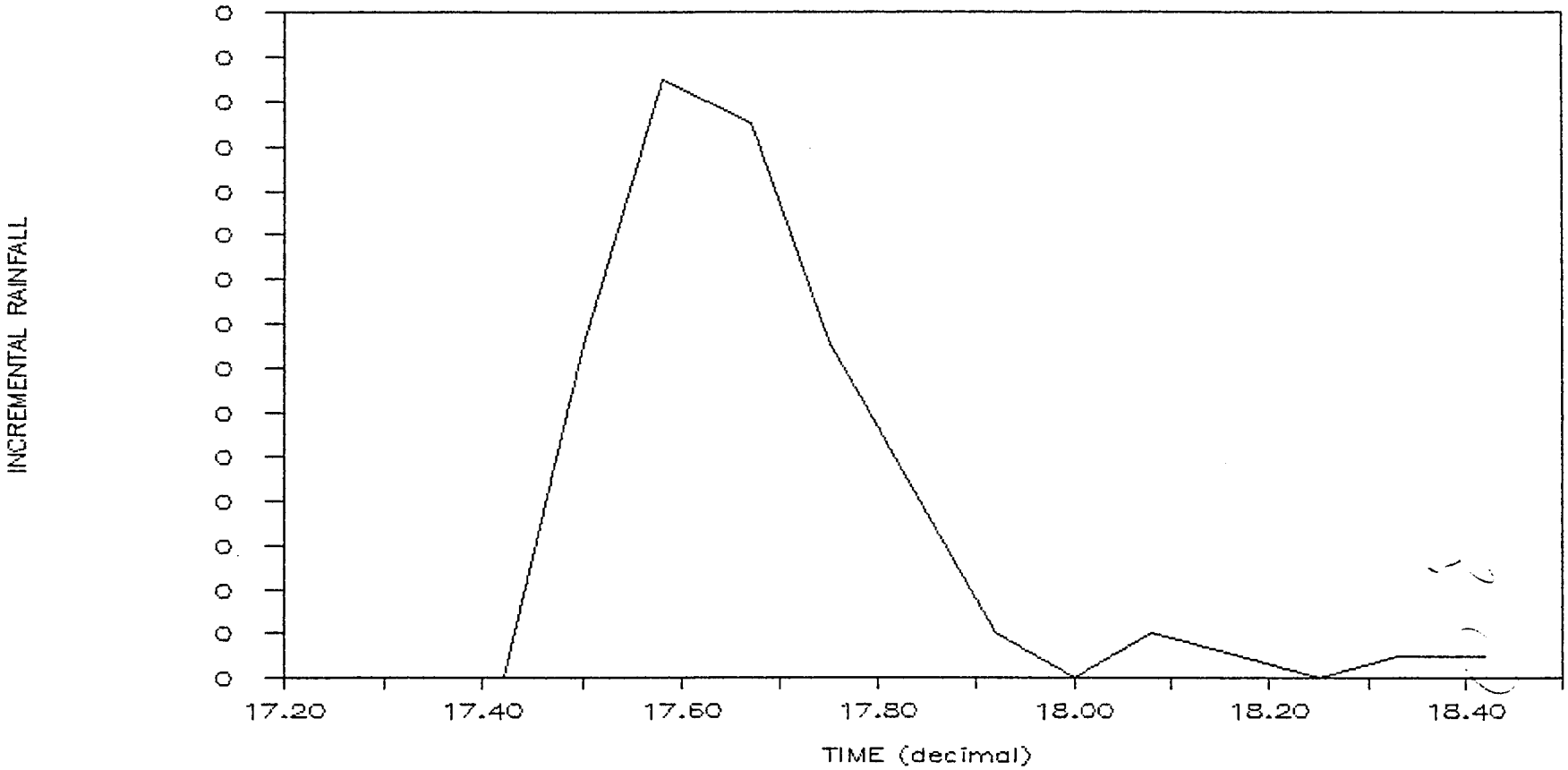
DATE	TIME	Q	DEC TI	UHG	SUM UHG	PQULT	PLAG
06-Sep-80	1930	0.00					
	1935	0.00					
	1940	0.00					
	1945	0.00	0.00	0.00	0.00	0.00	0.00
	1950	30.00	0.08	77.73	77.73	11.28	39.55
	1955	80.00	0.17	207.28	285.01	41.35	84.04
	2000	57.00	0.25	147.69	432.70	62.78	123.59
	2005	47.00	0.33	121.78	554.48	80.45	163.14
	2010	30.00	0.42	77.73	632.21	91.73	207.63
	2015	16.00	0.50	41.46	673.67	97.74	247.18
	2020	2.80	0.58	7.25	680.93	98.80	286.73
	2025	2.10	0.67	5.44	686.37	99.59	331.22
	2030	1.10	0.75	2.85	689.22	100.00	370.77

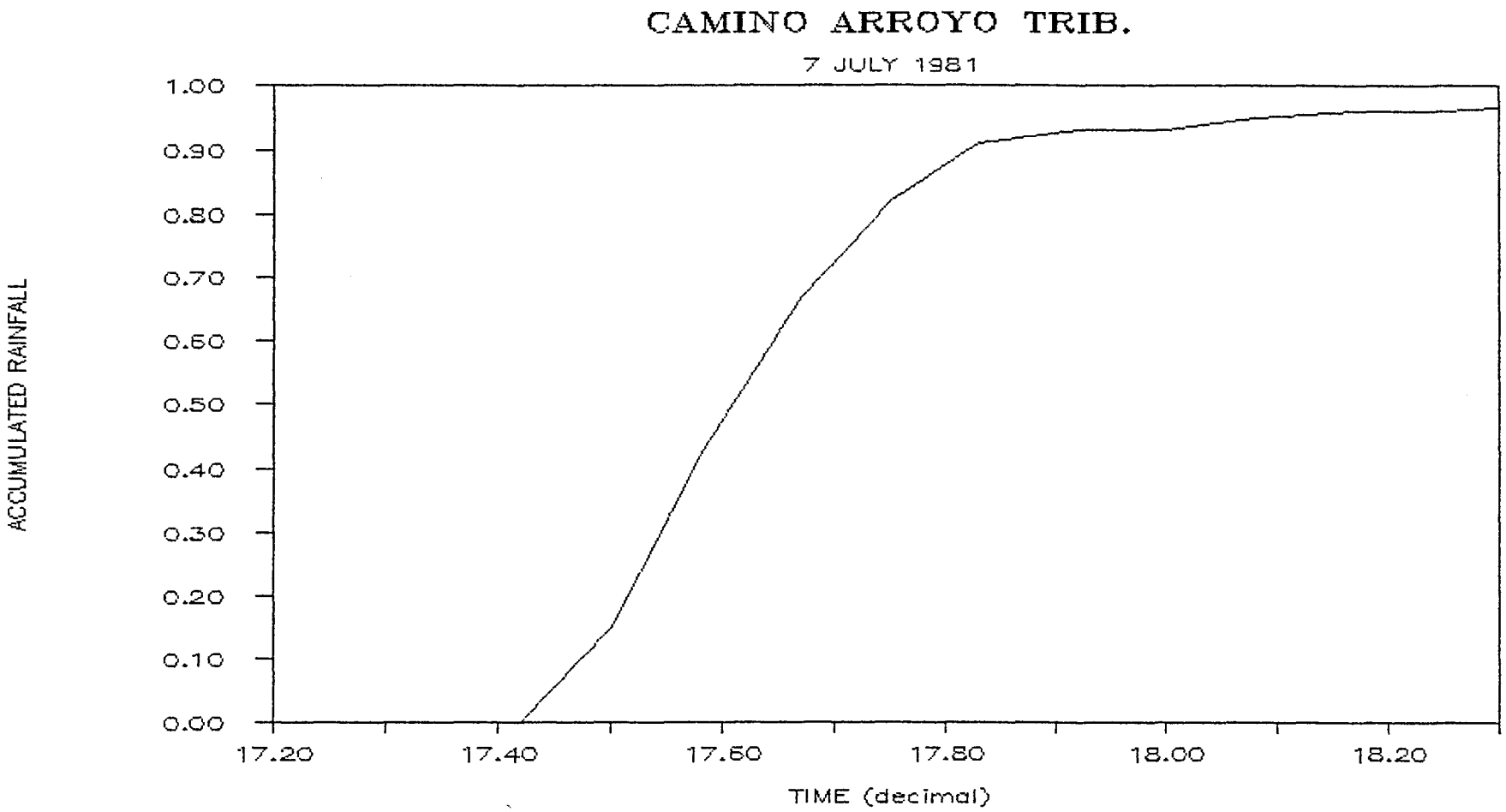

CAMINO ARROYO TRIB
6 SEPTEMBER 1980
PQULT
110
100
90
80
70
60
50
40
30
20
10
0
0
100
200
300
400
PLAG


CAMINO ARROYO TRIB.
7 JULY 81
DISCHARGE
50
40
30
20
10
0
17.20
17.40
17.60
17.80
18.00
18.20
18.40
TIME (decimal)

CAMINO ARROYO TRIB.

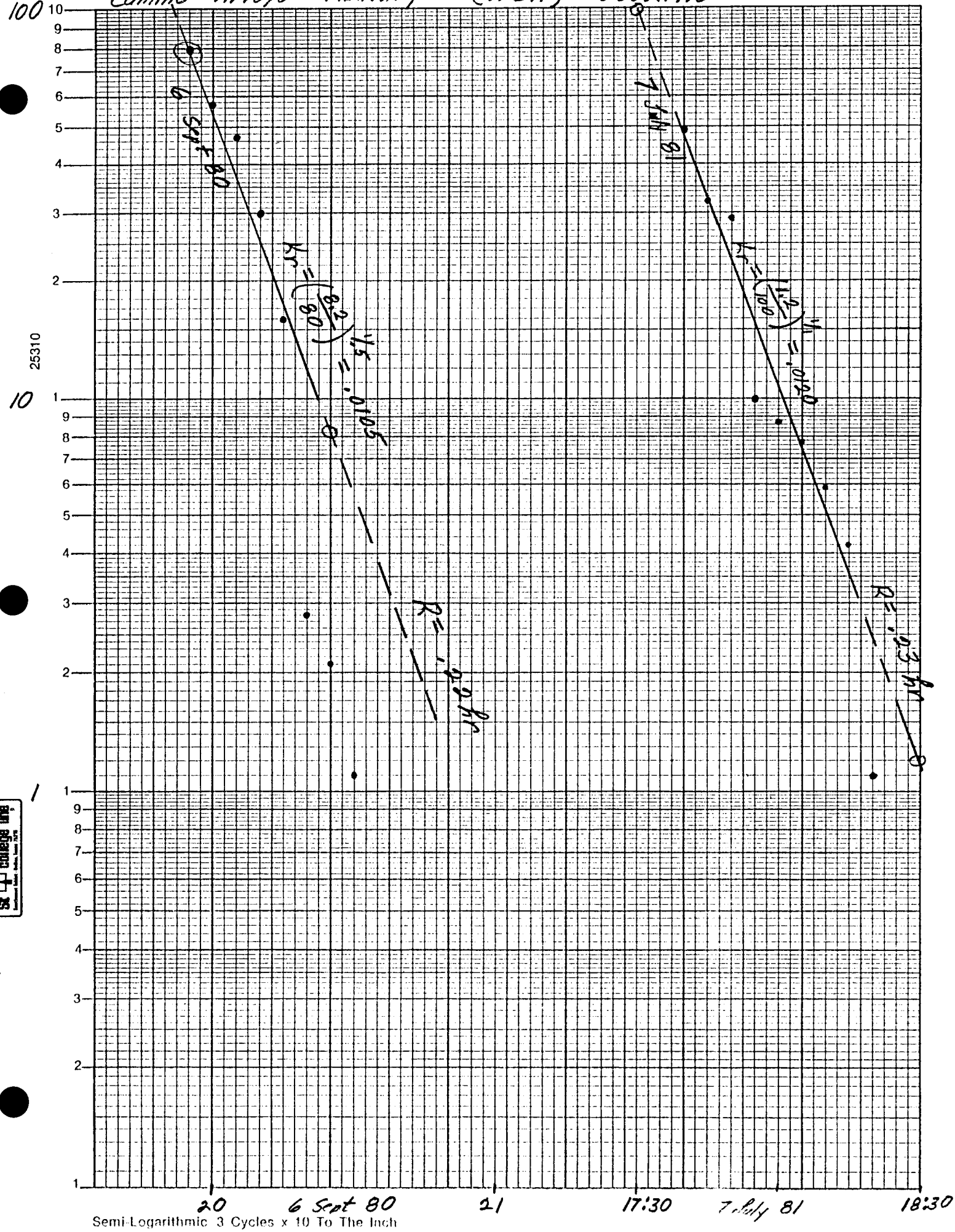
7 JULY 1981




CAMINO ARROYO TRIB.
7 JULY 1981
ACCUMULATED RAINFALL
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
17.20
17.40
17.60
17.80
18.00
18.20
TIME (decimal)

21 Aug 87

Camino Arroyo Tributary (ACA) 08329910



Semi-Logarithmic 3 Cycles x 10 To The Inch

Flood Reconstitution for Albuquerque North Camino Arroyo Trib. ANCA 1

Storm Event 14 Aug 80

Runoff: depth = .43 inches, Q_p = 131 cfs at t_p = 1.58 hours

$R_{recession}$ = .34 hrs

INPUT (1) Area acres	(2) Eff. Imp. Area %	(3) Rain in.	(4) Comp. Inter. min.	(5) Time-Area	(6)	Results (7) Q_p cfs	(8) t_p hr.	(9) T_c hr.	(10) R hr.	(11) STRTL in.	(12) CNSTL in/hr	(13) Output File	(14) Comment
134.4	0	3.69	5	D		160	1.58	.12	.17	1.95	.89	Ø2	stage recorder was silted on recession
"	"	"	2	"		119	1.53	.08	.40	2.19	1.37	Ø3	
"	"	"	"	N-1		121	1.53	.08	.38	2.15	1.50	Ø4	← best

Flood Reconstitution for Albuquerque North Camino Arroyo Trib. ANCA 2

Storm Event 7 July 81

Runoff: depth = .48 inches, Q_p = 134 cfs at t_p = .42 hours

$R_{recession}$ = .37 hrs

INPUT (1) Area acres	(2) Eff. Imp. Area %	(3) Rain in.	(4) Comp. Inter. min.	(5) Time-Area	(6)	Results (7) Q_p cfs	(8) t_p hr.	(9) T_c hr.	(10) R hr.	(11) STRTL in.	(12) CNSTL in/hr	(13) Output File	(14) Comment
134.4	0	.98	5	D		126	.42	.09	.29	.37	.23	Ø2	
"	"	"	"	U-1		125	.50	.15	.29	.36	.28	Ø3	
"	"	"	2	D		121	.43	.04	.36	.36	.17	Ø4	← slightly better
"	"	"	"	N-1		120	.43	.04	.36	.36	.16	Ø5	← selected because same T-A as ANCA1.Ø4

Table 10.--Station description, daily mean discharge values, monthly rainfall totals, and selected rainfall-discharge unit-value data for NORTH CAMINO ARROYO TRIBUTARY NEAR ALBUQUERQUE (08329914), 1979-83.

STATION DESCRIPTION

LOCATION.--Lat 35 deg 11 min 47 sec, long 106 deg 33 min 57 sec, Bernalillo County, Hydrologic Unit 13020203, in Elena Gallegos Grant, on left bank in right-of-way for extension of Wyoming Blvd, 150 ft (46 m) south of Venice Ave, 350 ft (107 m) north of Beverly Hills Ave, and 1.5 mi (2.4 km) north of intersection of Los Angles and Wyoming Blvds.

DRAINAGE AREA.--0.21 sq mi (0.544 sq km).

PERIOD OF RECORD.--June 1979 to current year (no winter records).

GAGE.--Water-stage recorder. Altitude of gage is 5,364 ft (1,634.95 m), from topographic orthophoto map.

REMARKS.--Records poor. Recording rain gage at station. Drainage basin is undeveloped semi-desert terrain.

STAGE-DISCHARGE RELATION.--Rating developed on basis of step-backwater analysis of natural stream channel and slope-area measurements at discharges of 119 cu ft per sec (3.37 cu m per sec) and 133 cu ft per sec (3.77 cu m per sec).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 134 cu ft per sec (3.79 cu m per sec) July 7, 1981, gage height, 2.10 ft (0.640 m), from slope-area measurement of peak flow; no flow most of the time.

EXTREMES.--Maximum discharge during period June to December 1979, 22 cu ft per sec (0.62 cu m per sec) Aug. 15, gage height, 1.18 ft (0.360 m); no flow most of the time.

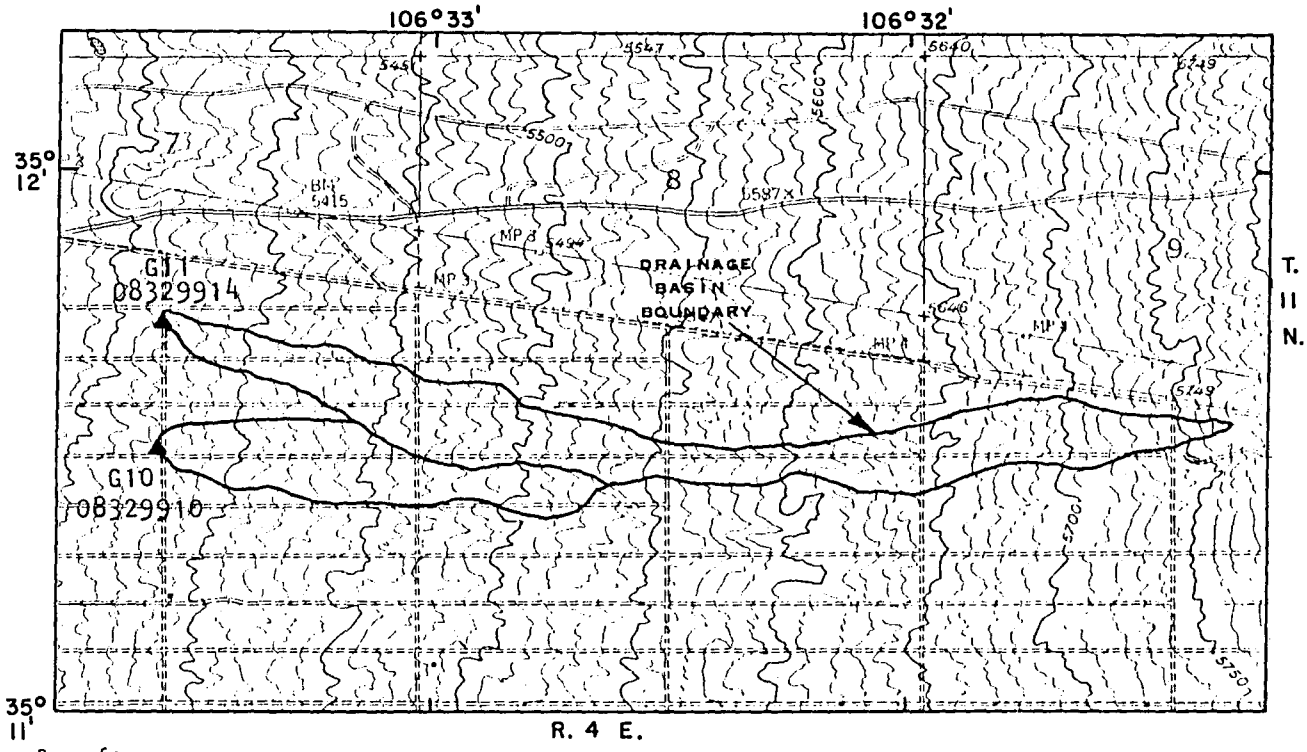
Calendar year 1980: Maximum discharge, 131 cu ft per sec (3.71 cu m per sec) Aug. 14, gage height, 2.08 ft (0.634 m); no flow most of the time.

Calendar year 1981: Maximum discharge, 134 cu ft per sec (3.79 cu m per sec) July 7, gage height, 2.10 ft (0.640 m); no flow most of the time.

Calendar year 1982: No flow recorded.

Calendar year 1983: No flow recorded.

Photograph 12.--North Camino Arroyo Tributary (08329914). Direction of view is upstream.



Base from
U.S. Geological Survey
Alameda 1:24,000, 1960.

0 — 1 MILE
0 — 1 KILOMETER

CONTOUR INTERVAL 10 FEET
DATUM IS SEA LEVEL

EXPLANATION

G10 ▲ 08329910 — FLOOD-HYDROGRAPH STATION--Includes streamflow gage (08329910) and raingage (G10)

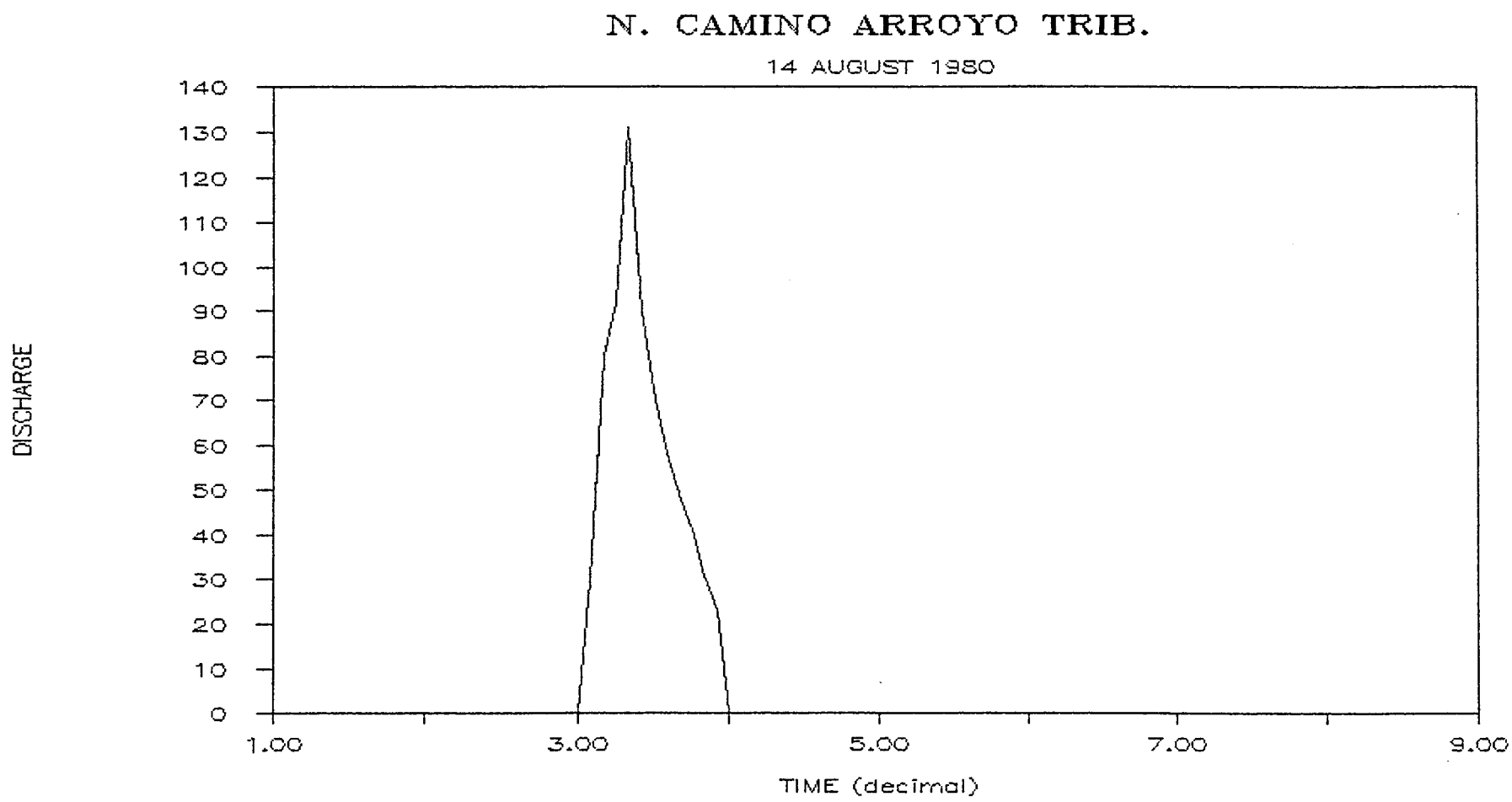
Figure 6.--Drainage basins for Camino Arroyo Tributary (08329910) and North Camino Arroyo Tributary (08329914).

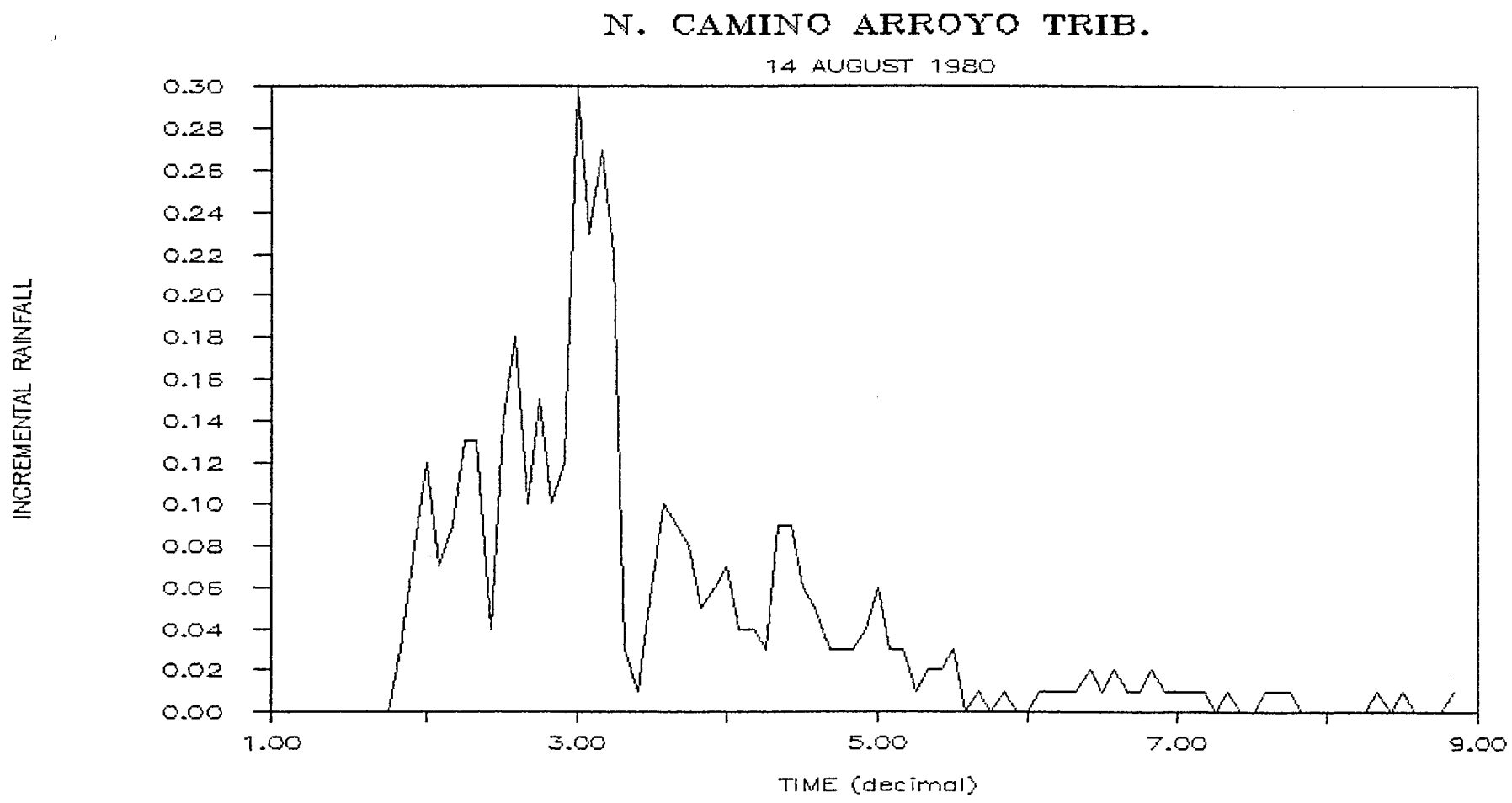
N. CAMINO ARROYO TRIB.

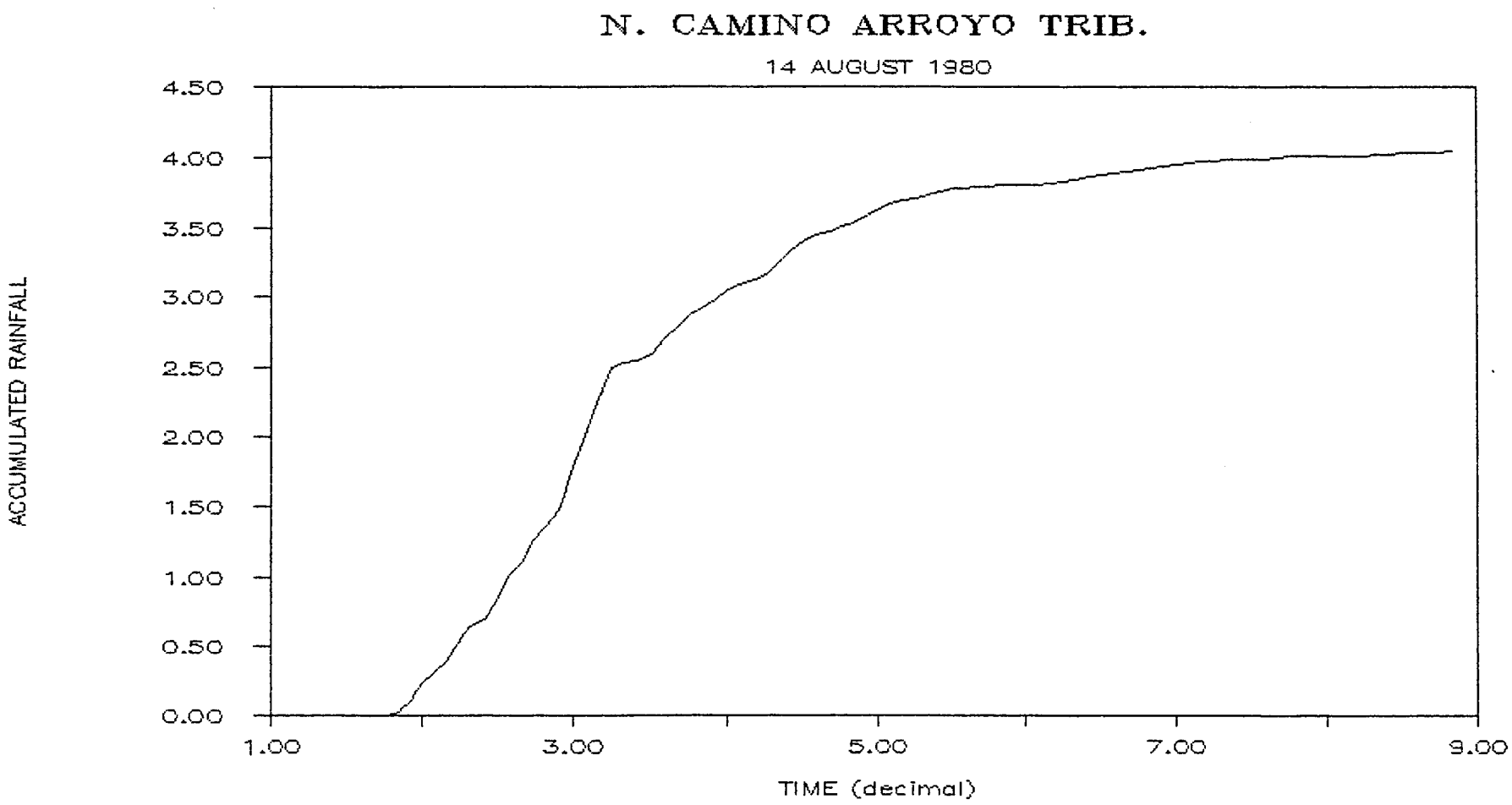
DATE	TIME	Q	P11	SUM P11
14-Aug-80	145	0.00	0.00	0.00
	150	0.00	0.03	0.03
	155	0.00	0.08	0.11
	200	0.00	0.12	0.23
	205	0.00	0.07	0.30
	210	0.00	0.09	0.39
	215	0.00	0.13	0.52
	220	0.00	0.13	0.65
	225	0.00	0.04	0.69
	230	0.00	0.14	0.83
	235	0.00	0.18	1.01
	240	0.00	0.10	1.11
	245	0.00	0.15	1.26
	250	0.00	0.10	1.36
	255	0.00	0.12	1.48
	300	0.00	0.30	1.78
	305	30.00	0.23	2.01
	310	80.00	0.27	2.28
	315	92.00	0.22	2.50
	320	131.00	0.03	2.53
	325	90.00	0.01	2.54
	330	70.00	0.06	2.60
	335	58.00	0.10	2.70
	340	48.00	0.09	2.79
	345	41.00	0.08	2.87
	350	31.00	0.05	2.92
	355	23.00	0.06	2.98
	400	0.00	0.07	3.05
	405	0.00	0.04	3.09
	410	0.00	0.04	3.13
	415	0.00	0.03	3.16
	420	0.00	0.09	3.25
	425	0.00	0.09	3.34
	430	0.00	0.06	3.40
	435	0.00	0.05	3.45
	440	0.00	0.03	3.48
	445	0.00	0.03	3.51
	450	0.00	0.03	3.54
	455	0.00	0.04	3.58
	500	0.00	0.06	3.64
	505	0.00	0.03	3.67
	510	0.00	0.03	3.70
	515	0.00	0.01	3.71
	520	0.00	0.02	3.73
	525	0.00	0.02	3.75
	530	0.00	0.03	3.78
	535	0.00	0.00	3.78
	540	0.00	0.01	3.79
	545	0.00	0.00	3.79
	550	0.00	0.01	3.80
	555	0.00	0.00	3.80
	600	0.00	0.00	3.80
	605	0.00	0.01	3.81
	610	0.00	0.01	3.82
	615	0.00	0.01	3.83
	620	0.00	0.01	3.84
	625	0.00	0.02	3.86

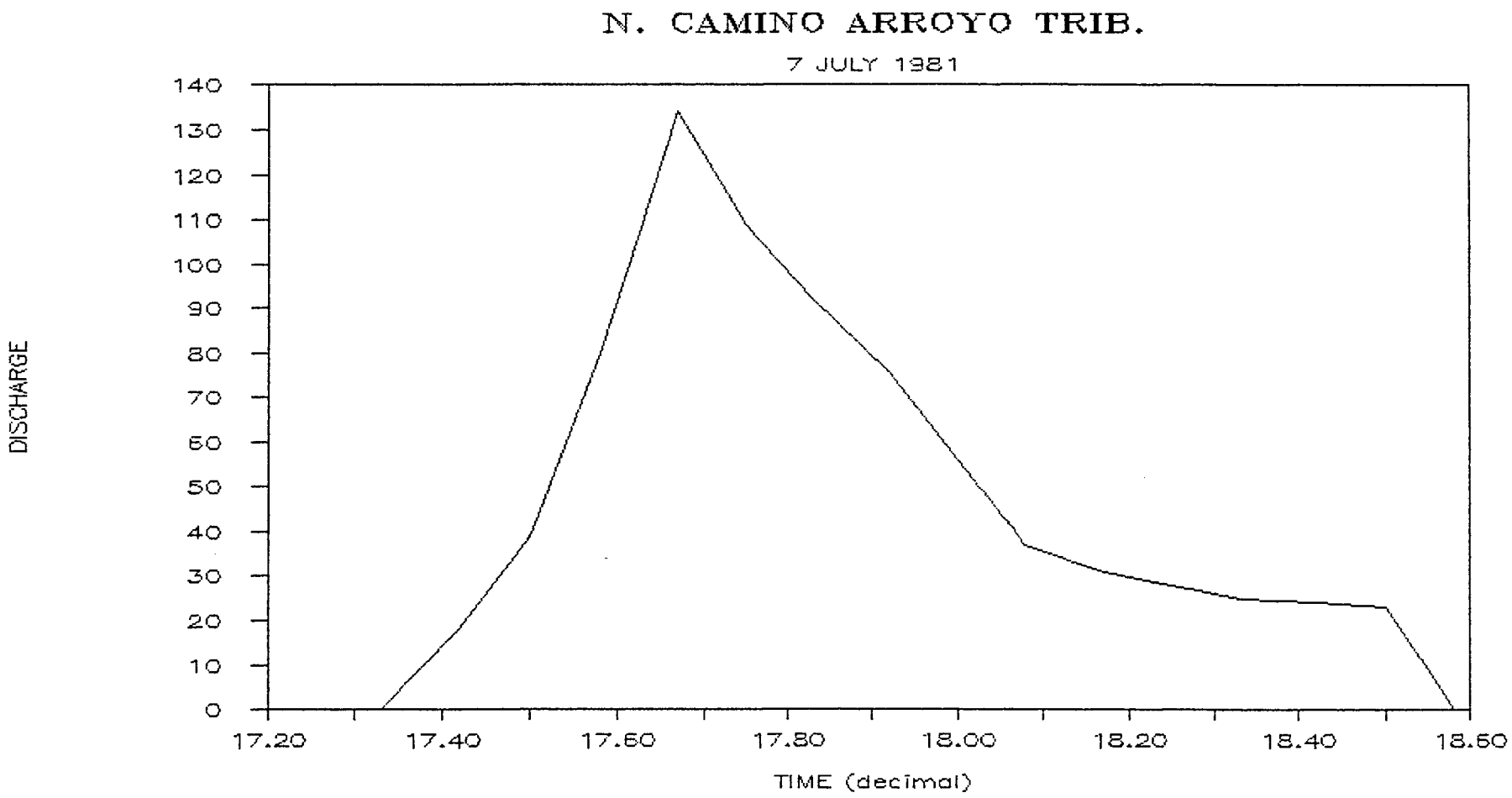
N. CAMINO ARROYO 1P1B

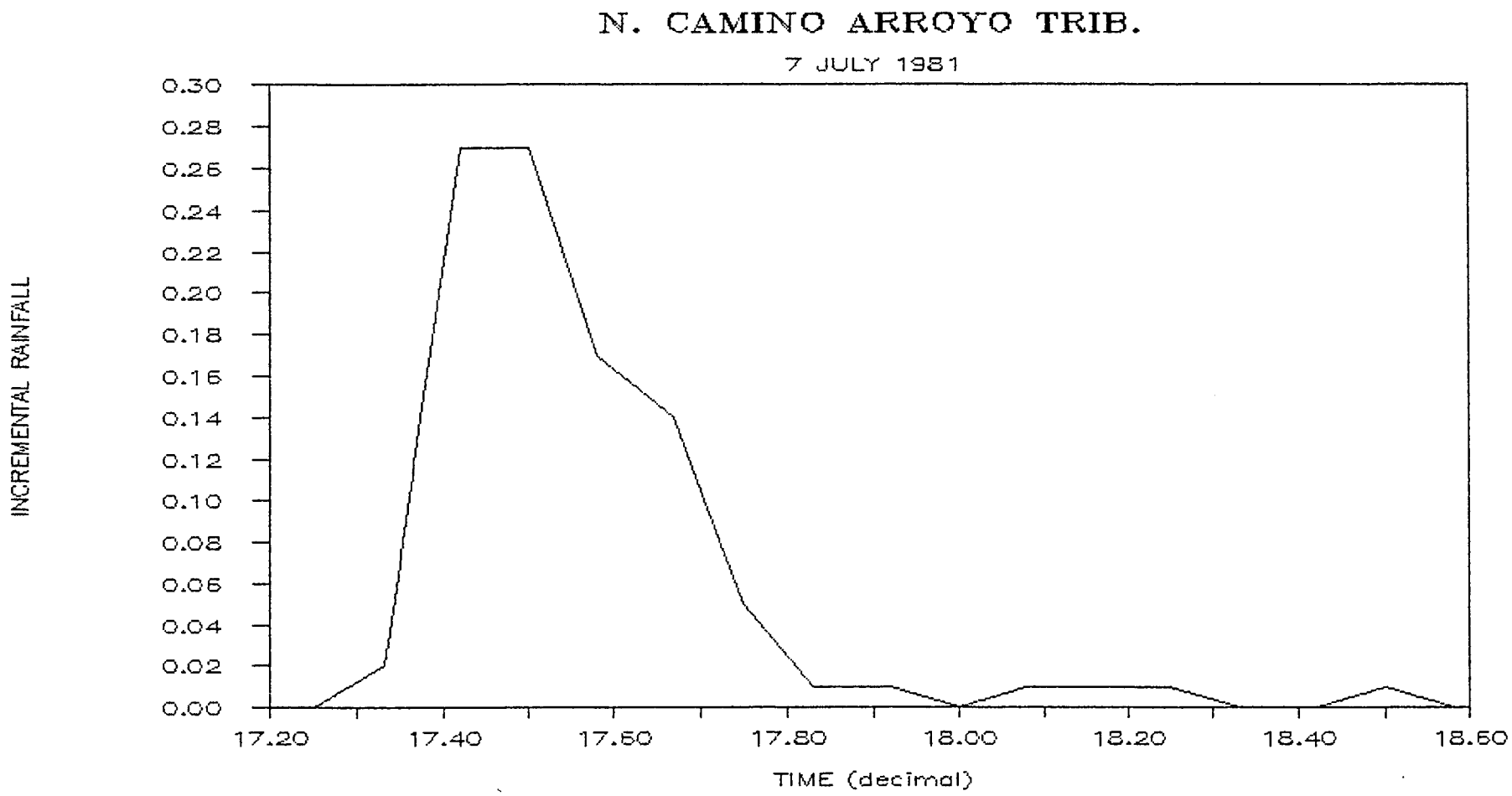
	630	0.00	0.01	3.87
	635	0.00	0.02	3.89
	640	0.00	0.01	3.90
	645	0.00	0.01	3.91
	650	0.00	0.02	3.93
	655	0.00	0.01	3.94
	700	0.00	0.01	3.95
	705	0.00	0.01	3.96
	710	0.00	0.01	3.97
	715	0.00	0.00	3.97
	720	0.00	0.01	3.98
	725	0.00	0.00	3.98
	730	0.00	0.00	3.98
	735	0.00	0.01	3.99
	740	0.00	0.01	4.00
	745	0.00	0.01	4.01
	750	0.00	0.00	4.01
	755	0.00	0.00	4.01
	800	0.00	0.00	4.01
	805	0.00	0.00	4.01
	810	0.00	0.00	4.01
	815	0.00	0.00	4.01
	820	0.00	0.01	4.02
	825	0.00	0.00	4.02
	830	0.00	0.01	4.03
	835	0.00	0.00	4.03
	840	0.00	0.00	4.03
	845	0.00	0.00	4.03
	850	0.00	0.01	4.04
07-Jul-81	1715	0.00	0.00	0.00
	1720	0.00	0.02	0.02
	1725	18.00	0.27	0.29
	1730	39.00	0.27	0.56
	1735	80.00	0.17	0.73
	1740	134.00	0.14	0.87
	1745	109.00	0.05	0.92
	1750	92.00	0.01	0.93
	1755	76.00	0.01	0.94
	1800	56.00	0.00	0.94
	1805	37.00	0.01	0.95
	1810	31.00	0.01	0.96
	1815	28.00	0.01	0.97
	1820	25.00	0.00	0.97
	1825	24.00	0.00	0.97
	1830	23.00	0.01	0.98
	1835	0.00	0.00	0.98

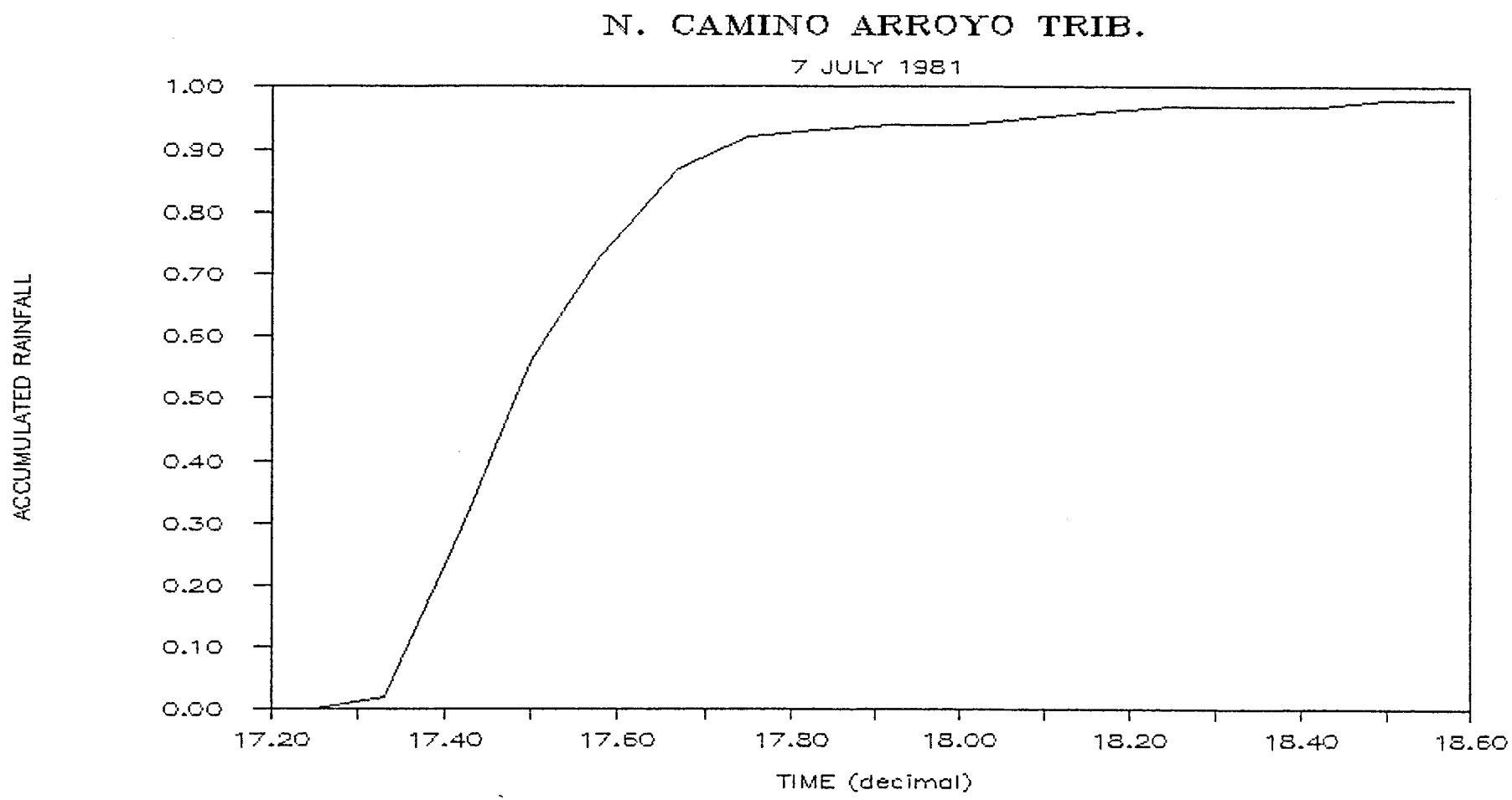

N. CAMINO ARROYO TRIB.
14 AUGUST 1980
DISCHARGE
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1.00
3.00
5.00
7.00
9.00
TIME (decimal)


N. CAMINO ARROYO TRIB.
14 AUGUST 1980
INCREMENTAL RAINFALL
0.30
0.28
0.26
0.24
0.22
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
1.00
3.00
5.00
7.00
9.00
TIME (decimal)


N. CAMINO ARROYO TRIB.
14 AUGUST 1980
ACCUMULATED RAINFALL
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
1.00
3.00
5.00
7.00
9.00
TIME (decimal)

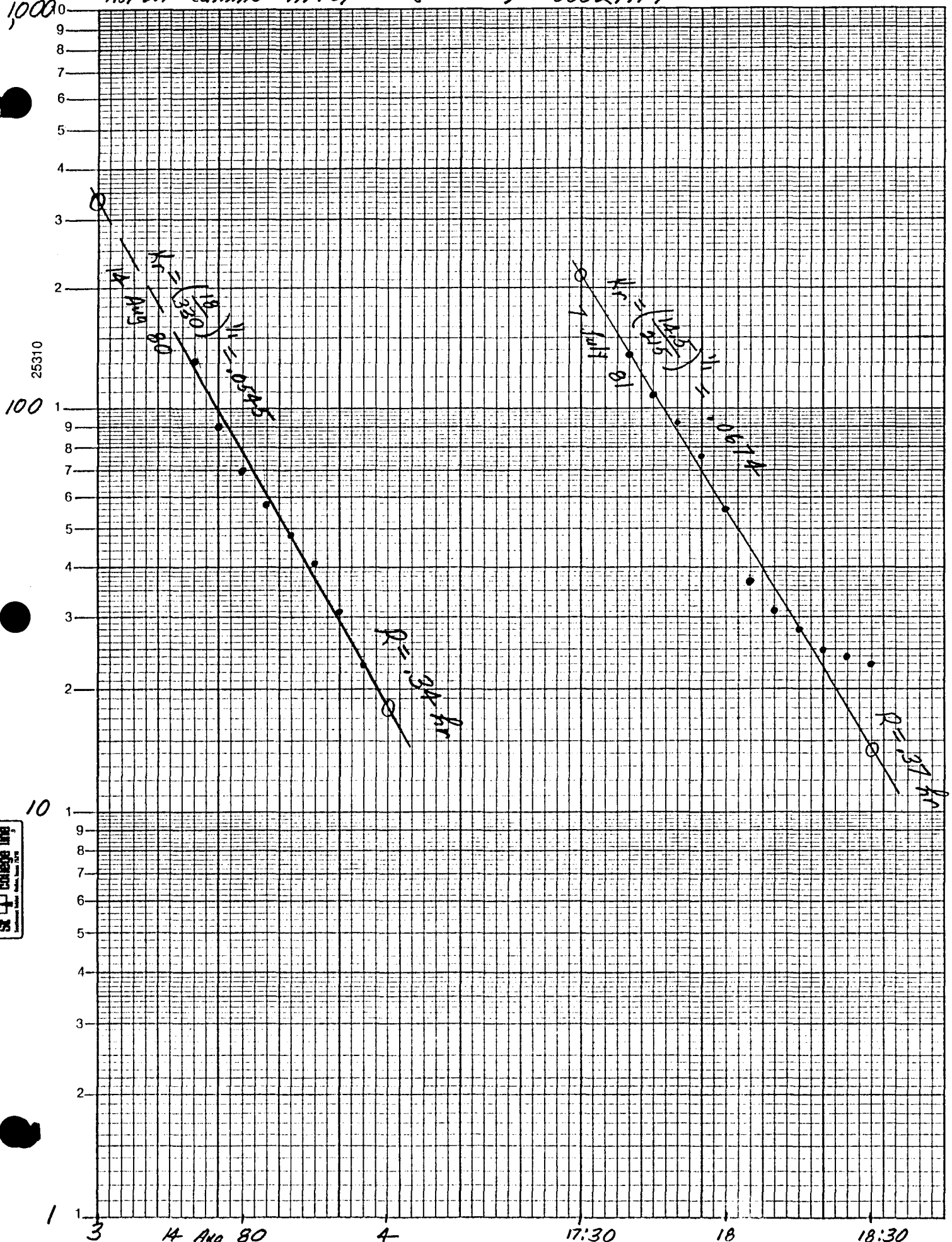

N. CAMINO ARROYO TRIB.
7 JULY 1981
DISCHARGE
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
17.20
17.40
17.60
17.80
18.00
18.20
18.40
18.60
TIME (decimal)


N. CAMINO ARROYO TRIB.
7 JULY 1981
INCREMENTAL RAINFALL
0.30
0.28
0.26
0.24
0.22
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
17.20
17.40
17.60
17.80
18.00
18.20
18.40
18.60
TIME (decimal)


N. CAMINO ARROYO TRIB.
7 JULY 1981
ACCUMULATED RAINFALL
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
17.20
17.40
17.60
17.80
18.00
18.20
18.40
18.60
TIME (decimal)

21 Aug 01

North Camino Arroyo (ANCA) 08329914



Flood Reconstitution for Albuquerque Taylor Ranch ATR 1

Storm Event 29 July 83

Runoff: depth = .13 inches, Q_p = 26 cfs at t_p = .40 hours

$R_{recession}$ = .26 hrs

INPUT (1) Area acres	(2) Eff. Imp. Area %	(3) Rain in.	(4) Comp. Inter. min.	(5) Time-Area	(6)	Results (7) Q_p cfs	(8) t_p hr.	(9) T_c hr.	(10) R hr.	(11) STRTL in.	(12) CNSTL in/hr	(13) Output File	(14) Comment
					comp/obs runoff								
87.0	38	.57	5	D	1.69	25	.50	.09	.39	.91	.18	Ø01	imp. area too large
"	23	"	"	"	1.02	26	.50	.22	.08	.68	.14	Ø02	"
"	9.6	"	2	"		36	.40	.03	.10	.40	.26	Ø09	
"	"	"	1	U-1		32	.38	.02	.18	.33	.50	Ø10	
"	"	"	"	U-3		32	.38	.02	.17	.33	.51	Ø11	
"	"	"	"	U-1	changed rain dist.	29	.38	.02	.16	.33	.49	Ø12	← best

Table 12.--Station description, daily mean discharge values, monthly rainfall totals, and selected rainfall-discharge unit-value data for TAYLOR RANCH DRAIN AT ALBUQUERQUE (08329936), 1978-83.

STATION DESCRIPTION

LOCATION.--Lat 35 deg 08 min 56 sec, long 106 deg 42 min 03 sec, in SE1/4 SW1/4 sec.26, T.11 N., R.2 E., Bernalillo County, Hydrologic Unit 13020203, on left bank of drainage outlet for Taylor Ranch subdivision, 120 ft (37 m) west of intersection of Calle Nuestra and Cabrillo St and 1,850 ft (564 m) southwest of intersection of Montano Rd and Valle Vista, in Albuquerque.

DRAINAGE AREA.--0.136 sq mi (0.352 sq km).

PERIOD OF RECORD.--August 1978 to current year (no winter records).

GAGE.--Water-stage recorder and 3-ft (0.9 m) Parshall Flume. Altitude 5,102 ft (1,555.09 m), from topographic orthophoto map.

REMARKS.--Records good except those for 1981 calendar year, which are poor. Recording rain gage at station. Basin drains residential area.

STAGE-DISCHARGE RELATION.--Rating developed on basis of theoretical rating for 3-ft (0.9 m) standard Parshall flume and discharge measurements at discharges of 0.10 cu ft per sec (0.003 cu m per sec), 0.40 cu ft per sec (0.01 cu m per sec), 0.90 cu ft per sec (0.025 cu m per sec), 1.2 cu ft per sec (0.03 cu m per sec), 1.6 cu ft per sec (0.05 cu m per sec) and 2.0 cu ft per sec (0.06 cu m per sec).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 43 cu ft per sec (1.22 cu m per sec) Sept. 8, 1980, gage height, 3.26 ft (0.994 m); no flow most of the time.

EXTREMES.--Maximum discharge during period August to December 1978, 7.3 cu ft per sec (0.21 cu m per sec) Oct. 25, gage height, 1.73 ft (0.527 m); no flow most of the time.

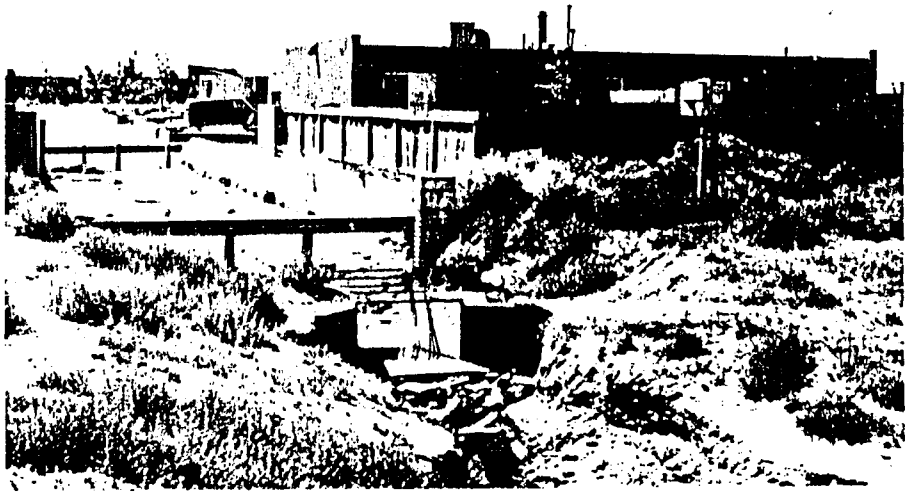
Calendar year 1979: Maximum discharge, 32 cu ft per sec (0.91 cu m per sec) July 17, gage height, 2.89 ft (0.881 m); no flow most of the time.

Calendar year 1980: Maximum discharge, 43 cu ft per sec (1.22 cu m per sec) Sept. 8, gage height, 3.26 ft (0.994 m); no flow most of the time.

Calenday year 1981: Maximum discharge, not determined, Oct. 2, gage height, 4.16 ft (1.268 m) (backwater from temporary culvert); no flow most of the time.

Calendar year 1982: Maximum discharge, 15 cu ft per sec (0.425 cu m per sec) Aug. 12, gage height, 2.15 ft (0.655 m); no flow most of the time.

Calendar year 1983: Maximum discharge, 26 cu ft per sec (0.736 cu m per sec) July 29, gage height, 2.65 ft (0.808 m); no flow most of the time.



Photograph 14.--Taylor Ranch Drain (08329936). Direction of view is upstream.

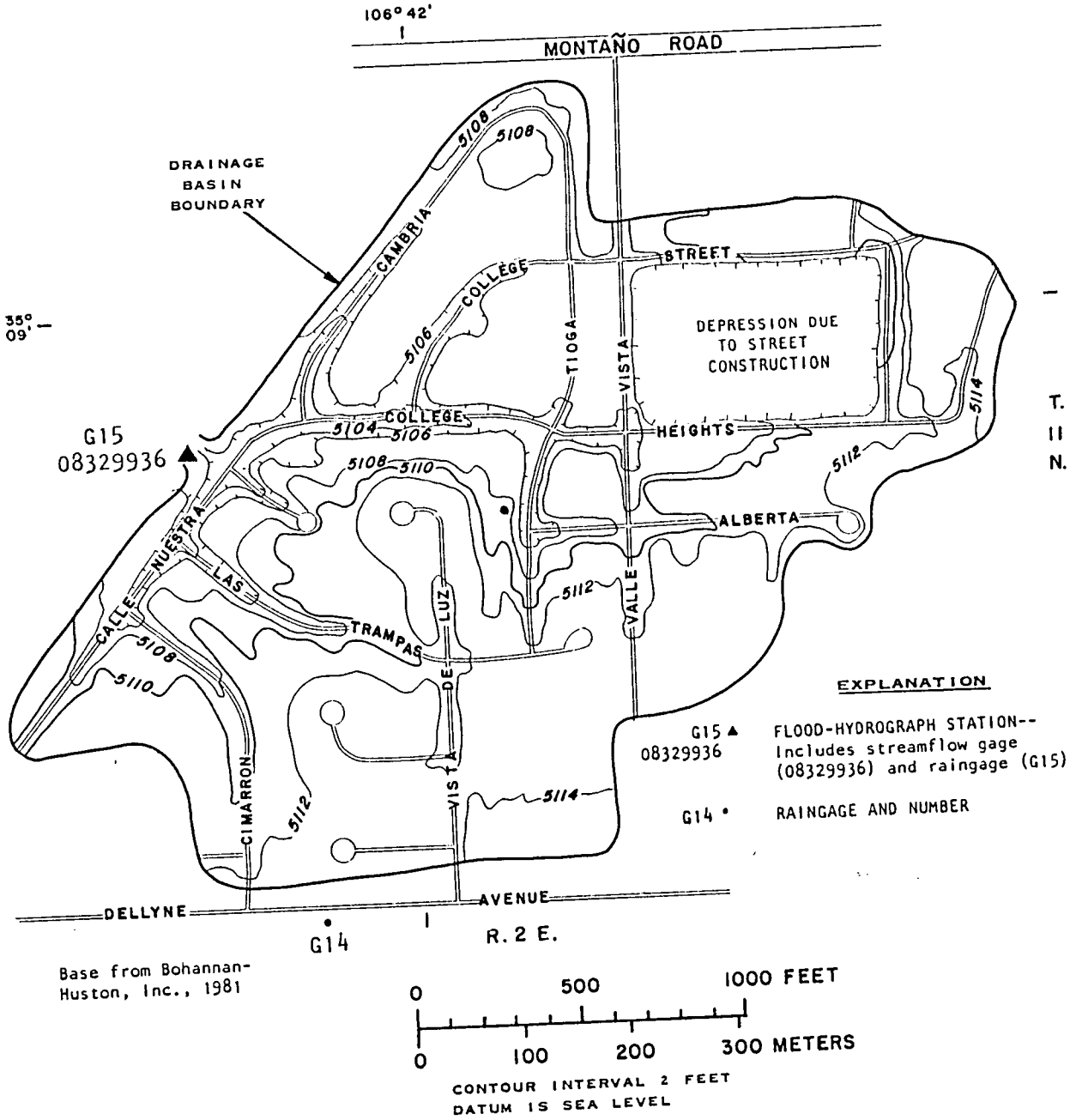
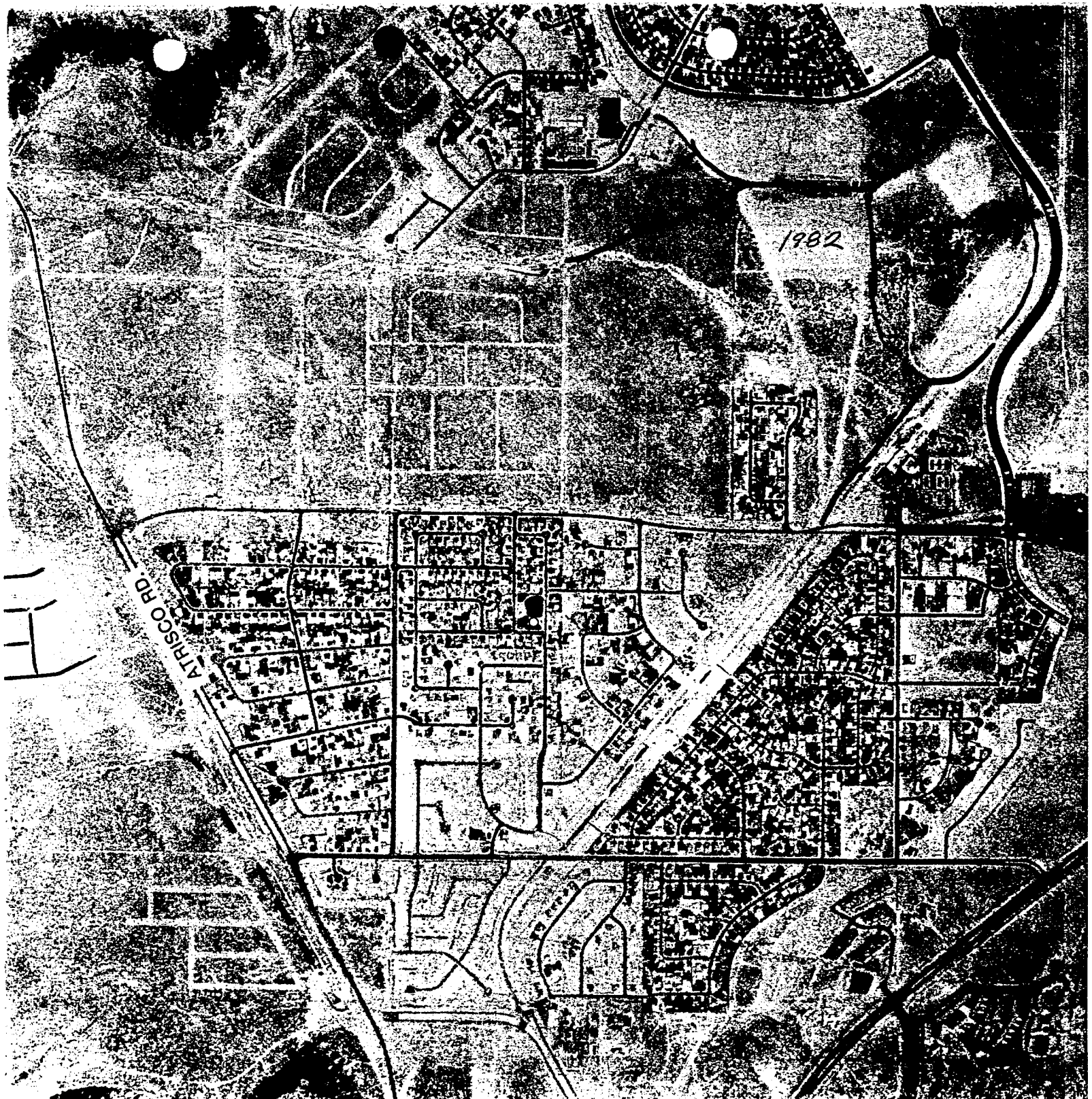
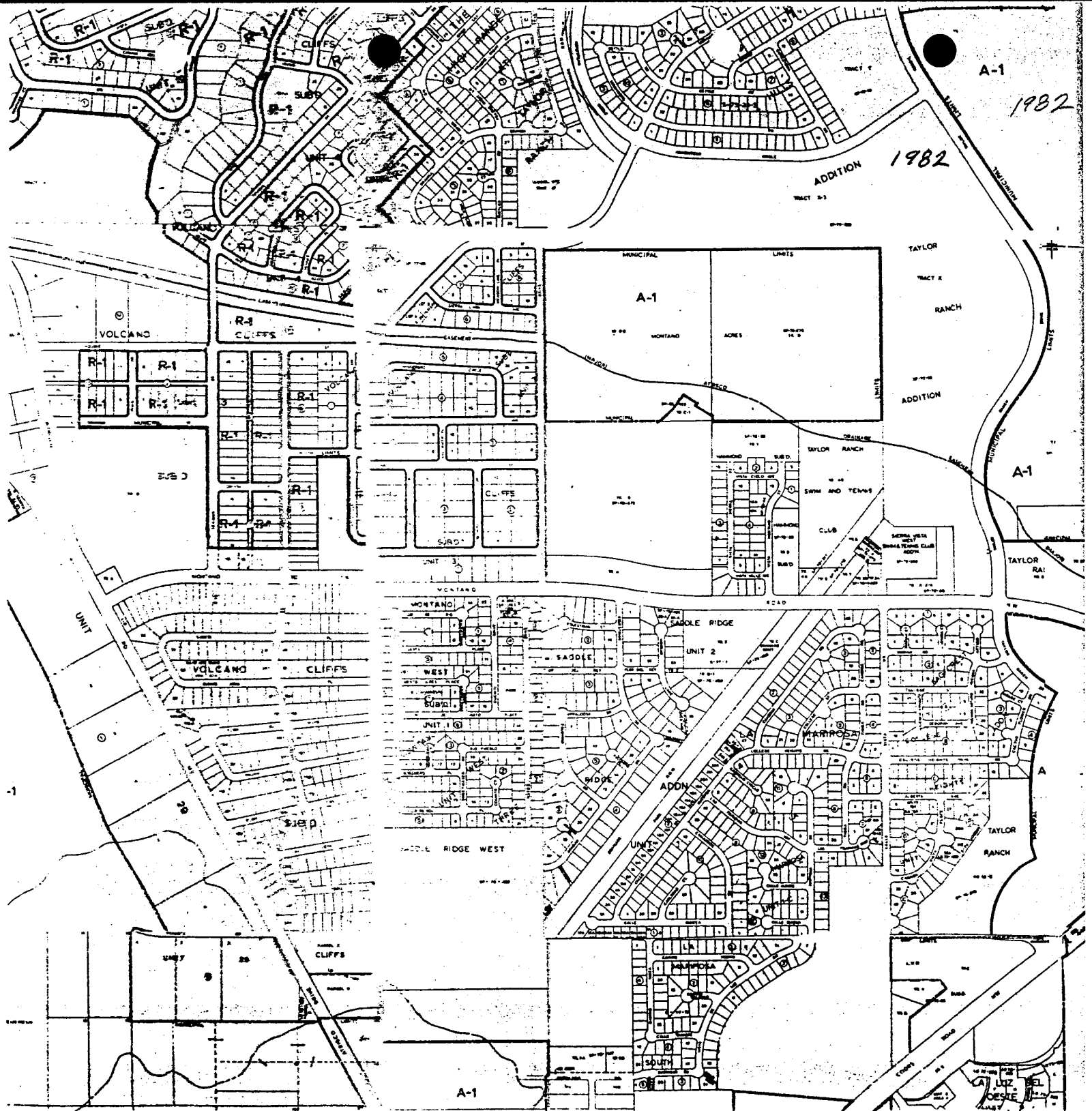


Figure 8.--Drainage basin for Taylor Ranch Drain (08329936).

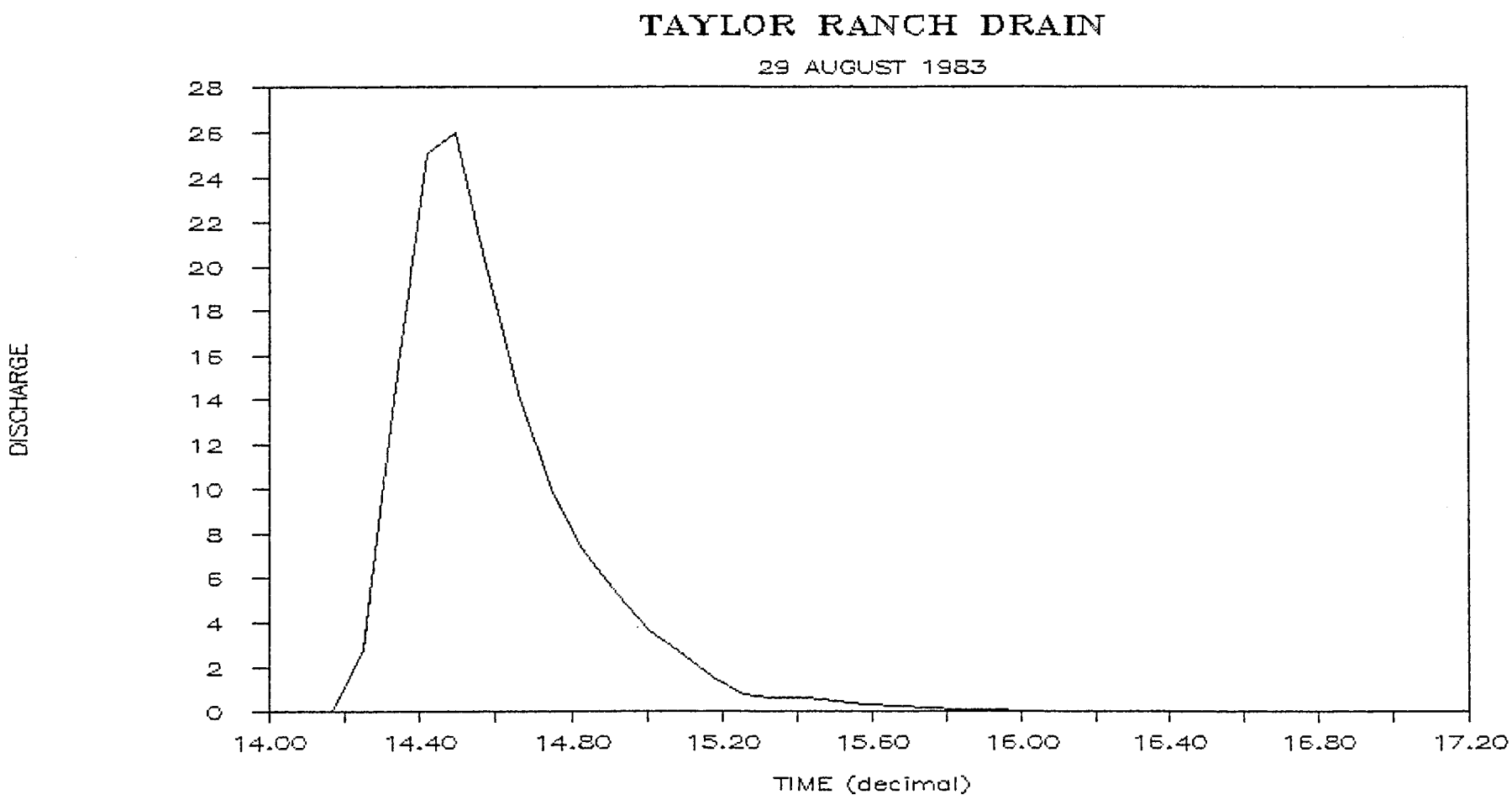
1983

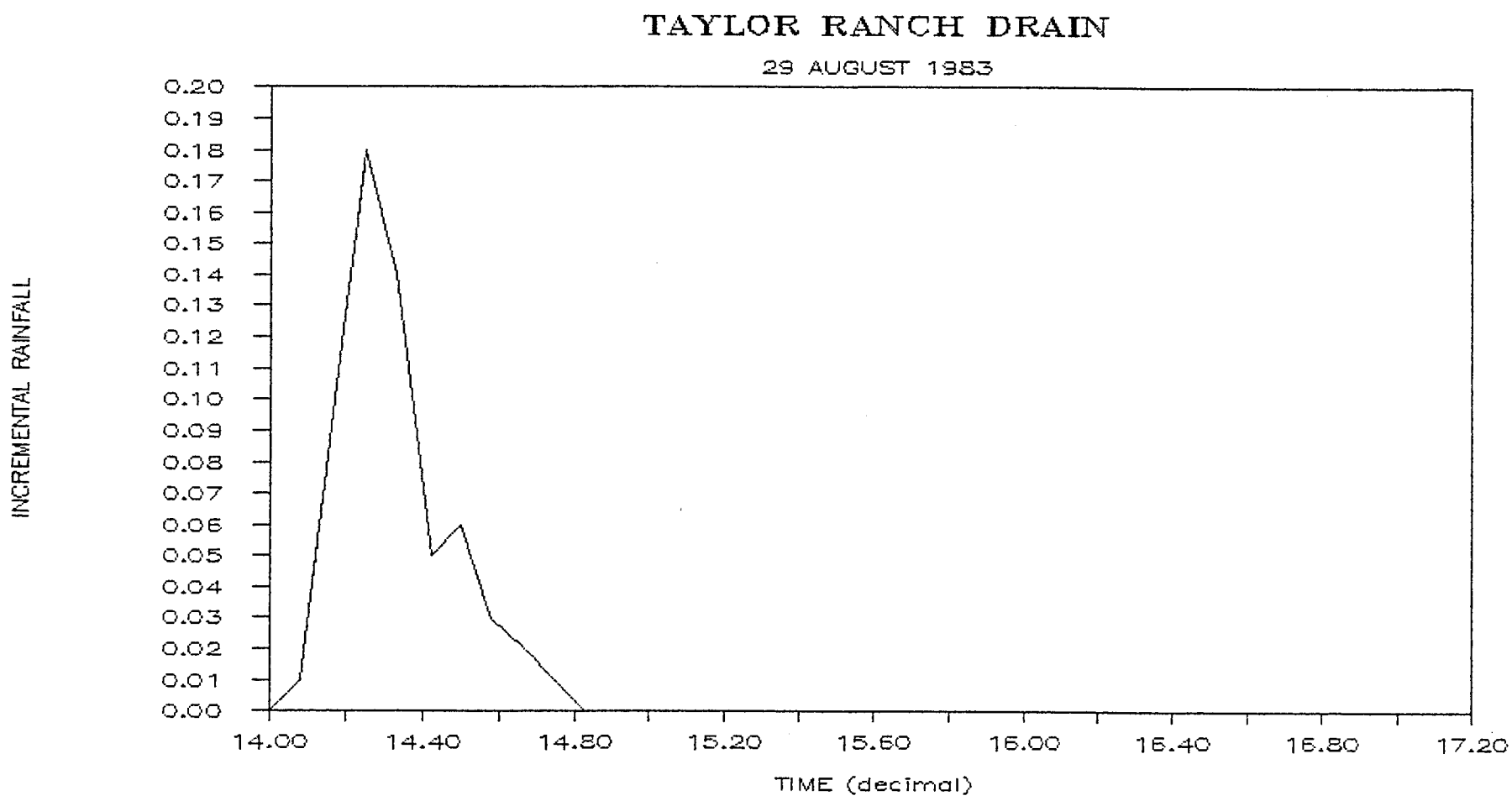

1982
ATRISCO RD.

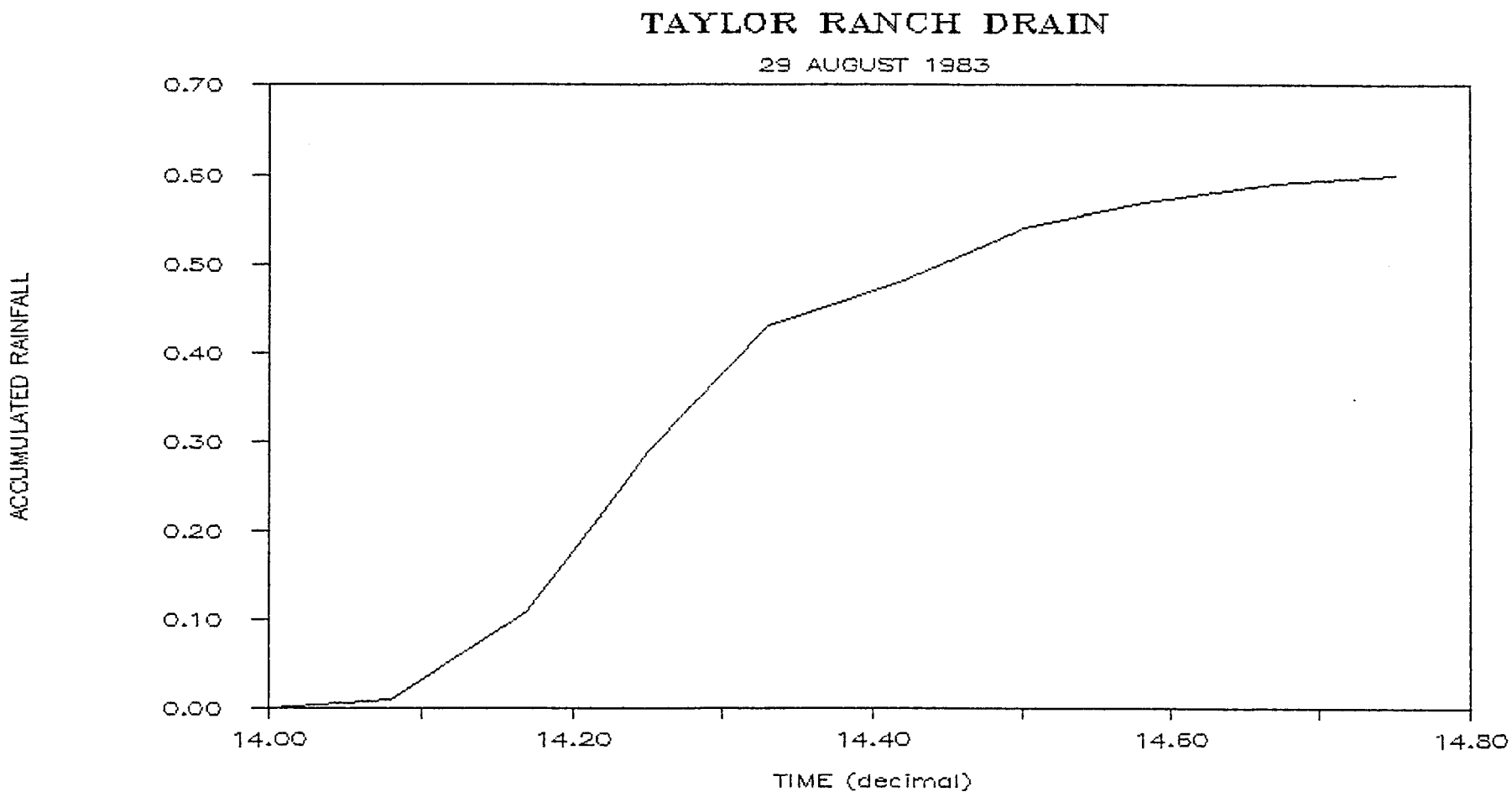

1982
1982
A-1
ADDITION
TAYLOR
RANCH
ADDITION
A-1
MUNICIPAL
LIMITS
A-1
MONTANO
ACRES
VOLCANO
CLIFFS
R-1
SUBD
UNIT 4
UNIT 3
CLIFFS
SUBD
TAYLOR RANCH
SWIM AND TENNIS
CLUB
TAYLOR RA
MONTANO
ROAD
MONTANO
WEST
SUBD
UNIT 1
SADDLE RIDGE
UNIT 2
SADDLE
VOLCANO
CLIFFS
UNIT
RIDGE
ADDN
UNIT
MARROSA
TAYLOR
RANCH
SADDLE RIDGE WEST
CLIFFS
UNIT 7
MARROSA
SOUTH
A-1
LA LUZ DEL OESTE

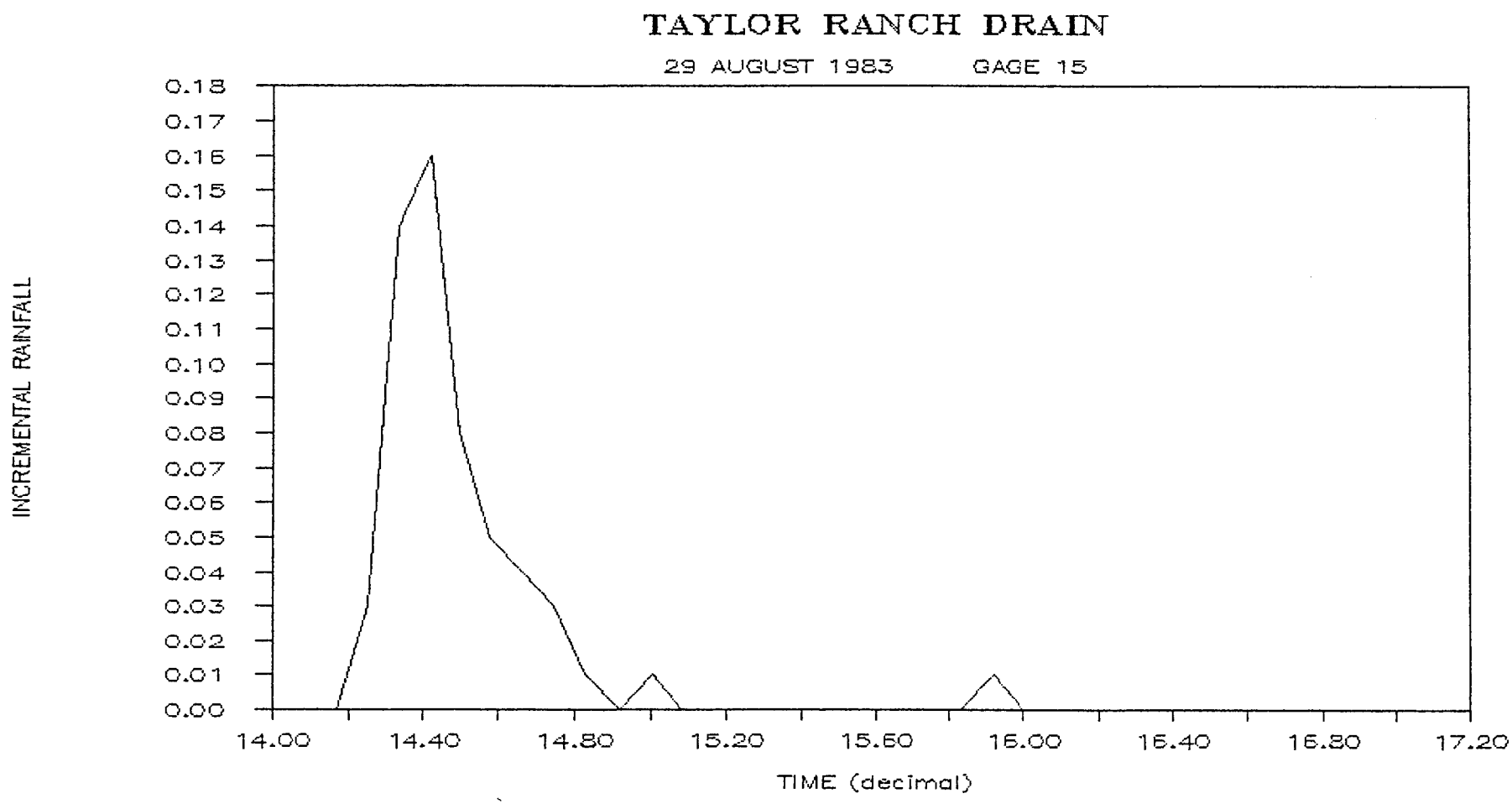
TAYLOR RANCH DRAIN

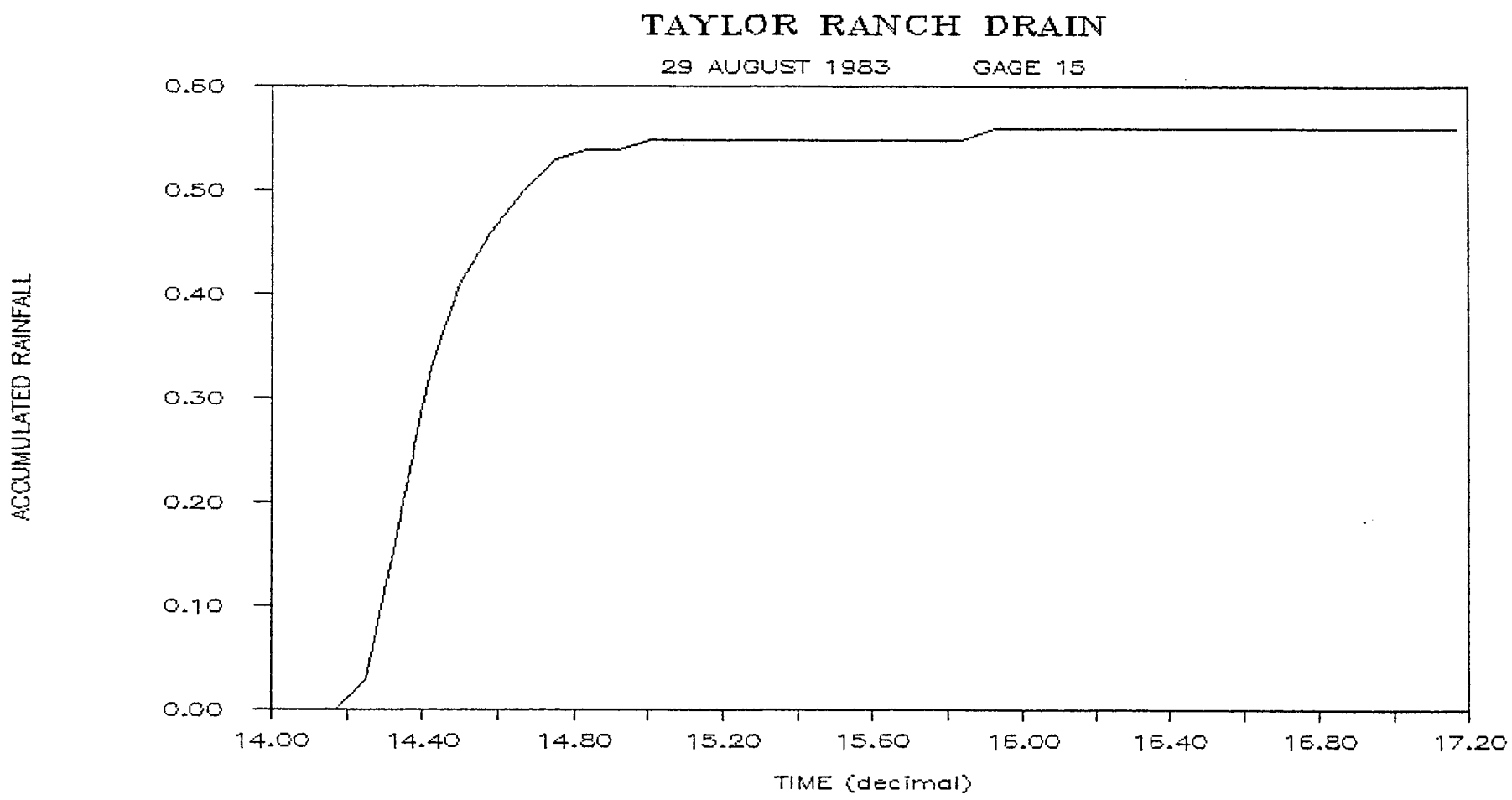
DATE	TIME	Q	P14	SUM P14	P15	SUM P15	Avg P14+P15
29-Jul-83	1400	0.00	0.00	0.00	0.00	0.00	0
	1405	0.00	0.01	0.01	0.00	0.00	0
	1410	0.03	0.10	0.11	0.00	0.00	.06
	1415	2.80	0.18	0.29	0.03	0.03	.16
	1420	14.00	0.14	0.43	0.14	0.17	.30
	1425	25.00	0.05	0.48	0.16	0.33	.41
	1430	26.00	0.06	0.54	0.08	0.41	.48
	1435	20.00	0.03	0.57	0.05	0.46	.52
	1440	14.00	0.02	0.59	0.04	0.50	.55
	1445	10.00	0.01	0.60	0.03	0.53	.57
	1450	7.30	0.00	0.60	0.01	0.54	.57
	1455	5.30	0.00	0.60	0.00	0.54	.57
	1500	3.60	0.00	0.60	0.01	0.55	.58
	1505	2.70	0.00	0.60	0.00	0.55	
	1510	1.50	0.00	0.60	0.00	0.55	
	1515	0.75	0.00	0.60	0.00	0.55	
	1520	0.61	0.00	0.60	0.00	0.55	
	1525	0.61	0.00	0.60	0.00	0.55	
	1530	0.49	0.00	0.60	0.00	0.55	
	1535	0.33	0.00	0.60	0.00	0.55	
	1540	0.23	0.00	0.60	0.00	0.55	
	1545	0.15	0.00	0.60	0.00	0.55	
	1550	0.11	0.00	0.60	0.00	0.55	
	1555	0.08	0.00	0.60	0.01	0.56	
	1600	0.00	0.00	0.60	0.00	0.56	


TAYLOR RANCH DRAIN
29 AUGUST 1983
DISCHARGE
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
14.00
14.40
14.80
15.20
15.60
16.00
16.40
16.80
17.20
TIME (decimal)


TAYLOR RANCH DRAIN
29 AUGUST 1983
INCREMENTAL RAINFALL
0.20
0.19
0.18
0.17
0.16
0.15
0.14
0.13
0.12
0.11
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
14.00
14.40
14.80
15.20
15.60
16.00
16.40
16.80
17.20
TIME (decimal)


TAYLOR RANCH DRAIN
29 AUGUST 1983
ACCUMULATED RAINFALL
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
14.00
14.20
14.40
14.60
14.80
TIME (decimal)


TAYLOR RANCH DRAIN
29 AUGUST 1983 GAGE 15
INCREMENTAL RAINFALL
0.18
0.17
0.16
0.15
0.14
0.13
0.12
0.11
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
14.00
14.40
14.80
15.20
15.60
16.00
16.40
16.80
17.20
TIME (decimal)


TAYLOR RANCH DRAIN
29 AUGUST 1983 GAGE 15
ACCUMULATED RAINFALL
0.60
0.50
0.40
0.30
0.20
0.10
0.00
14.00
14.40
14.80
15.20
15.60
16.00
16.40
16.80
17.20
TIME (decimal)

ATR.1	SUM Q	EVO	LAG	QULT
	135.59	0.13	0.42	1053.19

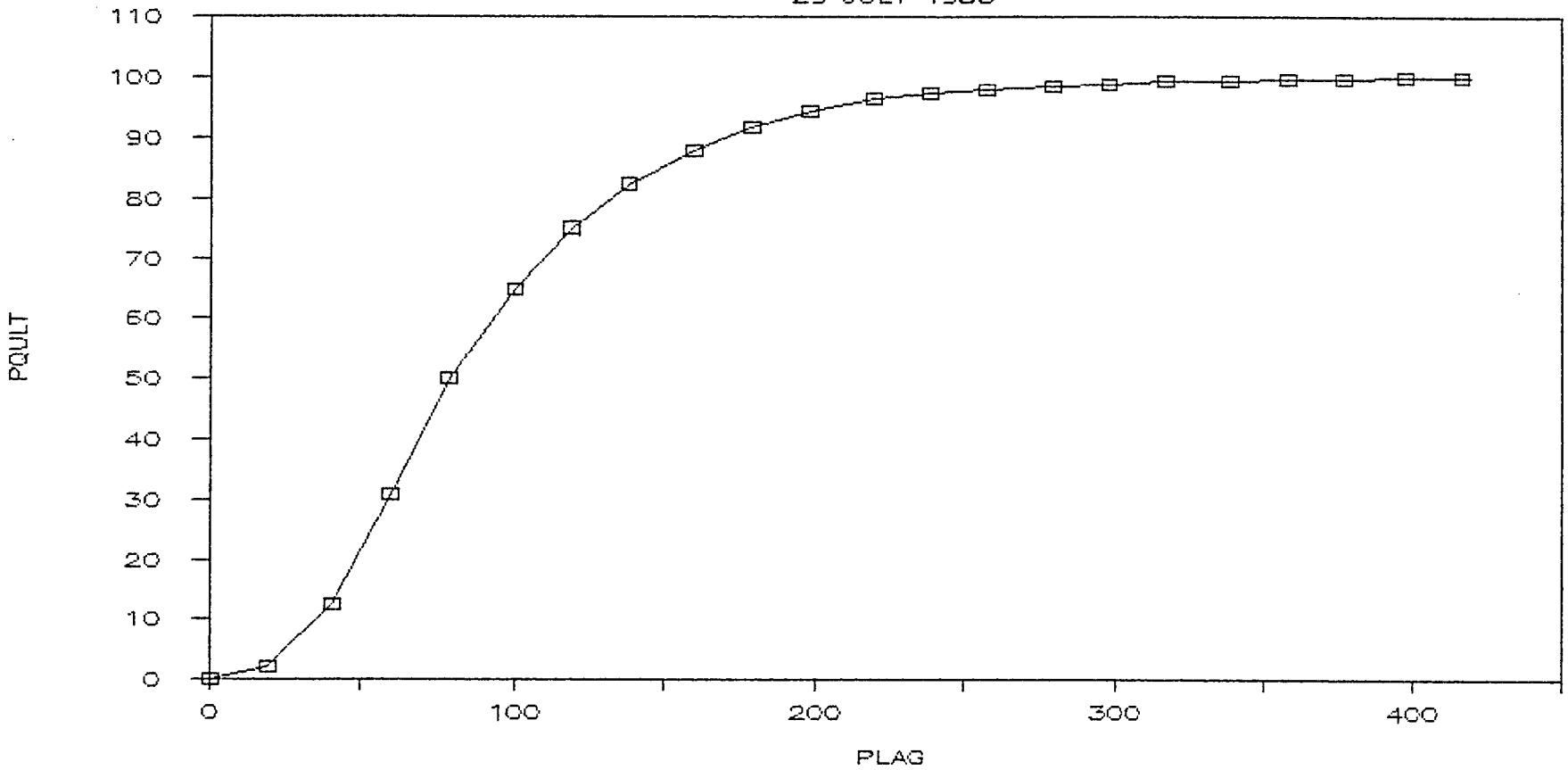
ALBUQUERQUE DATA
TAYLOR RANCH DRAIN

DATE	TIME	Q	DEC TI	UHG	SUM UHG	PQULT	PLAG
29-Jul-83	1400	0.00		0.00	0.00		
	1405	0.00	0.00	0.00	0.00		
	1410	0.03	0.08	0.23	0.23	0.02	0.00
	1415	2.80	0.17	21.75	21.98	2.09	19.05
	1420	14.00	0.25	108.74	130.73	12.41	40.49
	1425	25.00	0.33	194.19	324.91	30.85	59.54
	1430	26.00	0.42	201.95	526.86	50.03	78.59
	1435	20.00	0.50	155.35	682.21	64.78	100.03
	1440	14.00	0.58	108.74	790.96	75.10	119.08
	1445	10.00	0.67	77.67	868.63	82.48	138.13
	1450	7.30	0.75	56.70	925.33	87.86	159.57
	1455	5.30	0.83	41.17	966.50	91.77	178.62
	1500	3.60	0.92	27.96	994.46	94.42	197.67
	1505	2.70	1.00	20.97	1015.44	96.42	219.11
	1510	1.50	1.08	11.65	1027.09	97.52	238.16
	1515	0.75	1.17	5.83	1032.91	98.07	257.22
	1520	0.61	1.25	4.74	1037.65	98.52	278.65
	1525	0.61	1.33	4.74	1042.39	98.97	297.70
	1530	0.49	1.42	3.81	1046.20	99.34	316.76
	1535	0.33	1.50	2.56	1048.76	99.58	338.19
	1540	0.23	1.58	1.79	1050.54	99.75	357.24
	1545	0.15	1.67	1.17	1051.71	99.86	376.30
	1550	0.11	1.75	0.85	1052.56	99.94	397.73
	1555	0.08	1.83	0.62	1053.19	100.00	416.78
	~~1600~~	~~0.00~~	~~1.92~~	~~0.00~~	~~1053.19~~	~~100.00~~	~~435.84~~

U-fg duration = 5-min

TAYLOR RANCH DRAIN

29 JULY 1983



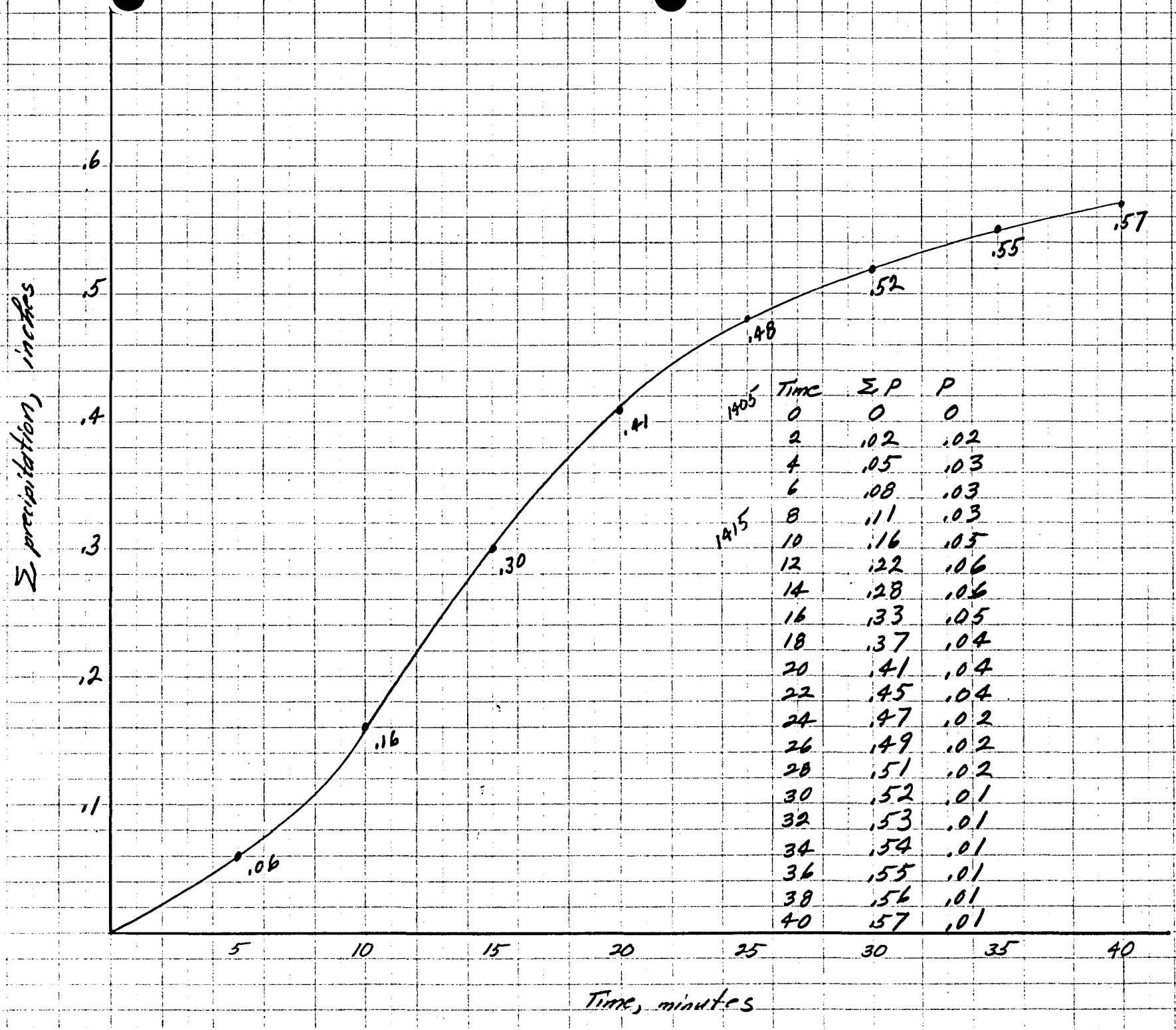
ATR 15 Sept 87

Total area = .136 mi^2 = 87.0 acres

Storm Date	Rainfall Depth inches	Rainfall Duration minutes	Runoff Volume ft^3	Effective Imp. Area acres	
20 May 79	.17	110	5,937	9.69	✓
15 Aug 79	.39	420	11,295	7.98	✓
15 Sept 79	.28	420	5,736	5.64	intermittant
2 Aug 80	.13	35	3,516	7.45	✓
6 Sept 80	.12	40	3,258	7.48	✓
6 Sept 80	.14	100	3,165	6.23	?
9 Sept 80	.62	450	19,524	8.68	✓
22 May 82	.44	125	14,523	9.09	✓
8 Sept 83	.105	60	3,951	10.37	intermittant
1 Oct 83	.27	180	8,820	9.00	intermittant

Average of checked events = 8.40 acres

% effective area = 9.6 %

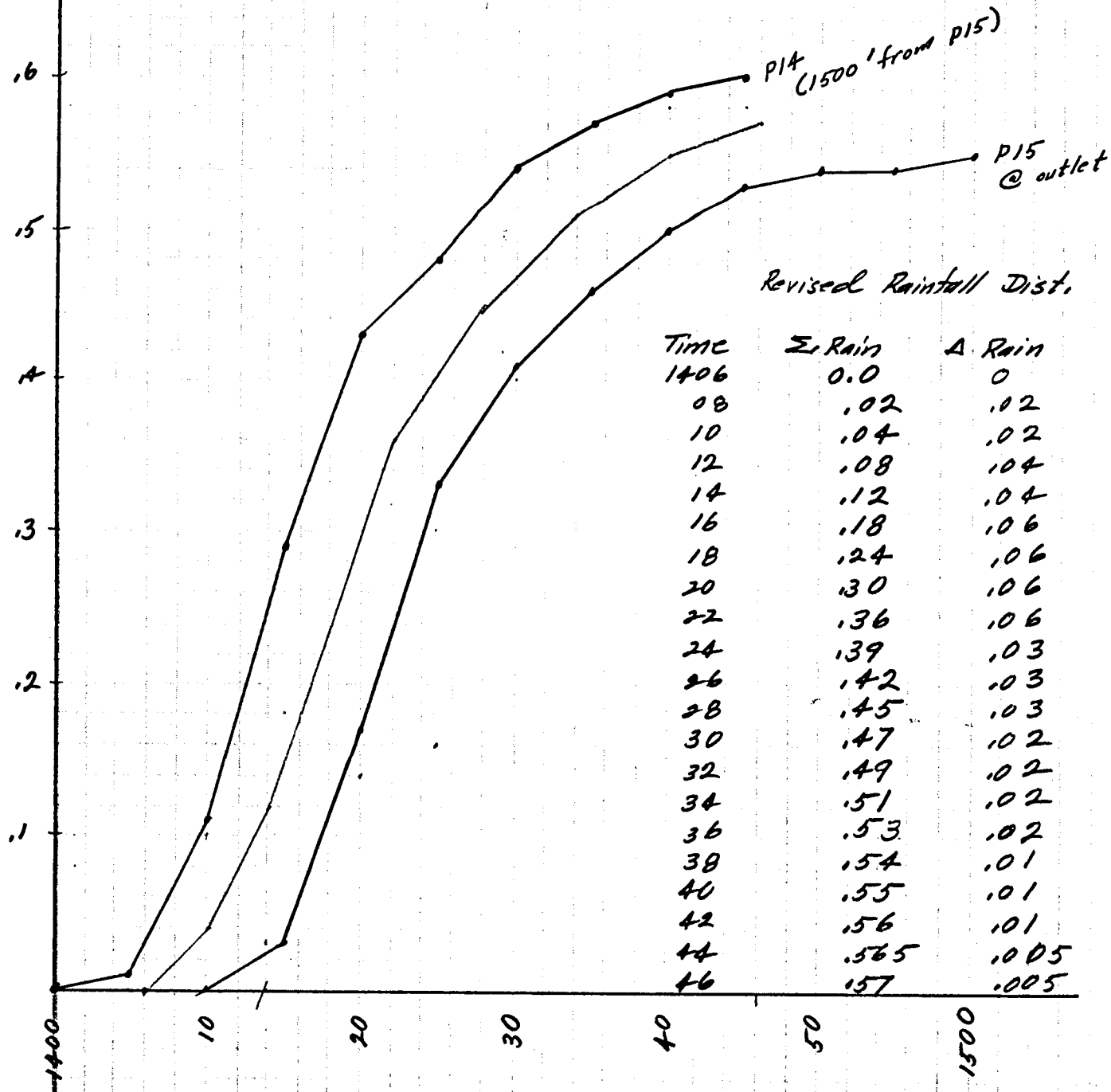


	Time	ΣP	P
1405	0	0	0
	2	.02	.02
	4	.05	.03
	6	.08	.03
	8	.11	.03
1415	10	.16	.05
	12	.22	.06
	14	.28	.06
	16	.33	.05
	18	.37	.04
	20	.41	.04
	22	.45	.04
	24	.47	.02
	26	.49	.02
	28	.51	.02
	30	.52	.01
	32	.53	.01
	34	.54	.01
	36	.55	.01
	38	.56	.01
	40	.57	.01

ATR 1
24 July 83

15 Sept 87

19 Oct 87

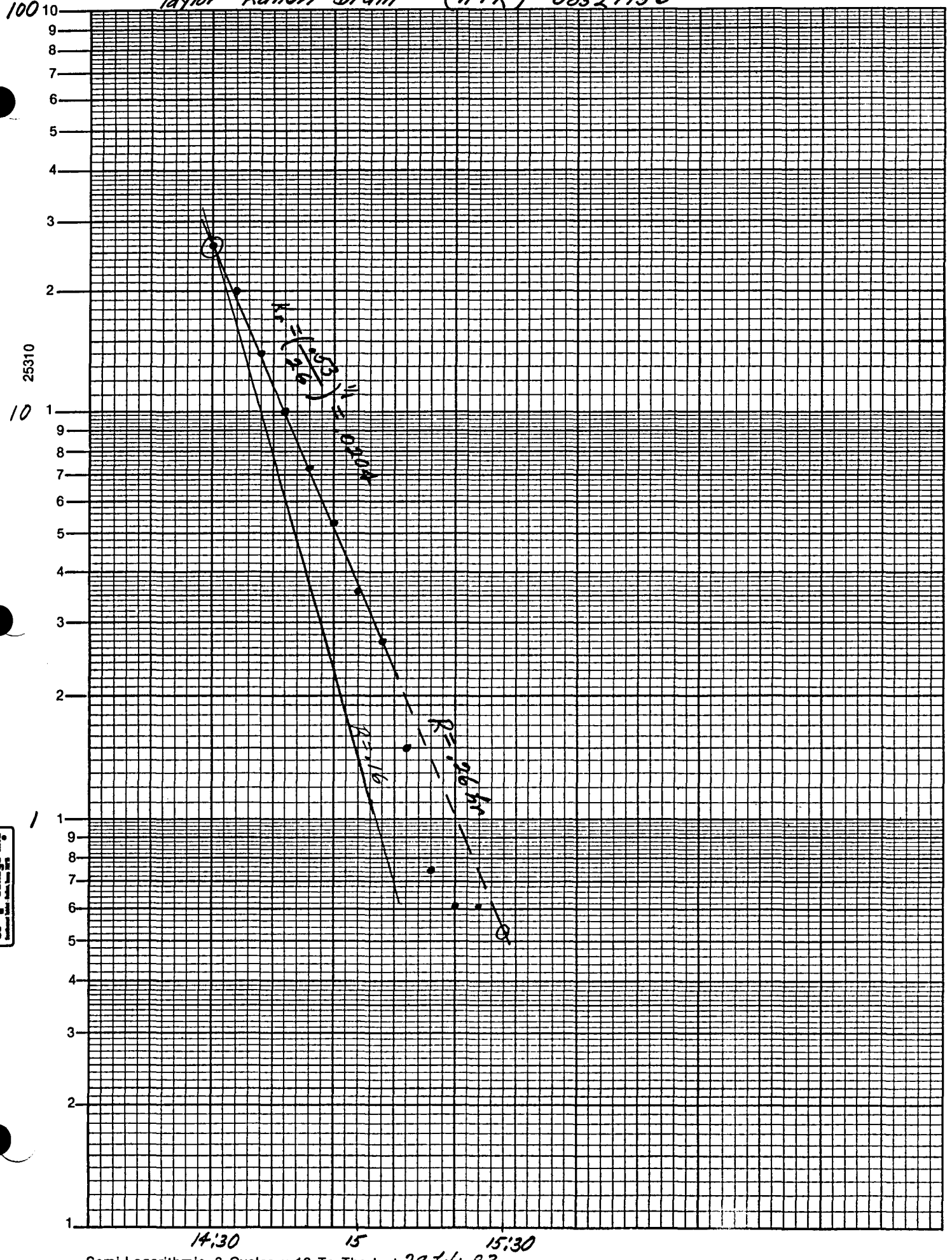


Revised Rainfall Dist.

Time	Σ Rain	Δ Rain
1406	0.0	0
08	.02	.02
10	.04	.02
12	.08	.04
14	.12	.04
16	.18	.06
18	.24	.06
20	.30	.06
22	.36	.06
24	.39	.03
26	.42	.03
28	.45	.03
30	.47	.02
32	.49	.02
34	.51	.02
36	.53	.02
38	.54	.01
40	.55	.01
42	.56	.01
44	.565	.005
46	.57	.005

21 Aug 01

Taylor Ranch Drain (ATR) 08329936



Semi-Logarithmic 3 Cycles x 10 To The Inch 29 Jul 83

Flood Reconstitution for Albuquerque La Cueva Arroyo ALA1

Storm Event 6 Sept 80

Runoff: depth = .26 inches, Q_p = 37 cfs at t_p = .58 hours

$R_{recession}$ = .19 hrs

INPUT (1) Area acres	(2) Eff. Imp. Area %	(3) Rain in.	(4) Comp. Inter. min.	(5) Time-Area	(6)	Results (7) Q_p cfs	(8) t_p hr.	(9) T_c hr.	(10) R hr.	(11) STRTL in.	(12) CNSTL in/hr	(13) Output File	(14) Comment
57.6	0	1.23	5	U-1		49	.58	.09	.05	.74	.39	Ø01	
"	"	"	1	"		33	.58	.04	.21	.68	.49	Ø2	
"	"	"	"	N-2		32	.58	.02	.23	.67	.50	Ø3	
"	"	"	"	U-8		34	.58	.05	.19	.69	.47	Ø4	← best

Flood Reconstitution for Albuquerque La Cueva Arroyo ALA2

Storm Event 8 Sept 80

Runoff: depth = .14 inches, Q_p = 15 cfs at t_p = .58 hours

$R_{recession}$ = .28 hrs

INPUT (1) Area acres	(2) Eff. Imp. Area %	(3) Rain in.	(4) Comp. Inter. min.	(5) Time-Area	(6)	Results (7) Q_p cfs	(8) t_p hr.	(9) T_c hr.	(10) R hr.	(11) STRTL in.	(12) CNSTL in/hr	(13) Output File	(14) Comment
57.6	0	.73	5	u-1		16	.58	.18	.36	.54	.15	Ø01	
"	"	"	1	u-8		16	.62	.26	.29	.55	.26	Ø2	← best

Flood Reconstitution for Albuquerque La Cueva Arroyo ALA3

Storm Event 7 July 81

Runoff: depth = .20 inches, Q_p = 18 cfs at t_p = .58 hours

$R_{recession}$ = .31 hrs

INPUT (1) Area acres	(2) Eff. Imp. Area %	(3) Rain in.	(4) Comp. Inter. min.	(5) Time-Area	(6)	Results (7) Q_p cfs	(8) t_p hr.	(9) T_c hr.	(10) R hr.	(11) STRTL in.	(12) CNSTL in/hr	(13) Output File	(14) Comment
57.6	0	.99	5	U-1		21	.50	.11	.41	.66	.32	Ø01	
"	"	"	1	U-8		20	.43	.02	.56	.58	.55	Ø2	← best high intensity rainfall for 15-minutes
"	"	"	"	D		20	.43	.02	.55	.59	.49	Ø3	

Table 8.--Station description, daily mean discharge values, monthly rainfall totals, and selected rainfall-discharge unit-value data for LA CUEVA ARROYO TRIBUTARY NEAR ALBUQUERQUE (08329890), 1977-83.

STATION DESCRIPTION

LOCATION.--Lat 35 deg 11 min 26 sec, long 106 deg 29 min 44 sec, in SW1/4 SW1/4 sec.11, T.11 N., R.4 E., Bernalillo County, Hydrologic Unit 13020203, on right bank 7 ft (2 m) upstream from culvert under State Highway 556 (Tramway Road), 115 ft (35 m) northeast of intersection of Tramway Rd and Tramway Blvd, 4.1 mi (6.6 km) north of intersection of Montgomery and Tramway Blvds, and 4.6 mi (7.4 km) east of intersection of Interstate Highway 25 and State Highway 556.

DRAINAGE AREA.--0.090 sq mi (0.233 sq km).

PERIOD OF RECORD.--May 1977 to December 1978, April 1979 to current year (no winter records).

GAGE.--Water-stage recorder. Altitude 6,100 ft (1,859.28 m), from topographic orthophoto map.

REMARKS.--Records good. Recording rain gage at station. Basin drains rural area with natural prairie vegetation.

STAGE-DISCHARGE RELATION.--Rating developed on basis of Culvert Computation.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 77 cu ft per sec (2.18 cu m per sec) June 29, 1981, gage height, 4.91 ft (1.497 m); no flow most of the time.

EXTREMES.--No flow recorded during period May to December 1977.

Calendar year 1978: No flow recorded.

Calendar year 1979: No flow recorded.

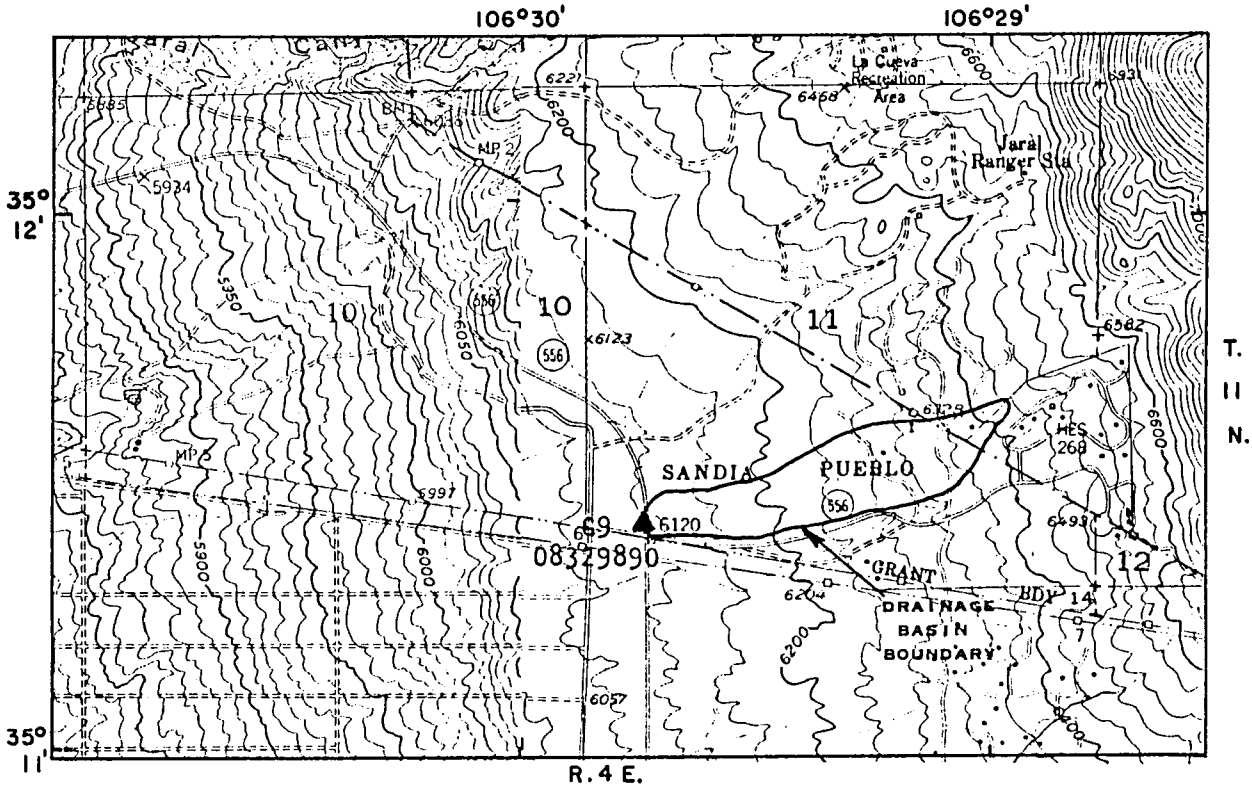
Calendar year 1980: Maximum discharge, 37 cu ft per sec (1.05 cu m per sec) Sept. 6, gage height, 3.56 ft (1.085 m); no flow most of the time.

Calendar year 1981: Maximum discharge, 77 cu ft per sec (2.18 cu m per sec) June 29, gage height, 4.91 ft (1.497 m); no flow most of the time.

Calendar year 1982: No flow recorded.

Calendar year 1983: Maximum discharge, 19 cu ft per sec (0.538 cu m per sec) Sept. 27, gage height, 2.72 ft (0.829 m); no flow most of the time.

Photograph 10.--La Cueva Arroyo Tributary (08329890).



Base from U.S. Geological Survey Alameda 1:24,000, 1960 and Sandia Crest 1:24,000, 1961.

0 — 1 MILE

0 — 1 KILOMETER

CONTOUR INTERVALS 10 AND 40 FEET
DATUM IS SEA LEVEL

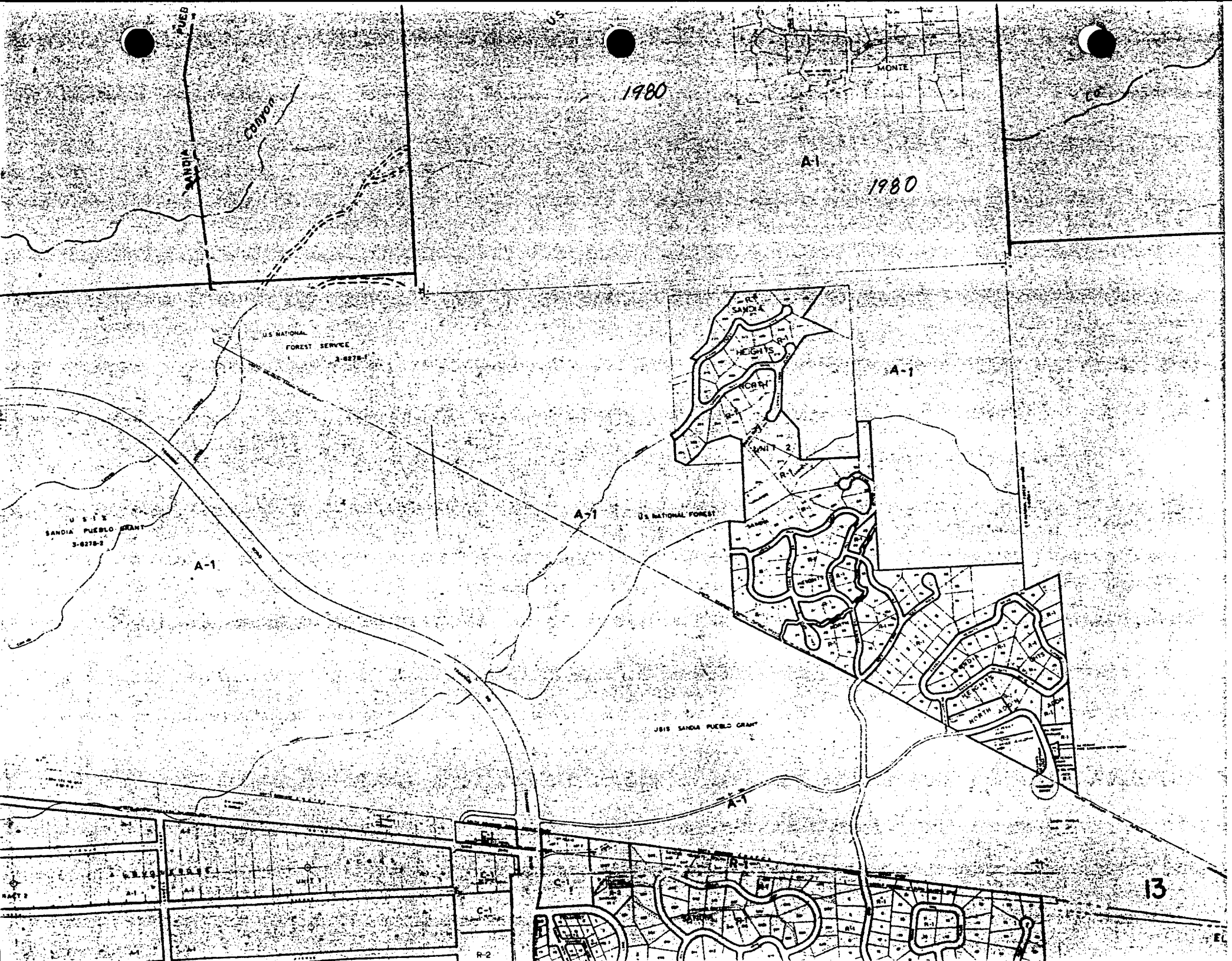
EXPLANATION

G9 ▲ 08329890	FLOOD-HYDROGRAPH STATION-- Includes streamflow gage (08329890) and raingage (G9)

Figure 5.--Drainage basin for La Cueva Arroyo Tributary (08329890).

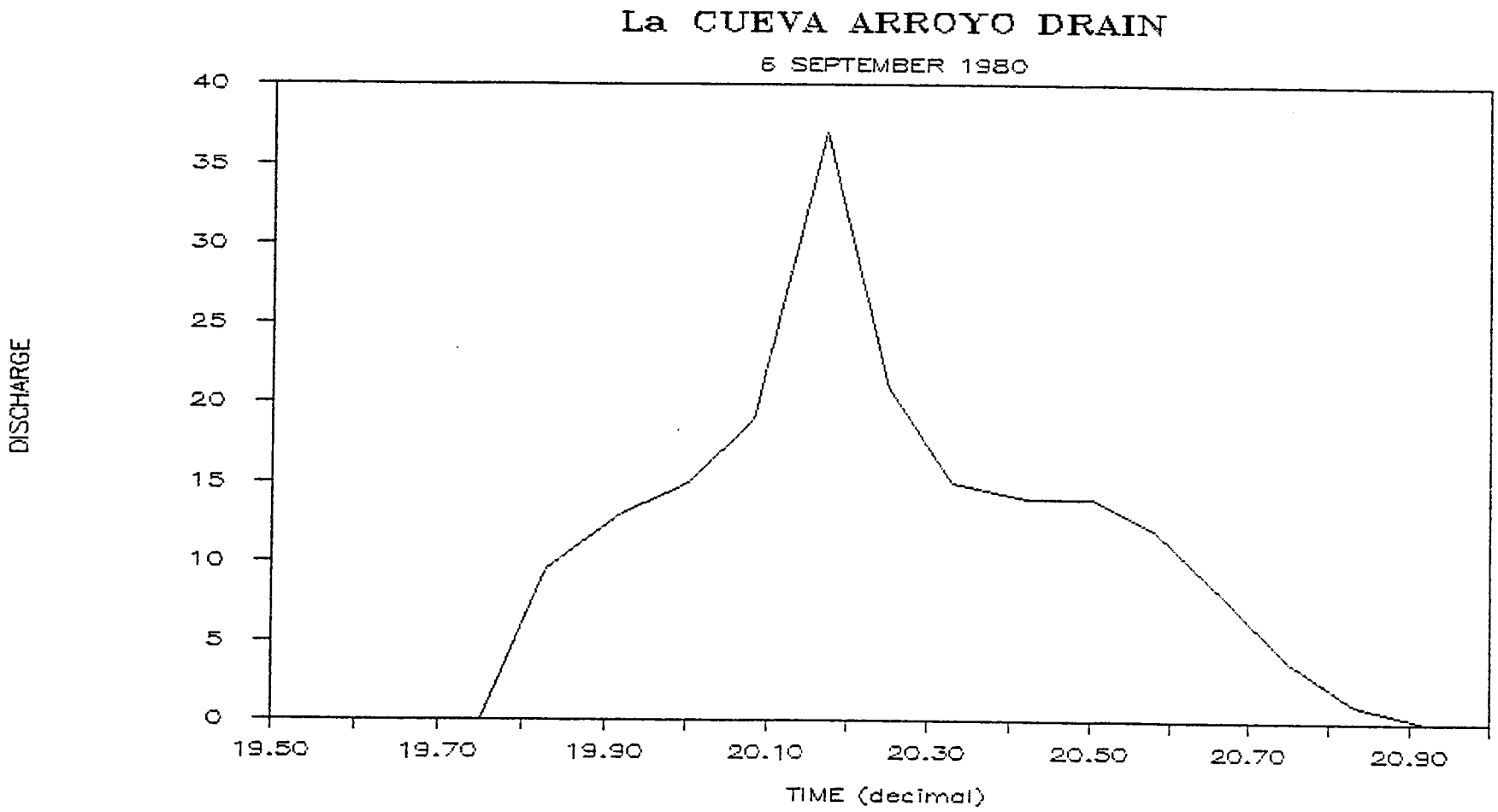
1980
1981

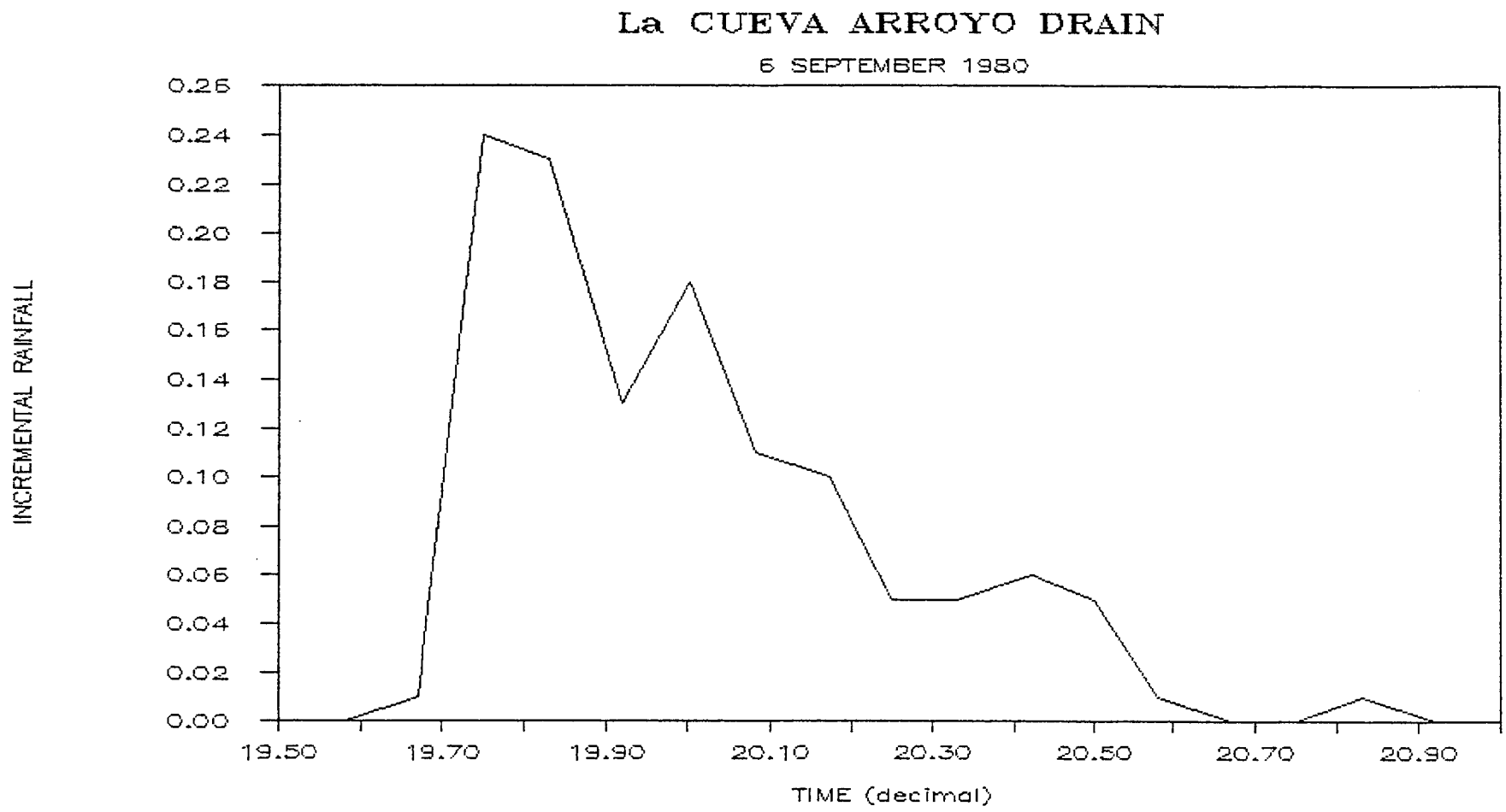
TRAMWAY BLVD.

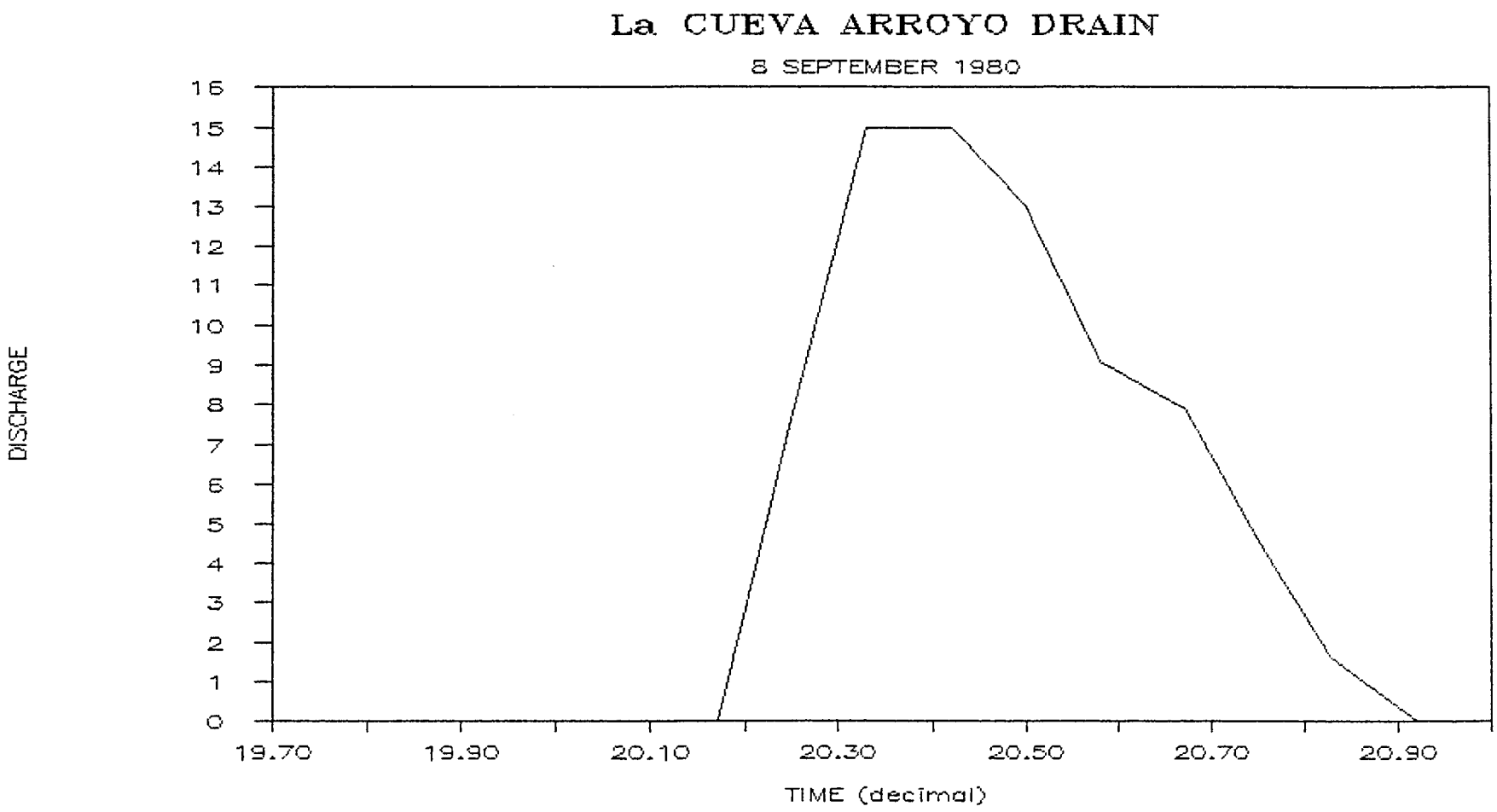

1980
1980
A-1
A-1
A-1
A-1
A-1
SANDIA
Canyon
MONTE
U.S. NATIONAL
FOREST SERVICE
3-6278-1
U S I S
SANDIA PUEBLO GRANT
3-6278-2
U.S. NATIONAL FOREST
USIS SANDIA PUEBLO GRANT
SANDIA
HEIGHTS
NORTH
UNIT 2
R-1
C-1
R-2
13

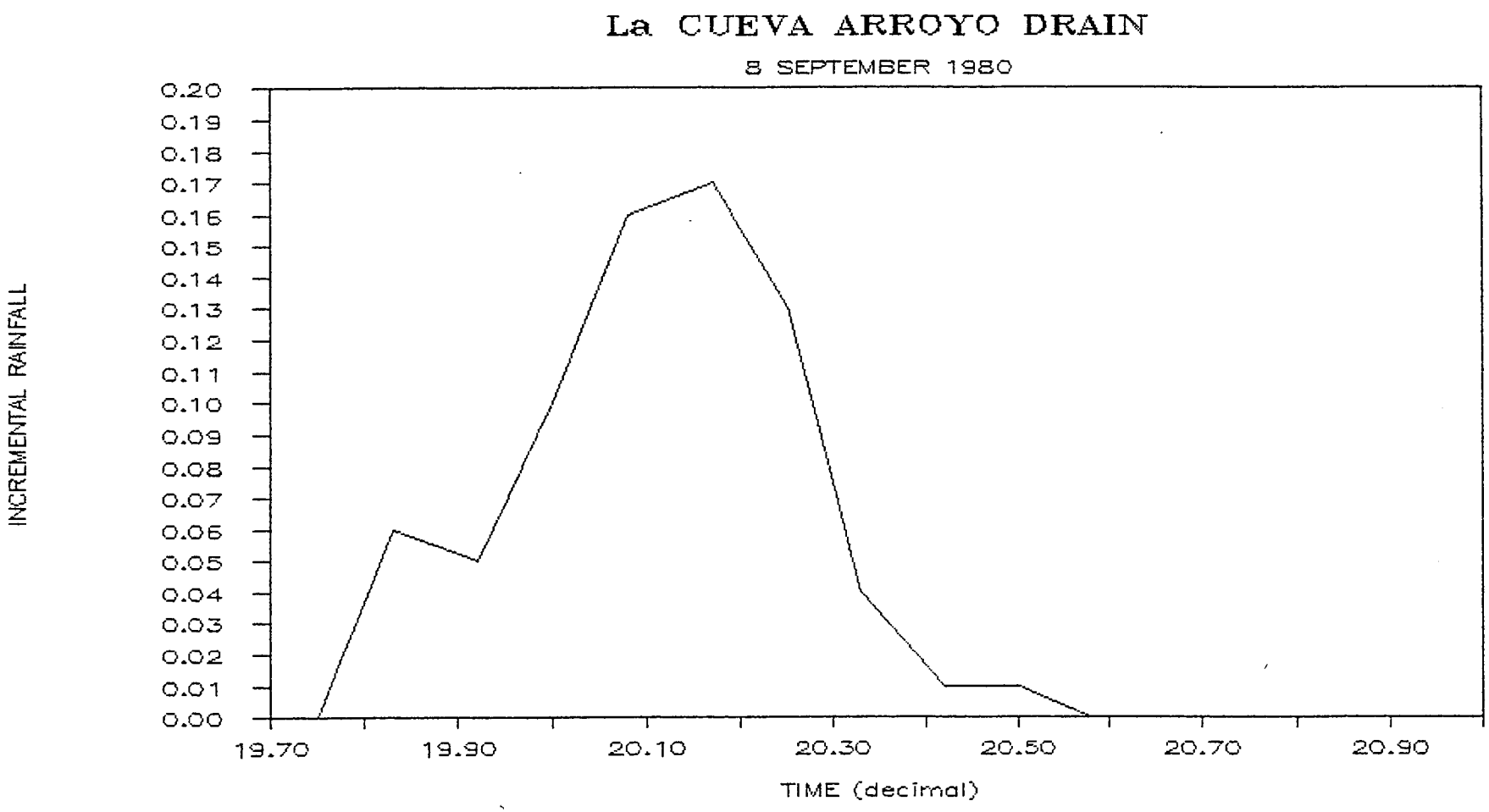
LA CUEVA ARROYO TRIB

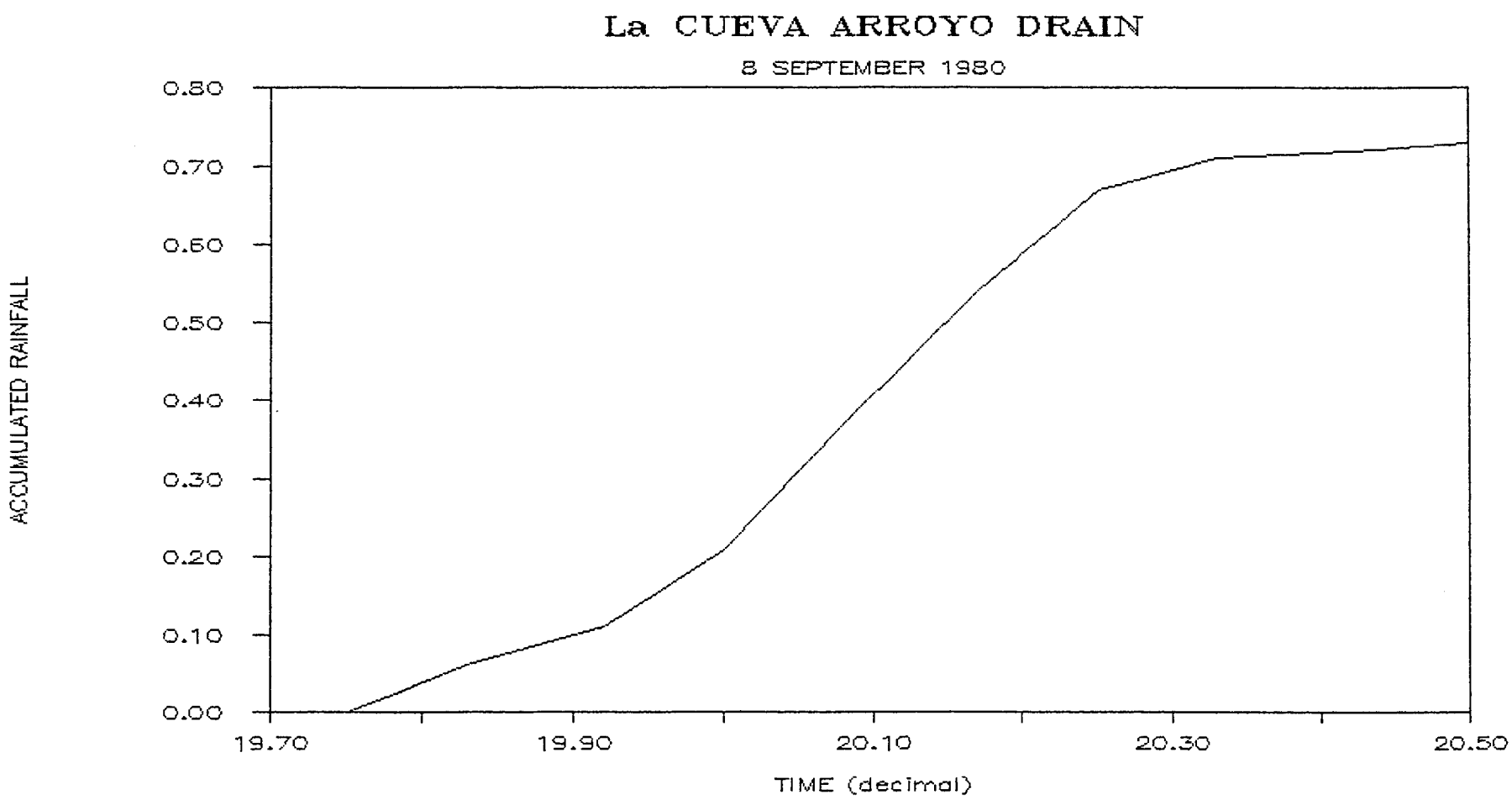
DATE	TIME	Q	P9	SUM P9
06-Sep-80	1935	0.00	0.00	0.00
	1940	0.00	0.01	0.01
	1945	0.00	0.24	0.25
	1950	9.60	0.23	0.48
	1955	13.00	0.13	0.61
	2000	15.00	0.18	0.79
	2005	19.00	0.11	0.90
	2010	37.00	0.10	1.00
	2015	21.00	0.05	1.05
	2020	15.00	0.05	1.10
	2025	14.00	0.06	1.16
	2030	14.00	0.05	1.21
	2035	12.00	0.01	1.22
	2040	7.80	0.00	1.22
	2045	3.80	0.00	1.22
	2050	1.10	0.01	1.23
	2055	0.00	0.00	1.23
08-Sep-80	1945	0.00	0.00	0.00
	1950	0.00	0.06	0.06
	1955	0.00	0.05	0.11
	2000	0.00	0.10	0.21
	2005	0.00	0.16	0.37
	2010	0.00	0.17	0.54
	2015	7.80	0.13	0.67
	2020	15.00	0.04	0.71
	2025	15.00	0.01	0.72
	2030	13.00	0.01	0.73
	2035	9.10	0.00	0.73
	2040	7.90	0.00	0.73
	2045	4.60	0.00	0.73
	2050	1.60	0.00	0.73
	2055	0.00	0.00	0.73
07-Jul-81	1720	0.00	0.00	0.00
	1725	0.00	0.04	0.04
	1730	0.00	0.27	0.31
	1735	6.30	0.25	0.56
	1740	14.00	0.20	0.76
	1745	16.00	0.13	0.89
	1750	17.00	0.03	0.92
	1755	18.00	0.02	0.94
	1800	16.00	0.01	0.95
	1805	14.00	0.00	0.95
	1810	11.00	0.01	0.96
	1815	7.40	0.01	0.97
	1820	4.60	0.01	0.98
	1825	0.72	0.01	0.99
	1830	0.00	0.00	0.99


La CUEVA ARROYO DRAIN
6 SEPTEMBER 1980
DISCHARGE
40
35
30
25
20
15
10
5
0
19.50
19.70
19.90
20.10
20.30
20.50
20.70
20.90
TIME (decimal)


La CUEVA ARROYO DRAIN
6 SEPTEMBER 1980
INCREMENTAL RAINFALL
0.26
0.24
0.22
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
19.50
19.70
19.90
20.10
20.30
20.50
20.70
20.90
TIME (decimal)


La CUEVA ARROYO DRAIN
8 SEPTEMBER 1980
DISCHARGE
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
19.70
19.90
20.10
20.30
20.50
20.70
20.90
TIME (decimal)

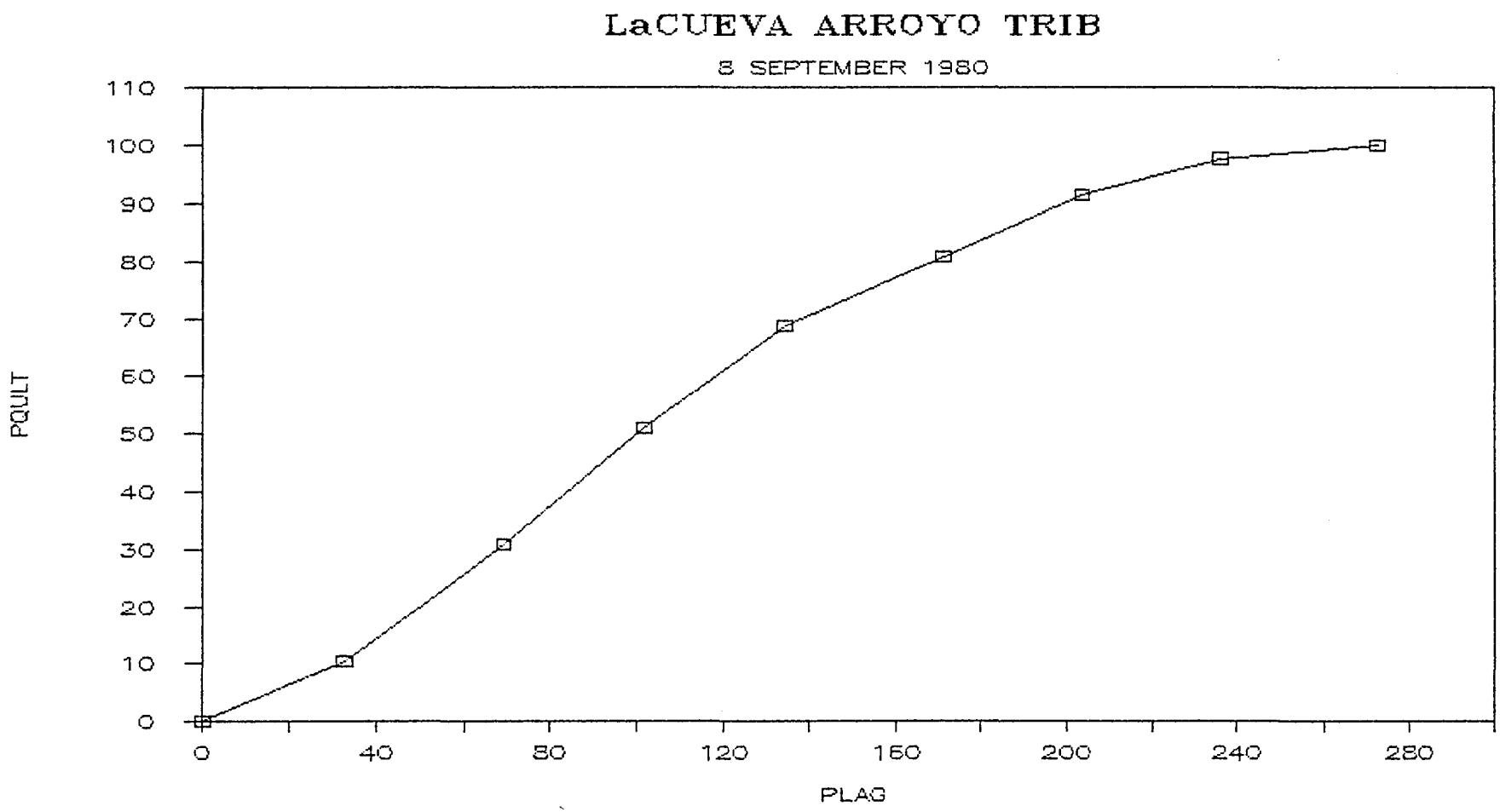

La CUEVA ARROYO DRAIN
8 SEPTEMBER 1980
INCREMENTAL RAINFALL
0.20
0.19
0.18
0.17
0.16
0.15
0.14
0.13
0.12
0.11
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
19.70
19.90
20.10
20.30
20.50
20.70
20.90
TIME (decimal)

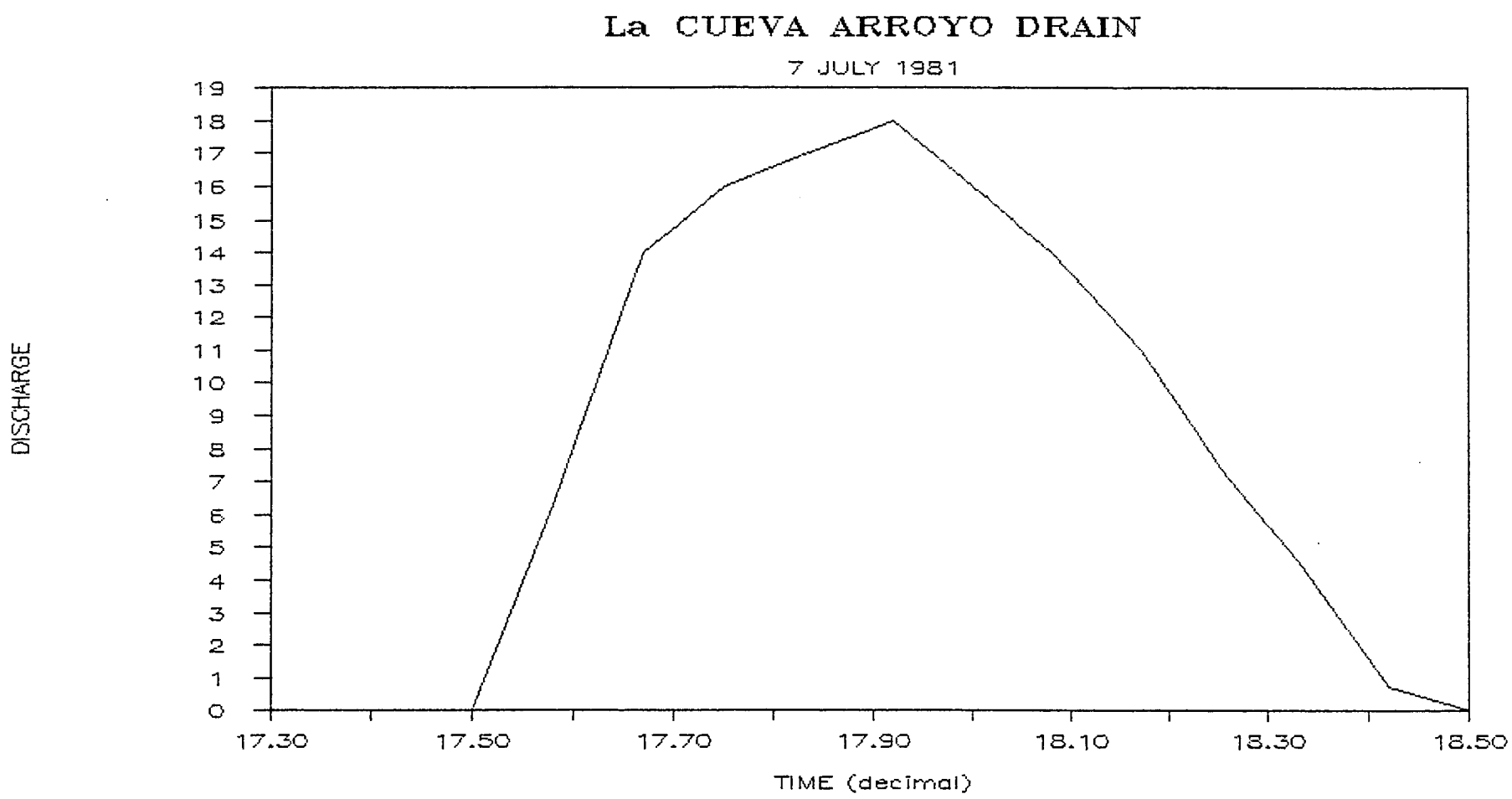

La CUEVA ARROYO DRAIN
8 SEPTEMBER 1980
ACCUMULATED RAINFALL
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
19.70
19.90
20.10
20.30
20.50
TIME (decimal)

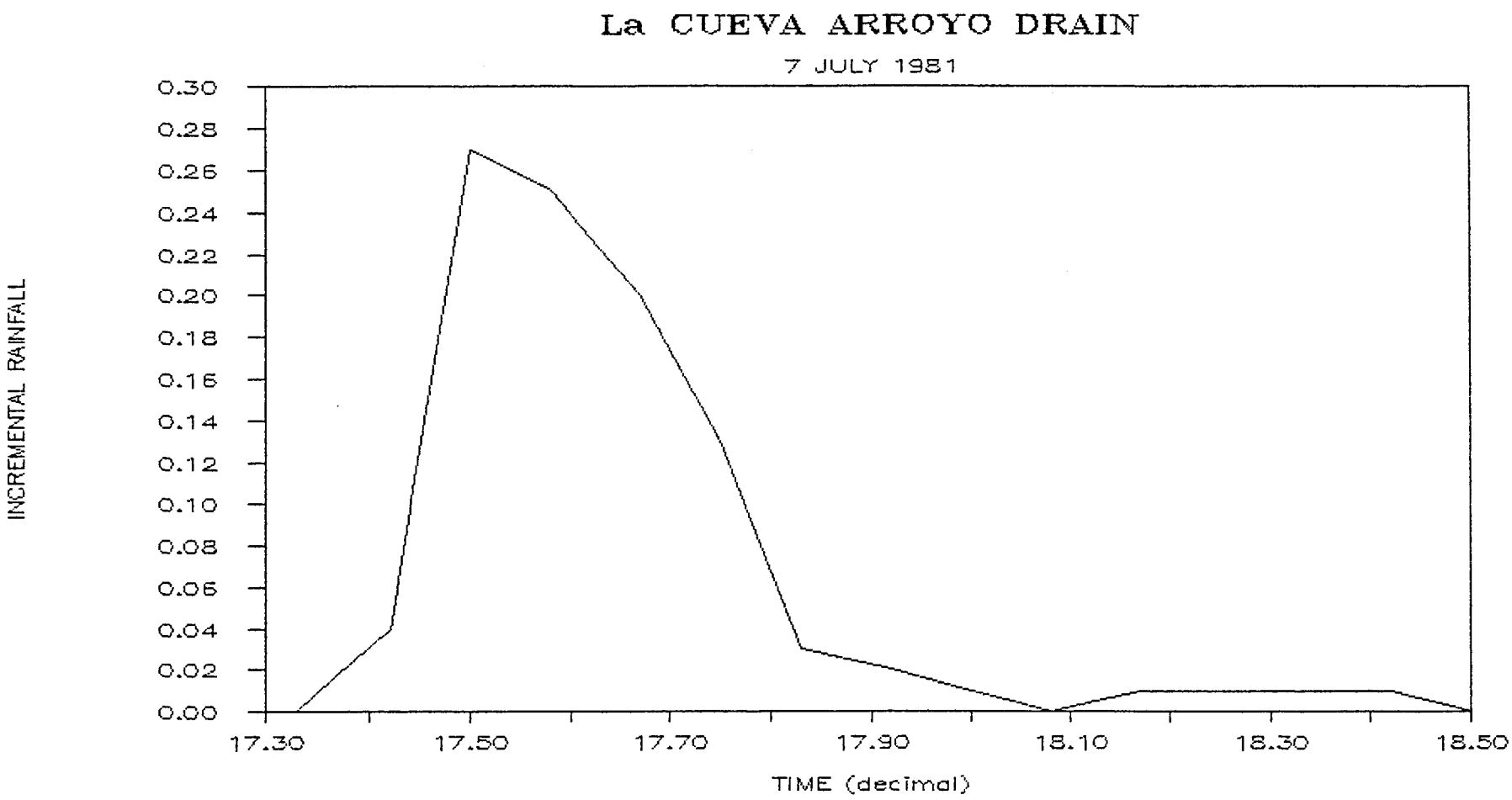
ALA.2	SUM Q	EUD	LAG	QULT
	74	0.11	0.25	696.96

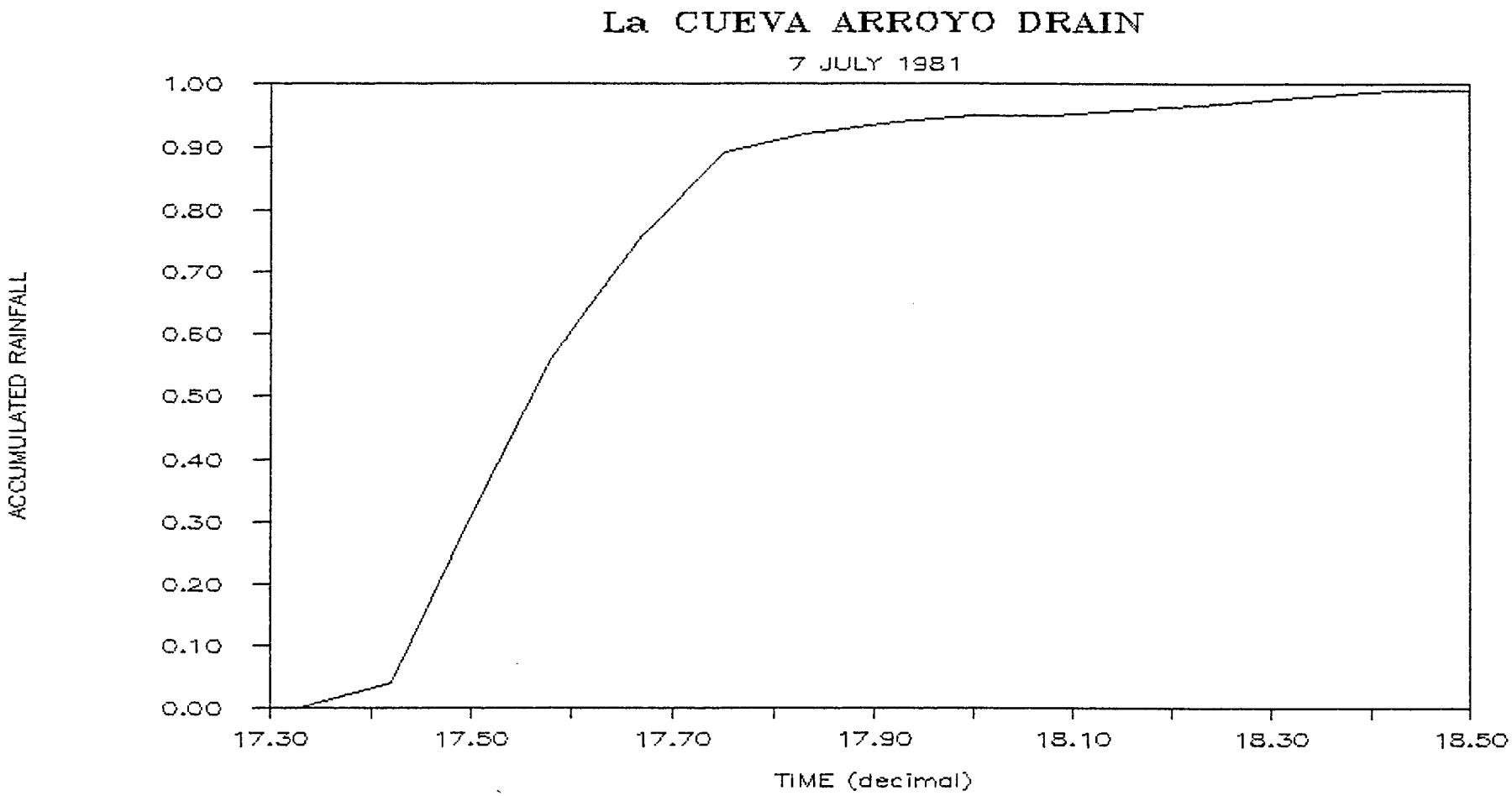
ALBUQUERQUE DATA	DATE	TIME	Q	DEC TI	UHG	SUM UHG	PQULT	PLAG
LA CUEVA ARROYO TRIB	08-Sep-80	1945	0.00		0.00	0.00		
		1950	0.00		0.00	0.00		
		1955	0.00		0.00	0.00		
		2000	0.00		0.00	0.00		
		2005	0.00		0.00	0.00		
		2010	0.00	0.00	0.00	0.00	0.00	0.00
		2015	7.80	0.08	73.46	73.46	10.54	32.56
		2020	15.00	0.17	141.28	214.74	30.81	69.18
		2025	15.00	0.25	141.28	356.02	51.08	101.74
		2030	13.00	0.33	122.44	478.45	68.65	134.29
		2035	9.10	0.42	85.71	564.16	80.95	170.92
		2040	7.90	0.50	74.41	638.57	91.62	203.47
		2045	4.60	0.58	43.32	681.89	97.84	236.03
		2050	1.60	0.67	15.07	696.96	100.00	272.66

u-hg duration = 5-min


LaCUEVA ARROYO TRIB
8 SEPTEMBER 1980
PQULT
110
100
90
80
70
60
50
40
30
20
10
0
0
40
80
120
160
200
240
280
PLAG


La CUEVA ARROYO DRAIN
7 JULY 1981
DISCHARGE
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
17.30
17.50
17.70
17.90
18.10
18.30
18.50
TIME (decimal)


La CUEVA ARROYO DRAIN
7 JULY 1981
INCREMENTAL RAINFALL
0.30
0.28
0.26
0.24
0.22
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
17.30
17.50
17.70
17.90
18.10
18.30
18.50
TIME (decimal)


La CUEVA ARROYO DRAIN
7 JULY 1981
ACCUMULATED RAINFALL
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
17.30
17.50
17.70
17.90
18.10
18.30
18.50
TIME (decimal)

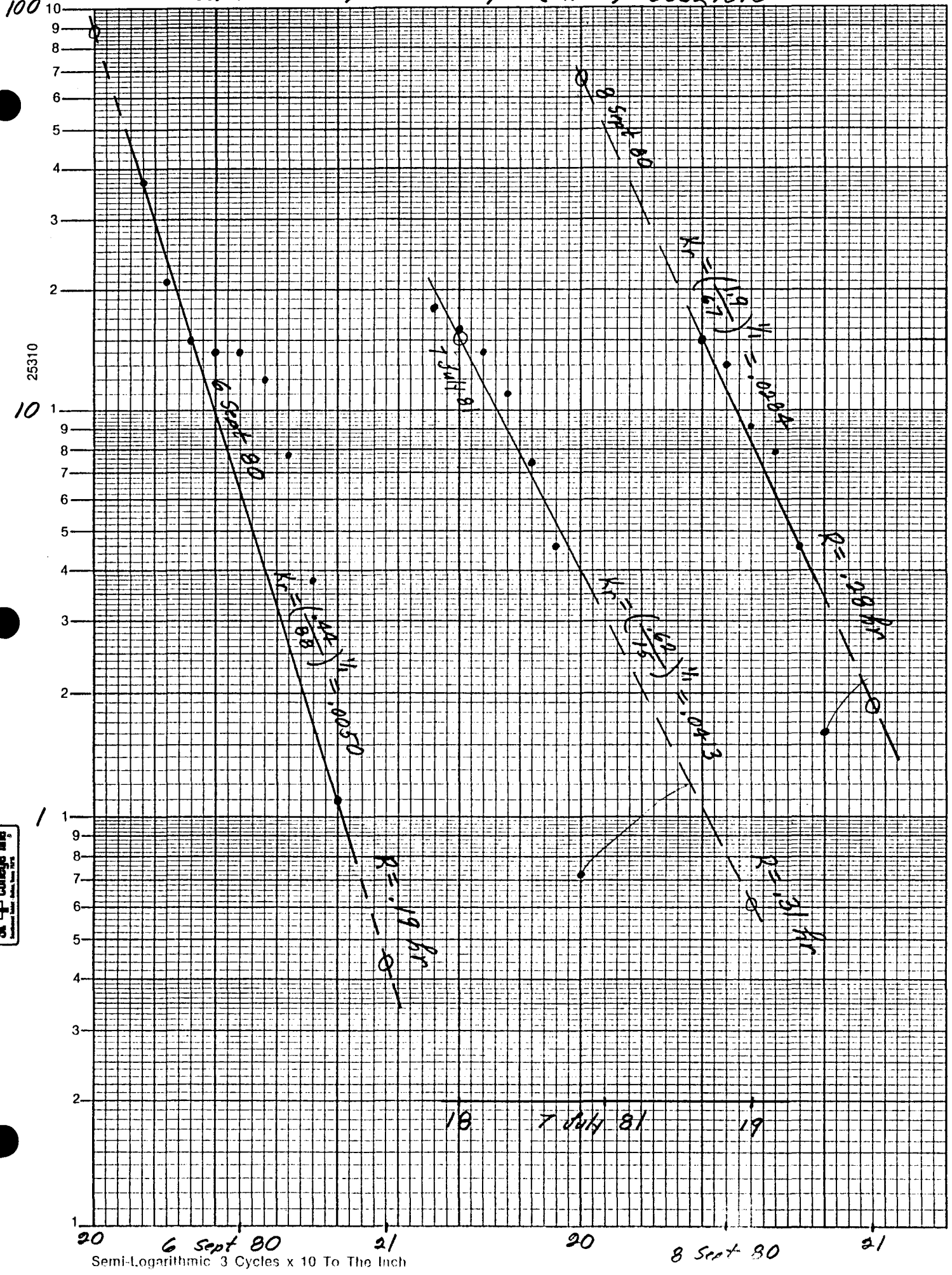
ALA.3	SUM Q	EUD	LAG	QULT
	125.02	0.18	0.38	696.96

ALBUQUERQUE DATA
LA CUEVA ARROYO TRIB

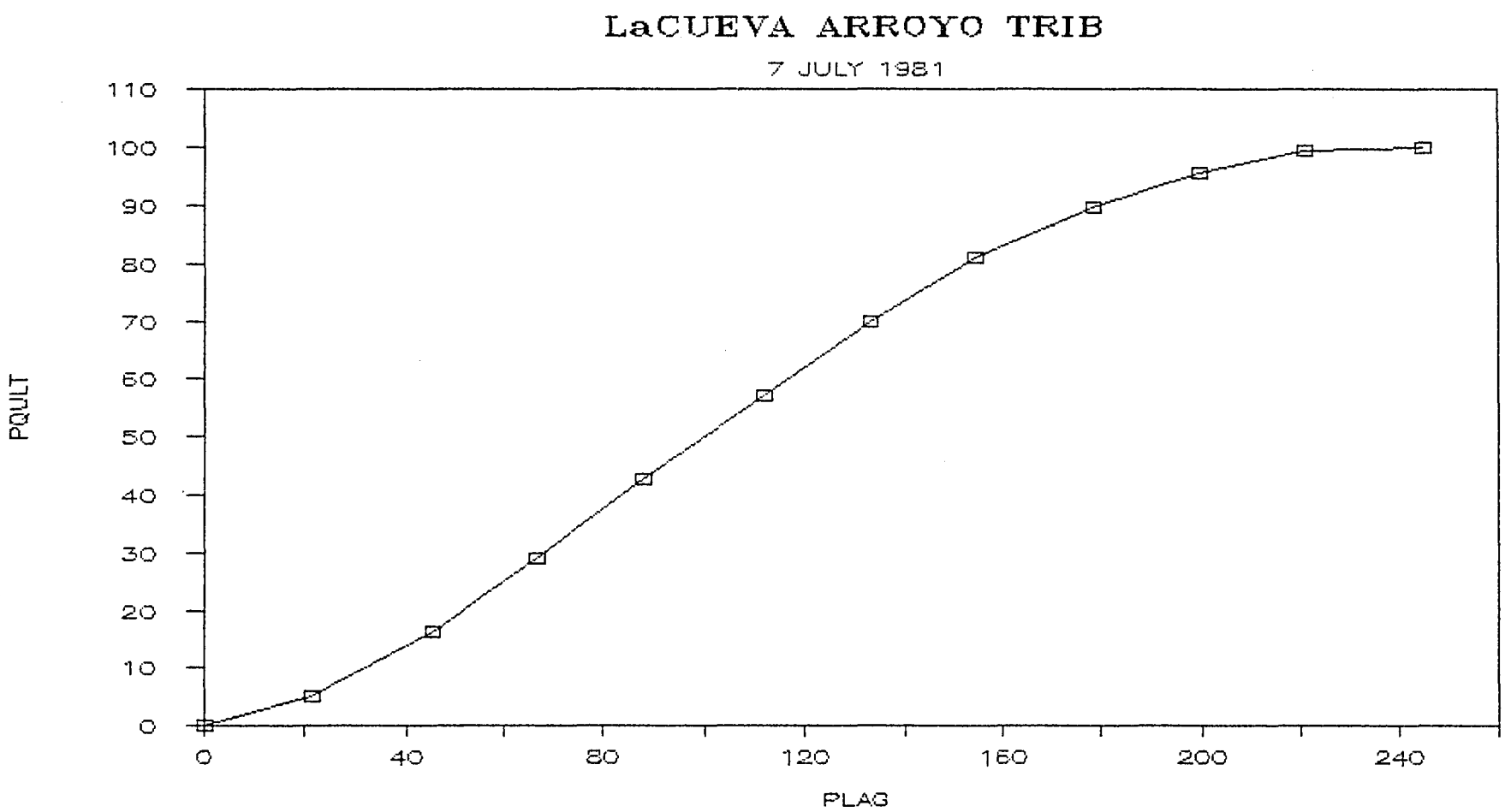
DATE	TIME	Q	DEC TI	UHG	SUM UHG	PQULT	PLAG
07-Jul-81	1720	0.00		0.00	0.00		
	1725	0.00		0.00	0.00		
	1730	0.00	0.00	0.00	0.00	0.00	0.00
	1735	6.30	0.08	35.12	35.12	5.04	21.27
	1740	14.00	0.17	78.05	113.17	16.24	45.21
	1745	16.00	0.25	89.20	202.37	29.04	66.48
	1750	17.00	0.33	94.77	297.14	42.63	87.75
	1755	18.00	0.42	100.35	397.48	57.03	111.69
	1800	16.00	0.50	89.20	486.68	69.83	132.96
	1805	14.00	0.58	78.05	564.73	81.03	154.24
	1810	11.00	0.67	61.32	626.05	89.83	178.17
	1815	7.40	0.75	41.25	667.30	95.74	199.44
	1820	4.60	0.83	25.64	692.95	99.42	220.72
	1825	0.72	0.92	4.01	696.96	100.00	244.65

21 Aug 81

La Cueva Arroyo Tributary (ALA) 08329890



Semi-Logarithmic 3 Cycles x 10 To The Inch


LaCUEVA ARROYO TRIB
7 JULY 1981
PQULT
110
100
90
80
70
60
50
40
30
20
10
0
0
40
80
120
160
200
240
PLAG