DRAINAGE DESIGN MANUAL

for Maricopa County, AZ

Technical Documentation Notebook – Volume 2 of 2

Hydrology

October 2002

Flood Control District
of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009
(602) 506-1501

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

DRAINAGE DESIGN MANUAL DOCUMENTATION NOTEBOOK

The purpose of this document is to provide a general tracking and background of the changes to the 1995 edition of the Drainage Design Manual for Maricopa County. This document is organized into two volumes. Volume I contains correspondence and is the key for understanding the changes to the manuals. The Correspondence Volume includes meeting minutes, memorandums and letters documenting discussions and decisions made regarding new methodologies, procedures and techniques for both the *Hydrology* and *Hydraulics Manuals* as well as data tables, figures and examples. Initially, a manual was to be prepared for the City of Phoenix only. Hydrologic and to a certain extent hydraulic methodologies and procedures for this new manual would have deviated somewhat significantly from the methodologies and procedures for the Flood Control District of Maricopa County. Much of the correspondence prior to 1998 dealing primarily with hydrologic issues was specific to new methodologies and procedures proposed for the City of Phoenix. After preparation of the manual began, the City of Phoenix and the Flood Control District of Maricopa County entered into an agreement that resulted in the City of Phoenix adopting the current Flood Control District of Maricopa County manuals with agreed upon revisions. This intergovernmental agreement primarily impacted the *Hydrology Manual*. The City of Phoenix agreed to adopt the current Flood Control District of Maricopa County hydrologic methodologies with improved/simplified procedures with additional focus on methodologies for the development of design discharges for more frequent flooding events. Correspondence prior to this agreement is provided primarily for an overall perspective on the project.

The second section of Volume I is the documentation for the *Hydraulics Manual*. Documentation for the *Hydraulics Manual* consists of copies of references used in the development of new methodologies, procedures, techniques and data. Only references considered not commonly available are provided in this volume.

Volume II is the documentation for the *Hydrology Manual*. Documentation of the *Hydrology Manual* is organized into two sections; technical analyses and testing/ verification. The technical analyses section includes source data and analyses used in the development of the methodologies, procedures and techniques presented in the new chapters. The testing and verification section is further divided into two subsections. The first subsection documents analyses conducted of current City of Phoenix hydrologic procedures in comparison to the current FCDMC hydrologic procedures. The second subsection presents the data and results for the testing of the multiple frequency modeling procedures.

MEMORANDUM

Post-it® Fax Note 7671	Date 7/10	# of pages ▶ 20
To Mike Gedach	From Amir M.	
Co./Dept. Stantec	Co. FCDMC	
Phone # 602-438-2200	Phone # 602-506-4871	
Fax # 602-431-9562	Fax # 602-506-4601	

DATE: APRIL 2, 1996

TO: TED LEHMAN
AMIR MOTAMEDI

FROM: RUSS CRUFF, PE

SUBJECT: FLOOD FREQUENCY ANALYSIS OF STREAM FLOW STATIONS

I AM ENCLOSING A PACKAGE OF FLOOD FREQUENCY MATERIAL THAT I HAVE PUT TOGETHER. THE PACKAGE INCLUDES THE FOLLOWING:

1. A COPY OF THE LOG PEARSON III ANALYSIS THROUGH 1990, WHICH I PUT TOGETHER A NUMBER OF YEARS AGO AS A PART OF THE PACKAGE THAT WE USED IN REBUTTAL OF THE FLOW MAGNITUDES FOR THE SCOTSDALE ALLUVIAL FAN AREA.
2. AN UPDATE OF THE LOG PEARSON III ANALYSIS THROUGH THE 1995 WATER YEAR. THIS INCLUDES A GRAPH SHOWING MAXIMUM AND AVERAGE VALUES FOR THE DATA. THIS IS SIMILIAR TO THE ONE PREPARED FOR THE ANALYSIS THROUGH 1990. IN FACT, THE AVERAGE AND MAXIMUM LINES TURN OUT TO BE THE SAME AS FOR THE PREVIOUS ANALYSIS.
3. I TOOK THE LOG PEARSON III ANALYSIS FOR EACH SITE AND COMPUTED THE GUMBEL PLOTTING POSITIONS FOR THE DATA. (THIS INFORMATION IS IN A SEPARATE FOLDER AND GIVEN TO TED LEHMAN FOR FILING.) I THEN PLOTTED THE DATA IN RED ON GUMBEL PLOTTING PAPER FOR EACH SITE AND DREW AN AVERAGE FLOOD FREQUENCY CURVE IN RED. NEXT I PLOTTED THE LOG PEARSON III COMPUTED VALUES IN A BLACK "X" ON THE PLOT. THE PLOTS WERE THEN REVIEWED AND A NEW CURVE DRAWN FOR SOME SITES IN PENCIL.

THE VALUES FOR THE 2-, 5-, 10-, 25-, 50-, AND 100-YEAR FREQUENCIES WERE THEN DETERMINED AND LISTED ON A TABLE. THE PENCIL LINE WAS USED WHERE IT WAS DEVELOPED OTHERWISE THE RED LINE WAS USED. THE TABLE WHICH IS INCLUDED, ALSO, HAS THE CFS AND CFS PER SQUARE MILE VALUES FOR EACH OF THE FREQUENCY LEVELS.

THE CFS PER SQUARE MILE VALUES WERE THEN PLOTTED VERSUS DRAINAGE AREA FOR EACH SITE. CURVES REPRESENTING MAXIMUM AND AVERAGE VALUE FOR THE DATA WERE DRAWN. A PLOT OF THIS TYPE WAS PREPARED FOR EACH OF THE FREQUENCY LEVELS. THE MAXIMUM AND AVERAGE CURVES WERE THEN TRANSFERRED TO A SEPARATE PLOT SO THAT A COMPARISON COULD BE MADE BETWEEN FREQUENCY LEVELS.

Stantec

Project: Project Number:

Notes: Scale:

Page of Page(s)

Computed By: Date: Checked By: How Date:

* Source: Basin Characteristics, 1996

do these plot on f.f. paper

Gage	LP3 Peak Discharge, in cfs*						2-YR RATIO
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR	
9501300	1,740	4,080	6,180	9,410	12,200	15,300	0.114
9510070	36	268	702	1,840	3,330	5,330	0.007
9510080	101	519	1,190	2,840	4,920	8,030	0.013
9510100	43	196	428	978	1,660	2,670	0.016
9510150	1,050	4,050	8,160	17,200	27,800	42,700	0.025
9510170	108	230	334	491	625	773	0.140
9510180	573	1,520	2,410	3,810	5,030	6,390	0.090
9510200	2,330	7,320	12,900	23,200	33,600	46,300	0.050
9512090	NOT A U.S.G.S. Gage						
9512100	378	1,440	2,950	6,400	10,600	16,800	0.023

Table 1. Summary of Log Pearson III Analysis for Maricopa County. (1990)

ID NO.	STATION NO.	STATION NAME	D.A. MI2	RECORD PERIOD	100-YEAR DISCHARGE CFS/MI2	100-YEAR DISCHARGE CFS
1	510070	W FK SYCAMORE CR N SUNFL	4.58	66-74		
				83-86	917	4,200
2	510080	W FY SYCAMORE CR N SUNFL	9.8	61-79	1,000	9,800
3	510100	E FK SYCAMORE CR N SUNFL	4.49	61-86	957	4,300
4	510150	SYCAMORE CR N SUNFLOWER	53.4	62-76	824	44,000
5	510170	CAMP CR NE SUNFLOWER	2.6	63-79	346	900
6	510180	ROCK CR NR SUNFLOWER	15	63-72	373	5,600
7	510200	SYCAMORE CR NR FT MCDOWELL	165	60-89	312	51,400
8	512100	INDIAN BEND WASH NR SCOTTS	142	61-84	293	41,600
9	512200	SALT R TRIB IN S MTN PK	1.75	61-89	1,714	3,000
10	512300	CAVE CR NR CAVE CREEK	121	58-89	165	20,000
11	513780	NEW R NR ROCK SPRINGS	67.3	62-89	602	40,500
12	513800	NEW R AT NEW RIVER	85.7	61-82	501	42,900
13	513820	DEADMAN WASH NR NEW RIVER	11.1	60-79	504	5,600
14	513860	SKUNK CR NR PHOENIX	64.6	60-89	467	30,200
15	514200	WATERMAN WASH NR BUCKEYE	403	64-90	21	8,600
16	515500	HASSAYAMPA R @ B D N WICK	417	46-83	120	50,300
17	515800	HARTMAN WASH NR WICKENBURG	5.57	64-79	1,400	7,800
18	516500	HASSAYAMPA R NR MORRISTOWN	774	39-42		
				64-89	85	65,700
19	516600	OX WASH NR MORRISTOWN	7.44	63-79	618	4,600
20	516800	JACKRABBIT WASH NR TONOPAH	137	64-79	237	32,500
21	517200	CENTENNIAL W TRIB NR WENDEN	2.79	63-79	394	1,100
22	517280	TIGER WASH NR AGUILA	85.2	63-79	121	10,300
23	517400	WINTERS WASH NR TONOPAH	47.8	62-79	92	4,400
24	519600	RAINBOW WASH TRIB N BUCKEYE	3.45	63-79	609	2,100
25	519750	BENDER WASH NR GILA BEND	68.8	63-79	190	13,100
26	519760	SAUCEDA WASH NR GILA BEND	126	63-79	90	11,300
27	520100	MILITARY WASH NR SENTINEL	8.70	63-79	551	4,800
28	520200	BLACK GAP WASH NR AJO	12.1	63-79	116	1,400
29	520230	CRATER RANGE WASH NR AJO	1.49	63-79	1,275	1,900

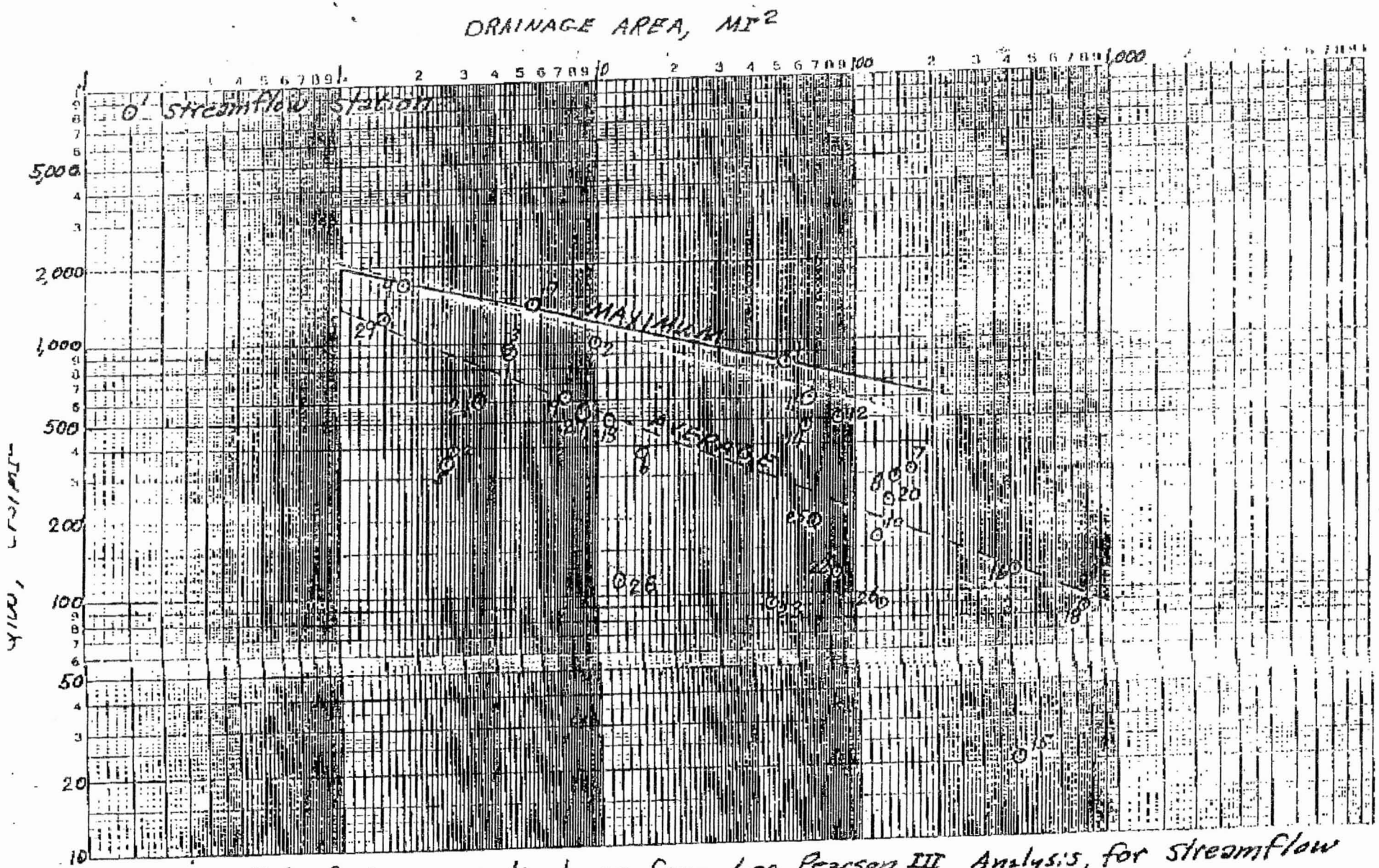


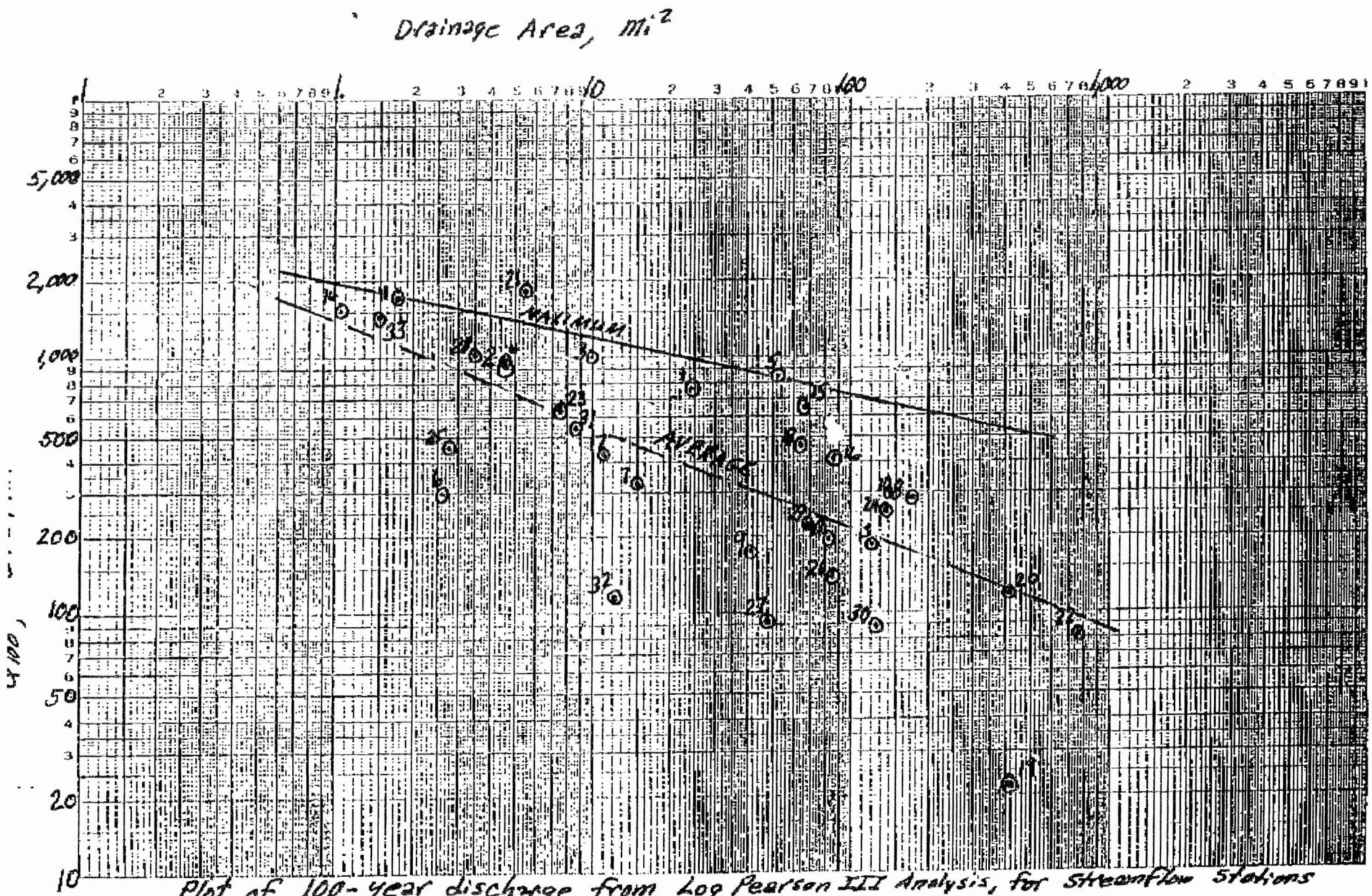
Figure 1.- Plot of 100-year discharge, from Log Pearson III Analysis, for streamflow stations in Maricopa County. (1990)

SUMMARY OF LOG PEARSON III ANALYSIS THROUGH 1995 WATER YEAR

ID NO.	STATION NO.	STATION NAME	DA MI2	RECORD PERIOD	100-YEAR DISCH CFS/MI2	100-YEAR DISCH CFS
1	501300	TORTILLA CR @ TOR FL	24.3	66-83,91-95	774	18,800
2	510070	W FK SYCAMORE CR N SUN	4.58	66-74,83-86	917	4,200
3	510080	W FK SYCAMORE CR N SUN	9.8	61-79	1,000	9,800
4	510100	E FK SYCAMORE CR N SUN	4.49	61-86	957	4,300
5	510150	SYCAMORE CR N SUNF	52.3	62-76	841	44,000
6	510170	CAMP CR NR SUNFLOWER	2.6	63-79,91-95	300	780
7	510180	ROCK CR NR SUNFLOWER	15	63-72,91-95	325	4,880
8	510200	SYCAMORE CR NR FT MCD	165	60-95	287	47,300
9	512090	INDIAN B W @ SHEA BLV'D	41.2	84-95	173	7,110
10	512100	INDIAN B W NR SCOTTSD	142	61-84	293	41,600
11	512200	SALT R TRIB IN S MTN PK	1.75	61-95	1,726	3,020
12	512280	CAVE CR BEL COT CR	82.7	81-95	195	15,800
13	512300	CAVE CR NR CAVE CR	121	58-81,83-89	183	22,200
14	512700	AGUA FRIA R TRIB #2	1.07	63-80,91-95	1,514	1,620
15	513780	NEW RIVER NR ROCK SPR	67.3	62-95	636	42,800
16	513800	NEW RIVER @ NEW RIVER	83.3	61-82	501	42,900
17	513820	DEADMAN WASH NR NEW R	11.1	60-79,91-95	432	4,800
18	513860	SKUNK CR NR PHOENIX	64.6	60-95	472	30,500
19	514200	WATERMAN W NR BUCK	420	64-95	22	9,280
20	515500	HASSAYAMPA R @ B D N W	417	46-83	120	50,300
21	515800	HARTMAN W NR WICKEN	5.57	64-79,83, 91-95	1,831	10,200
22	516500	HASSAYAMPA R NR MORRIS	774	39-47,54, 56,64-95	81	62,500
23	516600	OX WASH NR MORRISTOWN	7.44	63-79,91-95	633	4,710
24	516800	JACKRABBIT W N TONAPAH	137	64-79,83, 91-95	254	34,800
25	517200	CENTENIAL W TRIB N WEND	2.79	63-79,83, 91-95	462	1,290

ID NO.	STATION NO.	NAME	DA MI2	RECORD PERIOD	100-YEAR DISCH CFS/MI2	CFS
26	517280	TIGER WASH NR AGUILA	85.2	63-79,83, 91-95	137	11,700
27	517400	WINTERS WASH N TONAPAH	47.8	62-79	92	4,400
28	519600	RAINBOW W TRIB N BUCK	3.45	63-79,83, 91-95	1,003	3.460
29	519750	BENDER WASH N GILA BEND	68.8	63-79,83, 91-95	225	15,500
30	519760	SAUCEDA WASH N GILA B	126	63-79,90-95	89	11,200
31	520100	MILITARY W NR SENTINEL	8.70	63-79,83, 91-95	540	4,700
32	520200	BLACK GAP WASH N AJO	12.1	63-79	116	1,400
33	520230	CRATER RANGE W N AJO	1.49	63-79,83, 91-95	1,430	2,130

R. W. CRUFF, PE
MARCH 28, 1996



Plot of 100-year discharge, from Log Pearson III Analysis, for Streamflow Stations Through 1985 WY, in Maricopa County.

SUMMARY OF FLOOD FREQUENCY ANALYSIS THROUGH 1995 WATER YEAR

ID NO.	STA NO.	2-YR CFS/ MI2	2-YR CFS	5-YR CFS/ MI2	5-YR CFS	10-YR CFS/ MI2	10-YR CFS	25-YR CFS/ MI2	25-YR CFS	50-YR CFS/ MI2	50-YR CFS	100-YR CFS/ MI2	100-YR CFS	2-YR RATIO
1	501300	103	2,500	173	4,200	288	7,000	412	10,000	535	13,000	700	17,000	0.147
2	510070	9	40	114	520	186	850	306	1,400	459	2,100	655	3,000	0.013
3	510080	11	110	63	620	90	880	148	1,450	214	2,100	306	3,000	0.037
4	510100	9	40	56	250	91	410	156	700	245	1,100	356	1,600	0.025
5	510150	21	1,100	107	5,600	164	8,600	287	15,000	402	21,000	574	30,000	0.037
														0.259
6	510170	42	110	107	300	158	410	192	500	246	640	308	800	0.138
7	510180	63	950	107	1,600	140	2,100	207	3,100	267	4,000	347	5,200	0.183
8	510200	15	2,400	58	9,600	85	14,000	133	22,000	182	30,000	254	42,000	0.057
9	512090	24	1,000	48	2,000	75	3,100	126	5200	194	8,000	291	12,000	0.083
10	512100	3	420	11	1,500	85	12,000	148	21,000	239	34,000	366	52,000	0.008
														0.469
11	512200	23	40	120	210	274	480	571	1,000	1,029	1,800	1,771	3,100	0.013
12	512280	12	1,000	36	3,000	60	5,000	99	8,200	145	12,000	195	15,800	0.063
13	512300	11	1,300	41	5,000	63	7,600	99	12,000	132	16,000	183	22,200	0.058
14	512700	327	350	654	700	878	940	1,121	1,200	1,355	1,450	1,589	1,700	0.206
15	513780	28	2,400	110	9,500	140	12,000	198	17,000	257	22,000	327	28,000	0.086
														0.426
16	513800	32	2,700	103	8,600	180	15,000	300	25,000	408	34,000	540	45,000	0.060
17	513820	33	370	104	1,150	135	1,500	180	2,000	225	2,500	279	3,100	0.119
18	513860	15	1,000	101	6,500	155	8,000	201	13,000	279	18,000	387	25,000	0.040
19	514200	3	1,100	6	2,400	9	3,700	16	6,600	24	10,000	38	16,000	0.069
20	515500	8	3,400	29	12,000	48	20,000	82	34,000	120	50,000	177	74,000	0.046
														0.334
21	515800	39	220	197	1,100	323	1,800	539	3,900	790	4,400	1,185	6,600	0.033
22	516500	4	3,100	14	10,500	26	20,000	45	35,000	70	54,000	103	80,000	0.039
23	516600	34	250	105	780	202	1,500	403	3,000	685	5,100	1,183	8,800	0.028
24	516800	6	900	34	4,700	51	7,000	102	14,000	161	22,000	255	35,000	0.026
25	517200	47	130	115	320	161	450	251	700	340	750	466	1,300	0.100

Period of record end prior to 1990. Why do the 2's change

How do these plot on flood freq. paper

1.714

ID NO.	STA NO.	2-YR CFS/ MI2	2-YR CFS	5-YR CFS/ MI2	5-YR CFS	10-YR CFS/ MI2	10-YR CFS	25-YR CFS/ MI2	25-YR CFS	50-YR CFS/ MI2	50-YR CFS	100-YR CFS/ MI2	100-YR CFS	2-YR RATIO
26	517280	12	1,000	29	2,500	42	3,600	63	5,400	82	7,000	108	9,200	0.109
27	517400	18	880	32	1,550	46	2,200	71	3,400	98	4,700	138	6,600	0.133
28	519600	87	300	220	760	319	1,100	522	1,800	725	2,500	1,003	3.460	0.087
29	519750	9	640	23	1,650	33	2,300	52	3,600	71	4,900	96	6,600	0.097
30	519760	4	500	14	1,800	21	2,600	32	4,000	46	5,800	65	8,200	0.061
31	520100	18	160	80	700	138	1,200	230	2,000	333	2,900	460	4,000	0.040
32	520200	32	390	60	720	71	860	84	1,020	99	1,200	116	1,400	0.279
33	520230	54	80	208	310	282	420	416	620	544	810	738	1,100	0.073

AVG = 0.078

R. W. CRUFF, PE
APRIL 2, 1996

IN SUMMARY, I BELIEVE THAT THESE CURVES FROM THE ADJUSTED GUMBEL PLOTS GIVE A MUCH BETTER EVALUATION OF THE DATA THAN DO THE LOG PEARSON III ANALYSIS. THIS BEING PRIMARILY DO THE SHORTNESS OF THE RECORDS FOR MANY OF THE SITES.

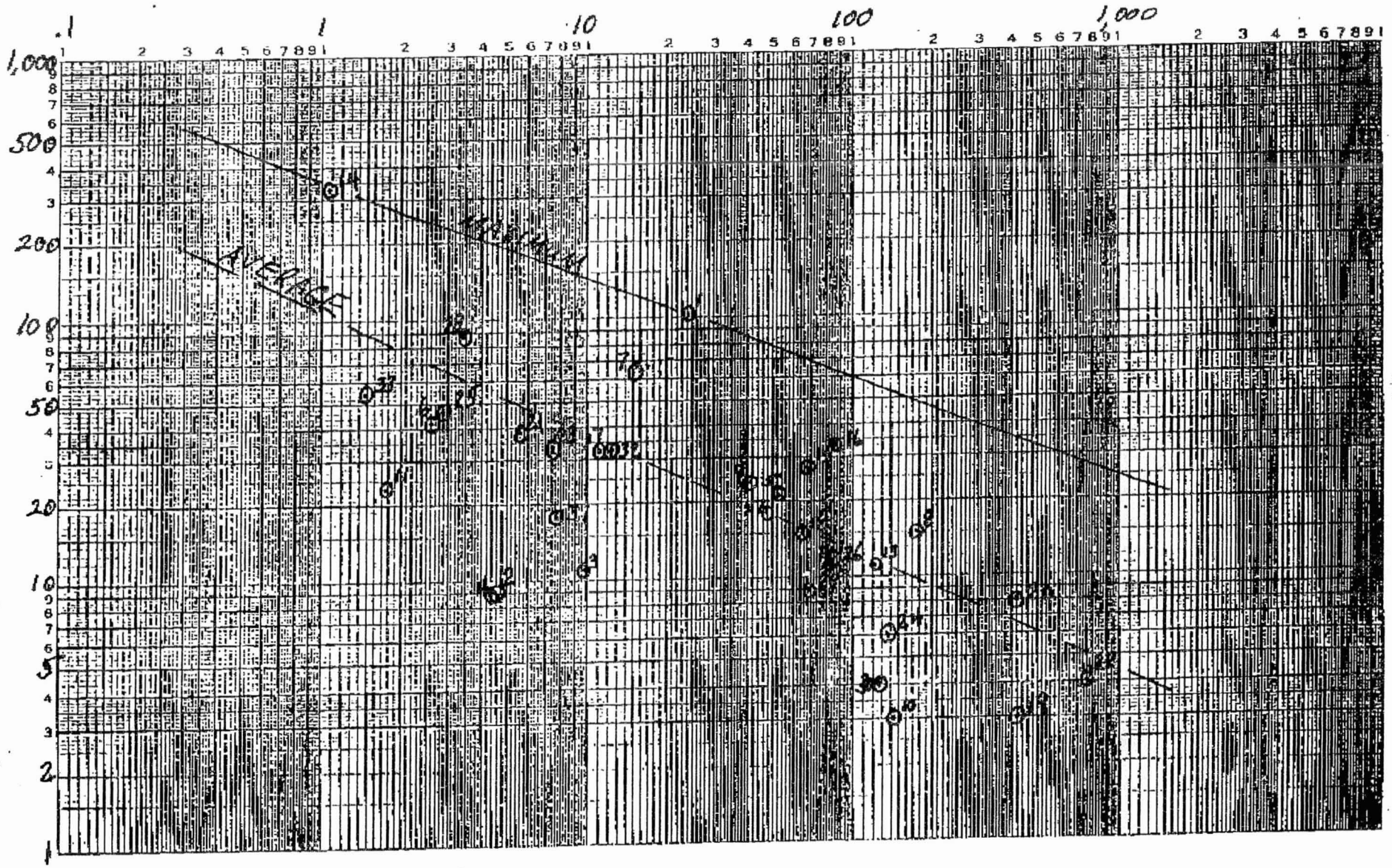
THE RATIO BETWEEN FREQUENCY LEVELS IS SOMEWHAT DEPENDANT ON BASIN SIZE. USING THE AVERAGE CURVES THE FOLLOWING INFORMATION WAS EXTRACTED.

FREQ	BASIN SIZE		
	100- SQ MI	10- SQ MI	1- SQ MI
Q100	1,100 CFS	500 CFS	230 CFS
Q50	680	300	140
Q25	560	235	100
Q10	420	160	60
Q5	300	105	37
Q2	110	37	13

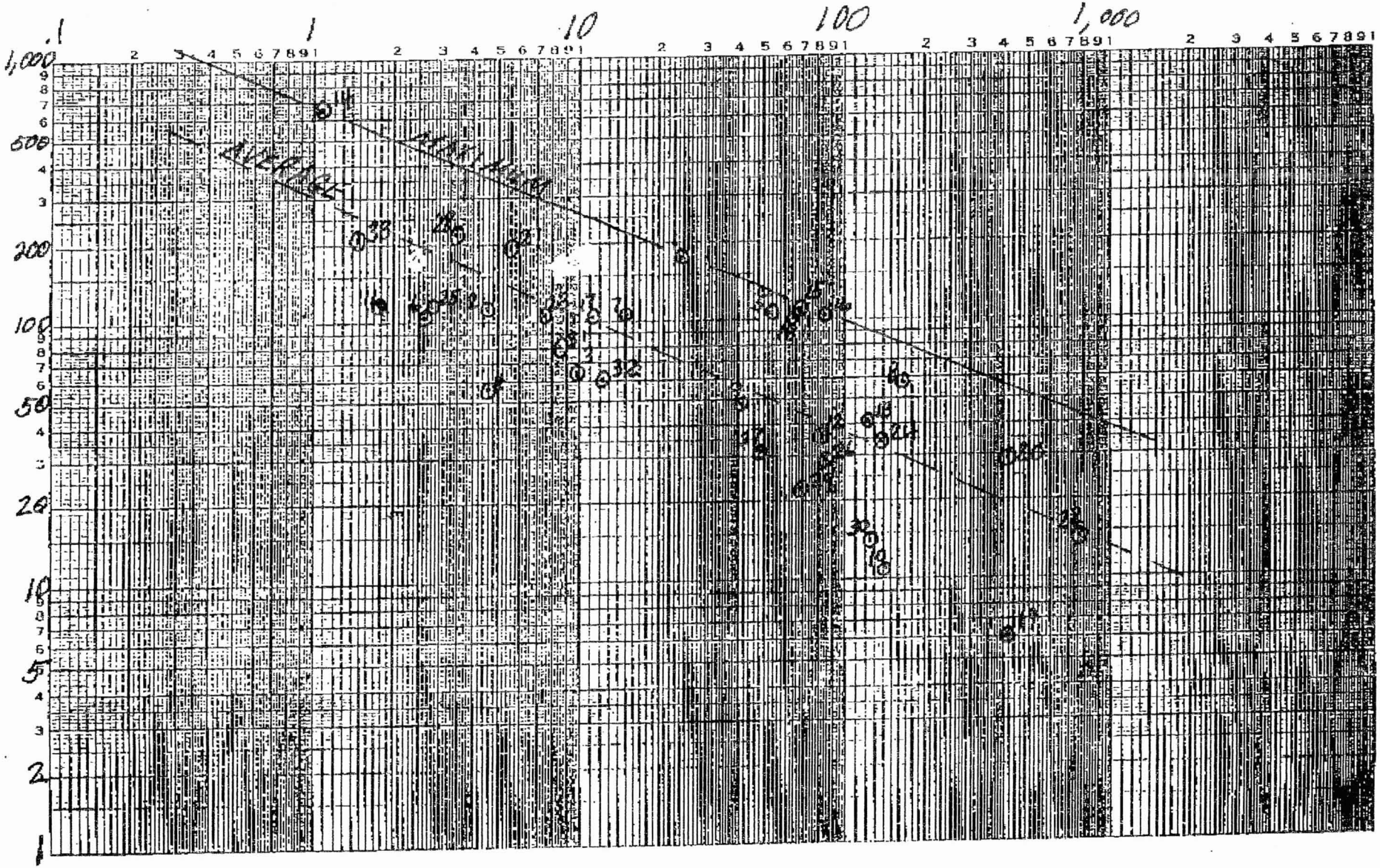
RATIO	BASIN SIZE		
	100- SQ MI	10- SQ MI	1- SQ MI
Q100 / Q50	1.6	1.6	1.6
Q100 / Q25	2.3	2.1	2.0
Q100 / Q10	3.8	3.1	2.6
Q100 / Q5	6.2	4.8	3.7
Q100 / Q2	17.3	13.5	10.0
Q50 / Q25	1.2	1.3	1.6
Q50 / Q10	1.6	1.9	2.3
Q50 / Q5	2.3	2.9	3.8
Q50 / Q2	6.2	8.1	10.8
Q25 / Q10	1.3	1.5	1.7
Q25 / Q5	1.9	2.2	2.7
Q25 / Q2	5.1	6.4	7.7
Q10 / Q5	1.4	1.5	1.6
Q10 / Q2	3.8	4.3	4.6
Q5 / Q2	2.7	2.8	2.8

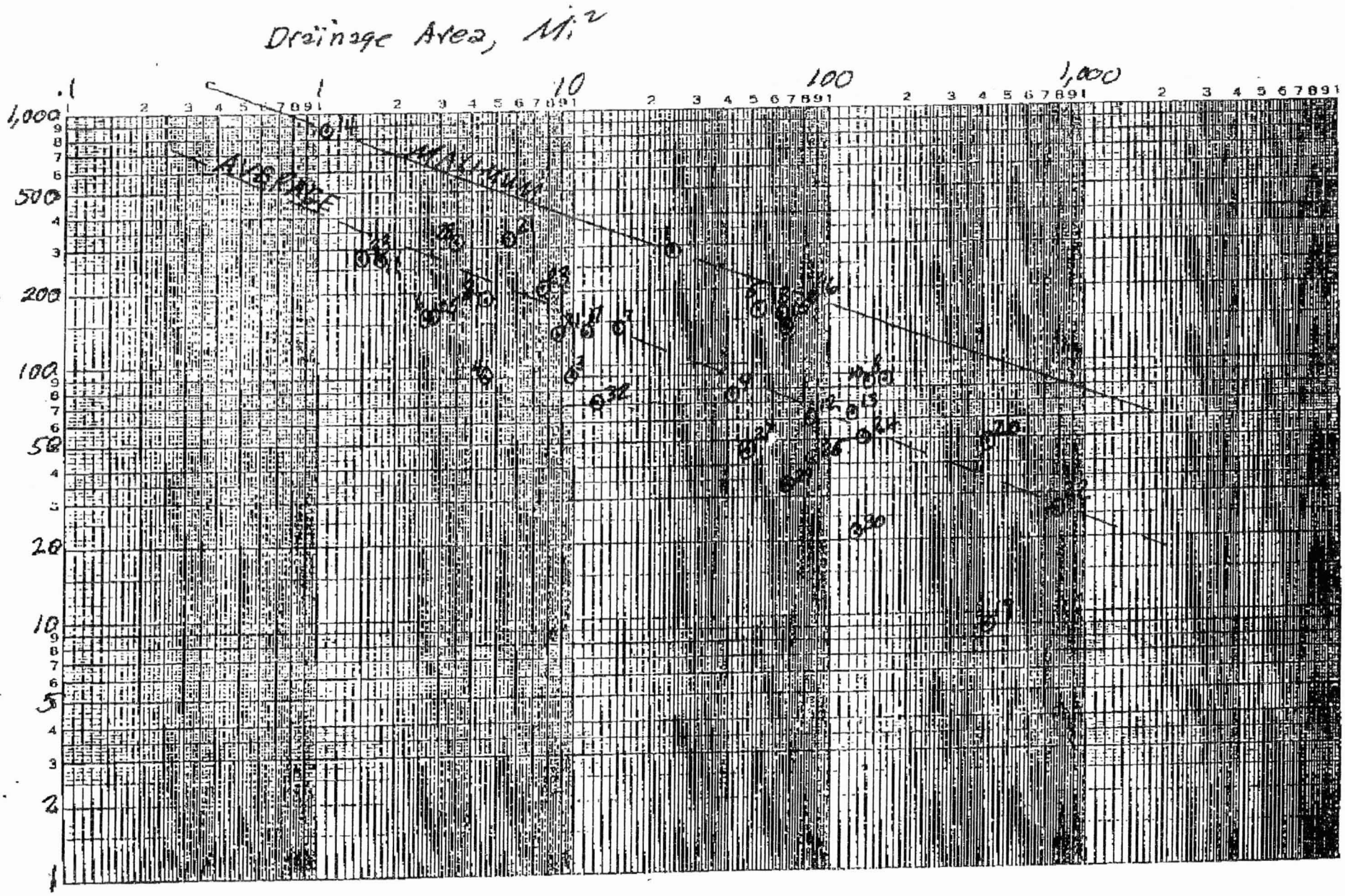
THE RESULTS OF THIS STUDY SHOULD AID IN DEVELOPING VERIFICATION VALUES FOR HYDROLOGY MODELING RESULTS.

Drainage Area, Mi^2



Drainage Area, Mi²




Drainage Area, Mi²
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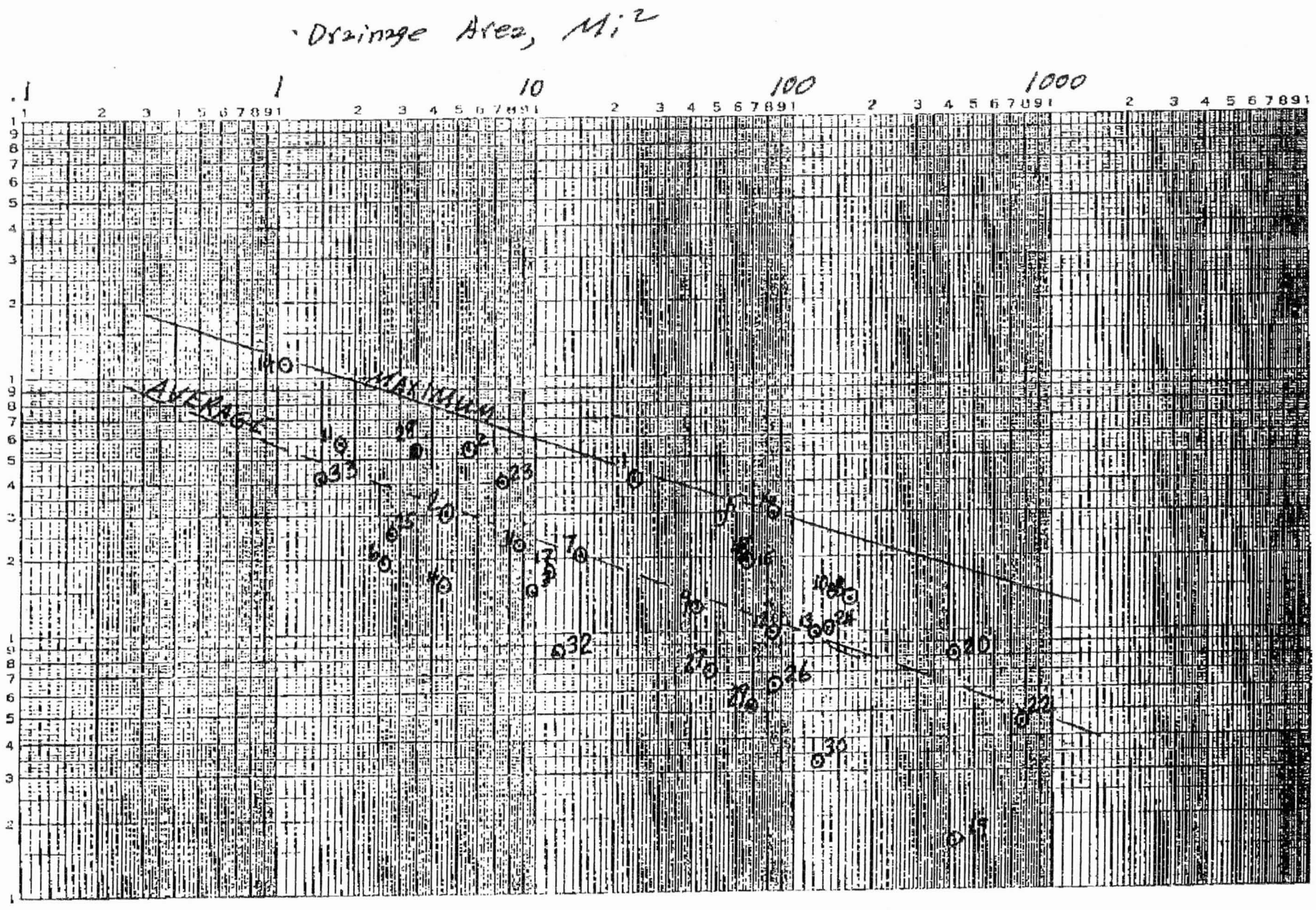
MAXIMUM


Drainage Area, Mi²
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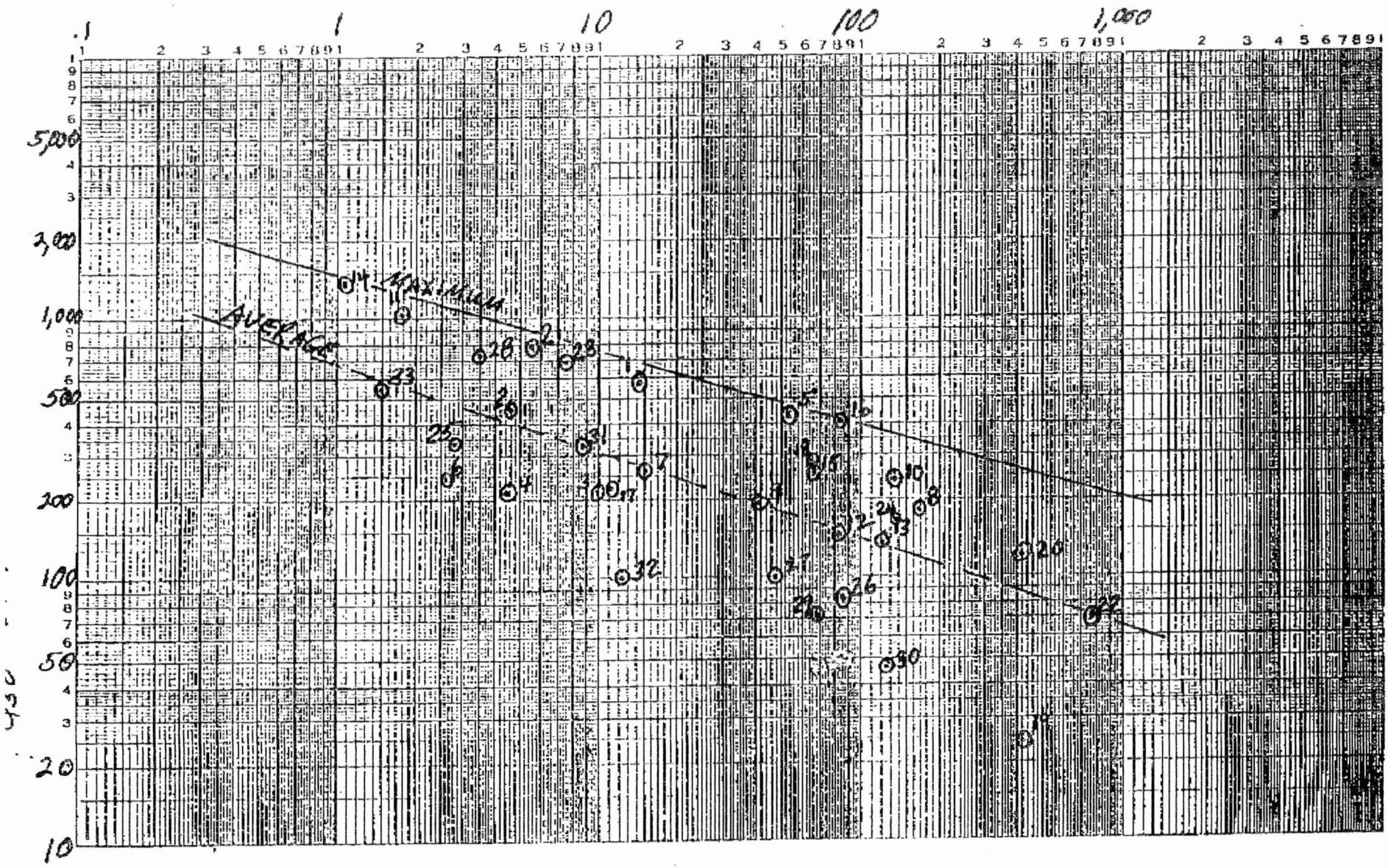
AVERAGE
MAXIMUM


Drainage Area, Mi.²
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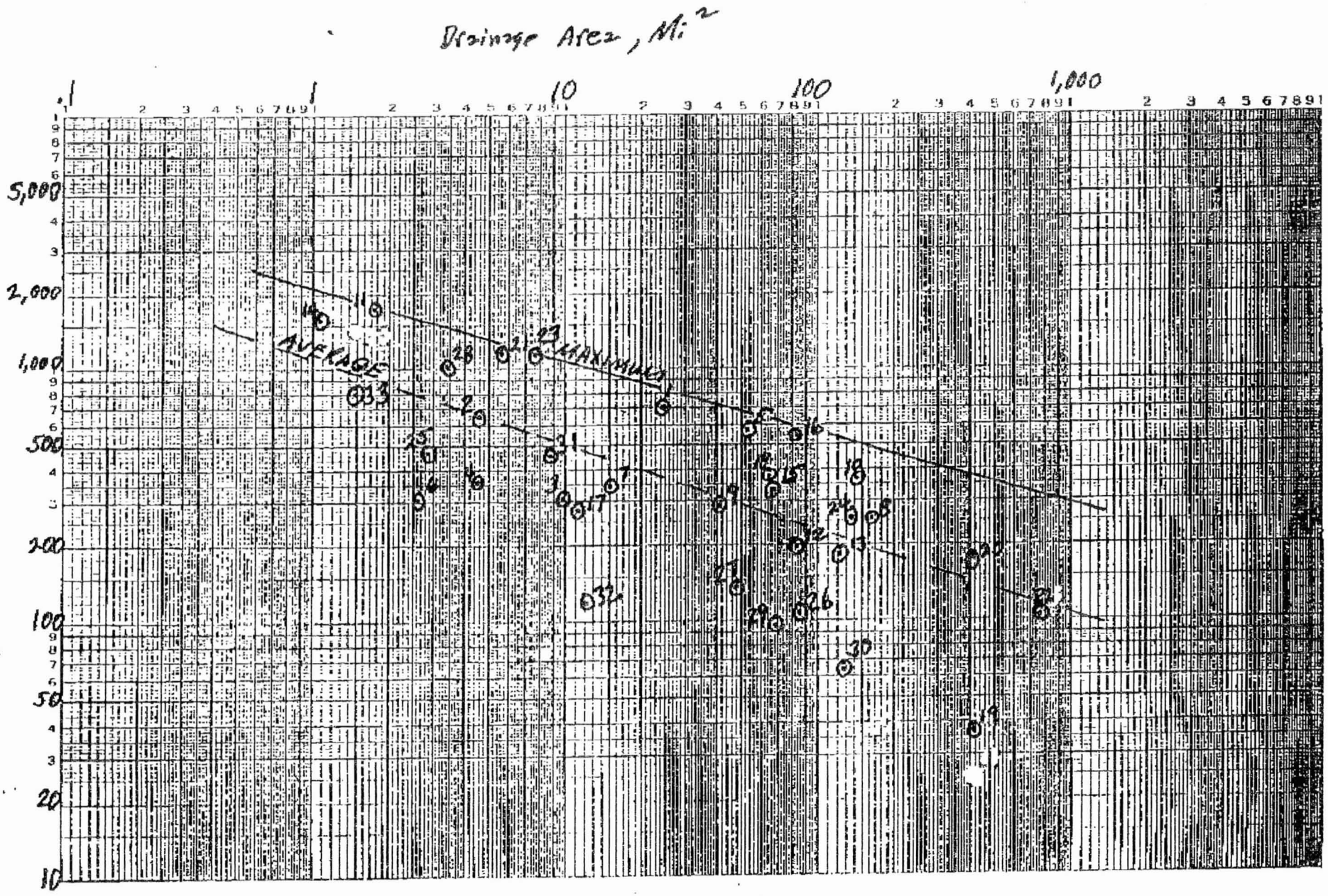
MAXIMUM
AVERAGE


Drainage Area, Mi²
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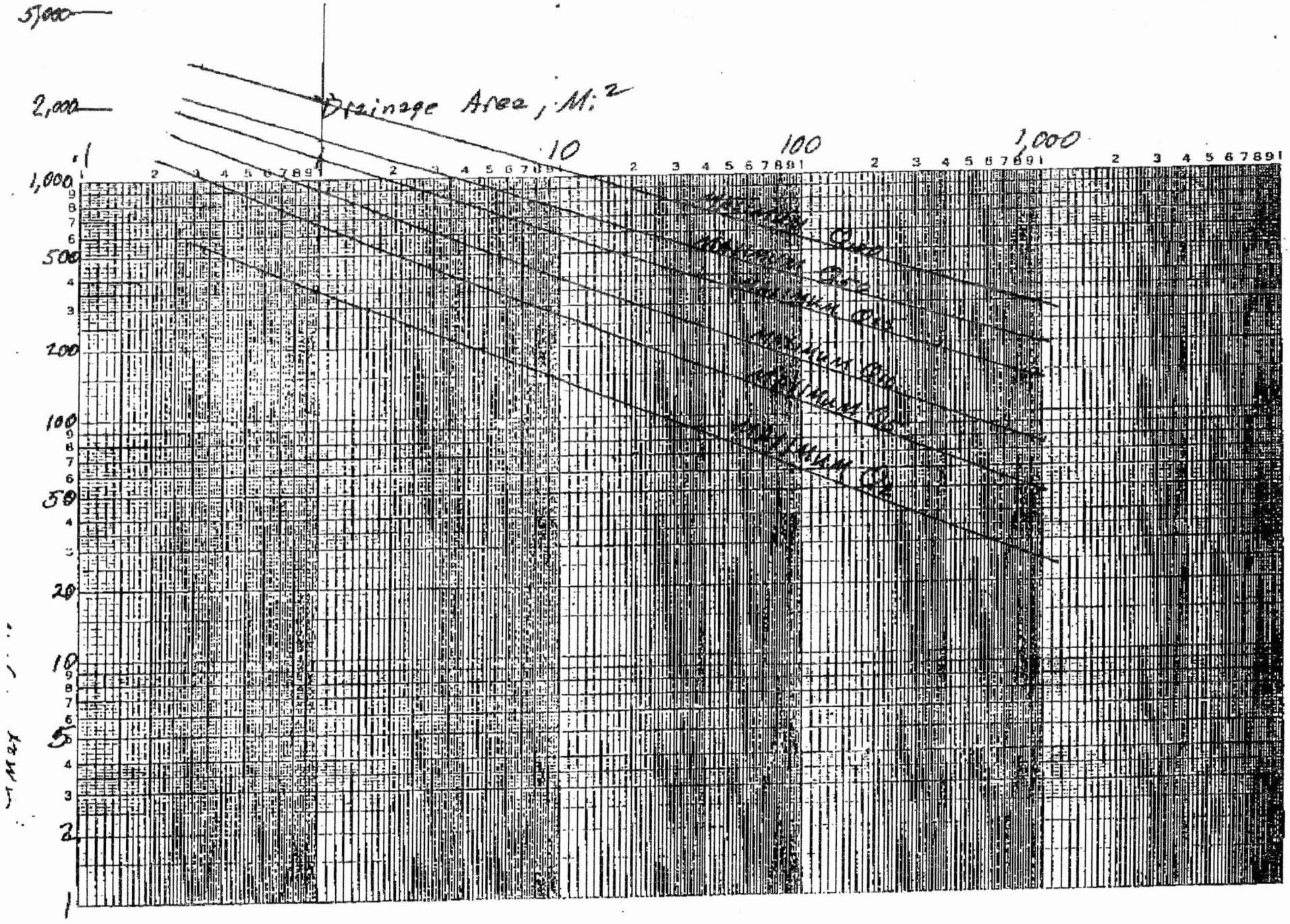
MAXIMUM


Drainage Area, Mi.²
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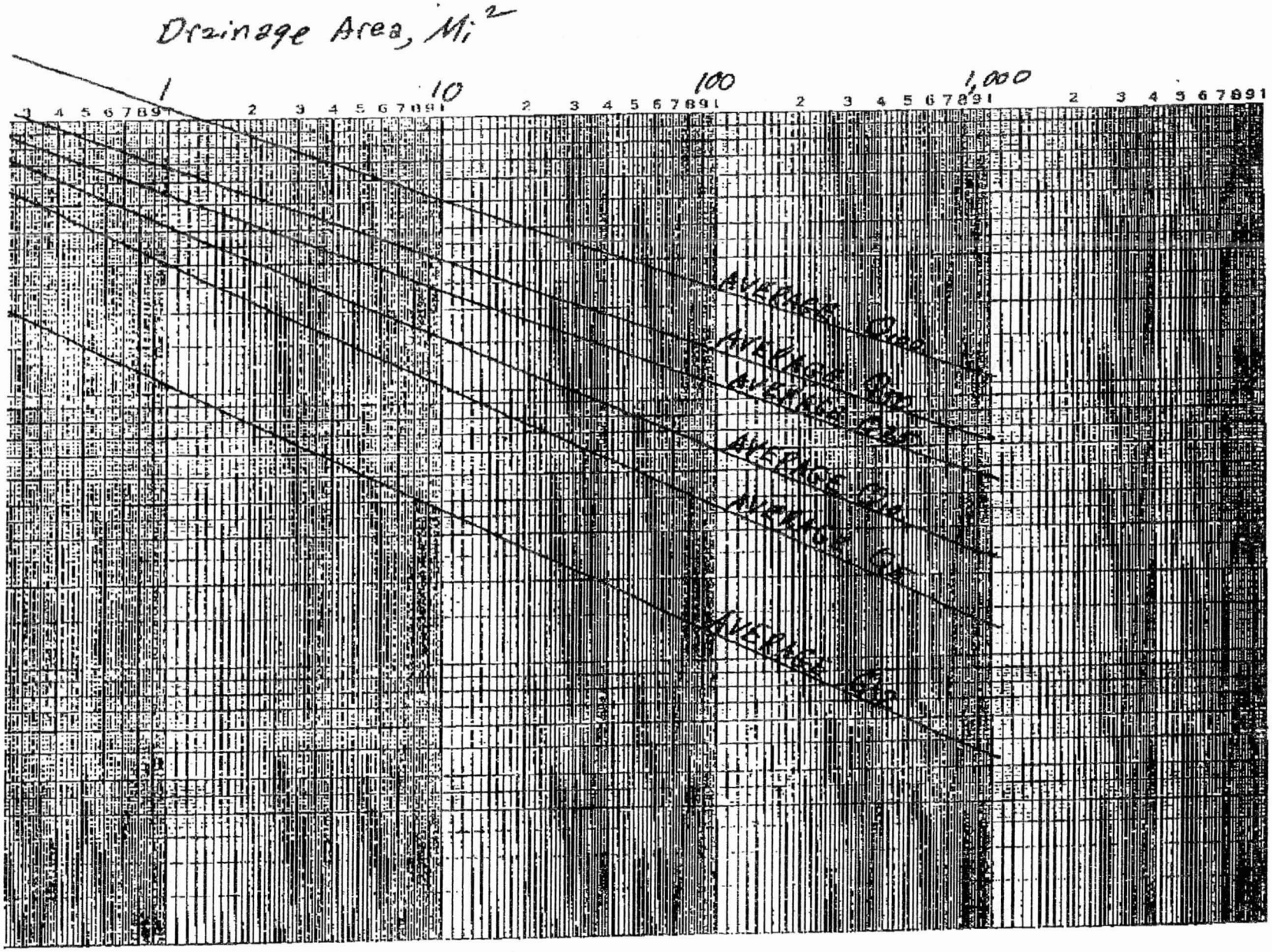
Drainage Area, Mi²
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1,000
AVERAGE
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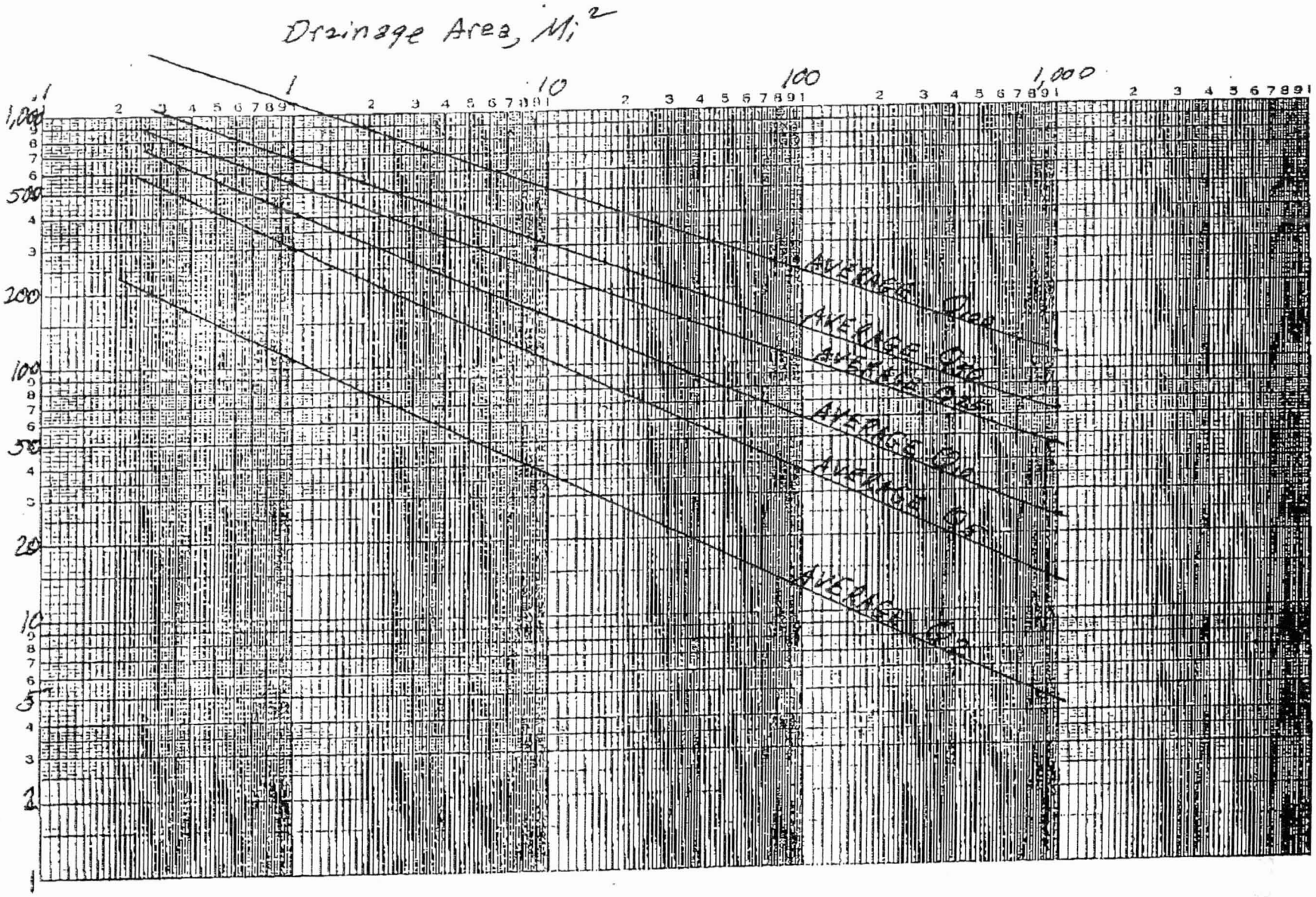
Drainage Area, Mi²
1
10
100
1,000
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5
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GILA RIVER BASIN
NEW RIVER
AND PHOENIX CITY STREAMS
ARIZONA

DESIGN MEMORANDUM NO. 2

HYDROLOGY

Part 2

U.S. Army Engineer District, Los Angeles
Corps of Engineers
1982

analysis were (1) to determine 100-year flood peak discharges for the design of ACDC and the delineation of the floodways below the authorized dams, and (2) to review previous results for the Agua Fria River. Design discharges for the urbanized watersheds below the authorized dams were determined from the discharge frequency relationships derived in the Part 1 hydrology report, which are summarized below. Revised discharge frequency values for the Agua Fria River downstream from Waddell Dam are based on the procedures discussed in this section.

6.02 Discharge Frequency Analysis for Urbanized Basins. Discharge frequency relationships for urbanized areas were derived in the Part 1 hydrology report from the discharge frequency curves for two stream gages located on catchments with significant percentages of impervious cover: Agua Fria Tributary at Youngtown (USGS No. 9-5137) and Tucson Arroyo at Vine Avenue (USGS No. 9-4830). Representing impervious cover of 40 percent and 60 percent, respectively, the ratios of n-year flood peak discharge to SPF peak discharge for the Youngtown gage frequency curve and for the Tucson gage frequency curve were averaged to derive the following adopted relationships for urbanized basins in the Phoenix region.

n-Year Flood	Percent of SPF for an urbanized watershed
SPF	100
100	45
50	32
25	21
10	12
5	7
2	3

6.03 Discharge Frequency Analysis for Agua Fria River. The discharge frequency analysis for the Agua Fria River was complicated by the existence of Waddell Dam and the lack of long-term streamflow records below the dam. The available stream gage records are given in tables 7 through 11. The records at Avondale and El Mirage are not only short but, except for 1978-1980, occurred during a relatively dry period. Moreover, the accuracy of the large recorded flows at Avondale may be questionable. Therefore, discharge frequency values at points of interest were determined by routing n-year "balanced hydrographs," developed from Waddell Dam volume inflow frequency relationships, through the dam and downstream, adding local flows as appropriate.

a. Waddell Dam Inflow Frequency Analysis. Waddell Dam inflow frequency relationships were developed, where sufficient data were available, from a statistical analysis of the record given in table 7. An attempt to fill gaps in the recorded flows at Waddell Dam by correlation with the fairly long-term Mayer stream gage record failed to yield usable results. Several peak discharge estimates made by the Corps of Engineers and others have been published (ref. 8, 9, and 10). These estimates were evaluated and considered reasonable, based on rain gage records and flow records from other stream gages in the region. Additional estimates were made for this study by

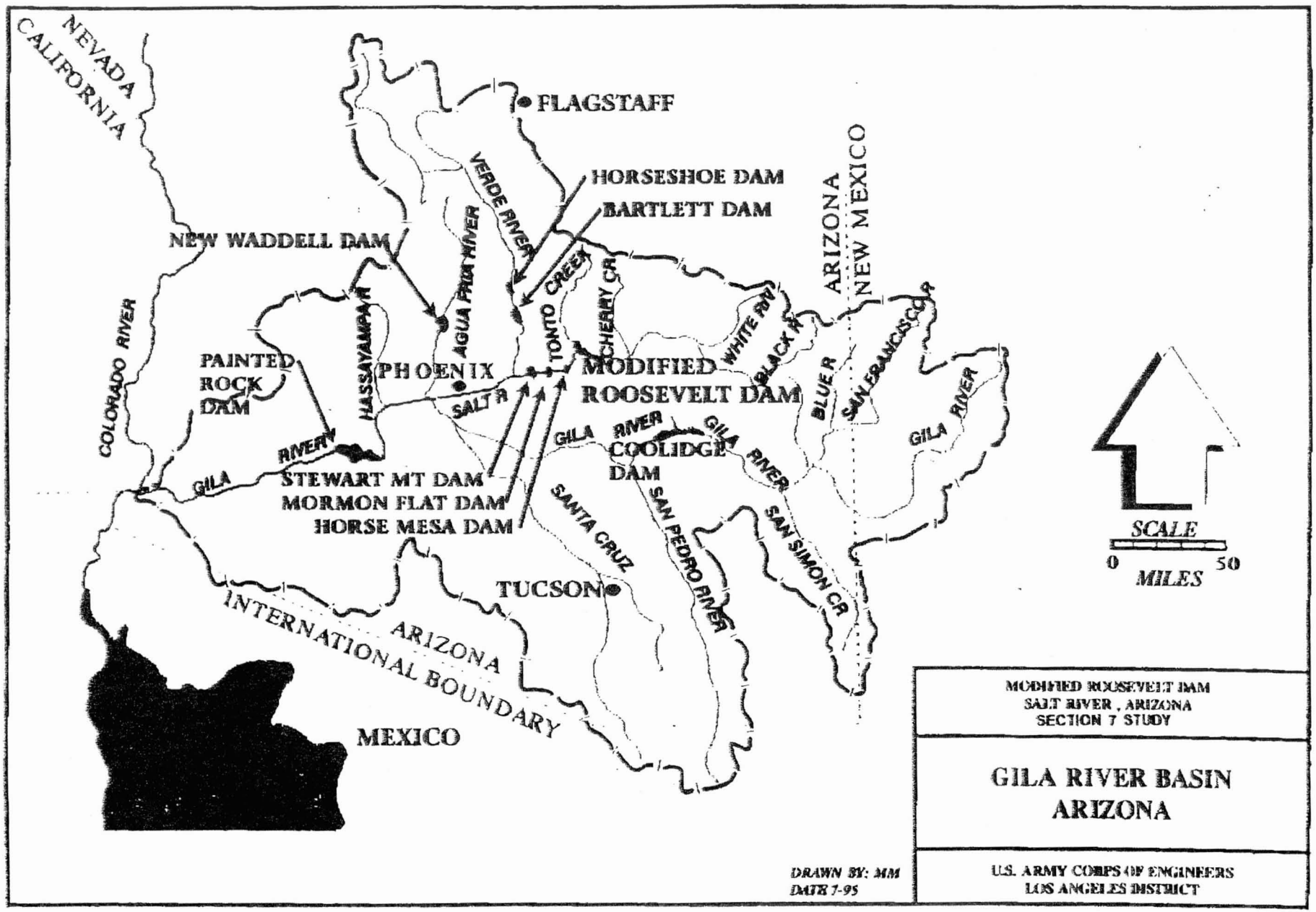

PLATE 1

TOTAL P.04

METHOD 1

ENVELOPE CURVE SOURCE DATA

Revised 30 November 1988

PEAK DISCHARGE RELATIONS AND ENVELOPE CURVES

PRELIMINARY
For Review Only

Literature Search

Various envelope curves and peak discharge relations have been identified and these are briefly discussed in chronological order of their development. The curves have been plotted for comparison purposes and these are shown in Figure 1.

Myers

The Myers equation (later a graphical relation) is believed to be the first attempt in the United States to provide such a guide for the determination of waterway area and was originally intended for use in railroad design. The equation was proposed by Major E.T.C. Myers, Chief Engineer of the Richmond, Fredericksburg, and Potomac Railway shortly after the Civil War. His equation was first presented by Cleemann (1879) in a paper before the Engineers' Club of Philadelphia and was published in the Club's Proceedings.

The equation met with limited acceptance and some open comment opposing the use of such "rules" for general design purposes. However, this equation did stimulate the development of other equations, and the use of graphical means to estimate peak discharges. Jarvis (1926a and 1926b) modified the Myers equation in connection with the study of floods by the U.S. Bureau of Public Roads and the U.S. Geological Survey (USGS). The modified Myers equation by Jarvis is shown in Figure 1, and the equation is

$$q = 10{,}000\ A^{-0.5} \qquad (1)$$

where q is peak discharge per unit drainage area in cfs/square mile, and A is drainage area, in square miles.

Creager curve A

Jarvis and Creager compiled a list of unusual flood discharges in the United States and abroad in 1941 and an equation was fit that enveloped the data

$$q = 46\ CA^{(0.894A^{-0.048})-1} \qquad (2)$$

where C is a coefficient, and q and A are as previously defined. With C=100 the equation enveloped all of the data except the data for three storms that occurred in Texas, North Carolina, and the Philippines. A graph of the equation with C=100 is shown in Figure 1.

Matthai - curve B

This envelope curve was first published by Matthai (1969) as the result of USGS studies of the extreme flood of June 1965 in Colorado. This curve was updated by Matthai in 1977 and published by Roeske (1978) in a study of methods for estimating the magnitude and frequency of floods in Arizona. This study by Roeske was performed by the Arizona District of the USGS in cooperation with ADOT. The 1977 curve is shown in Figure 1.

Malvick

Malvick (1980) compiled peak streamflow data for 143 streamgaging stations in Arizona that were operated by the USGS. The length of record for each gage varied from 6 to 69 years, and represented the period 1911 to 1975. The three Colorado River mainstem gaging stations were not included in the data base. Also, 38 isolated historic peaks were deleted from the data base "to avoid biasing the rare events." Eleven gaging stations from the Walnut Gulch Experimental Watershed near Tombstone, Arizona were included.

An upper envelope curve was fit to contain all the data, and this curve represents the maximum expected floods for Arizona. The equation for this envelope curve is

Curve D

$$Q_{max} = 2000\ A^{(0.789-0.067\ \log A)} \qquad (3)$$

where Q_{max} is in cfs, and A is area, in square miles. Log is to base 10. A frequency analysis of the data was performed and based on the results of that analysis coefficients for Equation 3 were determined to estimate peak discharge relations for various flood return periods. For a return period of 100 years the coefficient is 0.413 and Equation 3 becomes

Curve C

$$Q_{100} = 826\ A^{(0.789-0.067\ \log A)} \qquad (4)$$

where Q_{100} is the estimated 100-year peak discharge.

Both Equations 3 and 4 have been plotted as discharge per unit area in Figure 1. The maximum recorded discharge per unit area (q_m) and the estimated 100-year peak discharge (q_{100}) are shown.

Crippen

Crippen (1982) developed maximum recorded envelope curves for 17 regions in the conterminous United States. The equations are of the form

$$Q = K_1\ A^{K_2}\ Z^{K_3} \qquad (5)$$

where the variables K_1, K_2, and K_3 were computed by a trial-and-error procedure from postulated envelope curves, and $Z = A^{0.5} + 5$. Arizona is contained in two regions; Region 14 is generally the Little Colorado River basin in Northern Arizona, and Region 16 contains Central and Southern Arizona.

The equation for Region 14 is

$$Q = 10{,}000\ A^{0.710}\ Z^{-0.844} \qquad (6)$$

curve E

and for Region 16 is

curve F

$$Q = 98{,}900\ A^{1.029}\ Z^{-1.341}\ ,\ \text{for } A \geq 0.05 \text{ square miles} \quad (7)$$

and $$Q = 9{,}878\ A,\ \text{for } A < 0.05 \text{ square miles,} \quad (8)$$

where Q is peak discharge, in cfs.

The curves of these equations expressed as discharge per unit area are shown in Figure 1 and Region 16 (Central and Southern Arizona) is shown to have a significantly higher flood peak potential than Region 14 (Northern Arizona).

As noted by Crippen, these generalized equations may be useful as a rule-of-thumb estimate of potential flood risk, and they cannot be associated with any flood return period. However, these curves are representative of events that have occurred in the regions and will be equalled or exceeded at some future time.

Eychaner

Records of flood peaks through water year 1981 at 101 gaging stations were used in this study (Eychaner, 1984) and included 55 in Pima County and 46 in adjacent counties. Equations for estimating the flood discharge for ungaged rural watersheds at return periods of 2, 5, 10, 15, 50, 100, and 500 years were developed from regression analysis of this data. One set of primary estimating equations were developed with drainage area, channel slope, and basin shape factor as the independent variables. An alternate set of equations were developed with drainage area being the sole independent variable. A 100-year peak discharge relation for ungaged rural watersheds is shown in Figure 1. This line is from the alternate set of equations that are a function of drainage area. Separate equations were presented for use with urbanized watersheds and these urban equations were derived by Sauer and others (1983) from a nationwide sample of 199 urban basins with drainage areas between 0.2 and 100 square miles.

Boughton, Renard, and Stone

Discharge records for 18 streamgaging stations in southeastern Arizona were analyzed and a peak discharge relation for Q_{100} was developed (Boughton and others, 1987). The data base includes records of the extreme floods of 1983. The resulting 100-year flood frequency envelope curve for ungaged basins whose drainage areas are between 0.004 square miles (2.5 acres) and 3,860 square miles (0.01 to 10,000 square kilometers) is

curve H

$$Q_{100} = 31.6\ A^{(0.77\ -\ 0.0664\ \log A)} \qquad (9)$$

where Q is in cubic meters per second, and A is drainage area, in square kilometers. The line for this equation expressed as discharge per unit area is shown in Figure 1.

Costa curve I

Maximum rainfall induced floods that were measured by indirect methods in small basins between 0.15 square mile and 143 square miles (0.39 to 370 square kilometers) in the United States were examined. This analysis identified 12 floods that were the largest ever measured. These floods all occurred in semi-arid areas. These 12 floods defined an envelope curve as shown in Figure 1. No return period is associated with this envelope curve.

U.S. Army Corps of Engineers curve J

The Corps of Engineers often includes a plate in its hydrology reports that compares recorded peak discharges for regional floods to the Creager envelope curve, and an envelope curve for the regional peak discharge data is shown that generally lies somewhat below the Creager curve. Such an envelope curve for peak discharges and recorded peak discharges in the Phoenix area is shown in Plate 62 of the Corps hydrology report for the Phoenix area (U.S. Army Corps of Engineers, 1974). More recently, the Corps of Engineers completed a hydrology study for

the Clark County, Nevada area (U.S. Army Corps of Engineers, 1988). In this most recent study, the Corps has included an envelope curve of peak discharges and regional recorded peak discharge data for Arizona, Nevada, and New Mexico. The Corps 1988 envelope curve is shown in Figure 1.

Discussion of Peak Discharge Relations and Envelope Curves

The peak discharge relations and envelope curves shown in Figure 1 are somewhat consistent in that they are all generally parallel; however they vary over more than a full log cycle. For example, at 1 square mile the range of peak discharges ranges from about 800 cfs per square mile to about 10,000 cfs per square mile. It must be noted that not all these relations and envelope curves are strictly applicable to Arizona. Some of these are for peak discharge in the United States and some are based on world-wide data. Also, all but three of the lines are for historic peak discharges while the Malvick (1980), q_{100}, the Eychaner (1984), and the Boughton and others (1987) are for the 100-year peak discharges.

The Crippen (1982), Zone 16, line represents the upper envelope for drainage areas larger than 1 square mile. Zone 16 includes Central and Southern Arizona, the Rio Grande basin of New Mexico, most of Nevada, and much of California. This zone does not seem to be hydrologically or meteorologically homogeneous since the flood producing storms for this zone can come from the Gulf of Mexico, the Gulf of California, or the Pacific Ocean.

The line for Eychaner (1984) is only for rural watersheds and the data base does not include the extreme floods in Southeastern Arizona of 1983. Notice that the Eychaner line is significantly below the line by Boughton and others (1987) which represents a smaller data base but also includes the 1983 floods.

It is concluded that all envelope lines above the Corps of

Engineers (1988) are not representative of conditions in Arizona. The data base for the Corps of Engineers (1988) line is recorded data in Arizona, Nevada, and New Mexico and this data is for a time period of generally less than 100-years.

The Malvick (1980), q_{100}, line is based on data for Arizona only but this line does not include the data for the extreme floods in Southeastern Arizona that occurred in 1983, and 38 historic peak discharges were deleted from the data base by Malvick.

The line by Boughton and others (1987) is based on data for Southeastern Arizona only. However, it is of high quality analysis and would represent a state-of-the-art frequency analysis of data for part of Arizona. This peak discharge relation has been selected as a "benchmark" for use in comparing the results of drainage studies in Arizona. At this time, no inferrence is to be made that this relation is representative of peak discharges for all watersheds in Arizona.

The relation by Boughton and others (1987) is shown in Figure 2. The line has been truncated at 100 square miles and the line has been extended to 0.01 square miles. Unit discharges greater than the values shown are possible, especially for highly urbanized watersheds and watersheds with steep slopes. Unit discharges less than the values shown are likely for watersheds that would have unusually high rainfall loss rates or would be very flat, such as irrigated agricultural land.

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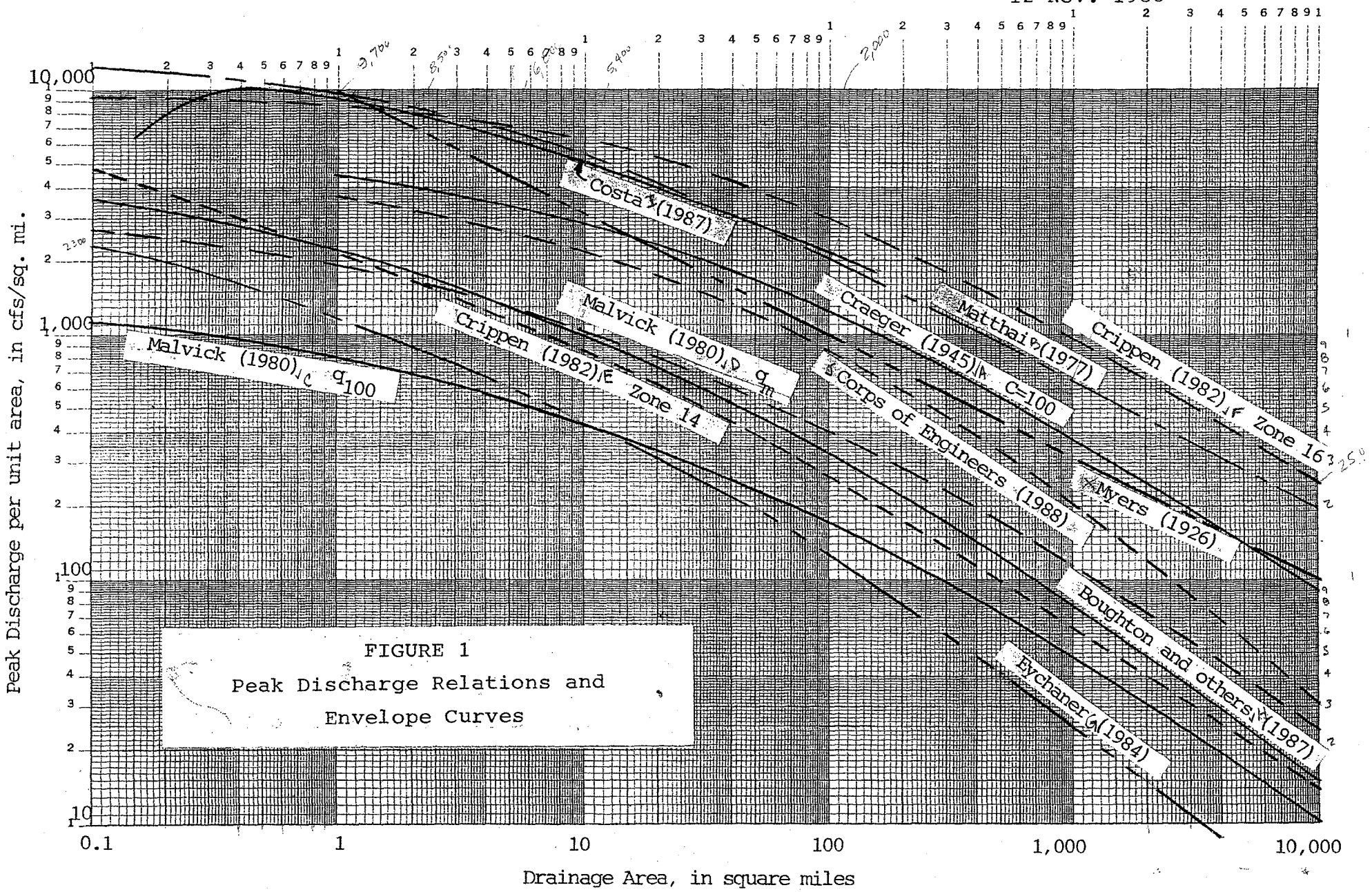

FIGURE 1
Peak Discharge Relations and
Envelope Curves

d = dispersibility;
D = molecular diffusion coefficient;
% DROOT = percentage of water extracted by plant roots for each growth stage;
d = statistical parameter;
K_r = relative hydraulic conductivity;
K_s, K_{sat} = saturated hydraulic conductivity;
K_x/K_z = ratio of aniosotropy;
m = $1-1/n$
n = statistical parameter;
S_s = storage coefficient;
TDS = total dissolved solids (in ppm);
θ = volumetric soil water content;
θ_r = residual soil water content;
θ_s = saturated soil water content; and
ρ_b = bulk density.

Flood Frequency Estimates in Southeastern Arizona

By Walter C. Boughton,[1] M. ASCE, Kenneth G. Renard,[2] F. ASCE, and Jeffry J. Stone[3]

Abstract: The effect of the October 1983 floods in southeastern Arizona, on a previously established generalized envelope for floods expected once in 100 years (Q_{100}), is studied. The design envelope is found to produce more conservative estimates of Q_{100} than individual data sets find. The design envelope for Q_{100} is revised to correct for some longer periods of record now available, and to be consistent with floods on a wider range of drainage area than previously considered. Additional design envelopes for floods expected once in 2 years (Q_2) and once in 10 years (Q_{10}) are prepared, and the three envelopes are used to provide conservative estimates of flood frequencies on ungaged watersheds in southeastern Arizona with drainage areas between 0.01 km^2 and 10,000 km^2. A procedure is presented for developing regional flood frequency estimates that could be used in geographically and climatically homogeneous areas.

Introduction

In the period from September 29 to October 2, 1983, Tropical Storm Octave, off the west coast of Baja, California, produced widespread rain in southern Arizona. In Tucson, 3.58 in. (91 cm) of rain fell in 29 hours; this storm produced about a 25-year return-period rainfall. Severe flooding occurred in many watersheds in southern Arizona, but the most damage was caused by bank erosion. The magnitude of the damage has been documented by the Pima County Department of Transportation and Flood Control District (no date).

The Santa Cruz River, at Congress Street, in Tucson, peaked at 1,490 m^3/s (52,700 cfs). This flood flow exceeds, by more than a factor of two, any other flood recorded at that station. It exceeds, by a factor of 1.75, the magnitude of the 1-in-100-year flood as established by the Federal Emergency Management Agency Flood Insurance Study (Federal Emergency Management Agency 1982; Saarinen, et al., 1984).

In a study prior to the 1983 event, Boughton and Renard (1984) analyzed the flood frequency characteristics of 18 watersheds in southeastern Arizona, and produced a design envelope for Q_{100} for watersheds between 0.02 and 10,000 km^2. The 1984 study considered the results of several earlier studies, but was undertaken before the 1983 floods. In the 1983

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Note. Discussion open until April 1, 1988. To extend the closing date one month, a written request must be filed with the ASCE Manager of Journals. The manuscript for this paper was submitted for review and possible publication on October 1, 1986. This paper is part of the *Journal of Irrigation and Drainage Engineering*, Vol. 113, No. 4, November, 1987. ©ASCE, ISSN 0733-9437/87/0004-0469/$01.00. Paper No. 21932.

TABLE [illegible] ls of Watersheds Used to Establish Design Envelope (Q_{100ENV}) in 1984 Stu[illegible]

Watershed (1)	Watershed identification (2)	Area (km²) (3)	Period of record (4)	Estimated Envelope: Q_{100} (m³/s) (5)	(Q_{100ENV}) Ratio (6)	Q_{100} envelope (7)
Walnut Gulch[a]	63.112	0.0186	1962–79	0.68	0.71	0.96
Walnut Gulch[a]	63.104	0.0453	1963–79	1.59	1.78	0.89
Safford	WS 1	2.10	1939–68	16.8	53.2	0.32
Safford	WS 5	2.93	1939–67	24.8	68.0	0.36
Cemetery Wash[a]	Tucson	3.37	1966–78	22.7	75.3	0.30
Walnut Gulch[a]	63.011	8.24	1963–80	110	139	0.79
Walnut Gulch[a]	63.003	8.99	1958–80	59.5	147	0.40
Rodeo Wash	Tucson	15.3	1970–79	33.1	206	0.16
Walnut Gulch[a]	63.008	15.5	1963–80	111	207	0.54
Sabino Creek[a]	Tucson	91.9	1933–79	317	546	0.58
Tanque Verde Creek[a]	Tucson	111	1960–79	198	600	0.33
Willow Creek	Point of pines	264	1945–67	124	875	0.14
Eagle Creek	Double circle above pumping plant	976	1944–67	544	1,400	0.39
Eagle Creek[a]		1,588	1944–75	1,130	1,620	0.70
San Carlos R.[a]	Peridot	2,660	1930–75	1,650	1,850	0.89
Santa Cruz R.	Tucson	5,750	1915–79	572	2,180	0.26
Gila R.[a]	Virden	8,296	1927–75	832	2,330	0.36
Gila R.[a]	Clifton	10,390	1911–17 and 1928–75	748	2,420	0.31

[a] These stations were operational in 1985, and were used to update the earlier study.

event, 3 of the 18 watersheds used in the study recorded the largest floods in the period of record. Floods in the Santa Cruz River, at Tucson, and in Tanque Verde Creek, were more than double the previously recorded highest flood.

This paper reviews the effects of the 1983 floods on the results of the earlier study (referred to hereafter as the 1984 study), and demonstrates the stability of the design envelope approach. The design envelope method is modified to obtain conservative estimates of flood frequency characteristics for ungaged watersheds whose drainage areas are between 0.01 and 10,000 km² in southeastern Arizona.

Design Envelope for Q_{100} in 1984 Study

Table 1 lists the 18 watersheds used in the 1984 study to develop an envelope of Q_{100} for ungaged watersheds. Details of the watersheds are contained in Boughton and Renard (1984).

Estimates of Q_{100} were obtained by fitting the log-Boughton distribution (Boughton 1980; Boughton and Shirley 1983) to each data set. These estimates were used with the results of earlier studies (Osborn and Laursen 1973; Roeske 1978; Reich, et al. 1979; Malvick 1980) to produce the design envelope for Q_{100}, shown in Fig. 1. Using the same form of equation that had been used in two of the earlier studies (Reich, et al. 1979; Malvick

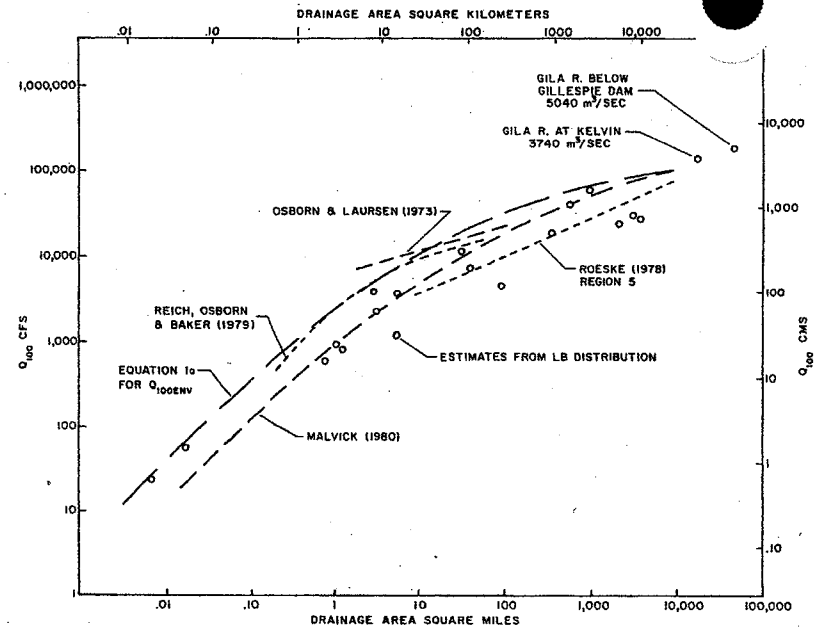

FIG. 1. Regional Flood Frequency Relationships for Peak Flow Estimation in Southeastern Arizona [Modified after Boughton and Renard (1984)]

1980), Boughton and Renard (1984) produced the following equation to define the envelope shown in Fig. 1:

$$Q_{100ENV} = 2{,}200\ D^{(0.736-0.082\log D)} \quad (1a)$$

where Q_{100ENV} = envelope value, in cfs; and D = drainage area in sq. miles. Eq. 1b shows the same equation converted to m³/s and km² units:

$$Q_{100ENV} = 29.9\ D^{(0.803-0.082\log D)} \quad (1b)$$

where Q_{100ENV} = envelope value, in m³/s; and D = drainage area in km².

Effects of 1983 Floods on Envelope

The data used in the 1984 study did not cover the same period of record on all watersheds. Some of the stream-gaging stations had ceased to operate in 1967 and 1968, but the flood data were used in the study because the watersheds provided information for particular sizes of drainage area for which other data could not be obtained. Six of the original eighteen stations were not in operation during the 1983 flood event, and could not be updated for the current study.

Data from the 12 stations that were in operation during the 1983 event were brought up to date to include the 1983 flood, and new estimates of Q_{100} were obtained by fitting the log-Boughton distribution to the annual maxima flood series in the same way as in the earlier study.

The new estimates of Q_{100}, obtained after including the additional flood data (up to, and including, the 1983 flood), were not all greater than the

earlier e[illegible]es. Seven of the new estimates of Q_{100} were greater than the old estimates, while five were smaller. Only one of the new estimates of Q_{100} (from the smallest of the 18 watersheds, the 1.86-ha Walnut Gulch watershed number 63.112) exceeded the old envelope value of Q_{100ENV}. Only 18 years of data were available for the original study, and the additional 5 years of data increased the estimate of Q_{100} from 0.68 m^3/s to 0.92 m^3/s. It should be noted that the 1983 flood on this watershed was only the 13th highest ranking flood with an estimated return period of 1.85 years. It was the additional accumulation of record, not the 1983 event, that caused the new estimate of Q_{100} to exceed the envelope value on this watershed.

The main effect of the 1983 flood event was to increase the estimates of Q_{100} on some watersheds whose earlier estimates were significantly low in relation to the design envelope. In general, the envelope proved to be much more stable than the estimates of Q_{100} based on individual data sets, even on watersheds with long periods of record, such as the Santa Cruz River at Tucson.

Revision of Envelope

The stability of the envelope, outlined in the preceding section, prompted further work that goes beyond the 1984 study, and extends the envelope approach into a complete method for obtaining a conservative estimate of flood frequency characteristics on ungaged watersheds in southeastern Arizona. In the course of this additional work, a study was made of the equation that is used to define the design envelope.

Eq. 1b has a maximum value of Q_{100ENV} at a particular value of drainage area. The value of Q_{100ENV} then decreases as drainage area increases beyond that particular value (see Fig. 2). The size of drainage area at which the maximum Q_{100ENV} value occurs is found by converting Eq. 1b into Eq. 2, differentiating, and then setting the differential to zero:

$$\log Q_{100ENV} = \log 29.9 + 0.803 \log D - 0.082 \log^2 D \quad (2)$$

$$\frac{d(\log Q_{100ENV})}{d(\log D)} = 0.803 - 0.164 \log D = 0 \quad (3)$$

Thus, the maximum Q_{100ENV} = 2,764 m^3/s (97,600 cfs) occurs at D = 78,800 km^2 (30,412 sq. mi).

The rational method for flood flows from small watersheds assumes them to vary in direct proportion to drainage area size. It is also generally accepted that flood flows from medium to large watersheds vary in proportion to D^n where the exponent n is less than 1.0. There would be little justification for any relationship in which flood flows increased at a faster rate than drainage area, i.e., $n > 1.0$.

Fig. 2 shows a straight line with Q_{100ENV} proportional to $D^{1.0}$ fitted to become tangential to the envelope curve at the point where

$$\frac{d(\log Q_{100ENV})}{d(\log D)} = 1.0 \quad (4a)$$

Solving $D = 0.063$ km^2 and $Q_{100ENV} = 2.47$ m^3/s (4b)

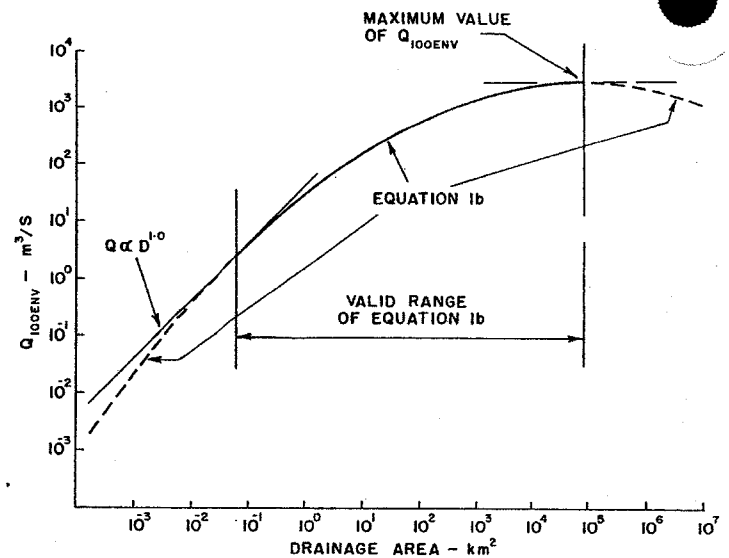

FIG. 2. Procedure Used to Obtain Design Envelope and Define Its Valid Range

At this point $Q_{100ENV} = 39.3\ D$ (5)

which is the equation of the tangential straight line in Fig. 2.

Therefore, the equation used to define the envelope will have an upper limit of applicability given by the point where Q_{100ENV} is a maximum (Eq. 3), and a lower limit of applicability given by the point where Eq. 4 holds.

The upper limit of 2,764 m^3/s for a drainage area of 78,800 km^2 is somewhat low. The Gila River, below Gillespie Dam, with a drainage area of 128,600 km^2 (49,650 sq. mi), has recorded a flood flow of 5,040 m^3/s (178,000 cfs), and the Gila River, at Kelvin, with a drainage area of 46,650 km^2 (18,010 sq. mi), has recorded a flood flow of 3,740 m^3/s (132,000 cfs).

Although the design envelope is not intended for use on watersheds as large as these, it is more satisfactory when the envelope is consistent with flood information from the whole range of watershed sizes. A second reason for revision of the envelope is to incorporate the recent estimate of Q_{100} found on watershed 63.112, as described earlier. For these reasons, the design envelope for Q_{100} was revised. The three pairs of data in Table 2 were used to parameterize the equation of the envelope. Using these values, the constants were evaluated to give the following relationship:

$$Q_{100ENV} = 31.6\ D^{(0.77 - 0.0664 \log D)} \quad (6)$$

A comparison between the 1984 envelope (Eq. 1b) and the new envelope (Eq. 6) is given in Table 3. It can be seen from Table 3 that the two envelopes are about the same for drainage areas in the range from 1 to 100 km^2, while the new envelope is about 40% higher at the upper end of the range of drainage area.

The maximum value of Q_{100ENV} in Eq. 6 is 5,395 m^3/s, and this occurs at a drainage area of 628,337 km^2. For design purposes, however, an

TABLE 2. Data Used to Parameterize Equation of Envelope

Drainage area (km^2) (1)	Q_{100ENV} (m^3/s) (2)
0.02	1.00
10.0	160
120,000	5,000

TABLE 3. Comparison of Old and New Envelopes (Q_{100ENV})

Drainage area (km^2) (1)	Old Q_{100ENV} Eq. 1b (m^3/s) (2)	New Q_{100ENV} Eq. 6 (m^3/s) (3)
0.01	0.348	0.495
0.1	3.90	4.61
1	29.9	31.6
10	157	160
100	567	595
1,000	1,400	1,630
10,000	2,380	3,290

appropriate upper limit of applicability of Eq. 6 would be 10,000 km^2, since most of the data were from watersheds smaller than this. The lower limit of applicability occurs at $D = 0.0185$ km^2, i.e., 1.85 ha, when $Q_{100ENV} = 0.927$ m^3/s.

Estimating Floods on Ungaged Watersheds

The new envelope (Eq. 6) provides a conservative estimate of only one return-period flood. In practice, it is more useful if one could estimate the distribution of flood magnitudes for return periods in the range of 2 to 200 years. The design envelope approach has been extended to provide the additional information.

Annual maxima flood data were obtained from six additional stream-gaging stations not used in the original study. The new stations and their drainage areas are listed in Table 4.

Estimates of Q_{100} were made for each station in the same manner as before, and these estimates were checked against the new design envelope (Eq. 6). All of the estimates were found to be less than the envelope, ranging from 0.32 to 0.84 of the envelope value. Estimates of Q_2 and Q_{10} were made for each of the 18 stream-gaging stations used in the 1984 study, and for the six additional stations. Two additional design envelopes were then derived to encompass the Q_2 and Q_{10} values from the 24 stations using the same form of equation as before. Eqs. 7 and 8 are the equations for Q_{2ENV} and Q_{10ENV}, respectively:

$$Q_{2ENV} = 5.44\ D^{(0.703 - 0.0658 \log D)} \quad (7)$$

$$Q_{10ENV} = 15.8\ D^{(0.703 - 0.0662 \log D)} \quad (8)$$

TABLE 4. Data for Six Stations not Included in 1984 Study

New Station (1)	Drainage area (km^2) (2)
Rincon Creek	116
Santa Cruz River at Lochiel	213
Santa Cruz River at Nogales	1,380
San Pedro River at Charleston	3,157
San Pedro River at Reddington	7,610
Santa Cruz River at Cortaro	9,070

where Q_{2ENV} = envelope value for two-year return period in m^3/s; and Q_{10ENV} = envelope value for 10-year return period in m^3/s.

Table 5 contains the estimates of Q_2, Q_{10}, and Q_{100}, together with the envelope values Q_{2ENV}, Q_{10ENV}, and Q_{100ENV} for each of the 24 stream-gaging stations.

Eqs. 6–8 can be used to obtain estimates of Q_{2ENV}, Q_{10ENV}, and Q_{100ENV} for any given size of drainage area within the range of applicability. These three envelope values can be used to interpolate and extrapolate to other return periods using the average shape of flood frequency distribution for watersheds in southeastern Arizona found in the 1984 study. Boughton and Renard (1984) normalized the logarithms of annual maxima floods in the original 18 data sets by subtracting the mean and dividing by the standard deviation. This gave a set of frequency factors that were related to return period by the following equation:

$$K = 4.3 + \frac{19.8}{\ln\ln\left[\dfrac{T}{T-1}\right] - 4.3} \quad (9)$$

where K = frequency factor corresponding to a return period of T years.

Eq. 9 was used to construct the probability paper shown in Fig. 3. The probability paper is used to estimate flood frequencies on ungaged watersheds as follows:

1. Using the size of drainage area of the ungaged watershed, estimate Q_{2ENV}, Q_{10ENV}, and Q_{100ENV} from Eqs. 6–8.
2. Plot these three values on the probability paper shown in Fig. 3.
3. By eye, draw a straight line of best fit through the three points.
4. The fitted line gives a conservative (i.e., envelope) estimate of the flood frequency characteristics for the given size of watershed in southeastern Arizona.

An alternative to this procedure is shown in Fig. 4, where values have been calculated and plotted for a wide range of watershed sizes. The envelope flood frequency for any given size of drainage area can be read directly from Fig. 4.

Regardless of whether values are calculated from Eqs. 6–8 and interpolated with Fig. 3 or read directly from Fig. 4, it must be remembered that the flood frequency curve is a design envelope encompassing the data from the 24 watersheds used in the derivation. Consequently, the estimated

TABLE [illegible] od Estimates from Streamflow Records Compared with Envelope Values

Watershed (1)	Drainage area (km^2) (2)	Estimates from Data (m^3/s) Q_2 (3)	Q_{10} (4)	Q_{100} (5)	Envelope Values (m^3/s) Q_{2ENV} (6)	Q_{10ENV} (7)	Q_{100ENV} (8)
Walnut Gulch 63.112	0.0186	0.195	0.555	0.923	0.210	0.608	0.930
Walnut Gulch 63.104	0.0453	0.462	0.926	1.31	0.470	1.36	2.21
Safford WS 1	2.10	2.80	8.75	16.8	9.02	26.2	55.1
Safford WS 5	2.93	3.37	11.9	24.8	11.2	32.5	69.9
Cemetery Wash, Tucson	3.37	8.92	15.2	20.8	12.3	35.6	77.2
Walnut Gulch 63.011	8.24	21.1	64.1	125	21.1	61.2	141
Walnut Gulch 63.003	8.99	5.92	22.5	50.2	22.2	64.4	149
Rodeo Wash, Tucson	15.3	6.60	19.0	33.1	29.9	86.8	208
Walnut Gulch 63.008	15.5	22.5	64.5	123	30.1	87.4	210
Sabino Creek, Tucson	91.9	37.0	125	276	72.8	211	570
Tanque Verde Creek, Tucson	111	48.9	130	245	79.1	229	626
* Rincon Creek	116	35.6	185	539	80.6	233	640
* Santa Cruz, Lochiel	213	46.8	137	278	104	300	856
Willow Creek, Point of Pines	264	23.3	63.4	124	113	326	944
Eagle Creek, Double Circle	976	80.0	248	544	177	511	1,610
* Santa Cruz River, Nogales	1,380	132	321	599	197	567	1,830
Eagle Creek, above pumping plant	1,588	82.8	409	1,260	205	590	1,920
San Carlos River, Peridot	2,660	223	698	1,580	235	676	2,280
* San Pedro River, Charleston	3,157	205	485	899	245	705	2,400
Santa Cruz River, Tucson	5,750	151	389	800	281	805	2,860
* San Pedro River, Reddington	7,610	205	604	1,330	297	851	3,080
Gila River, Virden	8,296	143	434	914	302	865	3,140
* Santa Cruz River, Cortaro	9,070	260	616	1,160	307	879	3,210
Gila River, Clifton	10,390	177	433	842	315	900	3,320

Note: Multiply m^3/s by 35.31 to obtain cfs. Multiply km^2 by 0.3861 to obtain sq mi.

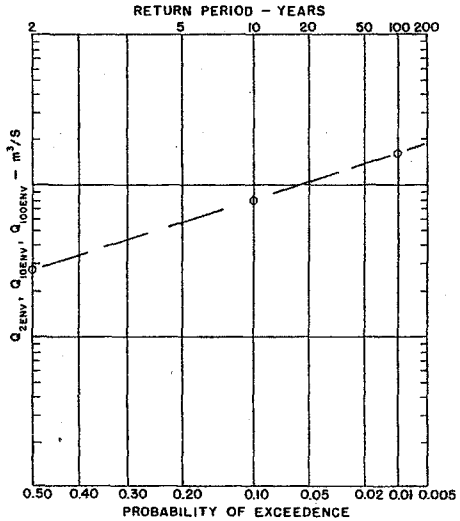

FIG. 3. Flood Frequency Interpolation Diagram for Specific Size Drainage areas

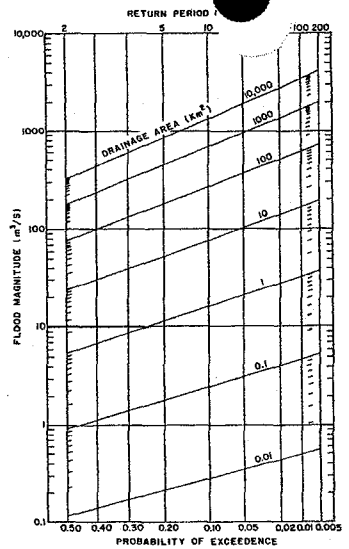

FIG. 4. Flood Frequency Interpolation Diagram for Varying Size Drainage areas

flood frequency distribution is conservative. It seems to the writers that it is desirable to be conservative when floods are estimated on ungaged watersheds.

Eqs. 6–8 and Figs. 3 and 4 are also useful with gaged watersheds. When flood frequency estimates from streamflow records are very low in relation to the envelope values, there is reason for caution in using the streamflow data alone. The Santa Cruz River, at Tucson, is one example of where a long record of streamflow was unreliable for estimating the flood potential of the watershed. Similarly, when estimates of floods made from a streamflow record are significantly higher than the envelope values, some additional investigation would be warranted.

Conclusion

The information of flood frequencies, which is summarized in Eqs. 6–8 and in Figs. 3 and 4 provides a simple means of obtaining a conservative estimate of the distribution of flood frequencies on ungaged watersheds with drainage areas ranging from 0.01 to 10,000 km^2 in southeastern Arizona. The procedure outlined in this paper also provides design envelope values against which flood frequencies derived from streamflow data can be compared to identify when estimates are significantly higher or lower than the generalized values from other watersheds in the region. The procedure has potential for use as a regional flood frequency technique in other areas.

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Classification of Irrigation Water Conveyance System Components

By David H. Manz[1]

Abstract: Classification systems for irrigation water conveyance facility components which directly affect the operation of open channel and pipeline systems are presented. Components are initially classified into four groups depending on the water management function they are intended to satisfy: diversion; depth-control, transfer; and storage. These groups, as presented in various tables, are further classified into thirty-two types of diversion structures, thirty-two types of depth-control structures, four types of transfer structures, and three types of storage facilities. General equations describing the hydraulics and operation of diversion, depth-control, and water transfer structures are also provided. Multiple outlet and compound and multifunction structures are also addressed.

Introduction

The proposed systems for classifying irrigation water conveyance facility components are intended to provide a method to identify, describe, and compare each of the numerous and diverse structural components found within open channel and pipeline irrigation conveyance systems. The proposed classification systems consider both the hydraulic and the operational characteristics of the components. The role of each component, in the management and/or control of water flows into, within, or out of the conveyance system, is emphasized.

The classification system presented identifies most of the common types of conveyance system components that different water management schemes may employ or require to satisfy the various types of irrigation water demand. This is achieved without presenting details of the physical configuration and operational characteristics of structural variations, which may exist for only one type of component. Use of the classification method to represent individual conveyance system components greatly facilitiates the analysis of relationships between water demand, operational procedures, and system physical characteristics (Manz 1985).

The primary level of classification considered is water management function. Four water management functions are identified: diversion; depth-control; head-control; and transfer and storage. Subsequent levels of classification are based on component hydraulic and operational characteristics and are specific to each of the four water management functions.

Diversion and depth-control structures are classified according to the type of hydraulic control governing flow through the structure, method of operation, type of operation control, and the degree with which the

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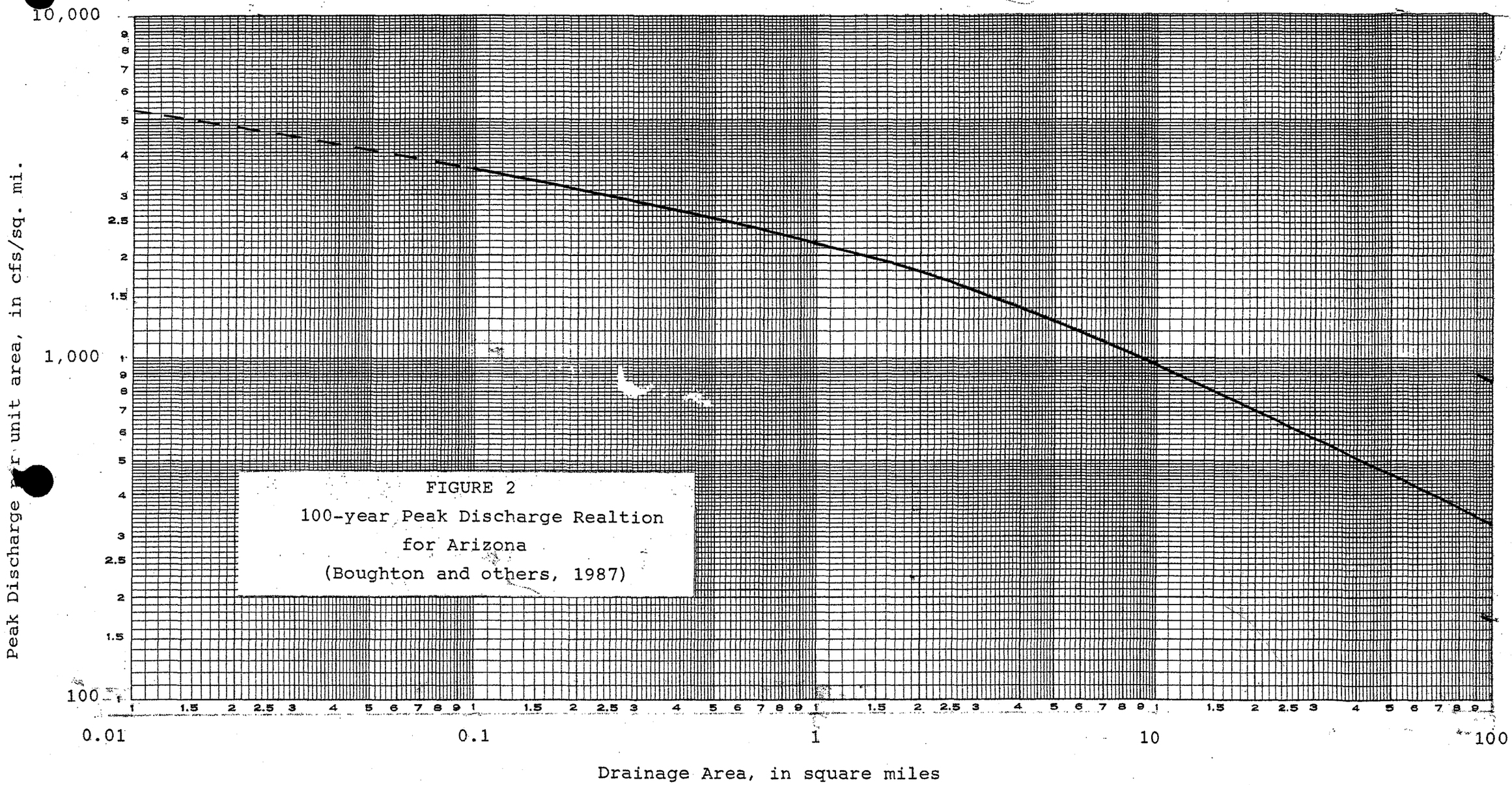


FIGURE 2
100-year Peak Discharge Realtion
for Arizona
(Boughton and others, 1987)

Method 1 - Data

Drainage Area		Peak Discharge					
		Curve A	Curve C	Curve D	Curve E	Curve F	Curve H
sq. miles	sq. km	cfs	cfs/sm	cfs/sm	cfs/sm	cfs/sm	
0.1	0		1,151	2,786	4,760	9,844	3,739
0.2	1		1,076	2,605	3,814	9,721	3,319
0.3	1		1,021	2,472	3,339	9,598	3,056
0.4	1		978	2,368	3,033	9,484	2,865
0.5	1		943	2,283	2,811	9,378	2,717
0.6	2		913	2,211	2,640	9,280	2,596
0.7	2		887	2,148	2,502	9,189	2,494
0.8	2		865	2,093	2,387	9,104	2,406
0.9	2		844	2,044	2,289	9,023	2,329
1.0	3	4,600	826	2,000	2,204	8,947	2,261
1.1	3	4,552	809	1,960	2,129	8,875	2,200
1.2	3	4,506	794	1,923	2,063	8,806	2,145
1.3	3	4,461	780	1,889	2,003	8,741	2,094
1.4	4	4,417	767	1,857	1,949	8,678	2,048
1.5	4	4,376	755	1,827	1,900	8,618	2,005
1.6	4	4,336	743	1,800	1,854	8,560	1,965
1.7	4	4,297	732	1,774	1,813	8,504	1,928
1.8	5	4,259	722	1,749	1,774	8,450	1,894
1.9	5	4,223	713	1,726	1,738	8,398	1,861
2.0	5	4,188	704	1,704	1,704	8,347	1,831
2.1	5	4,155	695	1,683	1,672	8,298	1,802
2.2	6	4,122	687	1,663	1,643	8,251	1,774
2.3	6	4,090	679	1,644	1,615	8,205	1,748
2.4	6	4,059	672	1,626	1,588	8,160	1,724
2.5	6	4,030	664	1,609	1,563	8,117	1,700
2.6	7	4,001	657	1,592	1,539	8,075	1,678
2.7	7	3,973	651	1,576	1,516	8,033	1,656
2.8	7	3,945	645	1,561	1,495	7,993	1,636
2.9	8	3,919	638	1,546	1,474	7,954	1,616
3.0	8	3,893	632	1,531	1,454	7,916	1,597
3.1	8	3,868	627	1,518	1,435	7,878	1,579
3.2	8	3,843	621	1,504	1,417	7,842	1,561
3.3	9	3,819	616	1,491	1,400	7,806	1,545
3.4	9	3,796	611	1,479	1,383	7,771	1,528
3.5	9	3,773	606	1,467	1,367	7,737	1,513
3.6	9	3,751	601	1,455	1,352	7,703	1,497
3.7	10	3,729	596	1,444	1,337	7,670	1,483
3.8	10	3,708	592	1,433	1,322	7,638	1,468
3.9	10	3,687	587	1,422	1,308	7,606	1,455
4.0	10	3,667	583	1,412	1,295	7,575	1,441
4.1	11	3,647	579	1,401	1,282	7,544	1,428
4.2	11	3,627	575	1,392	1,269	7,514	1,416
4.3	11	3,608	571	1,382	1,257	7,485	1,404
4.4	11	3,590	567	1,373	1,245	7,456	1,392
4.5	12	3,571	563	1,363	1,233	7,428	1,380
4.6	12	3,553	559	1,354	1,222	7,400	1,369
4.7	12	3,536	556	1,346	1,211	7,372	1,358
4.8	12	3,519	552	1,337	1,200	7,345	1,347
4.9	13	3,502	549	1,329	1,190	7,319	1,337
5.0	13	3,485	545	1,321	1,180	7,292	1,327
5.1	13	3,469	542	1,313	1,170	7,267	1,317
5.2	13	3,453	539	1,305	1,161	7,241	1,307
5.3	14	3,437	536	1,297	1,151	7,216	1,298
5.4	14	3,421	533	1,290	1,142	7,192	1,289
5.5	14	3,406	530	1,283	1,133	7,167	1,280
5.6	14	3,391	527	1,275	1,125	7,143	1,271
5.7	15	3,377	524	1,268	1,116	7,120	1,262
5.8	15	3,362	521	1,262	1,108	7,096	1,254
5.9	15	3,348	518	1,255	1,100	7,073	1,245

Method 1 - Data

Drainage Area		Peak Discharge					
		Curve A	Curve C	Curve D	Curve E	Curve F	Curve H
sq. miles	sq. km	cfs	cfs/sm	cfs/sm	cfs/sm	cfs/sm	
6.0	16	3,334	515	1,248	1,092	7,051	1,237
6.1	16	3,320	513	1,242	1,084	7,028	1,229
6.2	16	3,306	510	1,235	1,077	7,006	1,222
6.3	16	3,293	508	1,229	1,069	6,985	1,214
6.4	17	3,280	505	1,223	1,062	6,963	1,207
6.5	17	3,267	503	1,217	1,055	6,942	1,199
6.6	17	3,254	500	1,211	1,048	6,921	1,192
6.7	17	3,242	498	1,205	1,041	6,900	1,185
6.8	18	3,229	495	1,199	1,035	6,880	1,178
6.9	18	3,217	493	1,194	1,028	6,860	1,171
7.0	18	3,205	491	1,188	1,022	6,840	1,165
7.1	18	3,193	488	1,183	1,015	6,820	1,158
7.2	19	3,181	486	1,177	1,009	6,800	1,152
7.3	19	3,170	484	1,172	1,003	6,781	1,145
7.4	19	3,158	482	1,167	997	6,762	1,139
7.5	19	3,147	480	1,162	991	6,743	1,133
7.6	20	3,136	478	1,157	986	6,725	1,127
7.7	20	3,125	476	1,152	980	6,706	1,121
7.8	20	3,114	474	1,147	974	6,688	1,115
7.9	20	3,103	472	1,142	969	6,670	1,110
8.0	21	3,093	470	1,137	963	6,652	1,104
8.1	21	3,082	468	1,133	958	6,635	1,098
8.2	21	3,072	466	1,128	953	6,617	1,093
8.3	21	3,062	464	1,123	948	6,600	1,088
8.4	22	3,052	462	1,119	943	6,583	1,082
8.5	22	3,042	460	1,114	938	6,566	1,077
8.6	22	3,032	458	1,110	933	6,549	1,072
8.7	23	3,022	457	1,106	928	6,533	1,067
8.8	23	3,013	455	1,101	923	6,516	1,062
8.9	23	3,003	453	1,097	919	6,500	1,057
9.0	23	2,994	451	1,093	914	6,484	1,052
9.1	24	2,984	450	1,089	910	6,468	1,047
9.2	24	2,975	448	1,085	905	6,452	1,043
9.3	24	2,966	446	1,081	901	6,436	1,038
9.4	24	2,957	445	1,077	897	6,421	1,033
9.5	25	2,948	443	1,073	892	6,405	1,029
9.6	25	2,940	442	1,069	888	6,390	1,024
9.7	25	2,931	440	1,066	884	6,375	1,020
9.8	25	2,922	439	1,062	880	6,360	1,016
9.9	26	2,914	437	1,058	876	6,345	1,011
10	26	2,905	435	1,054	872	6,331	1,007
11	28	2,826	421	1,020	835	6,191	968
12	31	2,754	409	989	802	6,062	932
13	34	2,687	397	961	773	5,942	901
14	36	2,626	386	936	746	5,831	872
15	39	2,570	377	912	722	5,727	846
16	41	2,518	368	891	701	5,630	822
17	44	2,469	360	871	680	5,538	800
18	47	2,423	352	852	662	5,451	780
19	49	2,380	345	835	645	5,369	761
20	52	2,339	338	819	629	5,291	744
21	54	2,301	332	803	614	5,216	727
22	57	2,265	326	789	600	5,146	712
23	60	2,230	320	775	587	5,078	697
24	62	2,197	315	762	575	5,013	683
25	65	2,166	310	750	563	4,951	670
26	67	2,136	305	738	552	4,892	658
27	70	2,108	300	727	542	4,835	647
28	72	2,080	296	717	532	4,780	635

Method 1 - Data

Drainage Area		Peak Discharge					
		Curve A	Curve C	Curve D	Curve E	Curve F	Curve H
sq. miles	sq. km	cfs	cfs/sm	cfs/sm	cfs/sm	cfs/sm	
29	75	2,054	292	707	522	4,727	625
30	78	2,029	288	697	514	4,676	615
31	80	2,005	284	688	505	4,627	605
32	83	1,981	280	679	497	4,579	596
33	85	1,959	277	670	489	4,533	587
34	88	1,937	273	662	482	4,489	579
35	91	1,917	270	654	474	4,446	570
36	93	1,896	267	646	467	4,404	563
37	96	1,877	264	639	461	4,363	555
38	98	1,858	261	632	454	4,324	548
39	101	1,840	258	625	448	4,285	541
40	104	1,822	255	618	442	4,248	534
41	106	1,805	253	612	437	4,212	527
42	109	1,788	250	605	431	4,177	521
43	111	1,772	247	599	426	4,143	515
44	114	1,756	245	593	421	4,109	509
45	116	1,741	243	588	416	4,077	503
46	119	1,726	240	582	411	4,045	498
47	122	1,711	238	577	406	4,014	492
48	124	1,697	236	571	402	3,984	487
49	127	1,683	234	566	397	3,954	482
50	129	1,670	232	561	393	3,925	477
51	132	1,657	230	556	389	3,897	472
52	135	1,644	228	552	385	3,869	468
53	137	1,631	226	547	381	3,842	463
54	140	1,619	224	543	377	3,816	459
55	142	1,607	222	538	373	3,790	454
56	145	1,595	220	534	370	3,765	450
57	148	1,584	219	530	366	3,740	446
58	150	1,573	217	526	363	3,715	442
59	153	1,562	215	522	359	3,692	438
60	155	1,551	214	518	356	3,668	434
61	158	1,541	212	514	353	3,645	431
62	161	1,530	211	510	350	3,623	427
63	163	1,520	209	506	347	3,601	423
64	166	1,510	208	503	344	3,579	420
65	168	1,501	206	499	341	3,558	417
66	171	1,491	205	496	338	3,537	413
67	173	1,482	203	492	335	3,516	410
68	176	1,473	202	489	332	3,496	407
69	179	1,464	201	486	330	3,477	404
70	181	1,455	199	483	327	3,457	401
71	184	1,446	198	480	324	3,438	398
72	186	1,438	197	476	322	3,419	395
73	189	1,430	196	473	319	3,401	392
74	192	1,421	194	470	317	3,382	389
75	194	1,413	193	468	315	3,365	386
76	197	1,405	192	465	312	3,347	383
77	199	1,398	191	462	310	3,330	381
78	202	1,390	190	459	308	3,312	378
79	205	1,382	189	456	306	3,296	376
80	207	1,375	187	454	304	3,279	373
81	210	1,368	186	451	301	3,263	371
82	212	1,361	185	449	299	3,247	368
83	215	1,353	184	446	297	3,231	366
84	217	1,346	183	444	295	3,215	363
85	220	1,340	182	441	293	3,200	361
86	223	1,333	181	439	291	3,185	359
87	225	1,326	180	436	290	3,170	357

Method 1 - Data

Drainage Area		Peak Discharge					
		Curve A	Curve C	Curve D	Curve E	Curve F	Curve H
sq. miles	sq. km	cfs	cfs/sm	cfs/sm	cfs/sm	cfs/sm	
88	228	1,320	179	434	288	3,155	354
89	230	1,313	178	432	286	3,140	352
90	233	1,307	177	429	284	3,126	350
91	236	1,301	176	427	282	3,112	348
92	238	1,294	175	425	281	3,098	346
93	241	1,288	175	423	279	3,084	344
94	243	1,282	174	421	277	3,071	342
95	246	1,276	173	418	275	3,057	340
96	249	1,270	172	416	274	3,044	338
97	251	1,265	171	414	272	3,031	336
98	254	1,259	170	412	271	3,018	334
99	256	1,253	169	410	269	3,005	332
100	259	1,248	169	408	268	2,993	330
110	285	1,196	161	390	253	2,875	313
120	311	1,150	154	374	241	2,770	299
130	337	1,109	148	359	230	2,675	285
140	362	1,072	143	346	220	2,589	274
150	388	1,038	138	335	211	2,511	263
160	414	1,007	134	324	204	2,439	253
170	440	979	130	314	196	2,373	245
180	466	953	126	305	190	2,312	237
190	492	928	123	297	184	2,255	229
200	518	906	119	289	178	2,202	222
210	544	884	116	282	173	2,152	216
220	570	865	114	275	168	2,105	210
230	595	846	111	269	164	2,062	205
240	621	828	108	263	160	2,020	200
250	647	812	106	257	156	1,981	195
260	673	796	104	252	152	1,944	190
270	699	781	102	247	148	1,909	186
280	725	767	100	242	145	1,875	182
290	751	754	98	237	142	1,843	178
300	777	741	96	233	139	1,813	174
310	803	729	95	229	136	1,784	171
320	828	717	93	225	134	1,756	168
330	854	706	91	221	131	1,730	164
340	880	695	90	218	129	1,704	161
350	906	685	88	214	126	1,680	158
360	932	675	87	211	124	1,656	156
370	958	666	86	208	122	1,634	153
380	984	656	84	205	120	1,612	151
390	1,010	648	83	202	118	1,591	148
400	1,036	639	82	199	116	1,570	146
410	1,061	631	81	196	115	1,551	143
420	1,087	623	80	193	113	1,532	141
430	1,113	615	79	191	111	1,514	139
440	1,139	608	78	188	110	1,496	137
450	1,165	601	77	186	108	1,479	135
460	1,191	594	76	184	106	1,462	133
470	1,217	587	75	181	105	1,446	132
480	1,243	580	74	179	104	1,430	130
490	1,269	574	73	177	102	1,415	128
500	1,294	568	72	175	101	1,400	126
510	1,320	562	72	173	100	1,386	125
520	1,346	556	71	171	99	1,372	123
530	1,372	551	70	169	97	1,359	122
540	1,398	545	69	168	96	1,345	120
550	1,424	540	68	166	95	1,333	119
560	1,450	534	68	164	94	1,320	117

Method 1 - Data

Drainage Area		Peak Discharge					
		Curve A	Curve C	Curve D	Curve E	Curve F	Curve H
sq. miles	sq. km	cfs	cfs/sm	cfs/sm	cfs/sm	cfs/sm	
570	1,476	529	67	162	93	1,308	116
580	1,502	524	66	161	92	1,296	115
590	1,527	520	66	159	91	1,284	114
600	1,553	515	65	158	90	1,273	112
610	1,579	510	64	156	89	1,262	111
620	1,605	506	64	155	88	1,251	110
630	1,631	501	63	153	87	1,241	109
640	1,657	497	63	152	86	1,230	108
650	1,683	493	62	150	85	1,220	107
660	1,709	489	62	149	85	1,210	106
670	1,735	485	61	148	84	1,201	104
680	1,760	481	61	146	83	1,191	103
690	1,786	477	60	145	82	1,182	102
700	1,812	473	59	144	81	1,173	101
710	1,838	469	59	143	81	1,164	101
720	1,864	466	58	142	80	1,155	100
730	1,890	462	58	140	79	1,147	99
740	1,916	459	58	139	79	1,138	98
750	1,942	455	57	138	78	1,130	97
760	1,968	452	57	137	77	1,122	96
770	1,993	449	56	136	77	1,114	95
780	2,019	445	56	135	76	1,107	94
790	2,045	442	55	134	75	1,099	94
800	2,071	439	55	133	75	1,092	93
810	2,097	436	55	132	74	1,084	92
820	2,123	433	54	131	74	1,077	91
830	2,149	430	54	130	73	1,070	91
840	2,175	427	53	129	72	1,063	90
850	2,201	425	53	128	72	1,056	89
860	2,226	422	53	127	71	1,050	88
870	2,252	419	52	126	71	1,043	88
880	2,278	416	52	126	70	1,037	87
890	2,304	414	52	125	70	1,030	86
900	2,330	411	51	124	69	1,024	86
910	2,356	408	51	123	69	1,018	85
920	2,382	406	50	122	68	1,012	84
930	2,408	403	50	121	68	1,006	84
940	2,434	401	50	121	67	1,000	83
950	2,459	399	49	120	67	994	83
960	2,485	396	49	119	66	988	82
970	2,511	394	49	118	66	983	82
980	2,537	392	49	118	65	977	81
990	2,563	389	48	117	65	972	80
1000	2,589	387	48	116	65	967	80
1100	2,848	367	45	110	61	917	75
1200	3,107	349	43	104	57	874	70
1300	3,366	333	41	99	54	836	67
1400	3,624	319	39	94	52	802	63
1500	3,883	306	37	90	49	771	60
1600	4,142	294	36	87	47	743	58
1700	4,401	284	34	83	45	718	55
1800	4,660	274	33	80	44	695	53
1900	4,919	266	32	77	42	674	51
2000	5,178	257	31	75	41	654	49
2100	5,437	250	30	73	40	636	47
2200	5,696	243	29	70	38	619	46
2300	5,954	236	28	68	37	604	44
2400	6,213	230	27	66	36	589	43
2500	6,472	225	27	65	35	575	42

Method 1 - Data

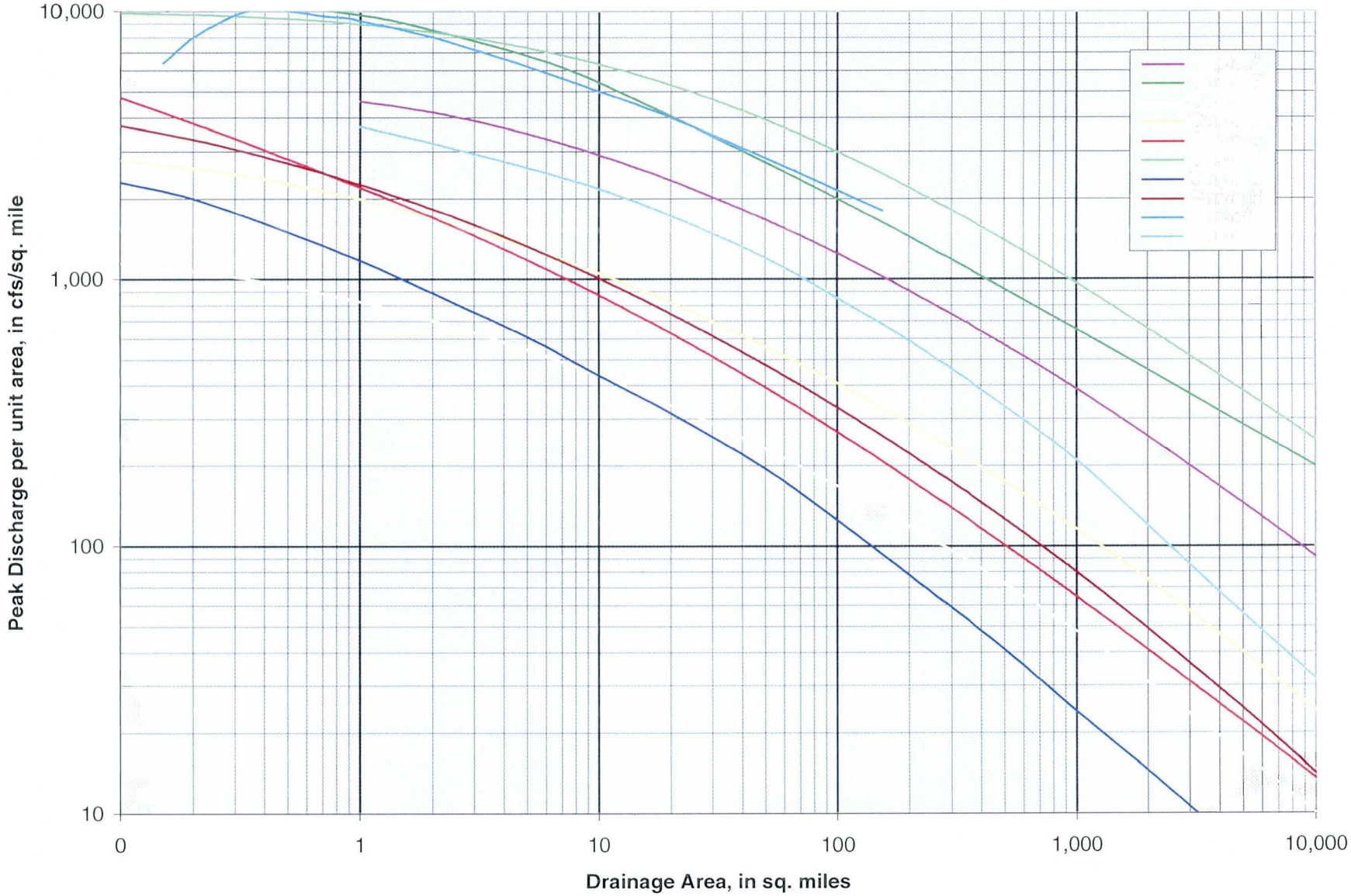
Drainage Area		Peak Discharge					
		Curve A	Curve C	Curve D	Curve E	Curve F	Curve H
sq. miles	sq. km	cfs	cfs/sm	cfs/sm	cfs/sm	cfs/sm	
2600	6,731	219	26	63	34	562	40
2700	6,990	214	25	61	33	550	39
2800	7,249	209	25	60	33	539	38
2900	7,508	205	24	59	32	528	37
3000	7,767	201	24	57	31	517	36
3100	8,026	197	23	56	30	507	36
3200	8,284	193	23	55	30	498	35
3300	8,543	189	22	54	29	489	34
3400	8,802	185	22	53	29	481	33
3500	9,061	182	21	51	28	473	32
3600	9,320	179	21	50	27	465	32
3700	9,579	176	20	50	27	457	31
3800	9,838	173	20	49	26	450	30
3900	10,097	170	20	48	26	443	30
4000	10,356	167	19	47	26	437	29
4100	10,614	165	19	46	25	430	29
4200	10,873	162	19	45	25	424	28
4300	11,132	160	18	45	24	418	28
4400	11,391	157	18	44	24	413	27
4500	11,650	155	18	43	24	407	27
4600	11,909	153	18	43	23	402	26
4700	12,168	151	17	42	23	397	26
4800	12,427	149	17	41	23	392	25
4900	12,686	147	17	41	22	387	25
5000	12,944	145	17	40	22	382	25
5100	13,203	143	16	40	22	378	24
5200	13,462	141	16	39	21	374	24
5300	13,721	139	16	39	21	369	24
5400	13,980	138	16	38	21	365	23
5500	14,239	136	16	38	21	361	23
5600	14,498	135	15	37	20	357	23
5700	14,757	133	15	37	20	354	22
5800	15,016	132	15	36	20	350	22
5900	15,274	130	15	36	20	346	22
6000	15,533	129	15	35	19	343	21
6100	15,792	127	14	35	19	339	21
6200	16,051	126	14	34	19	336	21
6300	16,310	125	14	34	19	333	21
6400	16,569	123	14	34	19	330	20
6500	16,828	122	14	33	18	327	20
6600	17,087	121	14	33	18	324	20
6700	17,346	120	13	33	18	321	20
6800	17,604	118	13	32	18	318	19
6900	17,863	117	13	32	18	315	19
7000	18,122	116	13	32	17	312	19
7100	18,381	115	13	31	17	310	19
7200	18,640	114	13	31	17	307	19
7300	18,899	113	13	31	17	305	18
7400	19,158	112	13	30	17	302	18
7500	19,417	111	12	30	17	300	18
7600	19,675	110	12	30	16	297	18
7700	19,934	109	12	29	16	295	18
7800	20,193	108	12	29	16	293	17
7900	20,452	107	12	29	16	290	17
8000	20,711	106	12	29	16	288	17
8100	20,970	105	12	28	16	286	17
8200	21,229	105	12	28	16	284	17
8300	21,488	104	12	28	15	282	17
8400	21,747	103	11	28	15	280	16

Method 1 - Data

Drainage Area		Peak Discharge					
		Curve A	Curve C	Curve D	Curve E	Curve F	Curve H
sq. miles	sq. km	cfs	cfs/sm	cfs/sm	cfs/sm	cfs/sm	
8500	22,005	102	11	27	15	278	16
8600	22,264	101	11	27	15	276	16
8700	22,523	100	11	27	15	274	16
8800	22,782	100	11	27	15	272	16
8900	23,041	99	11	26	15	270	16
9000	23,300	98	11	26	15	268	15
9100	23,559	97	11	26	15	267	15
9200	23,818	97	11	26	14	265	15
9300	24,077	96	11	26	14	263	15
9400	24,335	95	10	25	14	261	15
9500	24,594	95	10	25	14	260	15
9600	24,853	94	10	25	14	258	15
9700	25,112	93	10	25	14	256	15
9800	25,371	93	10	25	14	255	14
9900	25,630	92	10	24	14	253	14
10000	25,889	91	10	24	14	252	14

Method 1 - Data

Curve B		Curve G		Curve I		Curve J	
0.1	12500	0.1	2300	0.15	6400	1	3700
1	9700	0.2	2000	0.2	8000	2	3200
2	8500	0.5	1500	0.3	9700	5	2600
5	6800	1	1175	0.4	10200	10	2175
10	5400	2	890	0.5	10000	20	1725
100	2000	5	610	0.6	9800	50	1200
1000	650	10	435	0.7	9600	100	850
10000	200	20	315	0.8	9500	200	590
		50	195	0.9	9400	500	335
		100	125	1	9200	1000	210
		200	78	2	8000	2000	120
		500	41	5	6200	5000	56
		1000	24	10	5000	10000	32
		2000	14.5	20	4000		
		3250	10	50	2825		
				100	2150		
				155	1800		


10,000
1,000
100
10
0
1
10
100
1,000
10,000
Peak Discharge per unit area, in cfs/sq. mile
Drainage Area, in sq. miles

METHOD 2

GAGE ANALYSIS & DATA

Q = I . L . A

Stantec

Project: PHOENIX MANUAL | Project Number: 82000042

Notes: INDIRECT METHODS | Scale:

Page 1 of 3 Page(s)

Computed By: MCG Date: 8/10/00 Checked By: Date:

Summary of USGS gage data for use in the Indirect Method check, method 2.

ADOT Manual

- Based on the 1989 Basin Characteristics Report
- 314 gages listed in 1989 Basin Characteristics Report
  - 138 of which are continuous-record stream-flow gaging stations.
  - 176 of which are partial-record gaging stations
- Regression analysis is based on 240 of the 314 gages.
  - 33 of the gages listed in the 89 Basin Characteristics Report do not have an LP3 estimate.
  - 10 have unreliable data due to uncertainties in the discharge record due to upstream diversions or regulation.

1996 "Basin Characteristics Report"

- 320 gages
  - 142 of which are unregulated or partially regulated continuous-record stream-flow gaging stations.
  - 178 of which are peak-flow partial-record gaging stations
- Of the 6 new gages not reported in 1989, only 3 have a LP3 estimate.
- All 320 gage locations are shown on the attached figure (24"x36"). Also shown on the figure are county boundaries, munipal boundaries, major rivers and major roadways.

Stantec

Project: Project Number:

Notes: Scale:

Page 2 of 3 Page(s)

Computed By: Date: Checked By: Date:

Gage data comparison

- The attached table lists all the gages reported in the ADOT Manual along with all the gages reported in the 1996 "Basin Characteristics Report".
  - The 1996 gage data is color coded as follows:

    Black ≡ gages reported that have the same data as what is reported in the ADOT Manual.

    Green ≡ gages that are not reported in the ADOT Manual (only 6 of these are not reported in the 91 Basin Characteristics Report).

    Red ≡ gages that are not reported in the ADOT Manual and that have uncertainty associated with the discharge record due to u/s diversion or regulation.

    Blue ≡ gages that are reported in the ADOT Manual that different drainage areas, LP3 and/or Qmax values due to one or some combination of the following:
    - Extended period of record
    - Typos at some point in time
    - Correction of previously reported data

  - Of the 240 gages listed in the ADOT Manual, 91 have revised data per the 96 "Basin Char. Report" (shown in Blue).

- Selection criteria for a regression analysis specfic to Maricopa County / City of Phoenix
  - Drainage areas less than 500 sq. miles
  - Gage elevation less than 3500 feet (if listed) or mean basin elevation less than 6000 feet.
  - Physiographic / Meteorologic similarity to

Maricopa County / City of Phoenix watersheds.

- Gages reported in the 96 "Basin Characteristics Report" that meet the above criteria are highlighted on the figure and marked with an "X" in the table.

Statistical Analysis

- Carlos recommended SPSS for the analysis. He has used this package before and would be comfortable doing what we want.
  - A summary of SPSS functions is included.
    - Tolerance limits is not specifically mentioned
      - I copied a discussion of tolerance limits from one of my Statistical Text books.

Method 3

- A figure showing the two regions that apply to the County is included.

Notes:

Green = Gages that are not reported in the ADOT Manual.

Red = Gages that are not reported in the ADOT Manual and that have uncertainty associated with the discharge record due to upstream diversion or regulation.

Blue = Gages that are reported in the ADOT Manual that are updated or the data is different than what is reported previously.

ADOT Manual				1996 "Basin Characteristics"								
								Elevation				Sel.
Gage No.	Drainage Area sq. miles	LP3 Q100 cfs	Q Max cfs	Gage No.	Drainage Area sq. miles	LP3 Q100 cfs	Q Max cfs	Mean Basin feet	Gage feet	County	Station Name	Gages
9371100	16	1760	1350	9371100	16	1760	1350	7600	---	Apache	Teec Nos Pos Wash Near Teec Nos Pos, Ariz.	
9379030	80.7	4970	3100	9379030	80.7	4970	3100	5920	---	Apache	Black Mountain Wash Near Chinle, Ariz.	X
9379060	1.37	301	227	9379060	1.37	301	227	5820	---	Apache	Lukachukai Creek Tributary Near Lukachukai, A	X
9379100	1.38	5880	2060	9379100	1.38	5880	2060	6920	---	Navajo	Long House Wash Near Kayenta, Ariz.	
---	---	---	---	9379200	3650	16500	12000	6260	4720	Apache	Chinle Creek Near Mexican Water, Ariz.	
9379560	5.88	3530	2340	9379560	5.88	3530	2340	5690	---	Navajo	El Capitan Wash Near Kayenta, Ariz.	X
9379980	0.98	2850	200	9379980	0.98	2850	200	6180	---	Coconino	Jack Bench Wash Tributary Near Page, Ariz.	
---	---	---	---	9380000	107841	N/A	300000	---	3106	Coconino	Colorado R At Lees Ferry, Az.	
9382000	1410	20200	16100	9382000	1410	19800	16100	6150	3124	Coconino	Paria River At Lees Ferry, Ariz.	
9383020	3.54	913	1610	9383020	3.54	913	1610	5290	---	Coconino	House Rock Wash Trib Nr Marble Canyon, Az.	X
9383400	29.1	822	615	9383400	29.1	822	615	9400	---	Apache	Little Colorado River At Greer, Ariz.	
9383500	83.3	1100	700	9383500	83.3	1100	700	8550	---	Apache	Nutrioso Cr. Ab. Nelson Res Nr Springerville,Az.	
9383600	16.9	485	236	9383600	16.9	485	236	9160	---	Apache	Fish Creek Near Eagar Ariz.	
---	---	---	---	9384000	703.5	9400	16000	7760	6010	Apache	Little Colorado R Abv Lyman Lake Nr St. Johns, Az	
9384200	0.24	116	101	9384200	0.24	116	101	6100	---	Apache	Lyman Reservoir Trib Nr St Johns, Az	
9385800	0.35	672	326	9385800	0.35	672	326	6350	---	Apache	Little Colorado R Trib Nr St Johns, Az	
---	---	---	---	9386500	3557	2930	1310	7160	---	Apache	Little Colorado R Ab Zuni R Nr Hunt, Az.	
---	---	---	---	9388000	6173	8700	8000	7060	---	Apache	Little Colorado River Nr Hunt, Az	
9390500	68.6	11600	3880	9390500	68.6	16800	5550	7320	6610	Navajo	Show Low Creek Near Lakeside, Arizona	
9392800	5.22	4030	530	9392800	5.22	4030	530	6700	---	Navajo	Long Lake Tributary Near Show Low, Ariz.	
9393500	846	17900	25000	9393500	846	18200	25000	6400	5204	Navajo	Silver Creek Near Snowflake, Ariz.	
---	---	---	---	9394500	7775	18300	25000	6810	5130	Navajo	Little Colorado R At Woodruff, Ariz.	
9395100	1.28	345	140	9395100	1.28	345	140	5420	---	Navajo	Carr Lake Draw Tributary Near Holbrook, Ariz.	X
---	---	---	---	9395200	16.5	N/A	1170	6660	---	Navajo	Decker Wash Near Snowflake, Ariz.	
---	---	---	---	9395850	0.33	N/A	171	6830	---	Apache	Black Creek Tributary Near Window Rock, Az	

Notes:

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9395900	493	11200	7680	9395900	493	11200	7680	7500	6550	Apache	Black Creek Nr Lupton, Az	
9396400	1.22	1150	743	9396400	1.22	1150	743	5740	---	Apache	Dead Wash Tributary Near Holbrook, Ariz.	X
---	---	---	---	9396500	2603.5	57900	30000	6730	---	Apache	Puerco River Near Adamana, Ariz	
---	---	---	---	9397000	11115	37200	60000	6730	---	Apache	Little Colorado River At Holbrook, Ariz.	
---	---	---	---	9397200	0.17	296	120	5150	---	Navajo	Penzance Wash Near Joseph City, Ariz.	
9397500	271	41000	19800	9397500	271	41200	24700	7030	5095	Navajo	Chevelon Fork Below Wildcat Canyon, Near Winslow	
9397800	27.9	1070	666	9397800	27.9	1070	666	6950	---	Navajo	Brookbank Canyon Near Heber, Ariz.	
9398000	781	33800	33600	9398000	781	33800	33600	6440	---	Navajo	Chevelon Creek Near Winslow, Ariz.	
9398500	317	31100	19700	9398500	317	39700	29100	7100	5957	Coconino	Clear Creek Below Willow Creek, N Winslow, Az.	
9399000	621	60900	50000	9399000	607	59200	50000	6500	4861	Navajo	Clear Creek Near Winslow, Ariz.	
---	---	---	---	9399250	31.8	N/A	9330	6530	---	Coconino	Jacks Canyon Tributary No. 2 Near Winslow, Ar	
9400100	7.85	2320	1680	9400100	7.85	2320	1680	6770	---	Apache	Ganado Wash Trib Nr Ganado, Ariz.	
9400200	0.32	1520	383	9400200	0.32	1520	383	6750	---	Apache	Steamboat Wash Trib Nr Ganado, Ariz.	
9400290	9.3	3030	890	9400290	9.3	3030	890	6420	---	Navajo	Teshbito Wash Trib Nr Holbrook, Ariz.	
9400300	49.6	2320	1580	9400300	49.6	2320	1580	6280	---	Navajo	Teshbito Wash Nr Holbrook, Ariz.	
9400530	3.57	387	253	9400530	3.57	387	253	5380	---	Coconino	Cow Canyon Nr Winslow Ariz.	X
9400560	1.78	770	383	9400560	1.78	770	383	6020	---	Navajo	Oraibi Wash Trib Nr Oraibi, Ariz.	
9400565	6.45	2150	1130	9400565	6.45	2150	1130	6890	---	Navajo	Polacca Wash Trib Nr Chinle, Ariz.	
9400580	5.57	2220	2600	9400580	5.57	2220	860	5820	---	Navajo	Castle Butte Wash Nr Winslow, Ariz.	X
---	---	---	---	9400590	31.5	N/A	153	8130	---	Coconino	Rio De Flag @ Hidden Hollow Rd @ Flagstaff, Az	
---	---	---	---	9400595	6.09	N/A	48	8060	---	Coconino	Schultz Canyon At Flagstaff, Ariz.	
9400600	51	861	240	9400600	51	861	240	8050	---	Coconino	Rio De Flag At Flagstaff, Ariz.	
9400650	8.11	748	401	9400650	8.11	748	401	7200	---	Coconino	Sinclair Wash At Flagstaff, Ariz.	
---	---	---	---	9400655	82.4	N/A	421	7840	---	Coconino	Rio De Flag At I40 At Flagstaff,Az	
9400660	2.06	111	73	9400660	2.06	111	73	6990	---	Coconino	Bow And Arrow Wash At Flagstaff, Ariz.	

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9400680	1.87	413	135	9400680	1.87	413	135	7130	---	Coconino	Switzer Canyon At Flagstaff, Ariz.	
9400700	5.52	326	262	9400700	5.52	326	262	6950	---	Coconino	Switzer Canyon Trib At Flagstaff, Ariz.	
---	---	---	---	9400730	1.05	N/A	85	8020	---	Coconino	Lockett Fanning Diversion At Flagstaff, Ariz.	
9400740	2.41	293	183	9400740	2.41	293	183	7570	---	Coconino	Harenberg Wash At Flagstaff,Ariz.	
9400910	3.28	182	87	9400910	3.28	182	87	7000	---	Coconino	Fay Canyon Near Flagstaff, Ariz.	
---	---	---	---	9401000	21240	76000	120000	6440	4439	Coconino	Little Colo. River At Grand Falls, Ariz.	
---	---	---	---	9401210	5.43	N/A	88	7350	---	Coconino	Slate Mountain Wash Near Flagstaff, Ariz.	
9401220	579	30200	10400	9401220	579	30200	10400	6430	---	Coconino	Cedar Wash Near Cameron, Ariz.	
9401245	0.79	419	290	9401245	0.79	419	290	6730	---	Navajo	Klethla Valley Trib Near Kayenta Az	
9401260	1629	17300	10100	9401260	1629	15000	10100	5850	4610	Coconino	Moenkopi Wash At Moenkopi	
---	---	---	---	9401300	0.1	3040	110	5860	---	Coconino	Hamblin Wash Trib Near Cedar Ridge, Ariz.	
---	---	---	---	9401370	2.16	N/A	350	4670	---	Coconino	Hamblin Wash Trib No 2 Near Tuba City, Ariz.	
---	---	---	---	9401400	1300	14500	12100	5820	4309	Coconino	Moenkopi Wash Nr Tuba City, Ariz.	
---	---	---	---	9402000	26091	28700	120000	6300	3979	Coconino	Little Colorado River Near Cameron, Ariz.	
---	---	---	---	9402100	0.72	N/A	115	6810	---	Coconino	Forest Boundary Wash Near Cameron, Ariz.	
---	---	---	---	9402500	137641	N/A	300000	---	2419	Coconino	Colorado R. Near Grand Canyon, Ariz.	
9403000	101	4970	4400	9403000	101	4970	4400	7390	---	Coconino	Bright Angel Creek Near Grand Canyon, Ariz.	
---	---	---	---	9403750	0.68	N/A	150	5290	---	Coconino	Sagebrush Draw Near Fredonia, Ariz.	
9403780	1028	7140	15000	9403780	1085	7140	15000	6100	4500	Coconino	Kanab Creek Nr Fredonia, Ariz.	
9403800	2.85	7350	1950	9403800	2.85	7350	1950	5120	---	Mohave	Bitter Seeps Wash Trib Near Fredonia, Ariz.	X
9403930	3.18	708	151	9403930	3.18	708	151	7190	---	Coconino	West Cataract Creek Near Williams, Ariz.	
9404050	3.83	449	190	9404050	3.93	449	190	6750	---	Coconino	Spring Valley Wash Trib Near Williams, Ariz.	
---	---	---	---	9404070	21.8	N/A	62	6780	---	Coconino	Little Red Horse Wash Near Grand Canyon, Ariz	
9404310	0.2	237	117	9404310	0.2	237	117	5360	---	Mohave	Yampai Canyon Trib Near Peach Springs, Ariz.	X
9404340	370	25300	49000	9404340	370	26300	49000	4630	---	Mohave	Truxton Wash At Valentine, Ariz.	X

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9404350	3.15	18400	3800	9404350	3.15	18400	3800	4490	---	Mohave	Valentine Wash At Valentine, Ariz.	X
---	---	---	---	9415000	5090	35500	61000	5500	1764	Mohave	Virgin River At Littlefield, Ariz.	
9415050	7.27	5300	250	9415050	7.27	5300	250	2240	---	Mohave	Big Bend Wash Trib Near Littlefield, Ariz.	X
9419590	1.23	1080	470	9419590	1.23	1080	470	3710	---	Mohave	Detrital Wash Trib Near Chloride, Ariz.	X
---	---	---	---	9421800	1.21	N/A	310	2590	---	Mohave	Ringbolt Wash Near Hoover Dam, Ariz.	
9423760	8.47	4590	869	9423760	8.47	4590	869	3400	---	Mohave	Little Meadow Creek Near Oatman, Ariz.	X
9423780	31.3	892	715	9423780	31.3	892	715	5040	---	Mohave	Walnut Creek Near Kingman, Ariz.	X
9423820	787	21200	13000	9423820	787	21200	13000	3400	---	Mohave	Sacramento Wash Near Yucca, Ariz.	
9423900	14.7	5290	1030	9423900	14.7	5290	1030	1450	---	Mohave	Sacramento Wash Trib Near Topock, Ariz.	X
9424200	143	11700	7000	9424200	143	11700	7000	5350	4545	Mohave	Cottonwood Wash 1 N Kingman Ariz	X
9424407	13.5	3130	1000	9424407	13.5	3130	1000	4610	---	Mohave	Mcgarrys Wash Near Kingman, Ariz.	X
9424410	1.99	1090	353	9424410	1.99	1090	353	3700	---	Mohave	Big Sandy River Trib Near Kingman, Ariz.	X
9424430	1.7	2610	1310	9424430	1.7	2610	1310	3520	---	Mohave	Kaiser Spring Canyon Trib Near Wikieup, Ariz.	X
---	---	---	---	9424447	601	N/A	55300	---	1880	Mohave	Burro Creek At Old Us 93 Bridge Nr Bagdad, Az.	
---	---	---	---	9424450	2731.9	102400	68700	4490	1400	Mohave	Big Sandy River Near Wikieup,Ariz.	
---	---	---	---	9424470	109	N/A	10300	4665	---	Yavapai	Kirkland Creek Near Kirkland, Ariz.	
9424480	6.95	4250	4000	9424480	6.95	4250	4000	4680	---	Yavapai	Ash Creek Near Kirkland, Ariz.	X
9424700	0.64	993	250	9424700	0.64	993	180	3470	---	Yavapai	Iron Spring Wash Trib Near Bagdad, Ariz.	X
9424900	1128	37900	23100	9424900	1129	32600	23100	4010	1360	Mohave	Santa Maria River Near Bagdad, Ariz.	
9425500	1439	69600	33600	9425500	1439	69600	33600	3650	---	Mohave	Santa Maria River Near Alamo, Ariz.	
---	---	---	---	9426000	4623	N/A	200000	4120	967	La Paz	Bill Williams River Blw Alamo Dam, Az.	
---	---	---	---	9426500	5043.9	N/A	200000	3900	---	La Paz	Bill Williams River At Planet, Ariz.	
9427700	1.84	1640	320	9427700	1.84	1640	320	1130	---	La Paz	Monkeys Head Wash Near Parker, Ariz.	X
9428545	0.77	296	84	9428545	0.77	296	173	2330	---	La Paz	Cunningham Wash Trib Near Wenden, Ariz.	X
9428550	14.6	6170	2920	9428550	14.6	6170	2920	1230	---	La Paz	Bouse Wash Trib Near Bouse, Ariz.	X

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---	---	---	---	9428800	13.7	N/A	1950	1520	---	La Paz	Tyson Wash Trib Near Quartzsite, Ariz.	
9429150	1.98	1270	580	9429150	1.98	1270	580	509	---	La Paz	Creosote Wash Near Ehrenberg, Ariz.	X
9429400	2.56	131	98	9429400	2.56	131	98	1190	---	La Paz	Indian Wash Trib Near Yuma, Az.	X
9429510	0.3	346	165	9429510	0.3	346	165	346	---	Yuma	Mittry Lake Trib Near Yuma, Az.	X
---	---	---	---	9432000	3203	42100	41700	6690	3875	Navajo	Gila River Below Blue Creek, Near Virden Nm	
---	---	---	---	9442000	4010	47700	57000	6250	3336	Greenlee	Gila River Near Clifton, Ariz.	
9444100	11.6	667	342	9444100	11.6	667	619	8300	---	Greenlee	Campbell Blue Creek Near Alpine, Az	
9444200	506	52300	30000	9444200	506	46600	30000	6910	4160	Greenlee	Blue River Nr. Clifton Az.	
---	---	---	---	9444400	1.37	N/A	600	6840	---	Greenlee	Chase Creek Near Clifton, Ariz.	
---	---	---	---	9444500	2764	113900	90900	6880	3436	Greenlee	San Francisco River At Clifton, Ariz.	
9445500	102	4620	3710	9445500	102	4620	3710	6340	---	Graham	Willow C Nr Point Of Pines Nr Morenci, Ariz.	
9446000	149	10000	7500	9446000	149	10000	7500	6310	---	Graham	Willow C N Double Circle Rnch N Morenci Ariz.	
9446500	377	24600	30000	9446500	377	24600	30000	6410	---	Greenlee	Eagle C N Double Circle Rnch N Morenci Ariz	
9447000	613	34200	36400	9447000	622	47000	36800	6060	3674	Greenlee	Eagle Creek Abv. Pumping Plant Nr. Morenci, Az.	
---	---	---	---	9447800	302	27600	19500	---	3500	Graham	Bonita Creek Near Morenci, Arizona	
---	---	---	---	9448500	7896	140700	13200	6360	3060	Graham	Gila R At Head Of Safford Valley Nr Solomon Ariz	
---	---	---	---	9451800	0.12	225	63	4800	---	Graham	Tollgate Wash Trib Near Clifton, Ariz.	
9456000	814	8660	5350	9456000	814	8660	5350	4830	---	Cochise	San Simon River Near San Simon Ariz.	
9456400	15	4640	2550	9456400	15	4640	2550	5170	---	Cochise	Gold Gulch Near Bowie, Ariz.	X
---	---	---	---	9457000	2192	17000	27500	4270	2960	Graham	San Simon River Near Solomon, Ariz.	
---	---	---	---	9458200	4.78	N/A	2760	7520	4950	Graham	Deadman Creek Near Safford, Ariz.	
---	---	---	---	9458500	10459	35900	33000	5830	---	Graham	Gila River At Safford, Ariz.	
---	---	---	---	9460150	4.02	1580	2300	8400	5580	Graham	Frye Creek Near Thatcher, Ariz.	
---	---	---	---	9466500	11470	161000	150000	5650	2517	Graham	Gila River At Calva, Ariz.	
9467120	35.2	6910	3200	9467120	30.2	6910	3200	3490	---	Graham	Salt Creek Near Peridot, Ariz.	X

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9468300	0.83	1690	640	9468300	0.83	1690	640	4410	---	Gila	Sevenmile Wash Trib Near Globe, Ariz.	X
9468500	1026	54500	40600	9468500	1026	62100	54800	4480	2542	Gila	San Carlos River Near Peridot, Arizona	
9470500	737	21500	22000	9470500	741	21500	22000	4950	4188	Cochise	San Pedro River At Palominas, Ariz.	
9470900	5.25	2140	1460	9470900	5.25	2140	1460	4770	---	Cochise	San Pedro River Trib Near Bisbee, Ariz.	X
---	---	---	---	9471000	1234	49500	98000	4840	3954	Cochise	San Pedro River At Charleston, Ariz.	
9471550	1730	28000	24200	9471550	1730	28000	24200	4820	---	Cochise	San Pedro River Near Tombstone, Ariz.	
9471600	0.79	385	375	9471600	0.79	385	84	5240	---	Cochise	Canary Wash Near Benson, Ariz.	X
9471700	2.71	2270	950	9471700	2.71	2270	950	4180	---	Cochise	Fenner Wash Near Benson, Ariz.	X
---	---	---	---	9471800	2490	N/A	9800	4800	---	Cochise	San Pedro River Near Benson, Ariz.	
---	---	---	---	9472000	2927	52700	90000	4660	2930	Cochise	San Pedro River Nr. Redington, Ariz.	
9472100	8.02	4410	4340	9472100	8.02	4410	4340	3680	---	Pima	Peck Canyon Trib Near Redington, Ariz	X
9472400	2.4	6960	3200	9472400	2.4	6960	3200	3700	---	Pinal	Mammoth Wash Near Mammoth, Ariz.	X
9473000	537	28200	70800	9473000	537	26900	70800	4530	2345	Pinal	Aravaipa Creek Near Mammoth, Ariz.	
9473200	3.63	7490	3700	9473200	3.63	7490	3700	2590	---	Pinal	Green Lantern Wash Near Winkelman, Ariz.	X
---	---	---	---	9473500	4453	60900	135000	4520	---	Pinal	San Pedro R At Winkelman, Ariz.	
9473600	4.37	1460	1570	9473600	4.37	1460	1570	3050	---	Pinal	Tam O'Shanter Wash Near Hayden, Ariz.	X
---	---	---	---	9474000	5125	N/A	132000	5150	1745	Pinal	Gila R At Kelvin Ariz	
9478200	15.6	5710	3500	9478200	15.6	5710	3500	3670	---	Pinal	Durham Wash Near Florence, Ariz.	X
9478500	144	46100	42900	9478500	144	46100	42900	3180	---	Pinal	Queen C At Whitlow Damsite N Superior Ariz.	X
9478600	0.37	417	280	9478600	0.37	417	280	2320	---	Pinal	Queen Creek Trib No 3 At Whitlow Dam Ariz.	X
9479200	0.51	431	262	9479200	0.51	431	262	1760	---	Pinal	Queen C Trib A Apache Junc Ariz	X
---	---	---	---	9479500	20615	60900	65000	---	1019	Pinal	Gila River Near Laveen, Ariz.	
9480000	82.2	11200	12000	9480000	82.2	11600	12000	5150	4620	Santa Cruz	Santa Cruz River Near Lochiel, Ariz.	X
9480500	533	23600	31000	9480500	533	23200	31000	4850	3703	Santa Cruz	Santa Cruz River Nr. Nogales, Ariz.	
9481500	209	15100	16000	9481500	209	15100	16000	4800	---	Santa Cruz	Sonoita Creek Near Patagonia, Ariz.	X

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9481700	10.3	2540	1200	9481700	10.3	2540	1200	4360	---	Santa Cruz	Calabasas Canyon Near Nogales, Ariz.	X
9481750	176	17100	16000	9481750	176	17100	16000	3840	---	Santa Cruz	Sopori Wash At Amado, Ariz.	X
---	---	---	---	9481800	0.15	214	110	3620	---	Pima	Demetrie Wash Trib Near Continental, Ariz.	
---	---	---	---	9481900	3.6	N/A	1840	3280	---	Pima	Octillo Wash Near Continental, Ariz.	
9482000	1682	36500	45000	9482000	1682	45400	45000	4350	2807	Pima	Santa Cruz River At Continental, Ariz.	
---	---	---	---	9482200	6.7	N/A	4500	2770	---	Pima	Flato Wash Near Sahuarita, Ariz.	
9482330	0.81	560	337	9482330	0.81	560	337	3010	---	Pima	Pumping Wash Near Vail, Ariz.	X
---	---	---	---	9482350	4.38	N/A	1890	2740	---	Pima	South Fork Airport Wash Near Tucson, Ariz.	
---	---	---	---	9482370	5.28	N/A	1350	2780	---	Pima	North Fork Airport Wash Near Tucson, Ariz.	
9482400	23	1900	2900	9482400	23	1900	2900	2700	2460	Pima	Airport Wash At Tucson, Ariz.	X
9482410	7.24	1020	898	9482410	7.24	1020	898	2560	---	Pima	Rodeo Wash At Tucson, Ariz.	X
9482420	26.5	2310	1270	9482420	26.5	2310	1270	2900	---	Pima	Julian Wash At Tucson Ariz	X
---	---	---	---	9482450	23.6	N/A	910	2800	---	Pima	West Branch Santa Cruz River At Tucson, Ariz.	
9482480	2.94	4460	3000	9482480	2.94	4460	3000	2850	---	Pima	Big Wash At Tucson, Ariz.	X
---	---	---	---	9482500	2222	33300	37400	4050	2321	Pima	Santa Cruz River At Tucson, Ariz.	
9482950	2.3	2390	1590	9482950	2.3	2390	1590	2490	2425	Pima	Railroad Wash At Tucson,Arizona	X
9483000	8.2	4890	5000	9483000	8.2	4890	5000	2510	---	Pima	Tucson Arroyo At Vine Ave, At Tucson, Az.	X
9483010	0.95	1210	820	9483010	0.95	1210	800	2460	2415	Pima	High School Wash At Tucson Az	X
9483025	2.43	3360	1500	9483025	2.74	3360	1500	2540	---	Pima	Silvercroft Wash At Tucson Az	X
9483030	2.11	7390	2420	9483030	2.11	7390	2420	2700	---	Pima	Anklam Wash At Tucson, Ariz.	X
9483040	0.46	627	238	9483040	0.46	627	240	2750	---	Pima	West Speedway Wash Near Tucson, Ariz.	X
9483042	1.17	842	600	9483042	1.17	842	600	2370	---	Pima	Cemetery Wash At Tucson, Ariz.	X
9483045	3.53	2260	1470	9483045	3.53	2260	1470	2380	---	Pima	Flowing Wells Wash At Tucson Az	X
9483100	43	12300	8600	9483100	43	12300	8600	4780	---	Pima	Tanque Verde Creek Near Tucson, Ariz.	X
9483200	2.04	793	430	9483200	2.04	793	430	3300	---	Pima	Agua Caliente Wash Trib Near Tucson, Ariz.	X

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Gage No.	Drainage Area sq. miles	LP3 Q100 cfs	Q Max cfs	Gage No.	Drainage Area sq. miles	LP3 Q100 cfs	Q Max cfs	Mean Basin feet	Gage feet	County	Station Name	Gages
9483250	2.08	2870	1900	9483250	2.08	2870	1900	2710	---	Pima	Rob Wash At Tucson Az	X
9484000	35.5	10400	7730	9484000	35.5	12000	12900	6300	2720	Pima	Sabino Creek Near Tucson, Ariz.	X
9484200	16.3	1850	1400	9484200	16.3	1850	1400	5860	---	Pima	Bear Creek Near Tucson, Ariz.	X
9484500	219	29100	12700	9484500	219	35500	24500	4340	2470	Pima	Tanque Verde Cr At Tucson Ariz	X
9484510	6.46	329	260	9484510	6.46	329	260	4600	---	Pima	Ventana Canyon Wash Near Tucson, Ariz.	X
9484560	289	18500	20000	9484560	289	18500	20000	4890	---	Pima	Cienega Creek Near Pantano, Ariz	X
9484570	38.4	15400	27000	9484570	38.4	15400	27000	4260	---	Pima	Mescal Arroyo Near Pantano, Ariz.	X
9484580	14.1	4480	1900	9484580	14.1	4480	1900	5000	---	Pima	Barrel Canyon Near Sonoita, Ariz.	X
9484590	50.5	9340	6860	9484590	50.5	9340	6860	4340	---	Pima	Davidson Canyon Wash Near Vail, Ariz.	X
9484600	457	35000	38000	9484600	457	32100	38000	4500	3205	Pima	Pantano Wash Near Vail, Az	X
9485000	44.8	17100	9660	9485000	44.8	16700	9660	4850	3120	Pima	Rincon Creek Near Tucson, Ariz.	X
---	---	---	---	9485100	0.17	53	49	3040	---	Pima	Saguaro Corners Wash Near Tucson, Az	
9485500	602	22600	20000	9485500	602	22600	20000	4560	---	Pima	Pantano Wash Near Tucson Ariz	
9485550	2.72	1920	1210	9485550	2.72	1920	1210	2560	2485	Pima	Arcadia Wash At Tucson,Arizona	X
9485570	9.58	7460	4000	9485570	9.58	7460	4000	2590	---	Pima	Alamo Wash At Tucson Az	X
9485900	4.93	652	460	9485900	4.93	652	460	4430	---	Pima	Pima Wash Near Tucson, Ariz.	X
9485950	2.15	1090	705	9485950	2.15	1090	705	3600	---	Pima	Geronimo Wash Near Tucson, Ariz.	X
9486000	918	27700	29700	9486000	918	27700	29700	4400	---	Pima	Rillito Cr Near Tucson, Az	
9486300	250	23900	17000	9486300	250	23900	17000	4000	---	Pima	Canada Del Oro Near Tucson, Az	X
---	---	---	---	9486500	3503	46000	65000	4000	2100	Pima	Santa Cruz River At Cortaro, Ariz.	
---	---	---	---	9486700	7.13	N/A	560	3660	---	Pima	Chiltepines Wash Near Sasabe, Ariz.	
9486800	465	23600	22000	9486800	463	22400	22000	3920	2975	Pima	Altar Wash Nr Three Points, Az	X
9487000	776	19500	19100	9487000	776	21100	19100	3710	2540	Pima	Brawley Wash Near Three Points, Ariz.	
9487100	11.9	4400	13800	9487100	11.9	4440	13800	2800	---	Pima	Little Brawley Wash Near Three Points, Ariz.	X
9487140	0.45	987	520	9487140	0.45	987	520	2530	---	Pima	San Joaquin Wash Near Tucson, Ariz.	X

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9487250	1170	12500	32000	9487250	1170	12500	32000	3350	---	Pima	Los Robles Wash Near Marana, Ariz.	
9487400	2.44	1300	715	9487400	2.44	1300	715	2800	---	Pima	Quijotoa Wash Trib. Near Quijotoa, Ariz.	X
9488500	1782	29000	53100	9488500	1782	29000	53100	2340	1470	Pinal	Santa Rosa Wash Nr. Vaiva Vo, Ariz.	
9488600	12.8	3340	1400	9488600	12.8	3340	1400	1620	---	Pinal	Silver Reef Wash Near Casa Grande, Ariz.	X
---	---	---	---	9489000	8581	13300	33000	3060	1021	Pinal	Santa Cruz River Near Laveen, Ariz.	
9489070	38.1	1420	1070	9489070	38.1	1420	1070	9060	8650	Apache	North Fork Of East Fork Black R Nr Alpine, Az	
9489080	1.61	87	70	9489080	1.61	87	70	9160	---	Greenlee	Hannagan Creek Near Hannagan Meadow, Ariz.	
9489100	315	20500	14000	9489100	315	20500	14000	8700	6850	Apache	Black River Near Maverick, Ariz.	
9489200	14.8	426	323	9489200	14.8	426	323	8810	7850	Apache	Pacheta Creek At Maverick, Az	
---	---	---	---	9489500	560	23400	17900	8000	5725	Graham	Black River Blw Pumping Plant Nr. Point Of Pines	
9489700	119	6040	4510	9489700	119	6040	4510	7920	5910	Apache	Big Bonito C Nr Fort Apache, Ariz.	
9490500	1232	97900	50000	9490500	1232	103500	54700	7200	4345	Gila	Black River Near Fort Apache, Ariz. Mile 5.0	
9490800	40.2	535	510	9490800	40.2	535	510	9520	8372	Apache	North Fork White River Nr. Greer, Ariz.	
9491000	78.2	2280	2310	9491000	66	2280	2310	9320	7723	Apache	North Fork White R Near Mcnary, Ariz.	
---	---	---	---	9491800	2.27	N/A	120	6290	---	Apache	North Fork White R Trib N Whiteriver, Az	
9492400	38.8	1700	2700	9492400	38.8	1090	2700	8580	6050	Apache	East Fork White River Nr Fort Apache, Ariz.	
9494000	632	17600	14600	9494000	632	18200	14600	7400	4366	Gila	White River Near Fort Apache, Ariz. Mile 4.5	
9494300	225	11300	10000	9494300	225	11300	10000	6370	---	Navajo	Carrizo C Ab Corduroy C Nr Show Low, Ariz.	
9496000	203	33200	10900	9496000	203	33200	10900	6370	---	Navajo	Corduroy Creek Near Mouth, Near, Show Low, Ariz	
9496500	439	36400	23000	9496500	439	36900	23000	6320	4750	Gila	Carrizo Creek Near Show Low, Ariz.	
---	---	---	---	9496600	0.1	307	165	5390	---	Gila	Cibecue 1 Trib Carrizo Cr Nr Show Low, Ariz.	
---	---	---	---	9496700	0.07	161	120	5240	---	Gila	Cibecue 2, Trib Carrizo Cr, Nr Show Low, Ariz.	
9496800	2.55	2850	1260	9496800	2.55	2850	1260	5810	---	Gila	Carrizo Creek Trib Near Show Low, Ariz.	X
---	---	---	---	9497500	2849	122800	76600	6730	3355	Gila	Salt River Near Chrysotile, Ariz. Mile 34.8	
9497800	295	21800	22200	9497800	295	20800	22200	5700	3200	Gila	Cibecue Creek Near Chrysotile, Ariz.	X

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9497900	62.1	25300	7290	9497900	62.1	11600	7290	6030	4950	Gila	Cherry Creek Near Young, Ariz	
9497980	200	27000	15700	9497980	200	25400	15700	5600	3200	Gila	Cherry Creek Near Globe, Ariz.	X
---	---	---	---	9498400	162	8440	5950	---	2740	Gila	Pinal C At Inspiration Dam, Nr Globe, Az	
---	---	---	---	9498500	4306	227900	143000	6190	2177	Gila	Salt River Near Roosevelt, Ariz.	
9498600	0.66	348	265	9498600	0.66	348	265	6080	---	Gila	Cristopher Creek Trib Near Kohl'S Ranch, Ariz	
9498800	430	95500	38000	9498800	430	95500	38000	5810	---	Gila	Tonto Creek Near Gisela, Ariz.	X
9498870	122	35400	44400	9498870	122	35400	44400	4390	2730	Gila	Rye Creek Nr Gisela, Ariz.	X
9498900	6.44	4070	2820	9498900	6.44	4070	2800	4590	---	Gila	Gold Creek Near Payson, Ariz.	X
9499000	675	101000	61400	9499000	675	107900	72500	5020	2523	Gila	Tonto Creek Abv. Gun Cr., Nr Roosevelt, Az	
9501300	24.3	13900	7500	9501300	24.3	15300	7500	2960	---	Maricopa	Tortilla Creek At Tortilla Flat, Ariz.	X
9502700	6.01	6250	480	9502700	6.01	6250	480	5970	---	Yavapai	Crookton Wash Near Seligman, Ariz.	X
9502800	255	29200	14800	9502800	255	29200	14800	5120	4455	Yavapai	Williamson Valley W Nr Paulden, Ariz.	X
9503000	36.3	7310	6660	9503000	36.3	7710	6660	5900	5204	Yavapai	Granite Creek Near Prescott, Ariz.	X
---	---	---	---	9503700	2150	38400	23200	5410	4117	Yavapai	Verde River Near Paulden, Ariz.	
9503720	14.9	3860	1080	9503720	14.9	3860	1080	7110	---	Coconino	Hell Canyon Near Williams, Ariz.	
9503740	0.75	220	84	9503740	0.75	220	84	5180	---	Yavapai	Hell Canyon Trib N Ash Fork. Az	X
9503750	14.5	9820	4100	9503750	14.5	9820	4100	5310	---	Yavapai	Limestone Canyon Nr Paulden, Az	X
9503800	124	6890	2300	9503800	124	6890	2300	7620	---	Coconino	Volunteer Wash Near Bellemont, Ariz.	
---	---	---	---	9504000	3139	70200	53200	5490	3500	Yavapai	Verde River Nr Clarkdale, Ariz.	
9504100	0.85	561	500	9504100	0.85	561	500	7050	---	Yavapai	Hull Canyon Near Jerome, Ariz.	
9504400	1.15	1430	705	9504400	1.15	1430	705	6880	---	Coconino	Munds Canyon Trib Near Sedona, Ariz.	
9504500	355	43700	26400	9504500	355	50100	26400	6200	3470	Yavapai	Oak Creek Near Cornville, Ariz.	X
---	---	---	---	9504800	0.05	369	53	3570	---	Yavapai	Oak Creek Trib Near Cornville, Az	
9505200	111	16100	10900	9505200	111	15800	16000	6410	4020	Yavapai	Wet Beaver Creek Near Rimrock, Arizona	
---	---	---	---	9505220	1.4	N/A	1550	7190	6750	Coconino	Rocky Gulch Nr Rimrock, Az	

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9505250	48	10900	10500	9505250	49.4	10900	10500	5910	3920	Yavapai	Red Tank Draw Near Rimrock, Ariz	X
9505300	24.6	6290	4000	9505300	24.6	6290	4000	6560	4870	Yavapai	Rattlesnake Canyon Near Rimrock, Ariz.	
9505350	142	38200	26600	9505350	142	51400	26600	6220	3694	Yavapai	Dry Beaver Creek Near Rimrock, Ariz.	
---	---	---	---	9505550	4297	N/A	55000	5544	3045	Yavapai	Verde River Below Camp Verde,Ariz	
9505600	3.42	573	210	9505600	3.42	573	210	7140	---	Coconino	Dirty Neck Canyon Near Clints Well, Ariz.	
9505800	241	30000	22400	9505800	241	32700	24800	6680	3630	Yavapai	West Clear Creek Near Camp Verde, Ariz.	
9505900	0.64	619	180	9505900	0.64	619	250	3540	---	Yavapai	Cottonwood Wash Near Camp Verde, Ariz.	X
---	---	---	---	9506000	4644	166300	119000	5560	2874	Yavapai	Verde River Near Camp Verde, Ariz.	
9507600	6.44	8600	2800	9507600	6.34	8600	2820	6430	---	Gila	East Verde River Nr. Pine, Ariz.	
9507700	4.79	2480	1220	9507700	4.79	2480	1220	6980	---	Gila	Webber Cr Ab West Fork Webber Cr N Pine, Az	
9507980	328	52800	23500	9507980	331	56700	23500	5140	2500	Gila	East Verde River Near Childs, Ariz.	X
9508300	36.4	18500	6830	9508300	36.4	17600	7380	4810	2320	Gila	Wet Bottom Creek Nr Childs, Ariz.	X
---	---	---	---	9508500	5493	200300	150000	5470	2029	Yavapai	Verde River Blw Tangle Cr Ab Horseshoe Dam, Az	
9510070	4.58	5530	1700	9510070	4.58	5530	1700	5430	4380	Maricopa	Wf Sycamore Cr Ab Mcfar Can, N Sunflower, Az	X
9510080	9.8	8030	3480	9510080	9.8	8030	3480	5260	---	Maricopa	West Fork Sycamore Cr Nr Sunflower, Ariz.	X
9510100	4.49	2670	1940	9510100	4.49	2670	1940	5760	4140	Maricopa	East Fork Sycamore Creek Near Sunflower, Ariz.	X
9510150	52.3	42700	16100	9510150	52.3	42700	16100	4260	---	Maricopa	Sycamore Creek Near Sunflower, Ariz.	X
9510170	2.6	950	402	9510170	2.6	773	402	3520	---	Maricopa	Camp Creek Nr Sunflower, Az	X
9510180	15.2	5790	1900	9510180	15.2	6390	2550	3680	---	Maricopa	Rock Creek Near Sunflower, Ariz.	X
9510200	164	51400	24200	9510200	164	46300	24200	3820	1759	Maricopa	Sycamore Creek Near Fort Mcdowell	X
9512100	139	16800	21000	9512100	62	16800	21000	1780	1275	Maricopa	Indian Bend Wash At Scottsdale Ariz	X
9512200	1.75	3220	670	9512200	1.75	2230	1210	1730	1405	Maricopa	Salt River Trib. In S. Mnt. Park, Phoenix, Ariz.	X
9512300	121	20000	12400	9512300	121	21500	13800	3470	---	Maricopa	Cave Creek Nr Cave Creek Ariz	X
9512420	0.95	2910	800	9512420	0.95	2910	820	5900	---	Yavapai	Lynx Creek Trib Near Prescott, Ariz.	X
9512500	585	31700	33100	9512500	585	35900	33100	5000	3434	Yavapai	Agua Fria River Near Mayer, Az	

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---	---	---	---	9512600	89.4	9810	5230	5360	3140	Yavapai	Turkey Creek Near Cleator Arizona	
9512700	1.07	1730	1200	9512700	1.07	1570	1200	2140	---	Maricopa	Agua Fria River Trib #2 Nr Rock Springs, Ariz	X
9512800	1110	182000	85000	9512800	1111	211800	85000	4770	1800	Maricopa	Agua Fria River Near Rock Springs, Ariz.	X
---	---	---	---	9512830	37.8	N/A	10000	---	1890	Yavapai	Boulder Creek Nr Rock Springs Az.	
---	---	---	---	9512970	9.28	16400	1750	---	1660	Yavapai	Cottonwood Creek Nr Waddell Dam Az.	
9513780	67.3	34600	18600	9513780	68.3	35000	18600	3970	2310	Maricopa	New River Nr Rock Springs, Ariz.	X
9513800	83.3	37500	19500	9513800	83.3	37500	19500	3600	1984	Maricopa	New River At New River, Ariz.	X
9513820	11.1	6070	1850	9513820	11.1	4630	1850	1980	---	Maricopa	Deadman Wash Near New River, Ariz.	X
9513835	185	41800	14600	9513835	185	31700	14600	2700	1190	Maricopa	New River At Bell Road, Near Peoria, Ariz.	X
9513860	64.6	31000	11500	9513860	64.9	27600	11500	2180	1473	Maricopa	Skunk Creek Near Phoenix, Ariz.	X
9513890	317	75100	38000	9513890	317	75100	38000	2320	---	Maricopa	New River At Peoria, Ariz.	X
9513910	323	47100	38000	9513910	600	49800	38000	2130	1046	Maricopa	New River Nr Glendale, Ariz.	X
9513970	880	49000	29300	9513970	554	N/A	44200	3010	953	Maricopa	Agua Fria River At Avondale, Ariz.	X
9514200	420	7840	6300	9514200	420	8470	6310	1570	---	Maricopa	Waterman Wash Near Buckeye, Ariz.	X
9515500	417	43000	58000	9515500	417	43000	58000	4750	2236	Yavapai	Hassayampa River At Box Damsite Nr Wickenburg Az	X
9515800	5.57	7450	860	9515800	5.57	7100	1300	2690	---	Maricopa	Hartman Wash Near Wickenburg, Ariz.	X
9516500	796	43900	47500	9516500	796	45600	47500	3190	1831	Maricopa	Hassayampa River Nr Morristown, Ariz.	X
9516600	6.31	5330	2900	9516600	6.31	3720	2900	2290	---	Maricopa	Ox Wash Near Morristown, Ariz.	X
9516800	137	32900	6840	9516800	137	33900	13000	2260	---	Maricopa	Jack Rabbit Wash Near Tonopah, Ariz.	X
9517000	1470	49200	39000	9517000	1471	40500	39000	3010	825	Maricopa	Hassayampa River Near Arlington, Ariz.	X
9517200	2.79	1240	720	9517200	2.79	1080	720	2480	---	Maricopa	Centennial Wash Tributary Near Wenden, Ariz.	X
9517280	85.2	6910	4550	9517280	85.2	7340	4550	2590	---	Maricopa	Tiger Wash Near Aguila, Ariz.	X
9517400	47.8	4560	3640	9517400	47.8	4560	3640	1630	---	Maricopa	Winters Wash Near Tonopah, Ariz.	X
---	---	---	---	9517500	1810	N/A	14500	---	773	Maricopa	Centenial Wash Nr. Arlington, Ariz.	X
9519600	2.43	1670	1430	9519600	2.43	2050	1430	950	---	Maricopa	Rainbow Wash Trib Near Buckeye, Ariz.	X

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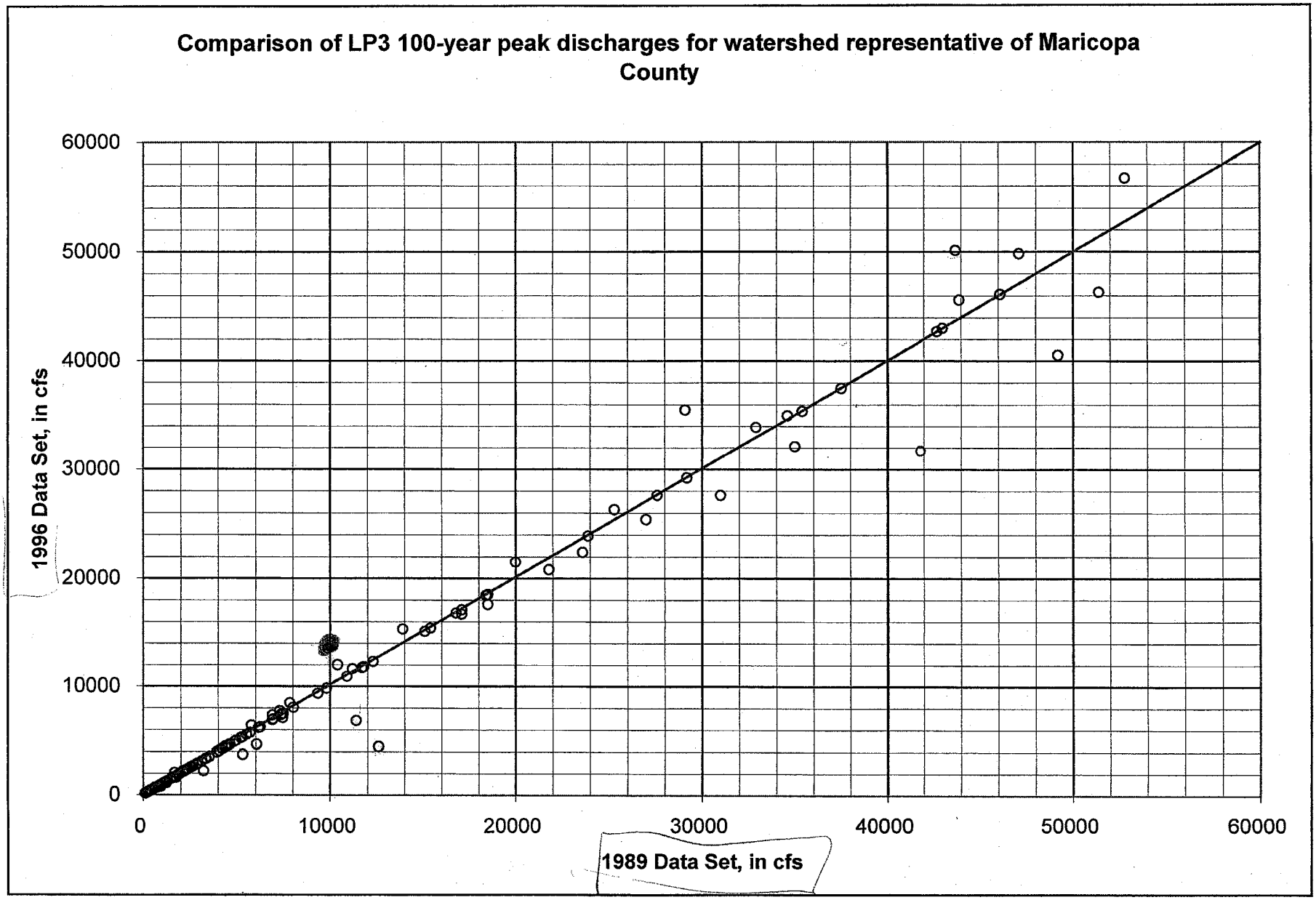
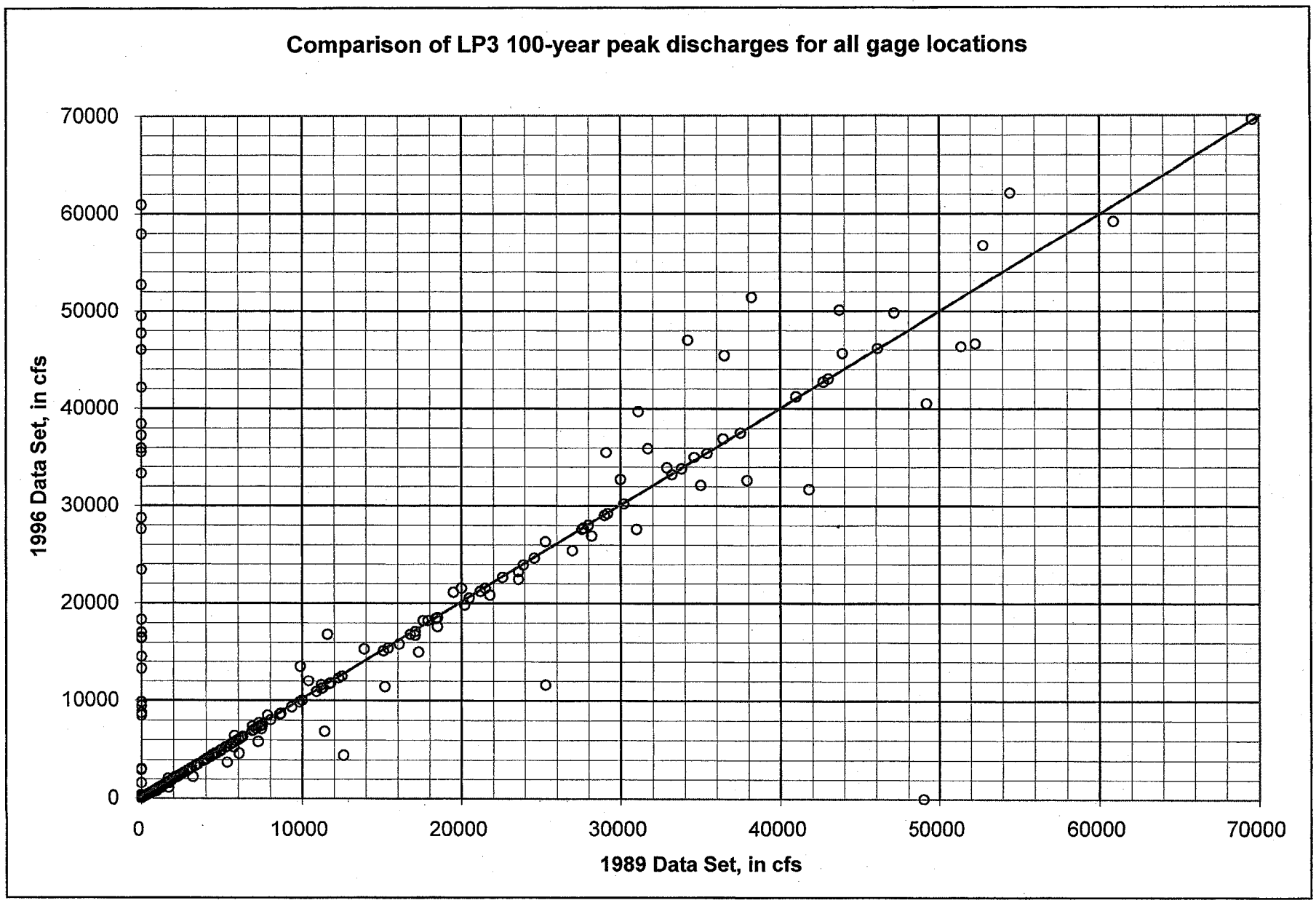
9519750	68.8	12600	2670	9519750	68.6	4450	3610	1900	---	Maricopa	Bender Wash Near Gila Bend, Ariz.	X
9519760	116	11400	3150	9519760	116	6850	3150	1980	848	Maricopa	Sauceda Wash Near Gila Bend, Ariz.	X
9519780	12.9	27600	4430	9519780	12.9	27600	4430	1050	---	Maricopa	Windmill Wash Near Gila Bend, Ariz.	X
9520100	8.7	5220	1530	9520100	8.7	5220	1530	674	---	Maricopa	Military Wash Near Sentinel, Ariz.	X
9520110	0.44	327	240	9520110	0.44	327	240	1760	---	Pima	Hot Shot Arroyo Near Ajo, Ariz.	X
9520130	4.72	2380	1670	9520130	4.72	2380	1670	1920	---	Pima	Darby Arroyo Near Ajo, Ariz.	X
9520160	2.18	1620	1800	9520160	2.18	1620	1800	2100	---	Pima	Gibson Arroyo At Ajo, Az	X
9520170	243	11800	8030	9520170	243	11800	8030	1950	1309	Pima	Rio Cornez Nr. Ajo, Ariz.	X
9520200	12.1	1490	940	9520200	12.1	1490	940	1280	---	Maricopa	Black Gap Wash Near Ajo, Ariz.	X
9520230	1.49	2130	590	9520230	1.49	2230	590	1280	---	Maricopa	Crater Range Wash Near Ajo, Ariz.	X
9520300	0.9	710	510	9520300	0.9	656	510	2040	---	Pima	Alamo Wash Trib Near Ajo, Ariz.	X
---	---	---	---	9520350	0.09	273	117	601	---	Yuma	Mohawk Pass Wash At Mohawk, Az.	
9520400	1.99	3930	1590	9520400	1.99	3930	1590	395	---	Yuma	Ligurta Wash At Ligurta, Az.	X
9535100	569	15200	12500	9535100	569	11400	12500	2250	1830	Pima	San Simon Wash Nr Pisinimo Az	
---	---	---	---	9535200	26.8	N/A	2800	2560	---	Pima	Sells Wash Trib At Sells, Ariz.	
9535300	1250	7250	10400	9535300	1250	5810	10400	2699	1770	Pima	Vamori Wash At Kom Vo, Az	
9536100	0.76	589	173	9536100	0.81	589	375	5210	---	Graham	Pitchfork Canyon Trib Near Fort Grant, Ariz.	X
9536350	0.65	413	191	9536350	0.65	413	191	6280	---	Cochise	Surprise Canyon Near Dos Cabezas, Ariz.	
9537200	79.1	9880	4600	9537200	79.1	13500	5200	5360	4620	Cochise	Leslie Creek Near Mcneal, Ariz.	X
9537500	1023	5750	5060	9537500	1023	5220	5060	4740	3909	Cochise	Whitewater Draw Near Douglas, Ariz.	


Comparison of LP3 100-year peak discharges for watershed representative of Maricopa County
1996 Data Set, in cfs
1989 Data Set, in cfs
0
10000
20000
30000
40000
50000
60000


Comparison of LP3 100-year peak discharges for all gage locations
1996 Data Set, in cfs
1989 Data Set, in cfs
0
10000
20000
30000
40000
50000
60000
70000

FCDMC Water-level Sensors Sorted by Name - Updated 02/09/2000

SENSOR_NAME	SENSOR_ID_#	DATE_INSTALLED	T_R_S	LATITUDE	LONGITUDE	ELEVATION	JURISDICTION	LOCATION
10th St. Wash Basin #1	4818	11/26/96	3N-3E-28	33 34 47	112 03 16	1150	Phoenix	1/4 mi. SW of Peoria Ave. and Cave Creek Rd.
ACDC @ 14th St.	4813	2/9/94	2N-3E-4	33 32 31	112 02 35	1230	Phoenix	1/2 mi. North of Glendale Ave. and 14th St.
ACDC @ 36th St.	4808	2/24/94	2N-3E-13	33 30 49	111 59 56	1260	Paradise Valley	1/2 mi. North of 36th St. and Camelback Rd.
ACDC @ 43rd Ave.	4823	11/14/90	3N-2E-22	33 35 03	112 09 16	1225	Phoenix	1/4 mi. NW of Peoria Ave. and 43rd Ave.
ACDC @ 67th Ave.	5523	6/7/90	3N-1E-12	33 37 26	112 12 10	1220	Glendale	67th Ave. Bridge at Arizona Canal, Glendale
Adobe Dam Outlet	5538	10/28/82	4N-2E-21	33 40 37	112 09 12	1413	Phoenix	1/4 mi. South of Deer Valley Rd. & 43rd Ave.
Adobe Dam Pool	5539	10/28/82	4N-2E-21	33 40 37	112 09 12	1413	Phoenix	1/4 mi. South of Deer Valley Rd. & 43rd Ave.
Agua Fria @ Buckeye	5403	10/12/88	1N-1W-14	33 26 05	112 19 54	940	Maricopa County	Buckeye Rd. Bridge over Agua Fria River, nr Avondale
Agua Fria @ Grand Ave.	5503	4/27/94	3N-1E-18	33 36 25	112 18 16	1125	El Mirage	Grand Ave. bridge at Agua Fria River
Apache Junction FRS	6673	1/1/82	1N-8E-8	33 26 28	111 33 07	1989	Apache Junction	1/3 mi. NW of Lost Dutchman Blvd. and Idaho Rd.
Aspen Dam	5988	1/2/97	3N-6E-4	33 37 34	111 44 48	1840	Fountain Hills	200 yards S. of Aspen Dr. & Golden Eagle Blvd.
Berneil Wash	4688	7/30/98	3N-4E-34	33 33 59	111 56 16	1340	Paradise Valley	Just east of Doubletree and Invergordon
Buckeye FRS #1	5203	7/26/83	1N-5W-3	33 27 36	112 44 02	1097	Maricopa County	West end of Buckeye FRS #1, I-10 @ Hassayampa River
Buckeye FRS #2	5208	11/11/92	1N-3W-07	33 26 26	112 35 47	1150	Maricopa County	5 mi. N of Buckeye nr the alignments of Yuma and Miller Roads
Buckeye FRS #3	6813	11/23/92	1N-3W-10	33 27 10	112 33 20	1200	Maricopa County	1/4 mi. NE of I-10 and Watson Rd.
Casandro Dam	7133	8/15/96	7N-5W-11	33 58 04	112 44 49	2180	Wickenburg	1.1 miles W of the US60 / US93 intersection
Casandro Wash	7093	7/12/94	7N-5W-10	33 57 44	112 45 53	2240	Wickenburg	On US 60 bridge, 2 mi. West of US 60 / US 93
Cave Buttes Outlet	4903	1/25/84	4N-3E-15	33 43 15	112 02 43	1649	Maricopa County	1/4 mi. North of the Happy Valley Rd. & 16th St. alignments
Cave Buttes Pool	4904	1/25/84	4N-3E-15	33 43 15	112 02 43	1649	Maricopa County	1/4 mi. North of the Happy Valley Rd. & 16th St. alignments
Cave Cr. nr Cave Cr.	4918	5/27/94	5N-3E-12	33 47 30	112 00 36	1800	Phoenix	3/4 mi. SW of Carefree Hwy. and 40th St. alignment
Cave Cr.@ Spur Cross	4923	6/16/93	6N-4E-04	33 53 05	111 57 17	2280	Maricopa County	3.5 mi. North of the Town of Cave Creek
Cave Creek @ Cactus	4833	6/27/91	3N-2E-13	33 35 56	112 07 01	1280	Phoenix	1/4 mi. ENE of I-17 and Cactus Rd.
Centennial @ Wenden	5093	9/2/98	6N-12W-32	33 49 27	113 32 00	1850	La Paz County	5.5 mi. NE of Salome on US 60 Bridge
Centennial Railroad	5103	2/9/90	1S-6W-28	33 18 35	112 52 56	850	Maricopa County	8 mi. NW of Old US 80 at the Gila River

Colter @ El Mirage	5408	6/29/94	2N-1W-13	33 30 38	112 19 32	1025	Phoenix	1/4 mi. N of Camelback and El Mirage Rd.
Columbus Wash	5013	9/21/99	4S-10W-6	33 06 27	113 19 57	685	Maricopa County	8 mi. N of Agua Caliente
Copper Wash	5033		3S-10W-6	33 12 17	113 17 07	1070		
Crossroads Park	6623	12/18/95	1S-6E-21	33 19 40	111 44 49	1270	Gilbert	1/2 mi. NW of Ray Rd. and Greenfield Rd.
Delaney Wash	5108	12/22/99	2N-7W-33	33 28 11	112 58 30	1130	Maricopa County	3 miles SSW of Tonopah
Dreamy Draw Dam	4803	1/24/84	3N-3E-34	33 33 45	112 01 54	1407	Phoenix	1/4 mi. SSW of the 24th St. and Dulap Ave. alignments
Dysart @ El Mirage	5423	3/7/97	2N-1W-02	33 32 38	112 19 35	1052	Maricopa County	1/2 mi. South of Northern Ave. near El Mirage Rd.
Dysart Drain @ LAFB	5413	8/22/96	2N-1W-03	33 32 38	112 20 57	1090	Maricopa County	1/4 mi. West of Northern Ave. & Litchfield Rd.
East Fork CC #1	4648	3/2/94	4N-3E-23	33 40 05	112 01 15	1515	Phoenix	1/4 mi. E of Beardsley Rd. and Cave Creek Rd.
East Fork CC #3	4683	9/13/94	4N-3E-34	33 38 44	112 02 24	1456	Phoenix	1/2 mi. SW of Union Hills Dr. and Cave Creek Rd.
East Fork CC #4	4658	1/18/94	4N-3E-25	33 38 31	112 01 01	1456	Phoenix	1/4 mi. S of Union Hills Dr. and 32nd St.
EFCC nr 7th Ave.	4668	5/8/97	3N-3E-05	33 37 43	112 04 50	1325	Phoenix	Near 7th Ave., 1/2 mile south of Greenway Rd.
EMF @ Arizona Ave.	6598	2/10/89	3S-5E-15	33 10 53	111 51 50	1214	Pinal County	On the SR 587 bridge 3 mi. South of Riggs Rd.
EMF @ Broadway	6573	8/10/89	1N-6E-26	33 24 21	111 42 42	1349	Maricopa County	1/2 mi. SSE of Broadway Rd. and Higley Rd.
EMF @ Queencreek Rd.	6583	1/18/89	2S-6E-15	33 15 50	111 43 35	1317	Maricopa County	1/3 mi. West of Queen Creek Rd. and Higley Rd.
Estrella Fan	6893	4/30/93	2S-1W-12	33 16 08	112 19 15	1425	Maricopa County	Alignments of El Mirage Rd. and Germann Rd.
Flying E Wash	7083	7/12/94	7N-5W-09	33 57 44	112 46 49	2302	Wickenburg	On US 60 bridge, 3 mi. West of US 60 / US 93
Freestone Basin	6608	12/19/95	1S-6E-08	33 21 29	111 46 21	1450	Gilbert	1/2 mi. SSE of Guadalupe Rd. and Lindsay Rd.
Gila @ Estrella Pkwy.	6853	12/2/92	1N-1W-31	33 23 19	112 23 33	900	Goodyear	Gila River at Estrella Parkway
Gila @ Maricopa Rd	778	4/6/95	3S-3E-13	33 10 16	112 00 21	1120	Gila R. Tribe	Gila River at Maricopa Road bridge
Gila @ Olberg	783	4/12/95	4S-6E-12	33 05 22	111 41 15	1290	Gila R. Tribe	Gila River at Olberg Bridge, 3 mi. ENE of Sacaton
Gila R. @ 116th Ave.	6848	12/16/98	1N-1W-36	33 23 24	112 18 28	940	Maricopa County	1/4 mile NNW of 115th Ave. and Baseline Rd.
GoldenEaglePark Dam	5978	12/12/96	3N-6E-10	33-37-07	111-44-07	1722	Fountain Hills	1/4 mi. N of Palisades Blvd. and Golden Eagle Blvd.
Greene Wash @ SR 84	793	3/23/94	6S-4E-21	32 52 48	111 56 03	1350	Pinal County	10 mi. West of SR 93 (Casa Grande) on SR 84
Guadalupe Channel	6603	8/7/98	1S-7E-06	33 21 48	111 40 33	1360	Mesa	1/4 mi. E of Power Rd. and Guadalupe Rd.
Guadalupe FRS	6503	6/29/89	1S-4E-5	33 22 16	111 58 10	1250	Phoenix	1/4 mi. SSW of Baseline Rd. and I-10

Harquahala FRS	5128	3/1/94	2N-8W-05	33 32 54	113 05 52	1420	Maricopa County	10 mi. WNW of Tonopah in Harquahala Valley
Hartman Wash	7063	7/6/94	7N-5W-12	33 57 47	112 49 40	2488	Maricopa County	On US 60 bridge, 6.3 mi. West of US 60 / US 93
Hassy @ Morristown	5223	5/7/96	T6N-R4W-3	33 53 06	112 39 41	1830	Maricopa County	3 mi. NW of Morristown and 7 miles SE of Wickenburg
Hassy R. @ Box Canyon	5308	11/17/83	8N-4W-7	34 05 18	112 44 10	2245	Yavapai County	6 mi. N of Wickenburg on Hassayampa River, Yavapai County
Hassy R. @ I-10	5283	11/9/94	1N-5W-03	33 27 33	112 45 46	1035	Maricopa County	I-10 bridge over Hassayampa River, 12 mi WNW of Buckeye
Hassy R. @ US 60	5228	3/14/94	7N-5W-12	33 57 56	112 43 40	2035	Wickenburg	Hassayampa River at US 60/93 in Wickenburg
Hassy R. @ Wagoner Rd.	5353	9/26/91	11N-3W-9	34 18 38	112 34 05	3785	Yavapai County	6 mi. ESE of Kirkland Junction
Hesperus Dam	5993	12/18/96	3N-6E-04	33 38 14	111 44 47	1894	Fountain Hills	1/4 mi. N of Richwood Ave. & Golden Eagle Blvd.
IBW @ Indian Bend Rd.	4613	9/28/83	2N-4E-11	33 32 00	111 54 53	1071	Scottsdale	On Indian Bend Wash just S. of Indian Bend Rd.
IBW @ Indian School	4618	11/26/97	2N-4E-23	33 29 28	111 54 20	1235	Scottsdale	Indian School Rd. at Hayden Road
IBW @ Interceptor	4623	4/21/94	2N-4E-12	33 31 57	111 53 55	1071	Scottsdale	On the Interceptor Channel, 1/4 mi. SW of Pima Rd. & Indian Bend Rd.
IBW @ McDonald Dr.	4628	11/25/97	2N-4E-11	33 31 15	111 54 08	1265	Scottsdale	McDonald Drive at Hayden Road
IBW @ McKellips Rd.	4603	5/21/85	1N-4E-11	33 26 58	111 54 58	1187	Scottsdale	On Indian Bend Wash 1/4 mi. South of McKellips
IBW @ Shea Blvd.	4693	6/9/98	3N-4E-29	33 34 56	111 58 08	1350	Phoenix	Shea Blvd. At 52nd Street
IBW @ Sweetwater	4643	12/27/90	3N-3E-13	33 36 15	112 00 18	1400	Phoenix	1/2 mi. E of 32nd St. and Sweetwater Ave.
Lahman Wash	5023		3S-10W-32	33 07 3.5	113 18 32	725		
Lake Marguarite	4678	11/25/97	3N-4E-36	33 33 49	111 53 56	1325	Scottsdale	1/4 mi. West of Doubletree and Hayden
Martinez Creek	7013	11/23/94	8N-5W-17	34 01 44	112 47 30	2300	Yavapai County	1 mi. East of the US 93 / US 89 junction
McMicken Dam	5448	3/24/83	4N-2W-24	33 40 38	112 25 23	1361	Surprise	N end of the dam, 1/4 mi SE of Deer Valley Rd and Cotton Lane
McMicken Floodway	5438	9/3/92	4N-1W-18	33 41 04	112 24 33	1337	Maricopa County	1/2 mi. N of Grand Ave. and Deer Valley Rd.
Narrows Dam	5153	9/1/94	4N-12W-04	33 43 29	113 30 45	1960	La Paz County	5 mi. SE of Salome off Salome Highway
New River @ Bell Rd.	5598	4/4/90	3N-1E-3	33 38 18	112 14 27	1200	Peoria	Bell Rd. at 83rd Ave.
New River @ Glendale	5508	3/21/90	3N-1E-8	33 32 14	112 17 00	1050	Glendale	1/2 mi. E of 99th Ave. on Glendale Ave. bridge
New River Outlet	5613	4/15/86	5N-1E-35	33 44 09	112 13 31	1498	Peoria	1/2 mi. NE of Jomax Rd. and 83rd Ave.
New River Pool	5614	4/15/86	5N-1E-35	33 44 09	112 13 31	1498	Peoria	1/2 mi. NE of Jomax Rd. and 83rd Ave.

North Heights Dam	5983	10/11/96	3N-6E-09	33 37 21	111 44 54	1819	Fountain Hills	400 yds. SW of Sierra Madre Dr. and Golden Eagle Blvd.
Old Camp Wash	5118		2N-6W-18	33 30 31	112 54 46			
Old X-cut @ McDowell	4748	7/27/94	1N-4E-06	33 27 55	111 58 49	1250	Phoenix	McDowell Rd. at Hohokam Expressway
Old X-cut @ Thomas	4753	7/26/94	2N-5W-30	33 29 17	111 54 52	1200	Phoenix	Thomas Rd. at 46th St.
Powder House Wash	7113	5/18/95	7N-4W-06	33 58 32	112 43 09	2120	Wickenburg	1/2 mi. NE of the junction of US 60 and Constellation Rd., Wickenburg
Powerline FRS	6683	12/3/92	1S 8E 09	33 21 06	111 32 34	1580	Pinal County	Alignments of Idaho Rd. and Warner Rd.
Queen Ck @ Rittenhouse	6707	9/14/93	2S-7E-25	33 13 50	111 35 41	1400	Maricopa County	1/3 mi. SE of the Signal Butte Rd. and Chandler Heights Rd. alignments
Queen Cr. @ CAP	6723	1/14/99	2S-8E-26	33 12 22	111 30 15	1565	Pinal County	Queen Creek at Central Arizona Project
Rawhide Wash	4863	7/26/99	5N-4E-36	33 44 27	111 53 55	2205	Scottsdale	1/3 mile west of Pima Rd. on Dynamite Blvd.
Reata Pass Dam	4938	2/25/93	5N-5E-33	33 44 06	111 50 36	2600	Scottsdale	1/2 mi. South of Dynamite Blvd. and 112th St.
Rittenhouse FRS	6703	9/27/88	2S-8E-2	33 17 22	111 30 26	1580	Pinal County	Alignments of Goldfield Rd. and Germann Rd.
Saddleback FRS	5113	12/16/88	2N-10W-34	33 27 55	113 04 21	1177	Maricopa County	7 mi. WSW of Tonopah in Harquahala Valley
Salt R. @ Priest Dr.	4523	12/7/93	1N-4E-17	33 26 00	111 57 43	1133	Tempe	West side of Salt River bridge at Priest Drive
Santa Cruz @ SR 84	788	3/16/94	6S-5E-21	32 52 55	111 49 45	1311	Pinal County	3 mi. West of SR 93 (Casa Grande) on SR 84
Santa Rosa @ SR 84	798	3/16/94	6S-4E-20	32 52 39	111 56 51	1305	Pinal County	11 mi. West of SR 93 (Casa Grande) on SR 84
Sauceda Wash	6923	2/28/90	6S-5W-04	32 52 27	112 44 57	726	Maricopa County	6 mi. SSW of Gila Bend
Scatter Wash	5543	9/18/96	4N-2E-27	33 40 20	112 08 30	1350	Phoenix	1/2 mile west of 35th Ave. and Beardsley Rd.
Signal Buttes FRS	6628	11/10/87	1N-7E-12	33 26 25	111 35 25	1650	Maricopa County	1/4 mi. NE of Signal Butte Rd. and Brown Rd.
Skunk Cr. nr New R.	5583	6/21/95	7N-3E-29	33 55 36	112 04 57	1854	Maricopa County	Skunk Cr. at Fig Springs Rd., 3.5 mi. E of New River
Skunk Creek @ I-17	5568	10/26/89	5N-2E-35	33 43 47	112 07 21	1475	Phoenix	I-17 at Jomax Rd. alignment
Sols Wash nr Matthie	7043	8/4/95	8N-5W-32	33 59 14	112 47 36	2220	Maricopa County	Sols Wash at SPRR bridge, 2 mi. N. of Wickenburg Airport
South Mountain Fan	6563	6/9/93	1S-2E-26	33 18 57	112 08 25	1420	Phoenix	Alignments of Ray Rd. and 35th Ave. in S. Mtn. Park
Spookhill FRS	4563	3/13/84	2N-7E-31	33 28 01	111 40 48	1595	Mesa	1/2 mi. N of McDowell Rd. and Bush Highway
StoneRidge Dam	5968	12/11/96	3N-6E-22	33-35-41	111-44-01	1710	Fountain Hills	1/4 mi. W of Cholla Dr. & Fountain Hills Blvd.

Sunnycove FRS	5248	7/1/86	7N-5W-11	33 57 25	112 44 24	2200	Wickenburg	1 mi. SW of the US 60 / US 93 intersection in Wickenburg
SunRidge Canyon Dam	5973	2/4/97	3N-6E-16	33 36 24	111 45 06	1932	Fountain Hills	200 yards W of Lago Blvd. and Palisades Blvd.
Sunset FRS	5233	5/11/89	7N-5W-11	33 57 50	112 44 33	2100	Wickenburg	3/4 mi. WSW of the US 60 / US 93 intersection in Wickenburg
Tatum Basin Inflow	4638	6/3/94	3N-4E-29	33 34 50	111 59 01	1400	Phoenix	Near Shea Blvd and 40th St.
Tatum Basin Outflow	4653	5/8/98	3N-4E-29	33 34 59	111 58 59	1400	Phoenix	Near Shea Blvd and 44th St.
Tiger Wash	5163	9/15/99	5N-10W-26	33 44 30	113 16 43	1960	Maricopa County	10 mi. N of the Eagle Eye Rd / Salome Hwy intersection
Vekol Wash	6983	3/7/90	7S-1E-3	32 50 30	112 14 58	1720	Maricopa County	On I-8 bridge, halfway between Gila Bend and Casa Grande
Vineyard FRS	6688	11/2/83	1S-8E-9	33 20 18	111 32 06	1582	Pinal County	Alignments of Tomahawk Rd. and Williams Field Rd.
White Tanks 3	5418	3/12/86	2N-2W-9	33 32 01	112 28 14	1190	Maricopa County	4 mi. N of I-10 on Jackrabbit Trail alignment
White Tanks 4	6823	1/9/86	1N-2W-5	33 27 04	112 29 40	1044	Maricopa County	1/4 mi. NE of Tuthill Rd. and Van Buren St.

Method 2 Data
ADOT Manual

Regression Equations			Gage Data			Selected Gages		
Area sq. miles	LP3 100 cfs	Qmax cfs	Area sq. miles	LP3 100 cfs	Qmax cfs	Area sq. miles	LP3 100 cfs	Qmax cfs
0.00	0	0	0.20	237	117	0.20	237	117
0.01	71	21	0.24	116	101	0.30	346	165
0.02	103	33	0.30	346	165	0.37	417	280
0.03	128	42	0.32	1520	383	0.44	327	240
0.04	149	50	0.35	672	326	0.45	987	520
0.05	169	58	0.37	417	280	0.46	627	238
0.06	186	65	0.44	327	240	0.51	431	262
0.07	202	71	0.45	987	520	0.64	993	250
0.08	217	77	0.46	627	238	0.64	619	180
0.09	232	83	0.51	431	262	0.75	220	84
0.10	245	89	0.64	619	180	0.76	589	173
0.11	258	94	0.64	993	250	0.77	296	84
0.12	271	99	0.65	413	191	0.79	385	375
0.13	282	104	0.66	348	265	0.81	560	337
0.14	294	109	0.75	220	84	0.83	1690	640
0.15	305	114	0.76	589	173	0.90	710	510
0.16	316	119	0.77	296	84	0.95	1210	820
0.17	326	123	0.79	419	290	0.95	2910	800
0.18	337	128	0.79	385	375	1.07	1730	1200
0.19	347	132	0.81	560	337	1.17	842	600
0.20	356	136	0.83	1690	640	1.22	1150	743
0.21	366	141	0.85	561	500	1.23	1080	470
0.22	375	145	0.90	710	510	1.28	345	140
0.23	384	149	0.95	2910	800	1.37	301	227
0.24	393	153	0.95	1210	820	1.49	2130	590
0.25	402	157	0.98	2850	200	1.70	2610	1310
0.26	411	161	1.07	1730	1200	1.75	3220	670
0.27	419	164	1.15	1430	705	1.84	1640	320
0.28	427	168	1.17	842	600	1.98	1270	580
0.29	436	172	1.22	1150	743	1.99	1090	353
0.30	444	175	1.23	1080	470	1.99	3930	1590
0.31	452	179	1.28	345	140	2.04	793	430
0.32	459	183	1.37	301	227	2.08	2870	1900
0.33	467	186	1.38	5880	2060	2.11	7390	2420
0.34	475	190	1.49	2130	590	2.15	1090	705
0.35	482	193	1.61	87	70	2.18	1620	1800
0.36	490	196	1.70	2610	1310	2.30	2390	1590
0.37	497	200	1.75	3220	670	2.40	6960	3200
0.38	504	203	1.78	770	383	2.43	3360	1500
0.39	511	206	1.84	1640	320	2.43	1670	1430
0.40	518	210	1.87	413	135	2.44	1300	715
0.41	525	213	1.98	1270	580	2.55	2850	1260
0.42	532	216	1.99	3930	1590	2.56	131	98
0.43	539	219	1.99	1090	353	2.60	950	402
0.44	546	222	2.04	793	430	2.71	2270	950
0.45	552	226	2.06	111	73	2.72	1920	1210
0.46	559	229	2.08	2870	1900	2.79	1240	720
0.47	565	232	2.11	7390	2420	2.85	7350	1950
0.48	572	235	2.15	1090	705	2.94	4460	3000
0.49	578	238	2.18	1620	1800	3.15	18400	3800
0.50	585	241	2.30	2390	1590	3.53	2260	1470

Method 2 Data
ADOT Manual

Regression Equations			Gage Data			Selected Gages		
Area sq. miles	LP3 100 cfs	Qmax cfs	Area sq. miles	LP3 100 cfs	Qmax cfs	Area sq. miles	LP3 100 cfs	Qmax cfs
0.51	591	244	2.40	6960	3200	3.54	913	1610
0.52	597	247	2.41	293	183	3.57	387	253
0.53	603	250	2.43	3360	1500	3.63	7490	3700
0.54	609	253	2.43	1670	1430	4.37	1460	1570
0.55	615	255	2.44	1300	715	4.49	2670	1940
0.56	621	258	2.55	2850	1260	4.58	5530	1700
0.57	627	261	2.56	131	98	4.72	2380	1670
0.58	633	264	2.60	950	402	4.93	652	460
0.59	639	267	2.71	2270	950	5.25	2140	1460
0.60	645	270	2.72	1920	1210	5.57	2220	2600
0.61	651	272	2.79	1240	720	5.57	7450	860
0.62	657	275	2.85	7350	1950	5.88	3530	2340
0.63	662	278	2.94	4460	3000	6.01	6250	480
0.64	668	281	3.15	18400	3800	6.31	5330	2900
0.65	674	283	3.18	708	151	6.44	4070	2820
0.66	679	286	3.28	182	87	6.46	329	260
0.67	685	289	3.42	573	210	6.95	4250	4000
0.68	690	291	3.53	2260	1470	7.24	1020	898
0.69	696	294	3.54	913	1610	7.27	5300	250
0.70	701	297	3.57	387	253	8.02	4410	4340
0.71	706	299	3.63	7490	3700	8.20	4890	5000
0.72	712	302	3.83	449	190	8.47	4590	869
0.73	717	304	4.37	1460	1570	8.70	5220	1530
0.74	722	307	4.49	2670	1940	9.58	7460	4000
0.75	728	310	4.58	5530	1700	9.80	8030	3480
0.76	733	312	4.72	2380	1670	10.30	2540	1200
0.77	738	315	4.79	2480	1220	11.10	6070	1850
0.78	743	317	4.93	652	460	11.90	4400	13800
0.79	748	320	5.22	4030	530	12.10	1490	940
0.80	754	322	5.25	2140	1460	12.80	3340	1400
0.81	759	325	5.52	326	262	12.90	27600	4430
0.82	764	327	5.57	7450	860	13.50	3130	1000
0.83	769	330	5.57	2220	2600	14.10	4480	1900
0.84	774	332	5.88	3530	2340	14.50	9820	4100
0.85	779	335	6.01	6250	480	14.60	6170	2920
0.86	784	337	6.31	5330	2900	14.70	5290	1030
0.87	788	339	6.44	4070	2820	15.00	4640	2550
0.88	793	342	6.44	8600	2800	15.20	5790	1900
0.89	798	344	6.45	2150	1130	15.60	5710	3500
0.90	803	347	6.46	329	260	16.30	1850	1400
0.91	808	349	6.95	4250	4000	23.00	1900	2900
0.92	813	351	7.24	1020	898	24.30	13900	7500
0.93	817	354	7.27	5300	250	26.50	2310	1270
0.94	822	356	7.85	2320	1680	31.30	892	715
0.95	827	358	8.02	4410	4340	35.20	6910	3200
0.96	831	361	8.11	748	401	35.50	10400	7730
0.97	836	363	8.20	4890	5000	36.30	7310	6660
0.98	841	365	8.47	4590	869	36.40	18500	6830
0.99	845	368	8.70	5220	1530	38.40	15400	27000
1	850	370	9.30	3030	890	43.00	12300	8600
2	1236	569	9.58	7460	4000	44.80	17100	9660

Method 2 Data
ADOT Manual

Regression Equations			Gage Data			Selected Gages		
Area sq. miles	LP3 100 cfs	Qmax cfs	Area sq. miles	LP3 100 cfs	Qmax cfs	Area sq. miles	LP3 100 cfs	Qmax cfs
3	1538	731	9.80	8030	3480	47.80	4560	3640
4	1797	874	10.30	2540	1200	48.00	10900	10500
5	2027	1004	11.10	6070	1850	50.50	9340	6860
6	2237	1124	11.60	667	342	52.30	42700	16100
7	2431	1236	11.90	4400	13800	64.60	31000	11500
8	2613	1343	12.10	1490	940	67.30	34600	18600
9	2784	1445	12.80	3340	1400	68.80	12600	2670
10	2947	1542	12.90	27600	4430	79.10	9880	4600
11	3103	1636	13.50	3130	1000	80.70	4970	3100
12	3252	1727	14.10	4480	1900	82.20	11200	12000
13	3396	1815	14.50	9820	4100	83.30	37500	19500
14	3535	1900	14.60	6170	2920	85.20	6910	4550
15	3669	1983	14.70	5290	1030	116	11400	3150
16	3799	2064	14.80	426	323	121	20000	12400
17	3925	2143	14.90	3860	1080	122	35400	44400
18	4048	2221	15.00	4640	2550	137	32900	6840
19	4168	2296	15.20	5790	1900	139	16800	21000
20	4285	2371	15.60	5710	3500	143	11700	7000
21	4400	2443	16.00	1760	1350	144	46100	42900
22	4512	2515	16.30	1850	1400	164	51400	24200
23	4621	2585	16.90	485	236	176	17100	16000
24	4729	2654	23.00	1900	2900	185	41800	14600
25	4834	2722	24.30	13900	7500	200	27000	15700
26	4937	2789	24.60	6290	4000	209	15100	16000
27	5039	2855	26.50	2310	1270	219	29100	12700
28	5139	2920	27.90	1070	666	243	11800	8030
29	5237	2985	29.10	822	615	250	23900	17000
30	5334	3048	31.30	892	715	255	29200	14800
31	5429	3111	35.20	6910	3200	289	18500	20000
32	5523	3172	35.50	10400	7730	295	21800	22200
33	5616	3234	36.30	7310	6660	317	75100	38000
34	5707	3294	36.40	18500	6830	323	47100	38000
35	5797	3354	38.10	1420	1070	328	52800	23500
36	5886	3413	38.40	15400	27000	355	43700	26400
37	5974	3471	38.80	1700	2700	370	25300	49000
38	6060	3529	40.20	535	510	417	43000	58000
39	6146	3586	43.00	12300	8600	420	7840	6300
40	6231	3643	44.80	17100	9660	430	95500	38000
41	6314	3699	47.80	4560	3640	457	35000	38000
42	6397	3755	48.00	10900	10500	465	23600	22000
43	6479	3810	49.60	2320	1580	796	43900	47500
44	6560	3865	50.50	9340	6860	880	49000	29300
45	6640	3919	51.00	861	240	1110	182000	85000
46	6719	3973	52.30	42700	16100	1470	49200	39000
47	6798	4026	62.10	25300	7290			
48	6875	4079	64.60	31000	11500			
49	6952	4132	67.30	34600	18600			
50	7029	4184	68.60	11600	3880			
51	7104	4235	68.80	12600	2670			
52	7179	4287	78.20	2280	2310			
53	7253	4338	79.10	9880	4600			

Method 2 Data
ADOT Manual

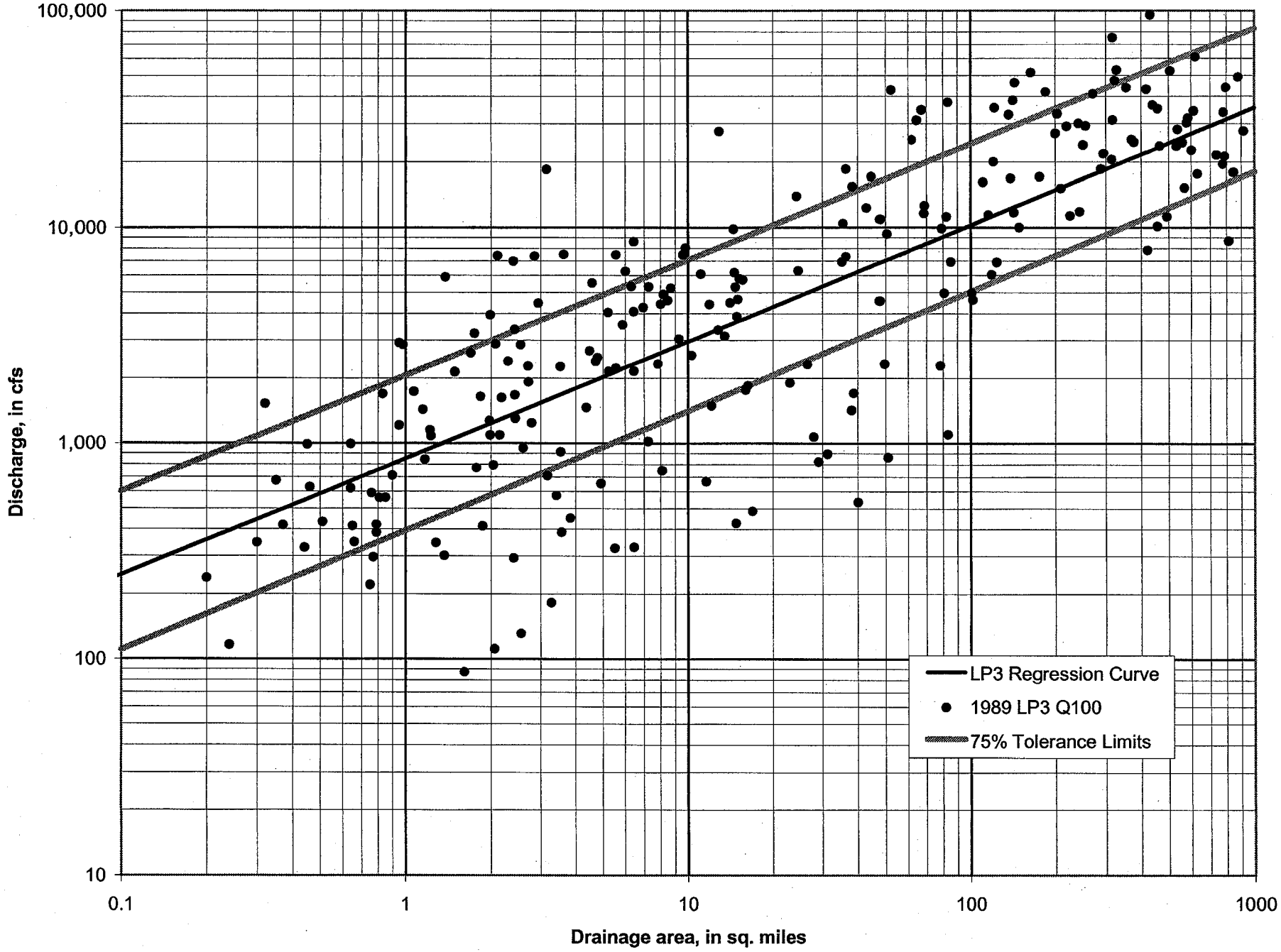
Regression Equations			Gage Data			Selected Gages		
Area sq. miles	LP3 100 cfs	Qmax cfs	Area sq. miles	LP3 100 cfs	Qmax cfs	Area sq. miles	LP3 100 cfs	Qmax cfs
54	7327	4388	80.70	4970	3100			
55	7400	4438	82.20	11200	12000			
56	7472	4488	83.30	37500	19500			
57	7544	4538	83.30	1100	700			
58	7615	4587	85.20	6910	4550			
59	7686	4636	101	4970	4400			
60	7756	4684	102	4620	3710			
61	7825	4733	111	16100	10900			
62	7894	4781	116	11400	3150			
63	7963	4828	119	6040	4510			
64	8031	4876	121	20000	12400			
65	8098	4923	122	35400	44400			
66	8165	4970	124	6890	2300			
67	8232	5016	137	32900	6840			
68	8298	5062	139	16800	21000			
69	8364	5108	142	38200	26600			
70	8429	5154	143	11700	7000			
71	8494	5200	144	46100	42900			
72	8558	5245	149	10000	7500			
73	8622	5290	164	51400	24200			
74	8686	5335	176	17100	16000			
75	8749	5379	185	41800	14600			
76	8812	5424	200	27000	15700			
77	8874	5468	203	33200	10900			
78	8936	5512	209	15100	16000			
79	8998	5556	219	29100	12700			
80	9059	5599	225	11300	10000			
81	9120	5642	241	30000	22400			
82	9181	5685	243	11800	8030			
83	9241	5728	250	23900	17000			
84	9301	5771	255	29200	14800			
85	9361	5814	271	41000	19800			
86	9420	5856	289	18500	20000			
87	9479	5898	295	21800	22200			
88	9538	5940	315	20500	14000			
89	9596	5982	317	75100	38000			
90	9654	6023	317	31100	19700			
91	9712	6065	323	47100	38000			
92	9769	6106	328	52800	23500			
93	9827	6147	355	43700	26400			
94	9883	6188	370	25300	49000			
95	9940	6229	377	24600	30000			
96	9996	6269	417	43000	58000			
97	10053	6310	420	7840	6300			
98	10108	6350	430	95500	38000			
99	10164	6390	439	36400	23000			
100	10219	6430	456	10100	16000			
110	10759	6821	457	35000	38000			
120	11277	7199	465	23600	22000			
130	11775	7566	493	11200	7680			
140	12255	7921	506	52300	30000			

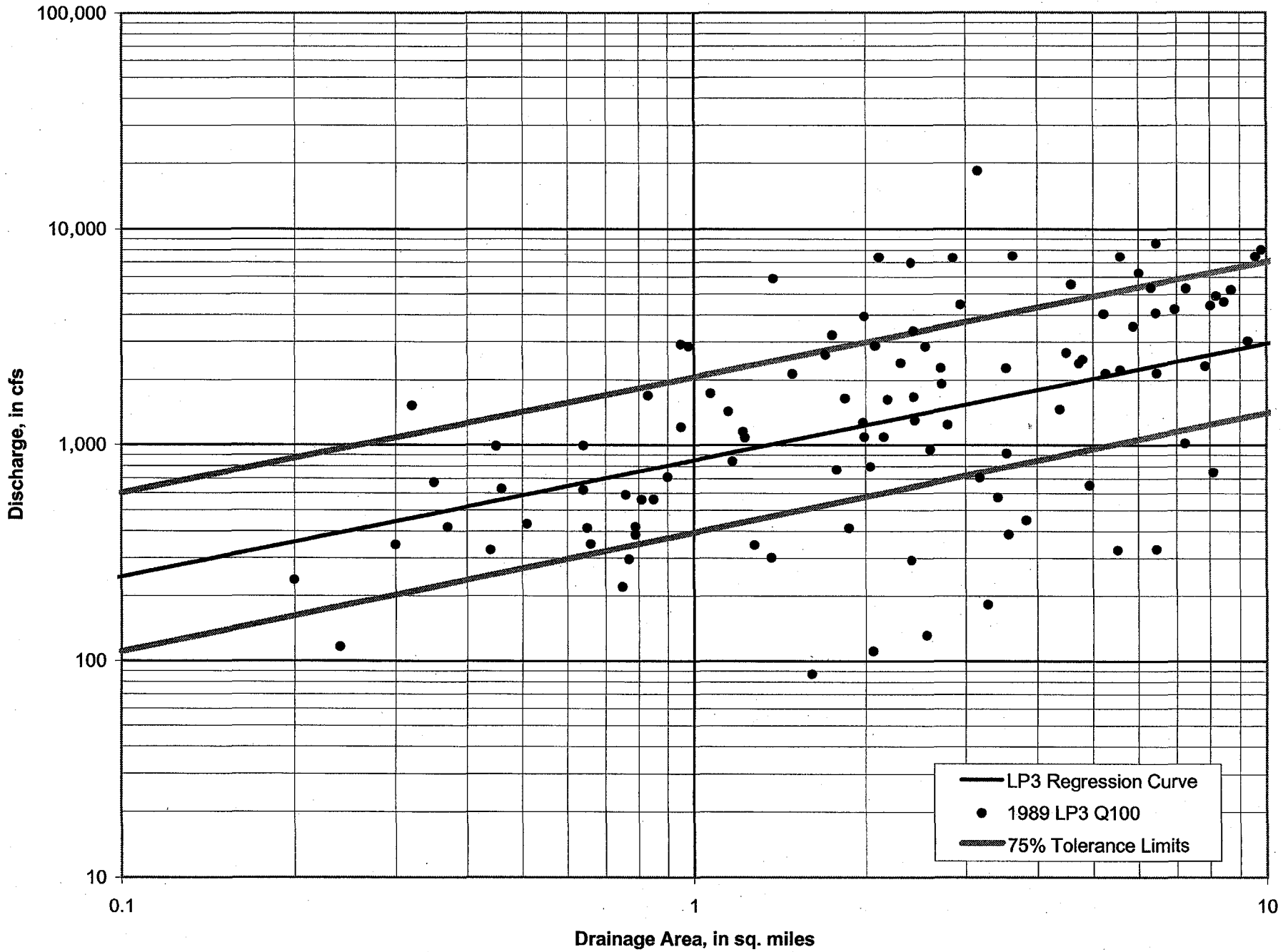
Method 2 Data
ADOT Manual

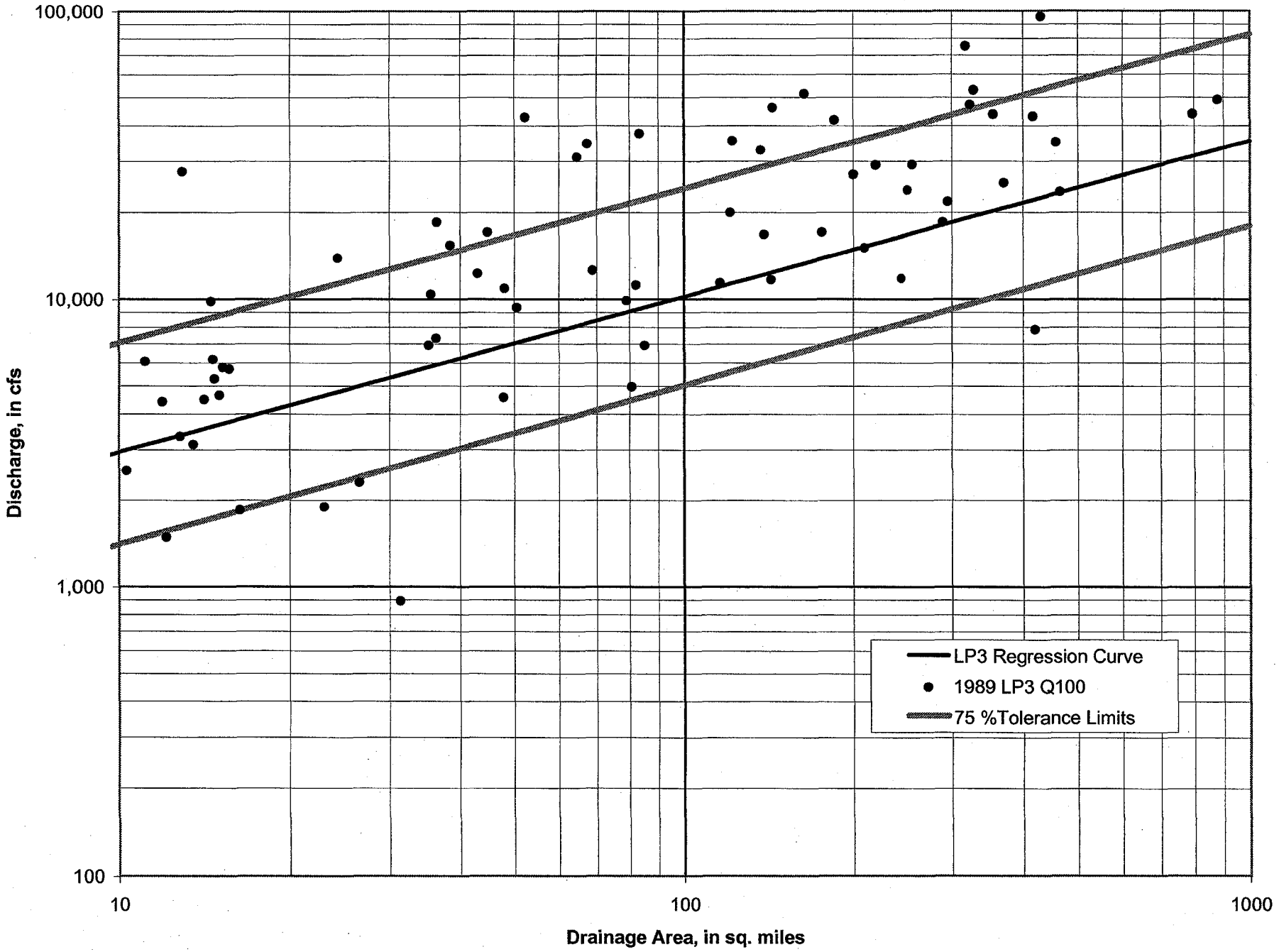
Regression Equations			Gage Data			Selected Gages		
Area sq. miles	LP3 100 cfs	Qmax cfs	Area sq. miles	LP3 100 cfs	Qmax cfs	Area sq. miles	LP3 100 cfs	Qmax cfs
150	12721	8268	533	23600	31000			
160	13172	8605	537	28200	70800			
170	13610	8935	560	24500	17900			
180	14037	9257	569	15200	12500			
190	14453	9573	579	30200	10400			
200	14859	9882	585	31700	33100			
210	15255	10185	602	22600	20000			
220	15643	10483	613	34200	36400			
230	16023	10776	621	60900	50000			
240	16396	11065	632	17600	14600			
250	16761	11348	675	101000	61400			
260	17120	11627	737	21500	22000			
270	17473	11903	776	19500	19100			
280	17819	12174	781	33800	16100			
290	18160	12442	787	21200	13000			
300	18495	12706	796	43900	47500			
310	18826	12967	814	8660	5350			
320	19151	13225	846	17900	25000			
330	19472	13480	880	49000	29300			
340	19789	13732	918	27700	29700			
350	20101	13981	1023	5750	5060			
360	20409	14227	1026	54500	40600			
370	20713	14471	1028	7140	15000			
380	21014	14712	1110	182000	85000			
390	21311	14951	1128	37900	23100			
400	21604	15187	1170	12500	32000			
410	21894	15422	1232	97900	50000			
420	22181	15654	1250	7250	10400			
430	22464	15884	1410	20200	16100			
440	22745	16112	1439	69600	33600			
450	23023	16338	1470	49200	39000			
460	23297	16562	1629	17300	10100			
470	23570	16784	1682	36500	45000			
480	23839	17005	1730	28000	24200			
490	24106	17224	1782	29000	53100			
500	24370	17441						
510	24632	17656						
520	24892	17870						
530	25149	18082						
540	25405	18293						
550	25658	18502						
560	25908	18710						
570	26157	18917						
580	26404	19122						
590	26649	19325						
600	26892	19528						
610	27133	19729						
620	27372	19929						
630	27610	20128						
640	27846	20325						
650	28080	20521						

Method 2 Data
ADOT Manual

Regression Equations			Gage Data			Selected Gages		
Area sq. miles	LP3 100 cfs	Qmax cfs	Area sq. miles	LP3 100 cfs	Qmax cfs	Area sq. miles	LP3 100 cfs	Qmax cfs
660	28312	20717						
670	28543	20911						
680	28772	21104						
690	29000	21296						
700	29226	21486						
710	29451	21676						
720	29674	21865						
730	29896	22053						
740	30116	22240						
750	30336	22425						
760	30553	22610						
770	30770	22794						
780	30985	22977						
790	31199	23160						
800	31411	23341						
810	31623	23521						
820	31833	23701						
830	32042	23880						
840	32250	24058						
850	32457	24235						
860	32662	24411						
870	32867	24587						
880	33070	24762						
890	33273	24936						
900	33474	25109						
910	33675	25282						
920	33874	25454						
930	34072	25625						
940	34270	25795						
950	34466	25965						
960	34661	26134						
970	34856	26303						
980	35049	26470						
990	35242	26638						
1000	35434	26804						


100,000
10,000
1,000
100
10
Discharge, in cfs
0.1
1
10
100
1000
Drainage area, in sq. miles
LP3 Regression Curve
1989 LP3 Q100
75% Tolerance Limits


100,000
10,000
1,000
100
10
Discharge, in cfs
0.1
1
10
Drainage Area, in sq. miles
LP3 Regression Curve
1989 LP3 Q100
75% Tolerance Limits


100,000
10,000
1,000
100
Discharge, in cfs
10
100
1000
Drainage Area, in sq. miles
LP3 Regression Curve
1989 LP3 Q100
75 %Tolerance Limits

METHOD 3

USGS REGIONAL REGRESSION EQN
SOURCE DATA

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USGS Regional Regression Equations

- Generalized least-squares multiple regression techniques and a hybrid method developed for the study.
  - Eqns. applicable to unregulated streams w/ drainag. areas < 200 sm.
  - Eqns considers
    - Drainage area
    - Mean basin elevation
    - Mean annual precipitation
    - Mean annual evaporation
    - Latitude / Longitude
    - Climatic characteristics

- Flood-frequency relations ~~estimated~~ defined based on LP3 distrib. and the method of moments.

- Low discharge threshold applied to adjust for the relations for low outliers

→ 80% of all gages (base on flood-frequency & low discharg threshold adjustment) were found to ~~be~~ have reliable data for generation of the generalized regression eqns.

* - For regional relations with multiple variables, the 100-year peak discharge relations are for mean values of the variables used in addition to drainage area.
  - Effects of these additional variables are not accounted for in the regional relations between 100-year peak discharge and drainage area; therefore, the plots of these regression lines may not appear to fit the data.

* Region 12 : Two parameter; Area and Elev. } Generalized
* Region 13 : Single parameter; Area } least-squar

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Flood Region 12 Gage Locations

		A	ELEV	Q_{100}	Q_{MAX}
1.	9424200	143	5350	11,800/20,200	7,000
2.	9424407	13.5	4610	--- /7,380	1,000
3.	9424410	1.99	3700	1,120/1,880	353
4.	9424430	1.70	3520	--- /2,050	1,310
5.	9424470	109	—	---/---	1,000
6.	9424480	6.95	4,680	4,430/4,700	4,000
7.	942700	0.64	3,470	1,040/975	180
8.	942900	1,210	4,010	36,700/55,600	23,100
9.	9425500	1,520	3,650	70,800/73,400	33,600
10.	9468300	0.83	4,410	1,820/1,310	640
11.	94685000	1,027	4,480	56,200/57,500	40,600
12.	9489100	315	8,700	21,700/25,300	14,800
13.	9489499	560	8,000	28,100/32,100	17,900
14.	9489700	119	7,920	6,340/13,300	4,510
15.	9490500	1,232	7,200	110,000/79,800	50,000
16	9492400	33.8	8,580	1,790/6,260	2,700
[illegible]	9494000	632	7,400	18,600/29,500	14,000
[illegible]	9494300	225	6,370	--- / 27,400	10,000
19.	9496000	203	6,370	35,800/30,300	10,900
20.	9496500	439	6,320	39,100/37,900	23,000
21.	9496600	0.1	5,390	326/193	165
22.	9496700	0.06	5,240	168/112	120
23	9496800	2.55	5,810	3,050/2,460	1,260
24	9497800	295	5,700	22,700/27,900	22,200
25	9497900	62.10	6,030	12,300/14,300	7,290
26	9497980	200	5,600	26,800/27,300	15,700
27	9498600	0.66	6,080	374,655	265
28	9498800	430	5,810	64,400/44,500	38,000
29	8870	122	4,390	29,300/26,400	44,400
30	8900	6.44	4,590	4,330/4540	2,800
31	9000	675	5,020	104,000/81,100	61,400
32	9501300	24.3	2,690	14,500/13,700	7,500
33	2700	6	5,970	6,700/4890	480
34	2800	255	5,120	30,300/31,300	14,800
35	3000	39.6	5,900	7,400/10,600	6,660
36	3720	14.9	7,110	---/6,430	1,080
37	3740	0.75	5,180	231/740	84
[illegible]	3750	14.5	5,310	8,170/7,460	4,100
[illegible]	3800	131	7,620	7,260/16,000	2,300
40	4100	0.91	7,050	597/801	500
41	4400	1.19	6,880	1,510/1,270	705
42	4500	357	6,200	46,600/41,300	26,400
43	4800	0.04	3,570	---/61	53

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	Gage No	Area	Elev	100-YR Q	Q Max
44	9505200	111	6,410	16,800 / 18,500	10,900
45	5220	1.4	7,190	1,640 / 1,430	1,550
46	5250	49.40	5,910	11,500 / 12,800	10,500
47	5300	24.60	6,560	6,510 / 7,910	4,000
48	5350	142	6,220	39,000 / 29,900	26,600
49	5600	3.42	7,140	--- / 2,470	210
50	5800	241	6,680	31,700 / 27,200	22,400
51	5900	0.64	3,540	663 / 853	250
52	7600	6.65	6,430	9,360 / 5,590	2,820
53	7700	4.92	6,980	2,670 / 3,030	1,220
54	7980	328	5,140	61,500 / 49,900	23,500
55	8300	36.4	4,810	21,600 / 16,000	6,830
56	10070	4.58	5,430	6,210 / 4,270	1,700
57	10080	9.8	5,260	9,000 / 6,760	3,480
58	10100	4.49	5,760	3,660 / 3,450	1,940
59	10150	52.3	4,260	47,000 / 26,100	16,100
[illegible]	10170	8.6	3,520	1,000 / 2,180	402
[illegible]	10180	15.2	3,680	6,280 / 8,180	1,900
62	10200	164	3,820	57,800 / 42,700	24,200
63	12100	139	1,780	17,400 / 34,100	21,000
64	12200	1.75	1,730	4,740 / 3,720	670
65	12300	121	3,470	20,700 / 24,200	12,400
66	12420	0.95	5,900	--- / 1,030	820
67	2500	588	5,000	29,300 / 36,000	33,100
68	2700	1.11	2,140	1,790 / 1,830	1,200
69	2800	1,130	4,770	199,000 / 108,000	59,500
70	3780	67.30	3,970	36,900 / 26,900	18,600
71	3800	83.3	3,600	39,100 / 29,100	19,500
72	3820	11.1	1,980	--- / 9,610	1,850
73	3835	187	2,700	44,100 / 40,000	14,600
74	3860	64.6	2,180	36,500 / 30,000	11,500
75	3890	317	2,320	35,000 / 46,100	20,000
76	3910	323	2,130	37,000 / 46,500	38,000
77	3970	633	---	--- / ---	29,300
78	5550	417	4,750	43,700 / 42,400	58,000
79	5800	5.57	2,690	7,820 / 6,190	2,600
80	6500	774	3,190	45,000 / 54,100	47,500
[illegible]	6600	6.31	2,290	5,570 / 6,040	2,900
[illegible]	6800	137	2,260	--- / 35,000	6,840

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Flood Region 13 Gage Data

	Gage No	Area	Elev	100-YR Q	Qmax
1	9428545	0.77	2,330	300 / 717	173
2	8550	14.60	1,230	6,170 / 5,990	2,920
3	8800	13.70	1,520	--- / 5,650	1,950
4	9470500	741.0	4,950	22,300 / 23,400	22,000
5	0900	5.25	---	2,620 / 3,030	1,460
6	1000	1,219	4,840	45,700 / 42,900	98,000
7	1080	6.42	4,970	3,080 / 3,470	2,220
8	1087	0.22	5,020	766 / 609	541
9	1090	9.11	4,840	7,490 / 6,000	2,640
10	1120	3.18	4,880	8,470 / 5,770	4,390
11	1140	36.70	4,790	8,030 / 8,420	6,590
12	1170	0.87	4,550	2,020 / 1,670	1,270
13	1185	0.01	4,500	38 / 33	31
14	1195	5.22	4,480	11,800 / 7,600	2,590
15	1200	57.7	4,700	14,000 / 12,700	11,500
16	1550	1,740	4,820	29,200 / 31,300	24,200
17	1600	0.79	5,240	--- / 1,070	84
18	1700	2.71	4,180	2470 / 2,420	950
19	2100	8.02	3,680	--- / 4,320	4,340
20	2400	2.40	3,700	7,950 / 4,870	3,200
21	3000	541	4,530	28,000 / 26,800	~~7080~~ 70,800
22	3200	3.63	2,590	8,140 / 5,190	3,700
23	3600	4.37	3,050	1,520 / 2,340	1,570
24	8200	15.6	3,670	6,030 / 6030	3,500
25	8500	144	3,180	47,200 / 31,700	42,900
26	8600	0.37	2,320	--- / 621	280
27	9200	0.51	1,760	--- / 788	262
28	9480000	82.2	5,150	11,300 / 11,600	12,000
29	0500	533	4,850	24,900 / 24,700	31,000
30	1500	209	4,800	15,400 / 16,000	16,000
31	1700	10.3	4,360	2,700 / 3,880	1,200
32	1750	176	3,840	17,800 / 17,200	16,000
33	1800	0.15	3,620	229 / 269	110
34	1900	3.6	3,280	8,050 / 4,800	1,840
35	2330	0.54	---	--- / 821	337
36	2420	26.5	2,900	2,470 / 5,470	1,270
37	2480	2.75	2,850	4,060 / 3,240	3,000
38	3030	2.11	2,700	--- / 2,030	2,420
39	3040	0.46	2,750	675 / 702	240
40	3100	43.0	4,780	13,000 / 11,700	8,600
41	3200	2.04	3,300	849 / 1,420	430

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	Gage No	Area	Elev	100-yr Q	Qmax
42	9484000	35.5	6,300	10,800 / 10,300	7,730
43	4200	16.3	5,860	1,940 / 4,120	1,400
44	4500	219	4,340	31,000 / 25,500	12,700
45	4510	6.46	4,600	339 / 2,050	260
46	4560	289	4,890	19,800 / 19,700	20,000
47	4570	38.4	4,260	14,300 / 12,800	27,000
48	4580	14.1	5,000	--- / 5,730	1,900
49	4590	50.5	4,340	--- / 10,200	6,860
50	4600	457.0	4,500	36,400 / 31,500	38,000
51	5000	44.8	4,850	18,800 / 15,900	9,660
52	5100	0.17	3,040	--- / 336	49
53	5500	602.0	4,560	23,700 / 24,300	20,000
54	5900	4.93	4,430	703 / 1,940	460
55	5950	2.08	3,600	1,170 / 1,570	705
56	6000	918.0	4,400	28,300 / 28,300	29,700
57	6300	250.0	4,000	25,200 / 22,100	17,000
58	6800	463.0	3,920	24,100 / 23,500	22,000
59	7000	776.0	3,710	20,000 / 23,600	19,100
60	7100	11.90	2,800	4,450 / 4,890	13,800
61	7140	0.45	2,530	--- / 719	520
62	7250	1,170.0	3,350	12,900 / 22,600	32,000
63	7400	2.44	2,800	1,320 / 1,820	715
64	8500	1,782.0	2,340	29,600 / 31,700	53,100
65	8600	12.8	1,620	3,500 / 4,590	1,400
66	9514200	403.0	1,570	9,140 / 14,600	6,300
67	7000	1,470.0	3,010	53,900 / 45,100	39,000
68	7200	2.79	2,480	1,260 / 1,820	720
69	7280	85.2	2,590	7,000 / 9,720	4,550
70	7400	47.8	1,630	4,640 / 7,150	3,640
71	9600	2.43	---	1,700 / 1,950	1,430
72	9750	68.8	1,900	--- / 11,600	2,670
73	9760	126.0	1,980	11,500 / 13,000	3,150
74	9780	12.9	1,050	--- / 5,490	4,430
75	20100	8.7	674	5,180 / 4,850	1,530
76	20110	0.44	1,760	325 / 517	240
77	20130	4.72	1,920	2,370 / 2,810	1,670
78	0160	2.18	2,100	1,580 / 1,840	1,800
79	0170	243.0	1,950	11,800 / 15,400	8,030
80	0200	12.1	1,280	1,480 / 3,290	940
81	0230	1.49	1,280	2,100 / 1,870	590
82	0300	0.9	2,040	741 / 923	510
83	0350	0.09	601	263 / 228	117

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Computed By: Date: / / Checked By: Date: / /

	Gage No	Area	Elev	100-yr	Qmax
84	9520400	1.97	395	3,680/2790	1,590
85	35100	569.0	2,250	18,700/21,700	12,500
86	5300	1,250.0	2,699	8,920/20,400	10,400
87	6100	0.81	5,210	621/873	375
88	6350	0.65	6,280	457/714	191
89	7200	79.10	5,360	11,100/11,700	4,600
90	7500	1023.0	4,740	5,910/10,700	5,060

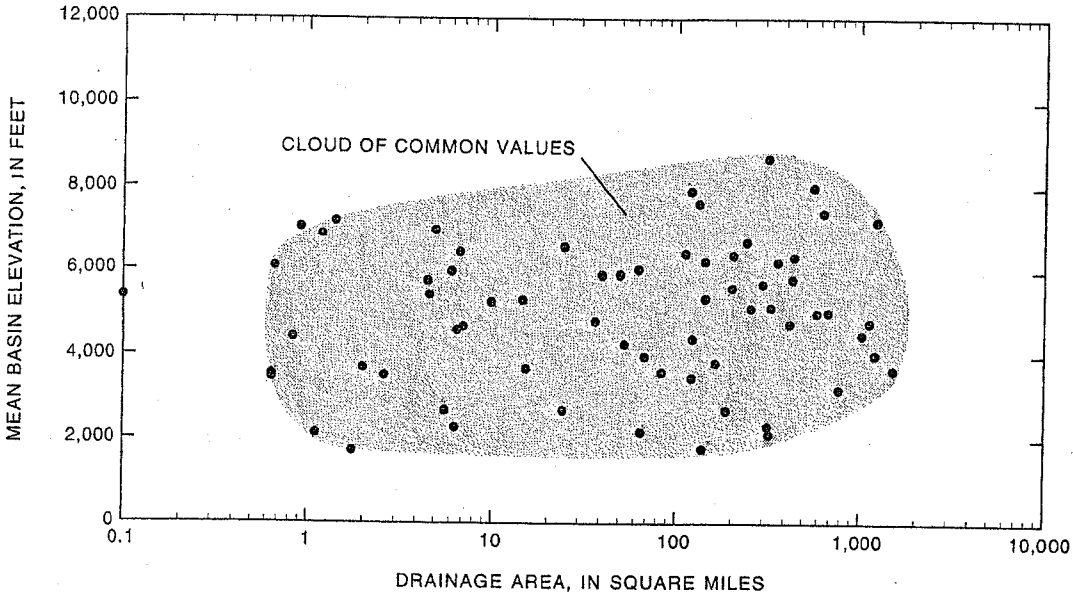

Figure 40. Joint distribution of mean basin elevation and drainage area for gaged sites in the Central Arizona Region 12.

Table 16. Generalized least-squares regression equations for estimating regional flood-frequency relations for the Central Arizona Region 12

Equation: Q, peak discharge, in cubic feet per second; AREA, drainage area, in square miles; and ELEV, mean basin elevation, in feet. Data were based on 68 stations. Average number of years of systematic record is 21.

Recurrence interval, in years	Equation	Average standard error of prediction, in percent	Equivalent years of record
2	$Q=41.1\text{AREA}^{0.629}$	105	0.23
5	$Q=238\text{AREA}^{0.687}(\text{ELEV}/1{,}000)^{-0.358}$	68	1.90
10	$Q=479\text{AREA}^{0.661}(\text{ELEV}/1{,}000)^{-0.398}$	52	6.24
25	$Q=942\text{AREA}^{0.630}(\text{ELEV}/1{,}000)^{-0.383}$	40	17.8
50	$Q=10^{(7.36-4.17\text{AREA}^{-0.08})}(\text{ELEV}/1000)^{-0.440}$	37	27.5
100	$Q=10^{(6.55-3.17\text{AREA}^{-0.11})}(\text{ELEV}/1{,}000)^{-0.454}$	39	32.1

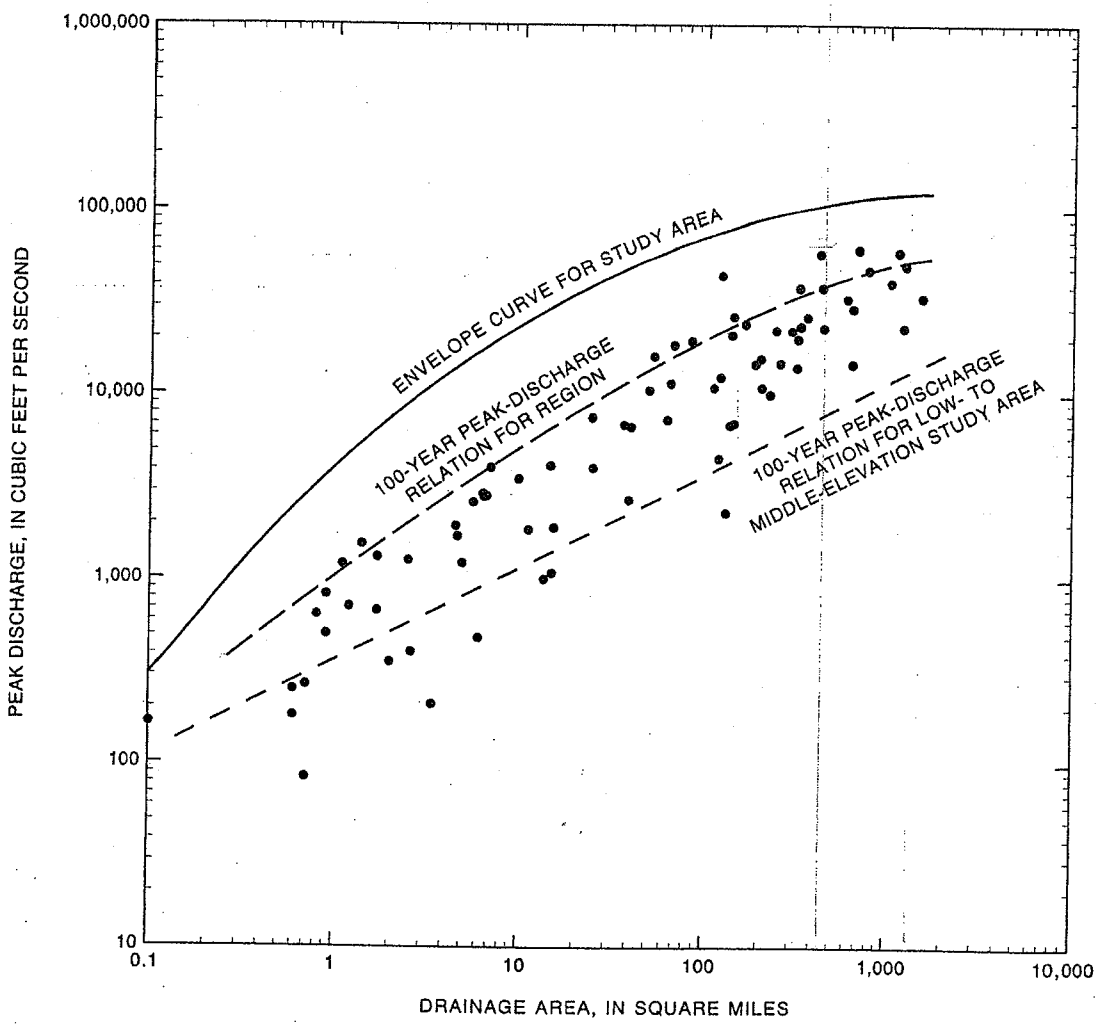

Figure 41. Relations between 100-year peak discharge and drainage area and plot of maximum peak discharge of record and drainage area for gaged sites in the Central Arizona Region 12.

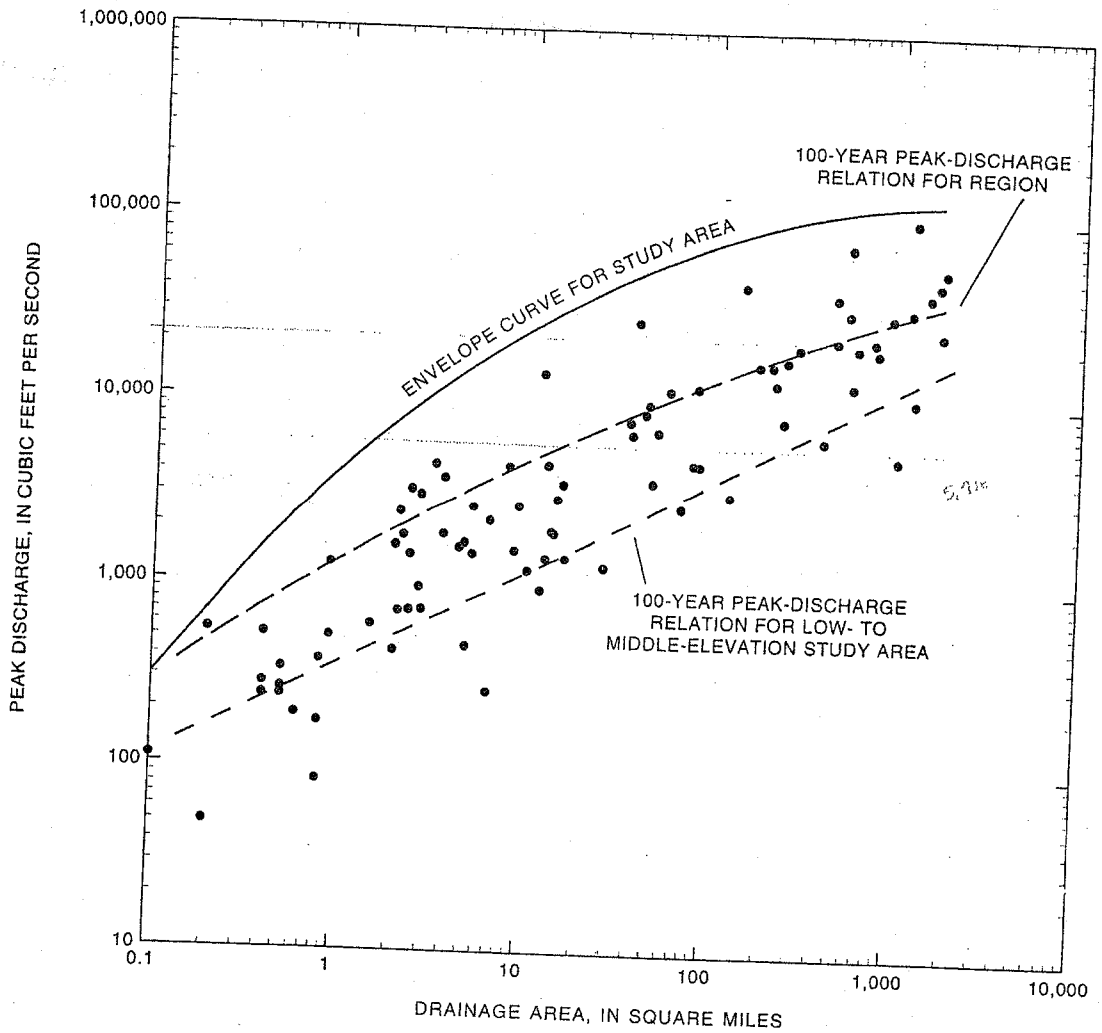

Figure 42. Relations between 100-year peak discharge and drainage area and plot of maximum peak discharge of record and drainage area for gaged sites in the Southern Arizona Region 13.

Table 17. Generalized least-squares regression equations for estimating regional flood-frequency relations for the Southern Arizona Region 13

Equation: Q, peak discharge, in cubic feet per second; and AREA, drainage area, in square miles. Data were based on 73 stations. Average number of years of systematic record is 21.

Recurrence interval, in years	Equation	Average standard error of prediction, in percent	Equivalent years of record
2	$Q=10^{(6.38-4.29AREA^{-0.06})}$	57	2.0
5	$Q=10^{(5.78-3.31AREA^{-0.08})}$	40	6.25
10	$Q=10^{(5.68-3.02AREA^{-0.09})}$	37	11.1
25	$Q=10^{(5.64-2.78AREA^{-0.10})}$	39	15.0
50	$Q=10^{(5.57-2.59AREA^{-0.11})}$	43	15.9
100	$Q=10^{(5.52-2.42AREA^{-0.12})}$	48	16.1

Notes:

Not shown in Figure 8.3

Not shown in Figure 8.4

Not shown in Figure 8.3 and Figure 8.4

Region 12

Mean, mean basin elevation = 5011 but used = 6,000

$Q_{100} = 10^{(6.55-3.17*A^{-.11})}(Elev/1000)^{-.454}$

Region 13

$Q_{100} = 10^{(5.52-2.42*A^{-.12})}$

	Gage No.	Flood Region	Drainage Area sq. miles	Mean Basin Elevation feet	LP3 Q100 cfs	Q Max cfs	100-yr Peak Discharge Relation cfs
43	9504800	12	0.0	3,570	61	53	48
22	9496700	12	0.1	5,240	168	120	75
21	9496600	12	0.1	5,390	326	165	130
7	9424700	12	0.6	3,470	993	250	737
51	9505900	12	0.6	3,540	619	180	737
27	9498600	12	0.7	6,080	348	265	756
37	9503740	12	0.8	5,180	220	84	841
10	9468300	12	0.8	4,410	1,690	640	914
40	9504100	12	0.9	7,050	561	500	932
66	9512420	12	1.0	5,900	2,910	800	1,020
68	9512700	12	1.1	2,140	1,730	1,200	1,123
41	9504400	12	1.2	6,880	1,430	705	1,189
45	9505220	12	1.4	7,190	1,640	1,430	1,386
4	9424430	12	1.7	3,520	2,610	1,310	1,609
64	9512200	12	1.8	1,730	3,220	670	1,644
3	9424410	12	2.0	3,700	1,090	353	1,811
23	9496800	12	2.6	5,810	2,850	1,260	2,172
60	9510170	12	2.6	3,520	950	402	2,203
49	9505600	12	3.4	7,140	573	210	2,678
58	9510100	12	4.5	5,760	2,670	1,940	3,232
56	9510070	12	4.6	5,430	5,530	1,700	3,276
53	9507700	12	4.8	6,980	2,480	1,220	3,377
79	9515800	12	5.6	2,690	7,450	2,600	3,736
33	9502700	12	6.0	5,970	6,250	480	3,929
81	9516600	12	6.3	2,290	5,330	2,900	4,057
30	9498900	12	6.4	4,590	4,070	2,820	4,111
52	9507600	12	6.4	6,430	8,600	2,800	4,111
6	9424480	12	7.0	4,680	4,250	4,000	4,321
57	9510080	12	9.8	5,260	8,030	3,480	5,377
72	9513820	12	11.1	1,980	6,070	1,850	5,809
2	9424407	12	13.5	4,610	3,130	1,000	6,545
38	9503750	12	14.5	5,310	9,820	4,100	6,832
36	9503720	12	14.9	7,110	3,860	1,080	6,944
61	9510180	12	15.2	3,680	5,790	1,900	7,027
32	9501300	12	24.3	2,960	13,900	7,500	9,225
47	9505300	12	24.6	6,560	6,290	4,000	9,290
35	9503000	12	36.3	5,900	7,310	6,660	11,518
55	9508300	12	36.4	4,810	18,500	6,830	11,535
16	9492400	12	38.8	8,580	1,700	2,700	11,939
46	9505250	12	48.0	5,910	10,900	10,500	13,366
59	9510150	12	52.3	4,260	42,700	16,100	13,978

Notes:

Not shown in Figure 8.3

Not shown in Figure 8.4

Not shown in Figure 8.3 and Figure 8.4

Region 12

Mean, mean basin elevation = 5011 but used = 6,000

$Q_{100} = 10^{(6.55-3.17*A^{-.11})}(Elev/1000)^{-.454}$

Region 13

$Q_{100} = 10^{(5.52-2.42*A^{-.12})}$

	Gage No.	Flood Region	Drainage Area sq. miles	Mean Basin Elevation feet	LP3 Q100 cfs	Q Max cfs	100-yr Peak Discharge Relation cfs
25	9497900	12	62.1	6,030	25,300	7,290	15,270
74	9513860	12	64.6	2,180	31,000	11,500	15,579
70	9513780	12	67.3	3,970	34,600	18,600	15,906
71	9513800	12	83.3	3,600	37,500	19,500	17,694
5	9424470	12	109.0	0	0	1,000	20,166
44	9505200	12	111.0	6,410	16,100	10,900	20,343
14	9489700	12	119.0	7,920	6,040	4,510	21,028
65	9512300	12	121.0	3,470	20,000	12,400	21,195
29	9498870	12	122.0	4,390	35,400	44,400	21,278
39	9503800	12	124.0	7,620	6,890	2,300	21,442
82	9516800	12	137.0	2,260	32,900	6,840	22,471
63	9512100	12	139.0	1,780	16,800	21,000	22,623
48	9505350	12	142.0	6,220	38,200	26,600	22,850
1	9424200	12	143.0	5,350	11,700	7,000	22,924
62	9510200	12	164.0	3,820	51,400	24,200	24,421
73	9513835	12	185.0	2,700	41,800	14,600	25,798
26	9497980	12	200.0	5,600	27,000	15,700	26,720
19	9496000	12	203.0	6,370	33,200	10,900	26,898
18	9494300	12	225.0	6,370	11,300	10,000	28,159
50	9505800	12	241.0	6,680	30,000	22,400	29,025
34	9502800	12	255.0	5,120	29,200	14,800	29,751
24	9497800	12	295.0	5,700	21,800	22,200	31,689
12	9489100	12	315.0	8,700	20,500	14,000	32,591
75	9513890	12	317.0	2,320	75,100	20,000	32,679
76	9513910	12	323.0	2,130	47,100	38,000	32,941
54	9507980	12	328.0	5,140	52,800	23,500	33,156
42	9504500	12	355.0	6,200	43,700	26,400	34,284
78	9515500	12	417.0	4,750	43,000	58,000	36,665
28	9498800	12	430.0	5,810	95,500	38,000	37,133
20	9496500	12	439.0	6,320	36,400	23,000	37,451
13	[redacted]	12	560.0	8,000	28,100	17,900	41,338
67	9512500	12	585.0	5,000	31,700	33,100	42,065
17	9494000	12	632.0	7,400	17,600	14,600	43,375
77	9513970	12	633.0	0	0	29,300	43,402
31	9499000	12	675.0	5,020	101,000	61,400	44,513
80	9516500	12	796.0	3,190	43,900	47,500	47,459
11	9468500	12	1,026.0	4,480	54,500	40,600	52,261
69	9512800	12	1,110.0	4,770	182,000	[redacted]	53,817
8	9424900	12	1,128.0	4,010	37,900	23,100	54,139
15	9490500	12	1,232.0	7,200	97,900	50,000	55,929
9	9425500	12	1,439.0	3,650	69,600	33,600	59,182

Notes:

Not shown in Figure 8.3

Not shown in Figure 8.4

Not shown in Figure 8.3 and Figure 8.4

Region 12

Mean, mean basin elevation = 5011 but used = 6,000

$Q_{100} = 10^{(5.55-3.17*A^{-.11})}(Elev/1000)^{-.454}$

Region 13

$Q_{100} = 10^{(5.52-2.42*A^{-.12})}$

	Gage No.	Flood Region	Drainage Area sq. miles	Mean Basin Elevation feet	LP3 Q100 cfs	Q Max cfs	100-yr Peak Discharge Relation cfs
	9471185	13	0.0		38	31	
173	9520350	13	0.1		263	117	
123	9481800	13	0.2		229	110	303
142	9485100	13	0.2		336	49	336
	9471087	13	0.2		766	541	415
116	9478600	13	0.4		417	280	621
166	9520110	13	0.4		327	240	707
151	9487140	13	0.5		987	520	719
129	9483040	13	0.5		627	238	731
117	9479200	13	0.5		431	262	788
178	9536350	13	0.7		413	191	937
177	9536100	13	0.8		589	173	1,045
100	9428545	13	0.8		296	84	1,054
107	9471600	13	0.8		385	375	1,073
125	9482330	13	0.8		560	337	1,092
	9471170	13	0.9		2,020	1,270	1,146
172	9520300	13	0.9		710	510	1,173
171	9520230	13	1.5		2,130	590	1,633
174	9520400	13	2.0		3,930	1,590	1,958
131	9483200	13	2.0		793	430	1,988
128	9483030	13	2.1		7,390	2,420	2,030
145	9485950	13	2.2		1,090	705	2,053
168	9520160	13	2.2		1,620	1,800	2,070
110	9472400	13	2.4		6,960	3,200	2,195
161	9519600	13	2.4		1,670	1,430	2,211
153	9487400	13	2.4		1,300	715	2,216
108	9471700	13	2.7		2,270	950	2,360
158	9517200	13	2.8		1,240	720	2,401
127	9482480	13	2.9		4,460	3,000	2,476
	9471120	13	3.2		8,470	4,390	2,592
124	9481900	13	3.6		8,050	1,840	2,785
112	9473200	13	3.6		7,490	3,700	2,798
113	9473600	13	4.4		1,460	1,570	3,108
167	9520130	13	4.7		2,380	1,670	3,245
144	9485900	13	4.9		652	460	3,324
	9471195	13	5.2		11,800	2,590	3,430
104	9470900	13	5.3		2,140	1,460	3,441
	9471080	13	6.4		3,080	2,220	3,837
135	9484510	13	6.5		329	260	3,850
109	9472100	13	8.0		4,410	4,340	4,315
165	9520100	13	8.7		5,220	1,530	4,501

Notes:

Not shown in Figure 8.3

Not shown in Figure 8.4

Not shown in Figure 8.3 and Figure 8.4

Region 12

Mean, mean basin elevation = 5011 but used = 6,000

$Q_{100} = 10^{(6.55-3.17*A^{-.11})}(Elev/1000)^{-.454}$

Region 13

$Q_{100} = 10^{(5.52-2.42*A^{-.12})}$

	Gage No.	Flood Region	Drainage Area sq. miles	Mean Basin Elevation feet	LP3 Q100 cfs	Q Max cfs	100-yr Peak Discharge Relation cfs
	9471090	13	9.1		7,490	2,640	4,609
121	9481700	13	10.3		2,540	1,200	4,906
150	9487100	13	11.9		4,400	13,800	5,274
170	9520200	13	12.1		1,490	940	5,318
155	9488600	13	12.8		3,340	1,400	5,468
164	9519780	13	12.9		27,600	4,430	5,489
138	9484580	13	14.1		4,480	1,900	5,733
101	9428550	13	14.6		6,170	2,920	5,831
102	9428800	13	14.6		5,650	1,950	5,831
114	9478200	13	15.6		5,710	3,500	6,021
133	9484200	13	16.3		1,850	1,400	6,149
126	9482420	13	26.5		2,310	1,270	7,706
132	9484000	13	35.5		10,400	7,730	8,773
	9471140	13	36.7		8,030	6,590	8,901
137	9484570	13	38.4		15,400	27,000	9,077
130	9483100	13	43.0		12,300	8,600	9,528
141	9485000	13	44.8		17,100	9,660	9,696
160	9517400	13	47.8		4,560	3,640	9,965
139	9484590	13	50.5		9,340	6,860	10,197
	9471200	13	57.7		14,000	11,500	10,776
162	9519750	13	68.8		12,600	2,670	11,575
179	9537200	13	79.1		9,880	4,600	12,238
118	9480000	13	82.2		11,200	12,000	12,425
159	9517280	13	85.2		6,910	4,550	12,601
163	9519760	13	116.0		11,400	3,150	14,191
115	9478500	13	144.0		46,100	42,900	15,384
122	9481750	13	176.0		17,100	16,000	16,549
120	9481500	13	209.0		15,100	16,000	17,593
134	9484500	13	219.0		29,100	12,700	17,884
169	9520170	13	243.0		11,800	8,030	18,543
147	9486300	13	250.0		23,900	17,000	18,726
136	9484560	13	289.0		18,500	20,000	19,677
156	9514200	13	420.0		7,840	6,300	22,271
140	9484600	13	457.0		35,000	38,000	22,885
148	9486800	13	465.0		23,600	22,000	23,013
119	9480500	13	533.0		23,600	31,000	24,031
111	9473000	13	537.0		28,200	70,800	24,088
175	9535100	13	569.0		15,200	12,500	24,529
143	9485500	13	602.0		22,600	20,000	24,963
103	9470500	13	737.0		21,500	22,000	26,560
149	9487000	13	776.0		19,500	19,100	26,977

Notes:

Not shown in Figure 8.3

Not shown in Figure 8.4

Not shown in Figure 8.3 and Figure 8.4

Region 12

Mean, mean basin elevation = 5011 but used = 6,000

$Q_{100} = 10^{(6.55-3.17*A^{-.11})}(Elev/1000)^{-.454}$

Region 13

$Q_{100} = 10^{(5.52-2.42*A^{-.12})}$

	Gage No.	Flood Region	Drainage Area sq. miles	Mean Basin Elevation feet	LP3 Q100 cfs	Q Max cfs	100-yr Peak Discharge Relation cfs
146	9486000	13	918.0		27,700	29,700	28,362
180	9537500	13	1,023.0		5,750	5,060	29,276
152	9487250	13	1,170.0		12,500	32,000	30,433
105	9471000	13	1,219.0		45,700	98,000	30,792
176	9535300	13	1,250.0		7,250	10,400	31,013
157	9517000	13	1,470.0		49,200	39,000	32,461
106	9471550	13	1,730.0		28,000	24,200	33,953
154	9488500	13	1,782.0		29,000	53,100	34,228

Station number	Station name	Flood region	Latitude, in decimal degrees	Longitude, in decimal degrees	Years of record	Drainage area, in square miles	Mean basin elevation, in feet	Mean annual precipitation, in inches	Mean annual evaporation, in inches
09399250	Jacks Canyon Tributary No. 2 near Winslow, Ariz.	11	34.765	111.012	14	31.80	6,530	19.2	53.8
09400100	Ganado Wash Tributary near Ganado, Ariz.	11	35.711	109.497	14	11.10	6,770	11.8	51.4
09400200	Steamboat Wash Tributary near Ganado, Ariz.	11	35.764	109.800	12	0.32	6,750	12.1	53.8
09400290	Teshbito Wash Tributary near Holbrook, Ariz.	11	35.481	110.087	14	16.40	6,420	8.2	54.0
09400300	Teshbito Wash near Holbrook, Ariz.	11	35.449	110.068	14	57.40	6,280	9.2	53.7
09400530	Cow Canyon near Winslow, Ariz.	11	35.100	110.987	15	3.53	--	10.0	55.5
09400560	Oraibi Wash Tributary near Oraibi, Ariz.	11	35.872	110.556	14	1.78	6,020	10.2	54.9
09400565	Polacca Wash Tributary near Chinle, Ariz.	11	36.047	110.081	13	6.17	6,890	12.3	55.0
09400580	Castle Butte Wash near Winslow, Ariz.	11	35.325	110.422	13	5.53	5,820	8.6	55.0
09400590	Rio de Flag at Hidden Hollow Road at Flagstaff, Ariz.	11	35.242	111.684	13	31.50	8,130	25.4	44.2
09400595	Schultz Canyon at Flagstaff, Ariz.	11	35.227	111.658	11	6.09	8,060	21.9	44.1
09400600	Rio de Flag at Flagstaff, Ariz.	11	35.222	111.657	18	51.00	8,050	25.3	44.1
09400650	Sinclair Wash at Flagstaff, Ariz.	11	35.164	111.680	11	8.16	7,200	22.5	44.2
09400655	Rio de Flag at 140 at Flagstaff, Ariz.	11	35.184	111.632	13	82.40	7,840	20.0	44.1
09400680	Switzer Canyon at Flagstaff, Ariz.	11	35.212	111.639	12	1.87	7,130	19.9	44.1
09400730	Lockett Fanning Diversion at Flagstaff, Ariz.	11	35.222	111.599	12	1.05	8,020	20.0	44.1
09400910	Fay Canyon near Flagstaff, Ariz.	11	35.135	111.630	16	2.76	7,000	19.6	44.2
09401210	Slate Mountain Wash near Flagstaff, Ariz.	11	35.515	111.835	14	5.43	7,350	19.7	51.0
09401220	Cedar Wash near Cameron, Ariz.	11	35.859	111.442	10	556.00	6,430	13.7	55.3
09401245	Klethla Valley Tributary near Kayenta, Ariz.	11	36.498	110.621	15	0.77	6,730	10.2	54.4
09401300	Hamblin Wash Tributary near Cedar Ridge, Ariz.	11	36.349	111.504	14	0.10	5,860	7.6	55.0
09401370	Hamblin Wash Tributary No. 2 near Tuba City, Ariz.	11	36.055	111.393	13	2.16	4,670	6.0	55.0
09402100	Forest Boundary Wash near Cameron, Ariz.	11	35.924	111.737	14	0.72	6,810	11.9	55.3
09403930	West Cataract Creek near Williams, Ariz.	11	35.248	112.224	13	3.18	7,190	23.5	49.6
09404050	Spring Valley Wash Tributary, near Williams, Ariz.	11	35.574	112.153	14	3.93	6,750	12.2	52.2
09424200	Cottonwood Wash No.1 near Kingman, Ariz.	12	35.181	113.469	15	143.00	5,350	14.0	53.9
09424407	McGarrys Wash near Kingman, Ariz.	12	35.117	113.650	12	13.50	4,610	12.0	60.5
09424410	Big Sandy River Tributary near Kingman, Ariz.	12	35.092	113.658	16	1.99	3,700	12.0	61.0
09424430	Kaiser Spring Canyon Tributary near Wikieup, Ariz.	12	34.572	113.478	16	1.70	3,520	11.2	60.9
09424470	Kirkland Creek near Kirkland, Ariz.	12	34.394	112.722	10	109.00	--	--	54.6
09424480	Ash Creek near Kirkland, Ariz.	12	34.453	112.796	16	6.95	4,680	10.4	54.7

Station number	Relation characteristic L	H	D	O	U	Peak discharge (cubic feet per second) for indicated recurrence interval (years): 2	5	10	25	50	100	Maximum peak discharge of record (cubic feet per second)
09399250	-	-	-	-	1	----	----	----	----	----	----	9,330
09400100	1	1	0	0	0	222	902	1,750	2,970	4,490	5,810	1,680
						238	533	820	1,310	1,780	2,350	
						234	528	846	1,450	2,000	2,400	383
09400200	-	-	-	-	1	----	----	----	----	----	----	
09400290	0	0	1	0	0	13	69	160	272	375	403	890
						369	873	1,310	1,970	2,510	3,090	
						362	831	1,290	2,050	2,770	3,170	1,580
09400300	1	0	1	0	0	652	1,050	1,340	1,730	2,040	2,350	
						642	1,080	1,600	2,990	3,680	2,850	253
09400530	1	0	0	0	0	64	128	182	261	327	400	
						64	149	279	660	758	507	383
09400560	-	-	-	-	1	----	----	----	----	----	----	
09400565	1	0	1	0	0	37	180	407	692	989	1,140	1,130
						361	708	995	1,410	1,770	2,150	
						352	647	939	1,360	1,840	2,170	860
09400580	1	0	0	0	0	85	288	540	1,040	1,590	2,320	
						85	297	591	1,160	1,690	2,310	153
09400590	-	-	-	-	1	----	----	----	----	----	----	
09400595	-	-	-	-	1	221	897	1,170	2,000	3,020	3,900	48
						----	----	----	----	----	----	
09400600	0	0	0	0	0	80	358	497	845	1,240	1,500	240
						17	74	158	349	580	910	
						24	222	433	1,420	1,700	1,200	401
09400650	1	0	0	0	0	73	167	261	424	583	780	
						74	218	356	768	981	887	421
09400655	-	-	-	-	1	----	----	----	----	----	----	
09400680	0	0	1	0	0	401	1,540	1,930	3,280	5,060	6,780	135
						38	96	152	245	331	430	
						38	112	185	370	471	462	85
09400730	-	-	-	-	1	----	----	----	----	----	----	
09400910	0	0	0	0	0	27	134	199	338	478	539	87
						9	26	47	88	132	190	
						10	57	111	333	380	248	88
09401210	-	-	-	-	1	----	----	----	----	----	----	
09401220	1	0	0	0	0	74	335	628	1,070	1,560	1,880	10,400
						1,500	4,550	8,070	14,800	21,900	31,000	
						1,490	4,540	8,110	14,200	22,100	31,100	290
09401245	1	0	0	0	0	121	193	244	313	366	421	
						118	180	247	380	461	442	110
09401300	-	-	-	-	1	----	----	----	----	----	----	
09401370	-	-	-	-	1	6	36	91	155	209	214	350
						----	----	----	----	----	----	
09402100	-	-	-	-	1	42	200	452	768	1,100	1,280	115
						----	----	----	----	----	----	
09403930	0	0	1	0	0	21	108	258	438	614	682	151
						26	96	183	350	524	744	
						27	123	253	584	763	795	190
09404050	1	0	0	0	0	18	61	114	217	326	465	
						19	97	224	618	741	565	7,000
09424200	1	0	1	0	0	3,680	5,860	7,320	9,140	10,500	11,800	
						3,640	5,650	7,090	10,300	14,800	20,200	1,000
09424407	-	-	-	-	1	----	----	----	----	----	----	
09424410	1	0	0	0	0	211	823	1,460	2,700	4,810	7,380	353
						18	80	174	399	686	1,120	
						19	97	251	653	1,170	1,880	1,310
09424430	-	-	-	-	1	----	----	----	----	----	----	
09424470	-	-	-	-	1	57	218	412	813	1,330	2,050	1,000
						----	----	----	----	----	----	
09424480	0	0	0	0	0	786	----	----	----	----	----	4,000
						132	457	887	1,820	2,900	4,430	
						132	464	900	1,790	3,040	4,700	

Station number	Station name	Flood region	Latitude, in decimal degrees	Longitude, in decimal degrees	Years of record	Drainage area, in square miles	Mean basin elevation, in feet	Mean annual precipitation, in inches	Mean annual evaporation, in inches
09424700	Iron Spring Wash Tributary near Bagdad, Ariz.	12	34.522	113.112	15	0.64	3,470	12.1	54.8
09424900	Santa Maria River near Bagdad, Ariz.	12	34.306	113.346	19	1,210.00	4,010	14.0	62.6
09425500	Santa Maria River near Alamo, Ariz.	12	34.300	113.517	28	1,520.00	3,650	14.4	63.3
09468300	Sevenmile Wash Tributary near Globe, Ariz.	12	33.586	110.650	16	0.83	4,410	19.0	53.1
09468500	San Carlos River near Peridot, Ariz.	12	33.296	110.451	57	1,027.00	4,480	17.2	58.2
09489100	Black River near Maverick, Ariz.	12	33.707	109.447	20	315.00	8,700	27.2	40.4
09489499	Black River above Willow Creek Diversion near Point of Pines, Ariz.	12	33.481	109.752	33	560.00	8,000	25.3	44.1
09489700	Big Bonito Creek near Fort Apache, Ariz.	12	33.667	109.846	24	119.00	7,920	27.9	44.4
09490500	Black River near Fort Apache, Ariz.	12	33.713	110.211	30	1,232.00	7,200	23.4	47.9
09492400	East Fork White River near Fort Apache, Ariz.	12	33.822	109.814	28	38.80	8,580	31.2	40.7
09494000	White River near Fort Apache, Ariz.	12	33.736	110.166	29	632.00	7,400	25.4	47.3
09[illegible]00	Carrizo Creek above Corduroy Creek near Show Low, Ariz.	12	34.000	110.289	14	225.00	6,370	22.5	44.7
09[illegible]0	Corduroy Creek near Mouth Near Show Low, Ariz.	12	34.018	110.242	24	203.00	6,370	21.7	44.0
09[illegible]500	Carrizo Creek near Show Low, Ariz.	12	33.985	110.280	36	439.00	6,320	22.0	44.7
09[illegible]00	Cibecue 1 Tributary to Carrizo Creek near Show Low, Ariz.	12	33.991	110.324	14	0.10	5,390	18.0	44.6
09[illegible]0	Cibecue 2 Tributary to Carrizo Creek near Show Low, Ariz.	12	33.988	110.311	14	0.06	5,240	18.0	44.7
09496800	Carrizo Creek Tributary near Show Low, Ariz.	12	33.954	110.331	14	2.55	5,810	20.0	44.6
09497800	Cibecue Creek near Chrysotile, Ariz.	12	33.843	110.557	28	295.00	5,700	20.7	45.7
09497900	Cherry Creek near Young, Ariz.	12	34.083	110.924	16	62.10	6,030	24.8	44.5
09497980	Cherry Creek near Globe, Ariz.	12	33.828	110.856	21	200.00	5,600	24.0	47.5
09498600	Cristopher Creek Tributary near Kohl's Ranch, Ariz.	12	34.322	111.067	11	0.66	6,080	29.0	45.0
09498800	Tonto Creek near Gisela, Ariz.	12	34.129	111.255	11	430.00	5,810	24.7	46.2
09498870	Rye Creek near Gisela, Ariz.	12	34.033	111.292	20	122.00	4,390	24.2	54.5
09498900	Gold Creek near Payson, Ariz.	12	34.003	111.358	15	6.44	4,590	21.0	57.1
09499000	Tonto Creek above Gun Creek, near Roosevelt, Ariz.	12	33.980	111.303	46	675.00	5,020	23.9	57.3
09501300	Tortilla Creek at Tortilla Flat, Ariz.	12	33.527	111.387	18	24.30	2,690	15.0	65.0
09502700	Crookton Wash near Seligman, Ariz.	12	35.287	112.732	17	6.00	5,970	15.5	52.7
09502800	Williamson Valley Wash near Paulden, Ariz.	12	34.867	112.612	21	255.00	5,120	17.3	52.2
0[illegible]00	Granite Creek near Prescott, Ariz.	12	34.567	112.450	16	39.60	5,900	22.1	54.0
0[illegible]20	Hell Canyon near Williams, Ariz.	12	35.160	112.210	13	14.90	7,110	24.1	46.9
09503740	Hell Canyon Tributary near Ash Fork, Ariz.	12	35.084	112.408	10	0.75	5,180	17.2	50.4

Station number	Relation characteristic L	H	D	O	U	Peak discharge (cubic feet per second) for indicated recurrence interval (years): 2	5	10	25	50	100	Maximum peak discharge of record (cubic feet per second)
09424700	0	0	0	0	0	12	63	147	357	629	1,040	180
						13	69	168	403	631	975	
09424900	1	0	1	0	0	7,310	13,800	18,800	25,600	31,100	36,700	23,100
						7,270	14,300	21,600	36,600	44,600	55,600	
09425500	1	0	1	0	0	3,250	9,860	17,600	32,900	49,200	70,800	33,600
						3,260	10,700	21,000	42,600	55,500	73,400	
09468300	1	0	0	0	0	27	134	299	686	1,150	1,820	640
						27	133	281	575	864	1,310	
09468500	1	0	0	0	0	7,440	15,200	22,300	33,700	44,100	56,200	40,600
						7,420	15,200	22,600	35,600	45,300	57,500	
09489100	0	0	1	0	0	1,600	3,840	6,260	10,800	15,500	21,700	14,000
						1,600	4,000	6,930	13,000	18,500	25,300	
09489499	0	0	0	0	0	2,210	5,390	8,700	14,600	20,600	28,100	17,900
						2,210	5,570	9,500	17,500	24,000	32,100	
09489700	0	0	0	0	0	622	1,430	2,220	3,550	4,820	6,340	4,510
						624	1,550	2,780	5,730	9,280	13,300	
09490500	0	0	1	0	0	6,860	19,800	33,500	57,800	81,500	110,000	50,000
						6,840	19,500	31,900	50,900	62,600	79,800	
09492400	0	1	0	1	0	274	508	720	1,070	1,390	1,790	2,700
						275	562	1,010	2,270	4,110	6,260	
09494000	0	0	0	0	0	3,400	6,100	8,390	11,900	15,000	18,600	14,00
						3,390	6,330	9,620	17,100	22,700	29,500	
09494300	-	-	-	-	1	----	----	----	----	----	----	10,000
						1,240	5,070	8,220	14,100	20,100	27,400	
09496000	1	0	1	0	0	1,050	3,630	7,060	14,500	23,300	35,800	10,900
						1,050	3,710	7,190	13,900	21,000	30,300	
09496500	1	0	0	0	0	3,190	7,430	11,900	20,000	28,400	39,100	23,000
						3,180	7,460	12,000	20,500	28,200	37,900	
09496600	0	0	0	0	0	44	92	134	200	259	326	165
						43	84	109	152	157	193	
09496700	1	0	0	0	0	43	69	89	118	142	168	120
						42	63	74	102	95	112	
09496800	0	0	0	0	0	283	657	1030	1,670	2,290	3,050	1,260
						280	607	849	1,220	1,720	2,460	
09497800	1	1	0	0	0	4,360	8,010	11,000	15,200	18,800	22,700	22,200
						4,340	7,900	10,900	16,100	21,400	27,900	
09497900	0	0	0	0	0	1,380	3,110	4,710	7,290	9,620	12,300	7,290
						1,370	3,010	4,400	6,810	10,200	14,300	
09497980	1	0	0	0	0	2,190	5,320	8,520	14,200	19,800	26,800	15,700
						2,180	5,290	8,400	14,000	19,900	27,300	
09498600	0	1	0	0	0	30	69	111	188	269	374	265
						30	73	135	296	438	655	
09498800	0	0	0	0	0	4,810	11,300	18,300	31,600	45,700	64,400	38,000
						4,750	10,800	16,400	25,600	33,500	44,500	
09498870	0	1	0	0	0	2,980	6,250	9,570	15,500	21,500	29,300	44,400
						2,960	6,040	8,810	13,400	19,100	26,400	
09498900	1	0	0	0	0	310	792	1,300	2,230	3,160	4,330	2,800
						307	759	1,180	1,940	3,050	4,540	
09499000	0	0	1	0	0	11,400	26,400	40,100	62,000	81,600	104,000	61,400
						11,400	25,800	37,500	53,300	65,100	81,100	
09501300	1	0	1	0	0	1,940	4,290	6,290	9,270	11,800	14,500	7,500
						1,920	4,020	5,360	7,050	9,940	13,700	
09502700	1	0	0	0	0	7	86	313	1,240	3,020	6,700	480
						9	120	435	1,360	2,730	4,890	
09502800	0	0	0	0	0	1,300	4,070	7,400	14,000	21,000	30,300	14,800
						1,300	4,230	7,940	15,200	22,400	31,300	
09503000	1	1	0	0	0	837	1,850	2,790	4,350	5,780	7,470	6,660
						831	1,820	2,760	4,610	7,310	10,600	
09503720	-	-	-	-	1	----	----	----	----	----	----	1,080
						225	754	1,310	2,440	4,220	6,430	
09503740	0	0	0	1	0	10	32	58	108	161	231	84
						11	44	115	307	483	740	

Station number	Station name	Flood region	Latitude, in decimal degrees	Longitude, in decimal degrees	Years of record	Drainage area, in square miles	Mean basin elevation, in feet	Mean annual precipitation, in inches	Mean annual evaporation, in inches
09503750	Limestone Canyon near Paulden, Ariz.	12	34.980	112.401	11	14.50	5,310	15.5	50.6
09503800	Volunteer Wash near Bellemont, Ariz.	12	35.151	111.898	14	131.00	7,620	25.7	44.0
09504100	Hull Canyon near Jerome, Ariz.	12	34.739	112.143	18	0.91	7,050	22.0	52.4
09504400	Munds Canyon Tributary near Sedona, Ariz.	12	34.922	111.644	16	1.19	6,880	26.0	44.2
09504500	Oak Creek near Cornville, Ariz.	12	34.766	111.890	45	357.0	6,200	22.6	51.9
09504800	Oak Creek Tributary near Cornville, Ariz.	12	34.712	111.881	15	0.04	3,570	12.4	52.8
09505200	Wet Beaver Creek near Rimrock, Ariz.	12	34.675	111.671	25	111.00	6,410	24.8	50.4
09505220	Rocky Gulch near Stoneman Lake, Ariz. (USFS)	12	34.747	111.494	24	1.40	7,190	25.0	44.3
09505250	Red Tank Draw near Rimrock, Ariz.	12	34.695	111.714	21	49.40	5,910	21.6	50.6
09505300	Rattlesnake Canyon near Rimrock, Ariz.	12	34.767	111.673	23	24.60	6,560	22.8	46.6
09505350	Dry Beaver Creek near Rimrock, Ariz.	12	34.729	111.775	26	142.00	6,220	23.1	51.3
09505600	Dirty Neck Canyon near Clints Well, Ariz.	12	34.512	111.358	12	3.42	7,140	26.0	44.0
09505800	West Clear Creek near Camp Verde, Ariz.	12	34.539	111.693	21	241.00	6,680	23.4	51.8
09505900	Cottonwood Wash near Camp Verde, Ariz.	12	34.506	111.753	14	0.64	3,540	14.5	53.1
09507600	East Verde River near Pine, Ariz.	12	34.392	111.268	13	6.65	6,430	30.0	44.6
09507700	Webber Creek above West Fork Webber Creek, near Pine, Ariz.	12	34.411	111.372	16	4.92	6,980	27.5	44.0
09507980	East Verde River near Childs, Ariz.	12	34.283	111.647	25	328.00	5,140	24.7	54.5
09508300	Wet Bottom Creek near Childs, Ariz.	12	34.161	111.692	19	36.40	4,810	25.0	57.8
09510070	West Fork Sycamore Creek above McFarland Creek, near Sunflower, Ariz.	12	33.961	111.487	14	4.58	5,430	24.5	58.0
09510080	West Fork Sycamore Creek near Sunflower, Ariz.	12	33.946	111.485	15	9.80	5,260	24.5	58.3
09510100	East Fork Sycamore Creek near Sunflower, Ariz.	12	33.949	111.461	23	4.49	5,760	24.5	58.2
09510150	Sycamore Creek near Sunflower, Ariz.	12	33.851	111.452	15	52.30	4,260	23.5	60.0
09510170	Camp Creek near Sunflower, Ariz.	12	33.760	111.496	17	2.60	3,520	20.0	63.1
09510180	Rock Creek near Sunflower, Ariz.	12	33.730	111.508	10	15.20	3,680	16.0	64.1
09510200	Sycamore Creek near Fort McDowell, Ariz.	12	33.694	111.541	27	164.00	3,820	21.2	65.0
09512100	Indian Bend Wash near Scottsdale, Ariz.	12	33.539	111.916	10	139.00	1,780	10.9	65.6
09512200	Salt River Tributary in South Mt Park, at Phoenix, Ariz.	12	33.347	112.084	26	1.75	1,730	9.0	65.6
09512300	Cave Creek near Cave Creek, Ariz.	12	33.783	112.007	28	121.00	3,470	15.7	62.2
09512420	Lynx Creek Tributary near Prescott, Ariz.	12	34.547	112.399	10	0.95	5,900	16.0	54.2
09512500	Agua Fria River near Mayer, Ariz.	12	34.315	112.063	47	588.00	5,000	16.7	60.9
09512700	Agua Fria River Tributary No 2 near Rock Springs, Ariz.	12	34.033	112.145	18	1.11	2,140	16.2	60.2

Station number	Relation characteristic L	H	D	O	U	Peak discharge (cubic feet per second) for indicated recurrence interval (years): 2	5	10	25	50	100	Maximum peak discharge of record (cubic feet per second)
09503750	1	0	1	0	0	273	901	1,710	3,420	5,400	8,170	4,100
						272	889	1,610	2,960	4,920	7,460	
09503800	0	0	0	0	0	353	1,160	2,060	3,700	5,310	7,260	2,300
						362	1,410	3,080	6,860	11,100	16,000	
09504100	1	1	0	0	0	2	23	67	189	351	597	500
						3	32	103	304	507	801	
09504400	0	0	0	0	0	73	232	413	749	1,090	1,510	705
						73	222	367	619	879	1,270	
09504500	0	0	1	0	0	5,000	12,000	18,300	28,300	36,900	46,600	26,400
						4,980	11,800	17,400	25,700	32,600	41,300	
09504800	-	-	-	-	1	----	----	----	----	----	----	53
						5	17	34	76	53	61	
09505200	1	0	0	0	0	3,280	6,450	8,820	12,000	14,400	16,800	10,900
						3,260	6,210	8,090	10,700	14,200	18,500	
09505220	0	1	0	0	0	45	152	297	629	1,040	1,640	1,550
						45	152	292	594	933	1,430	
09505250	1	1	0	0	0	717	1,850	3,110	5,520	8,080	11,500	10,500
						714	1,850	3,110	5,540	8,770	12,800	
09505300	1	0	0	0	0	865	1,880	2,760	4,100	5,240	6,510	4,000
						859	1,820	2,570	3,820	5,620	7,910	
09505350	1	0	0	0	0	4,850	10,500	15,700	23,700	30,900	39,000	26,600
						4,820	10,000	13,800	18,400	23,300	29,900	
09505600	-	-	-	-	1	----	----	----	----	----	----	210
						89	274	494	963	1,600	2,470	
09505800	1	0	0	0	0	4,850	9,830	14,000	20,400	25,800	31,700	22,400
						4,810	9,450	12,700	17,700	22,700	29,200	
09505900	0	0	0	0	0	23	75	142	282	441	663	250
						23	80	165	369	564	853	
09507600	0	0	0	0	0	282	948	1,830	3,760	6,060	9,360	2,820
						279	884	1,500	2,470	3,740	5,590	
09507700	0	0	0	0	0	88	289	549	1,110	1,750	2,670	1,220
						89	296	573	1,170	1,960	3,030	
09507980	0	0	0	0	0	3,200	9,330	16,300	29,600	43,600	61,500	23,500
						3,190	9,170	15,300	25,300	34,700	46,900	
09508300	1	0	1	0	0	1,730	4,650	7,530	12,300	16,600	21,600	6,830
						1,710	4,370	6,350	8,750	11,800	16,000	
09510070	0	0	0	0	0	35	267	717	1,950	3,630	6,210	1,700
						36	279	702	1,580	2,690	4,270	
09510080	1	0	0	0	0	99	516	1,210	3,000	5,350	9,000	3,480
						100	529	1,180	2,510	4,290	6,760	
09510100	0	0	0	0	0	37	188	446	1,140	2,100	3,660	1,940
						38	201	488	1,180	2,110	3,450	
09510150	0	0	0	0	0	1,030	4,020	8,270	18,000	29,800	47,000	16,100
						1,020	3,810	6,920	11,800	17,700	26,100	
09510170	0	0	0	0	0	116	261	394	603	790	1,000	402
						115	264	435	838	1,420	2,180	
09510180	0	0	1	0	0	497	1,340	2,170	3,550	4,820	6,280	1,900
						491	1,280	2,000	3,310	5,480	8,180	
09510200	0	0	0	0	0	2,270	7,590	14,000	26,700	40,200	57,800	24,200
						2,260	7,410	12,900	21,700	30,700	42,700	
09512100	1	0	0	0	0	375	1,440	2,960	6,500	10,900	17,400	21,000
						387	2,130	5,640	13,200	23,100	34,100	
09512200	0	0	0	0	0	19	184	531	1,500	2,790	4,740	670
						19	191	536	1,330	2,310	3,720	
09512300	1	0	0	0	0	1,730	4,310	6,910	11,400	15,600	20,700	12,400
						1,720	4,300	6,920	11,600	17,300	24,200	
09512420	-	-	-	-	1	----	----	----	----	----	----	820
						40	122	228	462	682	1,030	
09512500	1	0	0	0	0	5,850	10,200	13,900	19,300	24,000	29,300	33,100
						5,830	10,200	14,300	21,800	28,200	36,000	
09512700	1	0	1	0	0	307	564	785	1130	1,430	1,790	1,200
						304	529	681	942	1,290	1,830	

BASIN, CLIMATIC, AND FLOOD CHARACTERISTICS FOR STREAMFLOW-GAGING STATIONS IN THE SOUTHWESTERN UNITED STATES--Continued

Station number	Station name	Flood region	Latitude, in decimal degrees	Longitude, in decimal degrees	Years of record	Drainage area, in square miles	Mean basin elevation, in feet	Mean annual precipitation, in inches	Mean annual evaporation, in inches
09512800	Agua Fria River near Rock Springs, Ariz.	12	34.014	112.167	17	1,130.00	4,770	16.6	60.5
09513780	New River near Rock Springs, Ariz.	12	33.974	112.098	25	67.30	3,970	20.0	60.4
09513800	New River at New River, Ariz.	12	33.911	112.141	22	83.30	3,600	19.5	60.7
09513820	Deadman Wash near New River, Ariz.	12	33.842	112.144	20	11.10	1,980	11.0	62.3
09513835	New River at Bell Road, near Peoria, Ariz.	12	33.638	112.239	21	187.00	2,700	15.6	65.2
09513860	Skunk Creek near Phoenix, Ariz.	12	33.729	112.120	26	64.60	2,180	12.2	65.2
09513890	New River at Peoria, Ariz.	12	33.595	112.262	12	317.00	2,320	13.3	65.2
09513910	New River near Glendale, Ariz.	12	33.537	112.281	21	323.00	2,130	13.8	65.3
09513970	Agua Fria River at Avondale, Ariz.	12	33.435	112.333	23	633.00	--	16.3	65.3
09515500	Hassayampa River at Box Damsite near Wickenburg, Ariz.	12	34.045	112.709	38	417.00	4,750	19.3	58.6
09515800	Hartman Wash near Wickenburg, Ariz.	12	33.963	112.828	16	5.57	2,690	11.0	60.5
09516500	Hassayampa River near Morristown, Ariz.	12	33.885	112.661	30	774.00	3,190	16.9	60.8
09516600	Ox Wash near Morristown, Ariz.	12	33.883	112.650	17	6.31	2,290	12.2	60.7
09516800	Jack Rabbit Wash near Tonopah, Ariz.	12	33.659	112.828	16	137.00	2,260	9.2	61.4
09428545	Cunningham Wash Tributary near Wenden, Ariz.	13	34.007	113.578	13	0.77	2,330	8.1	65.2
09428550	Bouse Wash Tributary near Bouse, Ariz.	13	33.901	113.974	14	14.60	1,230	6.5	65.7
09428800	Tyson Wash Tributary near Quartzsite, Ariz.	13	33.512	114.217	14	13.70	1,520	6.0	75.1
09470500	San Pedro River at Palominas, Ariz.	13	31.380	110.111	48	741.00	4,950	17.9	65.2
09470900	San Pedro River Tributary near Bisbee, Ariz.	13	31.570	110.027	16	5.25	--	16.0	65.0
09471000	San Pedro River at Charleston, Ariz.	13	31.626	110.174	71	1,219.00	4,840	16.5	65.4
09471080	Walnut Gulch 63.010 near Tombstone, Ariz.: USDA	13	31.720	110.025	15	6.42	4,970	14.0	64.9
09471087	Walnut Gulch 63.111 near Tombstone, Ariz.: USDA	13	31.734	109.948	20	0.22	5,020	14.0	64.7
09471090	Walnut Gulch 63.009 near Tombstone, Ariz.: USDA	13	31.718	110.024	15	9.11	4,840	14.0	64.9
09471120	Walnut Gulch 63.011 near Tombstone, Ariz.: USDA	13	31.741	109.994	19	3.18	4,880	14.0	64.8
09471140	Walnut Gulch 63.006 near Tombstone, Ariz.: USDA	13	31.724	110.055	20	36.70	4,790	14.0	65.0
09471170	Agricultural Research Service Watershed W-IV Tombstone, Ariz.	13	31.739	110.044	24	0.87	4,550	14.0	64.9
09471185	Walnut Gulch 63.103 near Tombstone, Ariz.: USDA	13	31.742	110.054	19	0.01	4,500	14.0	64.9
09471195	Walnut Gulch 63.007 near Tombstone, Ariz.: USDA	13	31.733	110.097	16	5.22	4,480	14.0	65.0
09471200	Walnut Gulch near Fairbank, Ariz.	13	31.729	110.153	25	57.70	4,700	14.0	65.1
09471550	San Pedro River near Tombstone, Ariz.	13	31.751	110.201	20	1,740.00	4,820	16.2	65.5
09471600	Canary Wash near Benson, Ariz.	13	31.876	110.342	14	0.79	5,240	15.0	62.8

BASIN, CLIMATIC, AND FLOOD CHARACTERISTICS FOR STREAMFLOW-GAGING STATIONS IN THE SOUTHWESTERN UNITED STATES--Continued

Station number	Relation characteristic L	H	D	O	U	Peak discharge (cubic feet per second) for indicated recurrence interval (years): 2	5	10	25	50	100	Maximum peak discharge of record (cubic feet per second)
09512800	0	0	1	0	0	7,440	22,800	42,200	83,300	131,000	199,000	59,500
						7,390	22,200	38,100	62,900	80,000	108,000	
09513780	1	0	0	0	0	2,380	6,580	11,100	19,100	27,100	36,900	18,600
						2,360	6,300	9,780	14,400	19,800	26,900	
09513800	1	0	0	0	0	3,120	7,860	12,700	21,100	29,200	39,100	19,500
						3,100	7,490	11,100	15,800	21,500	29,100	
09513820	-	-	-	-	1	----	----	----	----	----	----	1,850
						187	974	1,790	3,300	6,160	9,610	
09513835	1	0	1	0	0	1,900	6,500	11,900	21,800	31,800	44,100	14,600
						1,890	6,460	11,500	19,800	28,900	40,000	
09513860	1	0	1	0	0	916	3,510	7,040	14,800	23,800	36,500	11,500
						913	3,490	6,750	12,700	20,200	30,000	
09513890	1	0	0	0	0	2,800	9,300	16,000	23,000	29,000	35,000	20,000
						2,780	9,290	15,800	24,600	34,600	46,100	
09513910	1	0	1	0	0	1,400	8,200	15,000	23,000	30,000	37,000	38,000
						1,400	8,320	15,300	24,800	35,000	46,500	
09513970	-	-	-	-	1	----	----	----	----	----	----	29,300
						2,376	----	----	----	----	----	
09515500	0	0	0	0	0	3,170	8,480	14,000	23,500	32,600	43,700	58,000
						3,160	8,490	14,000	23,400	31,900	42,400	
09515800	1	0	0	0	0	216	794	1,570	3,230	5,150	7,820	2,600
						215	767	1,410	2,530	4,070	6,190	
09516500	1	0	0	0	0	2,800	7,500	12,700	22,300	32,200	45,000	47,500
						2,800	7,960	14,700	28,900	40,200	54,100	
09516600	1	0	0	0	0	192	661	1,250	2,460	3,790	5,570	2,900
						191	658	1,230	2,320	3,930	6,040	
09516800	-	-	-	-	1	----	----	----	----	----	----	6,840
						907	5,220	8,950	15,300	24,600	35,000	
09428545	1	0	0	0	0	52	101	141	199	247	300	173
						68	150	254	420	553	717	
09428550	1	0	0	0	0	344	998	1,730	3,070	4,440	6,170	2,920
						398	1,090	1,860	3,170	4,410	5,990	
09428800	-	-	-	-	1	----	----	----	----	----	----	1,950
						517	1,250	1,970	3,160	4,250	5,650	
09470500	1	0	0	0	0	5,920	9,330	12,000	15,700	18,900	22,300	22,000
						5,630	9,030	11,700	15,800	19,400	23,400	
09470900	1	0	0	0	0	451	903	1,260	1,780	2,190	2,620	1,460
						415	863	1,240	1,850	2,390	3,030	
09471000	1	1	0	0	0	6,760	12,100	17,300	26,100	34,800	45,700	98,000
						6,540	11,800	16,600	24,800	32,900	42,900	
09471080	1	0	0	0	0	364	771	1,150	1,790	2,380	3,080	2,220
						360	793	1,230	1,970	2,640	3,470	
09471087	1	0	0	0	0	112	223	321	474	610	766	541
						98	196	266	380	483	609	
09471090	1	0	0	0	0	590	1,570	2,550	4,190	5,710	7,490	2,640
						544	1,410	2,150	3,380	4,550	6,000	
09471120	0	0	0	0	0	530	1,690	2,880	4,820	6,550	8,470	4,390
						464	1,420	2,150	3,340	4,450	5,770	
09471140	1	0	0	0	0	1,460	2,660	3,670	5,200	6,530	8,030	6,590
						1,320	2,500	3,480	5,120	6,620	8,420	
09471170	0	0	0	0	0	70	242	457	895	1,370	2,020	1,270
						78	248	445	805	1,170	1,670	
09471185	1	0	0	0	0	9	16	20	27	32	38	31
						9	15	19	25	29	33	
09471195	0	0	0	0	0	263	1,090	2,250	4,780	7,710	11,800	2,590
						276	997	1,820	3,400	5,150	7,600	
09471200	1	0	0	0	0	1,740	3,680	5,450	8,320	11,000	14,000	11,500
						1,610	3,430	4,950	7,500	9,900	12,700	
09471550	1	0	0	0	0	7,430	11,900	15,400	20,400	24,600	29,200	24,200
						6,760	11,200	14,800	20,600	25,600	31,300	
09471600	-	-	-	-	1	----	----	----	----	----	----	84
						107	255	394	622	817	1,070	

Station number	Station name	Flood region	Latitude, in decimal degrees	Longitude, in decimal degrees	Years of record	Drainage area, in square miles	Mean basin elevation, in feet	Mean annual precipitation, in inches	Mean annual evaporation, in inches
09471700	Fenner Wash near Benson, Ariz.	13	31.980	110.216	16	2.71	4,180	12.3	65.1
09472100	Peck Canyon Tributary near Redington, Ariz.	13	32.487	110.500	14	8.02	3,680	11.7	64.7
09472400	Mammoth Wash near Mammoth, Ariz.	13	32.676	110.685	14	2.40	3,700	13.8	70.6
09473000	Aravaipa Creek near Mammoth, Ariz.	13	32.844	110.619	36	541.00	4,530	16.2	65.0
09473200	Green Lantern Wash near Winkelman, Ariz.	13	32.925	110.726	13	3.63	2,590	14.0	64.5
09473600	Tam O'Shanter Wash near Hayden, Ariz.	13	33.029	110.873	15	4.37	3,050	15.6	64.0
09478200	Durham Wash near Florence, Ariz.	13	32.722	111.108	19	15.60	3,670	12.1	64.9
09478500	Queen Creek at Whitlow Damsite near Superior, Ariz.	13	33.299	111.274	17	144.00	3,180	17.9	65.0
09478600	Queen Creek Tributary No 3 at Whitlow Dam, Ariz.	13	33.292	111.281	14	0.37	2,320	12.0	65.0
09479200	Queen Creek Tributary at Apache Junction, Ariz.	13	33.404	111.541	19	0.51	1,760	10.5	65.0
09480000	Santa Cruz River near Lochiel, Ariz.	13	31.355	110.589	38	82.20	5,150	18.2	60.3
09480500	Santa Cruz River near Nogales, Ariz.	13	31.344	110.851	56	533.00	4,850	18.7	61.0
09481500	Sonoita Creek near Patagonia, Ariz.	13	31.500	110.817	43	209.00	4,800	19.3	61.0
09481700	Calabasas Canyon near Nogales, Ariz.	13	31.457	110.986	14	10.30	4,360	15.8	63.1
09481750	Sopori Wash at Amado, Ariz.	13	31.724	111.061	19	176.00	3,840	15.5	65.0
09481800	Demetrie Wash Tributary near Continental, Ariz.	13	31.871	111.087	14	0.15	3,620	14.5	65.0
09481900	Ocotillo Wash near Continental, Ariz.	13	31.833	111.000	10	3.60	3,280	14.1	65.0
09482330	Pumping Wash near Vail, Ariz.	13	32.069	110.806	16	0.54	--	11.2	61.9
09482420	Julian Wash at Tucson, Ariz.	13	32.171	110.940	12	26.50	2,900	11.0	64.8
09482480	Big Wash at Tucson, Ariz.	13	32.186	111.002	17	2.75	2,850	11.0	65.0
09483030	Anklam Wash at Tucson, Ariz.	13	32.225	111.031	17	2.11	2,700	11.8	65.2
09483040	West Speedway Wash near Tucson, Ariz.	13	32.239	111.045	17	0.46	2,750	11.8	64.8
09483100	Tanque Verde Creek near Tucson, Ariz.	13	32.247	110.679	26	43.00	4,780	17.0	59.2
09483200	Agua Caliente Wash Tributary near Tucson, Ariz.	13	32.269	110.737	16	2.04	3,300	14.0	59.4
09484000	Sabino Creek near Tucson, Ariz.	13	32.317	110.810	55	35.50	6,300	22.6	59.7
09484200	Bear Creek near Tucson, Ariz.	13	32.306	110.801	15	16.30	5,860	20.6	59.7
09484500	Tanque Verde Creek at Tucson, Ariz.	13	32.265	110.841	22	219.00	4,340	16.7	60.1
09484510	Ventana Canyon Wash near Tucson, Ariz.	13	32.310	110.839	17	6.46	4,600	13.0	60.1
09484560	Cienega Creek near Pantano, Ariz.	13	31.986	110.566	14	289.00	4,890	16.6	59.8
09484570	Mescal Arroyo near Pantano, Ariz.	13	31.990	110.564	17	38.40	4,260	15.0	59.8
09484580	Barrel Canyon near Sonoita, Ariz.	13	31.862	110.690	15	14.10	5,000	16.0	65.2

Station number	Relation characteristic L	H	D	O	U	Peak discharge (cubic feet per second) for indicated recurrence interval (years): 2	5	10	25	50	100	Maximum peak discharge of record (cubic feet per second)
09471700	0	0	0	0	0	192	498	809	1,340	1,860	2,470	950
						199	507	818	1,340	1,820	2,420	
09472100	-	-	-	-	1	----	----	----	----	----	----	4,340
09472400	0	0	0	0	0	392	950	1,500	2,410	3,240	4,320	3,200
						162	750	1,580	3,350	5,320	7,950	
						174	671	1,220	2,260	3,370	4,870	
09473000	0	0	0	0	0	4,100	8,190	11,800	17,400	22,300	28,000	70,800
						3,920	7,870	11,200	16,500	21,200	26,800	
09473200	1	0	0	0	0	499	1,370	2,320	4,070	5,870	8,140	3,700
						426	1,130	1,700	2,730	3,800	5,190	
09473600	1	1	0	0	0	365	584	762	1,030	1,260	1,520	1,570
						343	615	899	1,390	1,810	2,340	
09478200	1	1	0	0	0	554	1,320	2,070	3,350	4,560	6,030	3,500
						554	1,320	2,080	3,360	4,540	6,030	
09478500	0	0	0	0	0	3,610	8,830	14,300	24,300	34,400	47,200	42,900
						3,100	7,420	10,900	17,100	23,500	31,700	
09478600	-	-	-	-	1	----	----	----	----	----	----	280
						67	157	238	371	479	621	
09479200	-	-	-	-	1	----	----	----	----	----	----	262
						82	194	296	464	604	788	
09480000	1	0	0	0	0	1,550	3,090	4,490	6,760	8,860	11,300	12,000
						1,510	3,060	4,480	6,860	9,030	11,600	
09480500	0	0	0	0	0	4,200	7,780	10,900	15,700	20,000	24,900	31,000
						4,070	7,600	10,600	15,400	19,700	24,700	
09481500	1	0	0	0	0	3,110	5,340	7,210	10,100	12,600	15,400	16,000
						2,960	5,190	7,060	10,100	12,800	16,000	
09481700	1	0	0	0	0	305	688	1,040	1,610	2,120	2,700	1,200
						346	809	1,330	2,200	2,950	3,880	
09481750	0	1	0	0	0	2,210	4,600	6,820	10,400	13,800	17,800	16,000
						2,100	4,430	6,550	10,000	13,300	17,200	
09481800	0	0	0	0	0	25	57	86	134	178	229	110
						29	65	103	163	211	269	
09481900	1	0	0	0	0	62	338	843	2,290	4,420	8,050	1,840
						132	446	912	1,850	2,990	4,800	
09482330	-	-	-	-	1	----	----	----	----	----	----	337
						85	201	307	482	629	821	
09482420	0	0	0	0	0	421	814	1,140	1,620	2,030	2,470	1,270
						515	1,120	1,890	3,130	4,180	5,470	
09482480	1	1	0	0	0	67	365	803	1,730	2,750	4,060	3,000
						105	410	816	1,550	2,290	3,240	
09483030	-	-	-	-	1	----	----	----	----	----	----	2,420
						190	459	718	1,150	1,530	2,030	
09483040	0	0	1	0	0	91	201	296	435	551	675	240
						87	196	288	434	556	702	
09483100	1	0	0	0	0	1,510	3,110	4,650	7,280	9,840	13,000	8,600
						1,400	2,920	4,270	6,590	8,840	11,700	
09483200	1	0	0	0	0	97	207	311	486	650	849	430
						120	275	472	795	1,070	1,420	
09484000	1	0	0	0	0	1,150	2,640	4,040	6,310	8,380	10,800	7,730
						1,120	2,570	3,880	6,020	7,990	10,300	
09484200	1	0	0	0	0	366	673	923	1,290	1,600	1,940	1,400
						420	874	1,440	2,370	3,150	4,120	
09484500	1	0	0	0	0	1,920	5,390	9,150	15,900	22,700	31,000	12,700
						1,910	5,140	8,300	13,700	18,900	25,500	
09484510	1	0	0	1	0	146	201	236	279	309	339	260
						197	375	672	1,160	1,560	2,050	
09484560	0	1	0	0	0	1,850	3,990	6,190	10,200	14,400	19,800	20,000
						1,930	4,220	6,700	10,900	14,800	19,700	
09484570	1	1	0	0	0	743	2,050	3,640	6,960	10,800	16,300	27,000
						771	2,050	3,470	6,100	8,890	12,800	
09484580	-	-	-	-	1	----	----	----	----	----	----	1,900
						525	1,260	2,000	3,210	4,310	5,730	

BASIN, CLIMATIC, AND FLOOD CHARACTERISTICS FOR STREAMFLOW-GAGING STATIONS IN THE SOUTHWESTERN UNITED STATES--Continued

Station number	Station name	Flood region	Latitude, in decimal degrees	Longitude, in decimal degrees	Years of record	Drainage area, in square miles	Mean basin elevation, in feet	Mean annual precipitation, in inches	Mean annual evaporation, in inches
09484590	Davidson Canyon Wash near Vail, Ariz.	13	31.994	110.644	14	50.50	4,340	14.9	63.1
09484600	Pantano Wash near Vail, Ariz.	13	32.036	110.677	28	457.00	4,500	15.4	61.7
09485000	Rincon Creek near Tucson, Ariz.	13	32.129	110.626	34	44.80	4,850	19.2	59.3
09485100	Saguaro Corners Wash near Tucson, Ariz.	13	32.170	110.737	10	0.17	3,040	12.0	58.6
09485500	Pantano Wash at Tucson, Ariz.	13	32.250	110.850	16	602.00	4,560	17.1	60.0
09485900	Pima Wash near Tucson, Ariz.	13	32.337	110.960	18	4.93	4,430	16.0	63.5
09485950	Geronimo Wash near Tucson, Ariz.	13	32.332	110.944	18	2.08	3,600	15.0	63.1
09486000	Rillito Creek near Tucson, Ariz.	13	32.295	110.984	67	918.00	4,400	15.5	64.5
09486300	Canada del Oro near Tucson, Ariz.	13	32.374	111.009	17	250.00	4,000	16.4	64.9
09486800	Altar Wash near Three Points, Ariz.	13	31.836	111.403	14	463.00	3,920	15.6	65.0
09487000	Brawley Wash near Three Points, Ariz.	13	32.076	111.337	15	776.00	3,710	14.6	65.0
487100	Little Brawley Wash near Three Points, Ariz.	13	32.124	111.329	14	11.90	2,800	13.0	65.0
9487140	San Joaquin Wash near Tucson, Ariz.	13	32.169	111.133	13	0.45	2,530	11.0	65.5
09487250	Los Robles Wash near Marana, Ariz.	13	32.438	111.304	13	1,170.00	3,350	11.8	65.0
487400	Quijotoa Wash Tributary near Quijotoa, Ariz.	13	32.174	112.108	13	2.44	2,800	10.1	65.0
09488500	Santa Rosa Wash near Vaiva Vo, Ariz.	13	32.667	111.927	19	1,782.00	2,340	10.2	65.0
09488600	Silver Reef Wash near Casa Grande, Ariz.	13	32.682	111.834	13	12.80	1,620	8.5	65.0
09514200	Waterman Wash near Buckeye, Ariz.	13	33.330	112.509	22	403.00	1,570	9.2	65.0
09517000	Hassayampa River near Arlington, Ariz.	13	33.347	112.725	23	1,470.00	3,010	15.9	64.4
09517200	Centennial Wash Tributary near Wenden, Ariz.	13	33.844	113.450	17	2.79	2,480	8.0	65.0
09517280	Tiger Wash near Aguila, Ariz.	13	33.742	113.279	17	85.20	2,590	9.6	64.0
09517400	Winters Wash near Tonopah, Ariz.	13	33.489	112.918	18	47.80	1,630	9.1	61.9
09519600	Rainbow Wash Tributary near Buckeye, Ariz.	13	33.243	112.637	17	2.43	--	7.6	65.9
09519750	Bender Wash near Gila Bend, Ariz.	13	32.907	112.551	17	68.80	1,900	8.5	69.8
09519760	Sauceda Wash near Gila Bend, Ariz.	13	32.871	112.758	17	126.00	1,980	8.2	75.9
09519780	Windmill Wash near Gila Bend, Ariz.	13	33.048	112.838	15	12.90	1,050	6.1	74.8
09520100	Military Wash near Sentinel, Ariz.	13	32.845	113.279	17	8.70	674	5.0	75.0
09520110	Hot Shot Arroyo near Ajo, Ariz.	13	32.347	112.809	16	0.44	1,760	8.1	64.1
9520130	Darby Arroyo near Ajo, Ariz.	13	32.355	112.825	16	4.72	1,920	8.1	64.2
09520160	Gibson Arroyo at Ajo, Ariz.	13	32.380	112.861	14	2.18	2,100	8.1	64.8
09520170	Rio Cornez near Ajo, Ariz.	13	32.499	112.881	14	243.00	1,950	8.4	68.2

BASIN, CLIMATIC, AND FLOOD CHARACTERISTICS FOR STREAMFLOW-GAGING STATIONS IN THE SOUTHWESTERN UNITED STATES--Continued

Station number	Relation characteristic L	H	D	O	U	Peak discharge (cubic feet per second) for indicated recurrence interval (years): 2	5	10	25	50	100	Maximum peak discharge of record (cubic feet per second)
09484590	-	-	-	-	1	----	----	----	----	----	----	6,860
						976	2,300	3,620	5,780	7,720	10,200	
09484600	0	1	1	0	0	3,120	7,800	12,400	20,300	27,600	36,400	38,000
						3,030	7,410	11,400	18,000	24,000	31,500	
09485000	0	0	0	0	0	956	2,760	4,830	8,860	13,100	18,800	9,660
						951	2,670	4,490	7,830	11,300	15,900	
09485100	-	-	-	-	1	----	----	----	----	----	----	49
						41	92	137	209	265	336	
09485500	0	0	0	0	0	1,710	4,610	7,600	12,800	17,700	23,700	20,000
						2,010	5,070	8,420	13,800	18,600	24,300	
09485900	1	1	0	1	0	73	177	272	423	555	703	460
						128	321	610	1,080	1,460	1,940	
09485950	1	0	0	0	0	116	270	418	665	895	1,170	705
						133	318	530	880	1,190	1,570	
09486000	1	0	0	0	0	5,090	9,520	13,200	18,600	23,200	28,300	29,700
						4,960	9,330	12,900	18,300	23,000	28,300	
09486300	0	0	0	0	0	2,620	6,130	9,430	14,700	19,600	25,200	17,000
						2,470	5,690	8,460	12,900	17,100	22,100	
09486800	0	0	0	0	0	4,280	7,910	11,000	15,600	19,600	24,100	22,000
						3,790	7,220	10,000	14,600	18,700	23,500	
09487000	0	0	0	0	0	3,640	6,390	8,770	12,500	16,000	20,000	19,100
						3,510	6,530	9,500	14,400	18,600	23,600	
09487100	0	0	0	0	0	777	1,450	2,010	2,870	3,610	4,450	13,800
						692	1,360	1,930	2,910	3,800	4,890	
09487140	-	-	-	-	1	----	----	----	----	----	----	520
						76	179	272	426	552	719	
09487250	0	1	0	0	0	1,130	3,090	4,930	7,790	10,200	12,900	32,000
						1,920	4,660	8,210	13,600	17,800	22,600	
09487400	1	0	0	0	0	167	369	547	819	1,050	1,320	715
						179	411	655	1,050	1,390	1,820	
09488500	1	0	0	0	0	805	3,160	6,270	12,800	20,000	29,600	53,100
						1,620	4,640	9,050	16,500	23,200	31,700	
09488600	0	0	0	0	0	265	660	1,070	1,820	2,570	3,500	1,400
						336	837	1,450	2,480	3,420	4,590	
09514200	1	0	0	0	0	1,430	2,730	3,870	5,660	7,280	9,140	6,300
						1,640	3,320	5,360	8,640	11,400	14,600	
09517000	1	0	0	0	0	3,110	8,390	14,400	25,800	37,900	53,900	39,000
						3,300	8,430	13,900	23,500	32,900	45,100	
09517200	0	0	0	0	0	131	312	480	747	986	1,260	720
						154	373	624	1,030	1,380	1,820	
09517280	1	0	0	0	0	1,010	2,120	3,070	4,480	5,680	7,000	4,550
						1,070	2,330	3,650	5,760	7,570	9,720	
09517400	1	0	0	0	0	854	1,540	2,120	3,000	3,770	4,640	3,640
						877	1,720	2,660	4,200	5,540	7,150	
09519600	1	0	0	0	0	482	747	947	1,230	1,450	1,700	1,430
						413	680	881	1,240	1,550	1,950	
09519750	-	-	-	-	1	----	----	----	----	----	----	2,670
						1,130	2,630	4,130	6,590	8,790	11,600	
09519760	1	0	1	0	0	583	1,870	3,310	5,910	8,450	11,500	3,150
						806	2,280	4,100	7,090	9,770	13,000	
09519780	-	-	-	-	1	----	----	----	----	----	----	4,430
						501	1,210	1,910	3,070	4,120	5,490	
09520100	0	0	0	0	0	125	468	945	2,020	3,310	5,180	1,530
						196	609	1,190	2,250	3,340	4,850	
09520110	1	0	0	0	0	136	191	226	267	297	325	240
						120	187	243	341	420	517	
09520130	1	0	0	0	0	551	922	1,210	1,630	1,980	2,370	1,670
						485	865	1,180	1,720	2,210	2,810	
09520160	0	1	0	0	0	239	463	661	974	1,260	1,580	1,800
						226	464	692	1,080	1,420	1,840	
09520170	0	0	0	0	0	3,000	4,850	6,270	8,300	9,960	11,800	8,030
						2,710	4,720	6,540	9,610	12,300	15,400	

BASIN, CLIMATIC, AND FLOOD CHARACTERISTICS FOR STREAMFLOW-GAGING STATIONS
IN THE SOUTHWESTERN UNITED STATES--Continued

Station number	Station name	Flood region	Latitude, in decimal degrees	Longitude, in decimal degrees	Years of record	Drainage area, in square miles	Mean basin elevation, in feet	Mean annual precipitation, in inches	Mean annual evaporation, in inches
09520200	Black Gap Wash near Ajo, Ariz.	13	32.706	112.845	18	12.10	1,280	6.7	75.4
09520230	Crater Range Wash near Ajo, Ariz.	13	32.562	112.877	17	1.49	1,280	6.6	70.4
09520300	Alamo Wash Tributary near Ajo, Ariz.	13	32.100	112.771	22	0.90	2,040	9.7	64.4
09520350	Mohawk Pass Wash at Mohawk, Ariz.	13	32.729	113.742	15	0.09	601	4.9	75.0
09520400	Ligurta Wash at Ligurta, Ariz.	13	32.676	114.294	15	1.99	395	4.0	75.2
09535100	San Simon Wash near Pisinimo, Ariz.	13	32.045	112.370	15	569.00	2,250	10.0	65.0
09535300	Vamori Wash at Kom Vo, Ariz.	13	31.948	112.343	15	1,250.00	2,699	12.5	65.0
09536100	Pitchfork Canyon Tributary near Ft Grant, Ariz.	13	32.589	109.911	14	0.81	5,210	15.0	65.0
09536350	Surprise Canyon near Dos Cabezas, Ariz.	13	32.011	109.353	14	0.65	6,280	18.0	69.0
09537200	Leslie Creek near McNeal, Ariz.	13	31.590	109.508	13	79.10	5,360	18.0	69.2
09537500	Whitewater Draw near Douglas, Ariz.	13	31.352	109.584	62	1,023.00	4,740	14.8	70.7
09430500	Gila River near Gila, N. Mex.	14	33.061	108.537	59	1,864.00	8,100	18.0	44.9
09430900	Duck Creek at Cliff, N. Mex.	14	32.967	108.600	29	228.00	6,560	16.8	51.5
09438200	Animas Creek near Cloverdale, N. Mex.	14	31.571	108.875	28	157.00	6,200	15.3	74.1
09442630	Mail Hollow near Luna, N. Mex.	14	33.794	108.950	16	4.20	7,084	--	40.7
09442660	Trout Creek at Luna, N. Mex.	14	33.850	108.967	32	31.90	8,950	19.5	40.0
09442680	San Francisco River near Reserve, N. Mex.	14	33.737	108.771	28	350.00	8,540	17.0	44.2
09442690	Tularosa River near Aragon, N. Mex.	14	33.904	108.504	12	89.00	7,800	14.3	44.8
09442692	Tularosa River above Aragon, N. Mex.	14	33.891	108.515	20	94.00	7,720	13.0	44.8
09442695	Negro Canyon at Aragon, N. Mex.	14	33.883	108.550	27	9.62	7,900	12.0	44.8
09442700	Apache Creek near Apache Creek, N. Mex.	14	33.931	108.662	17	94.60	7,740	14.5	44.6
09442740	Tularosa River near Reserve, N. Mex.	14	33.733	108.703	28	426.00	8,200	14.4	44.9
09443000	San Francisco River near Alma, N. Mex.	14	33.368	108.910	23	1546.00	8,120	17.6	45.1
09444000	San Francisco River near Glenwood, N. Mex.	14	33.247	108.880	20	1653.00	7,780	17.6	45.1
09444200	Blue River near Clifton, Ariz.	14	33.291	109.196	20	506.00	6,910	20.7	46.2
09444400	Chase Creek near Clifton, Ariz.	14	33.172	109.369	14	1.37	6,840	20.0	48.4
09445500	Willow Creek near Point Of Pines near Morenci, Ariz.	14	33.379	109.650	23	102.00	6,340	19.8	44.2
09446000	Willow Creek near Double Circle Ranch near Morenci, Ariz.	14	33.354	109.525	24	149.00	6,310	19.2	44.0
09446500	Eagle Creek near Double Circle Ranch near Morenci, Ariz.	14	33.300	109.492	24	377.00	6,410	20.0	44.8
09447000	Eagle Creek above pumping plant near Morenci, Ariz.	14	33.070	109.451	43	613.00	6,060	19.2	48.7
09451800	Tollgate Wash Tributary near Clifton, Ariz.	14	32.850	109.337	14	0.12	4,800	13.5	55.0

BASIN, CLIMATIC, AND FLOOD CHARACTERISTICS FOR STREAMFLOW-GAGING STATIONS
IN THE SOUTHWESTERN UNITED STATES--Continued

Station number	Relation characteristic L	H	D	O	U	Peak discharge (cubic feet per second) for indicated recurrence interval (years): 2	5	10	25	50	100	Maximum peak discharge of record (cubic feet per second)
09520200	1	0	0	0	0	392	672	868	1,120	1,300	1,480	940
						414	801	1,240	1,960	2,560	3,290	
09520230	0	0	1	0	0	103	329	586	1,060	1,530	2,100	590
						116	341	585	999	1,390	1,870	
09520300	1	0	0	0	0	151	268	362	500	615	741	510
						144	270	384	572	731	923	
09520350	0	0	0	0	0	20	52	85	142	197	263	117
						22	54	85	134	176	228	
09520400	1	0	0	0	0	185	551	971	1,770	2,610	3,680	1,590
						185	520	853	1,440	2,030	2,790	
09535100	1	0	1	0	0	1,250	3,020	5,010	8,850	13,000	18,700	12,500
						1,670	3,930	6,880	11,800	16,100	21,700	
09535300	0	1	0	1	0	778	1,710	2,700	4,520	6,420	8,920	10,400
						1,610	3,590	6,790	11,700	15,700	20,400	
09536100	1	0	0	0	0	142	246	326	437	526	621	375
						132	250	359	538	688	873	
09536350	0	0	0	0	0	44	112	176	275	362	457	191
						59	147	252	415	550	714	
09537200	1	0	0	0	0	438	1,350	2,480	4,810	7,430	11,100	4,600
						668	1,820	3,360	5,980	8,460	11,700	
09537500	0	0	1	1	0	1,710	2,770	3,510	4,470	5,190	5,910	5,060
						1,860	3,210	4,730	7,060	8,820	10,700	
09430500	0	0	0	0	0	1,880	5,320	9,480	18,000	27,600	40,900	35,200
						1,920	5,440	9,670	18,100	27,300	39,600	
09430900	0	0	0	0	0	3,660	5,510	6,700	8,170	9,220	10,200	6,900
						3,530	5,220	6,380	7,950	9,310	10,800	
09438200	1	0	0	0	0	739	1,290	1,770	2,500	3,150	3,910	3,400
						757	1,420	2,070	3,260	4,410	5,790	
09442630	1	0	0	1	0	54	106	151	219	278	344	264
						59	147	281	515	742	1,010	
09442660	0	0	0	0	0	151	489	939	1,940	3,140	4,910	2,790
						156	522	1,050	2,120	3,310	4,940	
09442680	0	0	0	0	0	871	2,270	3,930	7,340	11,200	16,700	9,830
						885	2,350	4,160	7,640	11,300	16,300	
09442690	-	-	-	-	1	----	----	----	----	----	----	181
						565	1,540	2,900	4,620	6,200	8,070	
09442692	1	0	0	1	0	83	203	321	524	716	947	660
						122	413	847	1,700	2,550	3,580	
09442695	1	1	0	0	0	211	532	907	1,670	2,520	3,720	5,200
						207	526	926	1,670	2,440	3,470	
09442700	0	0	0	0	0	290	962	1,770	3,370	5,070	7,280	2,900
						317	1,070	2,040	3,800	5,540	7,690	
09442740	0	0	0	0	0	341	789	1,260	2,110	2,990	4,110	3,020
						397	1,080	1,970	3,720	5,500	7,700	
09443000	1	0	0	0	0	5,110	13,000	22,000	39,400	58,100	83,400	56,600
						4,960	12,200	20,000	33,800	47,800	66,000	
09444000	0	1	0	0	0	3,930	8,690	13,500	22,100	30,800	41,800	37,100
						3,870	8,460	13,100	20,900	28,600	38,000	
09444200	1	0	0	0	0	4,170	10,500	17,500	30,600	44,400	62,400	30,000
						3,990	9,550	15,300	24,900	34,500	46,500	
09444400	-	-	-	-	1	----	----	----	----	----	----	600
						58	190	418	672	901	1,170	
09445500	1	0	0	0	0	671	1,360	1,980	2,960	3,840	4,860	3,710
						680	1,430	2,180	3,460	4,660	6,080	
09446000	1	0	0	0	0	1,410	2,900	4,230	6,340	8,250	10,500	7,500
						1,380	2,830	4,140	6,220	8,140	10,400	
09446500	1	0	0	0	0	2,490	5,680	8,810	14,200	19,400	25,700	30,000
						2,440	5,430	8,270	12,900	17,300	22,500	
09447000	0	0	0	0	0	2,740	7,370	12,200	20,500	28,500	38,300	36,400
						2,730	7,190	11,700	19,100	26,000	34,500	
09451800	-	-	-	-	1	----	----	----	----	----	----	63
						22	68	135	218	292	378	

Notes:
This data is taken directly from the USGS report Methods for Estimating Magnitude and Frequency of Floods in the Southwestern United States, USGS Open-File Report 93-419. Some of the data listed in that report does not match what is listed in the "Basin Characteristic Reports" (either the 1989 or 1996 versions). The intent of the Hydrology Manual is not to update this data based on the more current "Basin Characteristics Report", but rather to simply adopt the indirect methods as published in the ADOT Hydrology Manual (as well as the State Standards). Updating this data would also require revising the regression analyses.

Region 12
Mean, mean basin elevation = 5048 but used = 6,000
$Q_{100} = 10^{(6.55-3.17*A^{-.11})}(Elev/1000)^{-.454}$

Region 13
$Q_{100} = 10^{(5.52-2.42*A^{-.12})}$

Gage No.	Flood Region	Drainage Area sq. miles	Mean Basin Elevation feet	LP3 Q100 cfs	Q Max cfs	100-yr Peak Discharge Relation cfs
9496700	12	0.1	5,240	168	120	75
9496600	12	0.1	5,390	326	165	130
9424700	12	0.6	3,470	1,040	180	737
9505900	12	0.6	3,540	663	250	737
9498600	12	0.7	6,080	374	265	756
9503740	12	0.8	5,180	231	84	841
9468300	12	0.8	4,410	1,820	640	914
9504100	12	0.9	7,050	597	500	932
9512700	12	1.1	2,140	1,790	1,200	1,123
9504400	12	1.2	6,880	1,510	705	1,189
9505220	12	1.4	7,190	1,640	1,430	1,386
9512200	12	1.8	1,730	4,740	670	1,644
9424410	12	2.0	3,700	1,120	353	1,811
9496800	12	2.6	5,810	3,050	1,260	2,172
9510170	12	2.6	3,520	1,000	402	2,203
9510100	12	4.5	5,760	3,660	1,940	3,232
9510070	12	4.6	5,430	6,210	1,700	3,276
9507700	12	4.9	6,980	2,670	1,220	3,438
9515800	12	5.6	2,690	7,820	2,600	3,736
9502700	12	6.0	5,970	6,700	480	3,929
9516600	12	6.3	2,290	5,570	2,900	4,057
9498900	12	6.4	4,590	4,330	2,820	4,111
9507600	12	6.7	6,430	9,360	2,820	4,198
9424480	12	7.0	4,680	4,430	4,000	4,321
9510080	12	9.8	5,260	9,000	3,480	5,377
9503750	12	14.5	5,310	8,170	4,100	6,832
9510180	12	15.2	3,680	6,280	1,900	7,027
9501300	12	24.3	2,960	14,500	7,500	9,225
9505300	12	24.6	6,560	6,510	4,000	9,290
9503000	12	36.3	5,900	7,470	6,660	11,518
9508300	12	36.4	4,810	21,600	6,830	11,535
9492400	12	38.8	8,580	1,790	2,700	11,939

Notes:

This data is taken directly from the USGS report Methods for Estimating Magnitude and Frequency of Floods in the Southwestern United States, USGS Open-File Report 93-419. Some of the data listed in that report does not match what is listed in the "Basin Characteristic Reports" (either the 1989 or 1996 versions). The intent of the Hydrology Manual is not to update this data based on the more current "Basin Characteristics Report", but rather to simply adopt the indirect methods as published in the ADOT Hydrology Manual (as well as the State Standards). Updating this data would also require revising the regression analyses.

Region 12

Mean, mean basin elevation = 5048 but used = 6,000

$Q_{100} = 10^{(6.55-3.17*A^{-.11})}(Elev/1000)^{-.454}$

Region 13

$Q_{100} = 10^{(5.52-2.42*A^{-.12})}$

Gage No.	Flood Region	Drainage Area sq. miles	Mean Basin Elevation feet	LP3 Q100 cfs	Q Max cfs	100-yr Peak Discharge Relation cfs
9505250	12	49.4	5,910	11,500	10,500	13,568
9510150	12	52.3	4,260	47,000	16,100	13,978
9497900	12	62.1	6,030	12,300	7,290	15,270
9513860	12	64.6	2,180	36,500	11,500	15,579
9513780	12	67.3	3,970	36,900	18,600	15,906
9513800	12	83.3	3,600	39,100	19,500	17,694
9505200	12	111.0	6,410	16,800	10,900	20,343
9489700	12	119.0	7,920	6,340	4,510	21,028
9512300	12	121.0	3,470	20,700	12,400	21,195
9498870	12	122.0	4,390	29,300	44,400	21,278
9503800	12	131.0	7,620	7,260	2,300	22,004
9512100	12	139.0	1,780	17,400	21,000	22,623
9505350	12	142.0	6,220	39,000	26,600	22,850
9424200	12	143.0	5,350	11,800	7,000	22,924
9510200	12	164.0	3,820	57,800	24,200	24,421
9513835	12	187.0	2,700	44,100	14,600	25,924
9497980	12	200.0	5,600	26,800	15,700	26,720
9496000	12	203.0	6,370	35,800	10,900	26,898
9505800	12	241.0	6,680	31,700	22,400	29,025
9502800	12	255.0	5,120	30,300	14,800	29,751
9497800	12	295.0	5,700	22,700	22,200	31,689
9489100	12	315.0	8,700	21,700	14,000	32,591
9513890	12	317.0	2,320	35,000	20,000	32,679
9513910	12	323.0	2,130	37,000	38,000	32,941
9507980	12	328.0	5,140	61,500	23,500	33,156
9504500	12	357.0	6,200	46,600	26,400	34,365
9515500	12	417.0	4,750	43,700	58,000	36,665
9498800	12	430.0	5,810	64,400	38,000	37,133
9496500	12	439.0	6,320	39,100	23,000	37,451
9489500	12	560.0	8,000	28,100	17,900	41,338
9512500	12	585.0	5,000	29,300	33,100	42,065
9494000	12	632.0	7,400	18,600	14,000	43,375

Notes:

This data is taken directly from the USGS report Methods for Estimating Magnitude and Frequency of Floods in the Southwestern United States, USGS Open-File Report 93-419. Some of the data listed in that report does not match what is listed in the "Basin Characteristic Reports" (either the 1989 or 1996 versions). The intent of the Hydrology Manual is not to update this data based on the more current "Basin Characteristics Report", but rather to simply adopt the indirect methods as published in the ADOT Hydrology Manual (as well as the State Standards). Updating this data would also require revising the regression analyses.

Region 12

Mean, mean basin elevation = 5048 but used = 6,000

$Q_{100} = 10^{(6.55-3.17*A^{-.11})}(Elev/1000)^{-.454}$

Region 13

$Q_{100} = 10^{(5.52-2.42*A^{-.12})}$

Gage No.	Flood Region	Drainage Area sq. miles	Mean Basin Elevation feet	LP3 Q100 cfs	Q Max cfs	100-yr Peak Discharge Relation cfs
9499000	12	675.0	5,020	104,000	61,400	44,513
9516500	12	774.0	3,190	45,000	47,500	46,948
9468500	12	1,027.0	4,480	56,200	40,600	52,280
9512800	12	1,130.0	4,770	199,000	59,500	54,175
9424900	12	1,210.0	4,010	36,700	23,100	55,560
9490500	12	1,232.0	7,200	110,000	50,000	55,929
9425500	12	1,520.0	3,650	70,800	33,600	60,359
9471185	13	0.0		38	31	21
9520350	13	0.1		263	117	195
9481800	13	0.2		229	110	303
9471087	13	0.2		766	541	415
9520110	13	0.4		325	240	707
9483040	13	0.5		675	240	731
9536350	13	0.7		547	191	937
9536100	13	0.8		621	375	1,045
9428545	13	0.8		300	173	1,054
9471170	13	0.9		2,020	1,270	1,146
9520300	13	0.9		741	510	1,173
9520230	13	1.5		2,100	590	1,633
9520400	13	2.0		3,680	1,590	1,958
9483200	13	2.0		849	430	1,988
9485950	13	2.2		1,170	705	2,053
9520160	13	2.2		1,580	1,800	2,070
9472400	13	2.4		7,950	3,200	2,195
9519600	13	2.4		1,700	1,430	2,211
9487400	13	2.4		1,320	715	2,216
9471700	13	2.7		2,470	950	2,360
9482480	13	2.8		4,060	3,000	2,380
9517200	13	2.8		1,260	720	2,401
9471120	13	3.2		8,470	4,390	2,592
9481900	13	3.6		8,050	1,840	2,785
9473200	13	3.6		8,140	3,700	2,798

Notes:
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Region 12
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Region 13
$Q_{100} = 10^{(5.52-2.42*A^{-.12})}$

Gage No.	Flood Region	Drainage Area sq. miles	Mean Basin Elevation feet	LP3 Q100 cfs	Q Max cfs	100-yr Peak Discharge Relation cfs
9473600	13	4.4		1,520	1,570	3,108
9520130	13	4.7		2,370	1,670	3,245
9485900	13	4.9		703	460	3,324
9471195	13	5.2		11,800	2,590	3,430
9470900	13	5.3		2,620	1,460	3,441
9471080	13	6.4		3,080	2,220	3,837
9484510	13	6.5		339	260	3,850
9520100	13	8.7		5,180	1,530	4,501
9471090	13	9.1		7,490	2,640	4,609
9481700	13	10.3		2,700	1,200	4,906
9487100	13	11.9		4,450	13,800	5,274
9520200	13	12.1		1,480	940	5,318
9488600	13	12.8		3,500	1,400	5,468
9428550	13	14.6		6,170	2,920	5,831
9478200	13	15.6		6,030	3,500	6,021
9484200	13	16.3		1,940	1,400	6,149
9482420	13	26.5		2,470	1,270	7,706
9484000	13	35.5		10,800	7,730	8,773
9471140	13	36.7		8,030	6,590	8,901
9484570	13	38.4		16,300	27,000	9,077
9483100	13	43.0		13,000	8,600	9,528
9485000	13	44.8		18,800	9,660	9,696
9517400	13	47.8		4,640	3,640	9,965
9471200	13	57.7		14,000	11,500	10,776
9537200	13	79.1		11,100	4,600	12,238
9480000	13	82.2		11,300	12,000	12,425
9517280	13	85.2		7,000	4,550	12,601
9519760	13	126.0		11,500	3,150	14,639
9478500	13	144.0		47,200	42,900	15,384
9481750	13	176.0		17,800	16,000	16,549
9481500	13	209.0		15,400	16,000	17,593
9484500	13	219.0		31,000	12,700	17,884

Notes:

This data is taken directly from the USGS report Methods for Estimating Magnitude and Frequency of Floods in the Southwestern United States, USGS Open-File Report 93-419. Some of the data listed in that report does not match what is listed in the "Basin Characteristic Reports" (either the 1989 or 1996 versions). The intent of the Hydrology Manual is not to update this data based on the more current "Basin Characteristics Report", but rather to simply adopt the indirect methods as published in the ADOT Hydrology Manual (as well as the State Standards). Updating this data would also require revising the regression analyses.

Region 12

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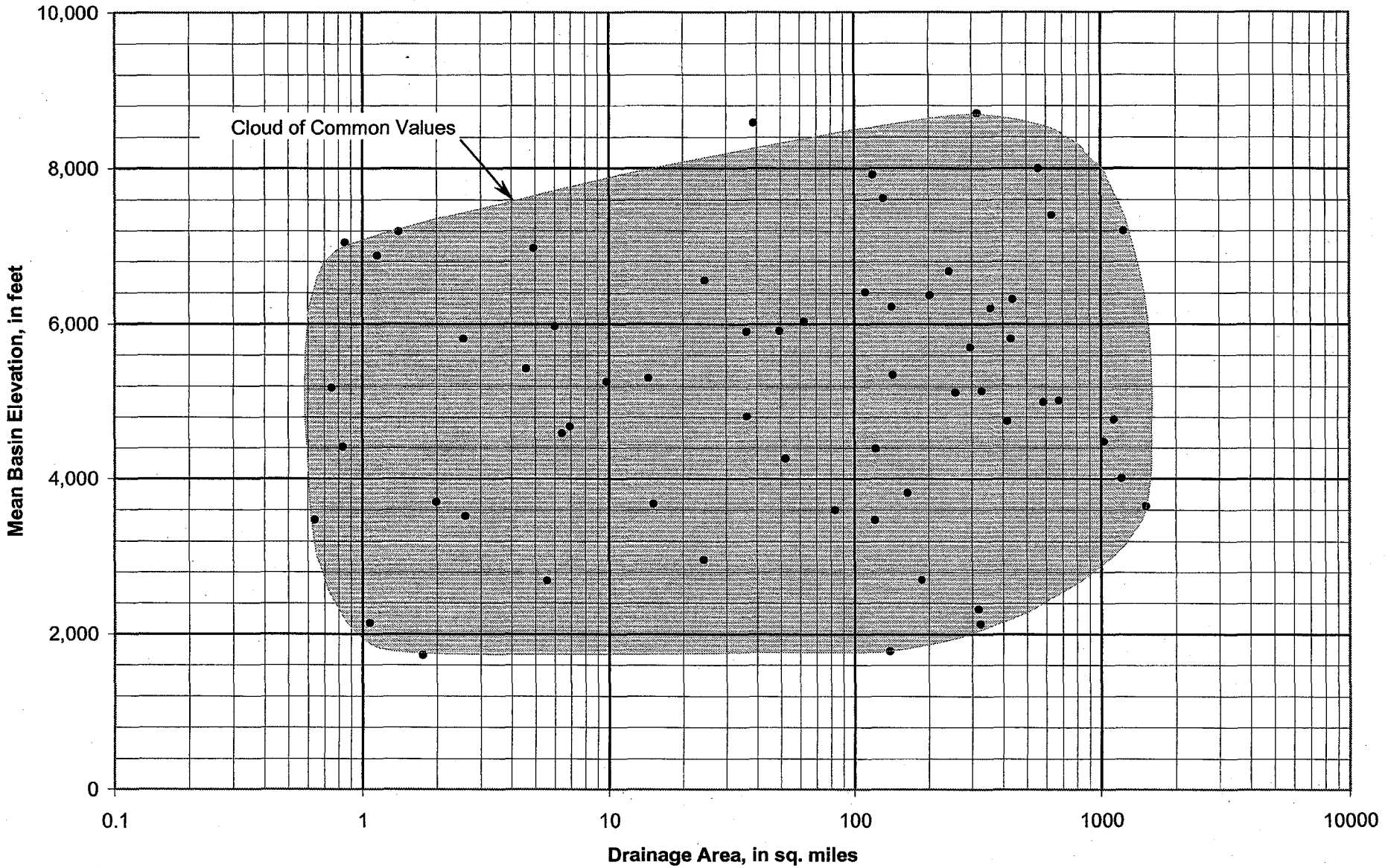
Region 13

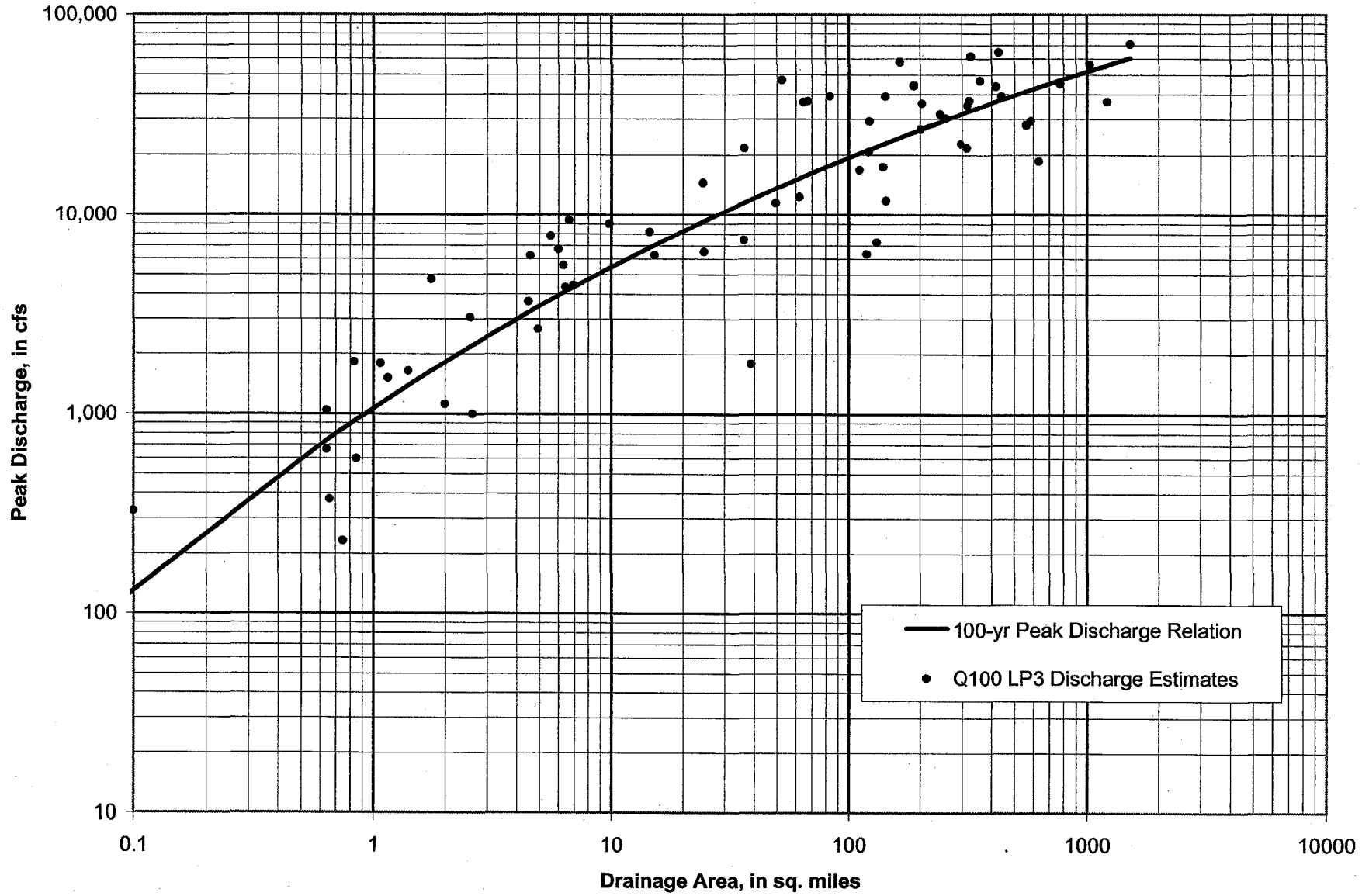
$Q_{100} = 10^{(5.52-2.42*A^{-.12})}$

Gage No.	Flood Region	Drainage Area sq. miles	Mean Basin Elevation feet	LP3 Q100 cfs	Q Max cfs	100-yr Peak Discharge Relation cfs
9520170	13	243.0		11,800	8,030	18,543
9486300	13	250.0		25,200	17,000	18,726
9484560	13	289.0		19,800	20,000	19,677
9514200	13	403.0		9,140	6,300	21,974
9484600	13	457.0		36,400	38,000	22,885
9486800	13	463.0		24,100	22,000	22,981
9480500	13	533.0		24,900	31,000	24,031
9473000	13	541.0		28,000	70,800	24,144
9535100	13	569.0		18,700	12,500	24,529
9485500	13	602.0		23,700	20,000	24,963
9470500	13	741.0		22,300	22,000	26,604
9487000	13	776.0		20,000	19,100	26,977
9486000	13	918.0		28,300	29,700	28,362
9537500	13	1,023.0		5,910	5,060	29,276
9487250	13	1,170.0		12,900	32,000	30,433
9471000	13	1,219.0		45,700	98,000	30,792
9535300	13	1,250.0		8,920	10,400	31,013
9517000	13	1,470.0		53,900	39,000	32,461
9471550	13	1,740.0		29,200	24,200	34,007
9488500	13	1,782.0		29,600	53,100	34,228

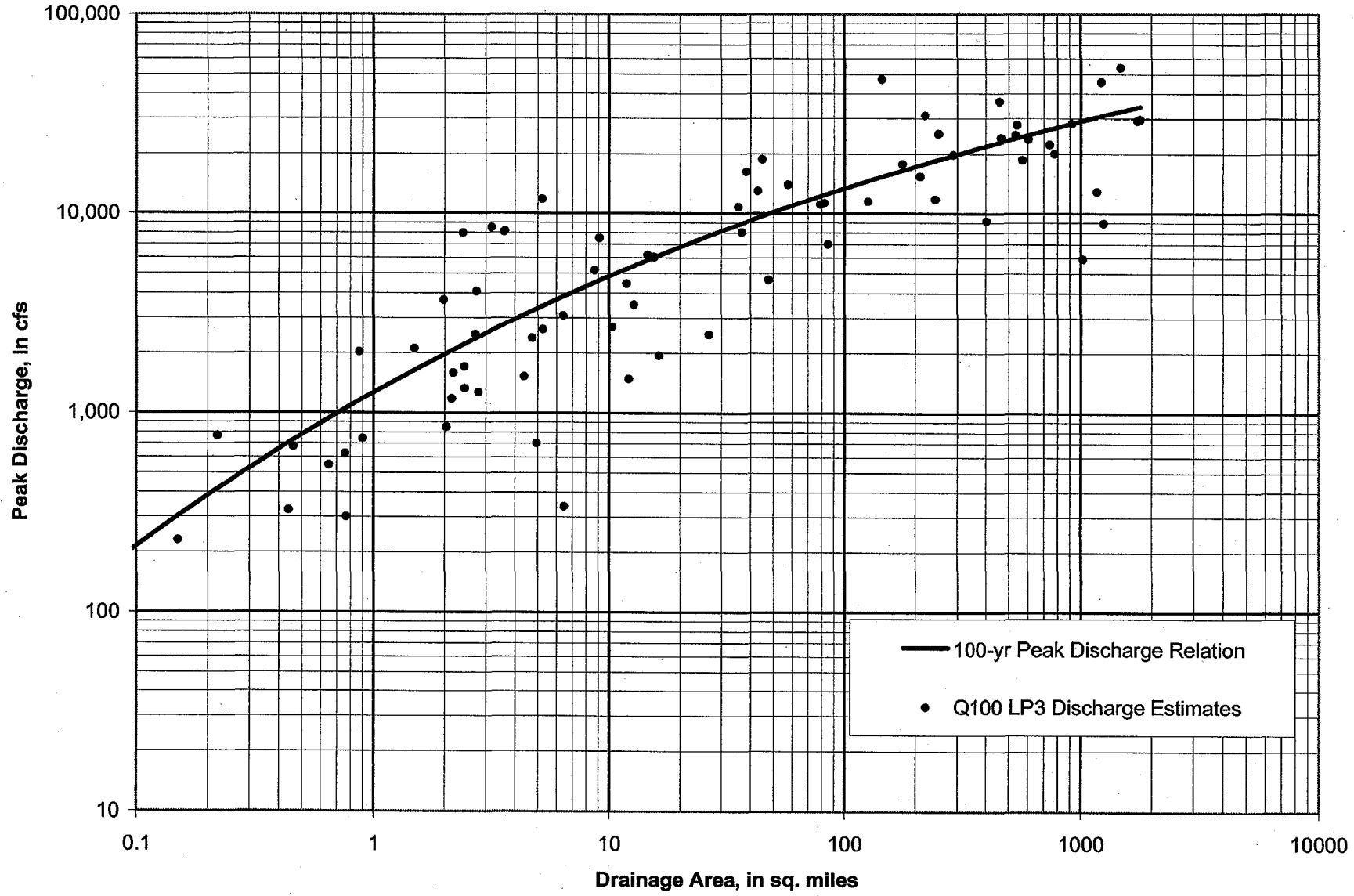
Flood Region 12



Flood Region 12



Flood Region 13



Summary of gage data ratio analyses

Data Source: Statistical Summaries of Streamflow Data and Characteristiecs of Drainage Basins for Selected Streamflow-Gaging Stations in Arizona Through Water Year 1996, USGS 98-4225

		2-Year Ratio, in %		5-Year Ratio, in %		10-Year Ratio, in %	
Case	Sample Size	Mean	Stand. Dev.	Mean	Stand. Dev.	Mean	Stand. Dev.
All gages	283	12	9	24	12	36	13
All undeveloped gages	266	12	9	24	12	36	13
Undev. w/period of record > 20-yrs	119	12	7	24	10	37	10
Undev. w/period of record > 30-yrs	71	12	7	24	9	36	10
Selected	133	10	8	22	12	34	14
Selected w/period of record > 20-yrs	44	9	6	21	8	33	9
Selected w/period of record > 30-yrs	17	10	6	23	8	35	8
All urbanized	17	15	9	28	13	40	15
Selected urbanized	13	16	10	29	15	40	16

Published Ratios to the 100-year event, in %

	2-YR	5-YR	10-YR
C.O.T. Rural[1]	10	N/A	35
C.O.T. Suburban[1]	15	N/A	40
C.O.T. Mod. Urban[1]	20	N/A	45
C.O.T. High urban[1]	25	N/A	50
Corps of Engineers[2]	7	16	27
FCDMC - 1.0 sq. mile[3]	10	27	38
FCDMC - 10.0 sq. mile[3]	7	21	32
FCDMC - 100.0 sq. mile[3]	6	16	26

Notes

1. Pima County Flood Control District Hydrology Manual, Sept. 79
2. New River and Phoenix City Streams, Arizona; Design Memorandum No. 2, Hydrology Part 1, Oct. 74
3. Flood Control District of Maricopa County, Study by Russ Cruff

APPROXIMATE RATIOS OF LESSER MAGNITUDE FLOODS TO THE 100-YEAR FLOOD

In an attempt to both simplify and reduce the computational procedures and time involved in estimating peak discharge values for floods of lesser magnitude than the 100-year flood, the following procedure may be employed if the user so desires:

First, the predicted value for the peak discharge of the 100-year flood which would occur upon the watershed under investigation should be determined using the procedures as outlined within this Manual.

Next, peak discharge values for floods of lesser magnitude than the 100-year flood may be calculated approximately by multiplying the previously determined 100-year flood value for the watershed under investigation by the factors shown within the table below:

	RECURRENCE INTERVAL			
WATERSHED DEVELOPMENT	2-Yr.	10-Yr.	25-Yr.	50-Yr.
Rural	0.10	0.35	0.55	0.75
Suburban	0.15	0.40	0.60	0.80
Moderately Urban	0.20	0.45	0.65	0.85
Highly Urban	0.25	0.50	0.70	0.85

Where

Rural = Watersheds which will remain in a natural condition (undeveloped), or where the anticipated future development will be negligible.

Suburban = Watersheds which contain two (2) houses per acre, or less, with drainage improvements being relatively few or nonexistent.

Moderately Urban = Watersheds which contain from two (2) to five (5) houses per acre (detached), with moderate to extensive drainage improvements present.

Highly Urban = Watersheds which contain more than five (5) houses per acre (including multiple dwellings, commercial and industrial development), with extensive drainage improvements present.

It is to be noted that the above factors are only applicable under typically "average" watershed conditions upon generally homogeneous drainage basins. For atypical or nonhomogeneous watersheds, all flood peaks, whatever their recurrence intervals, should be determined in a complete and detailed manner as outlined within this Manual; otherwise, serious errors might easily arise as a consequence of choosing expediency over good engineering judgement.

REF: Pima County Flood Control District Hydrology Manual, Sept 1979

Compilation of gage data for Arizona

Data source: Statistical Summaries of Streamflow Data and Characteristics of Drainage Basins for Selected Streamflow-Gaging Stations in Arizona Through Water Year 1996, USGS WR98-4225

Gage No.	Station Name	Drainage Area sq. miles	Mean Basin Elevation feet	Main Channel Slope ft/mi	Period of Record	Q Max cfs	Log Pearson Type III Peak Discharge 100-Year cfs	50-Year cfs	25-Year cfs	10-Year cfs	5-Year cfs	2-Year cfs	HUC	Latitude Dec. Degrees	Longitude Dec. Degrees
9371100	Teec Nos Pos Wash Near Teec Nos Pos, Ariz.	16	7600	411	9	1350	1760	1530	1320	1050	841	557	14080201	36.9325	109.1096
9379030	Black Mountain Wash Near Chinle, Ariz.	80.7	5920	46.2	14	3100	4970	4090	3280	2320	1650	844	14080204	36.3333	109.6235
9379060	Lukachukai Creek Tributary Near Lukachukai, A	1.37	5820	72.2	13	227	301	210	143	79.5	46.8	17.9	14080204	36.4694	109.4055
9379100	Long House Wash Near Kayenta, Ariz.	1.38	6920	236	14	2060	5880	4380	3100	1760	1000	304	15020018	36.5672	110.4880
9379200	Chinle Creek Near Mexican Water, Ariz.	3650	6260	12.3	33	12000	16500	13100	10100	6820	4710	2320	14080204	36.9437	109.7098
9379560	El Capitan Wash Near Kayenta, Ariz.	5.88	5690	78.4	13	2340	3530	2760	2100	1390	952	470	14080205	36.8587	110.2650
9379980	Jack Bench Wash Tributary Near Page, Ariz.	0.98	6180	133	14	200	2850	1330	560	141	37.1	2.6	14070006	36.7137	111.5915
9380000	Colorado R At Lees Ferry, Az.	107841	---	---	---	300000	---	---	---	---	---	---	14070006	36.8645	111.5874
9382000	Paria River At Lees Ferry, Ariz.	1410	6150	43	71	16100	19800	16000	12600	8810	6330	3420	14070007	36.8721	111.5937
9383020	House Rock Wash Trib Nr Marble Canyon, Az.	3.54	5290	209	13	1610	913	569	342	161	81.8	24.7	15010001	36.7014	111.9290
9383400	Little Colorado River At Greer, Ariz.	29.1	9400	180	22	615	822	695	575	425	316	175	15020001	34.0167	109.4566
9383500	Nutrioso Cr. Ab. Nelson Res Nr Springerville,Az.	83.3	8550	78	16	700	1100	854	636	403	263	117	15020001	34.0301	109.1858
9383600	Fish Creek Near Eagar Ariz.	16.9	9160	164	12	236	485	403	325	227	158	74.5	15020001	34.0762	109.4623
9384000	Little Colorado R Abv Lyman Lake Nr St. Johns, Az	703.5	7760	89.5	56	16000	9400	6850	4850	2880	1790	750	15020001	34.3142	109.3615
9384200	Lyman Reservoir Trib Nr St Johns, Az	0.24	6100	267	13	101	116	104	91.4	74.9	62	42.8	15020002	34.3915	109.3798
9385800	Little Colorado R Trib Nr St Johns, Az	0.35	6350	417	13	326	672	491	348	206	127	52	15020002	34.4511	109.2563
9386500	Little Colorado R Ab Zuni R Nr Hunt, Az.	3557	7160	40.2	32	1310	2930	2110	1460	819	474	164	15020002	34.6415	109.6762
9388000	Little Colorado River Nr Hunt, Az	6173	7060	37.6	36	8000	8700	6630	4890	3040	1930	801	15020002	34.6470	109.7027
9390500	Show Low Creek Near Lakeside, Arizona	68.6	7320	77.2	42	5550	16800	11000	6830	3210	1550	362	15020005	34.1792	109.9872
9392800	Long Lake Tributary Near Show Low, Ariz.	5.22	6700	133	11	530	4030	2460	1380	524	195	23.4	15020005	34.2609	109.8279
9393500	Silver Creek Near Snowflake, Ariz.	846	6400	35	64	25000	18200	14600	11400	7720	5330	2590	15020005	34.6667	110.0415
9394500	Little Colorado R At Woodruff, Ariz.	7775	6810	25.2	69	25000	18300	15400	12700	9340	6920	3790	15020002	34.7825	110.0434
9395100	Carr Lake Draw Tributary Near Holbrook, Ariz.	1.28	5420	103	12	140	345	266	196	120	73.8	27	15020002	34.8347	109.9333
9395200	Decker Wash Near Snowflake, Ariz.	16.5	6660	31.1	---	1170	---	---	---	---	---	---	15020008	34.4609	110.4041
9395850	Black Creek Tributary Near Window Rock, Az	0.33	6830	53.3	---	171	---	---	---	---	---	---	15020006	35.6541	109.0888
9395900	Black Creek Nr Lupton, Az	493	7500	11.2	18	7680	11200	9480	7880	5880	4440	2550	15020006	35.4525	109.1249
9396400	Dead Wash Tributary Near Holbrook, Ariz.	1.22	5740	60	12	743	1150	938	745	522	374	198	15020007	35.0721	109.7486
9396500	Puerco River Near Adamana, Ariz	2603.5	6730	15.7	9	30000	57900	48200	39200	28400	20900	11500	15020007	34.9790	109.7943
9397000	Little Colorado River At Holbrook, Ariz.	11115	6730	21.9	25	60000	37200	32100	27400	21400	17000	11000	15020008	34.8975	110.1623
9397200	Penzance Wash Near Joseph City, Ariz.	0.17	5150	237	13	120	296	240	188	126	85.4	38	15020008	34.9189	110.2536
9397500	Chevelon Fork Below Wildcat Canyon, Near Winslow	271	7030	54.4	36	24700	41200	30000	21000	11900	6950	2400	15020010	34.6363	110.7134
9397800	Brookbank Canyon Near Heber, Ariz.	27.9	6950	65.5	12	666	1070	866	679	460	315	147	15020010	34.4721	110.6470
9398000	Chevelon Creek Near Winslow, Ariz.	781	6440	27.7	45	33600	33800	24200	16800	9760	5860	2360	15020010	34.9262	110.5306
9398500	Clear Creek Below Willow Creek, N Winslow, Az.	317	7100	26	43	29100	39700	29000	20400	11700	6820	2360	15020008	34.6675	111.0068
9399000	Clear Creek Near Winslow, Ariz.	607	6500	24.1	49	50000	59200	39800	26000	13700	7750	2790	15020008	34.9694	110.6443
9399250	Jacks Canyon Tributary No. 2 Near Winslow, Ar	31.8	6530	71.6	---	9330	---	---	---	---	---	---	15020008	34.7653	111.0120
9400100	Ganado Wash Trib Nr Ganado, Ariz.	7.85	6770	55.5	13	1680	2320	1760	1300	819	533	238	15020011	35.7109	109.4970
9400200	Steamboat Wash Trib Nr Ganado, Ariz.	0.32	6750	100	12	383	1520	1020	648	322	167	46.6	15020011	35.7637	109.8000
9400290	Teshbito Wash Trib Nr Holbrook, Ariz.	9.3	6420	93.7	13	890	3030	2470	1950	1310	874	371	15020011	35.4803	110.0874
9400300	Teshbito Wash Nr Holbrook, Ariz.	49.6	6280	57.7	13	1580	2320	2020	1720	1340	1050	653	15020011	35.4484	110.0680
9400530	Cow Canyon Nr Winslow Ariz.	3.57	5380	61.8	14	253	387	319	257	181	129	64.8	15020008	35.1000	110.9874
9400560	Oraibi Wash Trib Nr Oraibi, Ariz.	1.78	6020	105	13	383	770	622	490	339	240	124	15020012	35.8721	110.5555
9400565	Polacca Wash Trib Nr Chinle, Ariz.	6.45	6890	160	12	1130	2150	1770	1420	995	708	361	15020013	36.0470	110.0803
9400580	Castle Butte Wash Nr Winslow, Ariz.	5.57	5820	83.8	12	860	2220	1540	1020	536	289	86	15020014	35.3249	110.4221
9400590	Rio De Flag @ Hidden Hollow Rd @ Flagstaff, Az	31.5	8130	129	---	153	---	---	---	---	---	---	15020015	35.2418	111.6839
9400595	Schultz Canyon At Flagstaff, Ariz.	6.09	8060	296	---	48	---	---	---	---	---	---	15020015	35.2268	111.6579

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Gage No.	Station Name	Drainage Area sq. miles	Mean Basin Elevation feet	Main Channel Slope ft/mi	Period of Record	Q Max cfs	Log Pearson Type III Peak Discharge 100-Year cfs	50-Year cfs	25-Year cfs	10-Year cfs	5-Year cfs	2-Year cfs	HUC	Latitude Dec. Degrees	Longitude Dec. Degrees
9400600	Rio De Flag At Flagstaff, Ariz.	51	8050	106	16	240	861	557	340	167	74.5	17.2	15020015	35.2216	111.6566
9400650	Sinclair Wash At Flagstaff, Ariz.	8.11	7200	69.9	10	401	748	566	416	260	168	74.2	15020015	35.1637	111.6798
9400655	Rio De Flag At I40 At Flagstaff,Az	82.4	7840	55.5	---	421	---	---	---	---	---	---	15020015	35.1844	111.6320
9400660	Bow And Arrow Wash At Flagstaff, Ariz.	2.06	6990	46.5	11	73	111	92	74.7	53.9	39.7	22.1	15020015	35.1658	111.6527
9400680	Switzer Canyon At Flagstaff, Ariz.	1.87	7130	375	11	135	413	321	240	151	95.9	38.4	15020015	35.2120	111.6391
9400700	Switzer Canyon Trib At Flagstaff, Ariz.	5.52	6950	267	12	262	326	271	221	163	124	75.2	15020015	35.2008	111.6126
9400730	Lockett Fanning Diversion At Flagstaff, Ariz.	1.05	8020	928	---	85	---	---	---	---	---	---	15020015	35.2219	111.5992
9400740	Harenberg Wash At Flagstaff,Ariz.	2.41	7570	594	11	183	293	243	198	144	107	60.2	15020015	35.2191	111.5877
9400910	Fay Canyon Near Flagstaff, Ariz.	3.28	7000	72.2	14	87	182	128	98	66	36	8	15020015	35.1350	111.6298
9401000	Little Colo. River At Grand Falls, Ariz.	21240	6440	10.5	37	120000	76000	56800	41500	26100	17280	8310	15020016	35.4456	111.2033
9401210	Slate Mountain Wash Near Flagstaff, Ariz.	5.43	7350	46.4	---	88	---	---	---	---	---	---	15020016	35.5150	111.8484
9401220	Cedar Wash Near Cameron, Ariz.	579	6430	123	9	10400	30200	21400	14600	8040	4550	1510	15020016	35.8585	111.4421
9401245	Klethla Valley Trib Near Kayenta Az	0.79	6730	87.7	14	290	419	365	312	244	193	121	15020018	36.4978	110.6208
9401260	Moenkopi Wash At Moenkopi	1629	5850	24.8	22	10100	15000	12700	10500	7760	5820	3320	15020018	36.1049	111.2011
9401300	Hamblin Wash Trib Near Cedar Ridge, Ariz.	0.1	5860	263	13	110	3040	1480	638	156	37.3	1.7	15020018	36.3484	111.5041
9401370	Hamblin Wash Trib No 2 Near Tuba City, Ariz.	2.16	4670	348	---	350	---	---	---	---	---	---	15020018	36.0555	111.3929
9401400	Moenkopi Wash Nr Tuba City, Ariz.	1300	5820	27.2	25	12100	14500	12400	10400	7900	6120	3740	15020018	36.0235	111.3964
9402000	Little Colorado River Near Cameron, Ariz.	26091	6300	7.48	48	120000	28700	24400	20500	15600	12200	7730	15020016	35.9262	111.5667
9402100	Forest Boundary Wash Near Cameron, Ariz.	0.72	6810	167	---	115	---	---	---	---	---	---	15020016	35.9235	111.7374
9402500	Colorado R. Near Grand Canyon, Ariz.	137641	---	---	---	300000	---	---	---	---	---	---	15010001	36.1014	112.0855
9403000	Bright Angel Creek Near Grand Canyon, Ariz.	101	7390	421	49	4400	4970	3670	2640	1600	1010	435	15010001	36.1030	112.0954
9403750	Sagebrush Draw Near Fredonia, Ariz.	0.68	5290	106	---	150	---	---	---	---	---	---	15010003	36.9014	112.3762
9403780	Kanab Creek Nr Fredonia, Ariz.	1085	6100	56.4	17	15000	7140	5440	4050	2610	1760	875	15010003	36.8637	112.5790
9403800	Bitter Seeps Wash Trib Near Fredonia, Ariz.	2.85	5120	129	13	1950	7350	4660	2780	1240	575	127	15010003	36.8568	112.7582
9403930	West Cataract Creek Near Williams, Ariz.	3.18	7190	465	12	151	708	505	342	181	96.4	26.2	15010004	35.2475	112.2243
9404050	Spring Valley Wash Trib Near Williams, Ariz.	3.93	6750	40.5	13	190	449	317	213	113	61.2	17.7	15010004	35.5743	112.1533
9404070	Little Red Horse Wash Near Grand Canyon, Ariz	21.8	6780	56.9	---	62	---	---	---	---	---	---	15010004	35.8456	112.1317
9404310	Yampai Canyon Trib Near Peach Springs, Ariz.	0.2	5360	444	12	117	237	167	114	63.5	37.2	13.8	15010007	35.5519	113.3880
9404340	Truxton Wash At Valentine, Ariz.	370	4630	57	12	49000	26300	18100	12000	6330	3510	1150	15010007	35.3861	113.6555
9404350	Valentine Wash At Valentine, Ariz.	3.15	4490	378	13	3800	18400	7090	2540	552	142	12.7	15010007	35.3833	113.6623
9415000	Virgin River At Littlefield, Ariz.	5090	5500	38.4	66	61000	35500	27800	21300	14200	9810	4920	15010010	36.8915	113.9235
9415050	Big Bend Wash Trib Near Littlefield, Ariz.	7.27	2240	55.8	12	250	5300	2120	759	152	32.8	1.7	15010010	36.8623	113.9680
9419590	Detrital Wash Trib Near Chloride, Ariz.	1.23	3710	200	13	470	1080	715	457	233	126	41.4	15010014	35.4317	114.2847
9421800	Ringbolt Wash Near Hoover Dam, Ariz.	1.21	2590	428	---	310	---	---	---	---	---	---	15030101	35.9680	114.6833
9423760	Little Meadow Creek Near Oatman, Ariz.	8.47	3400	241	11	869	4590	2610	1390	508	194	28.7	15030103	35.0303	114.3082
9423780	Walnut Creek Near Kingman, Ariz.	31.3	5040	255	11	715	892	764	644	496	389	247	15030103	35.0333	114.0180
9423820	Sacramento Wash Near Yucca, Ariz.	787	3400	45.2	11	13000	21200	16500	12500	8200	5540	2640	15030103	34.8109	114.1609
9423900	Sacramento Wash Trib Near Topock, Ariz.	14.7	1450	98.2	13	1030	5290	3180	1780	710	291	48.7	15030103	34.7295	114.3123
9424200	Cottonwood Wash 1 N Kingman Ariz	143	5350	67	14	7000	11700	10400	9110	7310	5860	3690	15030201	35.1809	113.4689
9424407	Mcgarrys Wash Near Kingman, Ariz.	13.5	4610	203	11	1000	3130	1790	963	369	150	26.9	15030201	35.1167	113.6500
9424410	Big Sandy River Trib Near Kingman, Ariz.	1.99	3700	214	15	353	1090	672	394	173	80.2	18.6	15030201	35.0915	113.6582
9424430	Kaiser Spring Canyon Trib Near Wikieup, Ariz.	1.7	3520	615	15	1310	2610	1600	933	413	196	49.2	15030202	34.5749	113.4776
9424447	Burro Creek At Old Us 93 Bridge Nr Bagdad, Az.	601	---	---	---	55300	---	---	---	---	---	---	15030202	34.5415	113.4443
9424450	Big Sandy River Near Wikieup,Ariz.	2731.9	4490	41.9	30	68700	102400	78100	57200	34700	21300	7900	15030201	34.4623	113.6235
9424470	Kirkland Creek Near Kirkland, Ariz.	109	4665	40.5	---	10300	---	---	---	---	---	---	15030203	34.3937	112.7219
9424480	Ash Creek Near Kirkland, Ariz.	6.95	4680	278	15	4000	4250	2810	1780	882	459	133	15030203	34.4533	112.7956

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9424700	Iron Spring Wash Trib Near Bagdad, Ariz.	0.64	3470	431	13	180	993	607	348	146	63.5	12.4	15030203	34.5221	113.1117
9424900	Santa Maria River Near Bagdad, Ariz.	1129	4010	91.9	29	23100	32600	28000	23500	17700	13400	7510	15030203	34.3057	113.3462
9425500	Santa Maria River Near Alamo, Ariz.	1439	3650	46.5	27	33600	69600	48600	32600	17600	9870	3260	15030204	34.3000	113.5167
9426000	Bill Williams River Blw Alamo Dam, Az.	4623	4120	42.6	---	200000	---	---	---	---	---	---	15030204	34.2306	113.6079
9426500	Bill Williams River At Planet, Ariz.	5043.9	3900	38.6	---	200000	---	---	---	---	---	---	15030204	34.2563	113.9779
9427700	Monkeys Head Wash Near Parker, Ariz.	1.84	1130	415	13	320	1640	1000	572	236	100	18.2	15030104	34.2678	114.1292
9428545	Cunningham Wash Trib Near Wenden, Ariz.	0.77	2330	365	12	173	296	245	198	140	101	52.1	15030105	34.0096	113.5776
9428550	Bouse Wash Trib Near Bouse, Ariz.	14.6	1230	50	13	2920	6170	4440	3070	1730	998	344	15030105	33.9014	113.9735
9428800	Tyson Wash Trib Near Quartzsite, Ariz.	13.7	1520	75	---	1950	---	---	---	---	---	---	15030106	33.5123	114.2167
9429150	Creosote Wash Near Ehrenberg, Ariz.	1.98	509	95.2	11	580	1270	932	660	390	239	95.6	15030104	33.6208	114.4945
9429400	Indian Wash Trib Near Yuma, Az.	2.56	1190	66.7	14	98	131	115	99	79.3	64.8	44.7	15030104	33.1090	114.2945
9429510	Mittry Lake Trib Near Yuma, Az.	0.3	346	122	11	165	346	256	182	106	62.8	22	15030107	32.8596	114.4347
9432000	Gila River Below Blue Creek, Near Virden Nm	3203	6690	35.8	69	41700	42100	33200	25400	16700	11200	5120	15040002	32.6478	108.8451
9442000	Gila River Near Clifton, Ariz.	4010	6250	29	65	57000	47700	37300	28300	18600	12600	6000	15040002	32.9656	109.3096
9444100	Campbell Blue Creek Near Alpine, Az	11.6	8300	90.2	30	619	667	470	321	181	108	42	15040004	33.7459	109.2046
9444200	Blue River Nr. Clifton Az.	506	6910	65.3	29	30000	46600	34000	24100	14400	8960	3780	15040004	33.2907	109.1954
9444400	Chase Creek Near Clifton, Ariz.	1.37	6840	363	---	600	---	---	---	---	---	---	15040004	33.1721	109.3694
9444500	San Francisco River At Clifton, Ariz.	2764	6880	48.9	88	90900	113900	80800	55400	31100	18300	6780	15040004	33.0492	109.2951
9445500	Willow C Nr Point Of Pines Nr Morenci, Ariz.	102	6340	73	22	3710	4620	3710	2890	1970	1370	678	15040005	33.3790	109.6500
9446000	Willow C N Double Circle Rnch N Morenci Ariz.	149	6310	77.7	24	7500	10000	7990	6210	4200	2910	1430	15040005	33.3541	109.5249
9446500	Eagle C N Double Circle Rnch N Morenci Ariz	377	6410	100	24	30000	24600	18800	13900	8760	5690	2510	15040005	33.3000	109.4915
9447000	Eagle Creek Abv. Pumping Plant Nr. Morenci, Az.	622	6060	60.9	52	36800	47000	35000	24900	14400	8300	2730	15040005	33.0699	109.4514
9447800	Bonita Creek Near Morenci, Arizona	302	---	---	15	19500	27600	20600	15000	9070	5680	2320	15040005	32.9555	109.5303
9448500	Gila R At Head Of Safford Valley Nr Solomon Ariz	7896	6360	26.4	82	13200	140700	100800	70000	40400	24500	9860	15040005	32.8683	109.5104
9451800	Tollgate Wash Trib Near Clifton, Ariz.	0.12	4800	878	13	63	225	170	123	70.5	39.7	11.4	15040005	32.8500	109.3374
9456000	San Simon River Near San Simon Ariz.	814	4830	23.8	11	5350	8660	7770	6860	5570	4520	2920	15040006	32.2249	109.1749
9456400	Gold Gulch Near Bowie, Ariz.	15	5170	201	13	2550	4640	3630	2760	1790	1180	527	15040006	32.3475	109.6027
9457000	San Simon River Near Solomon, Ariz.	2192	4270	14.6	52	27500	17000	14500	12200	9320	7250	4520	15040006	32.8016	109.6385
9458200	Deadman Creek Near Safford, Ariz.	4.78	7520	1100	---	2760	---	---	---	---	---	---	15040005	32.7328	109.8156
9458500	Gila River At Safford, Ariz.	10459	5830	23.6	21	33000	35900	29700	24100	17700	13500	8230	15040005	32.8470	109.7150
9460150	Frye Creek Near Thatcher, Ariz.	4.02	8400	1160	14	2300	1580	986	581	254	116	25.6	15040005	32.7437	109.8374
9466500	Gila River At Calva, Ariz.	11470	5650	20.4	67	150000	161000	106900	68700	35500	19600	6760	15040005	33.1855	110.2194
9467120	Salt Creek Near Peridot, Ariz.	30.2	3490	169	12	3200	6910	5580	4350	2890	1920	810	15040005	33.2708	110.3041
9468300	Sevenmile Wash Trib Near Globe, Ariz.	0.83	4410	280	16	640	1690	1090	660	295	134	27.3	15040007	33.5861	110.6500
9468500	San Carlos River Near Peridot, Arizona	1026	4480	29.4	66	54800	62100	48000	32600	23500	15800	7460	15040007	33.2962	110.4508
9470500	San Pedro River At Palominas, Ariz.	741	4950	23.5	56	22000	21500	18600	15800	12100	9300	5460	15050202	31.3798	110.1104
9470900	San Pedro River Trib Near Bisbee, Ariz.	5.25	4770	129	14	1460	2140	1840	1550	1170	885	498	15050202	31.5699	110.0265
9471000	San Pedro River At Charleston, Ariz.	1234	4840	18.4	80	98000	49500	36200	26200	16600	11300	6130	15050202	31.6257	110.1738
9471550	San Pedro River Near Tombstone, Ariz.	1730	4820	18	19	24200	28000	23900	20100	15400	12000	7490	15050202	31.7508	110.2082
9471600	Canary Wash Near Benson, Ariz.	0.79	5240	472	13	84	385	239	139	58	24.7	4.4	15050202	31.8762	110.3342
9471700	Fenner Wash Near Benson, Ariz.	2.71	4180	93.8	15	950	2270	1740	1290	798	501	196	15050202	31.9801	110.2156
9471800	San Pedro River Near Benson, Ariz.	2490	4800	17.3	---	9800	---	---	---	---	---	---	15050203	32.1262	110.2893
9472000	San Pedro River Nr. Redington, Ariz.	2927	4660	15.3	64	90000	52700	42200	32900	22200	15200	7220	15050203	32.3803	110.4456
9472100	Peck Canyon Trib Near Redington, Ariz	8.02	3680	146	13	4340	4410	2780	1680	793	402	118	15050203	32.4866	110.5000
9472400	Mammoth Wash Near Mammoth, Ariz.	2.4	3700	181	14	3200	6960	4810	3130	1540	752	167	15050203	32.6762	110.6847
9473000	Aravaipa Creek Near Mammoth, Ariz.	537	4530	45.7	44	70800	26900	21600	16800	11500	8000	3980	15050203	32.8434	110.6186

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Gage No.	Station Name	Drainage Area sq. miles	Mean Basin Elevation feet	Main Channel Slope ft/mi	Period of Record	Q Max cfs	Log Pearson Type III Peak Discharge 100-Year cfs	50-Year cfs	25-Year cfs	10-Year cfs	5-Year cfs	2-Year cfs	HUC	Latitude Dec. Degrees	Longitude Dec. Degrees
9473200	Green Lantern Wash Near Winkelman, Ariz.	3.63	2590	189	13	3700	7490	5520	3920	2290	1380	509	15050203	32.9249	110.7262
9473500	San Pedro R At Winkelman, Ariz.	4453	4520	18	21	135000	60900	44300	31600	19500	12800	6390	15050203	32.9770	110.7697
9473600	Tam O'Shanter Wash Near Hayden, Ariz.	4.37	3050	324	14	1570	1460	1220	1010	759	586	368	15050100	33.0292	110.8727
9474000	Gila R At Kelvin Ariz	5125	5150	17.8	---	132000	---	---	---	---	---	---	15050100	33.1027	110.9757
9478200	Durham Wash Near Florence, Ariz.	15.6	3670	143	17	3500	5710	4390	3260	2050	1320	561	15050100	32.7221	111.1082
9478500	Queen C At Whitlow Damsite N Superior Ariz.	144	3180	137	15	42900	46100	33800	24000	14300	8850	3630	15050100	33.2984	111.2735
9478600	Queen Creek Trib No 3 At Whitlow Dam Ariz.	0.37	2320	187	13	280	417	339	270	189	135	71.3	15050100	33.2915	111.2803
9479200	Queen C Trib A Apache Junc Ariz	0.51	1760	76.2	18	262	431	346	269	179	120	52.5	15050100	33.4044	111.5407
9479500	Gila River Near Laveen, Ariz.	20615	---	---	48	65000	60900	34800	19200	8040	3760	1020	15050100	33.2568	112.1661
9480000	Santa Cruz River Near Lochiel, Ariz.	82.2	5150	42.2	47	12000	11600	9010	6820	4460	3020	1450	15050301	31.3552	110.5888
9480500	Santa Cruz River Nr. Nogales, Ariz.	533	4850	26	66	31000	23200	18900	15000	10600	7610	4090	15050301	31.3443	110.8508
9481500	Sonoita Creek Near Patagonia, Ariz.	209	4800	76.7	44	16000	15100	12300	9950	7190	5360	3130	15050301	31.5000	110.8167
9481700	Calabasas Canyon Near Nogales, Ariz.	10.3	4360	75.4	14	1200	2540	2020	1560	1030	691	309	15050301	31.4568	110.9858
9481750	Sopori Wash At Amado, Ariz.	176	3840	35.9	18	16000	17100	13400	10200	6780	4610	2230	15050301	31.7235	111.0609
9481800	Demetrie Wash Trib Near Continental, Ariz.	0.15	3620	100	13	110	214	169	130	85.2	56.9	25.6	15050301	31.8708	111.0874
9481900	Octillo Wash Near Continental, Ariz.	3.6	3280	106	---	1840	---	---	---	---	---	---	15050301	31.8333	111.0000
9482000	Santa Cruz River At Continental, Ariz.	1682	4350	21	51	45000	45400	32000	22000	12800	7980	3580	15050301	31.8533	110.9667
9482200	Flato Wash Near Sahuarita, Ariz.	6.7	2770	40.4	---	4500	---	---	---	---	---	---	15050301	32.0451	110.9500
9482330	Pumping Wash Near Vail, Ariz.	0.81	3010	57.7	15	337	560	469	382	274	198	102	15050301	32.0694	110.8063
9482350	South Fork Airport Wash Near Tucson, Ariz.	4.38	2740	36.5	---	1890	---	---	---	---	---	---	15050301	32.1000	110.9082
9482370	North Fork Airport Wash Near Tucson, Ariz.	5.28	2780	40.6	---	1350	---	---	---	---	---	---	15050301	32.1109	110.9082
9482400	Airport Wash At Tucson, Ariz.	23	2700	37	17	2900	1900	1540	1230	889	666	403	15050301	32.1525	110.9809
9482410	Rodeo Wash At Tucson, Ariz.	7.24	2560	33.7	11	898	1020	880	746	572	441	260	15050301	32.1721	110.9762
9482420	Julian Wash At Tucson Ariz	26.5	2900	38.9	11	1270	2310	1930	1570	1130	817	428	15050302	32.1708	110.9402
9482450	West Branch Santa Cruz River At Tucson, Ariz.	23.6	2800	80.9	---	910	---	---	---	---	---	---	15050301	32.1333	111.0082
9482480	Big Wash At Tucson, Ariz.	2.94	2850	95.2	16	3000	4460	3060	1940	887	390	63	15050301	32.1861	111.0019
9482500	Santa Cruz River At Tucson, Ariz.	2222	4050	20.1	78	37400	33300	26300	20300	13800	9720	5110	15050301	32.2210	110.9809
9482950	Railroad Wash At Tucson,Arizona	2.3	2490	0.73	11	1590	2390	1870	1440	961	666	340	15050301	32.2137	110.9456
9483000	Tucson Arroyo At Vine Ave, At Tucson, Az.	8.2	2510	37	23	5000	4890	3920	3090	2150	1540	842	15050301	32.2167	110.9481
9483010	High School Wash At Tucson Az	0.95	2460	1.11	15	800	1210	1010	827	606	454	261	15050301	32.2243	110.9464
9483025	Silvercroft Wash At Tucson Az	2.74	2540	44.6	13	1500	3360	2200	1370	659	332	90	15050301	32.2311	111.0027
9483030	Anklam Wash At Tucson, Ariz.	2.11	2700	298	16	2420	7390	4140	2210	855	362	75.6	15050301	32.2249	111.0303
9483040	West Speedway Wash Near Tucson, Ariz.	0.46	2750	364	16	240	627	521	419	291	202	92.2	15050301	32.2388	111.0451
9483042	Cemetery Wash At Tucson, Ariz.	1.17	2370	40	24	600	842	743	646	517	418	274	15050301	32.2637	110.9770
9483045	Flowing Wells Wash At Tucson Az	3.53	2380	32.1	19	1470	2260	1920	1610	1200	911	524	15050301	32.2650	110.9943
9483100	Tanque Verde Creek Near Tucson, Ariz.	43	4780	156	25	8600	12300	9460	7110	4620	3130	1530	15050302	32.2464	110.6792
9483200	Agua Caliente Wash Trib Near Tucson, Ariz.	2.04	3300	368	15	430	793	619	470	309	208	98.9	15050302	32.2686	110.7374
9483250	Rob Wash At Tucson Az	2.08	2710	55.6	15	1900	2870	2160	1580	973	622	267	15050302	32.2355	110.8158
9484000	Sabino Creek Near Tucson, Ariz.	35.5	6300	482	64	12900	12000	9220	6850	4310	2780	1190	15050302	32.3169	110.8098
9484200	Bear Creek Near Tucson, Ariz.	16.3	5860	502	15	1400	1850	1550	1260	917	675	370	15050302	32.3060	110.8008
9484500	Tanque Verde Cr At Tucson Ariz	219	4340	109	28	24500	35500	26400	18800	11000	6580	2360	15050302	32.2648	110.8407
9484510	Ventana Canyon Wash Near Tucson, Ariz.	6.46	4600	553	16	260	329	303	275	235	202	147	15050302	32.3096	110.8388
9484560	Cienega Creek Near Pantano, Ariz	289	4890	59.8	14	20000	18500	13700	9930	6150	4020	1880	15050302	31.9855	110.5656
9484570	Mescal Arroyo Near Pantano, Ariz.	38.4	4260	82.9	17	27000	15400	10400	6800	3620	2060	753	15050302	31.9896	110.5642
9484580	Barrel Canyon Near Sonoita, Ariz.	14.1	5000	190	14	1900	4480	3580	2760	1810	1190	504	15050302	31.8615	110.6902
9484590	Davidson Canyon Wash Near Vail, Ariz.	50.5	4340	86.2	13	6860	9340	7800	6380	4640	3430	1900	15050302	31.9934	110.6443

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Gage No.	Station Name	Drainage Area sq. miles	Mean Basin Elevation feet	Main Channel Slope ft/mi	Period of Record	Q Max cfs	Log Pearson Type III Peak Discharge 100-Year cfs	50-Year cfs	25-Year cfs	10-Year cfs	5-Year cfs	2-Year cfs	HUC	Latitude Dec. Degrees	Longitude Dec. Degrees
9484600	Pantano Wash Near Vail, Az	457	4500	46.3	38	38000	32100	23900	17200	10400	6450	2600	15050302	32.0358	110.6768
9485000	Rincon Creek Near Tucson, Ariz.	44.8	4850	612	43	9660	16700	12100	8410	4760	2770	963	15050302	32.1292	110.6254
9485100	Saguaro Corners Wash Near Tucson, Az	0.17	3040	117	9	49	53	49.1	44.8	39.1	34.4	27.4	15050302	32.1697	110.7374
9485500	Pantano Wash Near Tucson Ariz	602	4560	56.4	16	20000	22600	17100	12500	7540	4620	1720	15050302	32.2489	110.8478
9485550	Arcadia Wash At Tucson,Arizona	2.72	2560	0.77	16	1210	1920	1600	1310	953	707	395	15050302	32.2434	110.8847
9485570	Alamo Wash At Tucson Az	9.58	2590	46.2	13	4000	7460	6340	5260	3890	2900	1600	15050302	32.2585	110.8836
9485900	Pima Wash Near Tucson, Ariz.	4.93	4430	533	18	460	652	524	407	269	177	74.2	15050302	32.3374	110.9596
9485950	Geronimo Wash Near Tucson, Ariz.	2.15	3600	699	17	705	1090	850	643	414	271	118	15050302	32.3320	110.9434
9486000	Rillito Cr Near Tucson, Az	918	4400	45.5	67	29700	27700	22800	18400	13100	9530	5120	15050302	32.2945	110.9833
9486300	Canada Del Oro Near Tucson, Az	250	4000	108	18	17000	23900	18800	14400	9340	6150	2650	15050301	32.3740	111.0085
9486500	Santa Cruz River At Cortaro, Ariz.	3503	4000	20.3	45	65000	46000	36800	29000	20400	15000	8780	15050302	32.3511	111.0937
9486700	Chiltepines Wash Near Sasabe, Ariz.	7.13	3660	116	---	560	---	---	---	---	---	---	15050304	31.8189	110.4377
9486800	Altar Wash Nr Three Points, Az	463	3920	74.1	17	22000	22400	18800	15400	11200	8180	4360	15050304	31.8361	111.4030
9487000	Brawley Wash Near Three Points, Ariz.	776	3710	30.8	22	19100	21100	17000	13300	9260	6630	3570	15050304	32.0754	111.3374
9487100	Little Brawley Wash Near Three Points, Ariz.	11.9	2800	112	14	13800	4440	3600	2860	2010	1450	777	15050304	32.1235	111.3290
9487140	San Joaquin Wash Near Tucson, Ariz.	0.45	2530	69.3	12	520	987	824	672	486	356	191	15050304	32.1686	111.1325
9487250	Los Robles Wash Near Marana, Ariz.	1170	3350	25.9	14	32000	12500	10000	7670	4900	3090	1140	15050304	32.4377	111.3036
9487400	Quijotoa Wash Trib. Near Quijotoa, Ariz.	2.44	2800	88.9	12	715	1300	1040	813	546	370	168	15050306	32.1735	112.1082
9488500	Santa Rosa Wash Nr. Vaiva Vo, Ariz.	1782	2340	25.5	26	53100	29000	19700	12600	6250	3160	808	15050306	32.6675	111.9273
9488600	Silver Reef Wash Near Casa Grande, Ariz.	12.8	1620	67.4	12	1400	3340	2480	1780	1070	663	268	15050306	32.6820	111.8342
9489000	Santa Cruz River Near Laveen, Ariz.	8581	3060	15.2	56	33000	13300	9940	7160	4270	2600	986	15050303	33.2320	112.1689
9489070	North Fork Of East Fork Black R Nr Alpine, Az	38.1	9060	48.8	12	1070	1420	1210	1000	741	553	306	15060101	33.9030	109.3221
9489080	Hannagan Creek Near Hannagan Meadow, Ariz.	1.61	9160	68.6	12	70	87	70.6	56.1	39.7	29	16.5	15060101	33.6492	109.2844
9489100	Black River Near Maverick, Ariz.	315	8700	69.4	19	14000	20500	14900	10500	6220	3860	1620	15060101	33.7074	109.4464
9489200	Pacheta Creek At Maverick, Az	14.8	8810	160	22	323	426	366	308	234	180	106	15060101	33.7396	109.5399
9489500	Black River Blw Pumping Plant Nr. Point Of Pines	560	8000	51.1	42	17900	23400	17700	13000	8090	5190	2230	15060101	33.4765	109.7631
9489700	Big Bonito C Nr Fort Apache, Ariz.	119	7920	106	23	4510	6040	4650	3470	2200	1440	629	15060101	33.6672	109.8459
9490500	Black River Near Fort Apache, Ariz. Mile 5.0	1232	7200	36.2	38	54700	103500	78800	57600	34600	21000	7460	15060101	33.7126	110.2109
9490800	North Fork White River Nr. Greer, Ariz.	40.2	9520	216	12	510	535	469	405	325	266	183	15060102	34.0150	109.6434
9491000	North Fork White R Near Mcnary, Ariz.	66	9320	153	38	2310	2280	1850	1460	1030	742	407	15060102	34.0462	109.7339
9491800	North Fork White R Trib N Whiteriver, Az	2.27	6290	272	---	120	---	---	---	---	---	---	15060102	33.9287	109.9385
9492400	East Fork White River Nr Fort Apache, Ariz.	38.8	8580	239	38	2700	1090	928	776	587	450	268	15060102	33.8221	109.8137
9494000	White River Near Fort Apache, Ariz. Mile 4.5	632	7400	76.8	38	14600	18200	14700	11500	8030	5760	3110	15060102	33.7363	110.1658
9494300	Carrizo C Ab Corduroy C Nr Show Low, Ariz.	225	6370	64.9	13	10000	11300	9140	7220	5020	3580	1870	15060104	34.0000	110.2888
9496000	Corduroy Creek Near Mouth, Near, Show Low, Ariz	203	6370	71.2	23	10900	33200	22000	14000	6980	3650	1070	15060104	34.0183	110.2415
9496500	Carrizo Creek Near Show Low, Ariz.	439	6320	61.8	45	23000	36900	27000	19200	11400	7020	2850	15060104	33.9858	110.2801
9496600	Cibecue 1 Trib Carrizo Cr Nr Show Low, Ariz.	0.1	5390	364	13	165	307	248	195	133	92	44	15060104	33.9910	110.3240
9496700	Cibecue 2, Trib Carrizo Cr, Nr Show Low, Ariz.	0.07	5240	200	13	120	161	138	116	88	69	43	15060104	33.9880	110.3104
9496800	Carrizo Creek Trib Near Show Low, Ariz.	2.55	5810	306	13	1260	2850	2180	1620	1020	660	287	15060104	33.9544	110.3311
9497500	Salt River Near Chrysotile, Ariz. Mile 34.8	2849	6730	31.9	72	76600	122800	91200	65600	39600	24700	10200	15060103	33.7978	110.4989
9497800	Cibecue Creek Near Chrysotile, Ariz.	295	5700	79.6	37	22200	20800	17300	14200	10300	7620	4200	15060103	33.8429	110.5568
9497900	Cherry Creek Near Young, Ariz	62.1	6030	106	15	7290	11600	9200	7080	4660	3120	1390	15060103	34.0825	110.9235
9497980	Cherry Creek Near Globe, Ariz.	200	5600	87.9	30	15700	25400	19300	14200	8700	5450	2190	15060103	33.8276	110.8555
9498400	Pinal C At Inspiration Dam, Nr Globe, Az	162	---	---	16	5950	8440	6740	5260	3600	2540	1320	15060103	33.5730	110.9005
9498500	Salt River Near Roosevelt, Ariz.	4306	6190	23.3	73	143000	227900	162600	112300	63800	38000	14400	15060103	33.6194	110.9208
9498600	Cristopher Creek Trib Near Kohl'S Ranch, Ariz	0.66	6080	510	10	265	348	256	182	110	69.5	30.2	15060105	34.3221	111.0667

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9498800	Tonto Creek Near Gisela, Ariz.	430	5810	126	10	38000	95500	73200	54200	33800	21500	8810	15060105	34.1287	111.2546
9498870	Rye Creek Nr Gisela, Ariz.	122	4390	91.4	20	44400	35400	24600	16800	9700	6100	2850	15060105	34.0322	111.2904
9498900	Gold Creek Near Payson, Ariz.	6.44	4590	295	14	2800	4070	3020	2160	1290	795	314	15060105	34.0027	111.3582
9499000	Tonto Creek Abv. Gun Cr., Nr Roosevelt, Az	675	5020	88.4	55	72500	107900	85100	64800	41700	27000	11100	15060105	33.9798	111.3027
9501300	Tortilla Creek At Tortilla Flat, Ariz.	24.3	2960	179	22	7500	15300	12200	9410	6180	4080	1740	15060106	33.5270	111.3869
9502700	Crookton Wash Near Seligman, Ariz.	6.01	5970	111	15	480	6250	2870	1200	310	86.2	7.2	15060201	35.2874	112.7317
9502800	Williamson Valley W Nr Paulden, Ariz.	255	5120	48.6	20	14800	29200	20400	13700	7360	4080	1310	15060201	34.8667	112.6456
9503000	Granite Creek Near Prescott, Ariz.	36.3	5900	104	17	6660	7710	6030	4580	2990	2000	916	15060202	34.5667	112.4500
9503700	Verde River Near Paulden, Ariz.	2150	5410	23.8	33	23200	38400	25900	16700	8540	4550	1380	15060202	34.8948	112.3404
9503720	Hell Canyon Near Williams, Ariz.	14.9	7110	47.8	11	1080	3860	2960	2190	1360	862	346	15060202	35.1601	112.2096
9503740	Hell Canyon Trib N Ash Fork. Az	0.75	5180	78.4	9	84	220	156	105	57.4	32.3	10.5	15060202	35.0839	112.4077
9503750	Limestone Canyon Nr Paulden, Az	14.5	5310	87.3	9	4100	9820	6670	4270	2080	1020	239	15060202	34.9798	112.4014
9503800	Volunteer Wash Near Bellemont, Ariz.	124	7620	56.6	14	2300	6890	5110	3610	2040	1160	357	15060202	35.1505	111.8981
9504000	Verde River Nr Clarkdale, Ariz.	3139	5490	22.9	33	53200	70200	54400	40700	25500	16100	6340	15060202	34.8514	112.0650
9504100	Hull Canyon Near Jerome, Ariz.	0.85	7050	1270	18	500	561	335	183	66.3	23.5	2.6	15060202	34.7388	112.1429
9504400	Munds Canyon Trib Near Sedona, Ariz.	1.15	6880	269	14	705	1430	1040	729	409	232	73.9	15060202	34.9221	111.6443
9504500	Oak Creek Near Cornville, Ariz.	355	6200	85	54	26400	50100	39200	29500	18700	12000	4810	15060202	34.7653	111.8899
9504800	Oak Creek Trib Near Cornville, Az	0.05	3570	65	14	53	369	240	144	61.7	25.9	4.1	15060202	34.7123	111.8803
9505200	Wet Beaver Creek Near Rimrock, Arizona	111	6410	131	34	16000	15800	13300	11000	8140	6130	3520	15060202	34.6746	111.6713
9505220	Rocky Gulch Nr Rimrock, Az	1.4	7190	421	---	1550	---	---	---	---	---	---	15060202	34.7467	111.4937
9505250	Red Tank Draw Near Rimrock, Ariz	49.4	5910	183	20	10500	10900	7810	5410	3090	1860	724	15060202	34.6951	111.7134
9505300	Rattlesnake Canyon Near Rimrock, Ariz.	24.6	6560	174	22	4000	6290	5110	4030	2750	1880	872	15060202	34.7669	111.6730
9505350	Dry Beaver Creek Near Rimrock, Ariz.	142	6220	137	35	26600	51400	38400	27400	16100	9590	3380	15060202	34.7284	111.7749
9505550	Verde River Below Camp Verde,Ariz	4297	5544	17.9	---	55000	---	---	---	---	---	---	15060203	34.5505	111.8505
9505600	Dirty Neck Canyon Near Clints Well, Ariz.	3.42	7140	190	11	210	573	458	353	231	151	62.7	15060203	34.5123	111.3582
9505800	West Clear Creek Near Camp Verde, Ariz.	241	6680	112	31	24800	32700	26500	20800	14200	9690	4510	15060203	34.5385	111.6932
9505900	Cottonwood Wash Near Camp Verde, Ariz.	0.64	3540	385	13	250	619	420	273	141	75.9	23.4	15060203	34.5055	111.7527
9506000	Verde River Near Camp Verde, Ariz.	4644	5560	17.9	18	119000	166300	118500	81500	45900	27000	9900	15060203	34.4500	111.7833
9507600	East Verde River Nr. Pine, Ariz.	6.34	6430	303	12	2820	8600	5700	3620	1810	954	288	15060203	34.3915	111.2680
9507700	Webber Cr Ab West Fork Webber Cr N Pine, Az	4.79	6980	634	15	1220	2480	1660	1070	544	291	90	15060203	34.3943	111.3721
9507980	East Verde River Near Childs, Ariz.	331	5140	91.6	33	23500	56700	40800	28300	16000	9300	3270	15060203	34.2776	111.6388
9508300	Wet Bottom Creek Nr Childs, Ariz.	36.4	4810	210	28	7380	17600	13900	10600	6760	4340	1740	15060203	34.1607	111.6921
9508500	Verde River Blw Tangle Cr Ab Horseshoe Dam, Az	5493	5470	16.2	72	150000	200300	151700	110800	67300	41600	16000	15060203	34.0730	111.7153
9510070	Wf Sycamore Cr Ab Mcfar Can, N Sunflower, Az	4.58	5430	260	22	1700	5530	3330	1840	702	268	36	15060203	33.9604	111.4866
9510080	West Fork Sycamore Cr Nr Sunflower, Ariz.	9.8	5260	353	13	3480	8030	4920	2840	1190	519	101	15060203	33.9456	111.4847
9510100	East Fork Sycamore Creek Near Sunflower, Ariz.	4.49	5760	370	25	1940	2670	1660	978	428	196	43	15060203	33.9492	111.4607
9510150	Sycamore Creek Near Sunflower, Ariz.	52.3	4260	58.6	14	16100	42700	27800	17200	8160	4050	1050	15060203	33.8514	111.4525
9510170	Camp Creek Nr Sunflower, Az	2.6	3520	498	21	402	773	625	491	334	230	108	15060203	33.7596	111.4954
9510180	Rock Creek Near Sunflower, Ariz.	15.2	3680	412	14	2550	6390	5030	3810	2410	1520	573	15060203	33.7301	111.5077
9510200	Sycamore Creek Near Fort Mcdowell	164	3820	116	36	24200	46300	33600	23200	12900	7320	2330	15060203	33.6940	111.5410
9512100	Indian Bend Wash At Scottsdale Ariz	62	1780	60	24	21000	16800	10600	6400	2950	1440	378	15060106	33.5355	111.9137
9512200	Salt River Trib. In S. Mnt. Park, Phoenix, Ariz.	1.75	1730	244	33	1210	2230	1500	925	420	191	37	15060106	33.3467	112.0842
9512300	Cave Creek Nr Cave Creek Ariz	121	3470	123	26	13800	21500	16400	12000	7360	4580	1780	15060106	33.7833	112.0066
9512420	Lynx Creek Trib Near Prescott, Ariz.	0.95	5900	101	9	820	2910	2100	1430	761	403	106	15060202	34.5473	112.3992
9512500	Agua Fria River Near Mayer, Az	585	5000	56.9	56	33100	35900	28700	22400	15500	11000	5920	15070102	34.3150	112.0631
9512600	Turkey Creek Near Cleator Arizona	89.4	5360	122	12	5230	9810	8160	6600	4700	3360	1700	15070102	34.2820	112.2068

Compilation of gage data for Arizona

Data source: Statistical Summaries of Streamflow Data and Characteristics of Drainage Basins for Selected Streamflow-Gaging Stations in Arizona Through Water Year 1996, USGS WR98-4225

Gage No.	Station Name	Drainage Area sq. miles	Mean Basin Elevation feet	Main Channel Slope ft/mi	Period of Record	Q Max cfs	Log Pearson Type III Peak Discharge 100-Year cfs	50-Year cfs	25-Year cfs	10-Year cfs	5-Year cfs	2-Year cfs	HUC	Latitude Dec. Degrees	Longitude Dec. Degrees
9512700	Agua Fria River Trib #2 Nr Rock Springs, Ariz	1.07	2140	173	22	1200	1570	1320	1090	808	611	359	15070102	34.0333	112.1448
9512800	Agua Fria River Near Rock Springs, Ariz.	1111	4770	61.2	27	85000	211800	140100	88900	44300	23300	7000	15070102	34.0137	112.1672
9512830	Boulder Creek Nr Rock Springs Az.	37.8	---	---	---	10000	---	---	---	---	---	---	15070102	33.9984	112.2156
9512970	Cottonwood Creek Nr Waddell Dam Az.	9.28	---	---	8	1750	16400	9600	5240	2020	804	131	15070102	33.8984	112.3107
9513780	New River Nr Rock Springs, Ariz.	68.3	3970	140	34	18600	35000	26400	19200	11400	6880	2440	15070102	33.9740	112.0981
9513800	New River At New River, Ariz.	83.3	3600	105	21	19500	37500	28300	20600	12600	7880	3150	15070102	33.9112	112.1404
9513820	Deadman Wash Near New River, Ariz.	11.1	1980	124	24	1850	4630	3550	2610	1590	969	348	15070102	33.8415	112.1443
9513835	New River At Bell Road, Near Peoria, Ariz.	185	2700	64.5	23	14600	31700	23300	16400	9410	5510	1900	15070102	33.6383	112.2393
9513860	Skunk Creek Near Phoenix, Ariz.	64.9	2180	49.2	36	11500	27600	18700	12100	6120	3230	940	15070102	33.7290	112.1191
9513890	New River At Peoria, Ariz.	317	2320	65.3	12	38000	75100	54900	38000	20800	11300	3160	15070102	33.5951	112.2623
9513910	New River Nr Glendale, Ariz.	600	2130	66.9	27	38000	49800	36300	25400	14400	8410	2890	15070102	33.5366	112.2809
9513970	Agua Fria River At Avondale, Ariz.	554	3010	38.7	22	44200	---	---	---	---	---	---	15070102	33.4350	112.3328
9514200	Waterman Wash Near Buckeye, Ariz.	420	1570	21.2	30	6310	8470	6630	5090	3420	2390	1250	15070101	33.3301	112.5090
9515500	Hassayampa River At Box Damsite Nr Wickenburg Az	417	4750	71	39	58000	43000	32300	23300	13900	8480	3180	15070103	34.0448	112.7090
9515800	Hartman Wash Near Wickenburg, Ariz.	5.57	2690	71.6	21	1300	7100	4910	3230	1660	869	239	15070103	33.9626	112.8276
9516500	Hassayampa River Nr Morristown, Ariz.	796	3190	84.9	39	47500	45600	34000	24400	14300	8540	3030	15070103	33.8850	112.6612
9516600	Ox Wash Near Morristown, Ariz.	6.31	2290	101	22	2900	3720	2760	1960	1120	647	209	15070103	33.8833	112.6500
9516800	Jack Rabbit Wash Near Tonopah, Ariz.	137	2260	34.4	21	13000	33900	22600	14200	6860	3400	847	15070103	33.6587	112.8276
9517000	Hassayampa River Near Arlington, Ariz.	1471	3010	39.9	32	39000	40500	29200	20500	12000	7340	3010	15070103	33.3470	112.7249
9517200	Centennial Wash Tributary Near Wenden, Ariz.	2.79	2480	193	22	720	1080	868	676	451	303	135	15070104	33.8443	113.4500
9517280	Tiger Wash Near Aguila, Ariz.	85.2	2590	35.2	22	4550	7340	5950	4670	3160	2140	961	15070104	33.7415	113.2784
9517400	Winters Wash Near Tonopah, Ariz.	47.8	1630	83.7	17	3640	4560	3720	2980	2120	1540	857	15070104	33.4893	112.9180
9517500	Centenial Wash Nr. Arlington, Ariz.	1810	---	---	---	14500	---	---	---	---	---	---	15070101	33.2699	112.7970
9519600	Rainbow Wash Trib Near Buckeye, Ariz.	2.43	950	323	22	1430	2050	1670	1330	920	648	323	15070101	33.2429	112.6374
9519750	Bender Wash Near Gila Bend, Ariz.	68.6	1900	867	22	3610	4450	3690	2990	2160	1580	867	15070101	32.9068	112.5514
9519760	Sauceda Wash Near Gila Bend, Ariz.	116	1980	591	22	3150	6850	5360	4030	2520	1580	591	15070101	32.8705	112.7582
9519780	Windmill Wash Near Gila Bend, Ariz.	12.9	1050	64.4	14	4430	27600	16000	8550	3210	1160	155	15070101	33.4276	112.8380
9520100	Military Wash Near Sentinel, Ariz.	8.7	674	56	22	1530	5220	3500	2240	1120	577	161	15070201	32.8451	113.2787
9520110	Hot Shot Arroyo Near Ajo, Ariz.	0.44	1760	83.3	15	240	327	298	268	226	191	136	15070202	32.3467	112.8085
9520130	Darby Arroyo Near Ajo, Ariz.	4.72	1920	71.1	15	1670	2380	1990	1640	1210	922	550	15070202	32.3552	112.8251
9520160	Gibson Arroyo At Ajo, Az	2.18	2100	171	14	1800	1620	1300	1010	686	474	231	15070202	32.3798	112.8609
9520170	Rio Cornez Nr. Ajo, Ariz.	243	1950	26.8	13	8030	11800	9980	8310	6280	4850	3000	15070202	32.4992	112.8803
9520200	Black Gap Wash Near Ajo, Ariz.	12.1	1280	21.8	17	940	1490	1300	1120	868	672	392	15070202	32.7063	112.8451
9520230	Crater Range Wash Near Ajo, Ariz.	1.49	1280	69.3	20	590	2230	1550	1020	522	270	70	15070202	32.5623	112.8762
9520300	Alamo Wash Trib Near Ajo, Ariz.	0.9	2040	64	30	510	656	546	445	326	240	141	15070203	32.1000	112.7708
9520350	Mohawk Pass Wash At Mohawk, Az.	0.09	601	707	14	117	273	202	145	85.7	52.4	20.2	15070203	32.7287	113.7415
9520400	Ligurta Wash At Ligurta, Az.	1.99	395	127	14	1590	3930	2730	1820	980	548	182	15070201	32.6757	114.2937
9535100	San Simon Wash Nr Pisinimo Az	569	2250	17.4	24	12500	11400	8190	5770	3450	2210	1020	15080101	32.0448	112.3699
9535200	Sells Wash Trib At Sells, Ariz.	26.8	2560	49.9		2800	---	---	---	---	---	---	15080101	31.9150	111.8781
9535300	Vamori Wash At Kom Vo, Az	1250	2699	14.1	24	10400	5810	4440	3340	2200	1540	833	15080101	31.9475	112.3432
9536100	Pitchfork Canyon Trib Near Fort Grant, Ariz.	0.81	5210	459	13	375	589	506	425	323	247	144	15050201	32.5888	109.9109
9536350	Surprise Canyon Near Dos Cabezas, Ariz.	0.65	6280	1040	13	191	413	335	261	172	113	44.9	15050201	32.0109	109.3533
9537200	Leslie Creek Near Mcneal, Ariz.	79.1	5360	62.1	21	5200	13500	9490	6380	3430	1910	612	15080301	31.5899	109.5082
9537500	Whitewater Draw Near Douglas, Ariz.	1023	4740	20.5	70	5060	5220	4660	4080	3270	2610	1620	15080301	31.3522	109.5844

Ratios for the 10-, 5- and 2-year USGS LP3 peak discharges to the 100-year for all gages in Arizona

Gage No.	Station Name	Drainage Area sq. miles	Mean Basin Elevation feet	Main Channel Slope ft/mi	Log Pearson Type III Peak Discharge 100-Year cfs	10-Year cfs	5-Year cfs	2-Year cfs	Ratio to the 100-Year Discharge 10-Year %	5-Year %	2-Year %
9371100	Teec Nos Pos Wash Near Teec Nos Pos, Ariz.	16	7600	411	1760	1050	841	557	0.60	0.48	0.32
9379030	Black Mountain Wash Near Chinle, Ariz.	80.7	5920	46.2	4970	2320	1650	844	0.47	0.33	0.17
9379060	Lukachukai Creek Tributary Near Lukachukai, A	1.37	5820	72.2	301	79.5	46.8	17.9	0.26	0.16	0.06
9379100	Long House Wash Near Kayenta, Ariz.	1.38	6920	236	5880	1760	1000	304	0.30	0.17	0.05
9379200	Chinle Creek Near Mexican Water, Ariz.	3650	6260	12.3	16500	6820	4710	2320	0.41	0.29	0.14
9379560	El Capitan Wash Near Kayenta, Ariz.	5.88	5690	78.4	3530	1390	952	470	0.39	0.27	0.13
9379980	Jack Bench Wash Tributary Near Page, Ariz.	0.98	6180	133	2850	141	37.1	2.6	0.05	0.01	0.00
9382000	Paria River At Lees Ferry, Ariz.	1410	6150	43	19800	8810	6330	3420	0.44	0.32	0.17
9383020	House Rock Wash Trib Nr Marble Canyon, Az.	3.54	5290	209	913	161	81.8	24.7	0.18	0.09	0.03
9383400	Little Colorado River At Greer, Ariz.	29.1	9400	180	822	425	316	175	0.52	0.38	0.21
9383500	Nutrioso Cr. Ab. Nelson Res Nr Springerville,Az.	83.3	8550	78	1100	403	263	117	0.37	0.24	0.11
9383600	Fish Creek Near Eagar Ariz.	16.9	9160	164	485	227	158	74.5	0.47	0.33	0.15
9384000	Little Colorado R Abv Lyman Lake Nr St. Johns, Az	703.5	7760	89.5	9400	2880	1790	750	0.31	0.19	0.08
9384200	Lyman Reservoir Trib Nr St Johns, Az	0.24	6100	267	116	74.9	62	42.8	0.65	0.53	0.37
9385800	Little Colorado R Trib Nr St Johns, Az	0.35	6350	417	672	206	127	52	0.31	0.19	0.08
9386500	Little Colorado R Ab Zuni R Nr Hunt, Az.	3557	7160	40.2	2930	819	474	164	0.28	0.16	0.06
9388000	Little Colorado River Nr Hunt, Az	6173	7060	37.6	8700	3040	1930	801	0.35	0.22	0.09
9390500	Show Low Creek Near Lakeside, Arizona	68.6	7320	77.2	16800	3210	1550	362	0.19	0.09	0.02
9392800	Long Lake Tributary Near Show Low, Ariz.	5.22	6700	133	4030	524	195	23.4	0.13	0.05	0.01
9393500	Silver Creek Near Snowflake, Ariz.	846	6400	35	18200	7720	5330	2590	0.42	0.29	0.14
9394500	Little Colorado R At Woodruff, Ariz.	7775	6810	25.2	18300	9340	6920	3790	0.51	0.38	0.21
9395100	Carr Lake Draw Tributary Near Holbrook, Ariz.	1.28	5420	103	345	120	73.8	27	0.35	0.21	0.08
9395900	Black Creek Nr Lupton, Az	493	7500	11.2	11200	5880	4440	2550	0.53	0.40	0.23
9396400	Dead Wash Tributary Near Holbrook, Ariz.	1.22	5740	60	1150	522	374	198	0.45	0.33	0.17
9396500	Puerco River Near Adamana, Ariz	2603.5	6730	15.7	57900	28400	20900	11500	0.49	0.36	0.20
9397000	Little Colorado River At Holbrook, Ariz.	11115	6730	21.9	37200	21400	17000	11000	0.58	0.46	0.30
9397200	Penzance Wash Near Joseph City, Ariz.	0.17	5150	237	296	126	85.4	38	0.43	0.29	0.13
9397500	Chevelon Fork Below Wildcat Canyon, Near Winslow	271	7030	54.4	41200	11900	6950	2400	0.29	0.17	0.06
9397800	Brookbank Canyon Near Heber, Ariz.	27.9	6950	65.5	1070	460	315	147	0.43	0.29	0.14
9398000	Chevelon Creek Near Winslow, Ariz.	781	6440	27.7	33800	9760	5860	2360	0.29	0.17	0.07
9398500	Clear Creek Below Willow Creek, N Winslow, Az.	317	7100	26	39700	11700	6820	2360	0.29	0.17	0.06
9399000	Clear Creek Near Winslow, Ariz.	607	6500	24.1	59200	13700	7750	2790	0.23	0.13	0.05
9400100	Ganado Wash Trib Nr Ganado, Ariz.	7.85	6770	55.5	2320	819	533	238	0.35	0.23	0.10
9400200	Steamboat Wash Trib Nr Ganado, Ariz.	0.32	6750	100	1520	322	167	46.6	0.21	0.11	0.03
9400290	Teshbito Wash Trib Nr Holbrook, Ariz.	9.3	6420	93.7	3030	1310	874	371	0.43	0.29	0.12
9400300	Teshbito Wash Nr Holbrook, Ariz.	49.6	6280	57.7	2320	1340	1050	653	0.58	0.45	0.28
9400530	Cow Canyon Nr Winslow Ariz.	3.57	5380	61.8	387	181	129	64.8	0.47	0.33	0.17
9400560	Oraibi Wash Trib Nr Oraibi, Ariz.	1.78	6020	105	770	339	240	124	0.44	0.31	0.16
9400565	Polacca Wash Trib Nr Chinle, Ariz.	6.45	6890	160	2150	995	708	361	0.46	0.33	0.17
9400580	Castle Butte Wash Nr Winslow, Ariz.	5.57	5820	83.8	2220	536	289	86	0.24	0.13	0.04
9400600	Rio De Flag At Flagstaff, Ariz.	51	8050	106	861	167	74.5	17.2	0.19	0.09	0.02
9400650	Sinclair Wash At Flagstaff, Ariz.	8.11	7200	69.9	748	260	168	74.2	0.35	0.22	0.10
9400660	Bow And Arrow Wash At Flagstaff, Ariz.	2.06	6990	46.5	111	53.9	39.7	22.1	0.49	0.36	0.20
9400680	Switzer Canyon At Flagstaff, Ariz.	1.87	7130	375	413	151	95.9	38.4	0.37	0.23	0.09
9400700	Switzer Canyon Trib At Flagstaff, Ariz.	5.52	6950	267	326	163	124	75.2	0.50	0.38	0.23

Ratios for the 10-, 5- and 2-year USGS LP3 peak discharges to the 100-year for all gages in Arizona

Gage No.	Station Name	Drainage Area sq. miles	Mean Basin Elevation feet	Main Channel Slope ft/mi	Log Pearson Type III Peak Discharge 100-Year cfs	10-Year cfs	5-Year cfs	2-Year cfs	Ratio to the 100-Year Discharge 10-Year %	5-Year %	2-Year %
9400740	Harenberg Wash At Flagstaff,Ariz.	2.41	7570	594	293	144	107	60.2	0.49	0.37	0.21
9400910	Fay Canyon Near Flagstaff, Ariz.	3.28	7000	72.2	182	66	36	8	0.36	0.20	0.04
9401000	Little Colo. River At Grand Falls, Ariz.	21240	6440	10.5	76000	26100	17280	8310	0.34	0.23	0.11
9401220	Cedar Wash Near Cameron, Ariz.	579	6430	123	30200	8040	4550	1510	0.27	0.15	0.05
9401245	Klethla Valley Trib Near Kayenta Az	0.79	6730	87.7	419	244	193	121	0.58	0.46	0.29
9401260	Moenkopi Wash At Moenkopi	1629	5850	24.8	15000	7760	5820	3320	0.52	0.39	0.22
9401300	Hamblin Wash Trib Near Cedar Ridge, Ariz.	0.1	5860	263	3040	156	37.3	1.7	0.05	0.01	0.00
9401400	Moenkopi Wash Nr Tuba City, Ariz.	1300	5820	27.2	14500	7900	6120	3740	0.54	0.42	0.26
9402000	Little Colorado River Near Cameron, Ariz.	26091	6300	7.48	28700	15600	12200	7730	0.54	0.43	0.27
9403000	Bright Angel Creek Near Grand Canyon, Ariz.	101	7390	421	4970	1600	1010	435	0.32	0.20	0.09
9403780	Kanab Creek Nr Fredonia, Ariz.	1085	6100	56.4	7140	2610	1760	875	0.37	0.25	0.12
9403800	Bitter Seeps Wash Trib Near Fredonia, Ariz.	2.85	5120	129	7350	1240	575	127	0.17	0.08	0.02
9403930	West Cataract Creek Near Williams, Ariz.	3.18	7190	465	708	181	96.4	26.2	0.26	0.14	0.04
9404050	Spring Valley Wash Trib Near Williams, Ariz.	3.93	6750	40.5	449	113	61.2	17.7	0.25	0.14	0.04
9404310	Yampai Canyon Trib Near Peach Springs, Ariz.	0.2	5360	444	237	63.5	37.2	13.8	0.27	0.16	0.06
9404340	Truxton Wash At Valentine, Ariz.	370	4630	57	26300	6330	3510	1150	0.24	0.13	0.04
9404350	Valentine Wash At Valentine, Ariz.	3.15	4490	378	18400	552	142	12.7	0.03	0.01	0.00
9415000	Virgin River At Littlefield, Ariz.	5090	5500	38.4	35500	14200	9810	4920	0.40	0.28	0.14
9415050	Big Bend Wash Trib Near Littlefield, Ariz.	7.27	2240	55.8	5300	152	32.8	1.7	0.03	0.01	0.00
9419590	Detrital Wash Trib Near Chloride, Ariz.	1.23	3710	200	1080	233	126	41.4	0.22	0.12	0.04
9423760	Little Meadow Creek Near Oatman, Ariz.	8.47	3400	241	4590	508	194	28.7	0.11	0.04	0.01
9423780	Walnut Creek Near Kingman, Ariz.	31.3	5040	255	892	496	389	247	0.56	0.44	0.28
9423820	Sacramento Wash Near Yucca, Ariz.	787	3400	45.2	21200	8200	5540	2640	0.39	0.26	0.12
9423900	Sacramento Wash Trib Near Topock, Ariz.	14.7	1450	98.2	5290	710	291	48.7	0.13	0.06	0.01
9424200	Cottonwood Wash 1 N Kingman Ariz	143	5350	67	11700	7310	5860	3690	0.62	0.50	0.32
9424407	Mcgarrys Wash Near Kingman, Ariz.	13.5	4610	203	3130	369	150	26.9	0.12	0.05	0.01
9424410	Big Sandy River Trib Near Kingman, Ariz.	1.99	3700	214	1090	173	80.2	18.6	0.16	0.07	0.02
9424430	Kaiser Spring Canyon Trib Near Wikieup, Ariz.	1.7	3520	615	2610	413	196	49.2	0.16	0.08	0.02
9424450	Big Sandy River Near Wikieup,Ariz.	2731.9	4490	41.9	102400	34700	21300	7900	0.34	0.21	0.08
9424480	Ash Creek Near Kirkland, Ariz.	6.95	4680	278	4250	882	459	133	0.21	0.11	0.03
9424700	Iron Spring Wash Trib Near Bagdad, Ariz.	0.64	3470	431	993	146	63.5	12.4	0.15	0.06	0.01
9424900	Santa Maria River Near Bagdad, Ariz.	1129	4010	91.9	32600	17700	13400	7510	0.54	0.41	0.23
9425500	Santa Maria River Near Alamo, Ariz.	1439	3650	46.5	69600	17600	9870	3260	0.25	0.14	0.05
9427700	Monkeys Head Wash Near Parker, Ariz.	1.84	1130	415	1640	236	100	18.2	0.14	0.06	0.01
9428545	Cunningham Wash Trib Near Wenden, Ariz.	0.77	2330	365	296	140	101	52.1	0.47	0.34	0.18
9428550	Bouse Wash Trib Near Bouse, Ariz.	14.6	1230	50	6170	1730	998	344	0.28	0.16	0.06
9429150	Creosote Wash Near Ehrenberg, Ariz.	1.98	509	95.2	1270	390	239	95.6	0.31	0.19	0.08
9429400	Indian Wash Trib Near Yuma, Az.	2.56	1190	66.7	131	79.3	64.8	44.7	0.61	0.49	0.34
9429510	Mittry Lake Trib Near Yuma, Az.	0.3	346	122	346	106	62.8	22	0.31	0.18	0.06
9432000	Gila River Below Blue Creek, Near Virden Nm	3203	6690	35.8	42100	16700	11200	5120	0.40	0.27	0.12
9442000	Gila River Near Clifton, Ariz.	4010	6250	29	47700	18600	12600	6000	0.39	0.26	0.13
9444100	Campbell Blue Creek Near Alpine, Az	11.6	8300	90.2	667	181	108	42	0.27	0.16	0.06
9444200	Blue River Nr. Clifton Az.	506	6910	65.3	46600	14400	8960	3780	0.31	0.19	0.08
9444500	San Francisco River At Clifton, Ariz.	2764	6880	48.9	113900	31100	18300	6780	0.27	0.16	0.06
9445500	Willow C Nr Point Of Pines Nr Morenci, Ariz.	102	6340	73	4620	1970	1370	678	0.43	0.30	0.15

Ratios for the 10-, 5- and 2-year USGS LP3 peak discharges to the 100-year for all gages in Arizona

Gage No.	Station Name	Drainage Area sq. miles	Mean Basin Elevation feet	Main Channel Slope ft/mi	Log Pearson Type III Peak Discharge 100-Year cfs	10-Year cfs	5-Year cfs	2-Year cfs	Ratio to the 100-Year Discharge 10-Year %	5-Year %	2-Year %
9446000	Willow C N Double Circle Rnch N Morenci Ariz.	149	6310	77.7	10000	4200	2910	1430	0.42	0.29	0.14
9446500	Eagle C N Double Circle Rnch N Morenci Ariz	377	6410	100	24600	8760	5690	2510	0.36	0.23	0.10
9447000	Eagle Creek Abv. Pumping Plant Nr. Morenci, Az.	622	6060	60.9	47000	14400	8300	2730	0.31	0.18	0.06
9447800	Bonita Creek Near Morenci, Arizona	302	0	0	27600	9070	5680	2320	0.33	0.21	0.08
9448500	Gila R At Head Of Safford Valley Nr Solomon Ariz	7896	6360	26.4	140700	40400	24500	9860	0.29	0.17	0.07
9451800	Tollgate Wash Trib Near Clifton, Ariz.	0.12	4800	878	225	70.5	39.7	11.4	0.31	0.18	0.05
9456000	San Simon River Near San Simon Ariz.	814	4830	23.8	8660	5570	4520	2920	0.64	0.52	0.34
9456400	Gold Gulch Near Bowie, Ariz.	15	5170	201	4640	1790	1180	527	0.39	0.25	0.11
9457000	San Simon River Near Solomon, Ariz.	2192	4270	14.6	17000	9320	7250	4520	0.55	0.43	0.27
9458500	Gila River At Safford, Ariz.	10459	5830	23.6	35900	17700	13500	8230	0.49	0.38	0.23
9460150	Frye Creek Near Thatcher, Ariz.	4.02	8400	1160	1580	254	116	25.6	0.16	0.07	0.02
9466500	Gila River At Calva, Ariz.	11470	5650	20.4	161000	35500	19600	6760	0.22	0.12	0.04
9467120	Salt Creek Near Peridot, Ariz.	30.2	3490	169	6910	2890	1920	810	0.42	0.28	0.12
9468300	Sevenmile Wash Trib Near Globe, Ariz.	0.83	4410	280	1690	295	134	27.3	0.17	0.08	0.02
9468500	San Carlos River Near Peridot, Arizona	1026	4480	29.4	62100	23500	15800	7460	0.38	0.25	0.12
9470500	San Pedro River At Palominas, Ariz.	741	4950	23.5	21500	12100	9300	5460	0.56	0.43	0.25
9470900	San Pedro River Trib Near Bisbee, Ariz.	5.25	4770	129	2140	1170	885	498	0.55	0.41	0.23
9471000	San Pedro River At Charleston, Ariz.	1234	4840	18.4	49500	16600	11300	6130	0.34	0.23	0.12
9471550	San Pedro River Near Tombstone, Ariz.	1730	4820	18	28000	15400	12000	7490	0.55	0.43	0.27
9471600	Canary Wash Near Benson, Ariz.	0.79	5240	472	385	58	24.7	4.4	0.15	0.06	0.01
9471700	Fenner Wash Near Benson, Ariz.	2.71	4180	93.8	2270	798	501	196	0.35	0.22	0.09
9472000	San Pedro River Nr. Redington, Ariz.	2927	4660	15.3	52700	22200	15200	7220	0.42	0.29	0.14
9472100	Peck Canyon Trib Near Redington, Ariz	8.02	3680	146	4410	793	402	118	0.18	0.09	0.03
9472400	Mammoth Wash Near Mammoth, Ariz.	2.4	3700	181	6960	1540	752	167	0.22	0.11	0.02
9473000	Aravaipa Creek Near Mammoth, Ariz.	537	4530	45.7	26900	11500	8000	3980	0.43	0.30	0.15
9473200	Green Lantern Wash Near Winkelman, Ariz.	3.63	2590	189	7490	2290	1380	509	0.31	0.18	0.07
9473500	San Pedro R At Winkelman, Ariz.	4453	4520	18	60900	19500	12800	6390	0.32	0.21	0.10
9473600	Tam O'Shanter Wash Near Hayden, Ariz.	4.37	3050	324	1460	759	586	368	0.52	0.40	0.25
9478200	Durham Wash Near Florence, Ariz.	15.6	3670	143	5710	2050	1320	561	0.36	0.23	0.10
9478500	Queen C At Whitlow Damsite N Superior Ariz.	144	3180	137	46100	14300	8850	3630	0.31	0.19	0.08
9478600	Queen Creek Trib No 3 At Whitlow Dam Ariz.	0.37	2320	187	417	189	135	71.3	0.45	0.32	0.17
9479200	Queen C Trib A Apache Junc Ariz	0.51	1760	76.2	431	179	120	52.5	0.42	0.28	0.12
9479500	Gila River Near Laveen, Ariz.	20615	0	0	60900	8040	3760	1020	0.13	0.06	0.02
9480000	Santa Cruz River Near Lochiel, Ariz.	82.2	5150	42.2	11600	4460	3020	1450	0.38	0.26	0.13
9480500	Santa Cruz River Nr. Nogales, Ariz.	533	4850	26	23200	10600	7610	4090	0.46	0.33	0.18
9481500	Sonoita Creek Near Patagonia, Ariz.	209	4800	76.7	15100	7190	5360	3130	0.48	0.35	0.21
9481700	Calabasas Canyon Near Nogales, Ariz.	10.3	4360	75.4	2540	1030	691	309	0.41	0.27	0.12
9481750	Sopori Wash At Amado, Ariz.	176	3840	35.9	17100	6780	4610	2230	0.40	0.27	0.13
9481800	Demetrie Wash Trib Near Continental, Ariz.	0.15	3620	100	214	85.2	56.9	25.6	0.40	0.27	0.12
9482000	Santa Cruz River At Continental, Ariz.	1682	4350	21	45400	12800	7980	3580	0.28	0.18	0.08
9482330	Pumping Wash Near Vail, Ariz.	0.81	3010	57.7	560	274	198	102	0.49	0.35	0.18
9482400	Airport Wash At Tucson, Ariz.	23	2700	37	1900	889	666	403	0.47	0.35	0.21
9482410	Rodeo Wash At Tucson, Ariz.	7.24	2560	33.7	1020	572	441	260	0.56	0.43	0.25
9482420	Julian Wash At Tucson Ariz	26.5	2900	38.9	2310	1130	817	428	0.49	0.35	0.19
9482480	Big Wash At Tucson, Ariz.	2.94	2850	95.2	4460	887	390	63	0.20	0.09	0.01

Ratios for the 10-, 5- and 2-year USGS LP3 peak discharges to the 100-year for all gages in Arizona

Gage No.	Station Name	Drainage Area sq. miles	Mean Basin Elevation feet	Main Channel Slope ft/mi	Log Pearson Type III Peak Discharge 100-Year cfs	10-Year cfs	5-Year cfs	2-Year cfs	Ratio to the 100-Year Discharge 10-Year %	5-Year %	2-Year %
9482500	Santa Cruz River At Tucson, Ariz.	2222	4050	20.1	33300	13800	9720	5110	0.41	0.29	0.15
9482950	Railroad Wash At Tucson,Arizona	2.3	2490	0.73	2390	961	666	340	0.40	0.28	0.14
9483000	Tucson Arroyo At Vine Ave, At Tucson, Az.	8.2	2510	37	4890	2150	1540	842	0.44	0.31	0.17
9483010	High School Wash At Tucson Az	0.95	2460	1.11	1210	606	454	261	0.50	0.38	0.22
9483025	Silvercroft Wash At Tucson Az	2.74	2540	44.6	3360	659	332	90	0.20	0.10	0.03
9483030	Anklam Wash At Tucson, Ariz.	2.11	2700	298	7390	855	362	75.6	0.12	0.05	0.01
9483040	West Speedway Wash Near Tucson, Ariz.	0.46	2750	364	627	291	202	92.2	0.46	0.32	0.15
9483042	Cemetery Wash At Tucson, Ariz.	1.17	2370	40	842	517	418	274	0.61	0.50	0.33
9483045	Flowing Wells Wash At Tucson Az	3.53	2380	32.1	2260	1200	911	524	0.53	0.40	0.23
9483100	Tanque Verde Creek Near Tucson, Ariz.	43	4780	156	12300	4620	3130	1530	0.38	0.25	0.12
9483200	Agua Caliente Wash Trib Near Tucson, Ariz.	2.04	3300	368	793	309	208	98.9	0.39	0.26	0.12
9483250	Rob Wash At Tucson Az	2.08	2710	55.6	2870	973	622	267	0.34	0.22	0.09
9484000	Sabino Creek Near Tucson, Ariz.	35.5	6300	482	12000	4310	2780	1190	0.36	0.23	0.10
9484200	Bear Creek Near Tucson, Ariz.	16.3	5860	502	1850	917	675	370	0.50	0.36	0.20
9484500	Tanque Verde Cr At Tucson Ariz	219	4340	109	35500	11000	6580	2360	0.31	0.19	0.07
9484510	Ventana Canyon Wash Near Tucson, Ariz.	6.46	4600	553	329	235	202	147	0.71	0.61	0.45
9484560	Cienega Creek Near Pantano, Ariz	289	4890	59.8	18500	6150	4020	1880	0.33	0.22	0.10
9484570	Mescal Arroyo Near Pantano, Ariz.	38.4	4260	82.9	15400	3620	2060	753	0.24	0.13	0.05
9484580	Barrel Canyon Near Sonoita, Ariz.	14.1	5000	190	4480	1810	1190	504	0.40	0.27	0.11
9484590	Davidson Canyon Wash Near Vail, Ariz.	50.5	4340	86.2	9340	4640	3430	1900	0.50	0.37	0.20
9484600	Pantano Wash Near Vail, Az	457	4500	46.3	32100	10400	6450	2600	0.32	0.20	0.08
9485000	Rincon Creek Near Tucson, Ariz.	44.8	4850	612	16700	4760	2770	963	0.29	0.17	0.06
9485100	Saguaro Corners Wash Near Tucson, Az	0.17	3040	117	53	39.1	34.4	27.4	0.74	0.65	0.52
9485500	Pantano Wash Near Tucson Ariz	602	4560	56.4	22600	7540	4620	1720	0.33	0.20	0.08
9485550	Arcadia Wash At Tucson,Arizona	2.72	2560	0.77	1920	953	707	395	0.50	0.37	0.21
9485570	Alamo Wash At Tucson Az	9.58	2590	46.2	7460	3890	2900	1600	0.52	0.39	0.21
9485900	Pima Wash Near Tucson, Ariz.	4.93	4430	533	652	269	177	74.2	0.41	0.27	0.11
9485950	Geronimo Wash Near Tucson, Ariz.	2.15	3600	699	1090	414	271	118	0.38	0.25	0.11
9486000	Rillito Cr Near Tucson, Az	918	4400	45.5	27700	13100	9530	5120	0.47	0.34	0.18
9486300	Canada Del Oro Near Tucson, Az	250	4000	108	23900	9340	6150	2650	0.39	0.26	0.11
9486500	Santa Cruz River At Cortaro, Ariz.	3503	4000	20.3	46000	20400	15000	8780	0.44	0.33	0.19
9486800	Altar Wash Nr Three Points, Az	463	3920	74.1	22400	11200	8180	4360	0.50	0.37	0.19
9487000	Brawley Wash Near Three Points, Ariz.	776	3710	30.8	21100	9260	6630	3570	0.44	0.31	0.17
9487100	Little Brawley Wash Near Three Points, Ariz.	11.9	2800	112	4440	2010	1450	777	0.45	0.33	0.18
9487140	San Joaquin Wash Near Tucson, Ariz.	0.45	2530	69.3	987	486	356	191	0.49	0.36	0.19
9487250	Los Robles Wash Near Marana, Ariz.	1170	3350	25.9	12500	4900	3090	1140	0.39	0.25	0.09
9487400	Quijotoa Wash Trib. Near Quijotoa, Ariz.	2.44	2800	88.9	1300	546	370	168	0.42	0.28	0.13
9488500	Santa Rosa Wash Nr. Vaiva Vo, Ariz.	1782	2340	25.5	29000	6250	3160	808	0.22	0.11	0.03
9488600	Silver Reef Wash Near Casa Grande, Ariz.	12.8	1620	67.4	3340	1070	663	268	0.32	0.20	0.08
9489000	Santa Cruz River Near Laveen, Ariz.	8581	3060	15.2	13300	4270	2600	986	0.32	0.20	0.07
9489070	North Fork Of East Fork Black R Nr Alpine, Az	38.1	9060	48.8	1420	741	553	306	0.52	0.39	0.22
9489080	Hannagan Creek Near Hannagan Meadow, Ariz.	1.61	9160	68.6	87	39.7	29	16.5	0.46	0.33	0.19
9489100	Black River Near Maverick, Ariz.	315	8700	69.4	20500	6220	3860	1620	0.30	0.19	0.08
9489200	Pacheta Creek At Maverick, Az	14.8	8810	160	426	234	180	106	0.55	0.42	0.25
9489500	Black River Blw Pumping Plant Nr. Point Of Pines	560	8000	51.1	23400	8090	5190	2230	0.35	0.22	0.10

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9489700	Big Bonito C Nr Fort Apache, Ariz.	119	7920	106	6040	2200	1440	629	0.36	0.24	0.10
9490500	Black River Near Fort Apache, Ariz. Mile 5.0	1232	7200	36.2	103500	34600	21000	7460	0.33	0.20	0.07
9490800	North Fork White River Nr. Greer, Ariz.	40.2	9520	216	535	325	266	183	0.61	0.50	0.34
9491000	North Fork White R Near Mcnary, Ariz.	66	9320	153	2280	1030	742	407	0.45	0.33	0.18
9492400	East Fork White River Nr Fort Apache, Ariz.	38.8	8580	239	1090	587	450	268	0.54	0.41	0.25
9494000	White River Near Fort Apache, Ariz. Mile 4.5	632	7400	76.8	18200	8030	5760	3110	0.44	0.32	0.17
9494300	Carrizo C Ab Corduroy C Nr Show Low, Ariz.	225	6370	64.9	11300	5020	3580	1870	0.44	0.32	0.17
9496000	Corduroy Creek Near Mouth, Near, Show Low, Ariz	203	6370	71.2	33200	6980	3650	1070	0.21	0.11	0.03
9496500	Carrizo Creek Near Show Low, Ariz.	439	6320	61.8	36900	11400	7020	2850	0.31	0.19	0.08
9496600	Cibecue 1 Trib Carrizo Cr Nr Show Low, Ariz.	0.1	5390	364	307	133	92	44	0.43	0.30	0.14
9496700	Cibecue 2, Trib Carrizo Cr, Nr Show Low, Ariz.	0.07	5240	200	161	88	69	43	0.55	0.43	0.27
9496800	Carrizo Creek Trib Near Show Low, Ariz.	2.55	5810	306	2850	1020	660	287	0.36	0.23	0.10
9497500	Salt River Near Chrysotile, Ariz. Mile 34.8	2849	6730	31.9	122800	39600	24700	10200	0.32	0.20	0.08
9497800	Cibecue Creek Near Chrysotile, Ariz.	295	5700	79.6	20800	10300	7620	4200	0.50	0.37	0.20
9497900	Cherry Creek Near Young, Ariz	62.1	6030	106	11600	4660	3120	1390	0.40	0.27	0.12
9497980	Cherry Creek Near Globe, Ariz.	200	5600	87.9	25400	8700	5450	2190	0.34	0.21	0.09
9498400	Pinal C At Inspiration Dam, Nr Globe, Az	162	0	0	8440	3600	2540	1320	0.43	0.30	0.16
9498500	Salt River Near Roosevelt, Ariz.	4306	6190	23.3	227900	63800	38000	14400	0.28	0.17	0.06
9498600	Cristopher Creek Trib Near Kohl'S Ranch, Ariz	0.66	6080	510	348	110	69.5	30.2	0.32	0.20	0.09
9498800	Tonto Creek Near Gisela, Ariz.	430	5810	126	95500	33800	21500	8810	0.35	0.23	0.09
9498870	Rye Creek Nr Gisela, Ariz.	122	4390	91.4	35400	9700	6100	2850	0.27	0.17	0.08
9498900	Gold Creek Near Payson, Ariz.	6.44	4590	295	4070	1290	795	314	0.32	0.20	0.08
9499000	Tonto Creek Abv. Gun Cr., Nr Roosevelt, Az	675	5020	88.4	107900	41700	27000	11100	0.39	0.25	0.10
9501300	Tortilla Creek At Tortilla Flat, Ariz.	24.3	2960	179	15300	6180	4080	1740	0.40	0.27	0.11
9502700	Crookton Wash Near Seligman, Ariz.	6.01	5970	111	6250	310	86.2	7.2	0.05	0.01	0.00
9502800	Williamson Valley W Nr Paulden, Ariz.	255	5120	48.6	29200	7360	4080	1310	0.25	0.14	0.04
9503000	Granite Creek Near Prescott, Ariz.	36.3	5900	104	7710	2990	2000	916	0.39	0.26	0.12
9503700	Verde River Near Paulden, Ariz.	2150	5410	23.8	38400	8540	4550	1380	0.22	0.12	0.04
9503720	Hell Canyon Near Williams, Ariz.	14.9	7110	47.8	3860	1360	862	346	0.35	0.22	0.09
9503740	Hell Canyon Trib N Ash Fork. Az	0.75	5180	78.4	220	57.4	32.3	10.5	0.26	0.15	0.05
9503750	Limestone Canyon Nr Paulden, Az	14.5	5310	87.3	9820	2080	1020	239	0.21	0.10	0.02
9503800	Volunteer Wash Near Bellemont, Ariz.	124	7620	56.6	6890	2040	1160	357	0.30	0.17	0.05
9504000	Verde River Nr Clarkdale, Ariz.	3139	5490	22.9	70200	25500	16100	6340	0.36	0.23	0.09
9504100	Hull Canyon Near Jerome, Ariz.	0.85	7050	1270	561	66.3	23.5	2.6	0.12	0.04	0.00
9504400	Munds Canyon Trib Near Sedona, Ariz.	1.15	6880	269	1430	409	232	73.9	0.29	0.16	0.05
9504500	Oak Creek Near Cornville, Ariz.	355	6200	85	50100	18700	12000	4810	0.37	0.24	0.10
9504800	Oak Creek Trib Near Cornville, Az	0.05	3570	65	369	61.7	25.9	4.1	0.17	0.07	0.01
9505200	Wet Beaver Creek Near Rimrock, Arizona	111	6410	131	15800	8140	6130	3520	0.52	0.39	0.22
9505250	Red Tank Draw Near Rimrock, Ariz	49.4	5910	183	10900	3090	1860	724	0.28	0.17	0.07
9505300	Rattlesnake Canyon Near Rimrock, Ariz.	24.6	6560	174	6290	2750	1880	872	0.44	0.30	0.14
9505350	Dry Beaver Creek Near Rimrock, Ariz.	142	6220	137	51400	16100	9590	3380	0.31	0.19	0.07
9505600	Dirty Neck Canyon Near Clints Well, Ariz.	3.42	7140	190	573	231	151	62.7	0.40	0.26	0.11
9505800	West Clear Creek Near Camp Verde, Ariz.	241	6680	112	32700	14200	9690	4510	0.43	0.30	0.14
9505900	Cottonwood Wash Near Camp Verde, Ariz.	0.64	3540	385	619	141	75.9	23.4	0.23	0.12	0.04
9506000	Verde River Near Camp Verde, Ariz.	4644	5560	17.9	166300	45900	27000	9900	0.28	0.16	0.06

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9507600	East Verde River Nr. Pine, Ariz.	6.34	6430	303	8600	1810	954	288	0.21	0.11	0.03
9507700	Webber Cr Ab West Fork Webber Cr N Pine, Az	4.79	6980	634	2480	544	291	90	0.22	0.12	0.04
9507980	East Verde River Near Childs, Ariz.	331	5140	91.6	56700	16000	9300	3270	0.28	0.16	0.06
9508300	Wet Bottom Creek Nr Childs, Ariz.	36.4	4810	210	17600	6760	4340	1740	0.38	0.25	0.10
9508500	Verde River Blw Tangle Cr Ab Horseshoe Dam, Az	5493	5470	16.2	200300	67300	41600	16000	0.34	0.21	0.08
9510070	Wf Sycamore Cr Ab Mcfar Can, N Sunflower, Az	4.58	5430	260	5530	702	268	36	0.13	0.05	0.01
9510080	West Fork Sycamore Cr Nr Sunflower, Ariz.	9.8	5260	353	8030	1190	519	101	0.15	0.06	0.01
9510100	East Fork Sycamore Creek Near Sunflower, Ariz.	4.49	5760	370	2670	428	196	43	0.16	0.07	0.02
9510150	Sycamore Creek Near Sunflower, Ariz.	52.3	4260	58.6	42700	8160	4050	1050	0.19	0.09	0.02
9510170	Camp Creek Nr Sunflower, Az	2.6	3520	498	773	334	230	108	0.43	0.30	0.14
9510180	Rock Creek Near Sunflower, Ariz.	15.2	3680	412	6390	2410	1520	573	0.38	0.24	0.09
9510200	Sycamore Creek Near Fort Mcdowell	164	3820	116	46300	12900	7320	2330	0.28	0.16	0.05
9512100	Indian Bend Wash At Scottsdale Ariz	62	1780	60	16800	2950	1440	378	0.18	0.09	0.02
9512200	Salt River Trib. In S. Mnt. Park, Phoenix, Ariz.	1.75	1730	244	2230	420	191	37	0.19	0.09	0.02
9512300	Cave Creek Nr Cave Creek Ariz	121	3470	123	21500	7360	4580	1780	0.34	0.21	0.08
9512420	Lynx Creek Trib Near Prescott, Ariz.	0.95	5900	101	2910	761	403	106	0.26	0.14	0.04
9512500	Agua Fria River Near Mayer, Az	585	5000	56.9	35900	15500	11000	5920	0.43	0.31	0.16
9512600	Turkey Creek Near Cleator Arizona	89.4	5360	122	9810	4700	3360	1700	0.48	0.34	0.17
9512700	Agua Fria River Trib #2 Nr Rock Springs, Ariz	1.07	2140	173	1570	808	611	359	0.51	0.39	0.23
9512800	Agua Fria River Near Rock Springs, Ariz.	1111	4770	61.2	211800	44300	23300	7000	0.21	0.11	0.03
9512970	Cottonwood Creek Nr Waddell Dam Az.	9.28	0	0	16400	2020	804	131	0.12	0.05	0.01
9513780	New River Nr Rock Springs, Ariz.	68.3	3970	140	35000	11400	6880	2440	0.33	0.20	0.07
9513800	New River At New River, Ariz.	83.3	3600	105	37500	12600	7880	3150	0.34	0.21	0.08
9513820	Deadman Wash Near New River, Ariz.	11.1	1980	124	4630	1590	969	348	0.34	0.21	0.08
9513835	New River At Bell Road, Near Peoria, Ariz.	185	2700	64.5	31700	9410	5510	1900	0.30	0.17	0.06
9513860	Skunk Creek Near Phoenix, Ariz.	64.9	2180	49.2	27600	6120	3230	940	0.22	0.12	0.03
9513890	New River At Peoria, Ariz.	317	2320	65.3	75100	20800	11300	3160	0.28	0.15	0.04
9513910	New River Nr Glendale, Ariz.	600	2130	66.9	49800	14400	8410	2890	0.29	0.17	0.06
9514200	Waterman Wash Near Buckeye, Ariz.	420	1570	21.2	8470	3420	2390	1250	0.40	0.28	0.15
9515500	Hassayampa River At Box Damsite Nr Wickenburg Az	417	4750	71	43000	13900	8480	3180	0.32	0.20	0.07
9515800	Hartman Wash Near Wickenburg, Ariz.	5.57	2690	71.6	7100	1660	869	239	0.23	0.12	0.03
9516500	Hassayampa River Nr Morristown, Ariz.	796	3190	84.9	45600	14300	8540	3030	0.31	0.19	0.07
9516600	Ox Wash Near Morristown, Ariz.	6.31	2290	101	3720	1120	647	209	0.30	0.17	0.06
9516800	Jack Rabbit Wash Near Tonopah, Ariz.	137	2260	34.4	33900	6860	3400	847	0.20	0.10	0.02
9517000	Hassayampa River Near Arlington, Ariz.	1471	3010	39.9	40500	12000	7340	3010	0.30	0.18	0.07
9517200	Centennial Wash Tributary Near Wenden, Ariz.	2.79	2480	193	1080	451	303	135	0.42	0.28	0.13
9517280	Tiger Wash Near Aguila, Ariz.	85.2	2590	35.2	7340	3160	2140	961	0.43	0.29	0.13
9517400	Winters Wash Near Tonopah, Ariz.	47.8	1630	83.7	4560	2120	1540	857	0.46	0.34	0.19
9519600	Rainbow Wash Trib Near Buckeye, Ariz.	2.43	950	323	2050	920	648	323	0.45	0.32	0.16
9519750	Bender Wash Near Gila Bend, Ariz.	68.6	1900	867	4450	2160	1580	867	0.49	0.36	0.19
9519760	Sauceda Wash Near Gila Bend, Ariz.	116	1980	591	6850	2520	1580	591	0.37	0.23	0.09
9519780	Windmill Wash Near Gila Bend, Ariz.	12.9	1050	64.4	27600	3210	1160	155	0.12	0.04	0.01
9520100	Military Wash Near Sentinel, Ariz.	8.7	674	56	5220	1120	577	161	0.21	0.11	0.03
9520110	Hot Shot Arroyo Near Ajo, Ariz.	0.44	1760	83.3	327	226	191	136	0.69	0.58	0.42
9520130	Darby Arroyo Near Ajo, Ariz.	4.72	1920	71.1	2380	1210	922	550	0.51	0.39	0.23

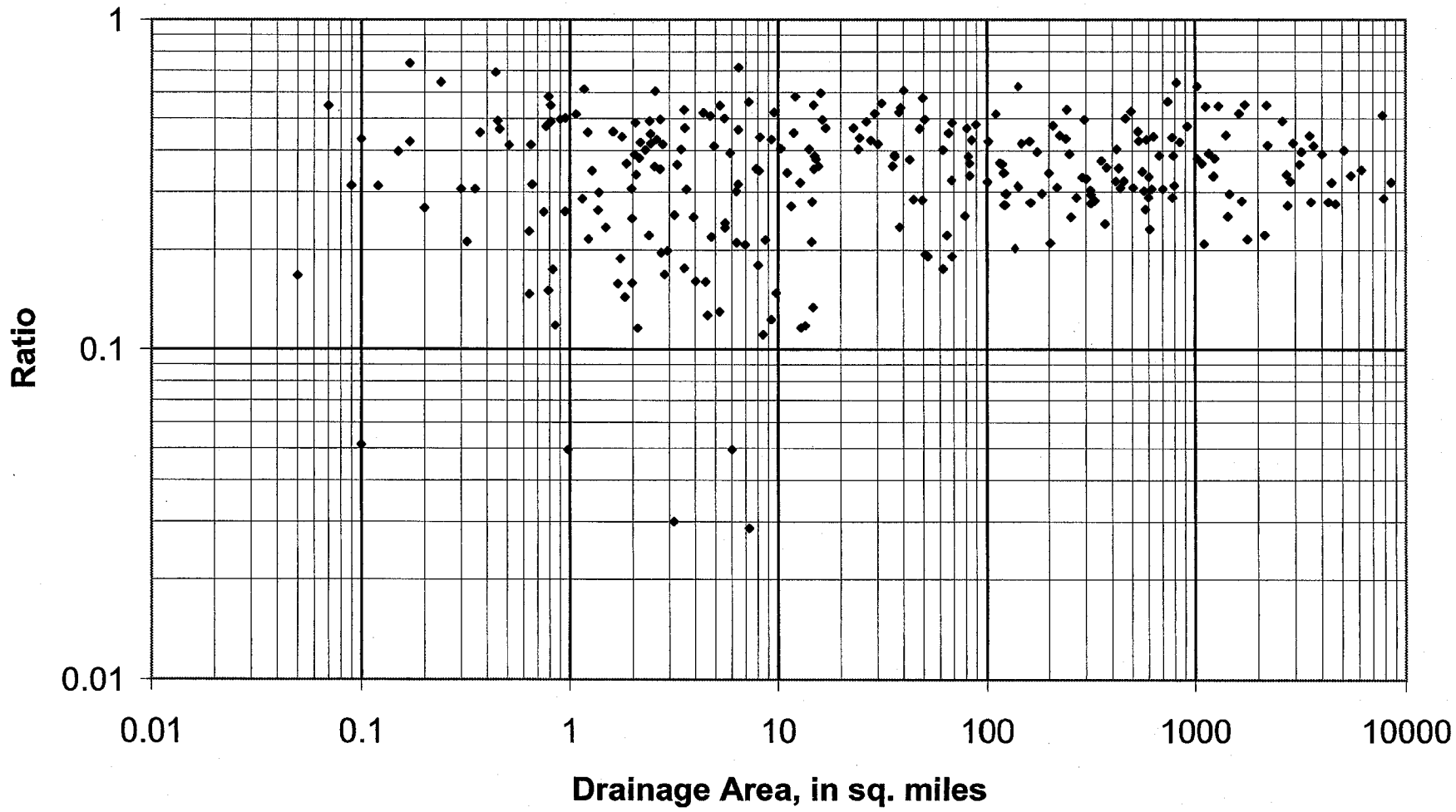
Ratios for the 10-, 5- and 2-year USGS LP3 peak discharges to the 100-year for all gages in Arizona

Gage No.	Station Name	Drainage Area sq. miles	Mean Basin Elevation feet	Main Channel Slope ft/mi	Log Pearson Type III Peak Discharge 100-Year cfs	10-Year cfs	5-Year cfs	2-Year cfs	Ratio to the 100-Year Discharge 10-Year %	5-Year %	2-Year %
9520160	Gibson Arroyo At Ajo, Az	2.18	2100	171	1620	686	474	231	0.42	0.29	0.14
9520170	Rio Cornez Nr. Ajo, Ariz.	243	1950	26.8	11800	6280	4850	3000	0.53	0.41	0.25
9520200	Black Gap Wash Near Ajo, Ariz.	12.1	1280	21.8	1490	868	672	392	0.58	0.45	0.26
9520230	Crater Range Wash Near Ajo, Ariz.	1.49	1280	69.3	2230	522	270	70	0.23	0.12	0.03
9520300	Alamo Wash Trib Near Ajo, Ariz.	0.9	2040	64	656	326	240	141	0.50	0.37	0.21
9520350	Mohawk Pass Wash At Mohawk, Az.	0.09	601	707	273	85.7	52.4	20.2	0.31	0.19	0.07
9520400	Ligurta Wash At Ligurta, Az.	1.99	395	127	3930	980	548	182	0.25	0.14	0.05
9535100	San Simon Wash Nr Pisinimo Az	569	2250	17.4	11400	3450	2210	1020	0.30	0.19	0.09
9535300	Vamori Wash At Kom Vo, Az	1250	2699	14.1	5810	2200	1540	833	0.38	0.27	0.14
9536100	Pitchfork Canyon Trib Near Fort Grant, Ariz.	0.81	5210	459	589	323	247	144	0.55	0.42	0.24
9536350	Surprise Canyon Near Dos Cabezas, Ariz.	0.65	6280	1040	413	172	113	44.9	0.42	0.27	0.11
9537200	Leslie Creek Near Mcneal, Ariz.	79.1	5360	62.1	13500	3430	1910	612	0.25	0.14	0.05
9537500	Whitewater Draw Near Douglas, Ariz.	1023	4740	20.5	5220	3270	2610	1620	0.63	0.50	0.31
								Mean:	**0.36**	**0.24**	**0.12**
								Standard Deviation:	**0.13**	**0.12**	**0.09**
								Sample Size:	**283**	**283**	**283**

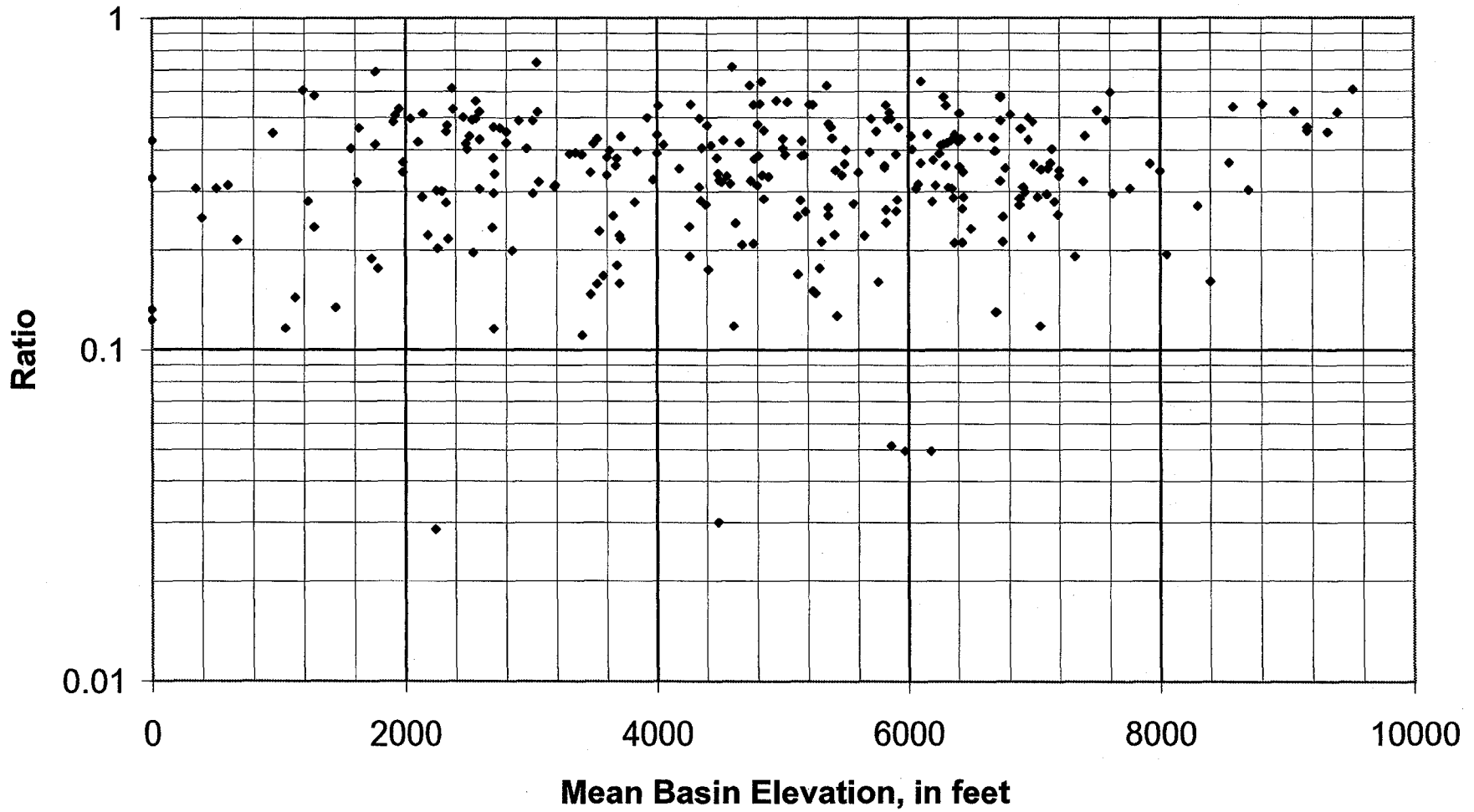
Descriptive Statistics

	10-Year	*5-Year*	*2-Year*
Mean	0.36	0.24	0.12
Standard Error	0.01	0.01	0.01
Median	0.36	0.23	0.10
Mode	0.31	0.33	0.13
Standard Deviation	0.13	0.12	0.09
Sample Variance	0.02	0.01	0.01
Kurtosis	-0.25	-0.05	1.66
Skewness	0.00	0.42	1.14
Range	0.71	0.64	0.52
Minimum	0.03	0.01	0.00
Maximum	0.74	0.65	0.52
Sum	101.99	68.60	33.49
Count	283	283	283

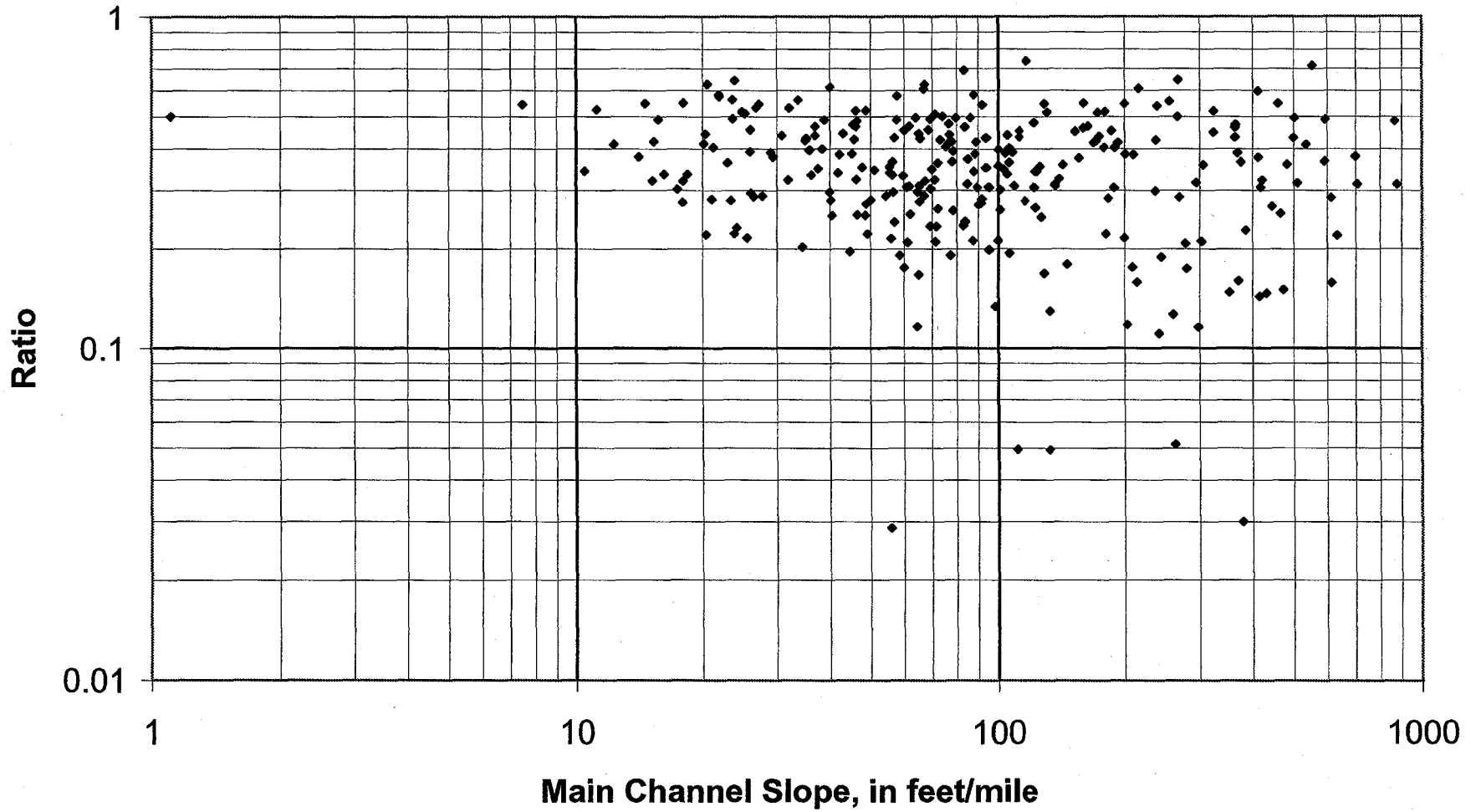
10-year ratios for all gaged watersheds using USGS LP3 peak discharge data



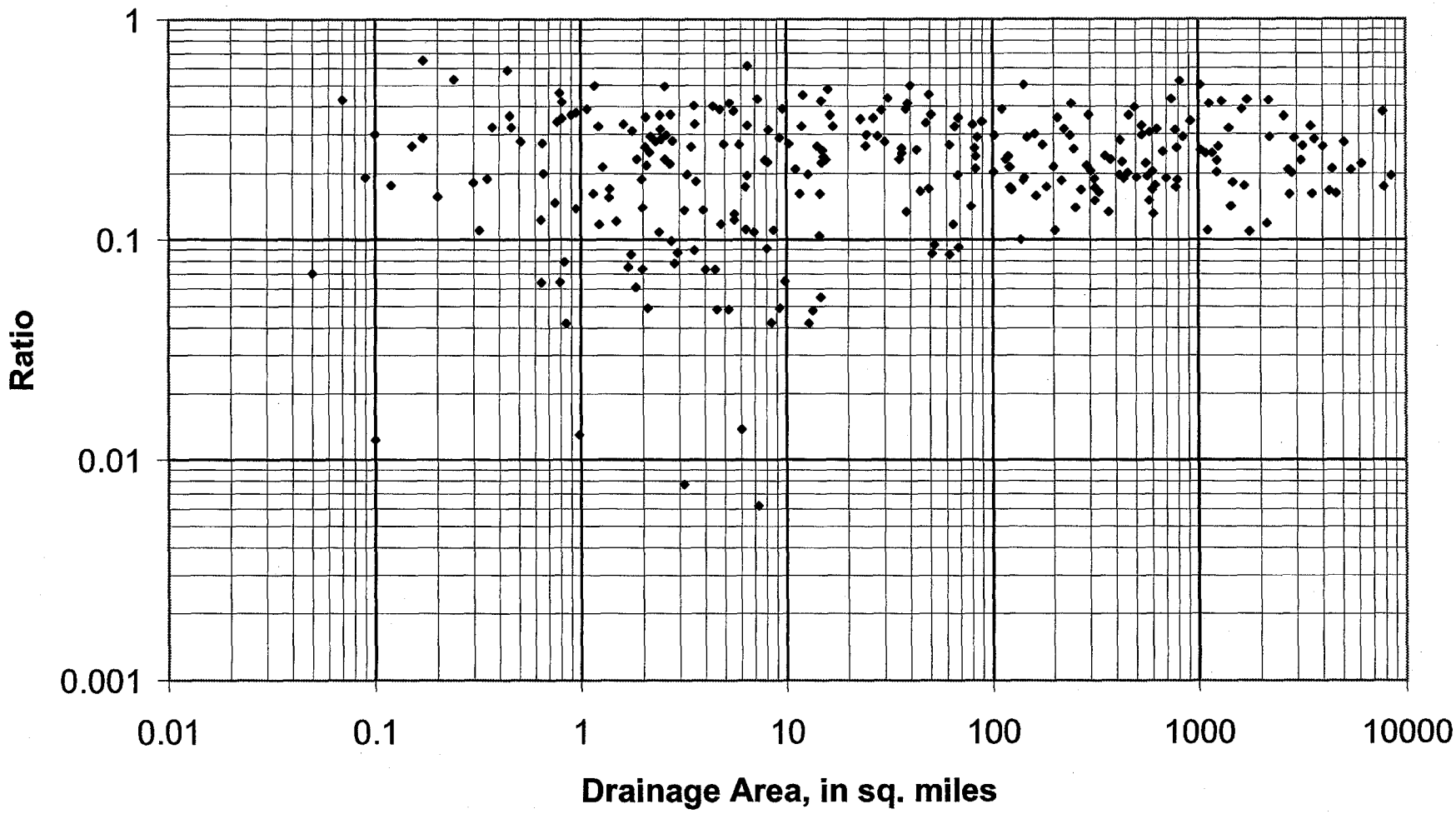
10-year ratios for all gaged watersheds using USGS LP3 peak discharge data



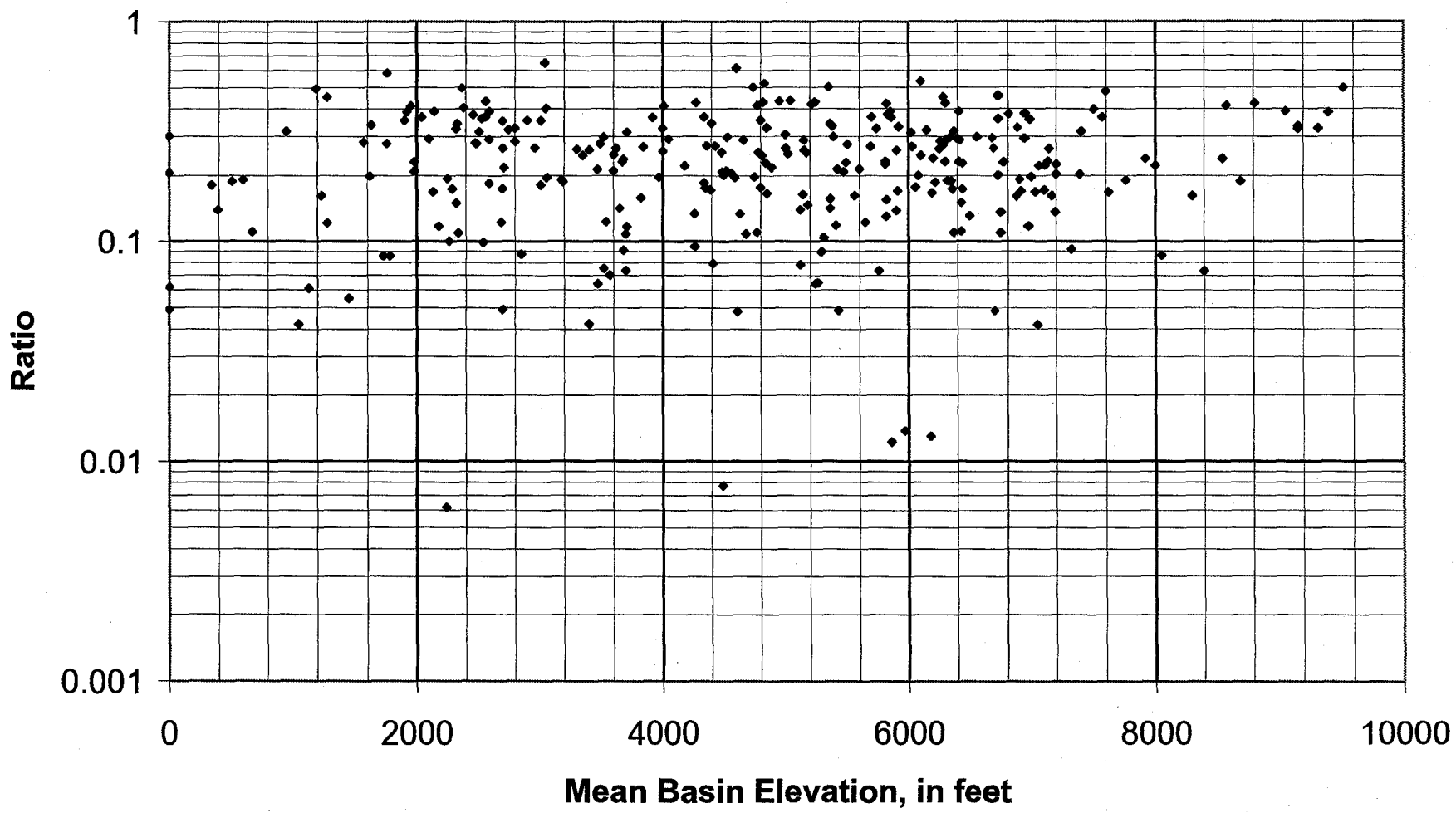
10-year ratios for all gaged watersheds using USGS LP3 peak discharge data



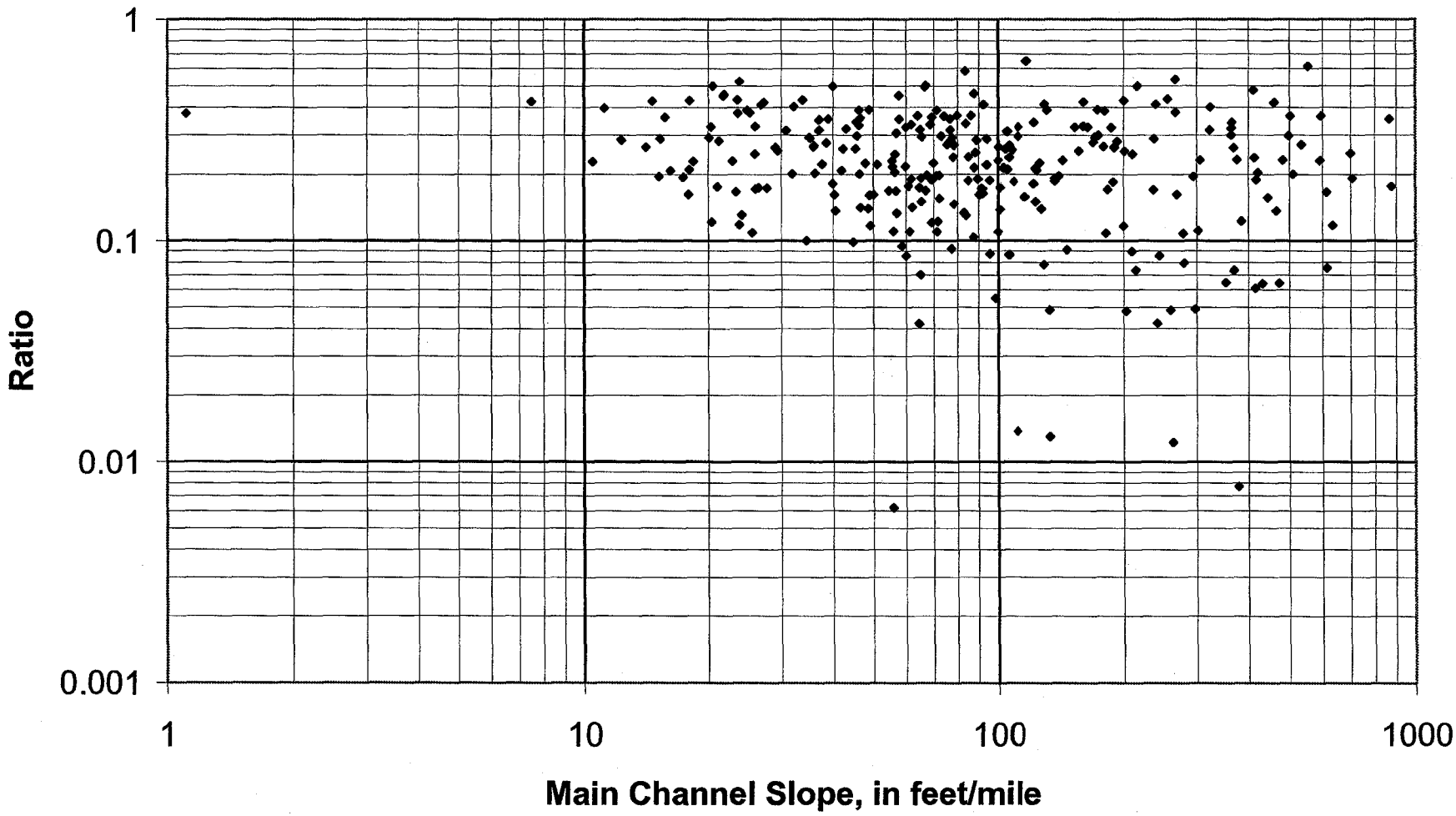
5-year ratios for all gaged watersheds using USGS LP3 peak discharge data



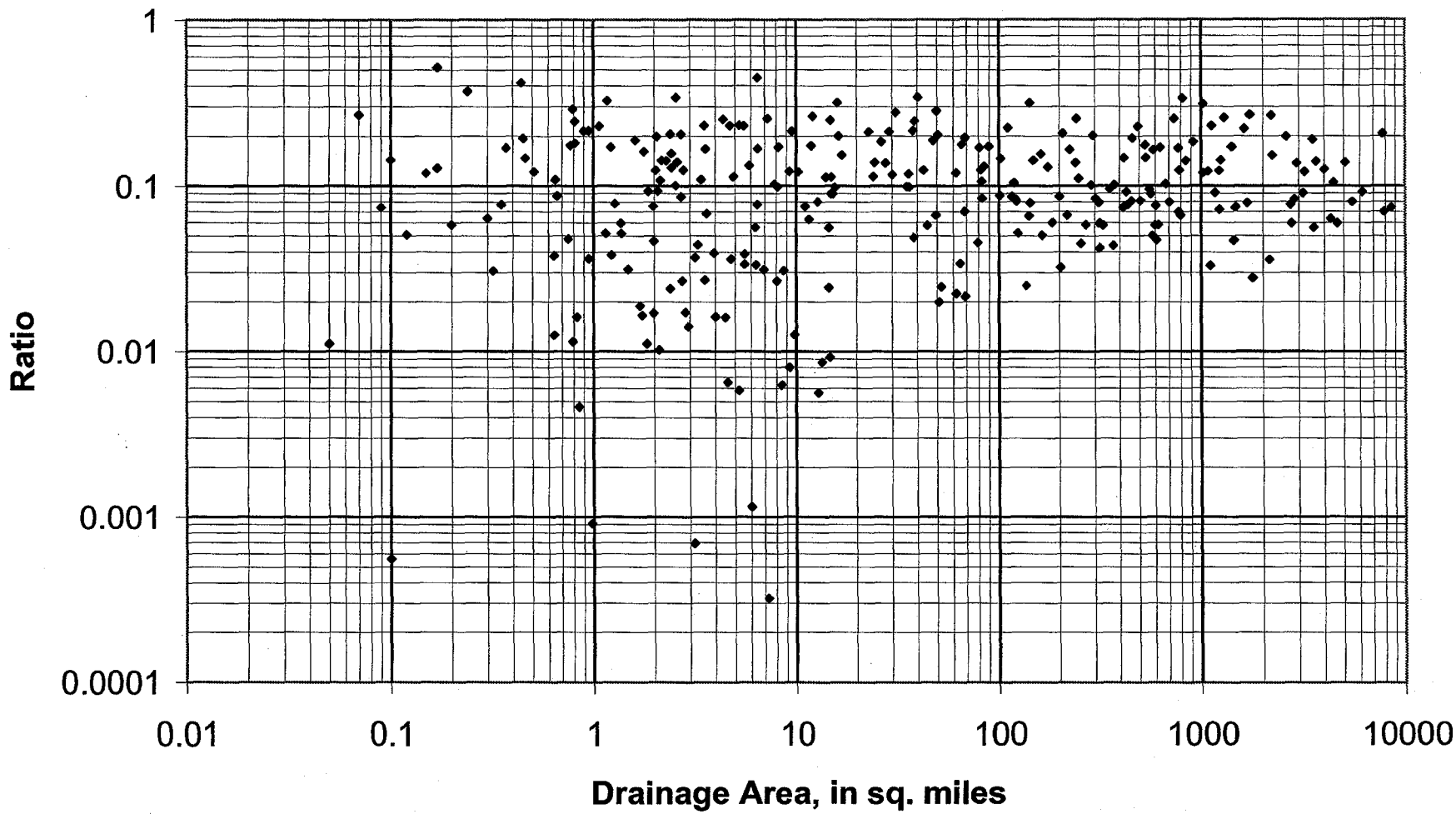
5-year ratios for all gaged watersheds using USGS LP3 peak discharge data



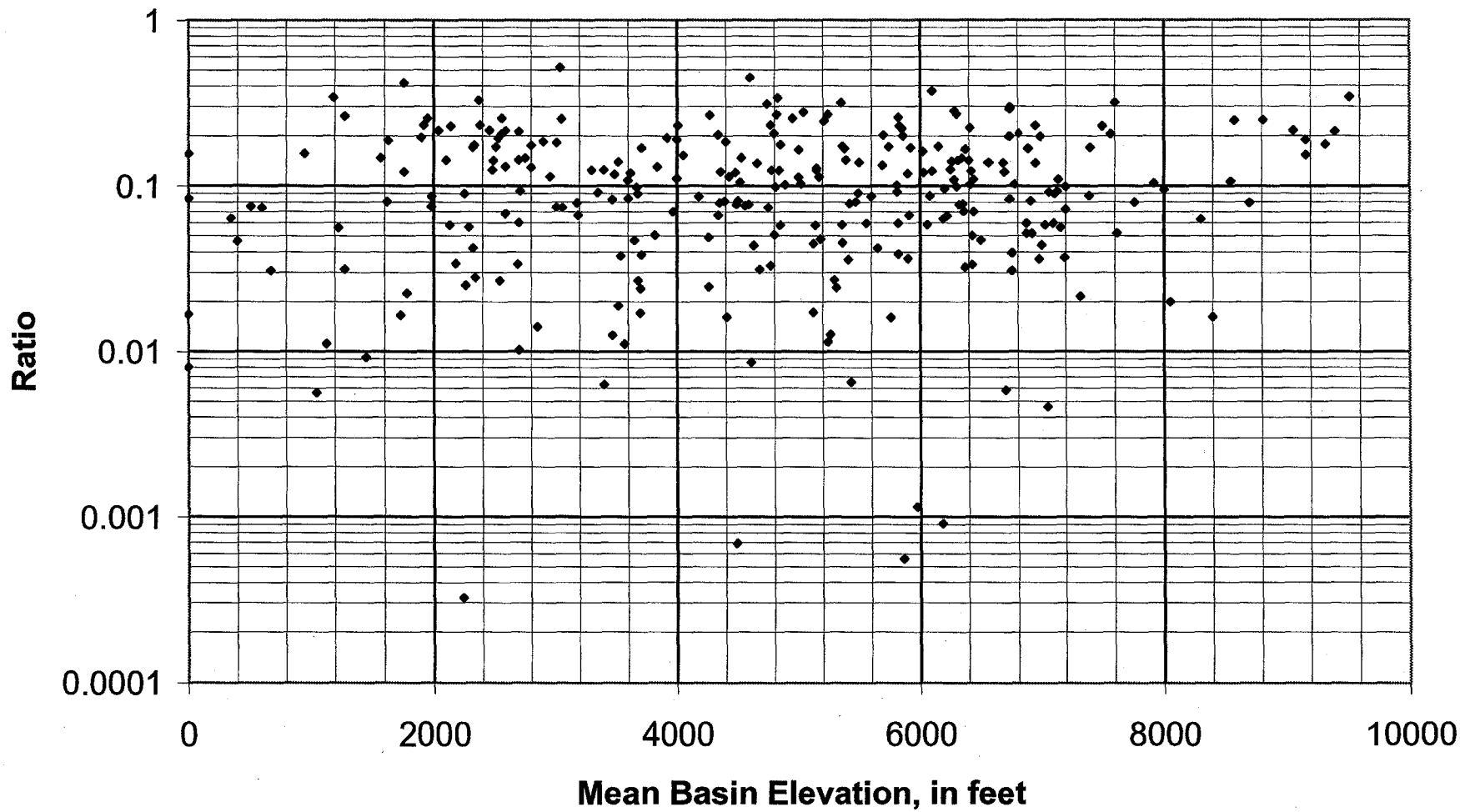
5-year ratios for all gaged watersheds using USGS LP3 peak discharge data



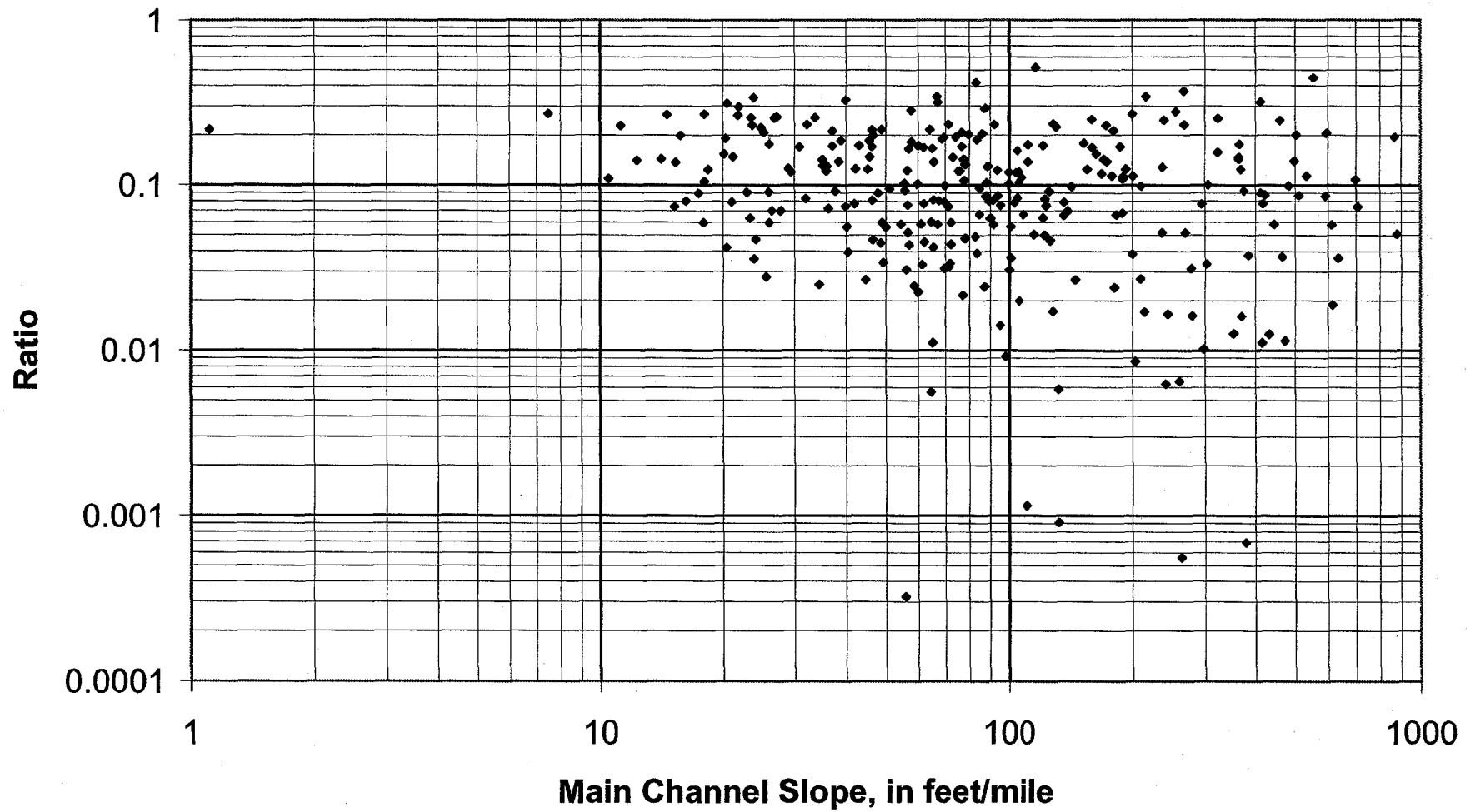
2-year ratios for all gaged watersheds using USGS LP3 peak discharge data



2-year ratios for all gaged watersheds using USGS LP3 peak discharge data



2-year ratios for all gaged watersheds using USGS LP3 peak discharge data



Ratios for the 10-, 5- and 2-year USGS LP3 peak discharges to the 100-year for all undeveloped watersheds in Arizona

Gage No.	Station Name	Drainage Area sq. miles	Mean Basin Elevation feet	Main Channel Slope ft/mi	Log Pearson Type III Peak Discharge				Ratio to the 100-Year Discharge		
					100-Year cfs	10-Year cfs	5-Year cfs	2-Year cfs	10-Year %	5-Year %	2-Year %
9371100	Teec Nos Pos Wash Near Teec Nos Pos, Ariz.	16	7600	411	1760	1050	841	557	0.60	0.48	0.32
9379030	Black Mountain Wash Near Chinle, Ariz.	80.7	5920	46.2	4970	2320	1650	844	0.47	0.33	0.17
9379060	Lukachukai Creek Tributary Near Lukachukai, A	1.37	5820	72.2	301	79.5	46.8	17.9	0.26	0.16	0.06
9379100	Long House Wash Near Kayenta, Ariz.	1.38	6920	236	5880	1760	1000	304	0.30	0.17	0.05
9379200	Chinle Creek Near Mexican Water, Ariz.	3650	6260	12.3	16500	6820	4710	2320	0.41	0.29	0.14
9379560	El Capitan Wash Near Kayenta, Ariz.	5.88	5690	78.4	3530	1390	952	470	0.39	0.27	0.13
9379980	Jack Bench Wash Tributary Near Page, Ariz.	0.98	6180	133	2850	141	37.1	2.6	0.05	0.01	0.00
9382000	Paria River At Lees Ferry, Ariz.	1410	6150	43	19800	8810	6330	3420	0.44	0.32	0.17
9383020	House Rock Wash Trib Nr Marble Canyon, Az.	3.54	5290	209	913	161	81.8	24.7	0.18	0.09	0.03
9383400	Little Colorado River At Greer, Ariz.	29.1	9400	180	822	425	316	175	0.52	0.38	0.21
9383500	Nutrioso Cr. Ab. Nelson Res Nr Springerville,Az.	83.3	8550	78	1100	403	263	117	0.37	0.24	0.11
9383600	Fish Creek Near Eagar Ariz.	16.9	9160	164	485	227	158	74.5	0.47	0.33	0.15
9384000	Little Colorado R Abv Lyman Lake Nr St. Johns, Az	703.5	7760	89.5	9400	2880	1790	750	0.31	0.19	0.08
9384200	Lyman Reservoir Trib Nr St Johns, Az	0.24	6100	267	116	74.9	62	42.8	0.65	0.53	0.37
9385800	Little Colorado R Trib Nr St Johns, Az	0.35	6350	417	672	206	127	52	0.31	0.19	0.08
9386500	Little Colorado R Ab Zuni R Nr Hunt, Az.	3557	7160	40.2	2930	819	474	164	0.28	0.16	0.06
9388000	Little Colorado River Nr Hunt, Az	6173	7060	37.6	8700	3040	1930	801	0.35	0.22	0.09
9390500	Show Low Creek Near Lakeside, Arizona	68.6	7320	77.2	16800	3210	1550	362	0.19	0.09	0.02
9392800	Long Lake Tributary Near Show Low, Ariz.	5.22	6700	133	4030	524	195	23.4	0.13	0.05	0.01
9393500	Silver Creek Near Snowflake, Ariz.	846	6400	35	18200	7720	5330	2590	0.42	0.29	0.14
9394500	Little Colorado R At Woodruff, Ariz.	7775	6810	25.2	18300	9340	6920	3790	0.51	0.38	0.21
9395100	Carr Lake Draw Tributary Near Holbrook, Ariz.	1.28	5420	103	345	120	73.8	27	0.35	0.21	0.08
9395900	Black Creek Nr Lupton, Az	493	7500	11.2	11200	5880	4440	2550	0.53	0.40	0.23
9396400	Dead Wash Tributary Near Holbrook, Ariz.	1.22	5740	60	1150	522	374	198	0.45	0.33	0.17
9396500	Puerco River Near Adamana, Ariz	2603.5	6730	15.7	57900	28400	20900	11500	0.49	0.36	0.20
9397000	Little Colorado River At Holbrook, Ariz.	11115	6730	21.9	37200	21400	17000	11000	0.58	0.46	0.30
9397200	Penzance Wash Near Joseph City, Ariz.	0.17	5150	237	296	126	85.4	38	0.43	0.29	0.13
9397500	Chevelon Fork Below Wildcat Canyon, Near Winslow	271	7030	54.4	41200	11900	6950	2400	0.29	0.17	0.06
9397800	Brookbank Canyon Near Heber, Ariz.	27.9	6950	65.5	1070	460	315	147	0.43	0.29	0.14
9398000	Chevelon Creek Near Winslow, Ariz.	781	6440	27.7	33800	9760	5860	2360	0.29	0.17	0.07
9398500	Clear Creek Below Willow Creek, N Winslow, Az.	317	7100	26	39700	11700	6820	2360	0.29	0.17	0.06
9399000	Clear Creek Near Winslow, Ariz.	607	6500	24.1	59200	13700	7750	2790	0.23	0.13	0.05
9400100	Ganado Wash Trib Nr Ganado, Ariz.	7.85	6770	55.5	2320	819	533	238	0.35	0.23	0.10
9400200	Steamboat Wash Trib Nr Ganado, Ariz.	0.32	6750	100	1520	322	167	46.6	0.21	0.11	0.03
9400290	Teshbito Wash Trib Nr Holbrook, Ariz.	9.3	6420	93.7	3030	1310	874	371	0.43	0.29	0.12
9400300	Teshbito Wash Nr Holbrook, Ariz.	49.6	6280	57.7	2320	1340	1050	653	0.58	0.45	0.28
9400530	Cow Canyon Nr Winslow Ariz.	3.57	5380	61.8	387	181	129	64.8	0.47	0.33	0.17
9400560	Oraibi Wash Trib Nr Oraibi, Ariz.	1.78	6020	105	770	339	240	124	0.44	0.31	0.16
9400565	Polacca Wash Trib Nr Chinle, Ariz.	6.45	6890	160	2150	995	708	361	0.46	0.33	0.17
9400580	Castle Butte Wash Nr Winslow, Ariz.	5.57	5820	83.8	2220	536	289	86	0.24	0.13	0.04
9400650	Sinclair Wash At Flagstaff, Ariz.	8.11	7200	69.9	748	260	168	74.2	0.35	0.22	0.10
9400680	Switzer Canyon At Flagstaff, Ariz.	1.87	7130	375	413	151	95.9	38.4	0.37	0.23	0.09
9400910	Fay Canyon Near Flagstaff, Ariz.	3.28	7000	72.2	182	66	36	8	0.36	0.20	0.04
9401000	Little Colo. River At Grand Falls, Ariz.	21240	6440	10.5	76000	26100	17280	8310	0.34	0.23	0.11

Ratios for the 10-, 5- and 2-year USGS LP3 peak discharges to the 100-year for all undeveloped watersheds in Arizona

Gage No.	Station Name	Drainage Area sq. miles	Mean Basin Elevation feet	Main Channel Slope ft/mi	Log Pearson Type III Peak Discharge 100-Year cfs	10-Year cfs	5-Year cfs	2-Year cfs	Ratio to the 100-Year Discharge 10-Year %	5-Year %	2-Year %
9401220	Cedar Wash Near Cameron, Ariz.	579	6430	123	30200	8040	4550	1510	0.27	0.15	0.05
9401245	Klethla Valley Trib Near Kayenta Az	0.79	6730	87.7	419	244	193	121	0.58	0.46	0.29
9401260	Moenkopi Wash At Moenkopi	1629	5850	24.8	15000	7760	5820	3320	0.52	0.39	0.22
9401300	Hamblin Wash Trib Near Cedar Ridge, Ariz.	0.1	5860	263	3040	156	37.3	1.7	0.05	0.01	0.00
9401400	Moenkopi Wash Nr Tuba City, Ariz.	1300	5820	27.2	14500	7900	6120	3740	0.54	0.42	0.26
9402000	Little Colorado River Near Cameron, Ariz.	26091	6300	7.48	28700	15600	12200	7730	0.54	0.43	0.27
9403000	Bright Angel Creek Near Grand Canyon, Ariz.	101	7390	421	4970	1600	1010	435	0.32	0.20	0.09
9403780	Kanab Creek Nr Fredonia, Ariz.	1085	6100	56.4	7140	2610	1760	875	0.37	0.25	0.12
9403800	Bitter Seeps Wash Trib Near Fredonia, Ariz.	2.85	5120	129	7350	1240	575	127	0.17	0.08	0.02
9403930	West Cataract Creek Near Williams, Ariz.	3.18	7190	465	708	181	96.4	26.2	0.26	0.14	0.04
9404050	Spring Valley Wash Trib Near Williams, Ariz.	3.93	6750	40.5	449	113	61.2	17.7	0.25	0.14	0.04
9404310	Yampai Canyon Trib Near Peach Springs, Ariz.	0.2	5360	444	237	63.5	37.2	13.8	0.27	0.16	0.06
9404340	Truxton Wash At Valentine, Ariz.	370	4630	57	26300	6330	3510	1150	0.24	0.13	0.04
9404350	Valentine Wash At Valentine, Ariz.	3.15	4490	378	18400	552	142	12.7	0.03	0.01	0.00
9415000	Virgin River At Littlefield, Ariz.	5090	5500	38.4	35500	14200	9810	4920	0.40	0.28	0.14
9415050	Big Bend Wash Trib Near Littlefield, Ariz.	7.27	2240	55.8	5300	152	32.8	1.7	0.03	0.01	0.00
9419590	Detrital Wash Trib Near Chloride, Ariz.	1.23	3710	200	1080	233	126	41.4	0.22	0.12	0.04
9423760	Little Meadow Creek Near Oatman, Ariz.	8.47	3400	241	4590	508	194	28.7	0.11	0.04	0.01
9423780	Walnut Creek Near Kingman, Ariz.	31.3	5040	255	892	496	389	247	0.56	0.44	0.28
9423820	Sacramento Wash Near Yucca, Ariz.	787	3400	45.2	21200	8200	5540	2640	0.39	0.26	0.12
9423900	Sacramento Wash Trib Near Topock, Ariz.	14.7	1450	98.2	5290	710	291	48.7	0.13	0.06	0.01
9424200	Cottonwood Wash 1 N Kingman Ariz	143	5350	67	11700	7310	5860	3690	0.62	0.50	0.32
9424407	Mcgarrys Wash Near Kingman, Ariz.	13.5	4610	203	3130	369	150	26.9	0.12	0.05	0.01
9424410	Big Sandy River Trib Near Kingman, Ariz.	1.99	3700	214	1090	173	80.2	18.6	0.16	0.07	0.02
9424430	Kaiser Spring Canyon Trib Near Wikieup, Ariz.	1.7	3520	615	2610	413	196	49.2	0.16	0.08	0.02
9424450	Big Sandy River Near Wikieup,Ariz.	2731.9	4490	41.9	102400	34700	21300	7900	0.34	0.21	0.08
9424480	Ash Creek Near Kirkland, Ariz.	6.95	4680	278	4250	882	459	133	0.21	0.11	0.03
9424700	Iron Spring Wash Trib Near Bagdad, Ariz.	0.64	3470	431	993	146	63.5	12.4	0.15	0.06	0.01
9424900	Santa Maria River Near Bagdad, Ariz.	1129	4010	91.9	32600	17700	13400	7510	0.54	0.41	0.23
9425500	Santa Maria River Near Alamo, Ariz.	1439	3650	46.5	69600	17600	9870	3260	0.25	0.14	0.05
9427700	Monkeys Head Wash Near Parker, Ariz.	1.84	1130	415	1640	236	100	18.2	0.14	0.06	0.01
9428545	Cunningham Wash Trib Near Wenden, Ariz.	0.77	2330	365	296	140	101	52.1	0.47	0.34	0.18
9428550	Bouse Wash Trib Near Bouse, Ariz.	14.6	1230	50	6170	1730	998	344	0.28	0.16	0.06
9429150	Creosote Wash Near Ehrenberg, Ariz.	1.98	509	95.2	1270	390	239	95.6	0.31	0.19	0.08
9429400	Indian Wash Trib Near Yuma, Az.	2.56	1190	66.7	131	79.3	64.8	44.7	0.61	0.49	0.34
9429510	Mittry Lake Trib Near Yuma, Az.	0.3	346	122	346	106	62.8	22	0.31	0.18	0.06
9432000	Gila River Below Blue Creek, Near Virden Nm	3203	6690	35.8	42100	16700	11200	5120	0.40	0.27	0.12
9442000	Gila River Near Clifton, Ariz.	4010	6250	29	47700	18600	12600	6000	0.39	0.26	0.13
9444100	Campbell Blue Creek Near Alpine, Az	11.6	8300	90.2	667	181	108	42	0.27	0.16	0.06
9444200	Blue River Nr. Clifton Az.	506	6910	65.3	46600	14400	8960	3780	0.31	0.19	0.08
9444500	San Francisco River At Clifton, Ariz.	2764	6880	48.9	113900	31100	18300	6780	0.27	0.16	0.06
9445500	Willow C Nr Point Of Pines Nr Morenci, Ariz.	102	6340	73	4620	1970	1370	678	0.43	0.30	0.15
9446000	Willow C N Double Circle Rnch N Morenci Ariz.	149	6310	77.7	10000	4200	2910	1430	0.42	0.29	0.14
9446500	Eagle C N Double Circle Rnch N Morenci Ariz	377	6410	100	24600	8760	5690	2510	0.36	0.23	0.10

Ratios for the 10-, 5- and 2-year USGS LP3 peak discharges to the 100-year for all undeveloped watersheds in Arizona

Gage No.	Station Name	Drainage Area sq. miles	Mean Basin Elevation feet	Main Channel Slope ft/mi	Log Pearson Type III Peak Discharge 100-Year cfs	10-Year cfs	5-Year cfs	2-Year cfs	Ratio to the 100-Year Discharge 10-Year %	5-Year %	2-Year %
9447000	Eagle Creek Abv. Pumping Plant Nr. Morenci, Az.	622	6060	60.9	47000	14400	8300	2730	0.31	0.18	0.06
9447800	Bonita Creek Near Morenci, Arizona	302	0	0	27600	9070	5680	2320	0.33	0.21	0.08
9448500	Gila R At Head Of Safford Valley Nr Solomon Ariz	7896	6360	26.4	140700	40400	24500	9860	0.29	0.17	0.07
9451800	Tollgate Wash Trib Near Clifton, Ariz.	0.12	4800	878	225	70.5	39.7	11.4	0.31	0.18	0.05
9456000	San Simon River Near San Simon Ariz.	814	4830	23.8	8660	5570	4520	2920	0.64	0.52	0.34
9456400	Gold Gulch Near Bowie, Ariz.	15	5170	201	4640	1790	1180	527	0.39	0.25	0.11
9457000	San Simon River Near Solomon, Ariz.	2192	4270	14.6	17000	9320	7250	4520	0.55	0.43	0.27
9458500	Gila River At Safford, Ariz.	10459	5830	23.6	35900	17700	13500	8230	0.49	0.38	0.23
9460150	Frye Creek Near Thatcher, Ariz.	4.02	8400	1160	1580	254	116	25.6	0.16	0.07	0.02
9466500	Gila River At Calva, Ariz.	11470	5650	20.4	161000	35500	19600	6760	0.22	0.12	0.04
9467120	Salt Creek Near Peridot, Ariz.	30.2	3490	169	6910	2890	1920	810	0.42	0.28	0.12
9468300	Sevenmile Wash Trib Near Globe, Ariz.	0.83	4410	280	1690	295	134	27.3	0.17	0.08	0.02
9468500	San Carlos River Near Peridot, Arizona	1026	4480	29.4	62100	23500	15800	7460	0.38	0.25	0.12
9470500	San Pedro River At Palominas, Ariz.	741	4950	23.5	21500	12100	9300	5460	0.56	0.43	0.25
9470900	San Pedro River Trib Near Bisbee, Ariz.	5.25	4770	129	2140	1170	885	498	0.55	0.41	0.23
9471000	San Pedro River At Charleston, Ariz.	1234	4840	18.4	49500	16600	11300	6130	0.34	0.23	0.12
9471550	San Pedro River Near Tombstone, Ariz.	1730	4820	18	28000	15400	12000	7490	0.55	0.43	0.27
9471600	Canary Wash Near Benson, Ariz.	0.79	5240	472	385	58	24.7	4.4	0.15	0.06	0.01
9471700	Fenner Wash Near Benson, Ariz.	2.71	4180	93.8	2270	798	501	196	0.35	0.22	0.09
9472000	San Pedro River Nr. Redington, Ariz.	2927	4660	15.3	52700	22200	15200	7220	0.42	0.29	0.14
9472100	Peck Canyon Trib Near Redington, Ariz	8.02	3680	146	4410	793	402	118	0.18	0.09	0.03
9472400	Mammoth Wash Near Mammoth, Ariz.	2.4	3700	181	6960	1540	752	167	0.22	0.11	0.02
9473000	Aravaipa Creek Near Mammoth, Ariz.	537	4530	45.7	26900	11500	8000	3980	0.43	0.30	0.15
9473200	Green Lantern Wash Near Winkelman, Ariz.	3.63	2590	189	7490	2290	1380	509	0.31	0.18	0.07
9473500	San Pedro R At Winkelman, Ariz.	4453	4520	18	60900	19500	12800	6390	0.32	0.21	0.10
9473600	Tam O'Shanter Wash Near Hayden, Ariz.	4.37	3050	324	1460	759	586	368	0.52	0.40	0.25
9478200	Durham Wash Near Florence, Ariz.	15.6	3670	143	5710	2050	1320	561	0.36	0.23	0.10
9478500	Queen C At Whitlow Damsite N Superior Ariz.	144	3180	137	46100	14300	8850	3630	0.31	0.19	0.08
9478600	Queen Creek Trib No 3 At Whitlow Dam Ariz.	0.37	2320	187	417	189	135	71.3	0.45	0.32	0.17
9479200	Queen C Trib A Apache Junc Ariz	0.51	1760	76.2	431	179	120	52.5	0.42	0.28	0.12
9479500	Gila River Near Laveen, Ariz.	20615	0	0	60900	8040	3760	1020	0.13	0.06	0.02
9480000	Santa Cruz River Near Lochiel, Ariz.	82.2	5150	42.2	11600	4460	3020	1450	0.38	0.26	0.13
9480500	Santa Cruz River Nr. Nogales, Ariz.	533	4850	26	23200	10600	7610	4090	0.46	0.33	0.18
9481500	Sonoita Creek Near Patagonia, Ariz.	209	4800	76.7	15100	7190	5360	3130	0.48	0.35	0.21
9481700	Calabasas Canyon Near Nogales, Ariz.	10.3	4360	75.4	2540	1030	691	309	0.41	0.27	0.12
9481750	Sopori Wash At Amado, Ariz.	176	3840	35.9	17100	6780	4610	2230	0.40	0.27	0.13
9481800	Demetrie Wash Trib Near Continental, Ariz.	0.15	3620	100	214	85.2	56.9	25.6	0.40	0.27	0.12
9482000	Santa Cruz River At Continental, Ariz.	1682	4350	21	45400	12800	7980	3580	0.28	0.18	0.08
9482330	Pumping Wash Near Vail, Ariz.	0.81	3010	57.7	560	274	198	102	0.49	0.35	0.18
9482420	Julian Wash At Tucson Ariz	26.5	2900	38.9	2310	1130	817	428	0.49	0.35	0.19
9482480	Big Wash At Tucson, Ariz.	2.94	2850	95.2	4460	887	390	63	0.20	0.09	0.01
9482500	Santa Cruz River At Tucson, Ariz.	2222	4050	20.1	33300	13800	9720	5110	0.41	0.29	0.15
9482950	Railroad Wash At Tucson,Arizona	2.3	2490	0.73	2390	961	666	340	0.40	0.28	0.14
9483030	Anklam Wash At Tucson, Ariz.	2.11	2700	298	7390	855	362	75.6	0.12	0.05	0.01

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9483042	Cemetery Wash At Tucson, Ariz.	1.17	2370	40	842	517	418	274	0.61	0.50	0.33
9483100	Tanque Verde Creek Near Tucson, Ariz.	43	4780	156	12300	4620	3130	1530	0.38	0.25	0.12
9483200	Agua Caliente Wash Trib Near Tucson, Ariz.	2.04	3300	368	793	309	208	98.9	0.39	0.26	0.12
9484000	Sabino Creek Near Tucson, Ariz.	35.5	6300	482	12000	4310	2780	1190	0.36	0.23	0.10
9484200	Bear Creek Near Tucson, Ariz.	16.3	5860	502	1850	917	675	370	0.50	0.36	0.20
9484500	Tanque Verde Cr At Tucson Ariz	219	4340	109	35500	11000	6580	2360	0.31	0.19	0.07
9484510	Ventana Canyon Wash Near Tucson, Ariz.	6.46	4600	553	329	235	202	147	0.71	0.61	0.45
9484560	Cienega Creek Near Pantano, Ariz	289	4890	59.8	18500	6150	4020	1880	0.33	0.22	0.10
9484570	Mescal Arroyo Near Pantano, Ariz.	38.4	4260	82.9	15400	3620	2060	753	0.24	0.13	0.05
9484580	Barrel Canyon Near Sonoita, Ariz.	14.1	5000	190	4480	1810	1190	504	0.40	0.27	0.11
9484590	Davidson Canyon Wash Near Vail, Ariz.	50.5	4340	86.2	9340	4640	3430	1900	0.50	0.37	0.20
9484600	Pantano Wash Near Vail, Az	457	4500	46.3	32100	10400	6450	2600	0.32	0.20	0.08
9485000	Rincon Creek Near Tucson, Ariz.	44.8	4850	612	16700	4760	2770	963	0.29	0.17	0.06
9485100	Saguaro Corners Wash Near Tucson, Az	0.17	3040	117	53	39.1	34.4	27.4	0.74	0.65	0.52
9485500	Pantano Wash Near Tucson Ariz	602	4560	56.4	22600	7540	4620	1720	0.33	0.20	0.08
9485900	Pima Wash Near Tucson, Ariz.	4.93	4430	533	652	269	177	74.2	0.41	0.27	0.11
9485950	Geronimo Wash Near Tucson, Ariz.	2.15	3600	699	1090	414	271	118	0.38	0.25	0.11
9486000	Rillito Cr Near Tucson, Az	918	4400	45.5	27700	13100	9530	5120	0.47	0.34	0.18
9486300	Canada Del Oro Near Tucson, Az	250	4000	108	23900	9340	6150	2650	0.39	0.26	0.11
9486500	Santa Cruz River At Cortaro, Ariz.	3503	4000	20.3	46000	20400	15000	8780	0.44	0.33	0.19
9486800	Altar Wash Nr Three Points, Az	463	3920	74.1	22400	11200	8180	4360	0.50	0.37	0.19
9487000	Brawley Wash Near Three Points, Ariz.	776	3710	30.8	21100	9260	6630	3570	0.44	0.31	0.17
9487100	Little Brawley Wash Near Three Points, Ariz.	11.9	2800	112	4440	2010	1450	777	0.45	0.33	0.18
9487140	San Joaquin Wash Near Tucson, Ariz.	0.45	2530	69.3	987	486	356	191	0.49	0.36	0.19
9487250	Los Robles Wash Near Marana, Ariz.	1170	3350	25.9	12500	4900	3090	1140	0.39	0.25	0.09
9487400	Quijotoa Wash Trib. Near Quijotoa, Ariz.	2.44	2800	88.9	1300	546	370	168	0.42	0.28	0.13
9488500	Santa Rosa Wash Nr. Vaiva Vo, Ariz.	1782	2340	25.5	29000	6250	3160	808	0.22	0.11	0.03
9488600	Silver Reef Wash Near Casa Grande, Ariz.	12.8	1620	67.4	3340	1070	663	268	0.32	0.20	0.08
9489000	Santa Cruz River Near Laveen, Ariz.	8581	3060	15.2	13300	4270	2600	986	0.32	0.20	0.07
9489070	North Fork Of East Fork Black R Nr Alpine, Az	38.1	9060	48.8	1420	741	553	306	0.52	0.39	0.22
9489080	Hannagan Creek Near Hannagan Meadow, Ariz.	1.61	9160	68.6	87	39.7	29	16.5	0.46	0.33	0.19
9489100	Black River Near Maverick, Ariz.	315	8700	69.4	20500	6220	3860	1620	0.30	0.19	0.08
9489200	Pacheta Creek At Maverick, Az	14.8	8810	160	426	234	180	106	0.55	0.42	0.25
9489500	Black River Blw Pumping Plant Nr. Point Of Pines	560	8000	51.1	23400	8090	5190	2230	0.35	0.22	0.10
9489700	Big Bonito C Nr Fort Apache, Ariz.	119	7920	106	6040	2200	1440	629	0.36	0.24	0.10
9490500	Black River Near Fort Apache, Ariz. Mile 5.0	1232	7200	36.2	103500	34600	21000	7460	0.33	0.20	0.07
9490800	North Fork White River Nr. Greer, Ariz.	40.2	9520	216	535	325	266	183	0.61	0.50	0.34
9491000	North Fork White R Near Mcnary, Ariz.	66	9320	153	2280	1030	742	407	0.45	0.33	0.18
9492400	East Fork White River Nr Fort Apache, Ariz.	38.8	8580	239	1090	587	450	268	0.54	0.41	0.25
9494000	White River Near Fort Apache, Ariz. Mile 4.5	632	7400	76.8	18200	8030	5760	3110	0.44	0.32	0.17
9494300	Carrizo C Ab Corduroy C Nr Show Low, Ariz.	225	6370	64.9	11300	5020	3580	1870	0.44	0.32	0.17
9496000	Corduroy Creek Near Mouth, Near, Show Low, Ariz	203	6370	71.2	33200	6980	3650	1070	0.21	0.11	0.03
9496500	Carrizo Creek Near Show Low, Ariz.	439	6320	61.8	36900	11400	7020	2850	0.31	0.19	0.08
9496600	Cibecue 1 Trib Carrizo Cr Nr Show Low, Ariz.	0.1	5390	364	307	133	92	44	0.43	0.30	0.14

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9496700	Cibecue 2, Trib Carrizo Cr, Nr Show Low, Ariz.	0.07	5240	200	161	88	69	43	0.55	0.43	0.27
9496800	Carrizo Creek Trib Near Show Low, Ariz.	2.55	5810	306	2850	1020	660	287	0.36	0.23	0.10
9497500	Salt River Near Chrysotile, Ariz. Mile 34.8	2849	6730	31.9	122800	39600	24700	10200	0.32	0.20	0.08
9497800	Cibecue Creek Near Chrysotile, Ariz.	295	5700	79.6	20800	10300	7620	4200	0.50	0.37	0.20
9497900	Cherry Creek Near Young, Ariz	62.1	6030	106	11600	4660	3120	1390	0.40	0.27	0.12
9497980	Cherry Creek Near Globe, Ariz.	200	5600	87.9	25400	8700	5450	2190	0.34	0.21	0.09
9498400	Pinal C At Inspiration Dam, Nr Globe, Az	162	0	0	8440	3600	2540	1320	0.43	0.30	0.16
9498500	Salt River Near Roosevelt, Ariz.	4306	6190	23.3	227900	63800	38000	14400	0.28	0.17	0.06
9498600	Cristopher Creek Trib Near Kohl'S Ranch, Ariz	0.66	6080	510	348	110	69.5	30.2	0.32	0.20	0.09
9498800	Tonto Creek Near Gisela, Ariz.	430	5810	126	95500	33800	21500	8810	0.35	0.23	0.09
9498870	Rye Creek Nr Gisela, Ariz.	122	4390	91.4	35400	9700	6100	2850	0.27	0.17	0.08
9498900	Gold Creek Near Payson, Ariz.	6.44	4590	295	4070	1290	795	314	0.32	0.20	0.08
9499000	Tonto Creek Abv. Gun Cr., Nr Roosevelt, Az	675	5020	88.4	107900	41700	27000	11100	0.39	0.25	0.10
9501300	Tortilla Creek At Tortilla Flat, Ariz.	24.3	2960	179	15300	6180	4080	1740	0.40	0.27	0.11
9502700	Crookton Wash Near Seligman, Ariz.	6.01	5970	111	6250	310	86.2	7.2	0.05	0.01	0.00
9502800	Williamson Valley W Nr Paulden, Ariz.	255	5120	48.6	29200	7360	4080	1310	0.25	0.14	0.04
9503000	Granite Creek Near Prescott, Ariz.	36.3	5900	104	7710	2990	2000	916	0.39	0.26	0.12
9503700	Verde River Near Paulden, Ariz.	2150	5410	23.8	38400	8540	4550	1380	0.22	0.12	0.04
9503720	Hell Canyon Near Williams, Ariz.	14.9	7110	47.8	3860	1360	862	346	0.35	0.22	0.09
9503740	Hell Canyon Trib N Ash Fork. Az	0.75	5180	78.4	220	57.4	32.3	10.5	0.26	0.15	0.05
9503750	Limestone Canyon Nr Paulden, Az	14.5	5310	87.3	9820	2080	1020	239	0.21	0.10	0.02
9503800	Volunteer Wash Near Bellemont, Ariz.	124	7620	56.6	6890	2040	1160	357	0.30	0.17	0.05
9504000	Verde River Nr Clarkdale, Ariz.	3139	5490	22.9	70200	25500	16100	6340	0.36	0.23	0.09
9504100	Hull Canyon Near Jerome, Ariz.	0.85	7050	1270	561	66.3	23.5	2.6	0.12	0.04	0.00
9504400	Munds Canyon Trib Near Sedona, Ariz.	1.15	6880	269	1430	409	232	73.9	0.29	0.16	0.05
9504500	Oak Creek Near Cornville, Ariz.	355	6200	85	50100	18700	12000	4810	0.37	0.24	0.10
9504800	Oak Creek Trib Near Cornville, Az	0.05	3570	65	369	61.7	25.9	4.1	0.17	0.07	0.01
9505200	Wet Beaver Creek Near Rimrock, Arizona	111	6410	131	15800	8140	6130	3520	0.52	0.39	0.22
9505250	Red Tank Draw Near Rimrock, Ariz	49.4	5910	183	10900	3090	1860	724	0.28	0.17	0.07
9505300	Rattlesnake Canyon Near Rimrock, Ariz.	24.6	6560	174	6290	2750	1880	872	0.44	0.30	0.14
9505350	Dry Beaver Creek Near Rimrock, Ariz.	142	6220	137	51400	16100	9590	3380	0.31	0.19	0.07
9505600	Dirty Neck Canyon Near Clints Well, Ariz.	3.42	7140	190	573	231	151	62.7	0.40	0.26	0.11
9505800	West Clear Creek Near Camp Verde, Ariz.	241	6680	112	32700	14200	9690	4510	0.43	0.30	0.14
9505900	Cottonwood Wash Near Camp Verde, Ariz.	0.64	3540	385	619	141	75.9	23.4	0.23	0.12	0.04
9506000	Verde River Near Camp Verde, Ariz.	4644	5560	17.9	166300	45900	27000	9900	0.28	0.16	0.06
9507600	East Verde River Nr. Pine, Ariz.	6.34	6430	303	8600	1810	954	288	0.21	0.11	0.03
9507700	Webber Cr Ab West Fork Webber Cr N Pine, Az	4.79	6980	634	2480	544	291	90	0.22	0.12	0.04
9507980	East Verde River Near Childs, Ariz.	331	5140	91.6	56700	16000	9300	3270	0.28	0.16	0.06
9508300	Wet Bottom Creek Nr Childs, Ariz.	36.4	4810	210	17600	6760	4340	1740	0.38	0.25	0.10
9508500	Verde River Blw Tangle Cr Ab Horseshoe Dam, Az	5493	5470	16.2	200300	67300	41600	16000	0.34	0.21	0.08
9510070	Wf Sycamore Cr Ab Mcfar Can, N Sunflower, Az	4.58	5430	260	5530	702	268	36	0.13	0.05	0.01
9510080	West Fork Sycamore Cr Nr Sunflower, Ariz.	9.8	5260	353	8030	1190	519	101	0.15	0.06	0.01
9510150	Sycamore Creek Near Sunflower, Ariz.	52.3	4260	58.6	42700	8160	4050	1050	0.19	0.09	0.02
9510170	Camp Creek Nr Sunflower, Az	2.6	3520	498	773	334	230	108	0.43	0.30	0.14

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9510180	Rock Creek Near Sunflower, Ariz.	15.2	3680	412	6390	2410	1520	573	0.38	0.24	0.09
9510200	Sycamore Creek Near Fort Mcdowell	164	3820	116	46300	12900	7320	2330	0.28	0.16	0.05
9512200	Salt River Trib. In S. Mnt. Park, Phoenix, Ariz.	1.75	1730	244	2230	420	191	37	0.19	0.09	0.02
9512300	Cave Creek Nr Cave Creek Ariz	121	3470	123	21500	7360	4580	1780	0.34	0.21	0.08
9512420	Lynx Creek Trib Near Prescott, Ariz.	0.95	5900	101	2910	761	403	106	0.26	0.14	0.04
9512500	Agua Fria River Near Mayer, Az	585	5000	56.9	35900	15500	11000	5920	0.43	0.31	0.16
9512600	Turkey Creek Near Cleator Arizona	89.4	5360	122	9810	4700	3360	1700	0.48	0.34	0.17
9512700	Agua Fria River Trib #2 Nr Rock Springs, Ariz	1.07	2140	173	1570	808	611	359	0.51	0.39	0.23
9512800	Agua Fria River Near Rock Springs, Ariz.	1111	4770	61.2	211800	44300	23300	7000	0.21	0.11	0.03
9512970	Cottonwood Creek Nr Waddell Dam Az.	9.28	0	0	16400	2020	804	131	0.12	0.05	0.01
9513780	New River Nr Rock Springs, Ariz.	68.3	3970	140	35000	11400	6880	2440	0.33	0.20	0.07
9513800	New River At New River, Ariz.	83.3	3600	105	37500	12600	7880	3150	0.34	0.21	0.08
9513820	Deadman Wash Near New River, Ariz.	11.1	1980	124	4630	1590	969	348	0.34	0.21	0.08
9513835	New River At Bell Road, Near Peoria, Ariz.	185	2700	64.5	31700	9410	5510	1900	0.30	0.17	0.06
9513890	New River At Peoria, Ariz.	317	2320	65.3	75100	20800	11300	3160	0.28	0.15	0.04
9513910	New River Nr Glendale, Ariz.	600	2130	66.9	49800	14400	8410	2890	0.29	0.17	0.06
9514200	Waterman Wash Near Buckeye, Ariz.	420	1570	21.2	8470	3420	2390	1250	0.40	0.28	0.15
9515500	Hassayampa River At Box Damsite Nr Wickenburg Az	417	4750	71	43000	13900	8480	3180	0.32	0.20	0.07
9515800	Hartman Wash Near Wickenburg, Ariz.	5.57	2690	71.6	7100	1660	869	239	0.23	0.12	0.03
9516500	Hassayampa River Nr Morristown, Ariz.	796	3190	84.9	45600	14300	8540	3030	0.31	0.19	0.07
9516600	Ox Wash Near Morristown, Ariz.	6.31	2290	101	3720	1120	647	209	0.30	0.17	0.06
9516800	Jack Rabbit Wash Near Tonopah, Ariz.	137	2260	34.4	33900	6860	3400	847	0.20	0.10	0.02
9517000	Hassayampa River Near Arlington, Ariz.	1471	3010	39.9	40500	12000	7340	3010	0.30	0.18	0.07
9517200	Centennial Wash Tributary Near Wenden, Ariz.	2.79	2480	193	1080	451	303	135	0.42	0.28	0.13
9517280	Tiger Wash Near Aguila, Ariz.	85.2	2590	35.2	7340	3160	2140	961	0.43	0.29	0.13
9517400	Winters Wash Near Tonopah, Ariz.	47.8	1630	83.7	4560	2120	1540	857	0.46	0.34	0.19
9519600	Rainbow Wash Trib Near Buckeye, Ariz.	2.43	950	323	2050	920	648	323	0.45	0.32	0.16
9519750	Bender Wash Near Gila Bend, Ariz.	68.6	1900	867	4450	2160	1580	867	0.49	0.36	0.19
9519760	Sauceda Wash Near Gila Bend, Ariz.	116	1980	591	6850	2520	1580	591	0.37	0.23	0.09
9519780	Windmill Wash Near Gila Bend, Ariz.	12.9	1050	64.4	27600	3210	1160	155	0.12	0.04	0.01
9520100	Military Wash Near Sentinel, Ariz.	8.7	674	56	5220	1120	577	161	0.21	0.11	0.03
9520110	Hot Shot Arroyo Near Ajo, Ariz.	0.44	1760	83.3	327	226	191	136	0.69	0.58	0.42
9520130	Darby Arroyo Near Ajo, Ariz.	4.72	1920	71.1	2380	1210	922	550	0.51	0.39	0.23
9520160	Gibson Arroyo At Ajo, Az	2.18	2100	171	1620	686	474	231	0.42	0.29	0.14
9520170	Rio Cornez Nr. Ajo, Ariz.	243	1950	26.8	11800	6280	4850	3000	0.53	0.41	0.25
9520200	Black Gap Wash Near Ajo, Ariz.	12.1	1280	21.8	1490	868	672	392	0.58	0.45	0.26
9520230	Crater Range Wash Near Ajo, Ariz.	1.49	1280	69.3	2230	522	270	70	0.23	0.12	0.03
9520300	Alamo Wash Trib Near Ajo, Ariz.	0.9	2040	64	656	326	240	141	0.50	0.37	0.21
9520350	Mohawk Pass Wash At Mohawk, Az.	0.09	601	707	273	85.7	52.4	20.2	0.31	0.19	0.07
9520400	Ligurta Wash At Ligurta, Az.	1.99	395	127	3930	980	548	182	0.25	0.14	0.05
9535100	San Simon Wash Nr Pisinimo Az	569	2250	17.4	11400	3450	2210	1020	0.30	0.19	0.09
9535300	Vamori Wash At Kom Vo, Az	1250	2699	14.1	5810	2200	1540	833	0.38	0.27	0.14
9536100	Pitchfork Canyon Trib Near Fort Grant, Ariz.	0.81	5210	459	589	323	247	144	0.55	0.42	0.24
9536350	Surprise Canyon Near Dos Cabezas, Ariz.	0.65	6280	1040	413	172	113	44.9	0.42	0.27	0.11

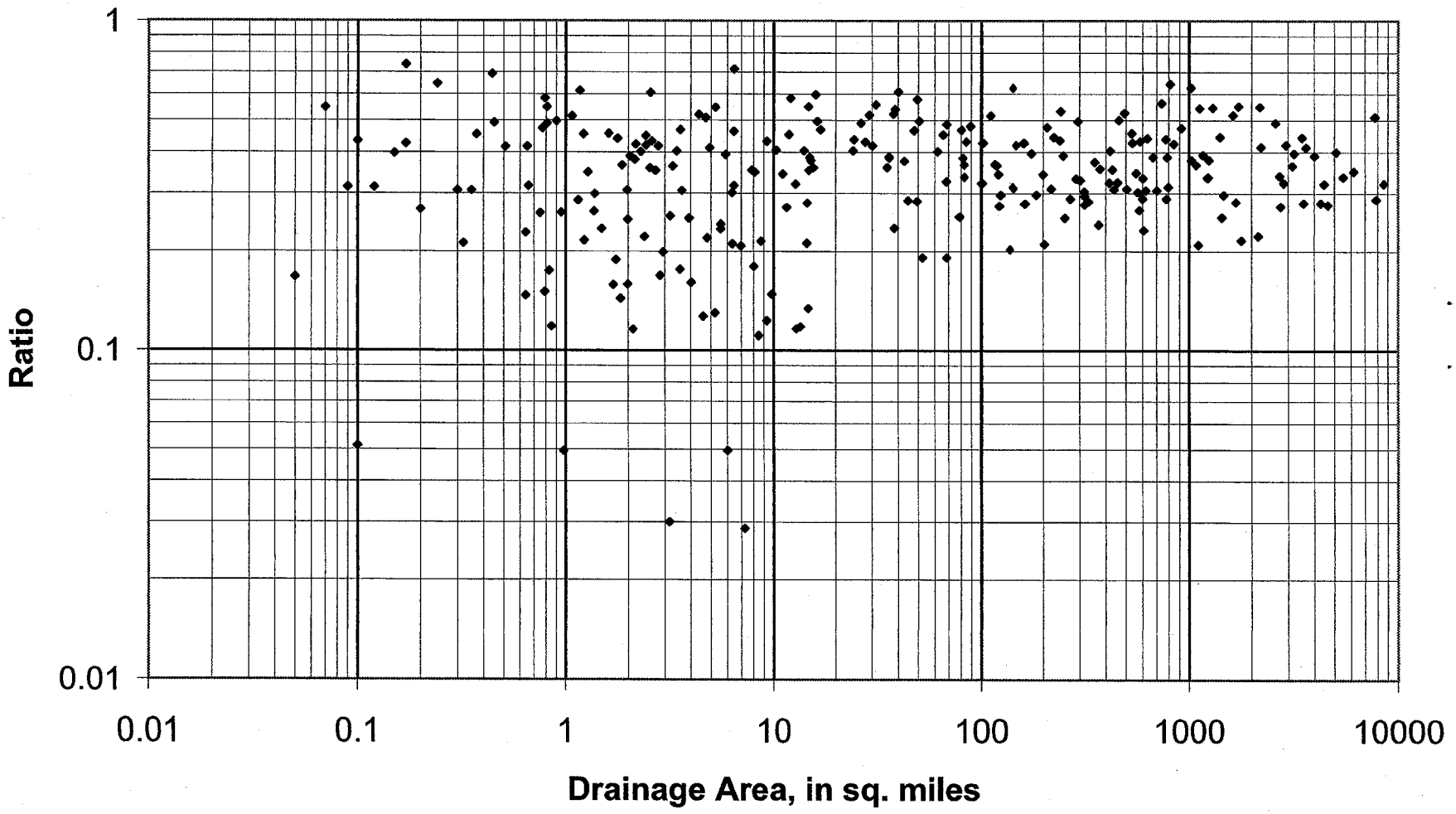
Ratios for the 10-, 5- and 2-year USGS LP3 peak discharges to the 100-year for all undeveloped watersheds in Arizona

Gage No.	Station Name	Drainage Area sq. miles	Mean Basin Elevation feet	Main Channel Slope ft/mi	Log Pearson Type III Peak Discharge 100-Year cfs	10-Year cfs	5-Year cfs	2-Year cfs	Ratio to the 100-Year Discharge 10-Year %	5-Year %	2-Year %
9537200	Leslie Creek Near Mcneal, Ariz.	79.1	5360	62.1	13500	3430	1910	612	0.25	0.14	0.05
9537500	Whitewater Draw Near Douglas, Ariz.	1023	4740	20.5	5220	3270	2610	1620	0.63	0.50	0.31
								Mean:	**0.36**	**0.24**	**0.12**
								Standard Deviation:	**0.13**	**0.12**	**0.09**
								Sample Size:	**266**	**266**	**266**

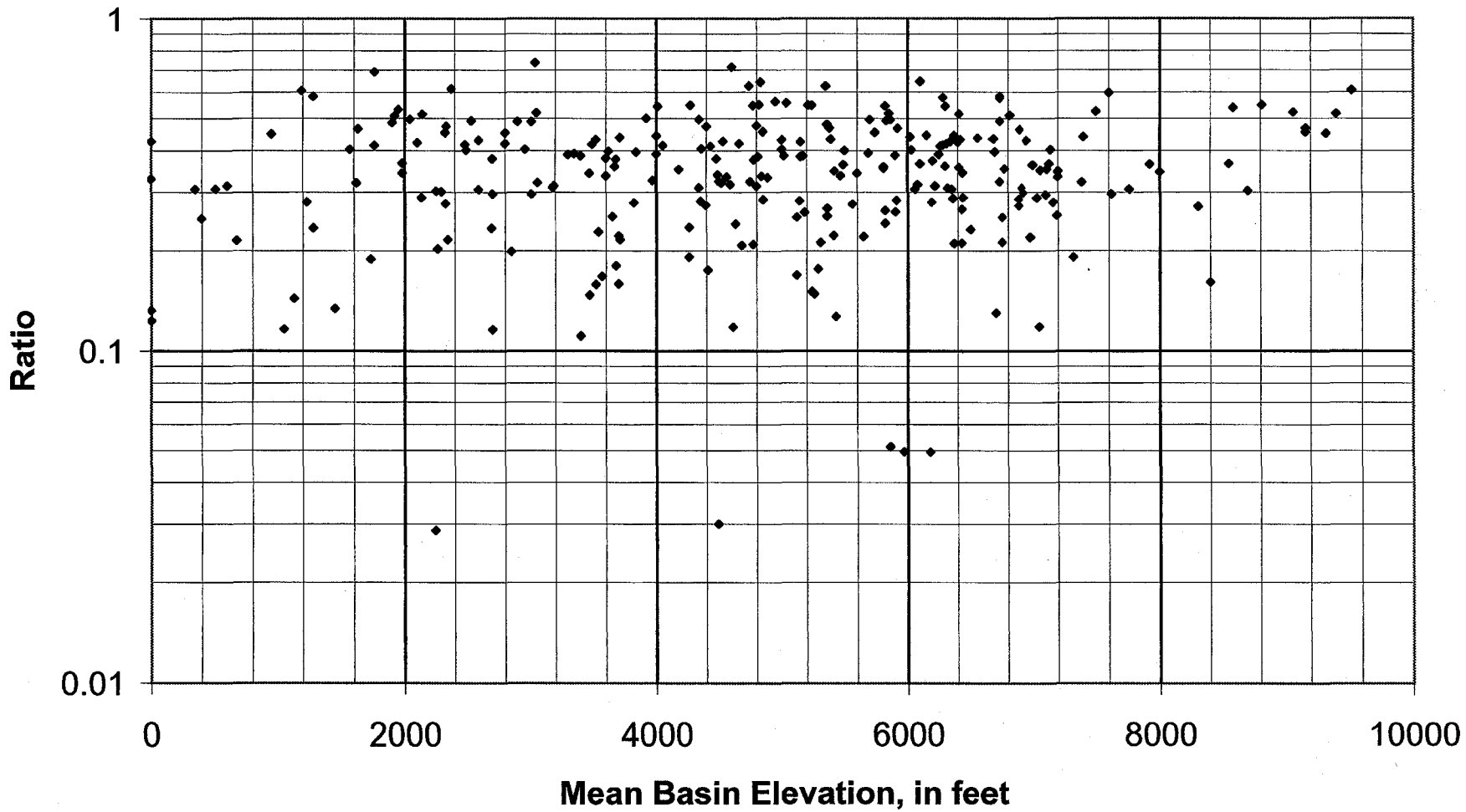
Descriptive Statistics

	10-Year	*5-Year*	*2-Year*
Mean	0.36	0.24	0.12
Standard Error	0.01	0.01	0.01
Median	0.36	0.23	0.10
Mode	0.31	0.33	0.13
Standard Deviation	0.13	0.12	0.09
Sample Variance	0.02	0.01	0.01
Kurtosis	-0.12	0.14	2.03
Skewness	0.05	0.50	1.26
Range	0.71	0.64	0.52
Minimum	0.03	0.01	0.00
Maximum	0.74	0.65	0.52
Sum	95.24	63.87	30.99
Count	266	266	266

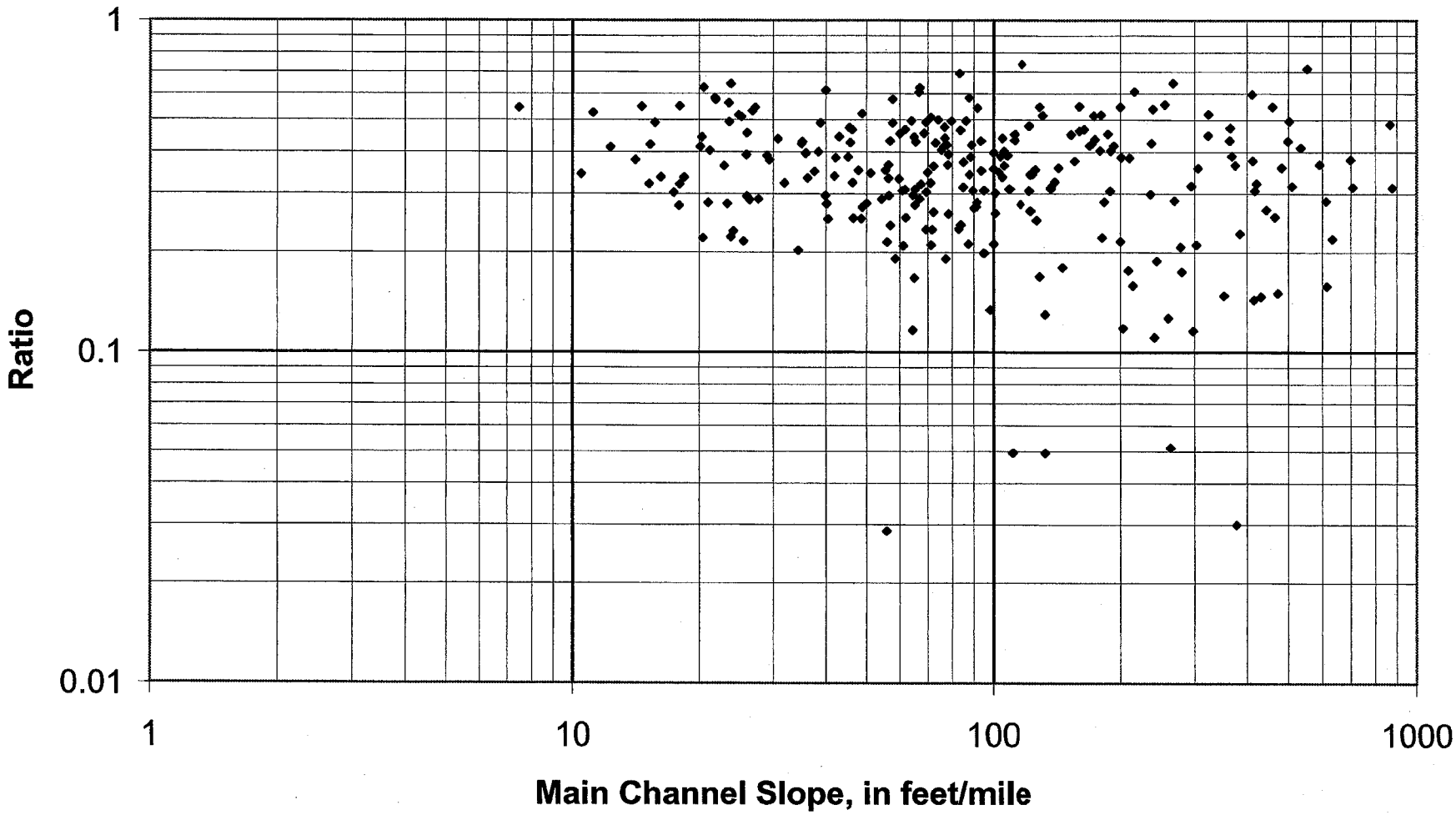
10-year ratios for all undeveloped gaged watersheds using USGS LP3 peak discharge data



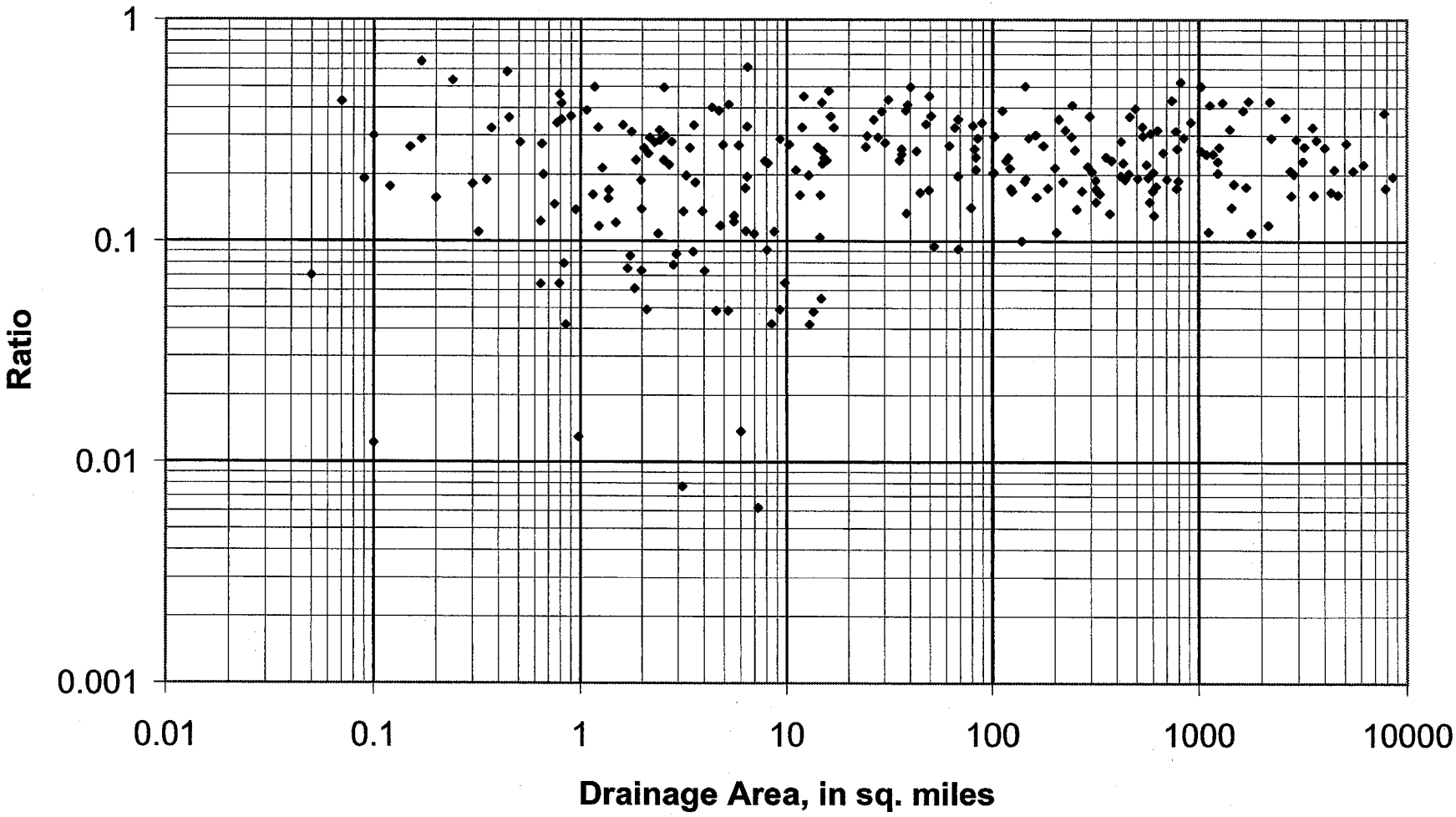
10-year ratios for all undeveloped gaged watersheds using USGS LP3 peak discharge data



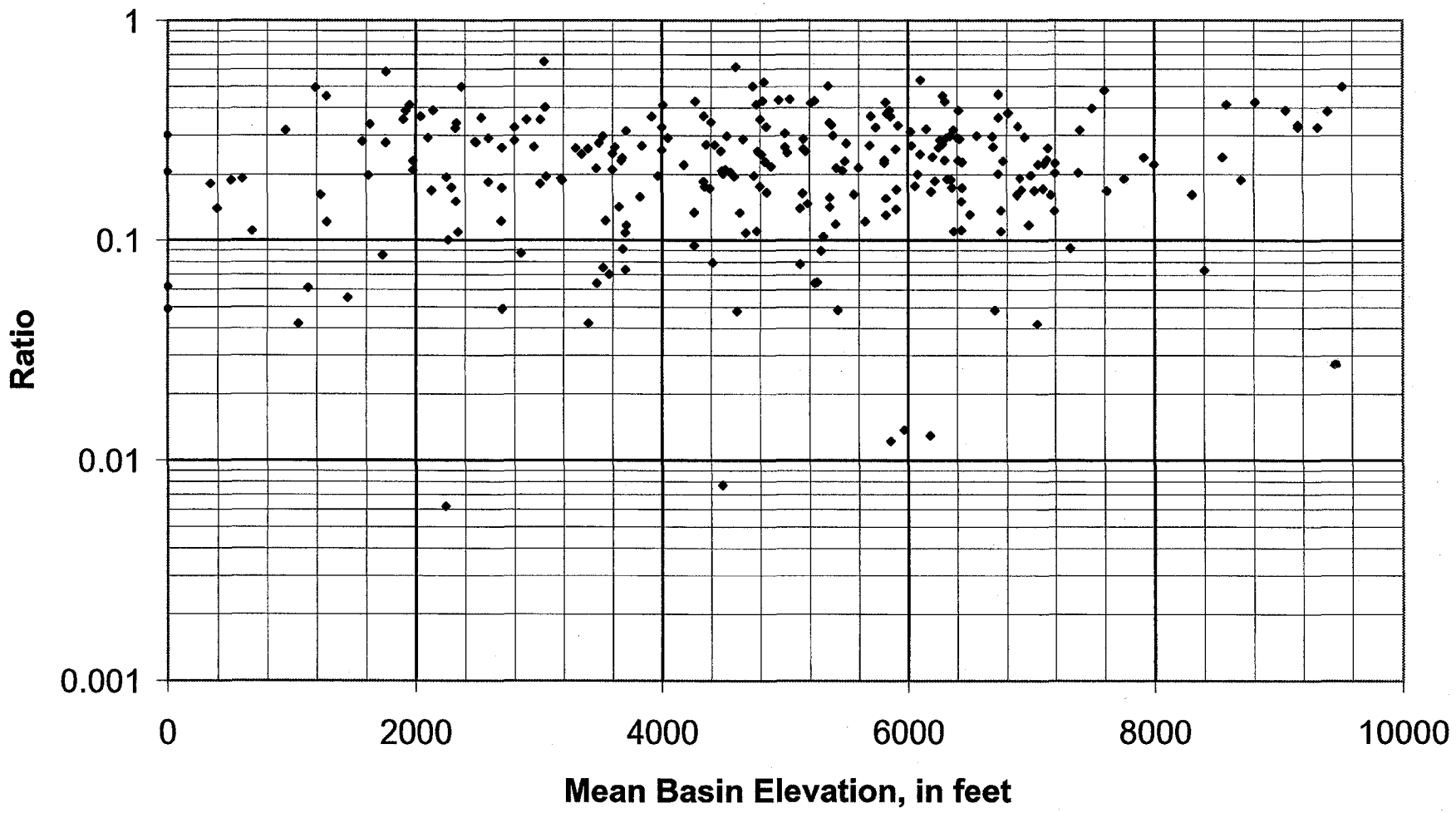
10-year ratios for all undeveloped gaged watersheds using USGS LP3 peak discharge data



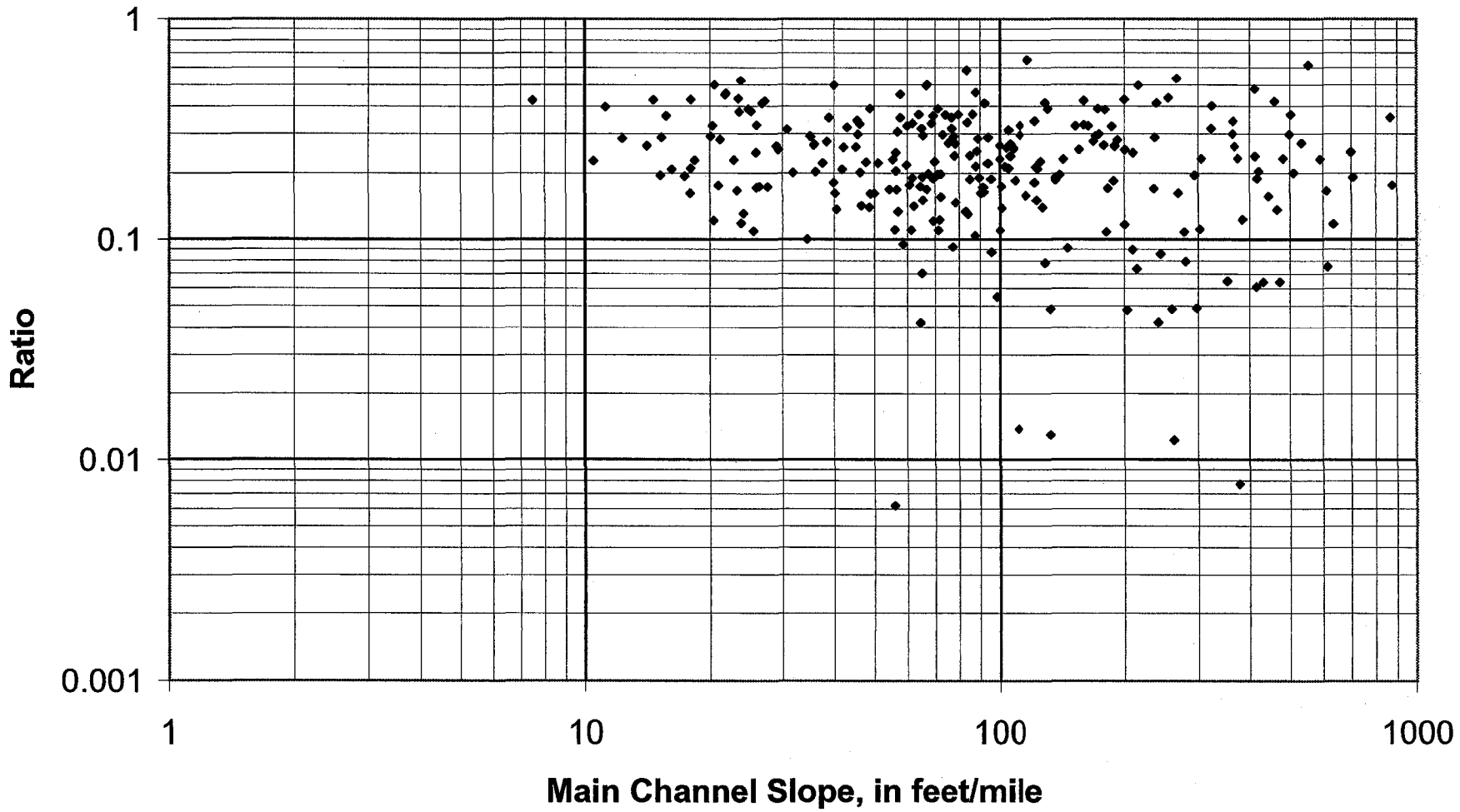
5-year ratios for all undeveloped gaged watersheds using USGS LP3 peak discharge data



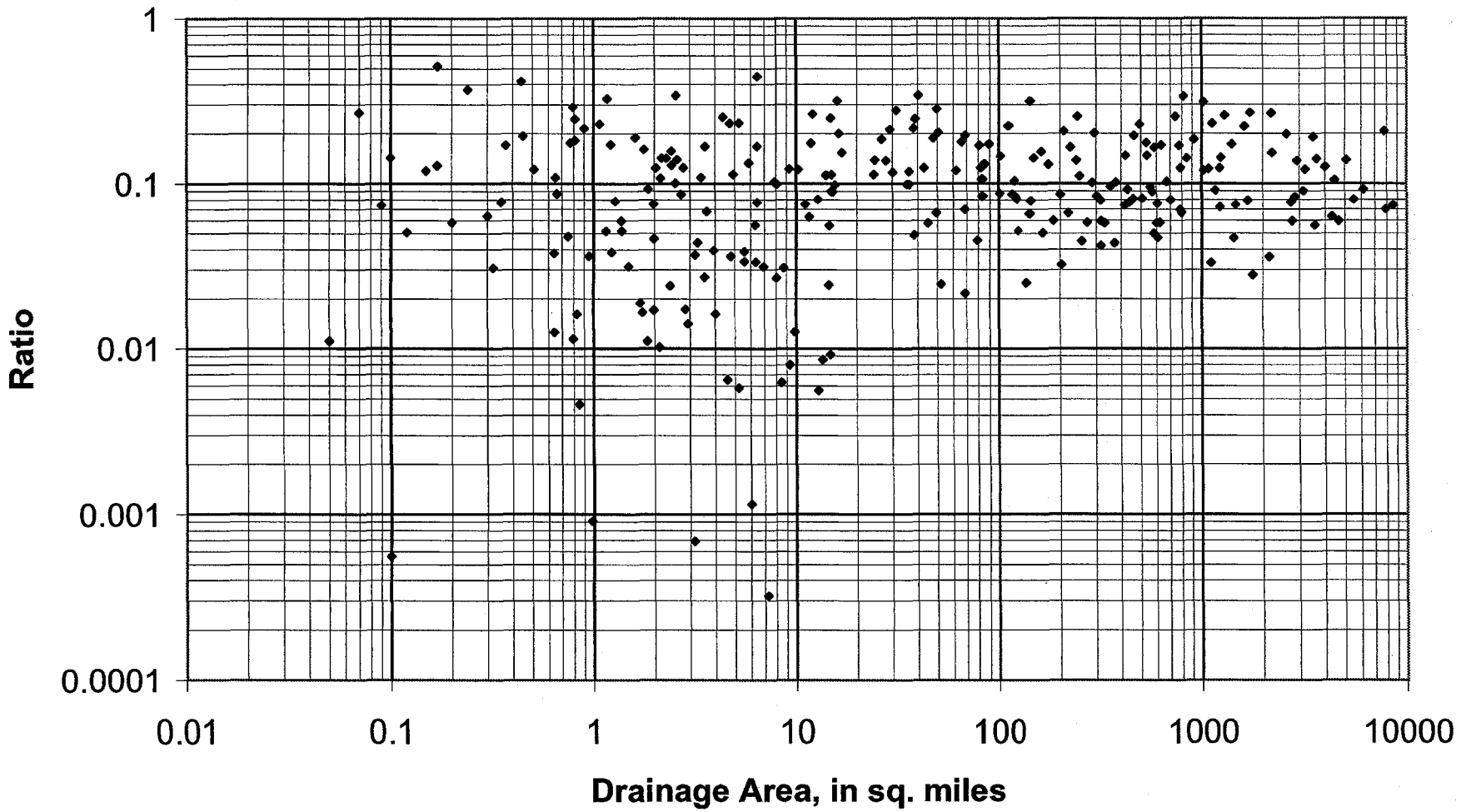
5-year ratios for all undeveloped gaged watersheds using USGS LP3 peak discharge data



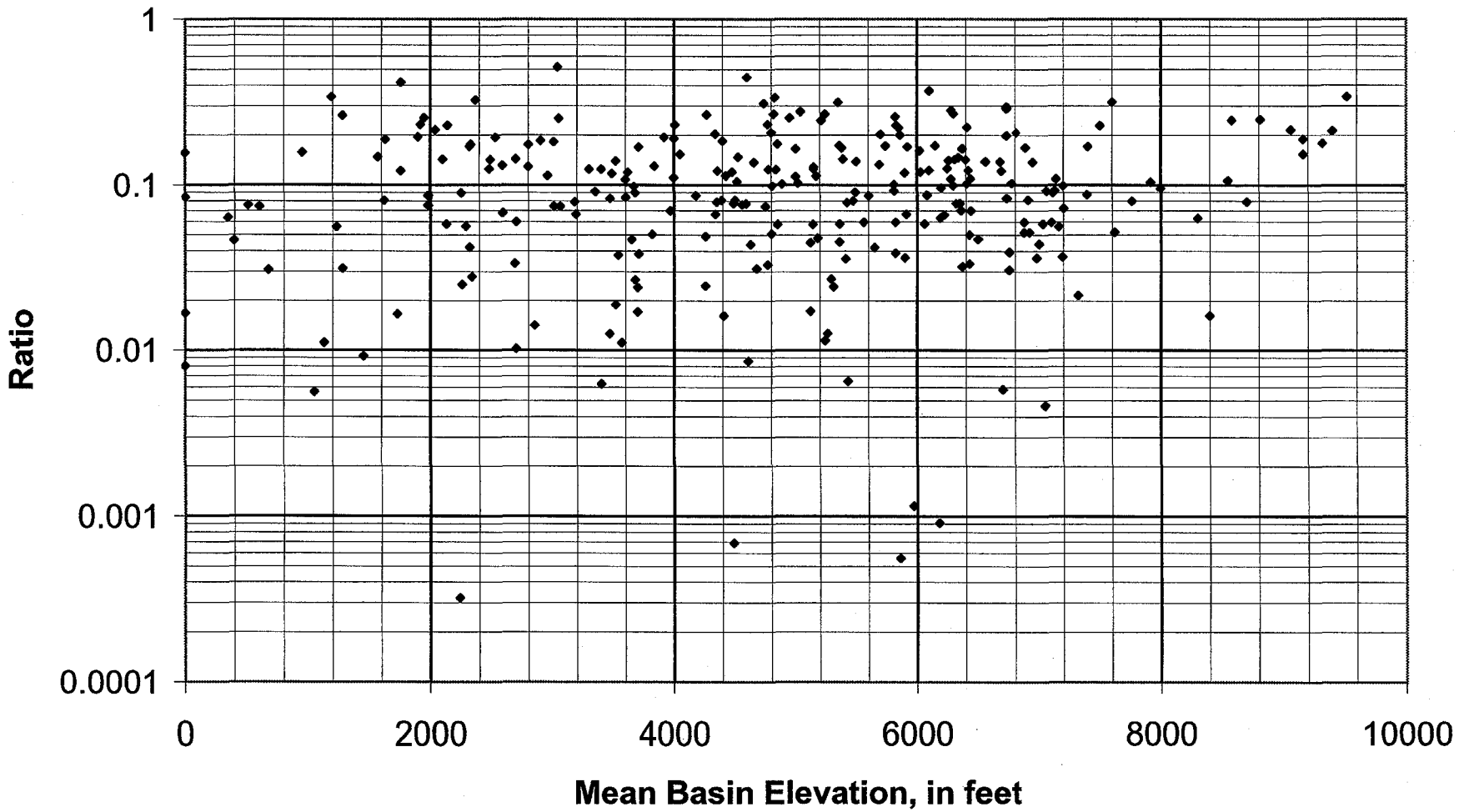
5-year ratios for all undeveloped gaged watersheds using USGS LP3 peak discharge data



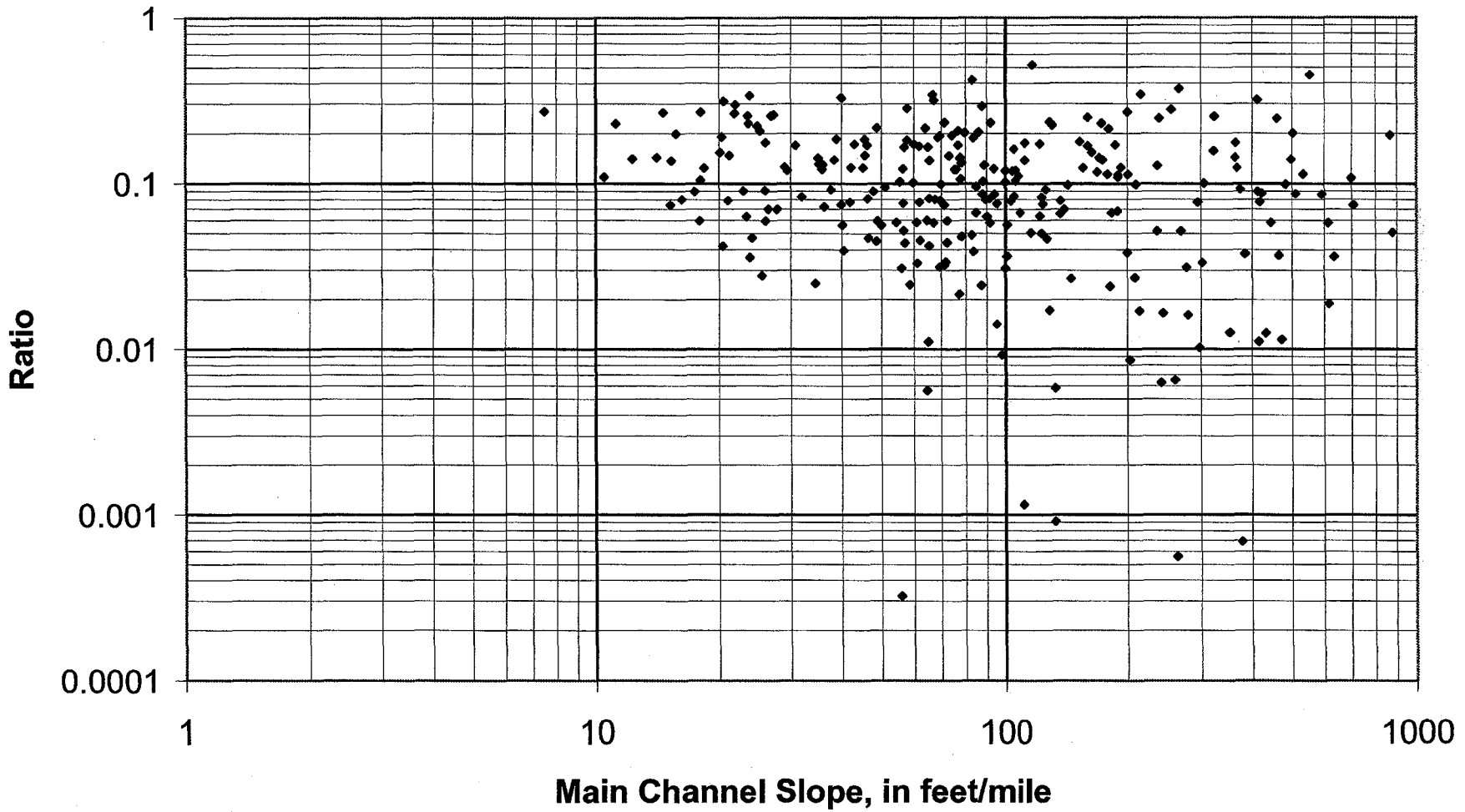
2-year ratios for all undeveloped gaged watersheds using USGS LP3 peak discharge data



2-year ratios for all undeveloped gaged watersheds using USGS LP3 peak discharge data



2-year ratios for all undeveloped gaged watersheds using USGS LP3 peak discharge data



Ratios for the 10-, 5- and 2-year USGS LP3 peak discharges to the 100-year for all undeveloped watersheds with period of records greater than 20-years in Arizona

Gage No.	Station Name	Drainage Area sq. miles	Mean Basin Elevation feet	Main Channel Slope ft/mi	Period of Record	Log Pearson Type III Peak Discharge 100-Year cfs	10-Year cfs	5-Year cfs	2-Year cfs	Ratio to the 100-Year Discharge 10-Year %	5-Year %	2-Year %
9379200	Chinle Creek Near Mexican Water, Ariz.	3650	6260	12.3	33	16500	6820	4710	2320	0.41	0.29	0.14
9382000	Paria River At Lees Ferry, Ariz.	1410	6150	43	71	19800	8810	6330	3420	0.44	0.32	0.17
9383400	Little Colorado River At Greer, Ariz.	29.1	9400	180	22	822	425	316	175	0.52	0.38	0.21
9384000	Little Colorado R Abv Lyman Lake Nr St. Johns, Az	703.5	7760	89.5	56	9400	2880	1790	750	0.31	0.19	0.08
9386500	Little Colorado R Ab Zuni R Nr Hunt, Az.	3557	7160	40.2	32	2930	819	474	164	0.28	0.16	0.06
9388000	Little Colorado River Nr Hunt, Az	6173	7060	37.6	36	8700	3040	1930	801	0.35	0.22	0.09
9390500	Show Low Creek Near Lakeside, Arizona	68.6	7320	77.2	42	16800	3210	1550	362	0.19	0.09	0.02
9393500	Silver Creek Near Snowflake, Ariz.	846	6400	35	64	18200	7720	5330	2590	0.42	0.29	0.14
9394500	Little Colorado R At Woodruff, Ariz.	7775	6810	25.2	69	18300	9340	6920	3790	0.51	0.38	0.21
9397000	Little Colorado River At Holbrook, Ariz.	11115	6730	21.9	25	37200	21400	17000	11000	0.58	0.46	0.30
9397500	Chevelon Fork Below Wildcat Canyon, Near Winslow	271	7030	54.4	36	41200	11900	6950	2400	0.29	0.17	0.06
9398000	Chevelon Creek Near Winslow, Ariz.	781	6440	27.7	45	33800	9760	5860	2360	0.29	0.17	0.07
9398500	Clear Creek Below Willow Creek, N Winslow, Az.	317	7100	26	43	39700	11700	6820	2360	0.29	0.17	0.06
9399000	Clear Creek Near Winslow, Ariz.	607	6500	24.1	49	59200	13700	7750	2790	0.23	0.13	0.05
9401000	Little Colo. River At Grand Falls, Ariz.	21240	6440	10.5	37	76000	26100	17280	8310	0.34	0.23	0.11
9401260	Moenkopi Wash At Moenkopi	1629	5850	24.8	22	15000	7760	5820	3320	0.52	0.39	0.22
9401400	Moenkopi Wash Nr Tuba City, Ariz.	1300	5820	27.2	25	14500	7900	6120	3740	0.54	0.42	0.26
9402000	Little Colorado River Near Cameron, Ariz.	26091	6300	7.48	48	28700	15600	12200	7730	0.54	0.43	0.27
9403000	Bright Angel Creek Near Grand Canyon, Ariz.	101	7390	421	49	4970	1600	1010	435	0.32	0.20	0.09
9415000	Virgin River At Littlefield, Ariz.	5090	5500	38.4	66	35500	14200	9810	4920	0.40	0.28	0.14
9424450	Big Sandy River Near Wikieup,Ariz.	2731.9	4490	41.9	30	102400	34700	21300	7900	0.34	0.21	0.08
9424900	Santa Maria River Near Bagdad, Ariz.	1129	4010	91.9	29	32600	17700	13400	7510	0.54	0.41	0.23
9425500	Santa Maria River Near Alamo, Ariz.	1439	3650	46.5	27	69600	17600	9870	3260	0.25	0.14	0.05
9432000	Gila River Below Blue Creek, Near Virden Nm	3203	6690	35.8	69	42100	16700	11200	5120	0.40	0.27	0.12
9442000	Gila River Near Clifton, Ariz.	4010	6250	29	65	47700	18600	12600	6000	0.39	0.26	0.13
9444100	Campbell Blue Creek Near Alpine, Az	11.6	8300	90.2	30	667	181	108	42	0.27	0.16	0.06
9444200	Blue River Nr. Clifton Az.	506	6910	65.3	29	46600	14400	8960	3780	0.31	0.19	0.08
9444500	San Francisco River At Clifton, Ariz.	2764	6880	48.9	88	113900	31100	18300	6780	0.27	0.16	0.06
9445500	Willow C Nr Point Of Pines Nr Morenci, Ariz.	102	6340	73	22	4620	1970	1370	678	0.43	0.30	0.15
9446000	Willow C N Double Circle Rnch N Morenci Ariz.	149	6310	77.7	24	10000	4200	2910	1430	0.42	0.29	0.14
9446500	Eagle C N Double Circle Rnch N Morenci Ariz	377	6410	100	24	24600	8760	5690	2510	0.36	0.23	0.10
9447000	Eagle Creek Abv. Pumping Plant Nr. Morenci, Az.	622	6060	60.9	52	47000	14400	8300	2730	0.31	0.18	0.06
9448500	Gila R At Head Of Safford Valley Nr Solomon Ariz	7896	6360	26.4	82	140700	40400	24500	9860	0.29	0.17	0.07
9457000	San Simon River Near Solomon, Ariz.	2192	4270	14.6	52	17000	9320	7250	4520	0.55	0.43	0.27
9458500	Gila River At Safford, Ariz.	10459	5830	23.6	21	35900	17700	13500	8230	0.49	0.38	0.23
9466500	Gila River At Calva, Ariz.	11470	5650	20.4	67	161000	35500	19600	6760	0.22	0.12	0.04
9468500	San Carlos River Near Peridot, Arizona	1026	4480	29.4	66	62100	23500	15800	7460	0.38	0.25	0.12
9470500	San Pedro River At Palominas, Ariz.	741	4950	23.5	56	21500	12100	9300	5460	0.56	0.43	0.25
9471000	San Pedro River At Charleston, Ariz.	1234	4840	18.4	80	49500	16600	11300	6130	0.34	0.23	0.12
9472000	San Pedro River Nr. Redington, Ariz.	2927	4660	15.3	64	52700	22200	15200	7220	0.42	0.29	0.14
9473000	Aravaipa Creek Near Mammoth, Ariz.	537	4530	45.7	44	26900	11500	8000	3980	0.43	0.30	0.15
9473500	San Pedro R At Winkelman, Ariz.	4453	4520	18	21	60900	19500	12800	6390	0.32	0.21	0.10
9479500	Gila River Near Laveen, Ariz.	20615	0	0	48	60900	8040	3760	1020	0.13	0.06	0.02
9480000	Santa Cruz River Near Lochiel, Ariz.	82.2	5150	42.2	47	11600	4460	3020	1450	0.38	0.26	0.13
9480500	Santa Cruz River Nr. Nogales, Ariz.	533	4850	26	66	23200	10600	7610	4090	0.46	0.33	0.18
9481500	Sonoita Creek Near Patagonia, Ariz.	209	4800	76.7	44	15100	7190	5360	3130	0.48	0.35	0.21
9482000	Santa Cruz River At Continental, Ariz.	1682	4350	21	51	45400	12800	7980	3580	0.28	0.18	0.08

Ratios for the 10-, 5- and 2-year USGS LP3 peak discharges to the 100-year for all undeveloped watersheds with period of records greater than 20-years in Arizona

Gage No.	Station Name	Drainage Area sq. miles	Mean Basin Elevation feet	Main Channel Slope ft/mi	Period of Record	Log Pearson Type III Peak Discharge 100-Year cfs	10-Year cfs	5-Year cfs	2-Year cfs	Ratio to the 100-Year Discharge 10-Year %	5-Year %	2-Year %
9482500	Santa Cruz River At Tucson, Ariz.	2222	4050	20.1	78	33300	13800	9720	5110	0.41	0.29	0.15
9483042	Cemetery Wash At Tucson, Ariz.	1.17	2370	40	24	842	517	418	274	0.61	0.50	0.33
9483100	Tanque Verde Creek Near Tucson, Ariz.	43	4780	156	25	12300	4620	3130	1530	0.38	0.25	0.12
9484000	Sabino Creek Near Tucson, Ariz.	35.5	6300	482	64	12000	4310	2780	1190	0.36	0.23	0.10
9484500	Tanque Verde Cr At Tucson Ariz	219	4340	109	28	35500	11000	6580	2360	0.31	0.19	0.07
9484600	Pantano Wash Near Vail, Az	457	4500	46.3	38	32100	10400	6450	2600	0.32	0.20	0.08
9485000	Rincon Creek Near Tucson, Ariz.	44.8	4850	612	43	16700	4760	2770	963	0.29	0.17	0.06
9486000	Rillito Cr Near Tucson, Az	918	4400	45.5	67	27700	13100	9530	5120	0.47	0.34	0.18
9486500	Santa Cruz River At Cortaro, Ariz.	3503	4000	20.3	45	46000	20400	15000	8780	0.44	0.33	0.19
9487000	Brawley Wash Near Three Points, Ariz.	776	3710	30.8	22	21100	9260	6630	3570	0.44	0.31	0.17
9488500	Santa Rosa Wash Nr. Vaiva Vo, Ariz.	1782	2340	25.5	26	29000	6250	3160	808	0.22	0.11	0.03
9489000	Santa Cruz River Near Laveen, Ariz.	8581	3060	15.2	56	13300	4270	2600	986	0.32	0.20	0.07
9489200	Pacheta Creek At Maverick, Az	14.8	8810	160	22	426	234	180	106	0.55	0.42	0.25
9489500	Black River Blw Pumping Plant Nr. Point Of Pines	560	8000	51.1	42	23400	8090	5190	2230	0.35	0.22	0.10
9489700	Big Bonito C Nr Fort Apache, Ariz.	119	7920	106	23	6040	2200	1440	629	0.36	0.24	0.10
9490500	Black River Near Fort Apache, Ariz. Mile 5.0	1232	7200	36.2	38	103500	34600	21000	7460	0.33	0.20	0.07
9491000	North Fork White R Near Mcnary, Ariz.	66	9320	153	38	2280	1030	742	407	0.45	0.33	0.18
9492400	East Fork White River Nr Fort Apache, Ariz.	38.8	8580	239	38	1090	587	450	268	0.54	0.41	0.25
9494000	White River Near Fort Apache, Ariz. Mile 4.5	632	7400	76.8	38	18200	8030	5760	3110	0.44	0.32	0.17
9496000	Corduroy Creek Near Mouth, Near, Show Low, Ariz	203	6370	71.2	23	33200	6980	3650	1070	0.21	0.11	0.03
9496500	Carrizo Creek Near Show Low, Ariz.	439	6320	61.8	45	36900	11400	7020	2850	0.31	0.19	0.08
9497500	Salt River Near Chrysotile, Ariz. Mile 34.8	2849	6730	31.9	72	122800	39600	24700	10200	0.32	0.20	0.08
9497800	Cibecue Creek Near Chrysotile, Ariz.	295	5700	79.6	37	20800	10300	7620	4200	0.50	0.37	0.20
9497980	Cherry Creek Near Globe, Ariz.	200	5600	87.9	30	25400	8700	5450	2190	0.34	0.21	0.09
9498500	Salt River Near Roosevelt, Ariz.	4306	6190	23.3	73	227900	63800	38000	14400	0.28	0.17	0.06
9498870	Rye Creek Nr Gisela, Ariz.	122	4390	91.4	20	35400	9700	6100	2850	0.27	0.17	0.08
9499000	Tonto Creek Abv. Gun Cr., Nr Roosevelt, Az	675	5020	88.4	55	107900	41700	27000	11100	0.39	0.25	0.10
9501300	Tortilla Creek At Tortilla Flat, Ariz.	24.3	2960	179	22	15300	6180	4080	1740	0.40	0.27	0.11
9502800	Williamson Valley W Nr Paulden, Ariz.	255	5120	48.6	20	29200	7360	4080	1310	0.25	0.14	0.04
9503700	Verde River Near Paulden, Ariz.	2150	5410	23.8	33	38400	8540	4550	1380	0.22	0.12	0.04
9504000	Verde River Nr Clarkdale, Ariz.	3139	5490	22.9	33	70200	25500	16100	6340	0.36	0.23	0.09
9504500	Oak Creek Near Cornville, Ariz.	355	6200	85	54	50100	18700	12000	4810	0.37	0.24	0.10
9505200	Wet Beaver Creek Near Rimrock, Arizona	111	6410	131	34	15800	8140	6130	3520	0.52	0.39	0.22
9505250	Red Tank Draw Near Rimrock, Ariz	49.4	5910	183	20	10900	3090	1860	724	0.28	0.17	0.07
9505300	Rattlesnake Canyon Near Rimrock, Ariz.	24.6	6560	174	22	6290	2750	1880	872	0.44	0.30	0.14
9505350	Dry Beaver Creek Near Rimrock, Ariz.	142	6220	137	35	51400	16100	9590	3380	0.31	0.19	0.07
9505800	West Clear Creek Near Camp Verde, Ariz.	241	6680	112	31	32700	14200	9690	4510	0.43	0.30	0.14
9507980	East Verde River Near Childs, Ariz.	331	5140	91.6	33	56700	16000	9300	3270	0.28	0.16	0.06
9508300	Wet Bottom Creek Nr Childs, Ariz.	36.4	4810	210	28	17600	6760	4340	1740	0.38	0.25	0.10
9508500	Verde River Blw Tangle Cr Ab Horseshoe Dam, Az	5493	5470	16.2	72	200300	67300	41600	16000	0.34	0.21	0.08
9510070	Wf Sycamore Cr Ab Mcfar Can, N Sunflower, Az	4.58	5430	260	22	5530	702	268	36	0.13	0.05	0.01
9510170	Camp Creek Nr Sunflower, Az	2.6	3520	498	21	773	334	230	108	0.43	0.30	0.14
9510200	Sycamore Creek Near Fort Mcdowell	164	3820	116	36	46300	12900	7320	2330	0.28	0.16	0.05
9512200	Salt River Trib. In S. Mnt. Park, Phoenix, Ariz.	1.75	1730	244	33	2230	420	191	37	0.19	0.09	0.02
9512300	Cave Creek Nr Cave Creek Ariz	121	3470	123	26	21500	7360	4580	1780	0.34	0.21	0.08
9512500	Agua Fria River Near Mayer, Az	585	5000	56.9	56	35900	15500	11000	5920	0.43	0.31	0.16
9512700	Agua Fria River Trib #2 Nr Rock Springs, Ariz	1.07	2140	173	22	1570	808	611	359	0.51	0.39	0.23

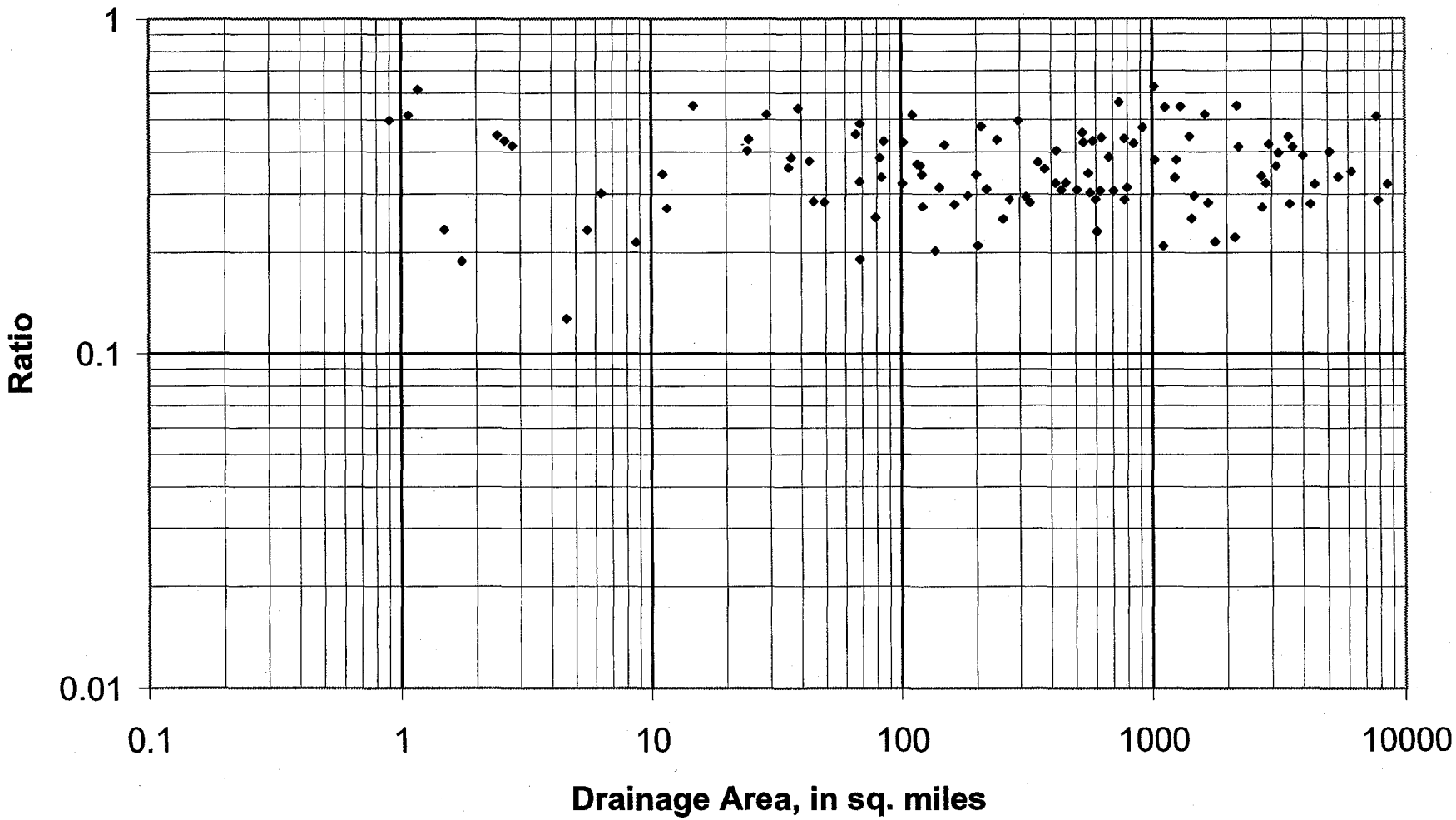
Ratios for the 10-, 5- and 2-year USGS LP3 peak discharges to the 100-year for all undeveloped watersheds with period of records greater than 20-years in Arizona

Gage No.	Station Name	Drainage Area sq. miles	Mean Basin Elevation feet	Main Channel Slope ft/mi	Period of Record	Log Pearson Type III Peak Discharge 100-Year cfs	10-Year cfs	5-Year cfs	2-Year cfs	Ratio to the 100-Year Discharge 10-Year %	5-Year %	2-Year %
9512800	Agua Fria River Near Rock Springs, Ariz.	1111	4770	61.2	27	211800	44300	23300	7000	0.21	0.11	0.03
9513780	New River Nr Rock Springs, Ariz.	68.3	3970	140	34	35000	11400	6880	2440	0.33	0.20	0.07
9513800	New River At New River, Ariz.	83.3	3600	105	21	37500	12600	7880	3150	0.34	0.21	0.08
9513820	Deadman Wash Near New River, Ariz.	11.1	1980	124	24	4630	1590	969	348	0.34	0.21	0.08
9513835	New River At Bell Road, Near Peoria, Ariz.	185	2700	64.5	23	31700	9410	5510	1900	0.30	0.17	0.06
9513910	New River Nr Glendale, Ariz.	600	2130	66.9	27	49800	14400	8410	2890	0.29	0.17	0.06
9514200	Waterman Wash Near Buckeye, Ariz.	420	1570	21.2	30	8470	3420	2390	1250	0.40	0.28	0.15
9515500	Hassayampa River At Box Damsite Nr Wickenburg Az	417	4750	71	39	43000	13900	8480	3180	0.32	0.20	0.07
9515800	Hartman Wash Near Wickenburg, Ariz.	5.57	2690	71.6	21	7100	1660	869	239	0.23	0.12	0.03
9516500	Hassayampa River Nr Morristown, Ariz.	796	3190	84.9	39	45600	14300	8540	3030	0.31	0.19	0.07
9516600	Ox Wash Near Morristown, Ariz.	6.31	2290	101	22	3720	1120	647	209	0.30	0.17	0.06
9516800	Jack Rabbit Wash Near Tonopah, Ariz.	137	2260	34.4	21	33900	6860	3400	847	0.20	0.10	0.02
9517000	Hassayampa River Near Arlington, Ariz.	1471	3010	39.9	32	40500	12000	7340	3010	0.30	0.18	0.07
9517200	Centennial Wash Tributary Near Wenden, Ariz.	2.79	2480	193	22	1080	451	303	135	0.42	0.28	0.13
9517280	Tiger Wash Near Aguila, Ariz.	85.2	2590	35.2	22	7340	3160	2140	961	0.43	0.29	0.13
9519600	Rainbow Wash Trib Near Buckeye, Ariz.	2.43	950	323	22	2050	920	648	323	0.45	0.32	0.16
9519750	Bender Wash Near Gila Bend, Ariz.	68.6	1900	867	22	4450	2160	1580	867	0.49	0.36	0.19
9519760	Sauceda Wash Near Gila Bend, Ariz.	116	1980	591	22	6850	2520	1580	591	0.37	0.23	0.09
9520100	Military Wash Near Sentinel, Ariz.	8.7	674	56	22	5220	1120	577	161	0.21	0.11	0.03
9520230	Crater Range Wash Near Ajo, Ariz.	1.49	1280	69.3	20	2230	522	270	70	0.23	0.12	0.03
9520300	Alamo Wash Trib Near Ajo, Ariz.	0.9	2040	64	30	656	326	240	141	0.50	0.37	0.21
9535100	San Simon Wash Nr Pisinimo Az	569	2250	17.4	24	11400	3450	2210	1020	0.30	0.19	0.09
9535300	Vamori Wash At Kom Vo, Az	1250	2699	14.1	24	5810	2200	1540	833	0.38	0.27	0.14
9537200	Leslie Creek Near Mcneal, Ariz.	79.1	5360	62.1	21	13500	3430	1910	612	0.25	0.14	0.05
9537500	Whitewater Draw Near Douglas, Ariz.	1023	4740	20.5	70	5220	3270	2610	1620	0.63	0.50	0.31
									Mean:	**0.37**	**0.24**	**0.12**
									Standard Deviation:	**0.10**	**0.10**	**0.07**
									Sample Size:	**119**	**119**	**119**

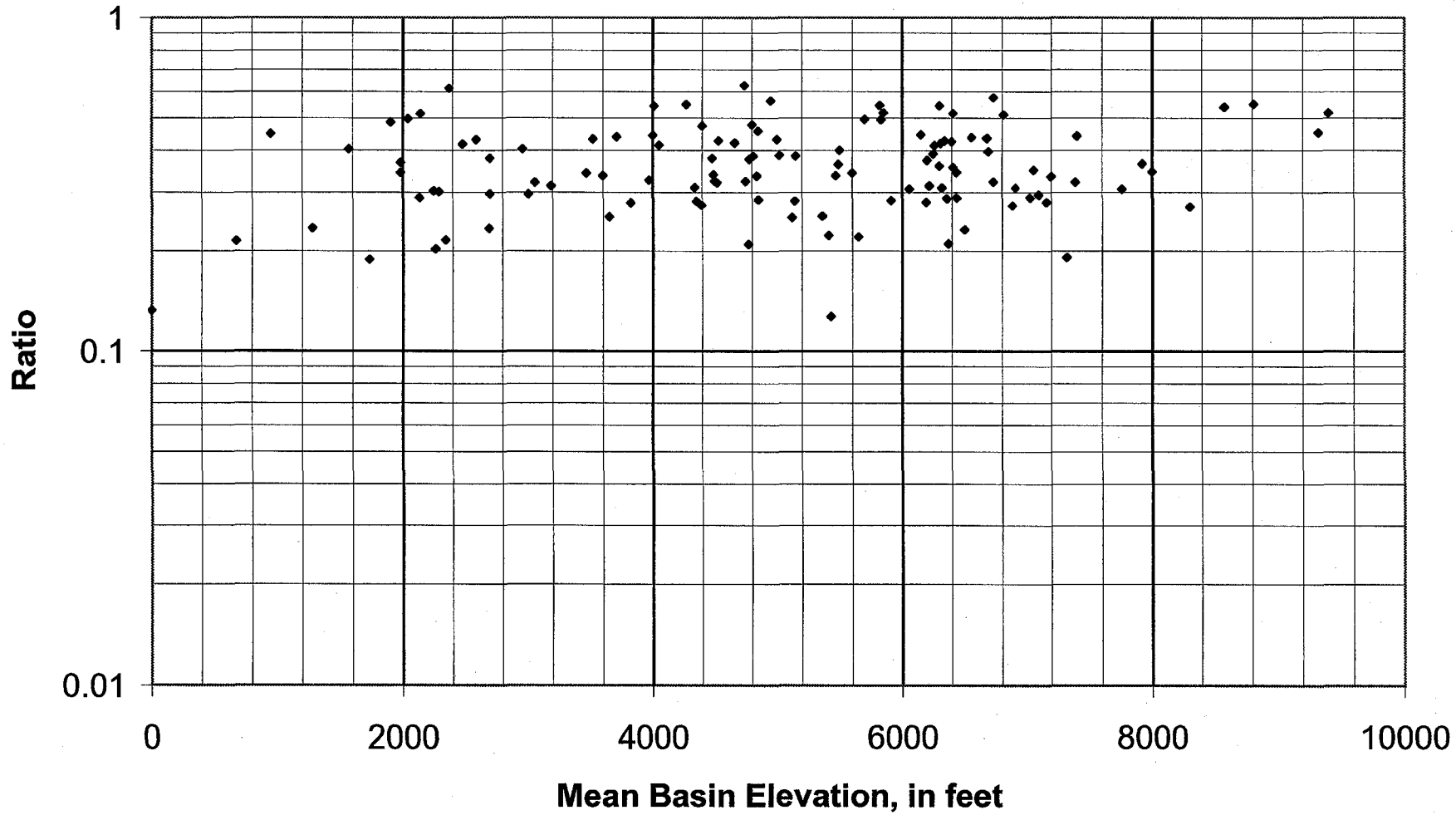
Descriptive Statistics

	10-Year	*5-Year*	*2-Year*
Mean	0.37	0.24	0.12
Standard Error	0.01	0.01	0.01
Median	0.35	0.23	0.10
Mode	0.31	#N/A	0.13
Standard Deviation	0.10	0.10	0.07
Sample Variance	0.01	0.01	0.01
Kurtosis	-0.37	-0.28	0.13
Skewness	0.26	0.51	0.88
Range	0.50	0.45	0.32
Minimum	0.13	0.05	0.01
Maximum	0.63	0.50	0.33
Sum	43.46	29.03	13.85
Count	119	119	119

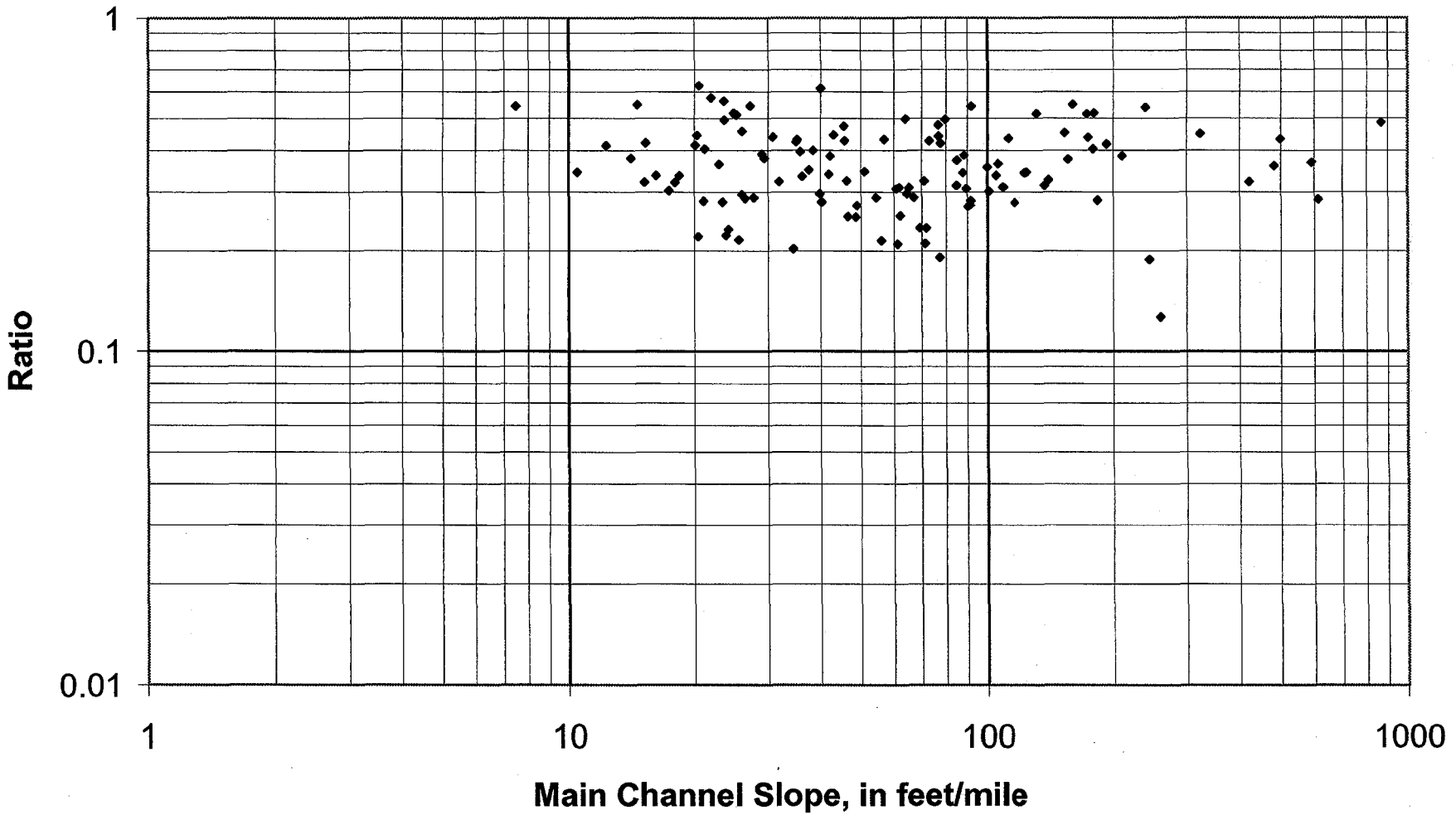
10-year ratios for all undeveloped gaged watersheds with period of records greater than 20 years using USGS LP3 peak discharge data



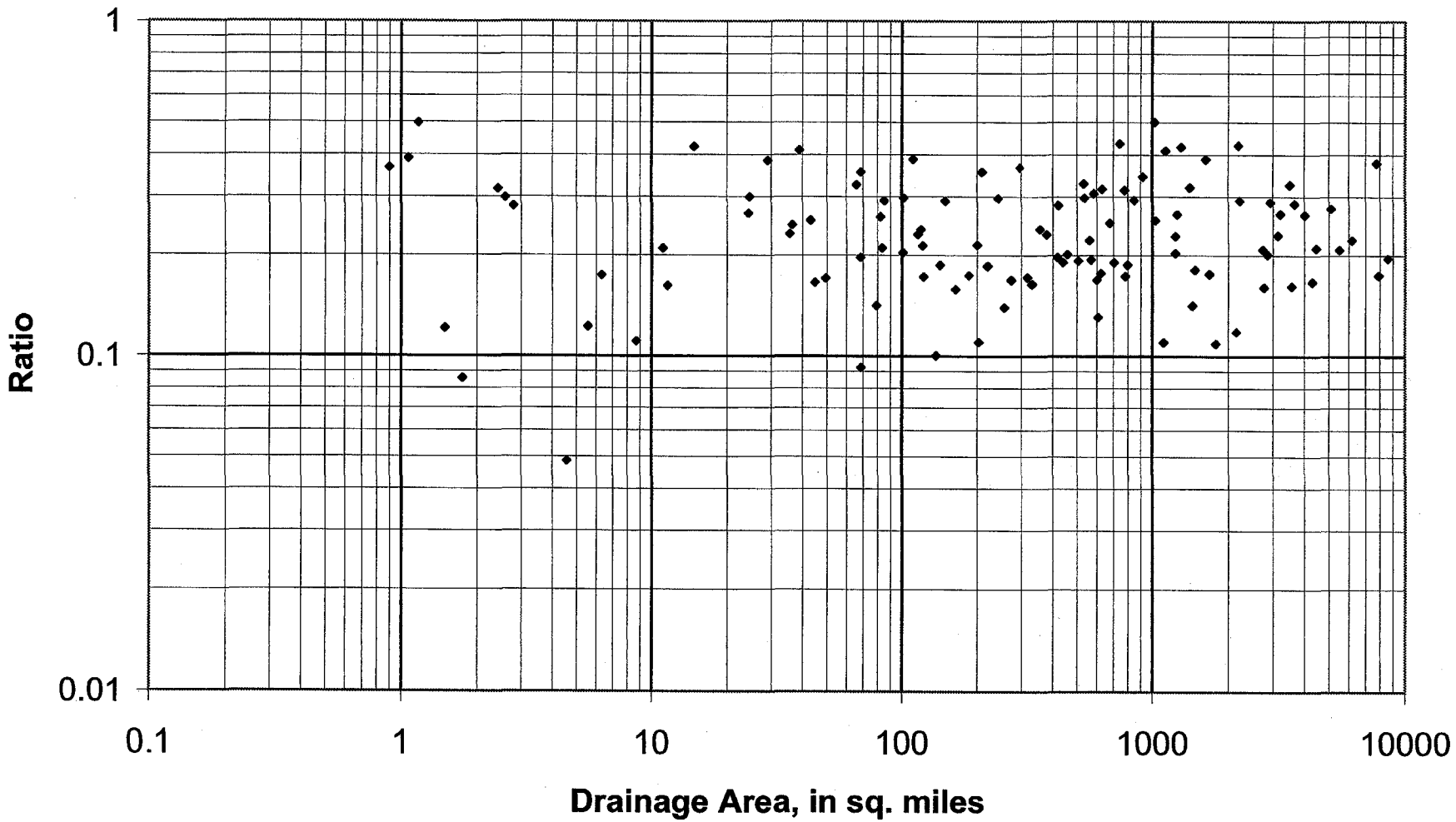
10-year ratios for all undeveloped gaged watersheds with period of record greater than 20 years using USGS LP3 peak discharge data



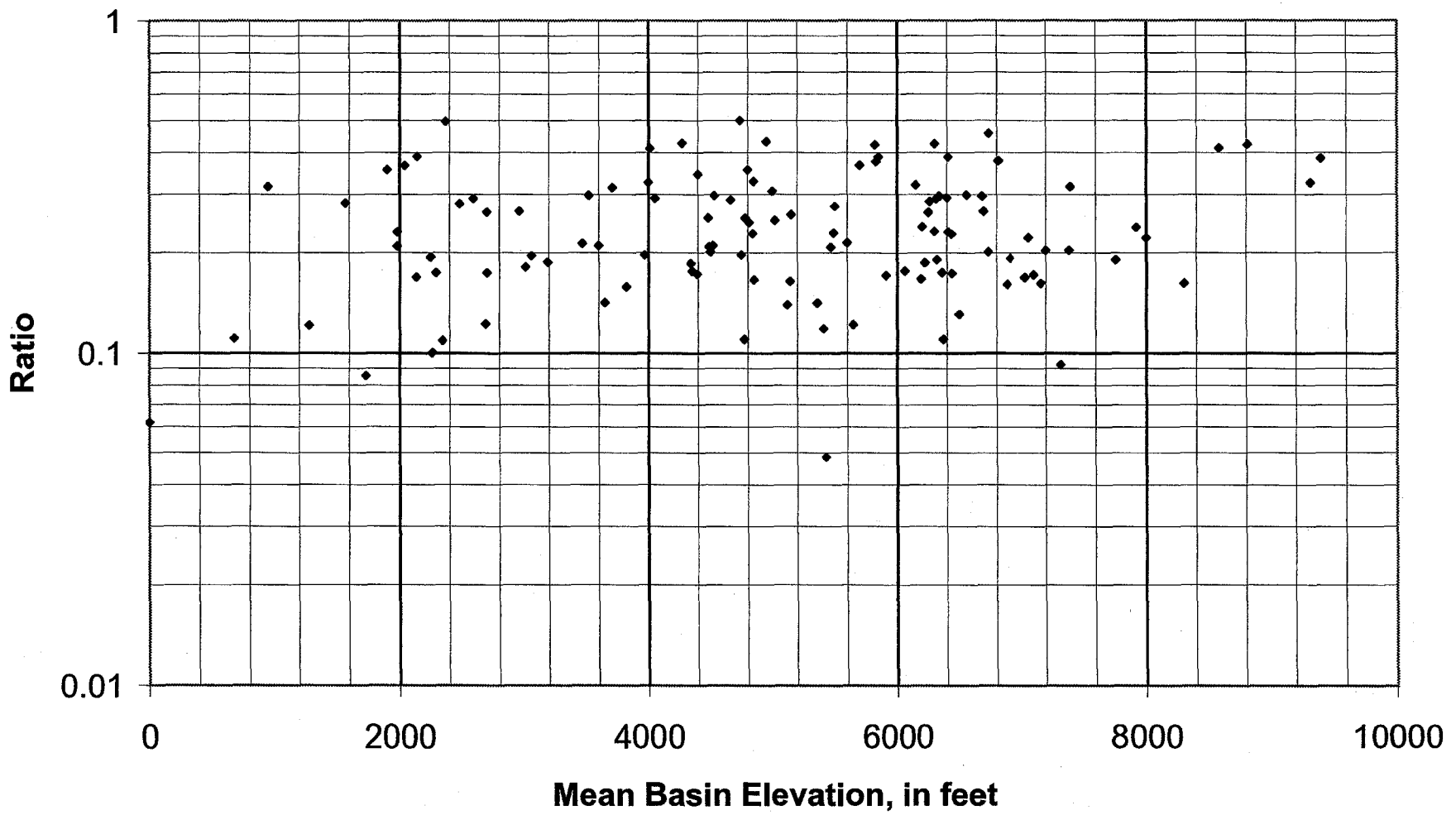
10-year ratios for all undeveloped gaged watersheds with period of record greater than 20 years using USGS LP3 peak discharge data



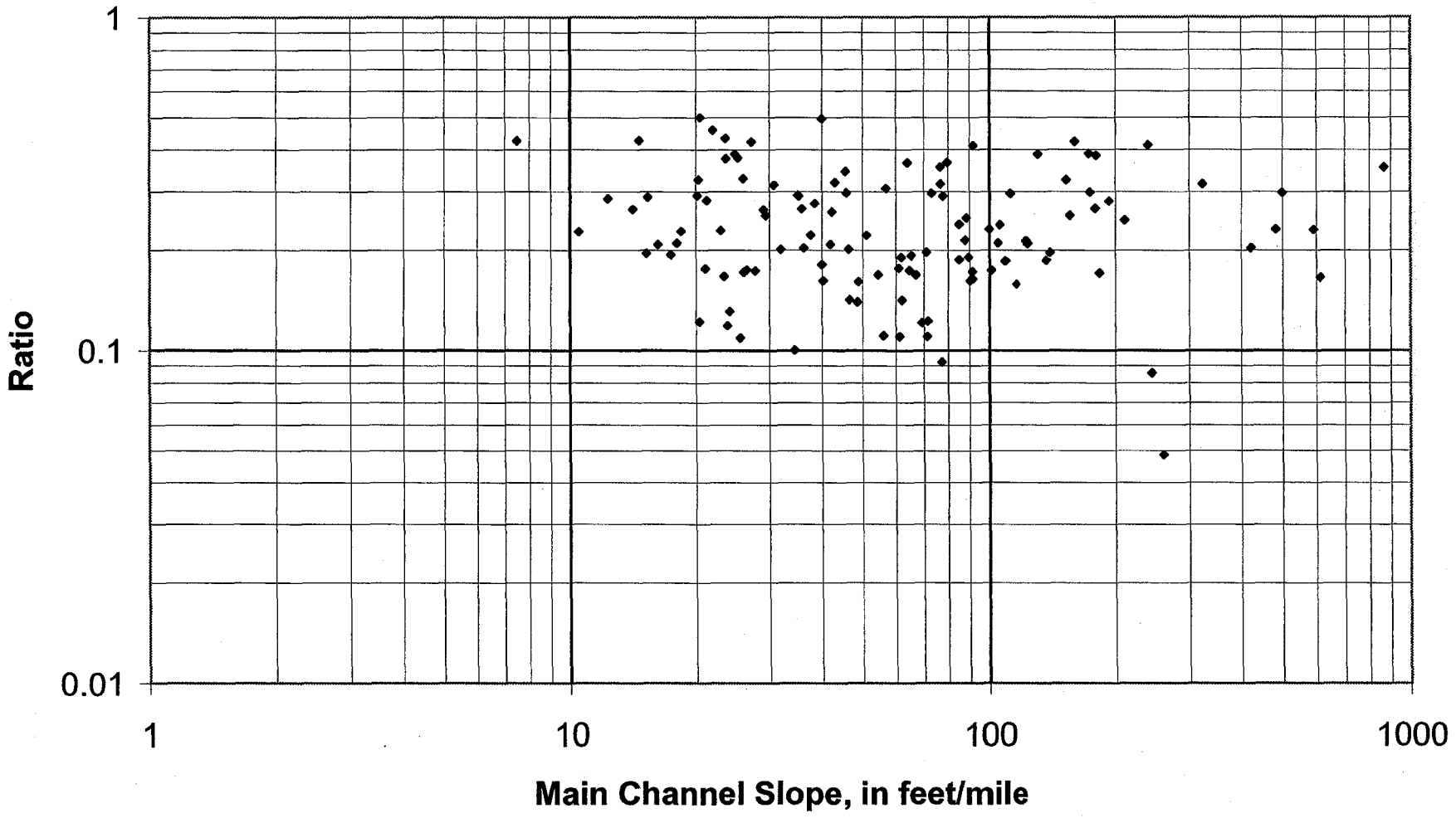
5-year ratios for all undeveloped gaged watersheds with period of record greater than 20 years using USGS LP3 peak discharge data



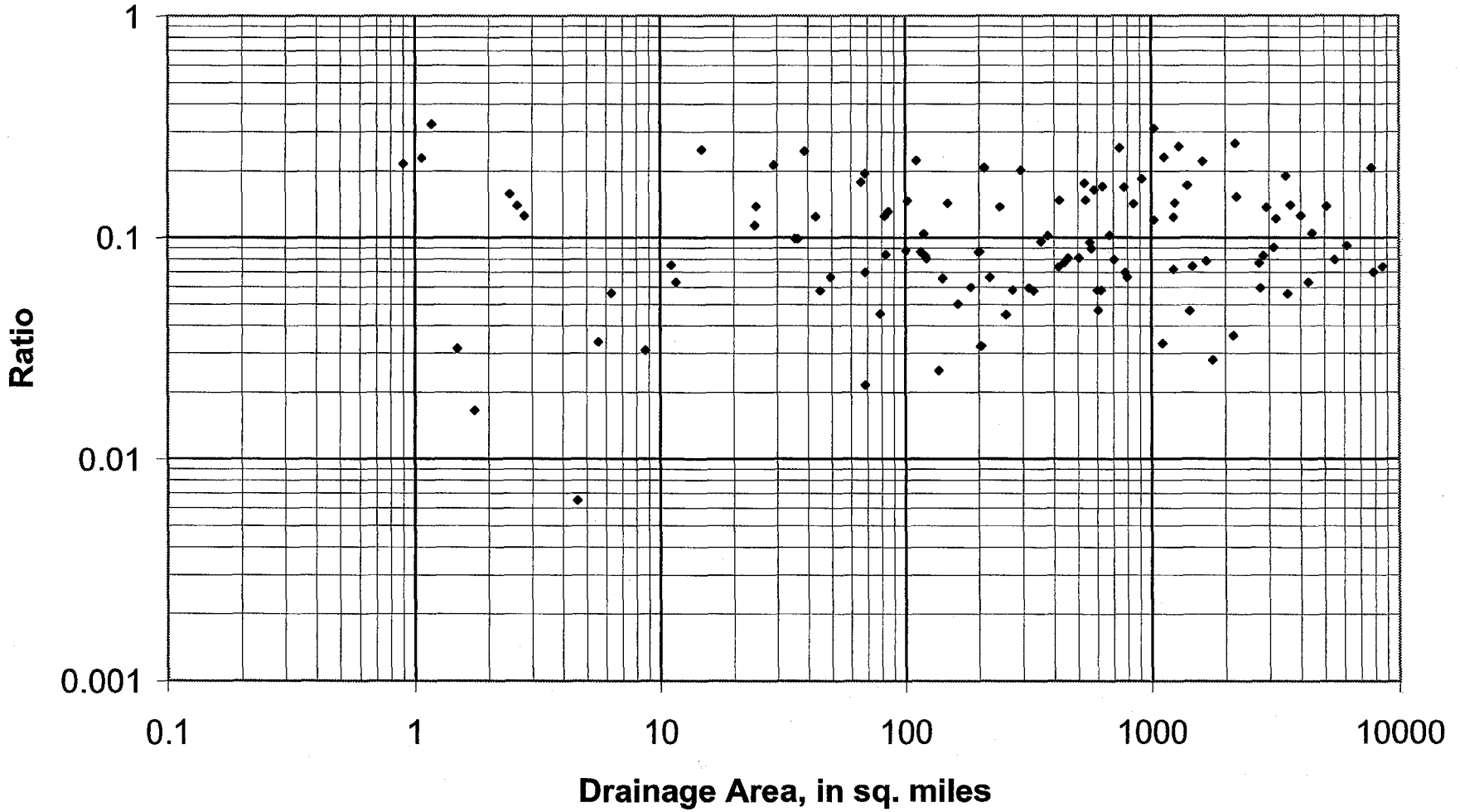
5-year ratios for all undeveloped gaged watersheds with period of record greater than 20 years using USGS LP3 peak discharge data



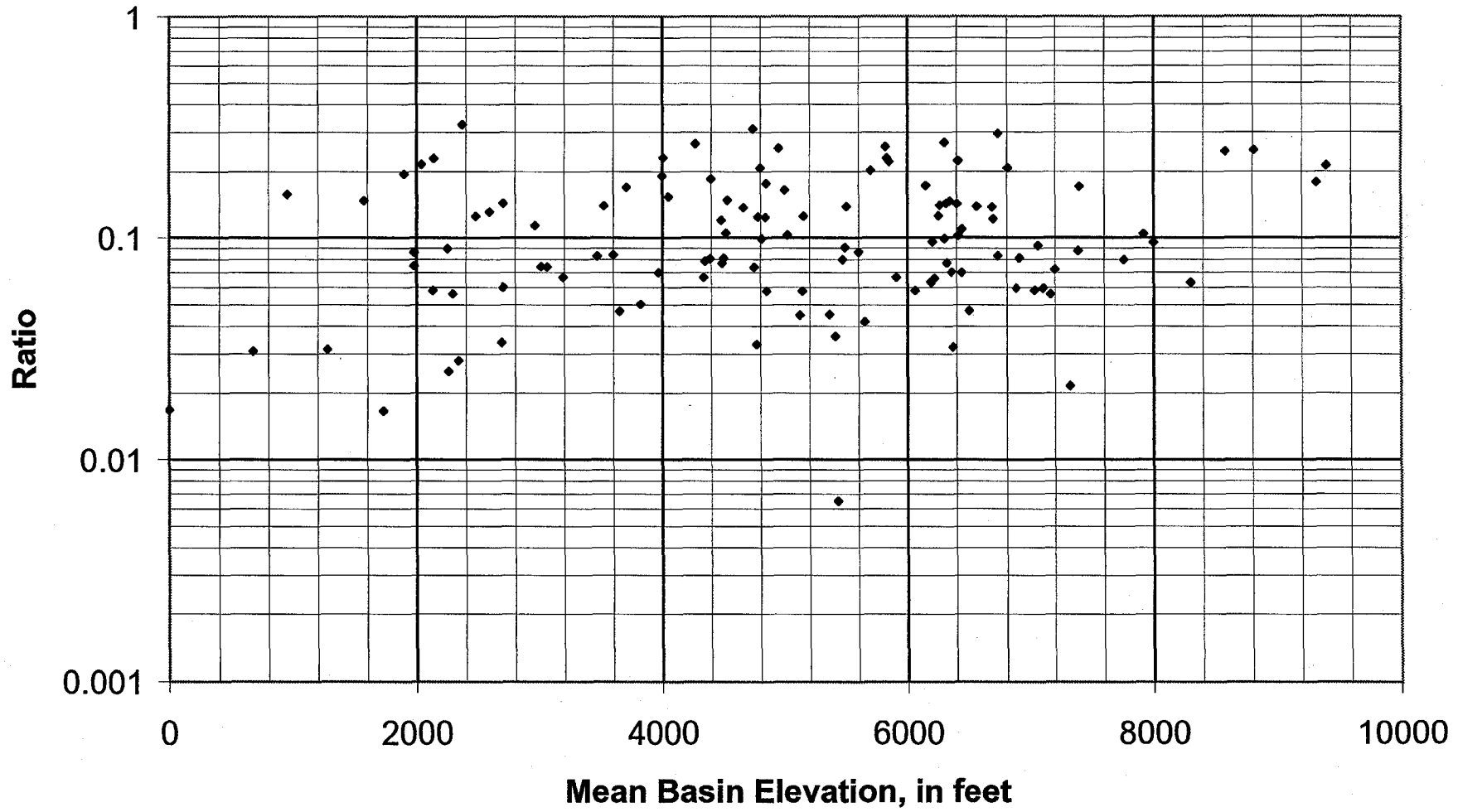
5-year ratios for all undeveloped gaged watersheds with period of record greater than 20 years using USGS LP3 peak discharge data



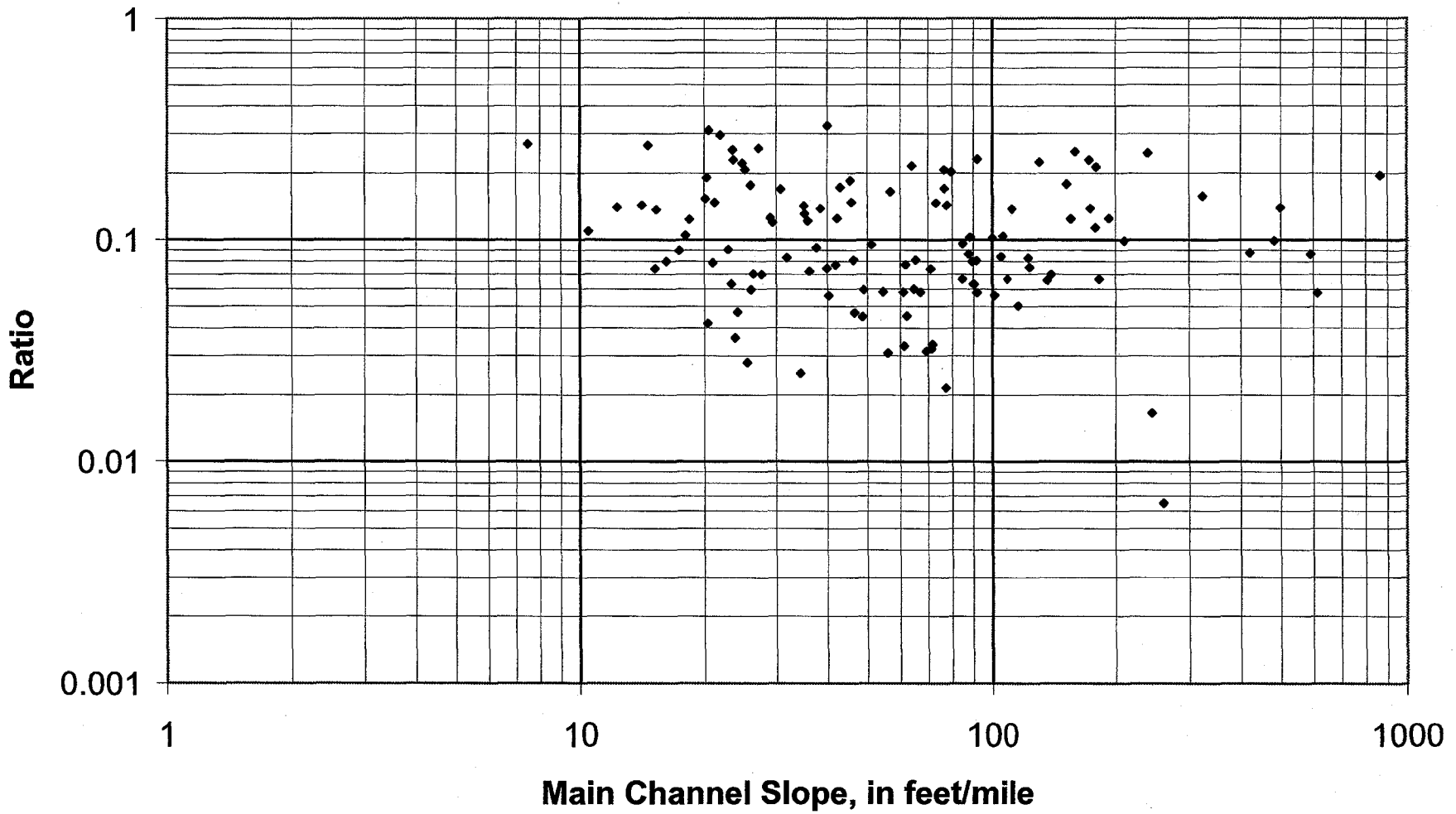
2-year ratios for all undeveloped gaged watersheds with period of record greater than 20 years using USGS LP3 peak discharge data



2-year ratios for all undeveloped gaged watersheds with period of record greater than 20 years using USGS LP3 peak discharge data



2-year ratios for all undeveloped gaged watersheds with period of record greater than 20 years using USGS LP3 peak discharge data



Ratios for the 10-, 5- and 2-year USGS LP3 peak discharges to the 100-year for all undeveloped watersheds with period of records greater than 30-years in Arizona

Gage No.	Station Name	Drainage Area sq. miles	Mean Basin Elevation feet	Main Channel Slope ft/mi	Period of Record	Log Pearson Type III Peak Discharge 100-Year cfs	10-Year cfs	5-Year cfs	2-Year cfs	Ratio to the 100-Year Discharge 10-Year %	5-Year %	2-Year %
9379200	Chinle Creek Near Mexican Water, Ariz.	3650	6260	12.3	33	16500	6820	4710	2320	0.41	0.29	0.14
9382000	Paria River At Lees Ferry, Ariz.	1410	6150	43	71	19800	8810	6330	3420	0.44	0.32	0.17
9384000	Little Colorado R Abv Lyman Lake Nr St. Johns, Az	703.5	7760	89.5	56	9400	2880	1790	750	0.31	0.19	0.08
9386500	Little Colorado R Ab Zuni R Nr Hunt, Az.	3557	7160	40.2	32	2930	819	474	164	0.28	0.16	0.06
9388000	Little Colorado River Nr Hunt, Az	6173	7060	37.6	36	8700	3040	1930	801	0.35	0.22	0.09
9390500	Show Low Creek Near Lakeside, Arizona	68.6	7320	77.2	42	16800	3210	1550	362	0.19	0.09	0.02
9393500	Silver Creek Near Snowflake, Ariz.	846	6400	35	64	18200	7720	5330	2590	0.42	0.29	0.14
9394500	Little Colorado R At Woodruff, Ariz.	7775	6810	25.2	69	18300	9340	6920	3790	0.51	0.38	0.21
9397500	Chevelon Fork Below Wildcat Canyon, Near Winslow	271	7030	54.4	36	41200	11900	6950	2400	0.29	0.17	0.06
9398000	Chevelon Creek Near Winslow, Ariz.	781	6440	27.7	45	33800	9760	5860	2360	0.29	0.17	0.07
9398500	Clear Creek Below Willow Creek, N Winslow, Az.	317	7100	26	43	39700	11700	6820	2360	0.29	0.17	0.06
9399000	Clear Creek Near Winslow, Ariz.	607	6500	24.1	49	59200	13700	7750	2790	0.23	0.13	0.05
9401000	Little Colo. River At Grand Falls, Ariz.	21240	6440	10.5	37	76000	26100	17280	8310	0.34	0.23	0.11
9402000	Little Colorado River Near Cameron, Ariz.	26091	6300	7.48	48	28700	15600	12200	7730	0.54	0.43	0.27
9403000	Bright Angel Creek Near Grand Canyon, Ariz.	101	7390	421	49	4970	1600	1010	435	0.32	0.20	0.09
9415000	Virgin River At Littlefield, Ariz.	5090	5500	38.4	66	35500	14200	9810	4920	0.40	0.28	0.14
9424450	Big Sandy River Near Wikieup,Ariz.	2731.9	4490	41.9	30	102400	34700	21300	7900	0.34	0.21	0.08
9432000	Gila River Below Blue Creek, Near Virden Nm	3203	6690	35.8	69	42100	16700	11200	5120	0.40	0.27	0.12
9442000	Gila River Near Clifton, Ariz.	4010	6250	29	65	47700	18600	12600	6000	0.39	0.26	0.13
9444100	Campbell Blue Creek Near Alpine, Az	11.6	8300	90.2	30	667	181	108	42	0.27	0.16	0.06
9444500	San Francisco River At Clifton, Ariz.	2764	6880	48.9	88	113900	31100	18300	6780	0.27	0.16	0.06
9447000	Eagle Creek Abv. Pumping Plant Nr. Morenci, Az.	622	6060	60.9	52	47000	14400	8300	2730	0.31	0.18	0.06
9448500	Gila R At Head Of Safford Valley Nr Solomon Ariz	7896	6360	26.4	82	140700	40400	24500	9860	0.29	0.17	0.07
9457000	San Simon River Near Solomon, Ariz.	2192	4270	14.6	52	17000	9320	7250	4520	0.55	0.43	0.27
9466500	Gila River At Calva, Ariz.	11470	5650	20.4	67	161000	35500	19600	6760	0.22	0.12	0.04
9468500	San Carlos River Near Peridot, Arizona	1026	4480	29.4	66	62100	23500	15800	7460	0.38	0.25	0.12
9470500	San Pedro River At Palominas, Ariz.	741	4950	23.5	56	21500	12100	9300	5460	0.56	0.43	0.25
9471000	San Pedro River At Charleston, Ariz.	1234	4840	18.4	80	49500	16600	11300	6130	0.34	0.23	0.12
9472000	San Pedro River Nr. Redington, Ariz.	2927	4660	15.3	64	52700	22200	15200	7220	0.42	0.29	0.14
9473000	Aravaipa Creek Near Mammoth, Ariz.	537	4530	45.7	44	26900	11500	8000	3980	0.43	0.30	0.15
9479500	Gila River Near Laveen, Ariz.	20615	0	0	48	60900	8040	3760	1020	0.13	0.06	0.02
9480000	Santa Cruz River Near Lochiel, Ariz.	82.2	5150	42.2	47	11600	4460	3020	1450	0.38	0.26	0.13
9480500	Santa Cruz River Nr. Nogales, Ariz.	533	4850	26	66	23200	10600	7610	4090	0.46	0.33	0.18
9481500	Sonoita Creek Near Patagonia, Ariz.	209	4800	76.7	44	15100	7190	5360	3130	0.48	0.35	0.21
9482000	Santa Cruz River At Continental, Ariz.	1682	4350	21	51	45400	12800	7980	3580	0.28	0.18	0.08
9482500	Santa Cruz River At Tucson, Ariz.	2222	4050	20.1	78	33300	13800	9720	5110	0.41	0.29	0.15
9484000	Sabino Creek Near Tucson, Ariz.	35.5	6300	482	64	12000	4310	2780	1190	0.36	0.23	0.10
9484600	Pantano Wash Near Vail, Az	457	4500	46.3	38	32100	10400	6450	2600	0.32	0.20	0.08
9485000	Rincon Creek Near Tucson, Ariz.	44.8	4850	612	43	16700	4760	2770	963	0.29	0.17	0.06
9486000	Rillito Cr Near Tucson, Az	918	4400	45.5	67	27700	13100	9530	5120	0.47	0.34	0.18
9486500	Santa Cruz River At Cortaro, Ariz.	3503	4000	20.3	45	46000	20400	15000	8780	0.44	0.33	0.19
9489000	Santa Cruz River Near Laveen, Ariz.	8581	3060	15.2	56	13300	4270	2600	986	0.32	0.20	0.07
9489500	Black River Blw Pumping Plant Nr. Point Of Pines	560	8000	51.1	42	23400	8090	5190	2230	0.35	0.22	0.10
9490500	Black River Near Fort Apache, Ariz. Mile 5.0	1232	7200	36.2	38	103500	34600	21000	7460	0.33	0.20	0.07
9491000	North Fork White R Near Mcnary, Ariz.	66	9320	153	38	2280	1030	742	407	0.45	0.33	0.18
9492400	East Fork White River Nr Fort Apache, Ariz.	38.8	8580	239	38	1090	587	450	268	0.54	0.41	0.25

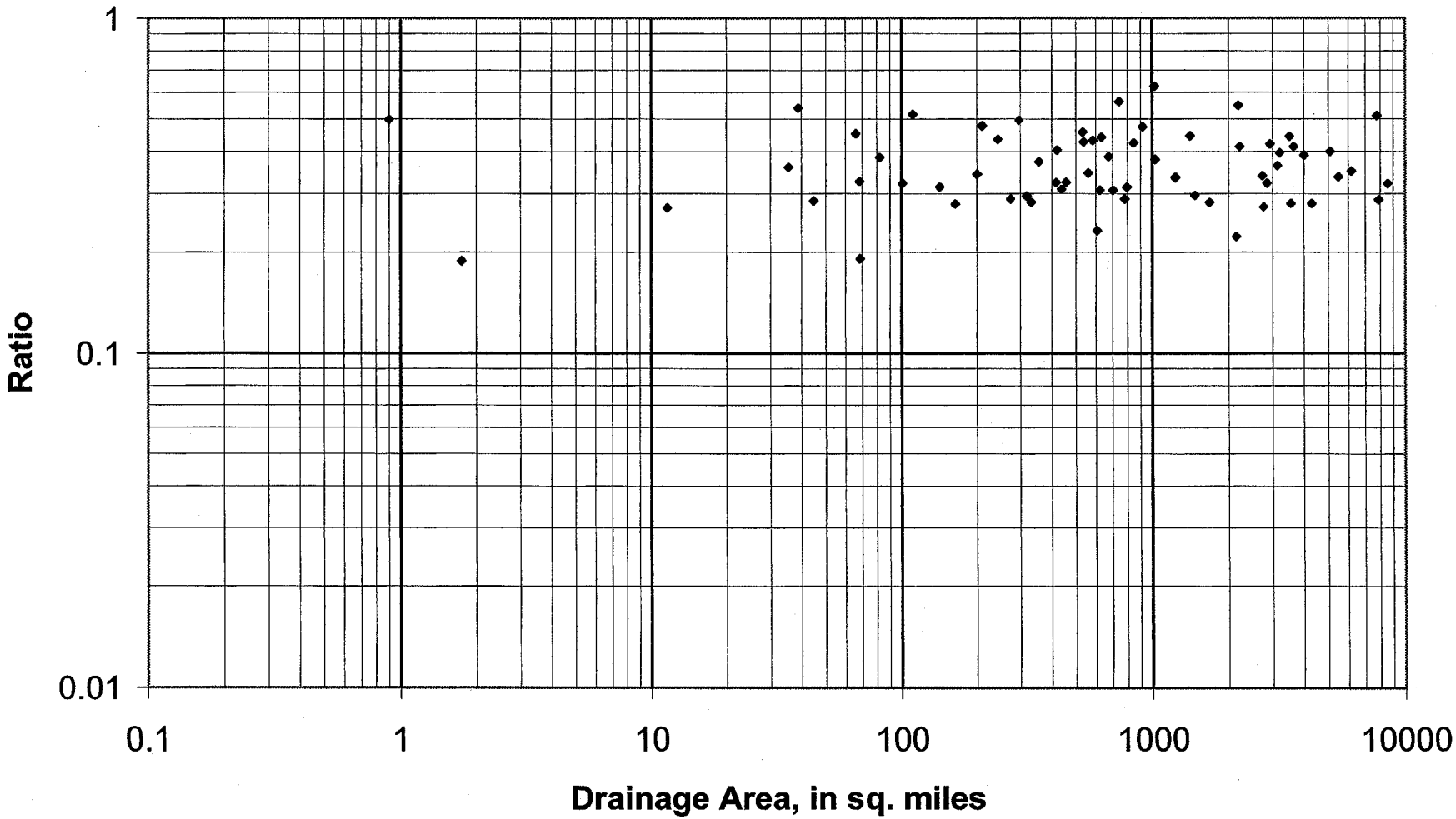
Ratios for the 10-, 5- and 2-year USGS LP3 peak discharges to the 100-year for all undeveloped watersheds with period of records greater than 30-years in Arizona

Gage No.	Station Name	Drainage Area sq. miles	Mean Basin Elevation feet	Main Channel Slope ft/mi	Period of Record	Log Pearson Type III Peak Discharge 100-Year cfs	10-Year cfs	5-Year cfs	2-Year cfs	Ratio to the 100-Year Discharge 10-Year %	5-Year %	2-Year %
9494000	White River Near Fort Apache, Ariz. Mile 4.5	632	7400	76.8	38	18200	8030	5760	3110	0.44	0.32	0.17
9496500	Carrizo Creek Near Show Low, Ariz.	439	6320	61.8	45	36900	11400	7020	2850	0.31	0.19	0.08
9497500	Salt River Near Chrysotile, Ariz. Mile 34.8	2849	6730	31.9	72	122800	39600	24700	10200	0.32	0.20	0.08
9497800	Cibecue Creek Near Chrysotile, Ariz.	295	5700	79.6	37	20800	10300	7620	4200	0.50	0.37	0.20
9497980	Cherry Creek Near Globe, Ariz.	200	5600	87.9	30	25400	8700	5450	2190	0.34	0.21	0.09
9498500	Salt River Near Roosevelt, Ariz.	4306	6190	23.3	73	227900	63800	38000	14400	0.28	0.17	0.06
9499000	Tonto Creek Abv. Gun Cr., Nr Roosevelt, Az	675	5020	88.4	55	107900	41700	27000	11100	0.39	0.25	0.10
9503700	Verde River Near Paulden, Ariz.	2150	5410	23.8	33	38400	8540	4550	1380	0.22	0.12	0.04
9504000	Verde River Nr Clarkdale, Ariz.	3139	5490	22.9	33	70200	25500	16100	6340	0.36	0.23	0.09
9504500	Oak Creek Near Cornville, Ariz.	355	6200	85	54	50100	18700	12000	4810	0.37	0.24	0.10
9505200	Wet Beaver Creek Near Rimrock, Arizona	111	6410	131	34	15800	8140	6130	3520	0.52	0.39	0.22
9505350	Dry Beaver Creek Near Rimrock, Ariz.	142	6220	137	35	51400	16100	9590	3380	0.31	0.19	0.07
9505800	West Clear Creek Near Camp Verde, Ariz.	241	6680	112	31	32700	14200	9690	4510	0.43	0.30	0.14
9507980	East Verde River Near Childs, Ariz.	331	5140	91.6	33	56700	16000	9300	3270	0.28	0.16	0.06
9508500	Verde River Blw Tangle Cr Ab Horseshoe Dam, Az	5493	5470	16.2	72	200300	67300	41600	16000	0.34	0.21	0.08
9510200	Sycamore Creek Near Fort Mcdowell	164	3820	116	36	46300	12900	7320	2330	0.28	0.16	0.05
9512200	Salt River Trib. In S. Mnt. Park, Phoenix, Ariz.	1.75	1730	244	33	2230	420	191	37	0.19	0.09	0.02
9512500	Agua Fria River Near Mayer, Az	585	5000	56.9	56	35900	15500	11000	5920	0.43	0.31	0.16
9513780	New River Nr Rock Springs, Ariz.	68.3	3970	140	34	35000	11400	6880	2440	0.33	0.20	0.07
9514200	Waterman Wash Near Buckeye, Ariz.	420	1570	21.2	30	8470	3420	2390	1250	0.40	0.28	0.15
9515500	Hassayampa River At Box Damsite Nr Wickenburg Az	417	4750	71	39	43000	13900	8480	3180	0.32	0.20	0.07
9516500	Hassayampa River Nr Morristown, Ariz.	796	3190	84.9	39	45600	14300	8540	3030	0.31	0.19	0.07
9517000	Hassayampa River Near Arlington, Ariz.	1471	3010	39.9	32	40500	12000	7340	3010	0.30	0.18	0.07
9520300	Alamo Wash Trib Near Ajo, Ariz.	0.9	2040	64	30	656	326	240	141	0.50	0.37	0.21
9537500	Whitewater Draw Near Douglas, Ariz.	1023	4740	20.5	70	5220	3270	2610	1620	0.63	0.50	0.31
									Mean:	**0.36**	**0.24**	**0.12**
									Standard Deviation:	**0.10**	**0.09**	**0.07**
									Sample Size:	**71**	**71**	**71**

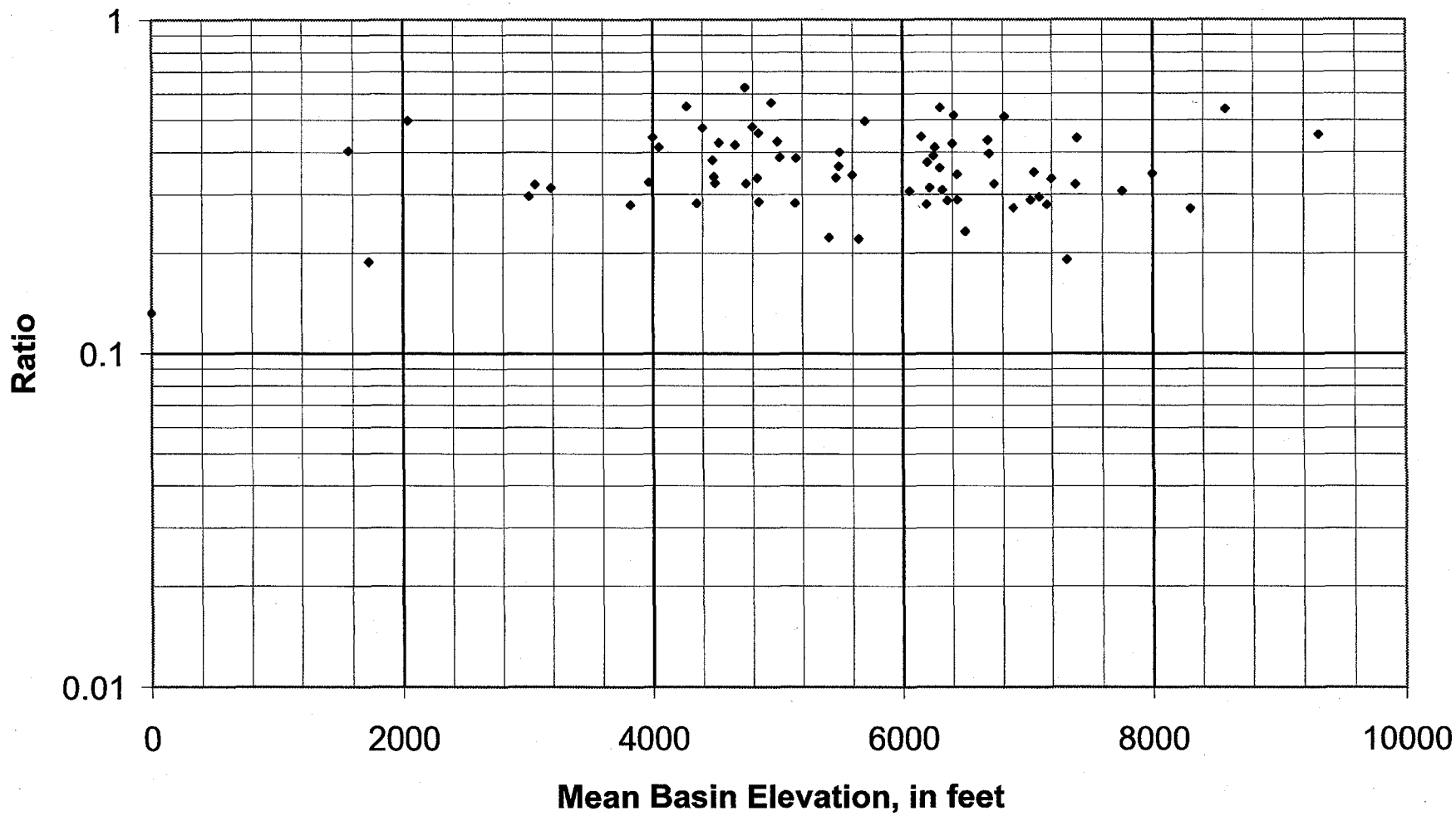
Descriptive Statistics

	10-Year	*5-Year*	*2-Year*
Mean	0.36	0.24	0.12
Standard Error	0.01	0.01	0.01
Median	0.34	0.22	0.09
Mode	0.31	#N/A	#N/A
Standard Deviation	0.10	0.09	0.07
Sample Variance	0.01	0.01	0.00
Kurtosis	0.02	0.03	0.25
Skewness	0.33	0.59	0.92
Range	0.49	0.44	0.29
Minimum	0.13	0.06	0.02
Maximum	0.63	0.50	0.31
Sum	25.91	17.28	8.22
Count	71	71	71

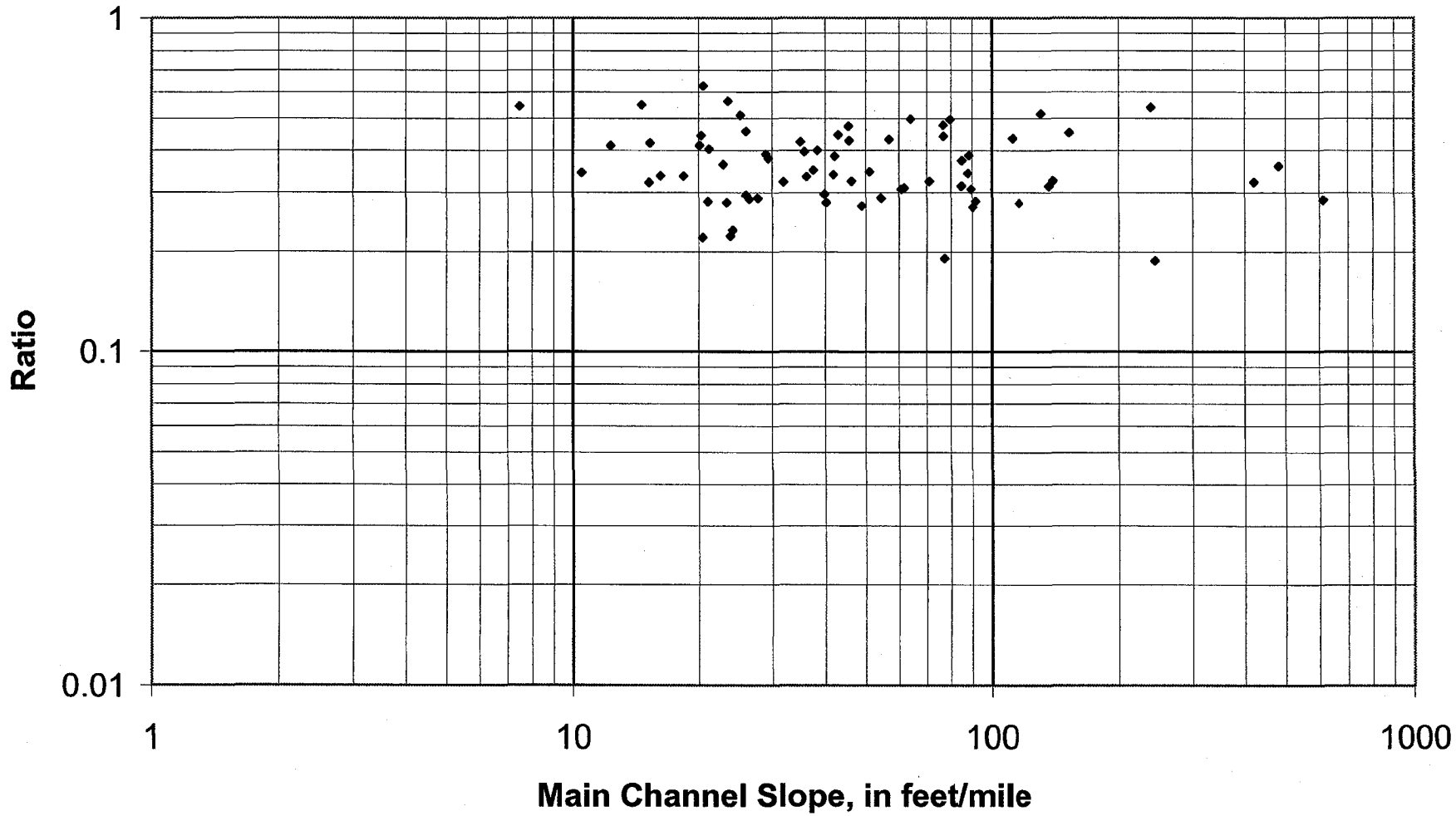
10-year ratios for all undeveloped gaged watersheds with period of records greater than 30 years using USGS LP3 peak discharge data



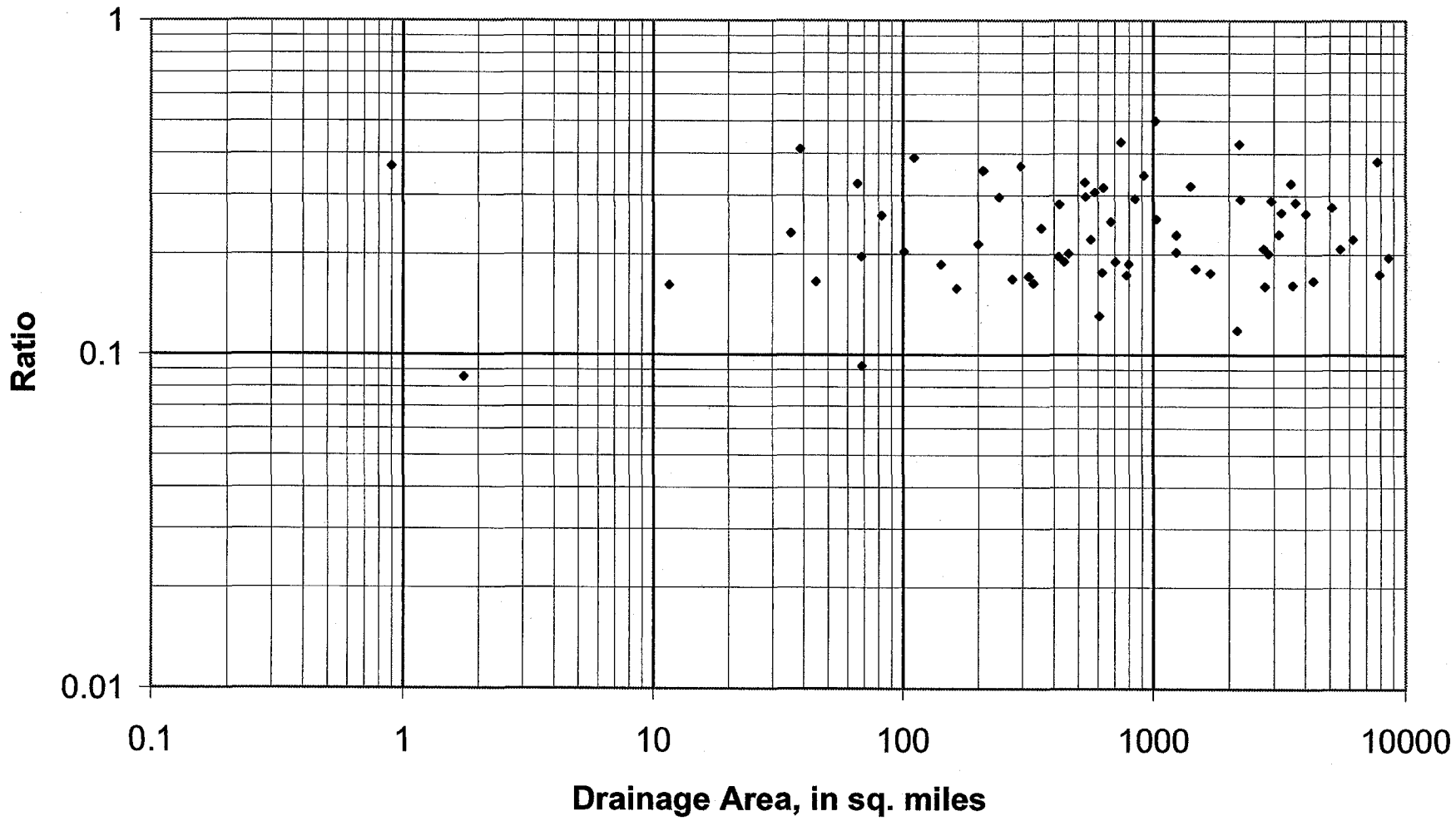
10-year ratios for all undeveloped gaged watersheds with period of record greater than 30 years using USGS LP3 peak discharge data



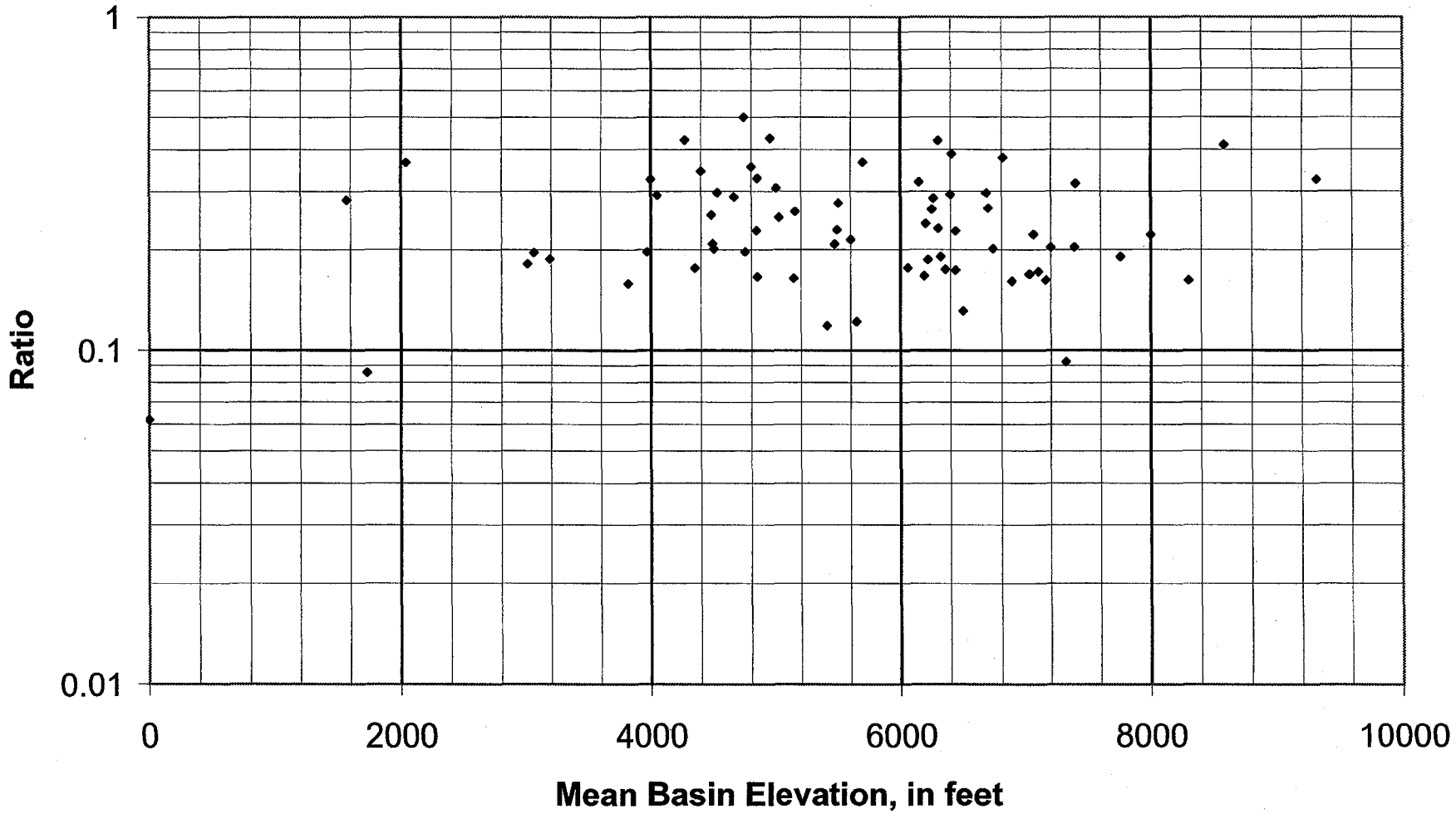
10-year ratios for all undeveloped gaged watersheds with period of record greater than 30 years using USGS LP3 peak discharge data



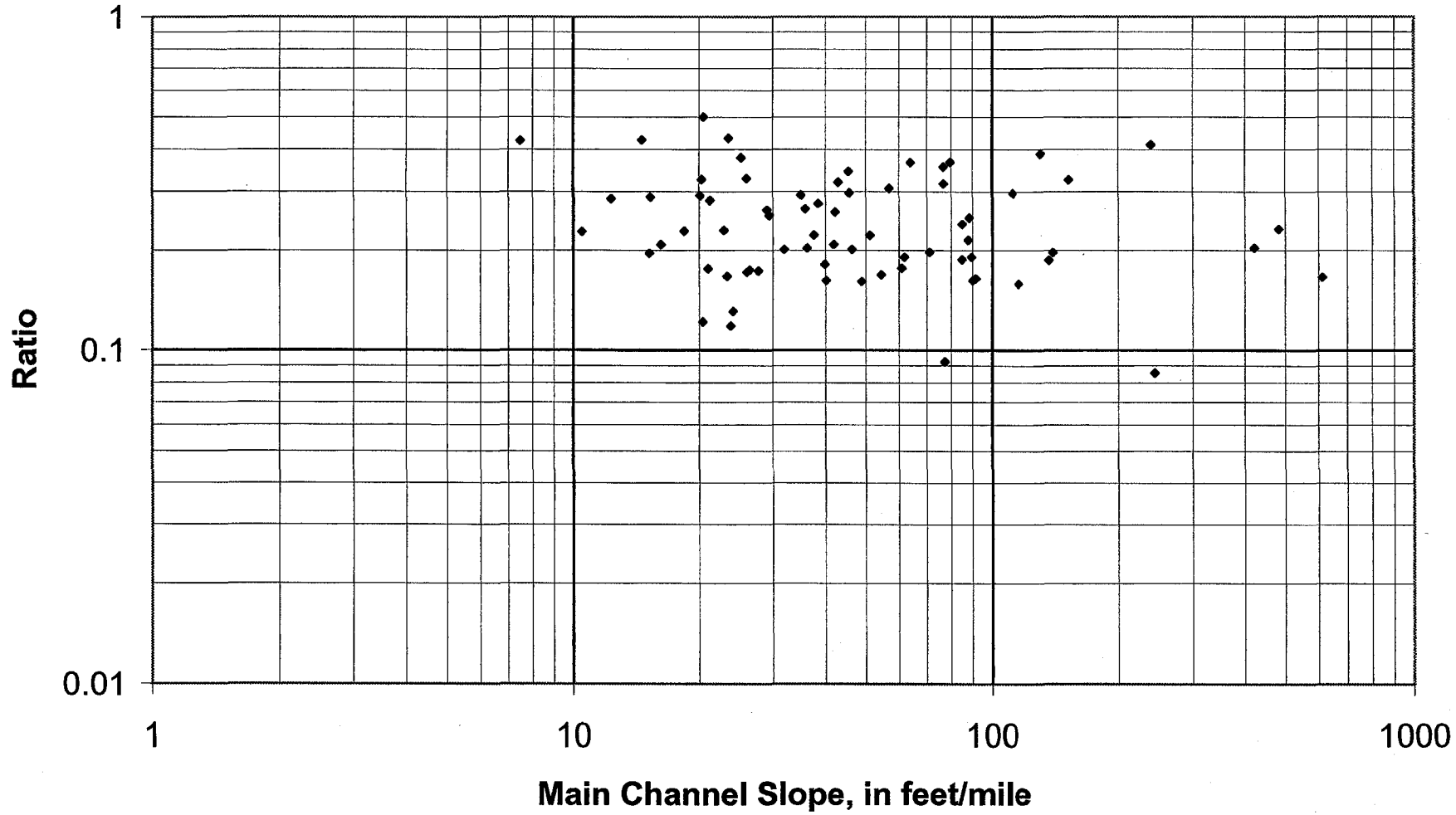
5-year ratios for all undeveloped gaged watersheds with period of record greater than 30 years using USGS LP3 peak discharge data



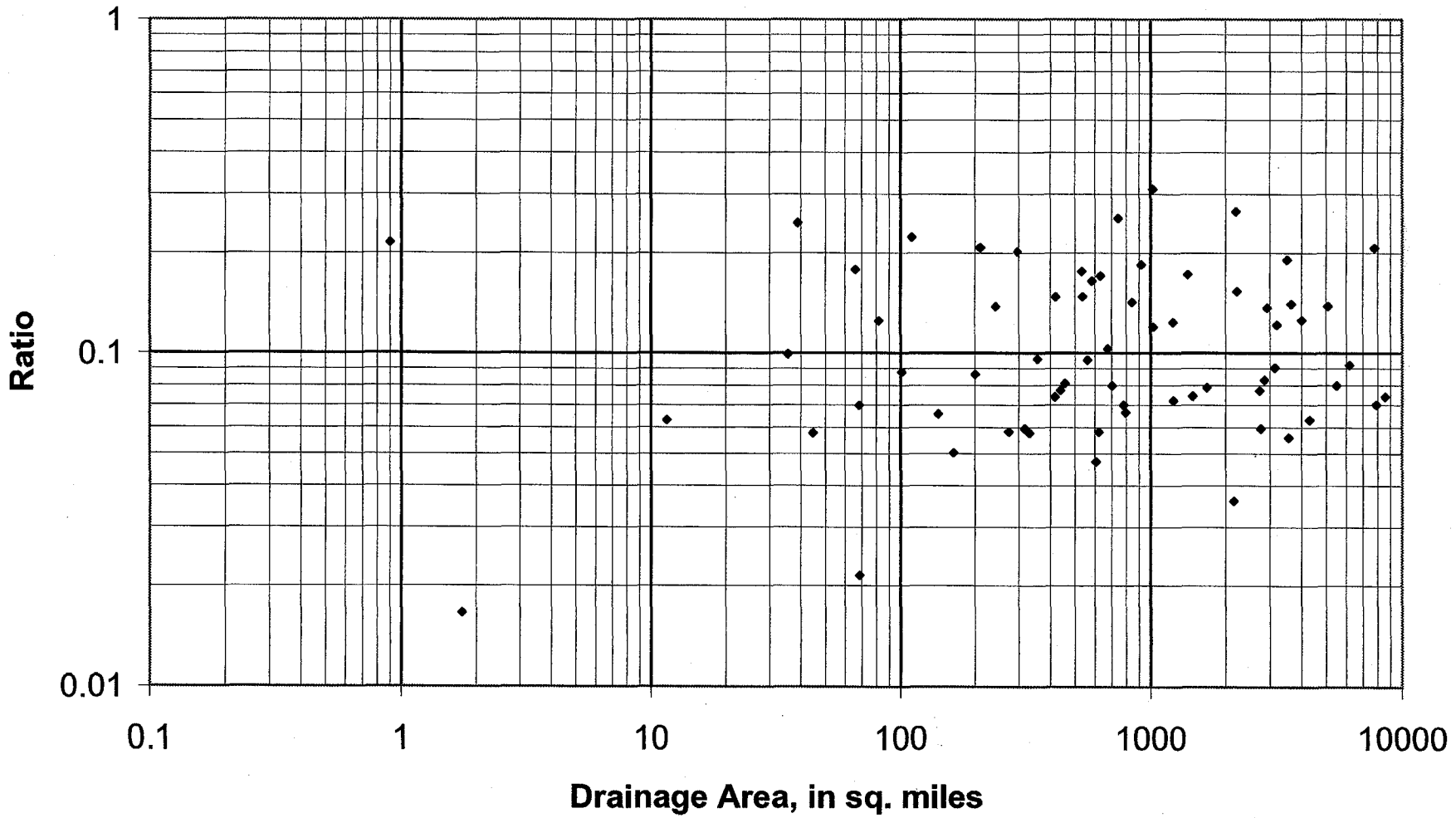
5-year ratios for all undeveloped gaged watersheds with period of record greater than 30 years using USGS LP3 peak discharge data



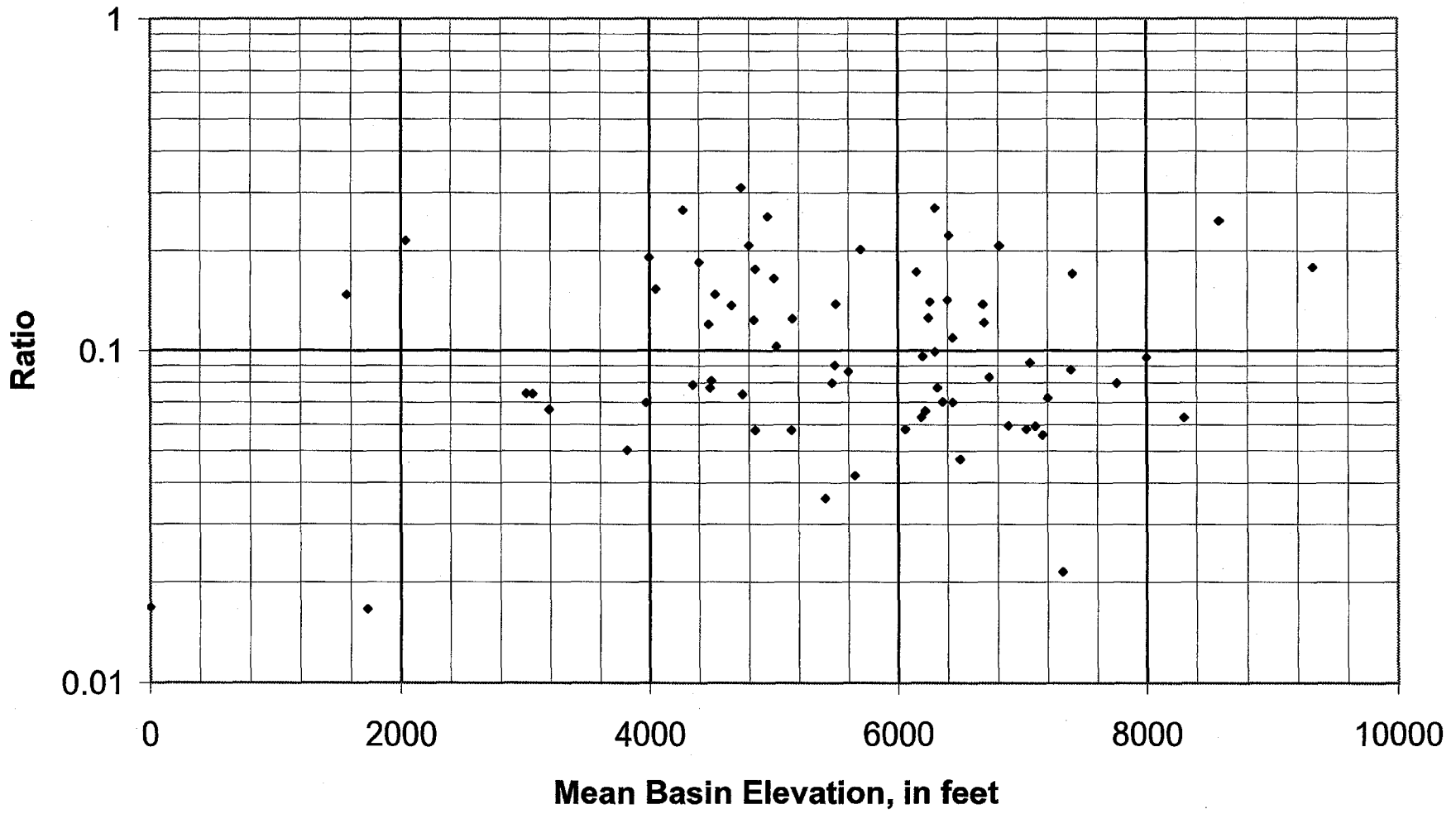
5-year ratios for all undeveloped gaged watersheds with period of record greater than 30 years using USGS LP3 peak discharge data



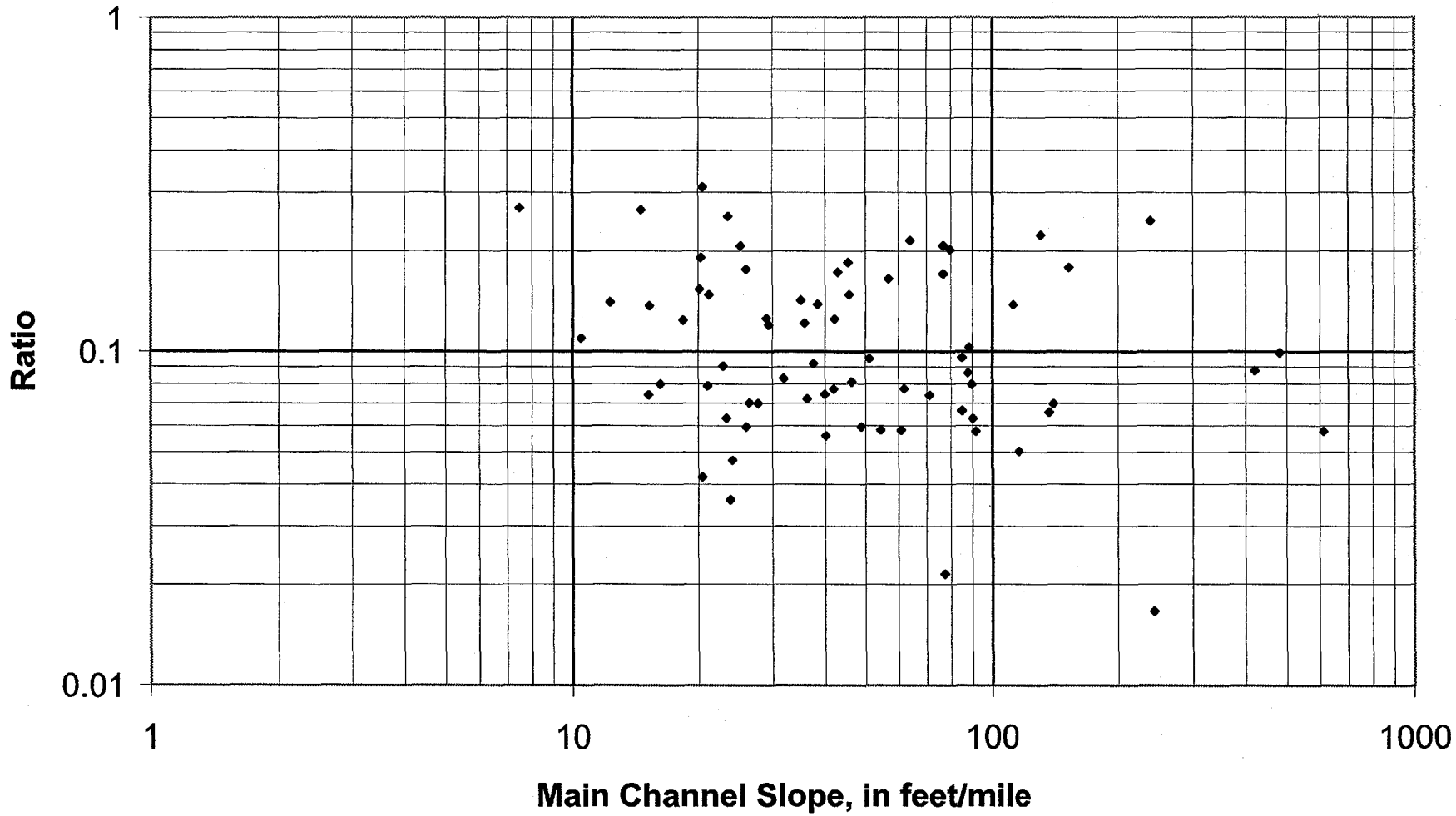
2-year ratios for all undeveloped gaged watersheds with period of record greater than 30 years using USGS LP3 peak discharge data



2-year ratios for all undeveloped gaged watersheds with period of record greater than 30 years using USGS LP3 peak discharge data



2-year ratios for all undeveloped gaged watersheds with period of record greater than 30 years using USGS LP3 peak discharge data



Ratios for the 10-, 5- and 2-year USGS LP3 peak discharges to the 100-year for selected undeveloped watersheds in Arizona

Gage No.	Station Name	Drainage Area sq. miles	Mean Basin Elevation feet	Main Channel Slope ft/mi	Log Pearson Type III Peak Discharge 100-Year cfs	10-Year cfs	5-Year cfs	2-Year cfs	Ratio to the 100-Year Discharge 10-Year %	5-Year %	2-Year %
9379030	Black Mountain Wash Near Chinle, Ariz.	80.7	5920	46.2	4970	2320	1650	844	0.47	0.33	0.17
9379060	Lukachukai Creek Tributary Near Lukachukai, A	1.37	5820	72.2	301	79.5	46.8	17.9	0.26	0.16	0.06
9379560	El Capitan Wash Near Kayenta, Ariz.	5.88	5690	78.4	3530	1390	952	470	0.39	0.27	0.13
9383020	House Rock Wash Trib Nr Marble Canyon, Az.	3.54	5290	209	913	161	81.8	24.7	0.18	0.09	0.03
9395100	Carr Lake Draw Tributary Near Holbrook, Ariz.	1.28	5420	103	345	120	73.8	27	0.35	0.21	0.08
9396400	Dead Wash Tributary Near Holbrook, Ariz.	1.22	5740	60	1150	522	374	198	0.45	0.33	0.17
9400530	Cow Canyon Nr Winslow Ariz.	3.57	5380	61.8	387	181	129	64.8	0.47	0.33	0.17
9400580	Castle Butte Wash Nr Winslow, Ariz.	5.57	5820	83.8	2220	536	289	86	0.24	0.13	0.04
9403800	Bitter Seeps Wash Trib Near Fredonia, Ariz.	2.85	5120	129	7350	1240	575	127	0.17	0.08	0.02
9404310	Yampai Canyon Trib Near Peach Springs, Ariz.	0.2	5360	444	237	63.5	37.2	13.8	0.27	0.16	0.06
9404340	Truxton Wash At Valentine, Ariz.	370	4630	57	26300	6330	3510	1150	0.24	0.13	0.04
9404350	Valentine Wash At Valentine, Ariz.	3.15	4490	378	18400	552	142	12.7	0.03	0.01	0.00
9415050	Big Bend Wash Trib Near Littlefield, Ariz.	7.27	2240	55.8	5300	152	32.8	1.7	0.03	0.01	0.00
9419590	Detrital Wash Trib Near Chloride, Ariz.	1.23	3710	200	1080	233	126	41.4	0.22	0.12	0.04
9423760	Little Meadow Creek Near Oatman, Ariz.	8.47	3400	241	4590	508	194	28.7	0.11	0.04	0.01
9423780	Walnut Creek Near Kingman, Ariz.	31.3	5040	255	892	496	389	247	0.56	0.44	0.28
9423900	Sacramento Wash Trib Near Topock, Ariz.	14.7	1450	98.2	5290	710	291	48.7	0.13	0.06	0.01
9424200	Cottonwood Wash 1 N Kingman Ariz	143	5350	67	11700	7310	5860	3690	0.62	0.50	0.32
9424407	Mcgarrys Wash Near Kingman, Ariz.	13.5	4610	203	3130	369	150	26.9	0.12	0.05	0.01
9424410	Big Sandy River Trib Near Kingman, Ariz.	1.99	3700	214	1090	173	80.2	18.6	0.16	0.07	0.02
9424430	Kaiser Spring Canyon Trib Near Wikieup, Ariz.	1.7	3520	615	2610	413	196	49.2	0.16	0.08	0.02
9424480	Ash Creek Near Kirkland, Ariz.	6.95	4680	278	4250	882	459	133	0.21	0.11	0.03
9424700	Iron Spring Wash Trib Near Bagdad, Ariz.	0.64	3470	431	993	146	63.5	12.4	0.15	0.06	0.01
9427700	Monkeys Head Wash Near Parker, Ariz.	1.84	1130	415	1640	236	100	18.2	0.14	0.06	0.01
9428545	Cunningham Wash Trib Near Wenden, Ariz.	0.77	2330	365	296	140	101	52.1	0.47	0.34	0.18
9428550	Bouse Wash Trib Near Bouse, Ariz.	14.6	1230	50	6170	1730	998	344	0.28	0.16	0.06
9429150	Creosote Wash Near Ehrenberg, Ariz.	1.98	509	95.2	1270	390	239	95.6	0.31	0.19	0.08
9429400	Indian Wash Trib Near Yuma, Az.	2.56	1190	66.7	131	79.3	64.8	44.7	0.61	0.49	0.34
9429510	Mittry Lake Trib Near Yuma, Az.	0.3	346	122	346	106	62.8	22	0.31	0.18	0.06
9456400	Gold Gulch Near Bowie, Ariz.	15	5170	201	4640	1790	1180	527	0.39	0.25	0.11
9467120	Salt Creek Near Peridot, Ariz.	30.2	3490	169	6910	2890	1920	810	0.42	0.28	0.12
9468300	Sevenmile Wash Trib Near Globe, Ariz.	0.83	4410	280	1690	295	134	27.3	0.17	0.08	0.02
9470900	San Pedro River Trib Near Bisbee, Ariz.	5.25	4770	129	2140	1170	885	498	0.55	0.41	0.23
9471600	Canary Wash Near Benson, Ariz.	0.79	5240	472	385	58	24.7	4.4	0.15	0.06	0.01
9471700	Fenner Wash Near Benson, Ariz.	2.71	4180	93.8	2270	798	501	196	0.35	0.22	0.09
9472100	Peck Canyon Trib Near Redington, Ariz	8.02	3680	146	4410	793	402	118	0.18	0.09	0.03
9472400	Mammoth Wash Near Mammoth, Ariz.	2.4	3700	181	6960	1540	752	167	0.22	0.11	0.02
9473200	Green Lantern Wash Near Winkelman, Ariz.	3.63	2590	189	7490	2290	1380	509	0.31	0.18	0.07
9473600	Tam O'Shanter Wash Near Hayden, Ariz.	4.37	3050	324	1460	759	586	368	0.52	0.40	0.25
9478200	Durham Wash Near Florence, Ariz.	15.6	3670	143	5710	2050	1320	561	0.36	0.23	0.10
9478500	Queen C At Whitlow Damsite N Superior Ariz.	144	3180	137	46100	14300	8850	3630	0.31	0.19	0.08
9478600	Queen Creek Trib No 3 At Whitlow Dam Ariz.	0.37	2320	187	417	189	135	71.3	0.45	0.32	0.17
9479200	Queen C Trib A Apache Junc Ariz	0.51	1760	76.2	431	179	120	52.5	0.42	0.28	0.12

Ratios for the 10-, 5- and 2-year USGS LP3 peak discharges to the 100-year for selected undeveloped watersheds in Arizona

Gage No.	Station Name	Drainage Area sq. miles	Mean Basin Elevation feet	Main Channel Slope ft/mi	Log Pearson Type III Peak Discharge 100-Year cfs	10-Year cfs	5-Year cfs	2-Year cfs	Ratio to the 100-Year Discharge 10-Year %	5-Year %	2-Year %
9480000	Santa Cruz River Near Lochiel, Ariz.	82.2	5150	42.2	11600	4460	3020	1450	0.38	0.26	0.13
9481500	Sonoita Creek Near Patagonia, Ariz.	209	4800	76.7	15100	7190	5360	3130	0.48	0.35	0.21
9481700	Calabasas Canyon Near Nogales, Ariz.	10.3	4360	75.4	2540	1030	691	309	0.41	0.27	0.12
9481750	Sopori Wash At Amado, Ariz.	176	3840	35.9	17100	6780	4610	2230	0.40	0.27	0.13
9482330	Pumping Wash Near Vail, Ariz.	0.81	3010	57.7	560	274	198	102	0.49	0.35	0.18
9482420	Julian Wash At Tucson Ariz	26.5	2900	38.9	2310	1130	817	428	0.49	0.35	0.19
9482480	Big Wash At Tucson, Ariz.	2.94	2850	95.2	4460	887	390	63	0.20	0.09	0.01
9482950	Railroad Wash At Tucson,Arizona	2.3	2490	0.73	2390	961	666	340	0.40	0.28	0.14
9483030	Anklam Wash At Tucson, Ariz.	2.11	2700	298	7390	855	362	75.6	0.12	0.05	0.01
9483040	West Speedway Wash Near Tucson, Ariz.	0.46	2750	364	627	291	202	92.2	0.46	0.32	0.15
9483100	Tanque Verde Creek Near Tucson, Ariz.	43	4780	156	12300	4620	3130	1530	0.38	0.25	0.12
9483200	Agua Caliente Wash Trib Near Tucson, Ariz.	2.04	3300	368	793	309	208	98.9	0.39	0.26	0.12
9484000	Sabino Creek Near Tucson, Ariz.	35.5	6300	482	12000	4310	2780	1190	0.36	0.23	0.10
9484200	Bear Creek Near Tucson, Ariz.	16.3	5860	502	1850	917	675	370	0.50	0.36	0.20
9484500	Tanque Verde Cr At Tucson Ariz	219	4340	109	35500	11000	6580	2360	0.31	0.19	0.07
9484510	Ventana Canyon Wash Near Tucson, Ariz.	6.46	4600	553	329	235	202	147	0.71	0.61	0.45
9484560	Cienega Creek Near Pantano, Ariz	289	4890	59.8	18500	6150	4020	1880	0.33	0.22	0.10
9484570	Mescal Arroyo Near Pantano, Ariz.	38.4	4260	82.9	15400	3620	2060	753	0.24	0.13	0.05
9484580	Barrel Canyon Near Sonoita, Ariz.	14.1	5000	190	4480	1810	1190	504	0.40	0.27	0.11
9484590	Davidson Canyon Wash Near Vail, Ariz.	50.5	4340	86.2	9340	4640	3430	1900	0.50	0.37	0.20
9484600	Pantano Wash Near Vail, Az	457	4500	46.3	32100	10400	6450	2600	0.32	0.20	0.08
9485000	Rincon Creek Near Tucson, Ariz.	44.8	4850	612	16700	4760	2770	963	0.29	0.17	0.06
9485900	Pima Wash Near Tucson, Ariz.	4.93	4430	533	652	269	177	74.2	0.41	0.27	0.11
9485950	Geronimo Wash Near Tucson, Ariz.	2.15	3600	699	1090	414	271	118	0.38	0.25	0.11
9486300	Canada Del Oro Near Tucson, Az	250	4000	108	23900	9340	6150	2650	0.39	0.26	0.11
9486800	Altar Wash Nr Three Points, Az	463	3920	74.1	22400	11200	8180	4360	0.50	0.37	0.19
9487100	Little Brawley Wash Near Three Points, Ariz.	11.9	2800	112	4440	2010	1450	777	0.45	0.33	0.18
9487140	San Joaquin Wash Near Tucson, Ariz.	0.45	2530	69.3	987	486	356	191	0.49	0.36	0.19
9487400	Quijotoa Wash Trib. Near Quijotoa, Ariz.	2.44	2800	88.9	1300	546	370	168	0.42	0.28	0.13
9488600	Silver Reef Wash Near Casa Grande, Ariz.	12.8	1620	67.4	3340	1070	663	268	0.32	0.20	0.08
9496800	Carrizo Creek Trib Near Show Low, Ariz.	2.55	5810	306	2850	1020	660	287	0.36	0.23	0.10
9497800	Cibecue Creek Near Chrysotile, Ariz.	295	5700	79.6	20800	10300	7620	4200	0.50	0.37	0.20
9497980	Cherry Creek Near Globe, Ariz.	200	5600	87.9	25400	8700	5450	2190	0.34	0.21	0.09
9498800	Tonto Creek Near Gisela, Ariz.	430	5810	126	95500	33800	21500	8810	0.35	0.23	0.09
9498870	Rye Creek Nr Gisela, Ariz.	122	4390	91.4	35400	9700	6100	2850	0.27	0.17	0.08
9498900	Gold Creek Near Payson, Ariz.	6.44	4590	295	4070	1290	795	314	0.32	0.20	0.08
9501300	Tortilla Creek At Tortilla Flat, Ariz.	24.3	2960	179	15300	6180	4080	1740	0.40	0.27	0.11
9502700	Crookton Wash Near Seligman, Ariz.	6.01	5970	111	6250	310	86.2	7.2	0.05	0.01	0.00
9502800	Williamson Valley W Nr Paulden, Ariz.	255	5120	48.6	29200	7360	4080	1310	0.25	0.14	0.04
9503000	Granite Creek Near Prescott, Ariz.	36.3	5900	104	7710	2990	2000	916	0.39	0.26	0.12
9503740	Hell Canyon Trib N Ash Fork. Az	0.75	5180	78.4	220	57.4	32.3	10.5	0.26	0.15	0.05
9503750	Limestone Canyon Nr Paulden, Az	14.5	5310	87.3	9820	2080	1020	239	0.21	0.10	0.02
9504500	Oak Creek Near Cornville, Ariz.	355	6200	85	50100	18700	12000	4810	0.37	0.24	0.10

Ratios for the 10-, 5- and 2-year USGS LP3 peak discharges to the 100-year for selected undeveloped watersheds in Arizona

Gage No.	Station Name	Drainage Area sq. miles	Mean Basin Elevation feet	Main Channel Slope ft/mi	Log Pearson Type III Peak Discharge 100-Year cfs	10-Year cfs	5-Year cfs	2-Year cfs	Ratio to the 100-Year Discharge 10-Year %	5-Year %	2-Year %
9505250	Red Tank Draw Near Rimrock, Ariz	49.4	5910	183	10900	3090	1860	724	0.28	0.17	0.07
9505900	Cottonwood Wash Near Camp Verde, Ariz.	0.64	3540	385	619	141	75.9	23.4	0.23	0.12	0.04
9507980	East Verde River Near Childs, Ariz.	331	5140	91.6	56700	16000	9300	3270	0.28	0.16	0.06
9508300	Wet Bottom Creek Nr Childs, Ariz.	36.4	4810	210	17600	6760	4340	1740	0.38	0.25	0.10
9510070	Wf Sycamore Cr Ab Mcfar Can, N Sunflower, Az	4.58	5430	260	5530	702	268	36	0.13	0.05	0.01
9510080	West Fork Sycamore Cr Nr Sunflower, Ariz.	9.8	5260	353	8030	1190	519	101	0.15	0.06	0.01
9510150	Sycamore Creek Near Sunflower, Ariz.	52.3	4260	58.6	42700	8160	4050	1050	0.19	0.09	0.02
9510170	Camp Creek Nr Sunflower, Az	2.6	3520	498	773	334	230	108	0.43	0.30	0.14
9510180	Rock Creek Near Sunflower, Ariz.	15.2	3680	412	6390	2410	1520	573	0.38	0.24	0.09
9510200	Sycamore Creek Near Fort Mcdowell	164	3820	116	46300	12900	7320	2330	0.28	0.16	0.05
9512200	Salt River Trib. In S. Mnt. Park, Phoenix, Ariz.	1.75	1730	244	2230	420	191	37	0.19	0.09	0.02
9512300	Cave Creek Nr Cave Creek Ariz	121	3470	123	21500	7360	4580	1780	0.34	0.21	0.08
9512420	Lynx Creek Trib Near Prescott, Ariz.	0.95	5900	101	2910	761	403	106	0.26	0.14	0.04
9512700	Agua Fria River Trib #2 Nr Rock Springs, Ariz	1.07	2140	173	1570	808	611	359	0.51	0.39	0.23
9512800	Agua Fria River Near Rock Springs, Ariz.	1111	4770	61.2	211800	44300	23300	7000	0.21	0.11	0.03
9512970	Cottonwood Creek Nr Waddell Dam Az.	9.28	0	0	16400	2020	804	131	0.12	0.05	0.01
9513780	New River Nr Rock Springs, Ariz.	68.3	3970	140	35000	11400	6880	2440	0.33	0.20	0.07
9513800	New River At New River, Ariz.	83.3	3600	105	37500	12600	7880	3150	0.34	0.21	0.08
9513820	Deadman Wash Near New River, Ariz.	11.1	1980	124	4630	1590	969	348	0.34	0.21	0.08
9513835	New River At Bell Road, Near Peoria, Ariz.	185	2700	64.5	31700	9410	5510	1900	0.30	0.17	0.06
9513890	New River At Peoria, Ariz.	317	2320	65.3	75100	20800	11300	3160	0.28	0.15	0.04
9513910	New River Nr Glendale, Ariz.	600	2130	66.9	49800	14400	8410	2890	0.29	0.17	0.06
9514200	Waterman Wash Near Buckeye, Ariz.	420	1570	21.2	8470	3420	2390	1250	0.40	0.28	0.15
9515500	Hassayampa River At Box Damsite Nr Wickenburg Az	417	4750	71	43000	13900	8480	3180	0.32	0.20	0.07
9515800	Hartman Wash Near Wickenburg, Ariz.	5.57	2690	71.6	7100	1660	869	239	0.23	0.12	0.03
9516500	Hassayampa River Nr Morristown, Ariz.	796	3190	84.9	45600	14300	8540	3030	0.31	0.19	0.07
9516600	Ox Wash Near Morristown, Ariz.	6.31	2290	101	3720	1120	647	209	0.30	0.17	0.06
9516800	Jack Rabbit Wash Near Tonopah, Ariz.	137	2260	34.4	33900	6860	3400	847	0.20	0.10	0.02
9517000	Hassayampa River Near Arlington, Ariz.	1471	3010	39.9	40500	12000	7340	3010	0.30	0.18	0.07
9517200	Centennial Wash Tributary Near Wenden, Ariz.	2.79	2480	193	1080	451	303	135	0.42	0.28	0.13
9517280	Tiger Wash Near Aguila, Ariz.	85.2	2590	35.2	7340	3160	2140	961	0.43	0.29	0.13
9517400	Winters Wash Near Tonopah, Ariz.	47.8	1630	83.7	4560	2120	1540	857	0.46	0.34	0.19
9519600	Rainbow Wash Trib Near Buckeye, Ariz.	2.43	950	323	2050	920	648	323	0.45	0.32	0.16
9519750	Bender Wash Near Gila Bend, Ariz.	68.6	1900	867	4450	2160	1580	867	0.49	0.36	0.19
9519760	Sauceda Wash Near Gila Bend, Ariz.	116	1980	591	6850	2520	1580	591	0.37	0.23	0.09
9519780	Windmill Wash Near Gila Bend, Ariz.	12.9	1050	64.4	27600	3210	1160	155	0.12	0.04	0.01
9520100	Military Wash Near Sentinel, Ariz.	8.7	674	56	5220	1120	577	161	0.21	0.11	0.03
9520110	Hot Shot Arroyo Near Ajo, Ariz.	0.44	1760	83.3	327	226	191	136	0.69	0.58	0.42
9520130	Darby Arroyo Near Ajo, Ariz.	4.72	1920	71.1	2380	1210	922	550	0.51	0.39	0.23
9520160	Gibson Arroyo At Ajo, Az	2.18	2100	171	1620	686	474	231	0.42	0.29	0.14
9520170	Rio Cornez Nr. Ajo, Ariz.	243	1950	26.8	11800	6280	4850	3000	0.53	0.41	0.25
9520200	Black Gap Wash Near Ajo, Ariz.	12.1	1280	21.8	1490	868	672	392	0.58	0.45	0.26
9520230	Crater Range Wash Near Ajo, Ariz.	1.49	1280	69.3	2230	522	270	70	0.23	0.12	0.03

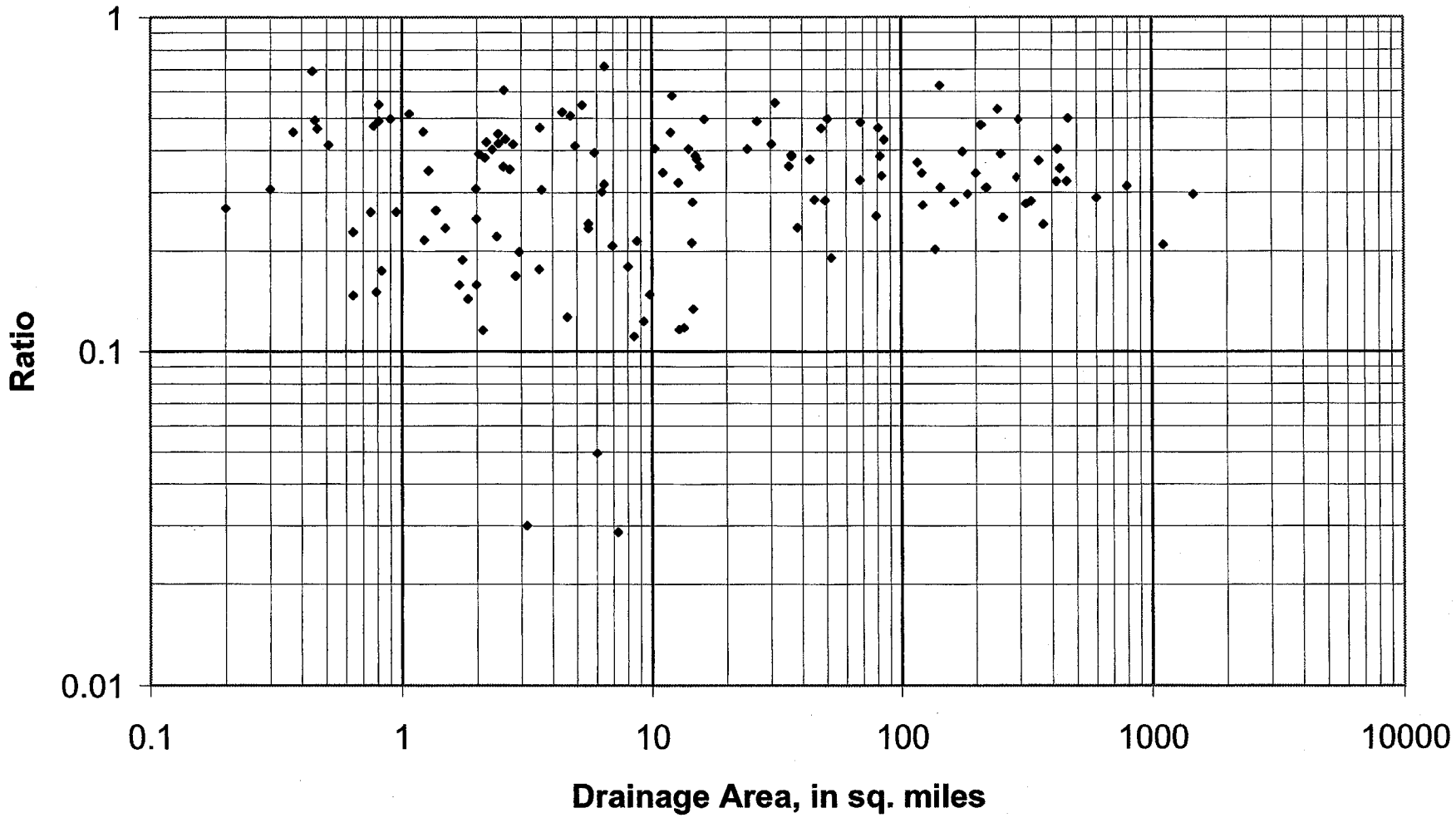
Ratios for the 10-, 5- and 2-year USGS LP3 peak discharges to the 100-year for selected undeveloped watersheds in Arizona

Gage No.	Station Name	Drainage Area sq. miles	Mean Basin Elevation feet	Main Channel Slope ft/mi	Log Pearson Type III Peak Discharge 100-Year cfs	10-Year cfs	5-Year cfs	2-Year cfs	Ratio to the 100-Year Discharge 10-Year %	5-Year %	2-Year %
9520300	Alamo Wash Trib Near Ajo, Ariz.	0.9	2040	64	656	326	240	141	0.50	0.37	0.21
9520400	Ligurta Wash At Ligurta, Az.	1.99	395	127	3930	980	548	182	0.25	0.14	0.05
9536100	Pitchfork Canyon Trib Near Fort Grant, Ariz.	0.81	5210	459	589	323	247	144	0.55	0.42	0.24
9537200	Leslie Creek Near Mcneal, Ariz.	79.1	5360	62.1	13500	3430	1910	612	0.25	0.14	0.05
								Mean:	**0.34**	**0.22**	**0.10**
								Standard Deviation:	**0.14**	**0.12**	**0.08**
								Sample Size:	**133**	**133**	**133**

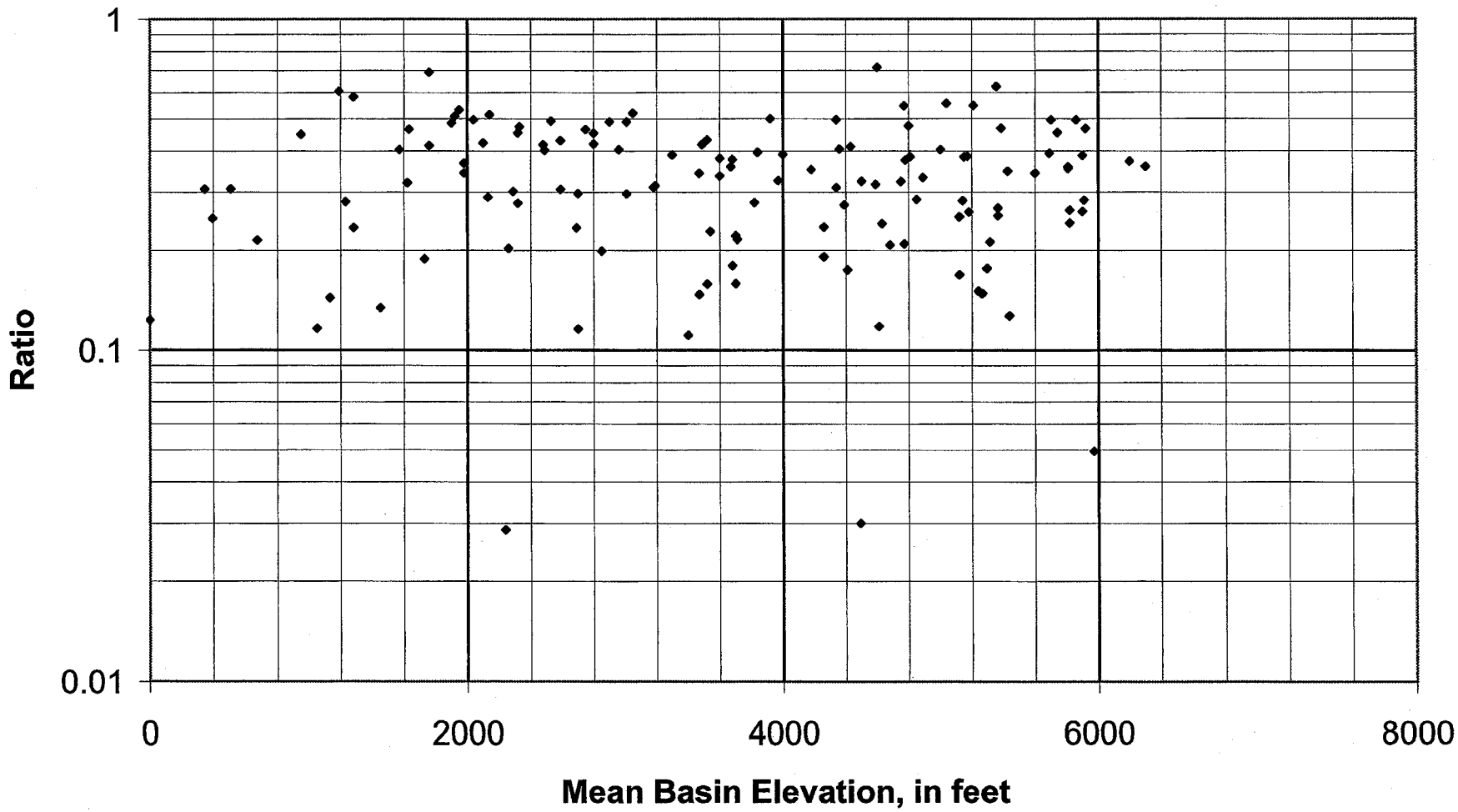
Descriptive Statistics

	10-Year	*5-Year*	*2-Year*
Mean	0.34	0.22	0.10
Standard Error	0.01	0.01	0.01
Median	0.34	0.21	0.08
Mode	#N/A	#N/A	0.13
Standard Deviation	0.14	0.12	0.08
Sample Variance	0.02	0.01	0.01
Kurtosis	-0.22	0.25	2.52
Skewness	0.11	0.57	1.38
Range	0.69	0.61	0.45
Minimum	0.03	0.01	0.00
Maximum	0.71	0.61	0.45
Sum	44.66	29.27	13.63
Count	133	133	133

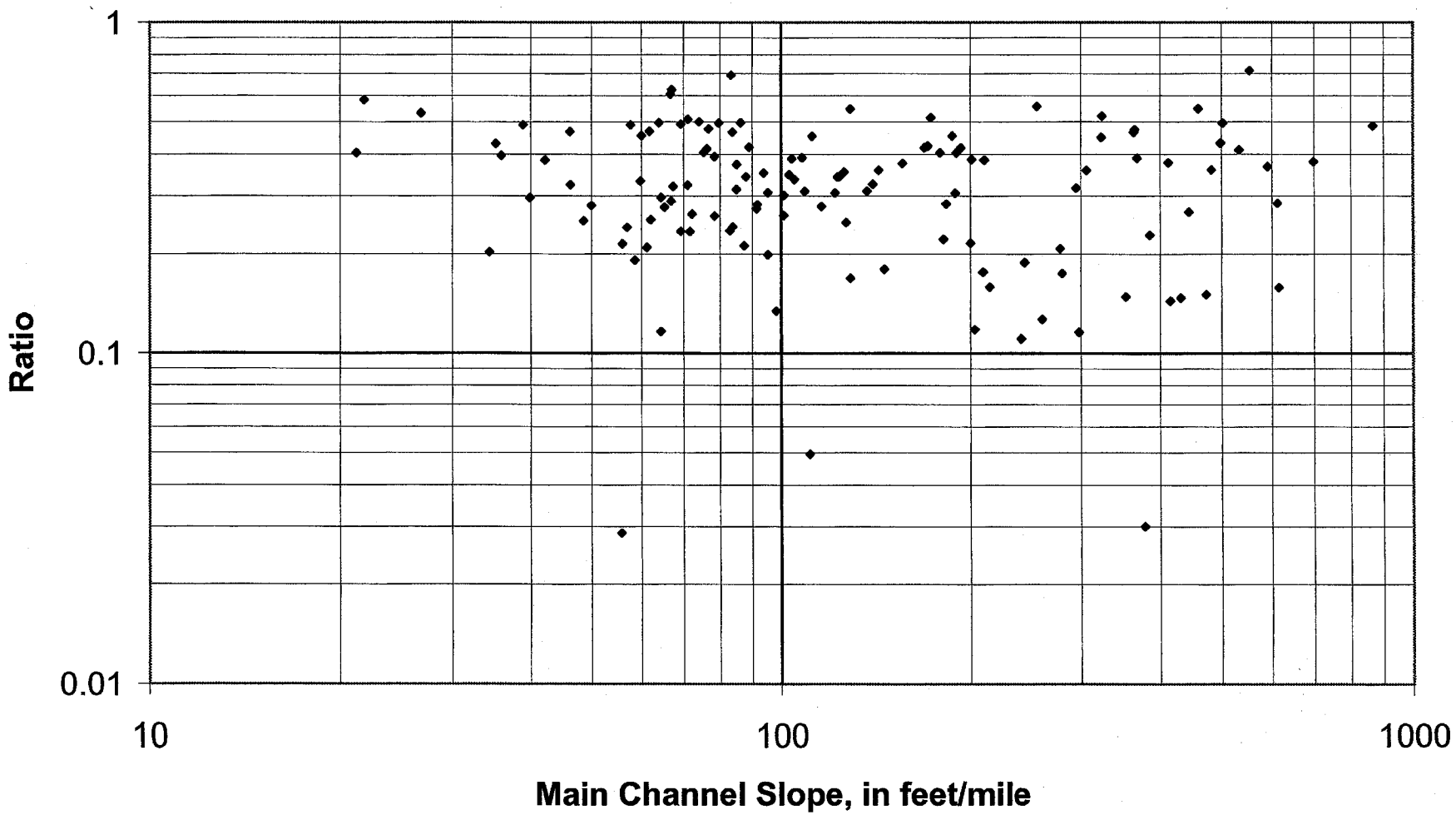
10-year ratios for selected undeveloped gaged watersheds using USGS LP3 peak discharge data



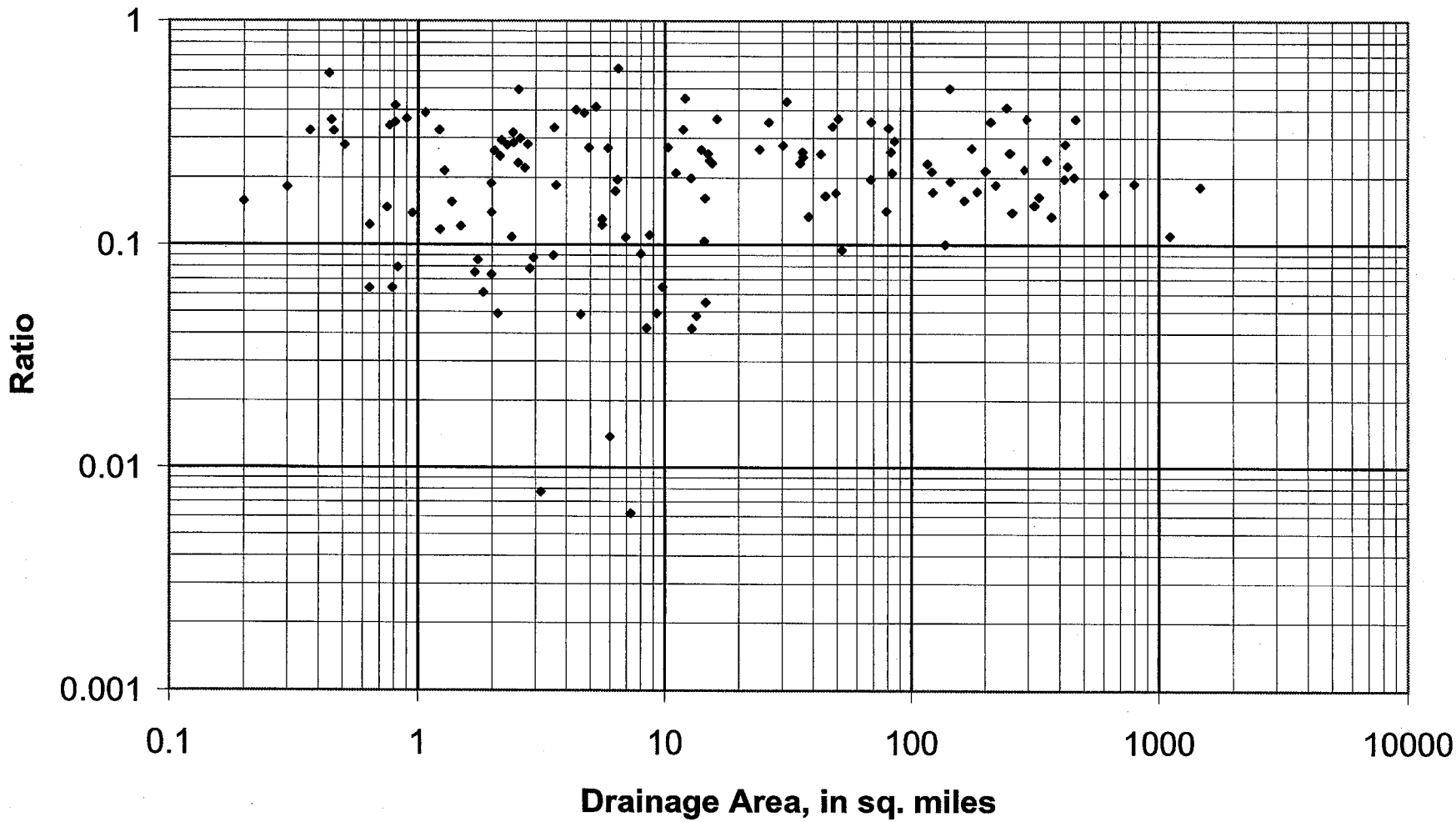
10-year ratios for selected undeveloped gaged watersheds using USGS LP3 peak discharge data



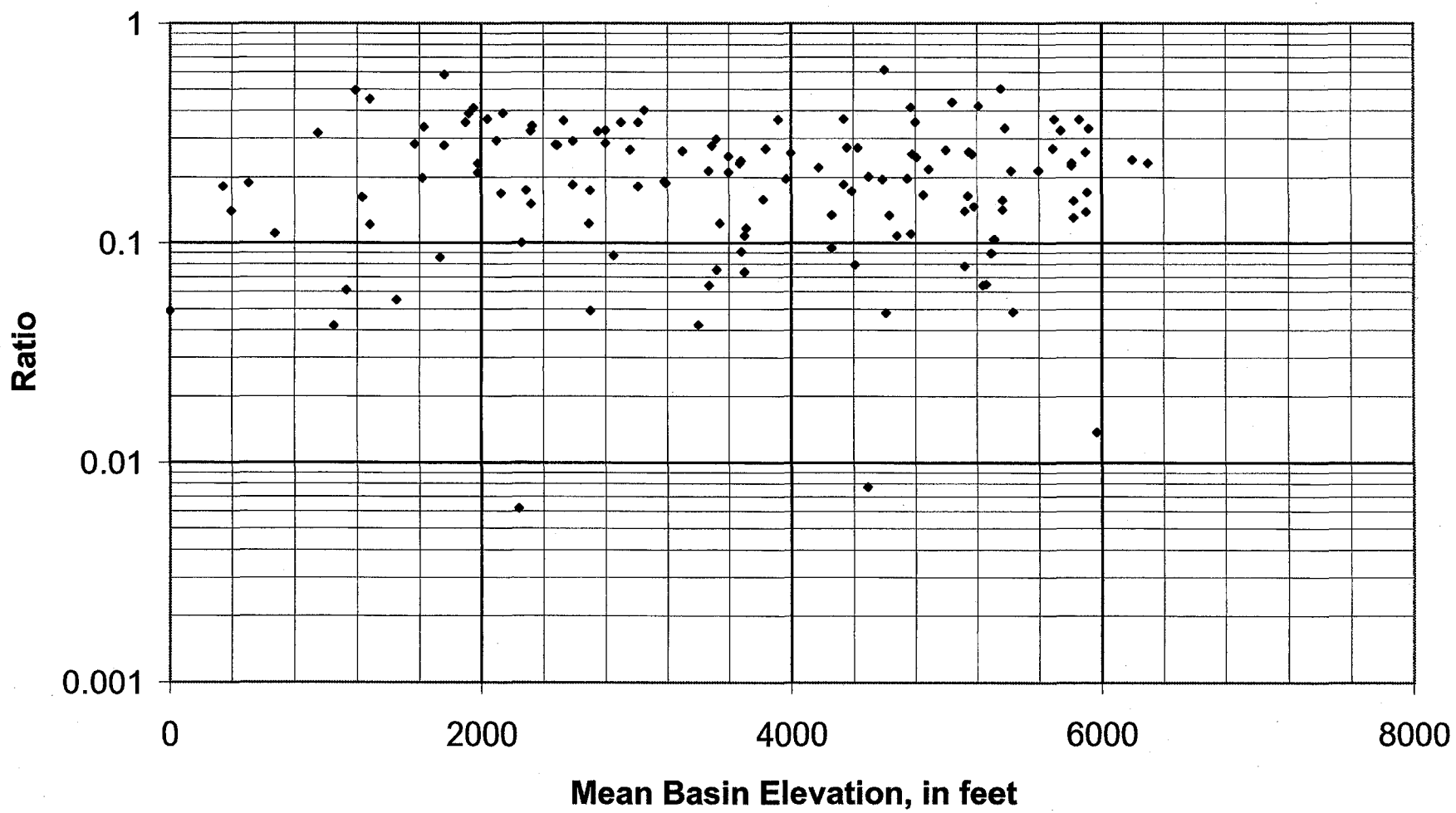
10-year ratios for all undeveloped gaged watersheds using USGS LP3 peak discharge data



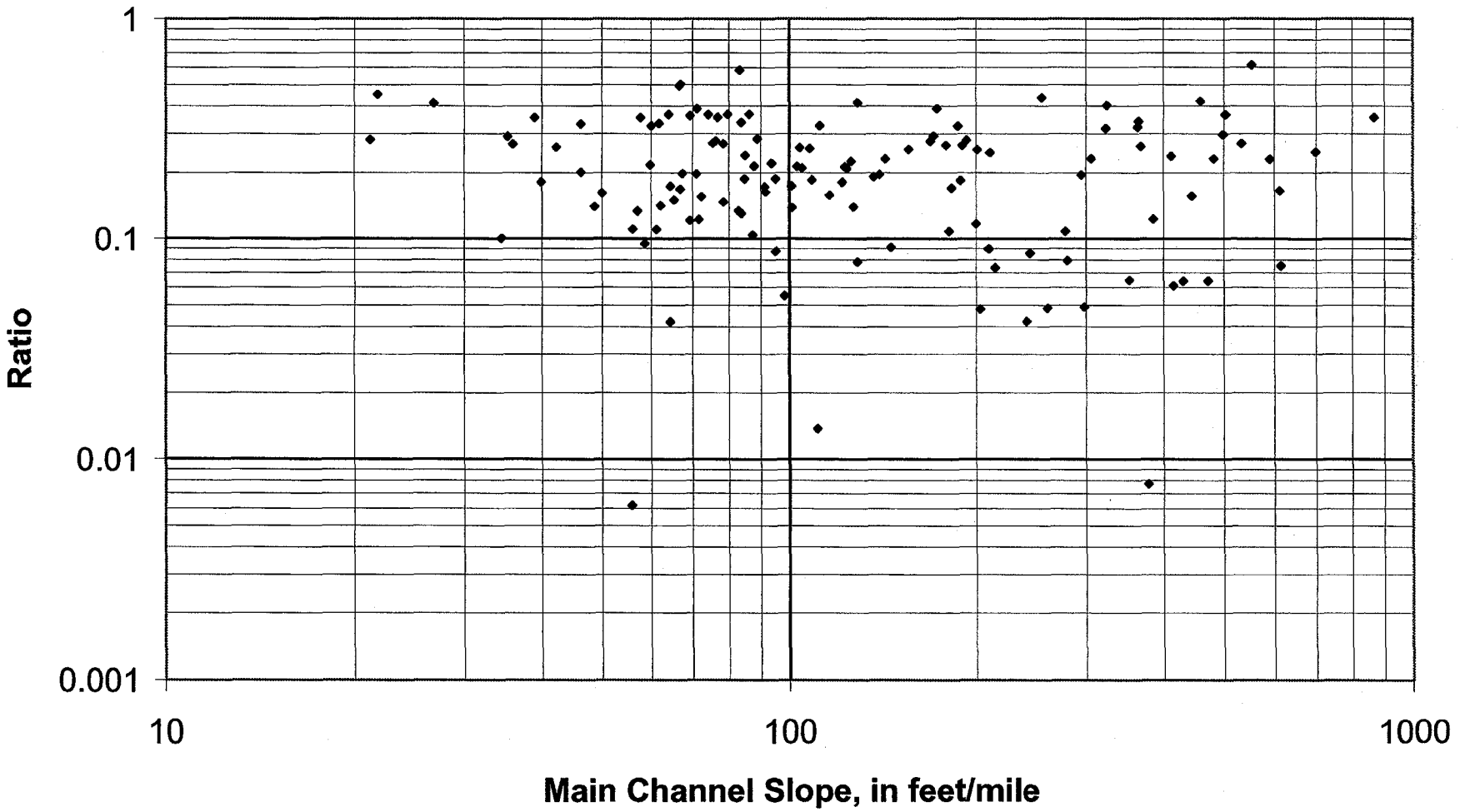
5-year ratios for selected undeveloped gaged watersheds using USGS LP3 peak discharge data



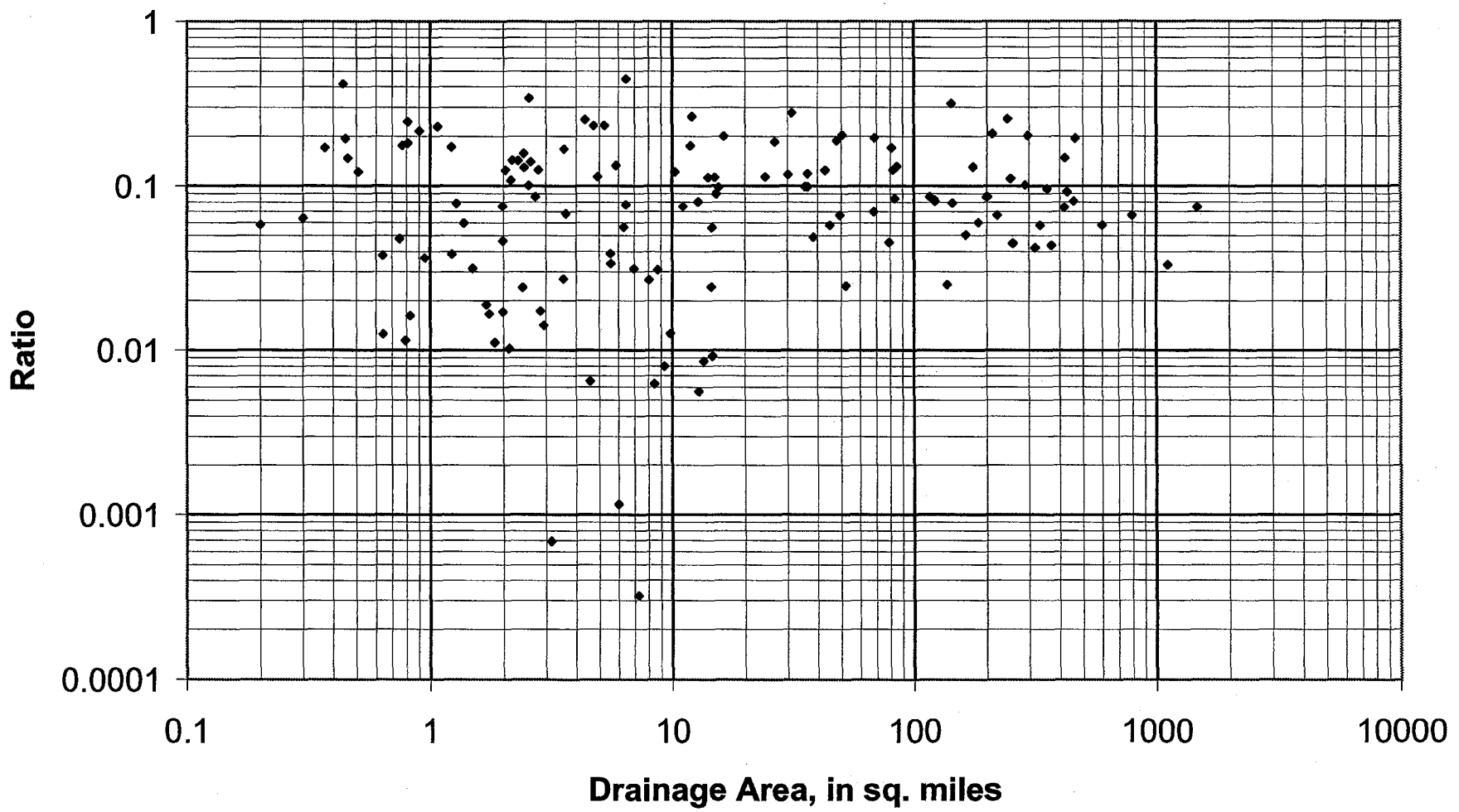
5-year ratios for selected undeveloped gaged watersheds using USGS LP3 peak discharge data



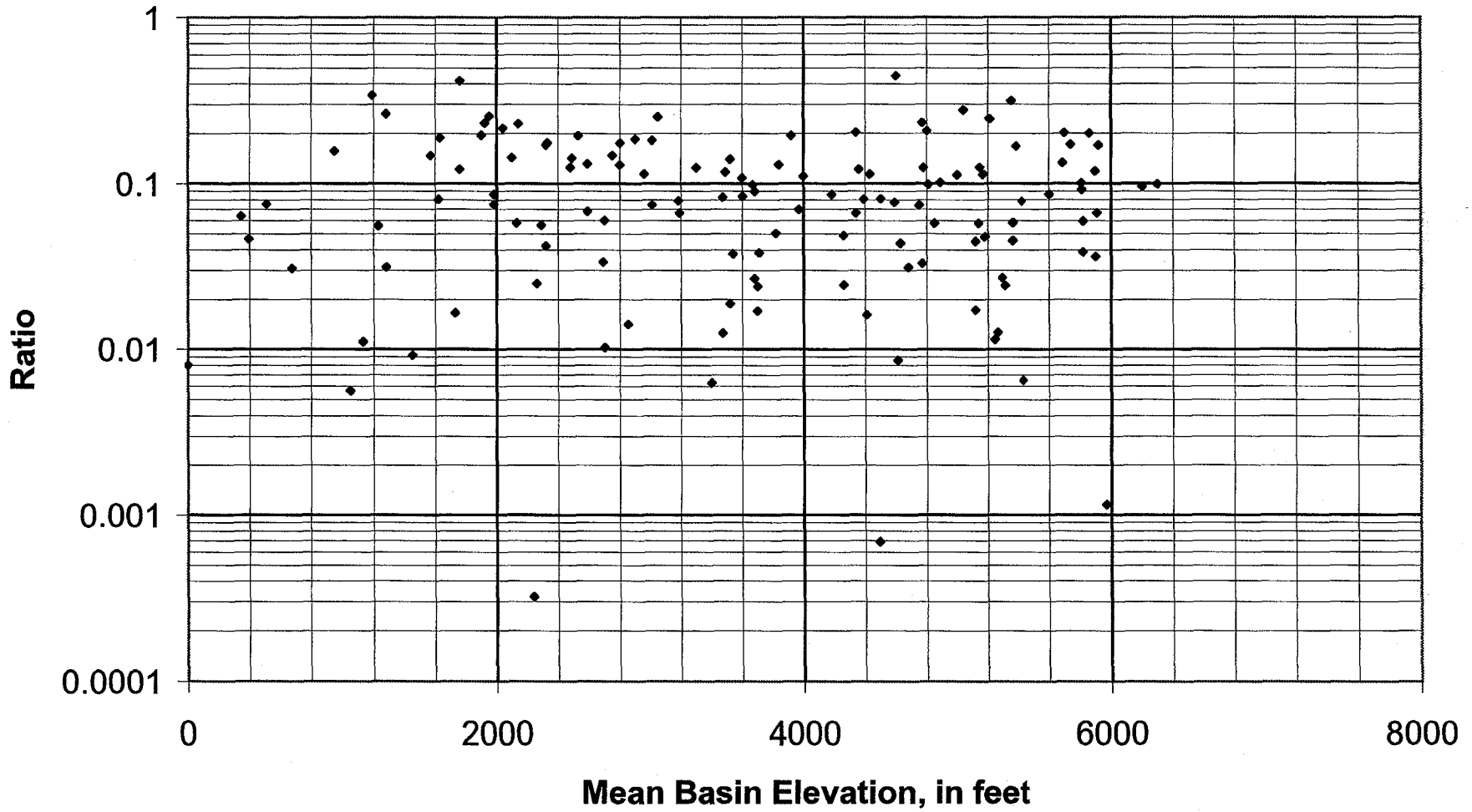
5-year ratios for all undeveloped gaged watersheds using USGS LP3 peak discharge data



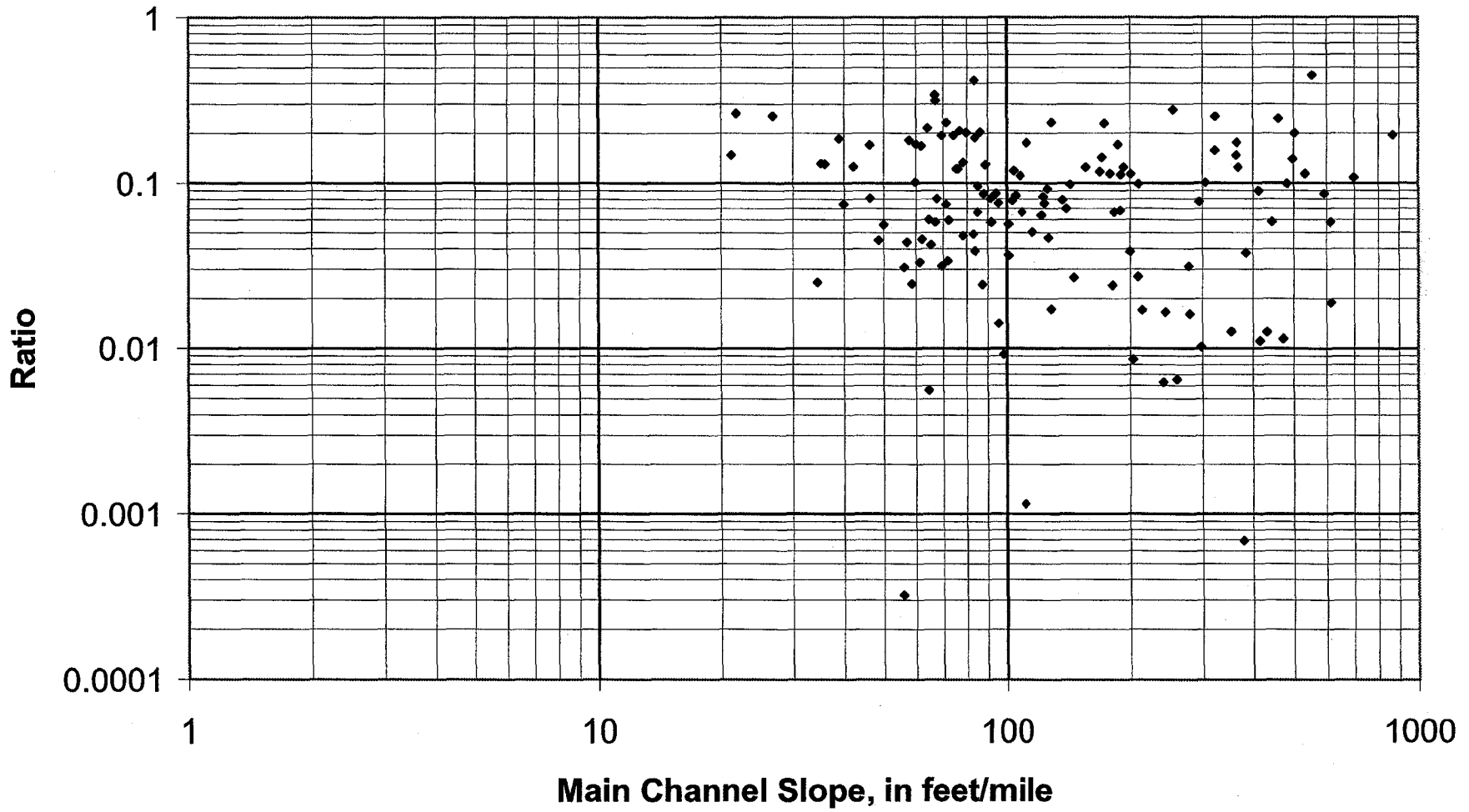
2-year ratios for selected undeveloped gaged watersheds using USGS LP3 peak discharge data



2-year ratios for selected undeveloped gaged watersheds using USGS LP3 peak discharge data



2-year ratios for all undeveloped gaged watersheds using USGS LP3 peak discharge data



Ratios for the 10-, 5- and 2-year USGS LP3 peak discharges to the 100-year for selected undeveloped watersheds with period of records greater than 20-years in Arizona

Gage No.	Station Name	Drainage Area sq. miles	Mean Basin Elevation feet	Main Channel Slope ft/mi	Period of Record	Log Pearson Type III Peak Discharge 100-Year cfs	10-Year cfs	5-Year cfs	2-Year cfs	Ratio to the 100-Year Discharge 10-Year %	5-Year %	2-Year %
9480000	Santa Cruz River Near Lochiel, Ariz.	82.2	5150	42.2	47	11600	4460	3020	1450	0.38	0.26	0.13
9481500	Sonoita Creek Near Patagonia, Ariz.	209	4800	76.7	44	15100	7190	5360	3130	0.48	0.35	0.21
9483100	Tanque Verde Creek Near Tucson, Ariz.	43	4780	156	25	12300	4620	3130	1530	0.38	0.25	0.12
9484000	Sabino Creek Near Tucson, Ariz.	35.5	6300	482	64	12000	4310	2780	1190	0.36	0.23	0.10
9484500	Tanque Verde Cr At Tucson Ariz	219	4340	109	28	35500	11000	6580	2360	0.31	0.19	0.07
9484600	Pantano Wash Near Vail, Az	457	4500	46.3	38	32100	10400	6450	2600	0.32	0.20	0.08
9485000	Rincon Creek Near Tucson, Ariz.	44.8	4850	612	43	16700	4760	2770	963	0.29	0.17	0.06
9497800	Cibecue Creek Near Chrysotile, Ariz.	295	5700	79.6	37	20800	10300	7620	4200	0.50	0.37	0.20
9497980	Cherry Creek Near Globe, Ariz.	200	5600	87.9	30	25400	8700	5450	2190	0.34	0.21	0.09
9498870	Rye Creek Nr Gisela, Ariz.	122	4390	91.4	20	35400	9700	6100	2850	0.27	0.17	0.08
9501300	Tortilla Creek At Tortilla Flat, Ariz.	24.3	2960	179	22	15300	6180	4080	1740	0.40	0.27	0.11
9502800	Williamson Valley W Nr Paulden, Ariz.	255	5120	48.6	20	29200	7360	4080	1310	0.25	0.14	0.04
9504500	Oak Creek Near Cornville, Ariz.	355	6200	85	54	50100	18700	12000	4810	0.37	0.24	0.10
9505250	Red Tank Draw Near Rimrock, Ariz	49.4	5910	183	20	10900	3090	1860	724	0.28	0.17	0.07
9507980	East Verde River Near Childs, Ariz.	331	5140	91.6	33	56700	16000	9300	3270	0.28	0.16	0.06
9508300	Wet Bottom Creek Nr Childs, Ariz.	36.4	4810	210	28	17600	6760	4340	1740	0.38	0.25	0.10
9510070	Wf Sycamore Cr Ab Mcfar Can, N Sunflower, Az	4.58	5430	260	22	5530	702	268	36	0.13	0.05	0.01
9510170	Camp Creek Nr Sunflower, Az	2.6	3520	498	21	773	334	230	108	0.43	0.30	0.14
9510200	Sycamore Creek Near Fort Mcdowell	164	3820	116	36	46300	12900	7320	2330	0.28	0.16	0.05
9512200	Salt River Trib. In S. Mnt. Park, Phoenix, Ariz.	1.75	1730	244	33	2230	420	191	37	0.19	0.09	0.02
9512300	Cave Creek Nr Cave Creek Ariz	121	3470	123	26	21500	7360	4580	1780	0.34	0.21	0.08
9512700	Agua Fria River Trib #2 Nr Rock Springs, Ariz	1.07	2140	173	22	1570	808	611	359	0.51	0.39	0.23
9512800	Agua Fria River Near Rock Springs, Ariz.	1111	4770	61.2	27	211800	44300	23300	7000	0.21	0.11	0.03
9513780	New River Nr Rock Springs, Ariz.	68.3	3970	140	34	35000	11400	6880	2440	0.33	0.20	0.07
9513800	New River At New River, Ariz.	83.3	3600	105	21	37500	12600	7880	3150	0.34	0.21	0.08
9513820	Deadman Wash Near New River, Ariz.	11.1	1980	124	24	4630	1590	969	348	0.34	0.21	0.08
9513835	New River At Bell Road, Near Peoria, Ariz.	185	2700	64.5	23	31700	9410	5510	1900	0.30	0.17	0.06
9513910	New River Nr Glendale, Ariz.	600	2130	66.9	27	49800	14400	8410	2890	0.29	0.17	0.06
9514200	Waterman Wash Near Buckeye, Ariz.	420	1570	21.2	30	8470	3420	2390	1250	0.40	0.28	0.15
9515500	Hassayampa River At Box Damsite Nr Wickenburg Az	417	4750	71	39	43000	13900	8480	3180	0.32	0.20	0.07
9515800	Hartman Wash Near Wickenburg, Ariz.	5.57	2690	71.6	21	7100	1660	869	239	0.23	0.12	0.03
9516500	Hassayampa River Nr Morristown, Ariz.	796	3190	84.9	39	45600	14300	8540	3030	0.31	0.19	0.07
9516600	Ox Wash Near Morristown, Ariz.	6.31	2290	101	22	3720	1120	647	209	0.30	0.17	0.06
9516800	Jack Rabbit Wash Near Tonopah, Ariz.	137	2260	34.4	21	33900	6860	3400	847	0.20	0.10	0.02
9517000	Hassayampa River Near Arlington, Ariz.	1471	3010	39.9	32	40500	12000	7340	3010	0.30	0.18	0.07
9517200	Centennial Wash Tributary Near Wenden, Ariz.	2.79	2480	193	22	1080	451	303	135	0.42	0.28	0.13
9517280	Tiger Wash Near Aguila, Ariz.	85.2	2590	35.2	22	7340	3160	2140	961	0.43	0.29	0.13
9519600	Rainbow Wash Trib Near Buckeye, Ariz.	2.43	950	323	22	2050	920	648	323	0.45	0.32	0.16
9519750	Bender Wash Near Gila Bend, Ariz.	68.6	1900	867	22	4450	2160	1580	867	0.49	0.36	0.19
9519760	Sauceda Wash Near Gila Bend, Ariz.	116	1980	591	22	6850	2520	1580	591	0.37	0.23	0.09
9520100	Military Wash Near Sentinel, Ariz.	8.7	674	56	22	5220	1120	577	161	0.21	0.11	0.03
9520230	Crater Range Wash Near Ajo, Ariz.	1.49	1280	69.3	20	2230	522	270	70	0.23	0.12	0.03
9520300	Alamo Wash Trib Near Ajo, Ariz.	0.9	2040	64	30	656	326	240	141	0.50	0.37	0.21

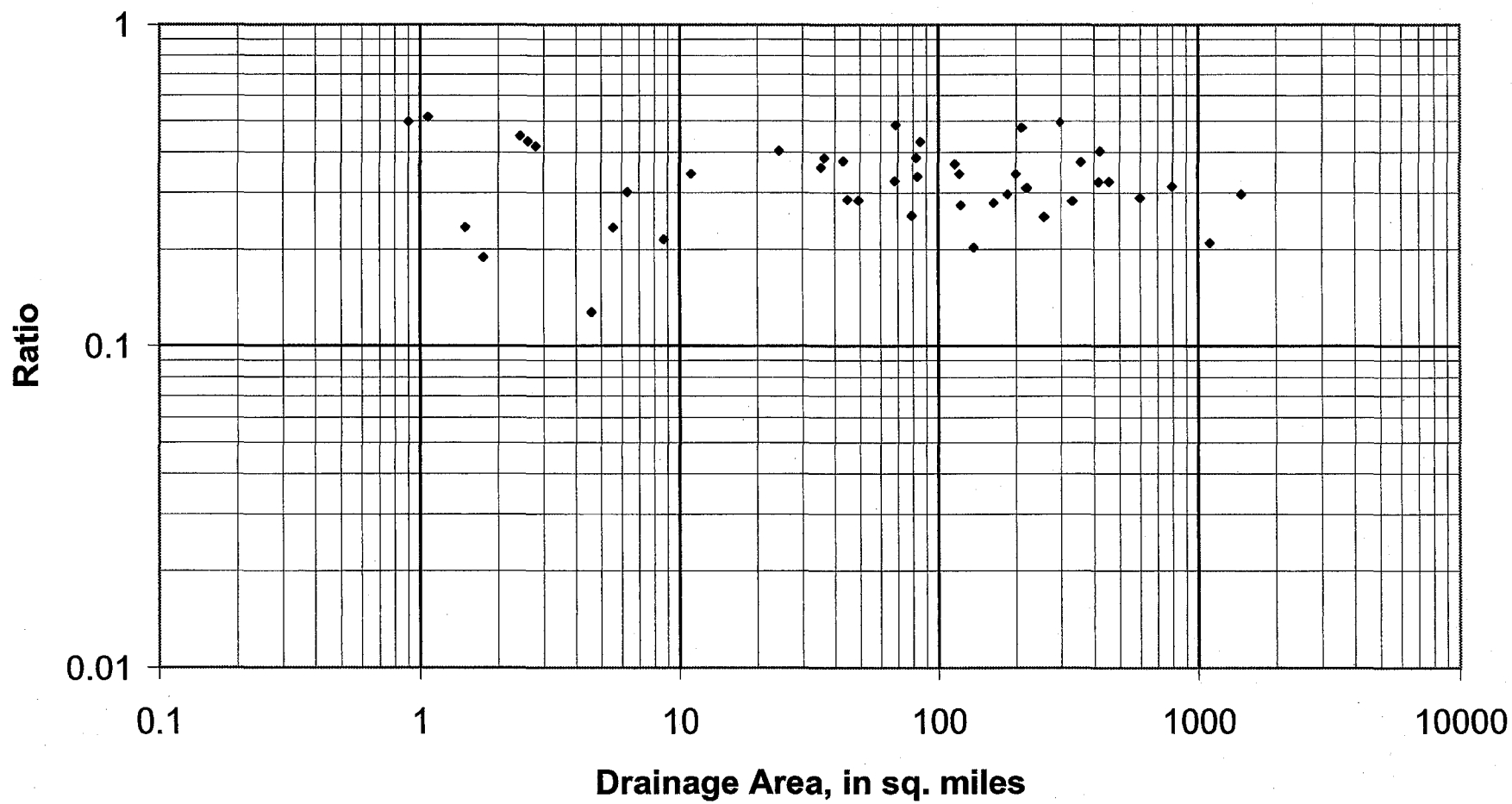
Ratios for the 10-, 5- and 2-year USGS LP3 peak discharges to the 100-year for selected undeveloped watersheds with period of records greater than 20-years in Arizona

Gage No.	Station Name	Drainage Area sq. miles	Mean Basin Elevation feet	Main Channel Slope ft/mi	Period of Record	Log Pearson Type III Peak Discharge 100-Year cfs	10-Year cfs	5-Year cfs	2-Year cfs	Ratio to the 100-Year Discharge 10-Year %	5-Year %	2-Year %
9537200	Leslie Creek Near Mcneal, Ariz.	79.1	5360	62.1	21	13500	3430	1910	612	0.25	0.14	0.05
									Mean:	**0.33**	**0.21**	**0.09**
									Standard Deviation:	**0.09**	**0.08**	**0.06**
									Sample Size:	**44**	**44**	**44**

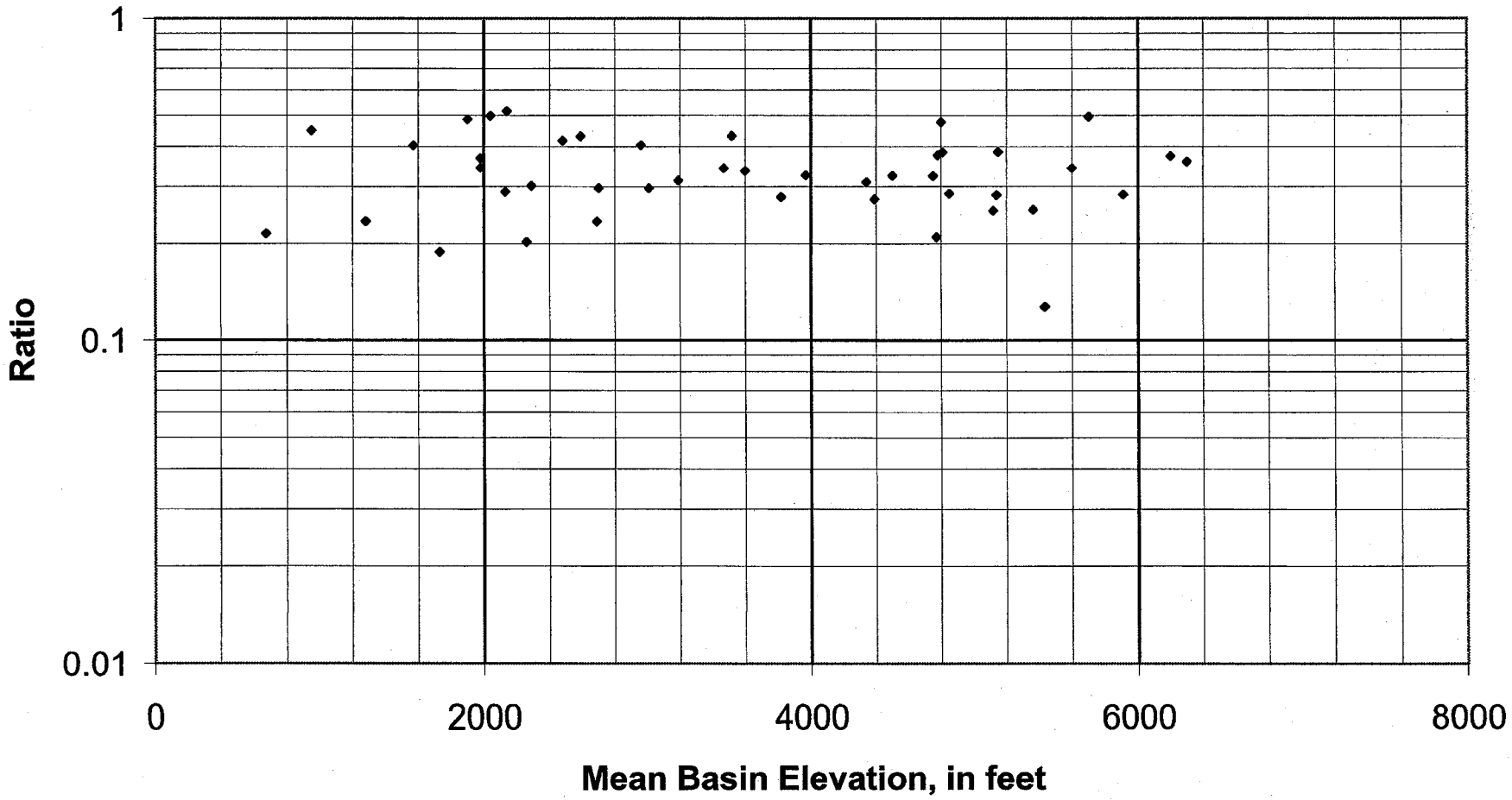
Descriptive Statistics

	10-Year	*5-Year*	*2-Year*
Mean	0.33	0.21	0.09
Standard Error	0.01	0.01	0.01
Median	0.32	0.20	0.08
Mode	#N/A	#N/A	0.13
Standard Deviation	0.09	0.08	0.06
Sample Variance	0.01	0.01	0.00
Kurtosis	-0.36	-0.31	0.32
Skewness	0.11	0.40	0.96
Range	0.39	0.34	0.22
Minimum	0.13	0.05	0.01
Maximum	0.51	0.39	0.23
Sum	14.71	9.35	4.01
Count	44	44	44

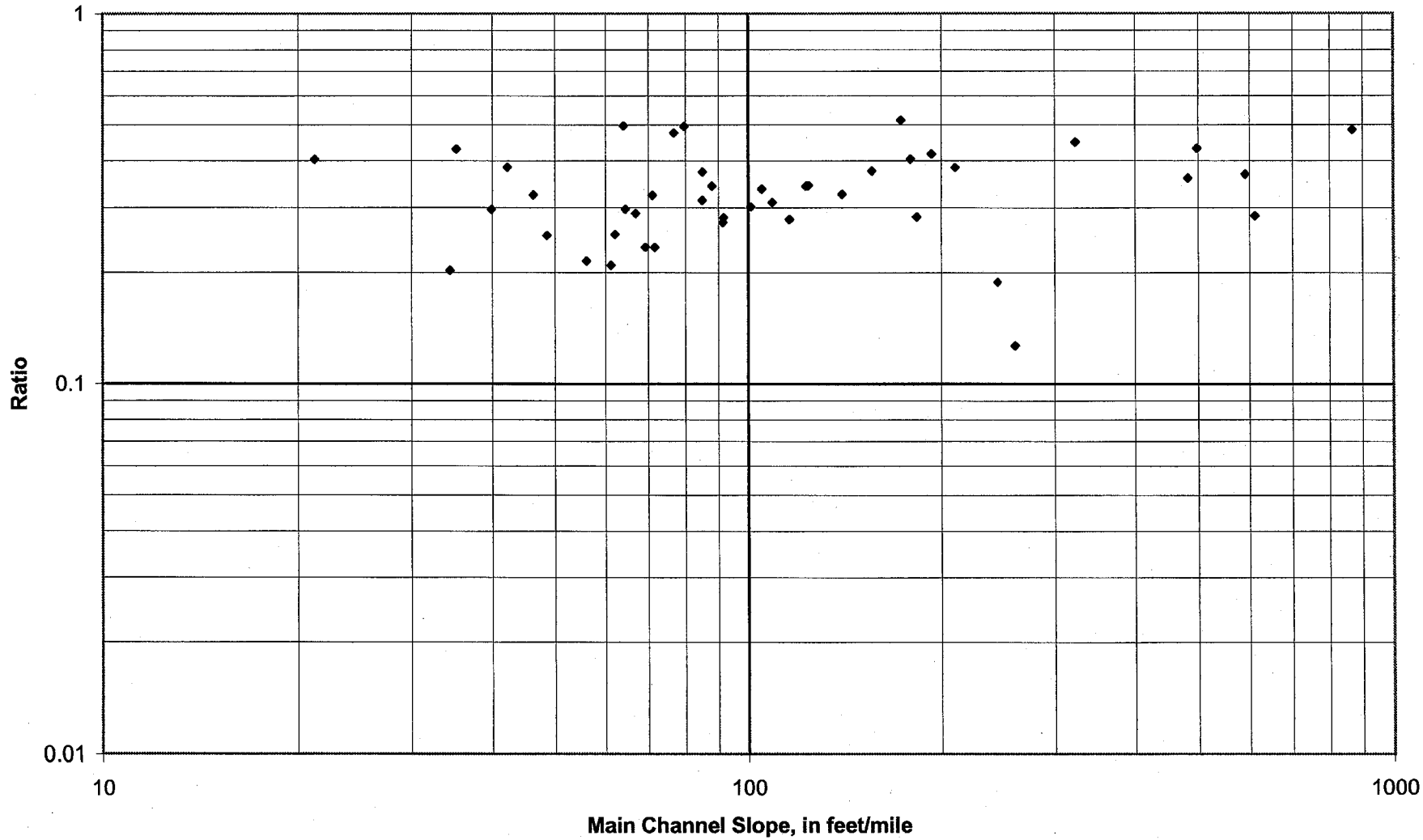
10-year ratios for selected undeveloped gaged watersheds with period of records greater than 20 years using USGS LP3 peak discharge data



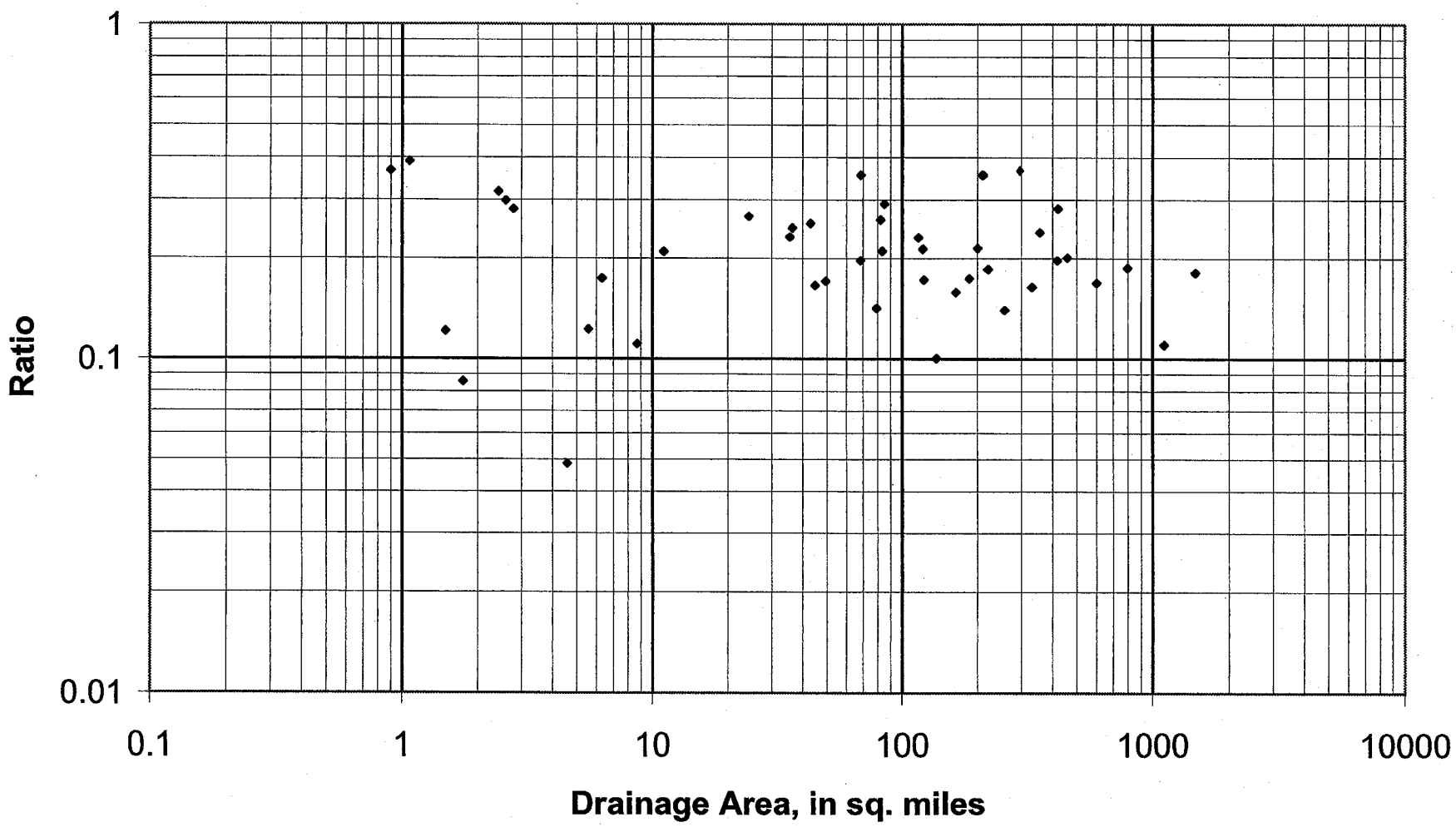
10-year ratios for selected undeveloped gaged watersheds with period of record greater than 20 years using USGS LP3 peak discharge data



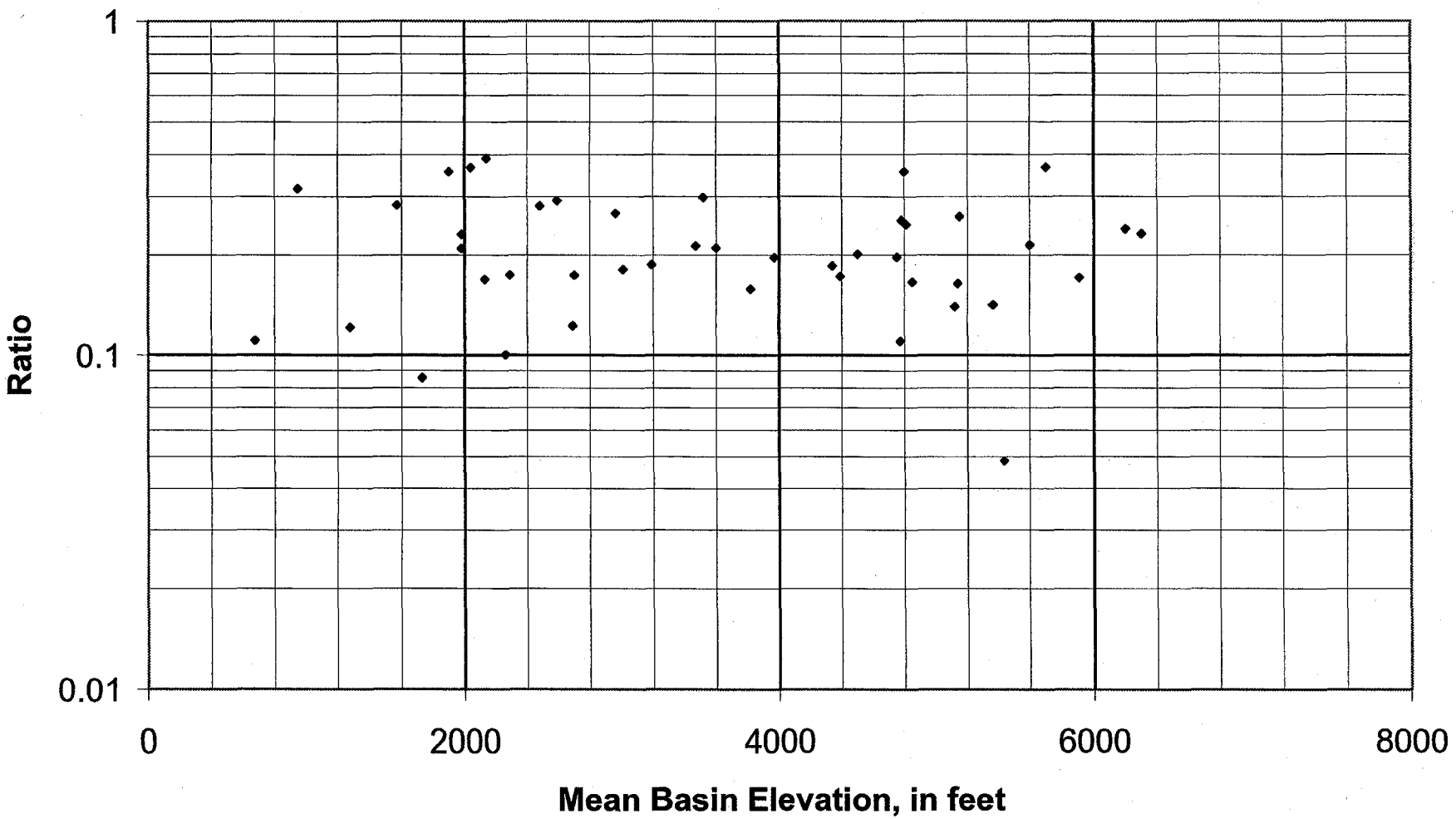
10-year ratios for selected undeveloped gaged watersheds with period of record greater than 20 years using USGS LP3 peak discharge data



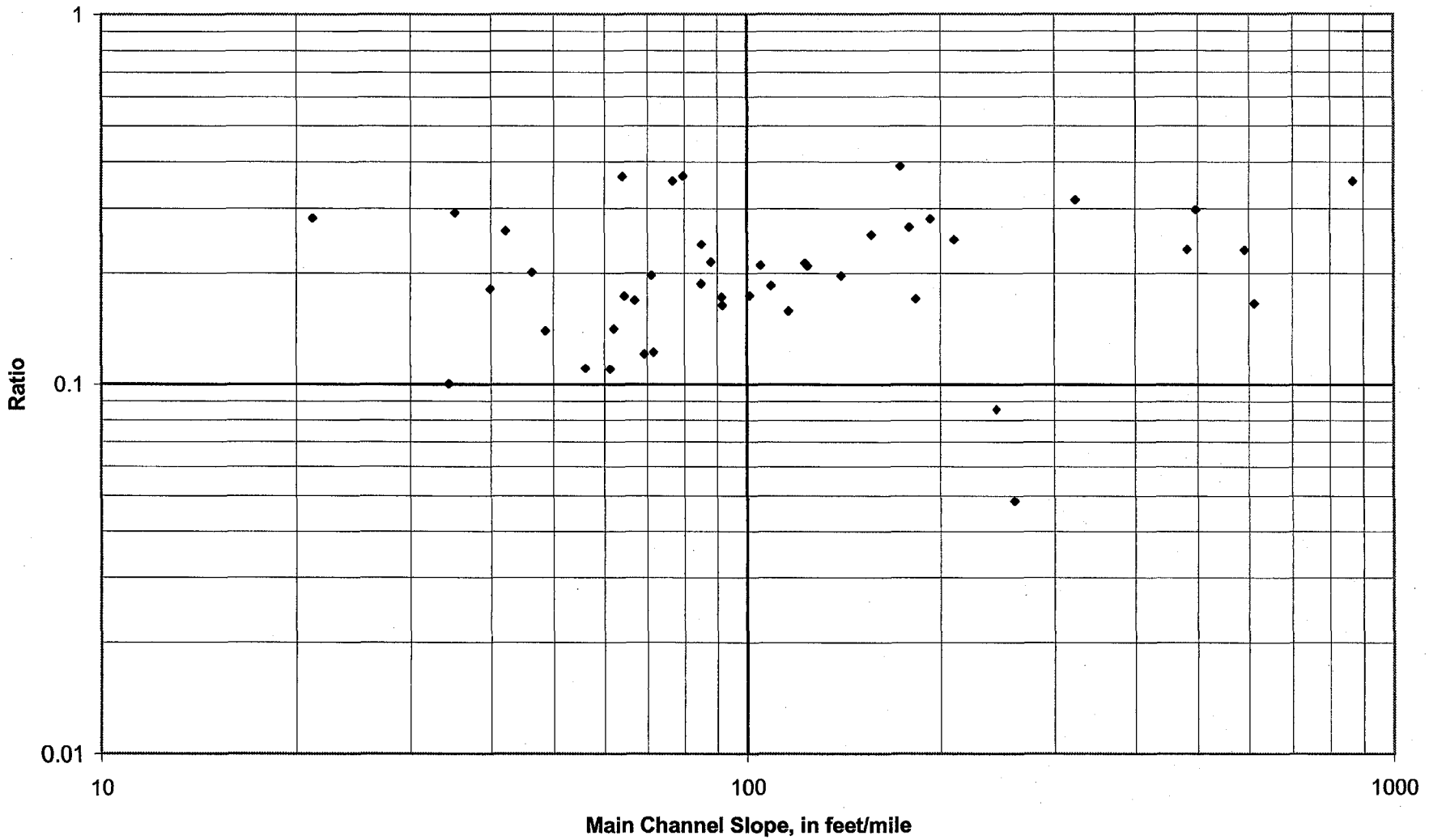
5-year ratios for selected undeveloped gaged watersheds with period of record greater than 20 years using USGS LP3 peak discharge data



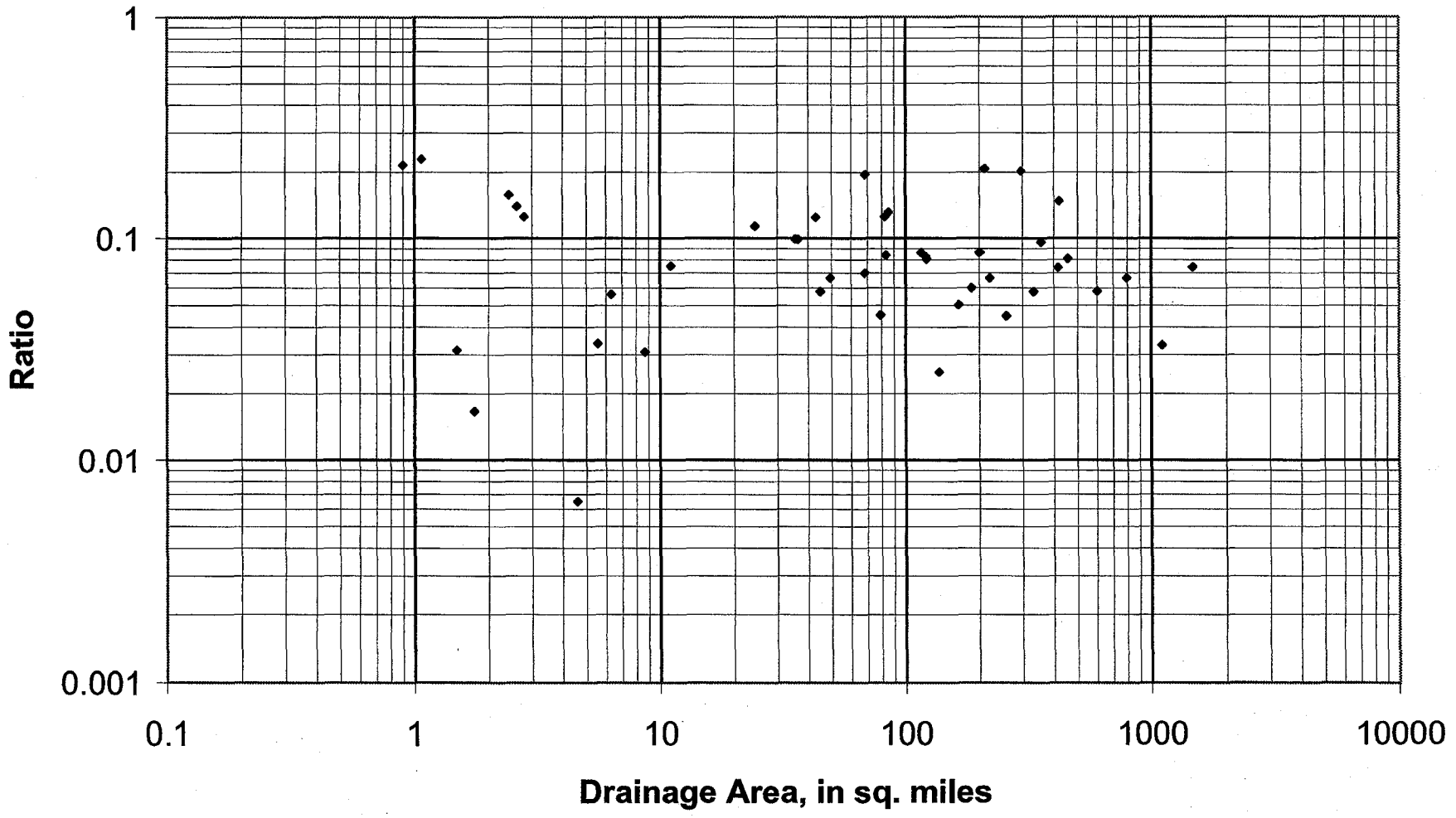
5-year ratios for selected undeveloped gaged watersheds with period of record greater than 20 years using USGS LP3 peak discharge data



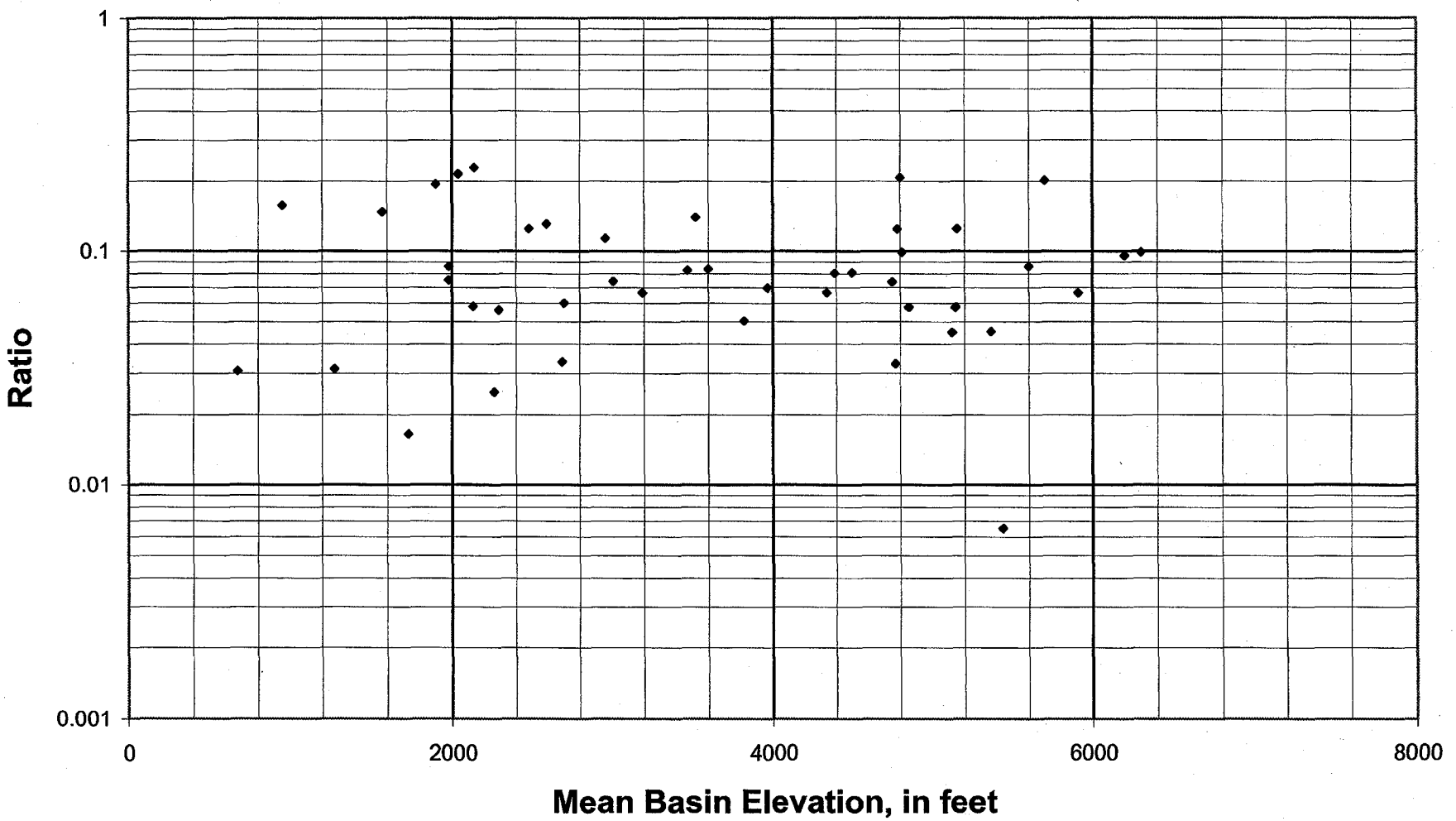
5-year ratios for selected undeveloped gaged watersheds with period of record greater than 20 years using USGS LP3 peak discharge data



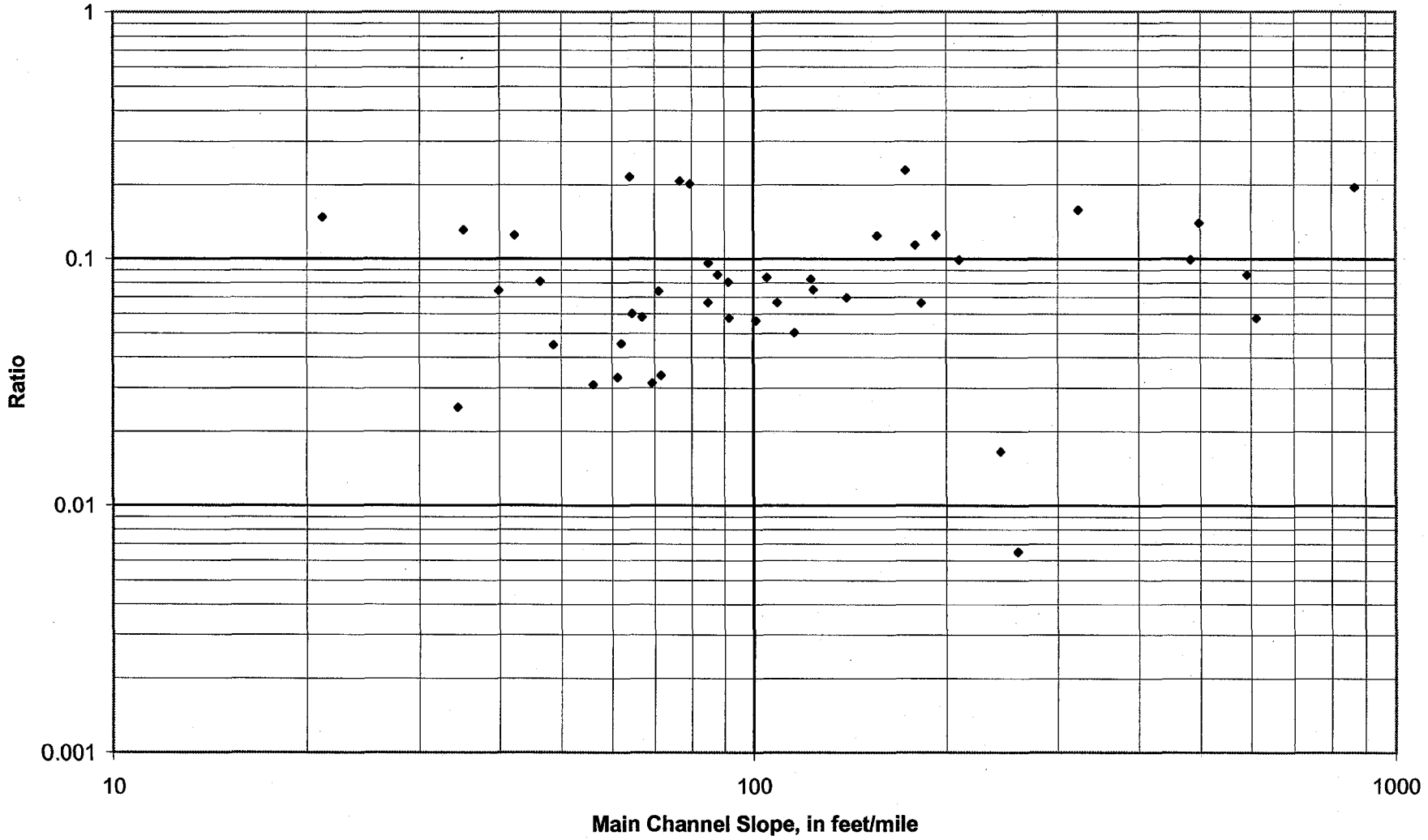
2-year ratios for selected undeveloped gaged watersheds with period of record greater than 20 years using USGS LP3 peak discharge data



2-year ratios for selected undeveloped gaged watersheds with period of record greater than 20 years using USGS LP3 peak discharge data



2-year ratios for selected undeveloped gaged watersheds with period of record greater than 20 years using USGS LP3 peak discharge data



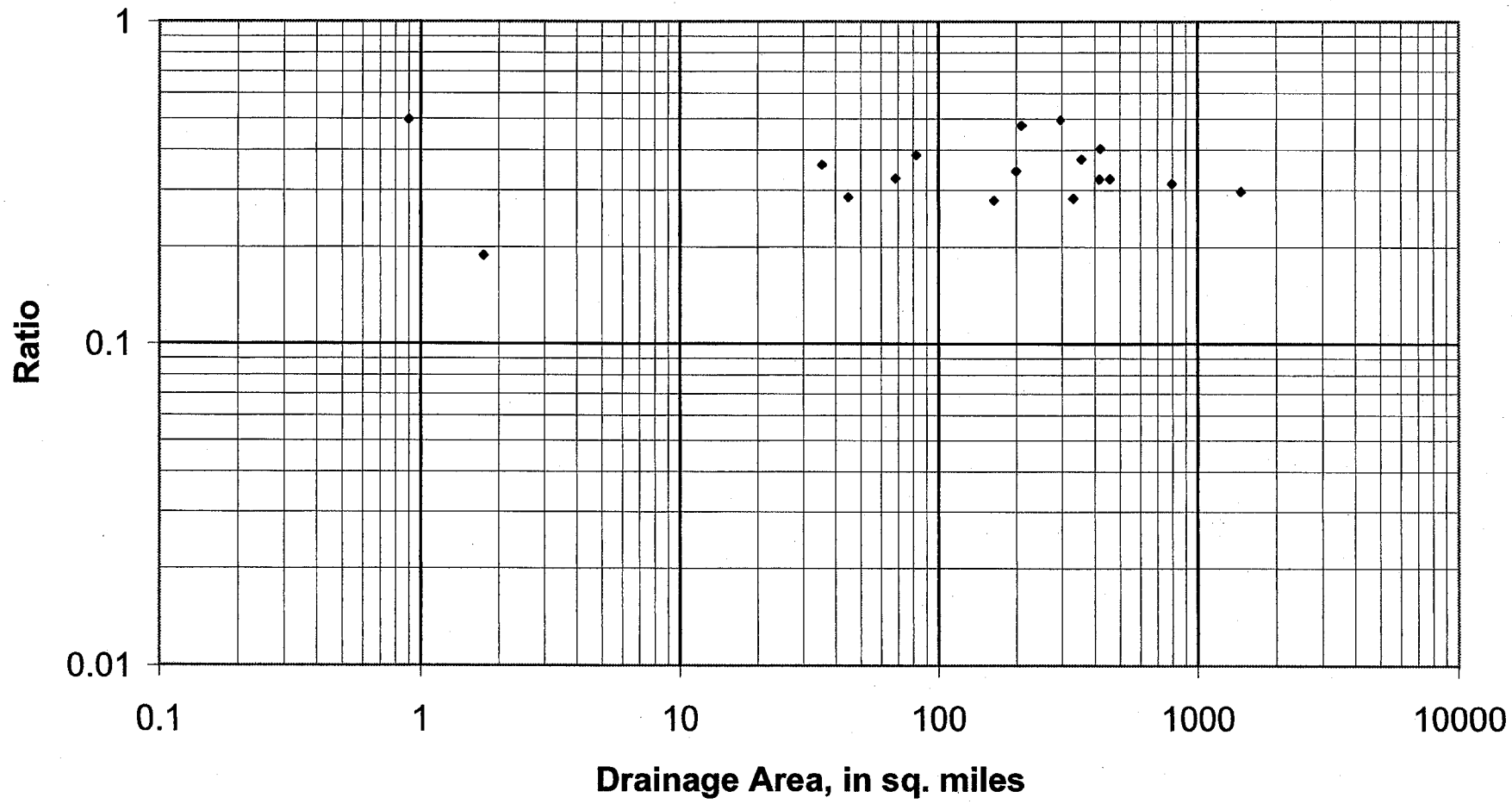
Ratios for the 10-, 5- and 2-year USGS LP3 peak discharges to the 100-year for selected undeveloped watersheds with period of records greater than 30-years in Arizona

Gage No.	Station Name	Drainage Area sq. miles	Mean Basin Elevation feet	Main Channel Slope ft/mi	Period of Record	Log Pearson Type III Peak Discharge 100-Year cfs	10-Year cfs	5-Year cfs	2-Year cfs	Ratio to the 100-Year Discharge 10-Year %	5-Year %	2-Year %
9480000	Santa Cruz River Near Lochiel, Ariz.	82.2	5150	42.2	47	11600	4460	3020	1450	0.38	0.26	0.13
9481500	Sonoita Creek Near Patagonia, Ariz.	209	4800	76.7	44	15100	7190	5360	3130	0.48	0.35	0.21
9484000	Sabino Creek Near Tucson, Ariz.	35.5	6300	482	64	12000	4310	2780	1190	0.36	0.23	0.10
9484600	Pantano Wash Near Vail, Az	457	4500	46.3	38	32100	10400	6450	2600	0.32	0.20	0.08
9485000	Rincon Creek Near Tucson, Ariz.	44.8	4850	612	43	16700	4760	2770	963	0.29	0.17	0.06
9497800	Cibecue Creek Near Chrysotile, Ariz.	295	5700	79.6	37	20800	10300	7620	4200	0.50	0.37	0.20
9497980	Cherry Creek Near Globe, Ariz.	200	5600	87.9	30	25400	8700	5450	2190	0.34	0.21	0.09
9504500	Oak Creek Near Cornville, Ariz.	355	6200	85	54	50100	18700	12000	4810	0.37	0.24	0.10
9507980	East Verde River Near Childs, Ariz.	331	5140	91.6	33	56700	16000	9300	3270	0.28	0.16	0.06
9510200	Sycamore Creek Near Fort Mcdowell	164	3820	116	36	46300	12900	7320	2330	0.28	0.16	0.05
9512200	Salt River Trib. In S. Mnt. Park, Phoenix, Ariz.	1.75	1730	244	33	2230	420	191	37	0.19	0.09	0.02
9513780	New River Nr Rock Springs, Ariz.	68.3	3970	140	34	35000	11400	6880	2440	0.33	0.20	0.07
9514200	Waterman Wash Near Buckeye, Ariz.	420	1570	21.2	30	8470	3420	2390	1250	0.40	0.28	0.15
9515500	Hassayampa River At Box Damsite Nr Wickenburg Az	417	4750	71	39	43000	13900	8480	3180	0.32	0.20	0.07
9516500	Hassayampa River Nr Morristown, Ariz.	796	3190	84.9	39	45600	14300	8540	3030	0.31	0.19	0.07
9517000	Hassayampa River Near Arlington, Ariz.	1471	3010	39.9	32	40500	12000	7340	3010	0.30	0.18	0.07
9520300	Alamo Wash Trib Near Ajo, Ariz.	0.9	2040	64	30	656	326	240	141	0.50	0.37	0.21
									Mean:	**0.35**	**0.23**	**0.10**
									Standard Deviation:	**0.08**	**0.08**	**0.06**
									Sample Size:	**17**	**17**	**17**

Descriptive Statistics

	10-Year	*5-Year*	*2-Year*
Mean	0.35	0.23	0.10
Standard Error	0.02	0.02	0.01
Median	0.33	0.20	0.08
Mode	#N/A	#N/A	#N/A
Standard Deviation	0.08	0.08	0.06
Sample Variance	0.01	0.01	0.00
Kurtosis	0.10	-0.04	-0.04
Skewness	0.38	0.58	0.96
Range	0.31	0.28	0.20
Minimum	0.19	0.09	0.02
Maximum	0.50	0.37	0.21
Sum	5.95	3.85	1.73
Count	17	17	17

10-year ratios for selected undeveloped gaged watersheds with period of records greater than 30 years using USGS LP3 peak discharge data



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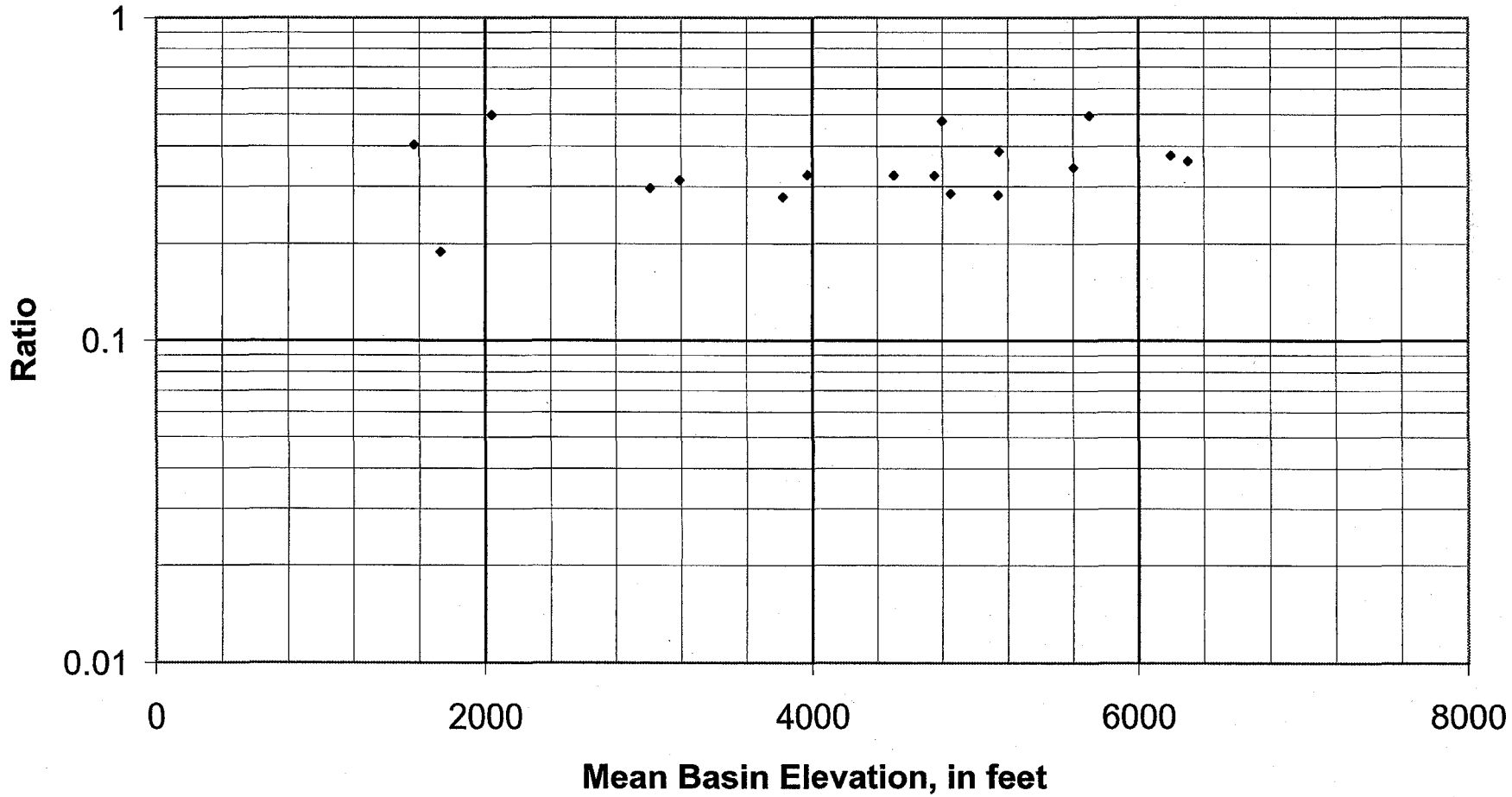
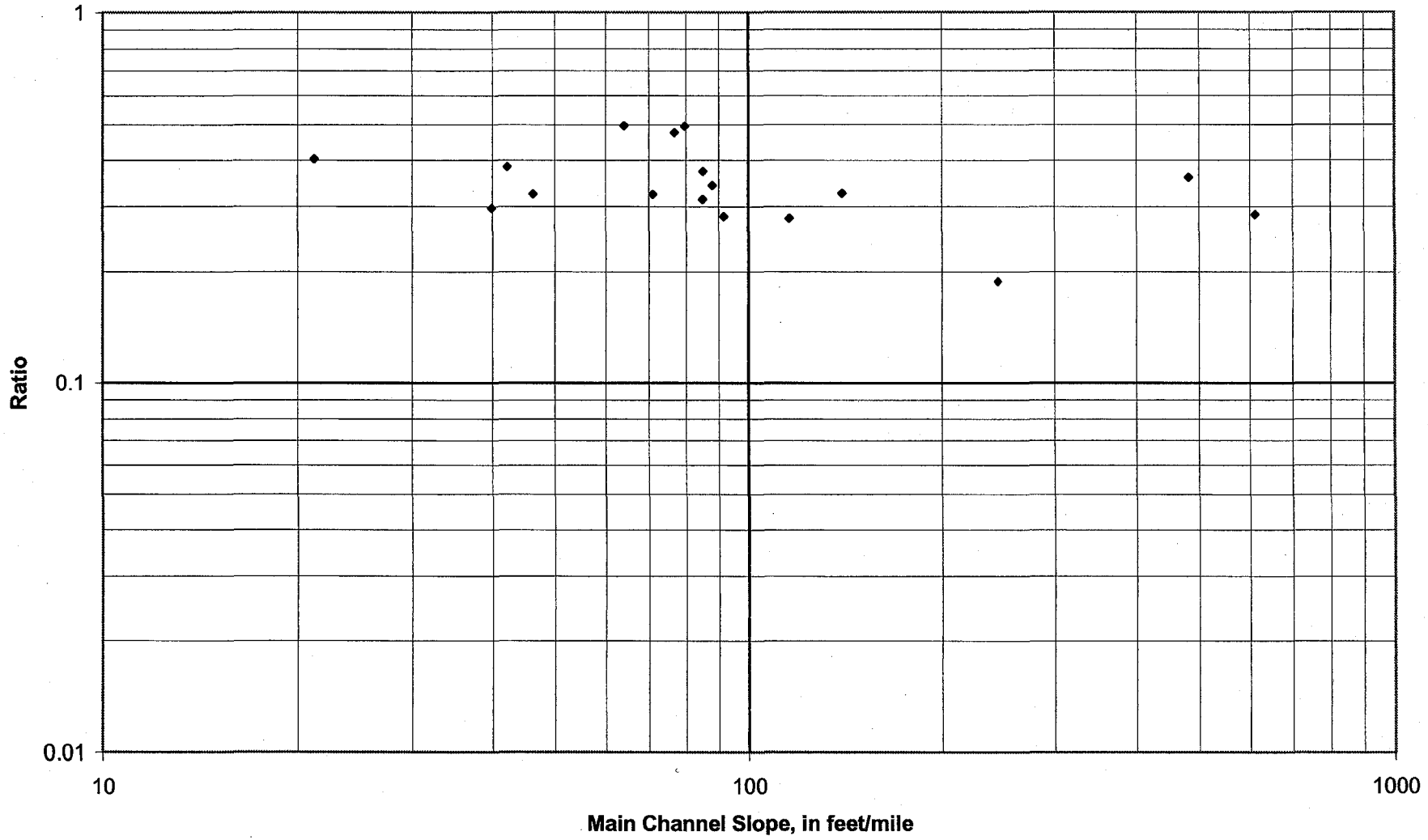
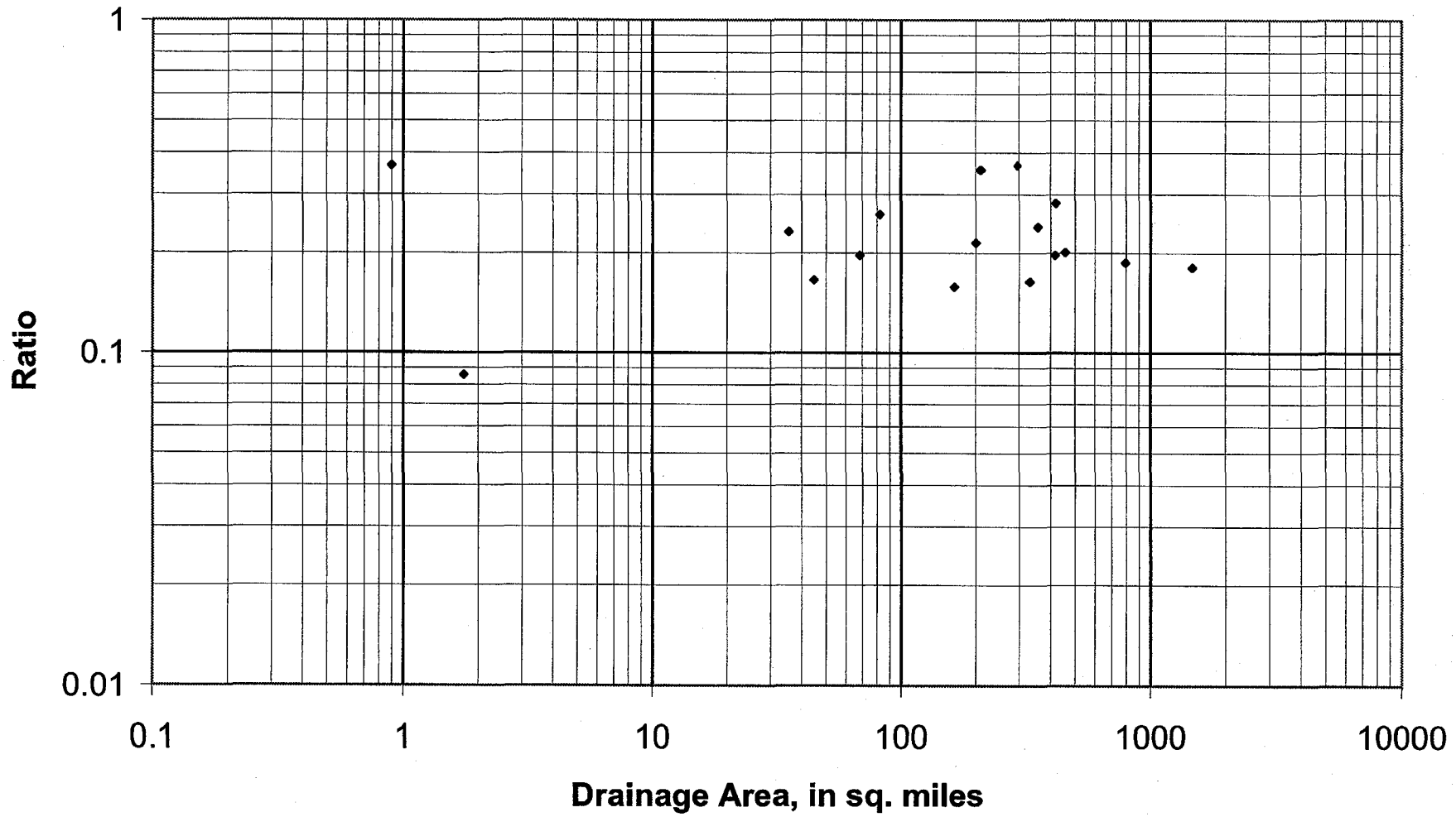


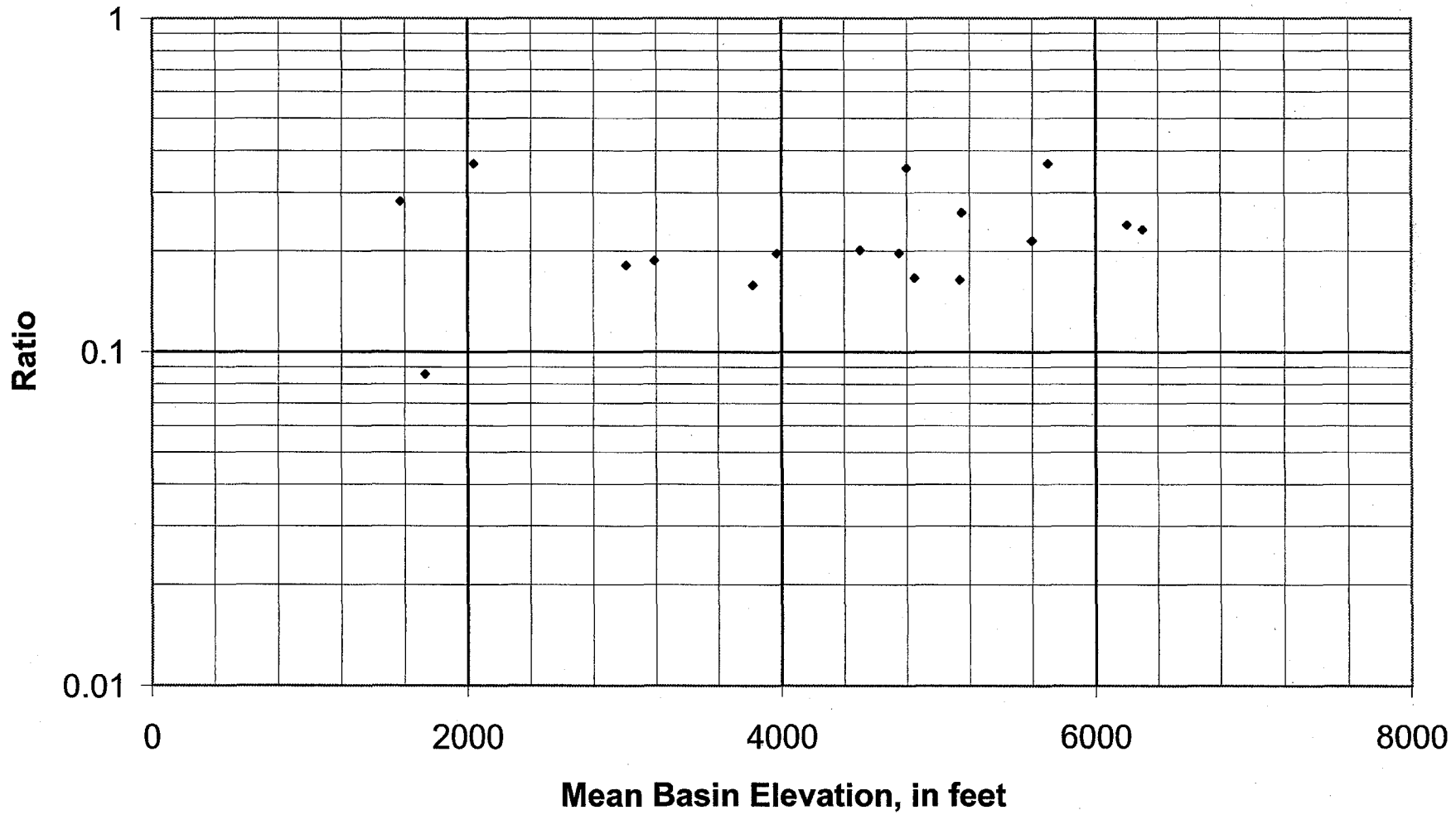
10-year ratios for selected undeveloped gaged watersheds with period of record greater than 30 years using USGS LP3 peak discharge data



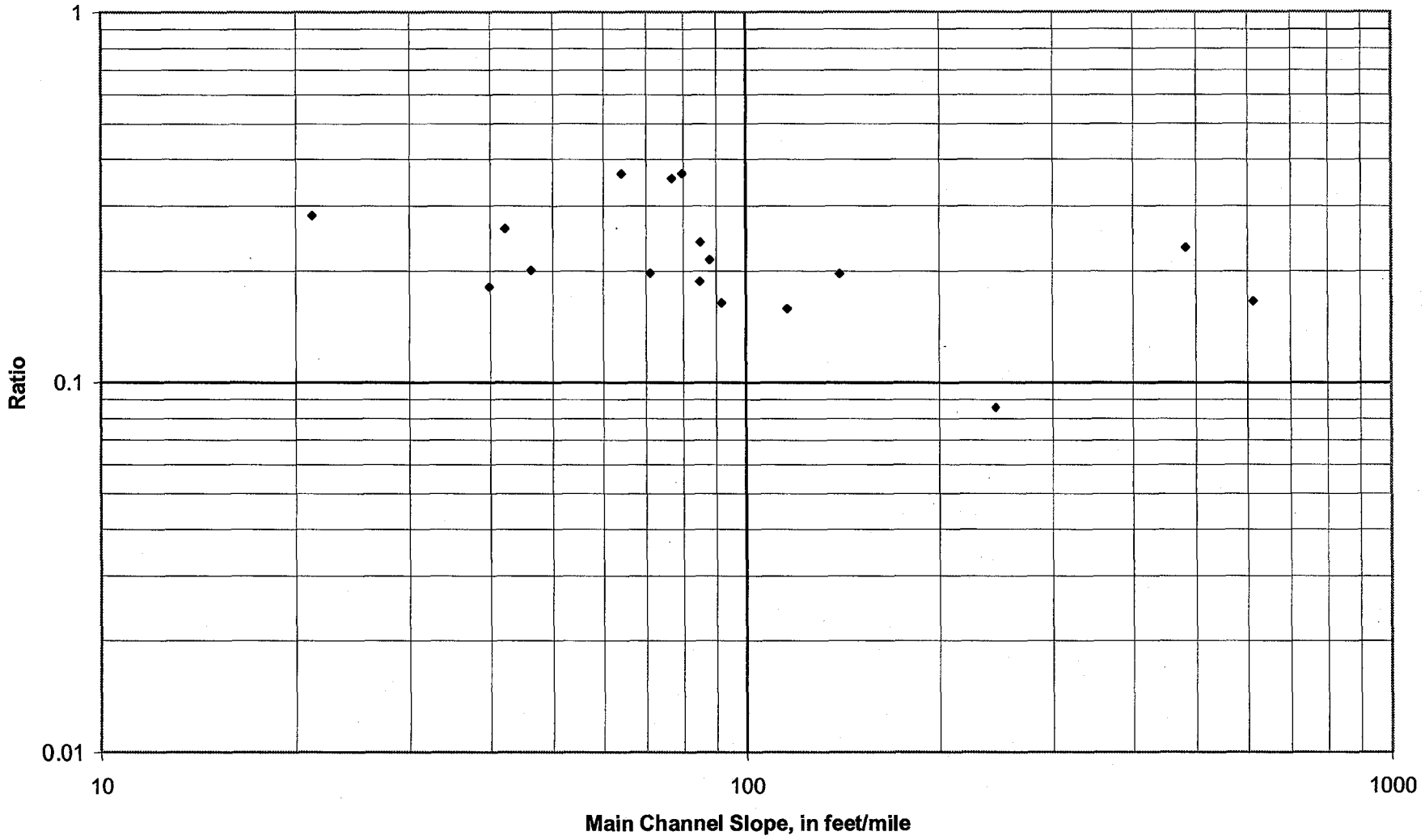
5-year ratios for selected undeveloped gaged watersheds with period of record greater than 30 years using USGS LP3 peak discharge data



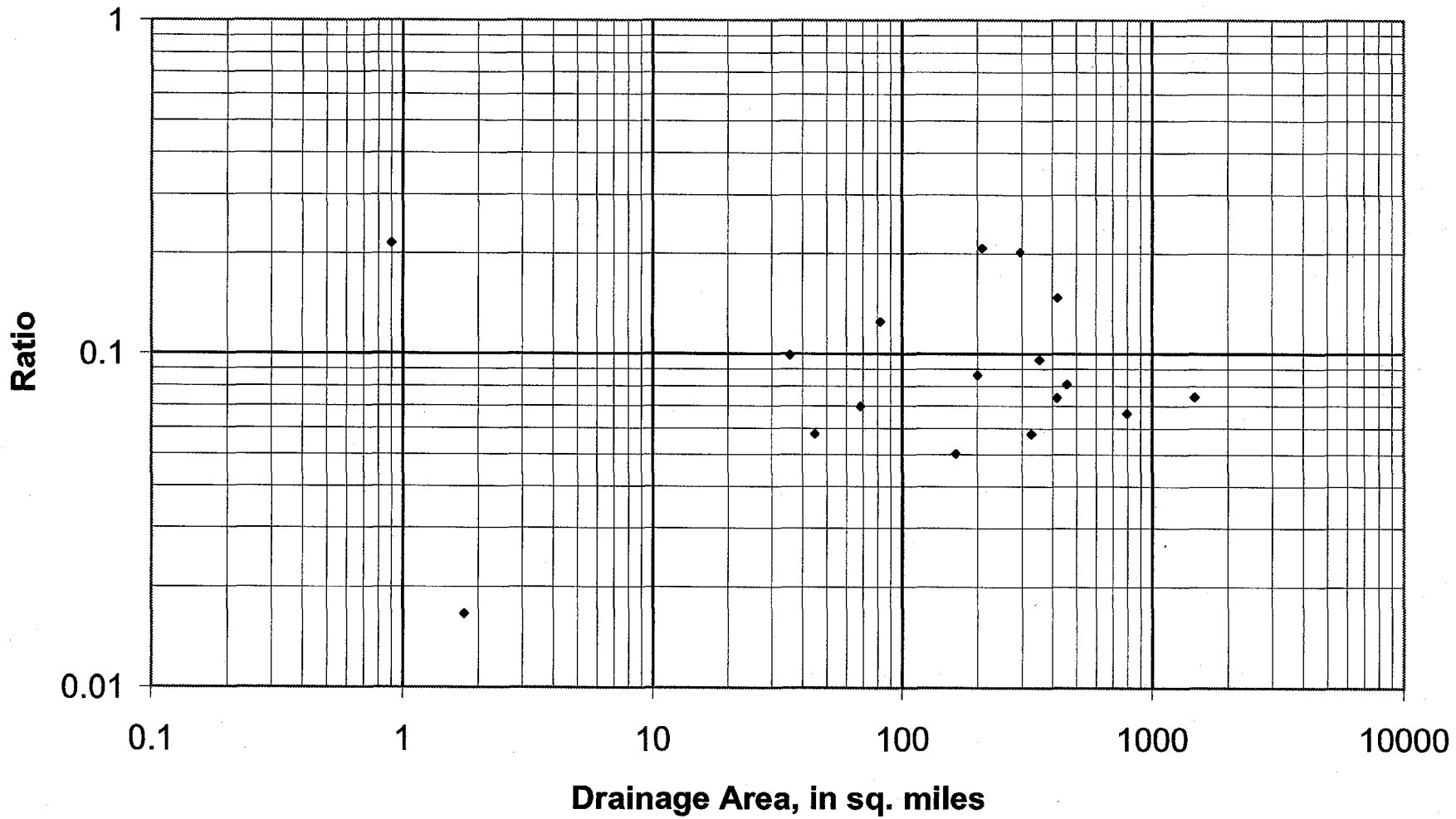
5-year ratios for selected undeveloped gaged watersheds with period of record greater than 30 years using USGS LP3 peak discharge data



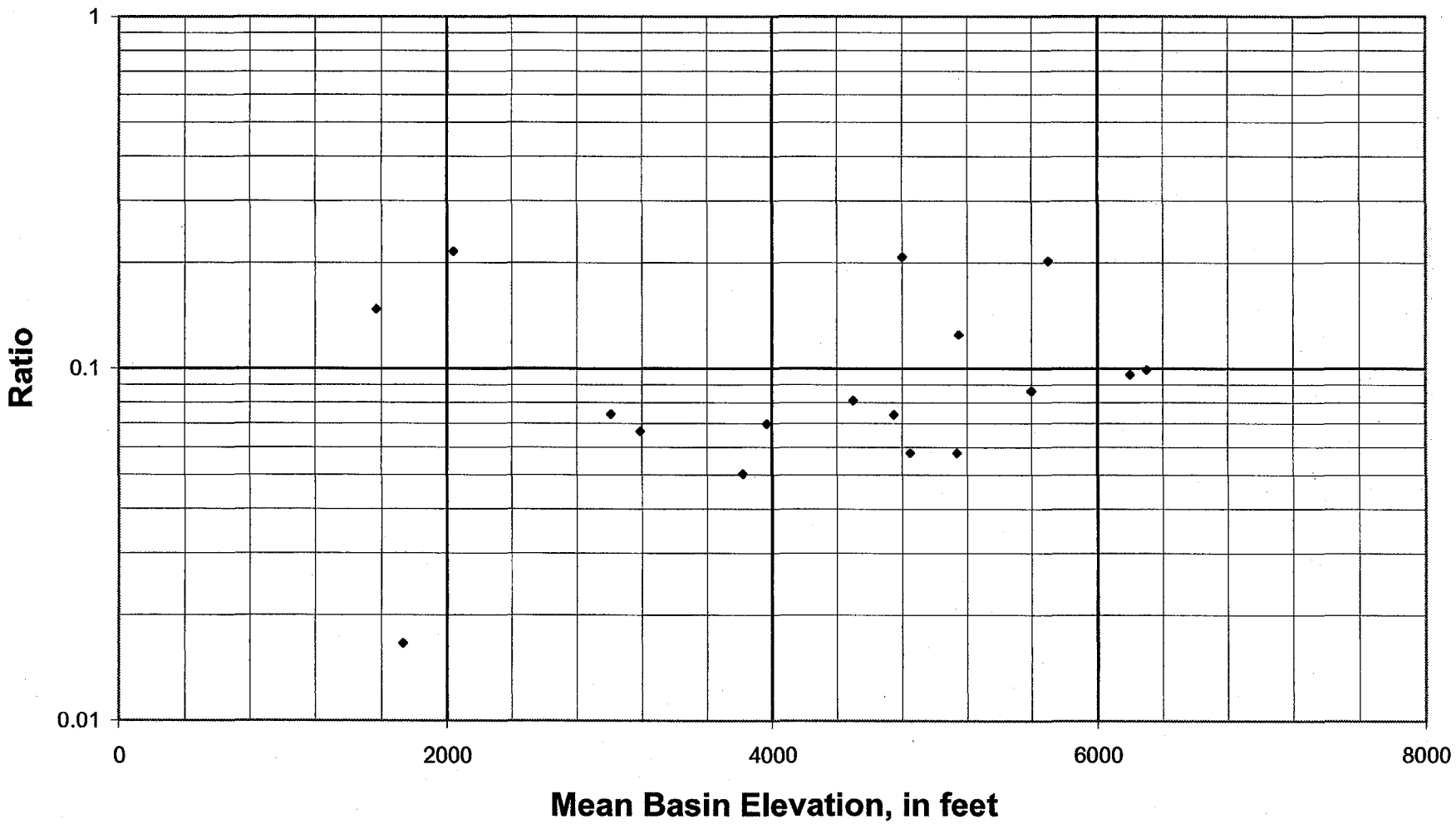
5-year ratios for selected undeveloped gaged watersheds with period of record greater than 30 years using USGS LP3 peak discharge data



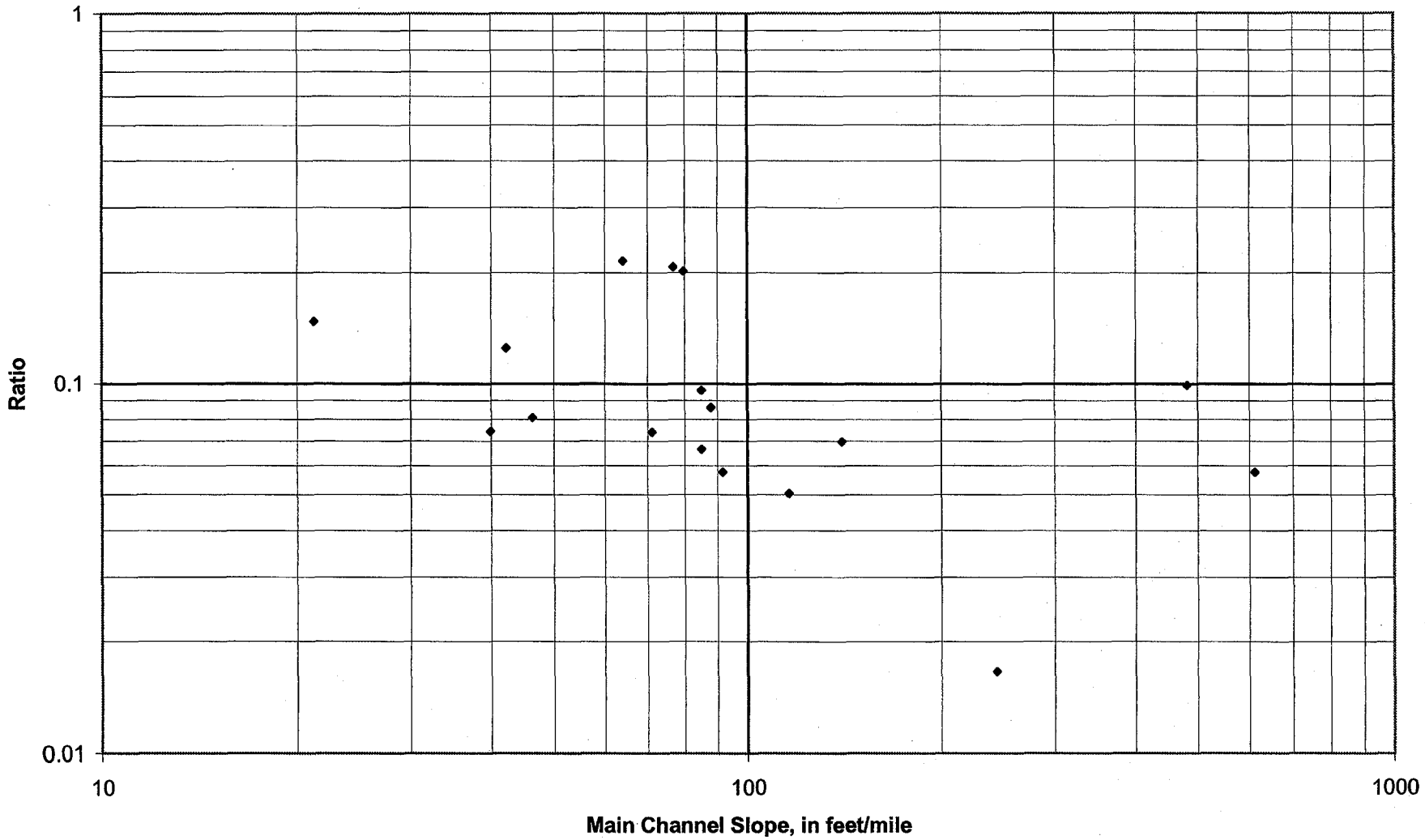
2-year ratios for selected undeveloped gaged watersheds with period of record greater than 30 years using USGS LP3 peak discharge data



2-year ratios for selected undeveloped gaged watersheds with period of record greater than 30 years using USGS LP3 peak discharge data



2-year ratios for selected undeveloped gaged watersheds with period of record greater than 30 years using USGS LP3 peak discharge data



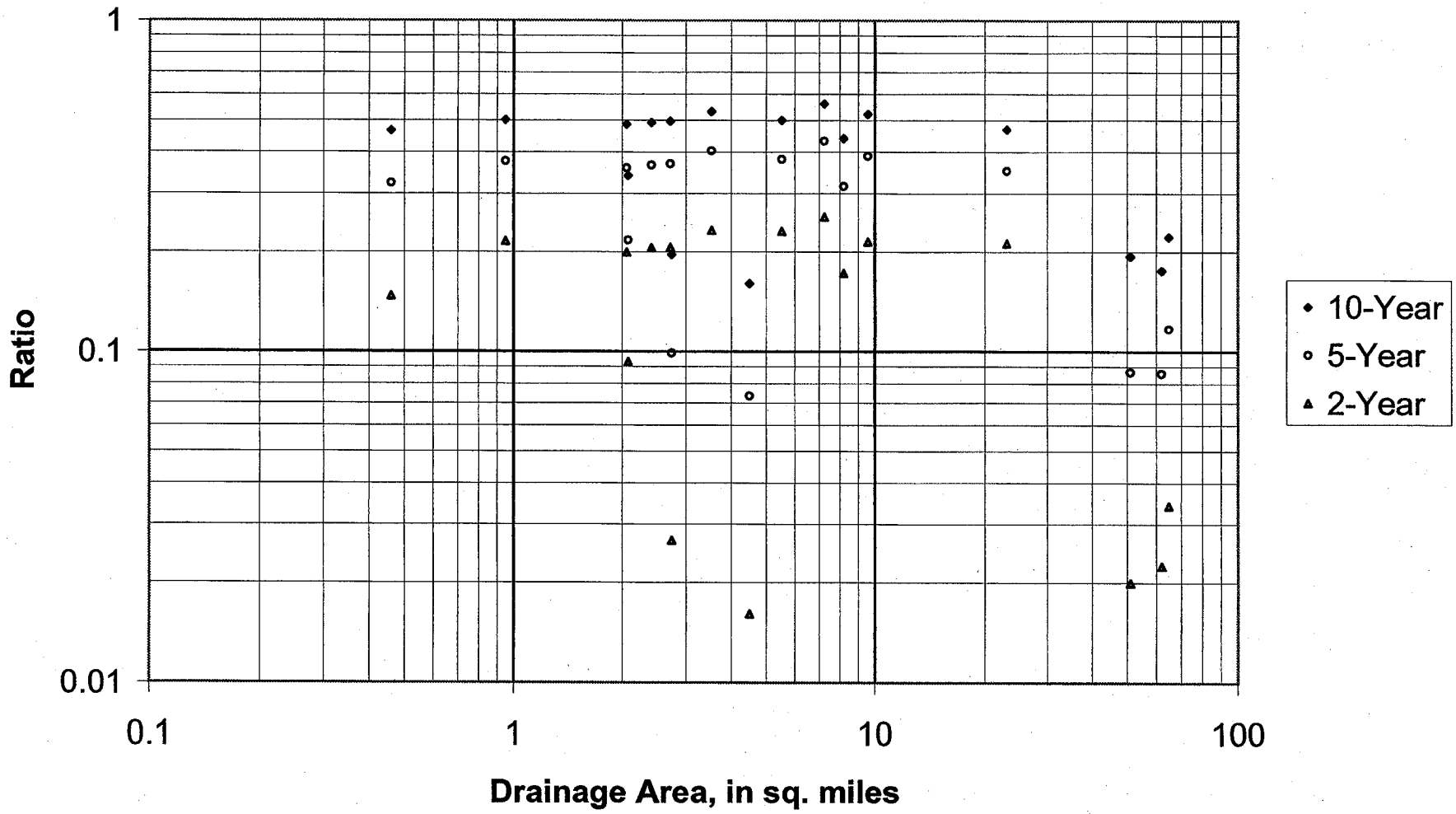
Ratios for the 10-, 5- and 2-year USGS LP3 peak discharges to the 100-year for all urbanized watersheds in Arizona

Gage No.	Station Name	Drainage Area sq. miles	Mean Basin Elevation feet	Main Channel Slope ft/mi	Log Pearson Type III Peak Discharge 100-Year cfs	10-Year cfs	5-Year cfs	2-Year cfs	Ratio to the 100-Year Discharge 10-Year %	5-Year %	2-Year %
9400600	Rio De Flag At Flagstaff, Ariz.	51	8050	106	861	167	74.5	17.2	0.19	0.09	0.02
9400660	Bow And Arrow Wash At Flagstaff, Ariz.	2.06	6990	46.5	111	53.9	39.7	22.1	0.49	0.36	0.20
9400700	Switzer Canyon Trib At Flagstaff, Ariz.	5.52	6950	267	326	163	124	75.2	0.50	0.38	0.23
9400740	Harenberg Wash At Flagstaff,Ariz.	2.41	7570	594	293	144	107	60.2	0.49	0.37	0.21
9482400	Airport Wash At Tucson, Ariz.	23	2700	37	1900	889	666	403	0.47	0.35	0.21
9482410	Rodeo Wash At Tucson, Ariz.	7.24	2560	33.7	1020	572	441	260	0.56	0.43	0.25
9483000	Tucson Arroyo At Vine Ave, At Tucson, Az.	8.2	2510	37	4890	2150	1540	842	0.44	0.31	0.17
9483010	High School Wash At Tucson Az	0.95	2460	1.11	1210	606	454	261	0.50	0.38	0.22
9483025	Silvercroft Wash At Tucson Az	2.74	2540	44.6	3360	659	332	90	0.20	0.10	0.03
9483040	West Speedway Wash Near Tucson, Ariz.	0.46	2750	364	627	291	202	92.2	0.46	0.32	0.15
9483045	Flowing Wells Wash At Tucson Az	3.53	2380	32.1	2260	1200	911	524	0.53	0.40	0.23
9483250	Rob Wash At Tucson Az	2.08	2710	55.6	2870	973	622	267	0.34	0.22	0.09
9485550	Arcadia Wash At Tucson,Arizona	2.72	2560	0.77	1920	953	707	395	0.50	0.37	0.21
9485570	Alamo Wash At Tucson Az	9.58	2590	46.2	7460	3890	2900	1600	0.52	0.39	0.21
9510100	East Fork Sycamore Creek Near Sunflower, Ariz.	4.49	5760	370	2670	428	196	43	0.16	0.07	0.02
9512100	Indian Bend Wash At Scottsdale Ariz	62	1780	60	16800	2950	1440	378	0.18	0.09	0.02
9513860	Skunk Creek Near Phoenix, Ariz.	64.9	2180	49.2	27600	6120	3230	940	0.22	0.12	0.03
								Mean:	**0.40**	**0.28**	**0.15**
								Standard Deviation:	**0.15**	**0.13**	**0.09**
								Sample Size:	**17**	**17**	**17**

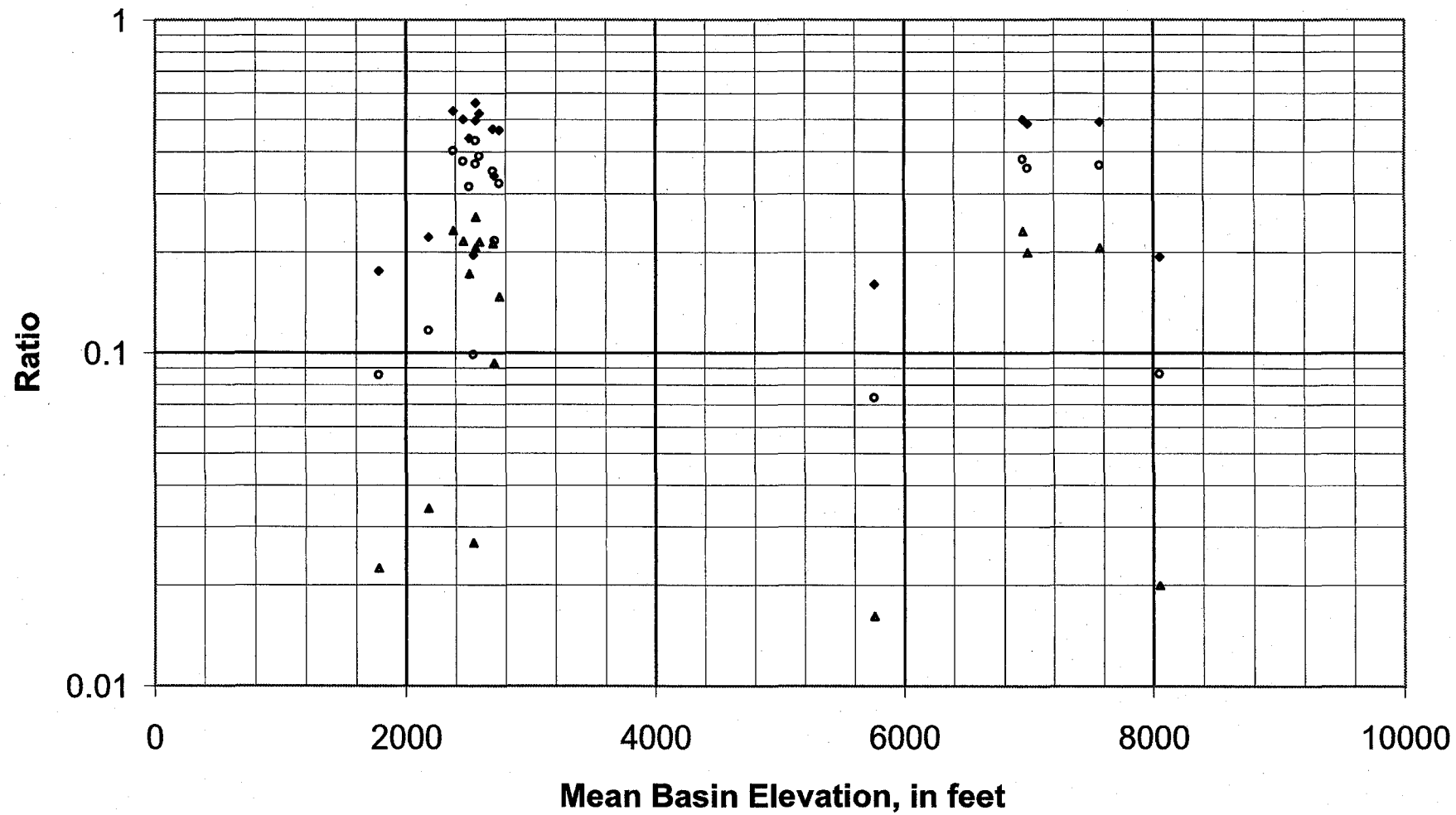
Descriptive Statistics

	10-Year	*5-Year*	*2-Year*
Mean	0.40	0.28	0.15
Standard Error	0.04	0.03	0.02
Median	0.47	0.35	0.20
Mode	#N/A	#N/A	#N/A
Standard Deviation	0.15	0.13	0.09
Sample Variance	0.02	0.02	0.01
Kurtosis	-1.32	-1.39	-1.53
Skewness	-0.73	-0.67	-0.56
Range	0.40	0.36	0.24
Minimum	0.16	0.07	0.02
Maximum	0.56	0.43	0.25
Sum	6.75	4.74	2.50
Count	17	17	17

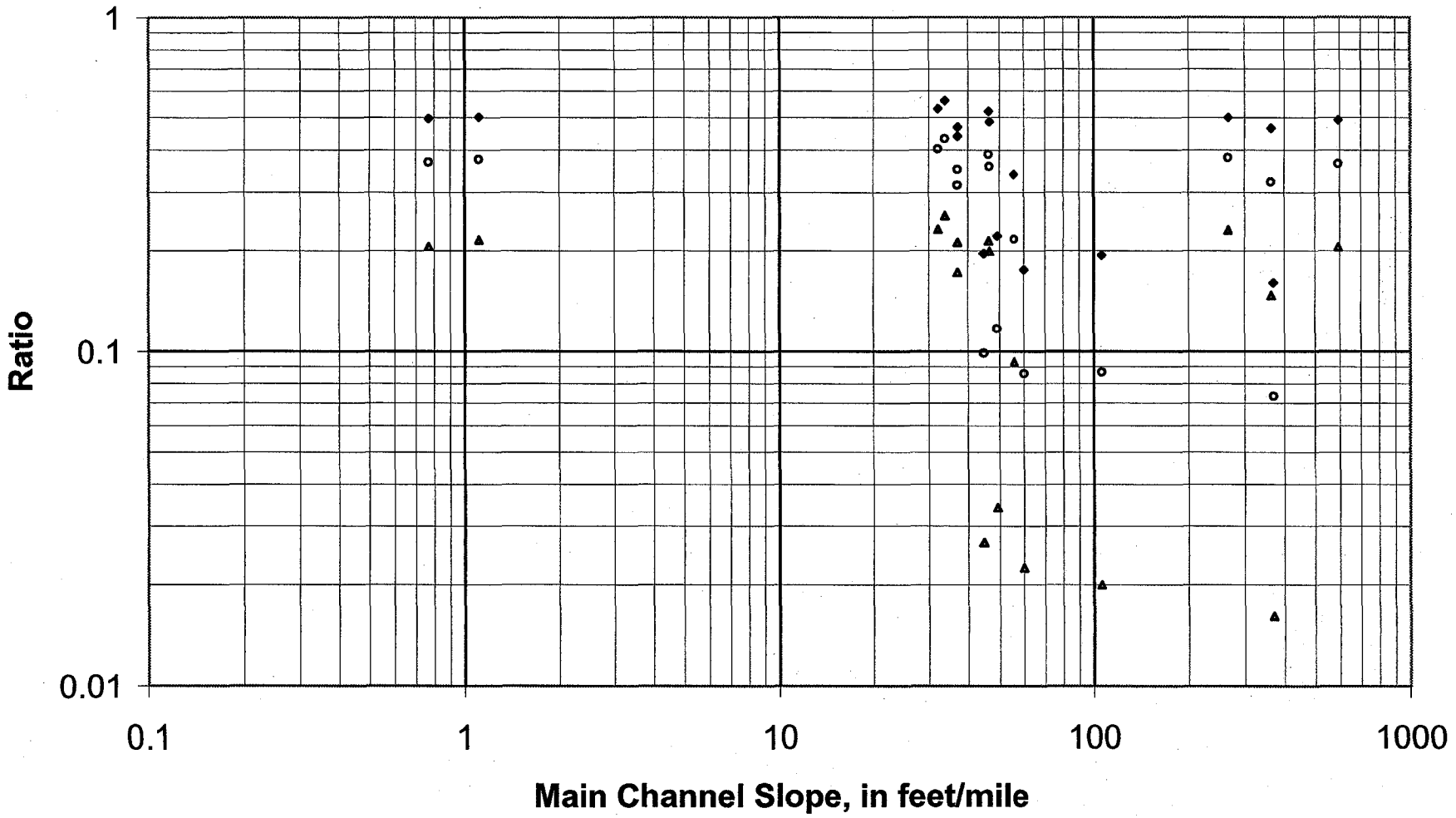
Ratios for all urban gaged watersheds using USGS LP3 peak discharge data



Ratios for all urban gaged watersheds using USGS LP3 peak discharge data



Ratios for all urban gaged watersheds using USGS LP3 peak discharge data



Ratios for the 10-, 5- and 2-year USGS LP3 peak discharges to the 100-year for selected urbanized watersheds in Arizona

Gage No.	Station Name	Drainage Area sq. miles	Mean Basin Elevation feet	Main Channel Slope ft/mi	Log Pearson Type III Peak Discharge 100-Year cfs	10-Year cfs	5-Year cfs	2-Year cfs	Ratio to the 100-Year Discharge 10-Year %	5-Year %	2-Year %
9482400	Airport Wash At Tucson, Ariz.	23	2700	37	1900	889	666	403	0.47	0.35	0.21
9482410	Rodeo Wash At Tucson, Ariz.	7.24	2560	33.7	1020	572	441	260	0.56	0.43	0.25
9483000	Tucson Arroyo At Vine Ave, At Tucson, Az.	8.2	2510	37	4890	2150	1540	842	0.44	0.31	0.17
9483010	High School Wash At Tucson Az	0.95	2460	1.11	1210	606	454	261	0.50	0.38	0.22
9483025	Silvercroft Wash At Tucson Az	2.74	2540	44.6	3360	659	332	90	0.20	0.10	0.03
9483042	Cemetery Wash At Tucson, Ariz.	1.17	2370	40	842	517	418	274	0.61	0.50	0.33
9483045	Flowing Wells Wash At Tucson Az	3.53	2380	32.1	2260	1200	911	524	0.53	0.40	0.23
9483250	Rob Wash At Tucson Az	2.08	2710	55.6	2870	973	622	267	0.34	0.22	0.09
9485550	Arcadia Wash At Tucson,Arizona	2.72	2560	0.77	1920	953	707	395	0.50	0.37	0.21
9485570	Alamo Wash At Tucson Az	9.58	2590	46.2	7460	3890	2900	1600	0.52	0.39	0.21
9510100	East Fork Sycamore Creek Near Sunflower, Ariz.	4.49	5760	370	2670	428	196	43	0.16	0.07	0.02
9512100	Indian Bend Wash At Scottsdale Ariz	62	1780	60	16800	2950	1440	378	0.18	0.09	0.02
9513860	Skunk Creek Near Phoenix, Ariz.	64.9	2180	49.2	27600	6120	3230	940	0.22	0.12	0.03
								Mean:	**0.40**	**0.29**	**0.16**
								Standard Deviation:	**0.16**	**0.15**	**0.10**
								Sample Size:	**13**	**13**	**13**

Descriptive Statistics

	10-Year	*5-Year*	*2-Year*
Mean	0.40	0.29	0.16
Standard Error	0.04	0.04	0.03
Median	0.47	0.35	0.21
Mode	#N/A	#N/A	#N/A
Standard Deviation	0.16	0.15	0.10
Sample Variance	0.03	0.02	0.01
Kurtosis	-1.46	-1.47	-1.34
Skewness	-0.49	-0.39	-0.20
Range	0.45	0.42	0.31
Minimum	0.16	0.07	0.02
Maximum	0.61	0.50	0.33
Sum	5.22	3.72	2.02
Count	13	13	13

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12TH STREET STORM DRAIN

- BOTH RATIONAL METHOD AND HEC-1 ARE USED.
  - RATIONAL METHOD WAS USED TO SIZE ALL CATCH BASINS AND A PORTION OF THE PIPE.
  - HEC-1 WAS USED TO SIZE THE REMAINING PIPE SEGMENTS

- RATIONAL METHOD - CITY OF PHOENIX MANUAL
  - 2-YR, 24-HOUR STORM
  - LAND USE BASED ON CITY'S ZONING MAPS
  - RUNOFF COEFFICIENT SELECTED & WEIGHTED IF NEC.
  - TIME OF CONCENTRATION CALCULATED BY ADDING LOT TRAVEL TIME TO STREET TRAVEL TIME
    - STREET TRAVEL TIME BASED ON SLOPE & FULL GUTTER VELOCITY
    - LOT TRAVEL TIME SET TO 0 MIN (IT APPEARS) I BELIEVE IT HAS TO DO W/ THE ON-LOT RETENTION FOR IRRIGATION

- HEC-1 - CITY OF PHOENIX MANUAL
  - RAINFALL DISTRIBUTION FROM COP MANUAL PC CARDS
  - SCS CURVE # USING TR55
  - SCS DIMENSIONLESS HYDROGRAPH
  - 2-YR, 24-HOUR STORM

- OVERALL WATERSHED AREA = 350 AC (0.55 SM)
  - ONLY 40% OF WHICH CONTRIBUTES RUNOFF

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DESERT RIDGE

- WATERSHED IS PART OF THE INDIAN BEND WASH REGIONAL DRAINAGE AND FLOOD CONTROL WATERSHED
- RAINFALL BROKEN INTO 3 ZONES
  - 100-YEAR, 24-HOUR HYPOTHETICAL DISTRIBUTION FOR EACH ZONE. 10^{YR}
  - POINT RAINFALL VALUES TAKEN FROM FCDMC MANUAL ISOPLUVIAL MAPS. APPROX 0.5" DIFFERENCE ACROSS ALL 3 ZONES
  - USED ADOT DDF PROCEDURES TO DETERMINE DISTRIBUTION FOR EACH ZONE
  - TAREA USED ON PH CARD, AREA IS FOR EACH ZONE.
- RAINFALL LOSSES
  - SCS CURVE #'S USING TR55
  - EXISTING CONDITION RTIMP = 0
  - POST-DEVELOPMENT RTIMP CALCULATED USING CITY OF SCOTTSDALE CURVE & WEIGHTING OF THE VALUES PER SUBBASIN.
- RUNOFF CALCULATED USING KINEMATIC WAVE PARAMETERS
- HYDROGRAPH ROUTING PERFORMED USING MODIFIED PULS NORMAL DEPTH
  - KINEMATIC WAVE ROUTING PARAMETERS; BOTTOM WIDTH CHANNEL LENGTH AND SLOPE WERE TRANSLATED TO NORMAL DEPTH.
- DESIGN DISCHARGES COMPARED W/ INDIRECT PROCEDURE FROM ADOT
- POST DEVELOPMENT Q'S REDUCED TO PRE DEVELOPMENT W/ DETENTION. STORAGE ROUTING DESIGNED TO SATISFY CITY OF PHOENIX REQUIREMENTS, 100-YR, 2-HR FOR 36 HPS.
- ON SITE DRAINAGE AREA IS 5700 ACRES (8.9 SM)
- TOTAL DRAINAGE AREA IS ≈ 55 SM

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FOOTHILLS PHASE 3 (SOUTH MOUNTAIN)

- MODELED USING HEC-1 FOLLOWING COP MANUAL
  - HYPOTHETICAL RAINFALL DISTRIBUTION FOR 2-HR (100-YR & 10-YR)
  - SCS CURVE #
    - OFFSITE: HSG & 15% VEG COVER - COP CHART
    - ON SITE: SOIL TYPE & LAND USE - COP CHART
  - SCS DIMENSIONLESS HYDROGRAPH - COP LAG
  - KINEMATIC WAVE HYDROGRAPH ROUTING
  - DENTENTION USING MODIFIED PULS
  - * STEEP SLOPES (1-3%)

- ON SITE DRAINAGE AREA IS 1500 AC (2.3 SM)
  TOTAL DRAINAGE AREA ≈ 5 SM

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SILVERADO RIDGE (SOUTH MOUNTAIN)

- MODELED USING TR-20 FOLLOWING COP MANUAL
  - COP RAINFALL DISTRIBUTION FOR 24-HR STORM (100-YR & 10-YR)
  - SCS CURVE #
  - RETENTION PER COP REQ.

- ON SITE DRAINAGE AREA IS 159 AC
- NO OFF SITE MAP

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48TH ST & CHANDLER BLVD

* THIS PROJECT IS ADJACENT TO SILVERADO RIDGE. THE STUDY WAS PERFORMED BEFORE SILVERADO RIDGE. ACCORDING TO SCOTT, THE SITE @ 48TH & CHANDLER WAS COMPLETELY REVISED BY CLOUSE AFTER COMPLETION OF THE STUDY. THEREFOR THE REPORT THAT WE HAVE DOES NOT REFLECT THE ACTUAL SITE CONDITIONS.

- MODELED USING TR-20 FOLLOWING COP MANUAL
  - COP RAINFALL DISTRIBUTION
  - SCS CN
  - RETENTION PER COP REQ.
- ON SITE DRAINAGE AREA IS 160 AC

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Memo

Stantec

To: File

From: Mike Gerlach
Stantec Consulting Inc.

File: 82000042

Date: 24 September 2001

Reference: Hydrology Testing

The purpose of this task is to reproduce existing watershed models using the procedures and methodologies set forth by the Flood Control District of Maricopa County. The results of the updated models are compared to those of the original models to determine potential differences due to modeling methodology. Two test studies are selected for this purpose. To the extent possible, physical data required for the determination of the Flood Control District of Maricopa County (District) methodology modeling parameters are taken directly from the original reports. Parameter estimation and other input values are then determined using the procedures specified in the Drainage Design Manual for Maricopa County, Volume I, Hydrology, Jan. 95 (Design Manual).

Master Drainage Study for Silverado Ridge

General

Silverado Ridge is a single family residential development located in Phoenix, Arizona at the intersection of Ray Rd. and 48th Street. The total drainage area, including off-site drainage is approximately 1.3 sq. miles. Hydrologic modeling was performed for the 100-year, 24-hour storm event for both pre- and post-development conditions using the Natural Resource Conservation Service (NCRS) TR-20 computer program. The 100-year, 24-hour point rainfall depth determined for the site was 4.04 inches. Rainfall losses were modeled using curve numbers that were selected based on the hydrologic soil group B. A portion of the off-site area was already developed at the time of this study, but the original modeling was not used. The remaining portion of the off-site area had already been studied and the resulting runoff hydrographs were incorporated directly into the TR-20 model for the Silverado Ridge study.

Rainfall

Updated models are developed for both the 6- and 24-hour storms for both pre- and post-development conditions. However, due to the input of the 24-hour off-site runoff hydrographs, the 6-hour storm is used for on-site comparisons only. The 100-year, 6-hour point rainfall depth for this area is estimated to be 3.25 inches. Rainfall depth-area reduction and distribution patterns are taken directly from the Design Manual.

Reference: Hydrology Testing

Pre-Development Condition Rainfall Loss Parameters

Rainfall losses are estimated for each subbasin using the Green & Ampt infiltration equation with additional consideration given to surface retention losses and impervious areas. The XKSAT variable of the Green & Ampt equation and the naturally occurring impervious percentage for each soil map unit present in the watershed are taken directly from Appendix C of the Design Manual. Identification of the soil map units present in the watershed was made by overlaying the subbasin delineation on a soil map from the NCRS publication entitled Soil Survey of Eastern Maricopa and Northern Pinal Counties Area, Arizona (1974). These map units along with the corresponding values for XKSAT and percent impervious are listed in Table 1.

Table 1

Summary of XKSAT and RTIMP values by soil map unit

Soil Class (1)	Bare Ground XKSAT in/hr (2)	RTIMP % (3)
AnB	0.40	0
AoB	0.40	0
Es	0.25	0
Gm	0.25	0
RIB	0.40	0
Ro	0.25	0
TrB	0.10	0
Va	0.40	0

The areal percentage of each map unit as it occurs within each subbasin was estimated from the soil map and was used to calculate an area weighted value of the XKSAT and percent impervious (RTIMP) parameters. Values for the parameters DTEHTA and PSIF are then selected base on the area weighted value of XKSAT. Values for the surface retention parameter (IA) as well as pre-development vegetative cover density (VCD) are assigned to each subbasin. Those values are 0.35 inches and 10% for IA and VCD, respectively.

For the two subbasins that were developed prior to this study, Land use parameters are selected based on an aerial photo included in the study report and guidance provided in the Design Manual. Table 2 lists the pre-development land uses present in the watershed and the corresponding rainfall loss characteristics. The areal percentage of land use as it occurs within the subbasins was estimated from an aerial photograph included with the study report and was used to calculate area weighted values of the rainfall loss parameters.

Table 2

Rainfall loss characteristics for each land use classification for pre-development conditions

Land-use Class (1)	Base RTIMP % (2)	Veg. Cover % (3)	IA in (4)
MDR	30	35	0.25
MFR	45	28	0.25
C	80	15	0.10
OPEN	0	0	0.00

Composite rainfall loss parameters are then computed for each subbasin based on the developed percentage. Those calculations are summarized in Table A-1 of Appendix A. The resulting area averaged rainfall loss parameters for each subbasin are summarized in Table 3. Intermediate calculations are also provided in Appendix A along with the soils and land use work maps.

Table 3

Summary of Green and Ampt rainfall loss input parameters for pre-development conditions

Subbasin ID (1)	Total sq. mi. (2)	IA inches (3)	DTHETA (4)	PSIF inches (5)	XKSAT in/hr (6)	RTIMP % (7)
S12	0.010	0.35	0.35	3.95	0.40	0
S20	0.100	0.24	0.25	4.40	0.40	38
S25	0.100	0.34	0.35	4.50	0.30	4
S30	0.090	0.35	0.35	4.15	0.37	0
S35	0.010	0.10	0.25	4.35	0.35	80
S40	0.100	0.35	0.35	4.25	0.35	0
S50	0.040	0.35	0.35	3.95	0.40	0
S60	0.110	0.35	0.35	4.20	0.36	0

Pre-Development Condition Unit Hydrograph Parameters

Stantec

Runoff hydrograph development is determined using the Clark unit hydrograph. Physical data required for the calculation of the input parameters, Time of Concentration (Tc) and Storage Coefficient (R) is taken directly from the study report. Those values are listed in Table 4. With the exception of subbasins S20 and S35, the watershed resistance coefficient (Kb) computed for each subbasin are based on

surface roughness category B. Subbasin S20 is completely developed and therefore the surface roughness category A is selected for the Kb calculation. The resulting values for Kb for each subbasin are listed in Table 4. The resulting Tc and R values for each subbasin are summarized in Table 5 for both the 6- and 24-hour storms. In addition to the Tc and R parameters, the Clark unit hydrograph requires the input of a time-area relation. With the exception of subbasins S20 and S35, the natural time-area relation is used for all subbasins. For subbasin S20 the urban time-area is used.

Table 4

Summary of Tc and R calculation parameters for pre-developed conditions

Sub-basin ID (1)	Area sq. mi. (2)	Flow Path Length feet (3)	Flow Path Length miles (4)	Slope ft/mile (5)	Surface Roughness Type (6)	Kb (7)	Time-Area Relation (8)
S12	0.010	900	0.170	52.80	B	0.07	Natural
S20	0.100	5100	0.966	52.80	A	0.03	Urban
S25	0.100	3200	0.606	52.80	B	0.06	Natural
S30	0.090	2800	0.530	52.80	B	0.06	Natural
S35	0.010	3540	0.670	52.80	A	0.03	Urban
S40	0.100	2900	0.549	52.80	B	0.06	Natural
S50	0.040	2600	0.492	52.80	B	0.06	Natural
S60	0.110	3400	0.644	52.80	B	0.05	Natural

Table 5

Summary of Clark unit hydrograph input parameters for pre-developed conditions

Subbasin ID (1)	6-Hour Tc hour (2)	6-Hour R hours (3)	24-Hour Tc hour (4)	24-Hour R hours (5)
S12	0.188	0.193	0.242	0.256
S20	0.288	0.335	0.350	0.417
S25	0.358	0.295	0.413	0.345
S30	0.333	0.259	0.392	0.310
S35	0.225	0.708	0.279	0.899
S40	0.338	0.255	0.400	0.308
S50	0.317	0.367	0.379	0.448
S60	0.333	0.270	0.392	0.323

Post-Development Condition Rainfall Loss Parameters

Post-development condition rainfall loss parameters are computed using the same data and procedures as for the pre-development condition. The only differences are the on-site subbasin delineation and the addition of the Park land use type. The post-development rainfall loss characteristics are summarized by land use in Table 6.

Table 6

Rainfall loss characteristics for each land use classification for post-development conditions

Land-use Class (1)	Base RTIMP % (2)	Veg. Cover % (3)	IA in (4)
MDR	30	35	0.25
MFR	45	28	0.25
C	80	15	0.10
OPEN	0	0	0.00
PARK	0	90	0.20

The composite rainfall loss parameters for post-development conditions are summarized in Table A-2 of Appendix A. The resulting area averaged rainfall loss parameters for each subbasin are summarized in Table 7. Intermediate calculations are also provided in Appendix A along with the soils and land use work maps.

Table 7

Summary of Green and Ampt rainfall loss input parameters for post-development conditions

Subbasin ID (1)	Total sq. mi. (2)	IA inches (3)	DTHETA (4)	PSIF inches (5)	XKSAT in/hr (6)	RTIMP % (7)
S12	0.010	0.35	0.35	3.95	0.40	0
S20	0.100	0.24	0.25	4.40	0.40	38
S25	0.100	0.34	0.35	4.50	0.30	4
S30	0.090	0.35	0.35	4.15	0.37	0
S35	0.010	0.10	0.25	4.35	0.35	80
S40	0.030	0.10	0.25	3.95	0.42	80
S50	0.060	0.25	0.25	4.00	0.50	30
S60	0.010	0.25	0.25	3.95	0.51	30
S62	0.030	0.25	0.25	4.15	0.47	30
S65	0.050	0.25	0.25	4.35	0.42	30
S70	0.040	0.25	0.25	4.55	0.37	30
S75	0.020	0.03	0.25	4.70	0.47	8

Post-Development Condition Unit Hydrograph Parameters

As with the pre-development condition, runoff hydrograph development is determined using the Clark unit hydrograph. Physical data required for the calculation of the input parameters, Time of Concentration (Tc) and Storage Coefficient (R) is taken directly from the study report. Those values are listed in Table 8. For subbasins S40 and S75, the Tc was set at 10-minutes. No other physical data was documented for these subbasins, therefore R was calculated using an arbitrary value for the flow path length with a Tc of 10-minutes. The Kb value for each subbasin was calculated based on type A for all on-site subbasins, with the off-site subbasins remaining unchanged. The resulting values for Kb for each subbasin are listed in Table 8. The resulting Tc and R values for each subbasin are summarized in Table 9 for both the 6- and 24-hour storms.

Table 8

Summary of Tc and R calculation parameters for post-developed conditions

Sub-basin ID (1)	Area sq. mi. (2)	Flow Path Length feet (3)	Flow Path Length miles (4)	Slope ft/mile (5)	Surface Roughness Type (6)	Kb (7)	Time-Area Relation (8)
S12	0.010	900	0.170	52.80	B	0.07	Natural
S20	0.100	5100	0.966	52.80	A	0.03	Urban
S25	0.100	3200	0.606	52.80	B	0.06	Natural
S30	0.090	2800	0.530	52.80	B	0.06	Natural
S35	0.010	3540	0.670	52.80	A	0.03	Urban
S40	0.030	---	---	---	---	---	Urban
S50	0.060	2500	0.473	52.80	A	0.03	Urban
S60	0.010	1450	0.275	52.80	A	0.03	Urban
S62	0.030	1750	0.331	52.80	A	0.03	Urban
S65	0.050	2950	0.559	52.80	A	0.03	Urban
S70	0.040	1675	0.317	52.80	A	0.03	Urban
S75	0.020	---	---	---	---	---	Urban

Table 9

Summary of Clark unit hydrograph input parameters for post-developed conditions

Subbasin ID (1)	6-Hour Tc hour (2)	6-Hour R hours (3)	24-Hour Tc hour (4)	24-Hour R hours (5)
S12	0.188	0.193	0.242	0.256
S20	0.288	0.335	0.392	0.310
S25	0.358	0.295	0.350	0.417
S30	0.333	0.259	0.413	0.345
S35	0.388	1.294	0.433	1.465
S40	0.167	0.059	0.167	0.059
S50	0.196	0.165	0.117	0.050
S60	0.150	0.221	0.250	0.217
S62	0.167	0.154	0.192	0.291
S65	0.213	0.230	0.208	0.198
S70	0.158	0.120	0.271	0.301
S75	0.167	0.075	0.167	0.075

Channel Routing

Channel routing is accomplished using the normal depth option. Physical data for the required input is taken directly from the study report.

Results

As specified in the Design Manual, for a drainage area of this size, the 6-hour storm is the design storm. Because some of the off-site flow was modeled as user input runoff hydrographs from an existing 24-hour model, a full comparison of the original results to those computed for the 6-hour design storm cannot be made. Therefore the 6-hour watershed models only contain the individual subbasin operations. Peak discharge and runoff volumes results from these models are compared to the results from the original 24-hour model in Tables 10 and 11 for pre- and post-development conditions, respectively. A comparison of peak discharge results for the 24-hour models is made for each modeling operation in Tables 12 and 13 for pre- and post-development conditions, respectively. In general the 6-hour FCDMC method peak discharge results for each subbasin are significantly higher for both pre- and post-development conditions than those of the original study. Conversely, the rainfall excess and thus runoff volume results are slightly lower for both pre- and post-development conditions than those of the original study. For the 24-hour comparison, the peak discharge and runoff volume results compare very favorably for both the pre- and post-development conditions.

Table 10

Comparison of new FCDMC 6-hour results with the original 24-hour results for pre-development conditions

Sub-basin ID	Drainage Area		Rainfall Excess		Runoff Volume		Peak Discharge		Unit Discharge	
	Original sq. miles	Updated sq. miles	Original inches	Updated inches	Original acre-ft	Updated acre-ft	Original cfs	Updated cfs	Original cfs/sq. mi.	Updated cfs/sq. mi.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
S12	0.01	0.01	1.84	1.40	1	1	12	21	1200	2100
S20	0.10	0.10	2.49	2.19	13	12	120	178	1200	1780
S25	0.10	0.10	1.92	1.59	10	8	116	167	1160	1670
S30	0.09	0.09	1.92	1.43	9	7	102	154	1133	1711
S35	0.01	0.01	3.80	2.93	2	2	23	14	2300	1400
S40	0.10	0.10	1.84	1.45	10	8	106	173	1060	1730
S50	0.04	0.04	1.84	1.40	4	3	48	56	1200	1400
S60	0.11	0.11	1.84	1.44	11	8	117	185	1064	1682

Table 11

Comparison of new FCDMC 6-hour results with the original 24-hour results for post-development conditions

Sub-basin ID	Drainage Area		Rainfall Excess		Runoff Volume		Peak Discharge		Unit Discharge	
	Original sq. miles	Updated sq. miles	Original inches	Updated inches	Original acre-ft	Updated acre-ft	Original cfs	Updated cfs	Original cfs/sq. mi.	Updated cfs/sq. mi.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
S12	0.01	0.01	1.84	1.40	1	1	12	21	1200	2100
S20	0.10	0.10	2.49	2.19	13	12	120	178	1200	1780
S25	0.10	0.10	1.92	1.59	10	8	116	167	1160	1670
S30	0.09	0.09	1.92	1.43	9	7	102	154	1133	1711
S35	0.01	0.01	3.80	2.93	2	2	26	14	2600	1400
S40	0.03	0.03	3.15	2.92	5	5	58	106	1933	3533
S50	0.06	0.06	2.49	1.97	8	6	84	140	1400	2333
S60	0.01	0.01	2.49	1.97	1	1	20	21	2000	2100
S62	0.03	0.03	2.49	1.99	4	3	43	74	1433	2467
S65	0.05	0.05	2.49	2.03	7	5	62	104	1240	2080
S70	0.04	0.04	2.49	2.07	5	4	51	111	1275	2775
S75	0.02	0.02	2.76	1.64	3	2	24	59	1200	2950

Table 12

Comparison of new FCDMC 24-hour results with the original 24-hour results for pre-development conditions

Sub-basin ID	Drainage Area		Rainfall Excess		Runoff Volume		Peak Discharge		Unit Discharge	
	Original sq. miles	Updated sq. miles	Original inches	Updated inches	Original acre-ft	Updated acre-ft	Original cfs	Updated cfs	Original cfs/sq. mi.	Updated cfs/sq. mi.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
MFR213	0.52	0.52	---	---	---	---	464	464	892	892
MFR214	0.05	0.05	---	---	---	---	60	60	1200	1200
C10	0.56	0.57	---	---	---	---	504	509	900	893
R11	0.56	0.57	---	---	---	---	504	499	900	875
S12	0.01	0.01	1.84	1.06	1	1	12	11	1200	1100
C13	0.57	0.58	---	---	---	---	514	508	902	876
B14	N/A	0.58	---	---	---	---	N/A	375	N/A	647
D14	0.15	0.58	---	---	---	---	139	133	927	229
S30	0.09	0.09	1.92	1.08	9	5	102	88	1133	978
C18	0.24	0.67	---	---	---	---	220	219	917	327
S20	0.1	0.10	2.49	2.24	13	12	120	104	1200	1040
R26	0.1	0.10	---	---	---	---	117	101	1170	1010
S25	0.1	0.10	1.92	1.26	10	7	116	100	1160	1000
C27	0.2	0.20	---	---	---	---	226	198	1130	990
C32	0.44	0.87	---	---	---	---	403	413	916	475
BB33	N/A	0.87	---	---	---	---	N/A	330	N/A	379
D33	0.13	0.87	---	---	---	---	95	83	731	95
S35	0.01	0.01	3.80	3.47	2	2	23	8	2300	800
C36	0.14	0.88	---	---	---	---	117	90	836	102
BB14	0.42	0.58	---	---	---	---	375	375	893	647
C37	0.56	0.88	---	---	---	---	492	465	879	528
R38	0.56	0.88	---	---	---	---	491	442	877	502
S40	0.1	0.10	1.84	1.10	10	6	106	100	1060	1000
C41	0.66	0.98	---	---	---	---	598	530	906	541
BB42	N/A	0.98	---	---	---	---	N/A	479	N/A	489
D42	0.07	0.98	---	---	---	---	60	51	857	52
MFR198	0.14	0.14	---	---	---	---	185	185	1321	1321
R51	0.14	0.14	---	---	---	---	174	169	1243	1207

Table 13

Comparison of new FCDMC 24-hour results with the original 24-hour results for post-development conditions

Sub-basin ID	Drainage Area		Rainfall Excess		Runoff Volume		Peak Discharge		Unit Discharge	
	Original sq. miles	Updated sq. miles	Original inches	Updated inches	Original acre-ft	Updated acre-ft	Original cfs	Updated cfs	Original cfs/sq. mi.	Updated cfs/sq. mi.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
MFR213	0.52	0.52	---	---	---	---	464	464	892	892
MFR214	0.05	0.05	---	---	---	---	60	60	1200	1200
C10	0.56	0.57	---	---	---	---	504	509	900	893
R11	0.56	0.57	---	---	---	---	504	499	900	875
S12	0.01	0.01	1.84	1.06	1	1	12	11	1200	1100
C13	0.57	0.58	---	---	---	---	514	508	902	876
B14	N/A	0.58	---	---	---	---	N/A	375	N/A	647
D14	0.15	0.58	---	---	---	---	139	133	927	229
S30	0.09	0.09	1.92	1.08	9	5	102	88	1133	978
C18	0.24	0.67	---	---	---	---	220	219	917	327
S20	0.1	0.10	2.49	2.24	13	12	120	104	1200	1040
R26	0.1	0.10	---	---	---	---	117	101	1170	1010
S25	0.1	0.10	1.92	1.26	10	7	116	100	1160	1000
C27	0.2	0.20	---	---	---	---	226	198	1130	990
C32	0.44	0.87	---	---	---	---	403	413	916	475
BB33	N/A	0.87	---	---	---	---	N/A	330	N/A	379
D33	0.13	0.87	---	---	---	---	95	83	731	95
S35	0.01	0.01	3.80	3.47	2	2	26	8	2600	800
C36	0.14	0.88	---	---	---	---	120	90	857	102
BB14	N/A	0.58	---	---	---	---	N/A	375	N/A	647
C37	0.57	0.88	---	---	---	---	495	465	868	528
R38	0.57	0.88	---	---	---	---	495	459	868	522
S40	0.03	0.03	3.15	3.46	5	6	58	56	1933	1867
C41	0.6	0.91	---	---	---	---	551	473	918	520
R42	0.6	0.91	---	---	---	---	551	468	918	514
S75	0.02	0.02	2.76	1.33	3	1	24	29	1200	1450
C76	0.62	0.93	---	---	---	---	575	474	927	510
S50	0.06	0.06	2.49	1.96	8	6	84	77	1400	1283

12th Street Storm Drain

General

The 12th Street storm drain project is for the extension of an existing storm drain from Bethany Home Road to the Arizona Canal. The total storm drain length along 12th Street is approximately 7,000 feet. The contributing watershed area is approximately 0.70 sq. miles and is a fully developed urban watershed. However, most of the residential portions of the watershed has on-lot retention for flood irrigation purposes. Therefore, these areas were excluded from the modeling effort. The remaining contributing drainage area is approximately 0.23 sq. miles. Hydrologic modeling was performed for the 2-year, 24-hour storm event using both HEC-1 and the Rational Method. The 2-year, 24-hour point rainfall depth was 1.44 inches. The Rational Method was used for sizing the catch basins and connector pipes while HEC-1 was used for sizing the main trunk line. For the HEC-1 modeling, rainfall losses were simulated using curve numbers based on land use. The SCS lag equation was used for the determination of runoff hydrographs.

Rainfall

The 2-year, 6-hour rainfall depth used for the HEC-1 modeling for this site is 1.20. Rainfall depth-area reduction and distribution patterns are taken directly from the Design Manual. For the Rational Method, the PREFRE computer program is used for the determination of a depth-duration-frequency table. The program requires the input of the 2-year, 6- and 24-hour rainfall depths along with the 100-year, 6- and 24-hour rainfall depths. Those values were estimated from the isopluvial maps provided in the Design Manual. The depth-duration-frequency data is listed in Table B-1 of Appendix B and is used to develop an average rainfall intensity-duration-frequency table for use in the Rational Method time of concentration calculations. The intensity-duration-frequency table developed for this site is listed in Table 14.

Table 14

Average rainfall intensity-duration-frequency data

Duration	Average Intensity, in inches/hour					
Minutes	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
5	3.84	4.92	5.76	6.96	7.80	8.64
10	2.82	3.78	4.38	5.28	5.94	6.66
15	2.32	3.12	3.68	4.48	5.08	5.68
30	1.52	2.10	2.48	3.02	3.44	3.84
60	0.93	1.30	1.54	1.88	2.14	2.40
120	0.51	0.71	0.85	1.04	1.18	1.32
180	0.36	0.50	0.60	0.73	0.83	0.93
360	0.20	0.28	0.33	0.41	0.46	0.52
720	0.11	0.15	0.18	0.22	0.26	0.29
1440	0.06	0.08	0.10	0.12	0.14	0.16

Rainfall Loss Parameters

Rainfall losses are estimated for each subbasin using the Green & Ampt infiltration equation with additional consideration given to surface retention losses and impervious areas. The XKSAT variable of the Green & Ampt equation and the naturally occurring impervious percentage for each soil map unit present in the watershed are taken directly from Appendix B of the Design Manual. Identification of the soil map units present in the watershed was made by overlaying the subbasin delineation on a soil map from the NCRS publication entitled Soil Survey of Maricopa County, Central Part (1977). These map units along with the corresponding values for XKSAT and percent impervious are listed in Table 15.

Table 15

Summary of XKSAT and RTIMP values by soil map unit

Soil Class (1)	Bare Ground XKSAT in/hr (2)	RTIMP % (3)
AbA	0.38	0
AdA	0.40	0
AdB	0.40	0
Cp	0.40	0
CrB	0.40	0
LcA	0.25	0

Because the majority of the watershed area is designated as non-contributing due to on-lot retention combined with the fact that the majority of the soil area within the watershed has the same rainfall loss characteristics, all subbasins are assigned an XKSAT value of 0.40 inches/hour with no naturally occurring impervious area. Values for the surface retention parameter (IA) as well as pre-development vegetative cover density (VCD) are assigned to each subbasin. Those values are 0.35 inches and 10% for IA and VCD, respectively.

Land use parameters are selected based on a current aerial photo of the area and guidance provided in the Design Manual. Table 16 lists the land uses present in the watershed and the corresponding rainfall loss characteristics. It is stated in the Design Manual that the rainfall loss characteristics for each land use are reflective of typical conditions and are inclusive of street right-of-way. This statement is particularly important for this analysis as the consideration of on-lot retention has, in general, resulted in drainage basins composed almost exclusively of the roadway limits. The areal percentage of land use associated with each subbasins was estimated from an aerial photograph based on an assumption of the extent of the land area that could drain to street system.

Table 16

Rainfall loss characteristics for each land use classification

Land-use Class (1)	Base RTIMP % (2)	Veg. Cover % (3)	IA in (4)
MDR	30	35	0.25
MFR	45	28	0.25
C	80	15	0.10
OPEN	0	0	0.00
LDR	15	43	0.30
VLDR	5	29	0.30

Composite rainfall loss parameters are then computed for each subbasin based on the developed percentage. Those calculations are summarized in Table B-2 of Appendix B. The resulting area averaged rainfall loss parameters for each subbasin are summarized in Table 17. Intermediate calculations are also provided in Appendix B.

Table 17

Summary of Green and Ampt rainfall loss input

Subbasin ID (1)	Total sq. mi. (2)	IA inches (3)	DTHETA (4)	PSIF inches (5)	XKSAT in/hr (6)	RTIMP % (7)
1S	0.013	0.25	0.25	3.95	0.51	30
2S	0.015	0.25	0.25	3.95	0.48	44
22S	0.002	0.25	0.25	3.95	0.51	30
9AS	0.043	0.24	0.25	3.95	0.50	35
23S	0.005	0.21	0.25	3.95	0.49	44
12S	0.011	0.25	0.25	3.95	0.51	30
11S	0.009	0.21	0.25	3.95	0.48	45
16S	0.033	0.27	0.25	3.95	0.51	30
15S	0.010	0.21	0.25	3.95	0.48	46
19AS	0.028	0.25	0.25	3.95	0.50	34
19BS	0.026	0.25	0.25	3.95	0.50	34
19C	0.020	0.25	0.25	3.95	0.50	33
20S	0.002	0.25	0.25	3.95	0.48	45
18S	0.010	0.24	0.25	3.95	0.47	49
26S	0.003	0.25	0.25	3.95	0.48	45

Unit Hydrograph Parameters

Runoff hydrograph development is determined using the Clark unit hydrograph. Physical data required for the calculation of the input parameters, Time of Concentration (Tc) and Storage Coefficient (R) is taken directly from the design report. Those values are listed in Table 18. The watershed resistance coefficient (Kb) computed for each subbasin are based on surface roughness category A. The resulting values for Kb for each subbasin are listed in Table 18. The resulting Tc and R values for each subbasin are summarized in Table 19. In addition to the Tc and R parameters, the Clark unit hydrograph requires the input of a time-area relation. The urban time-area relation is used for all subbasins.

Table 18

Summary of Tc and R calculation parameters

Sub-basin ID (1)	Area sq. mi. (2)	Flow Path Length feet (3)	Flow Path Length miles (4)	Slope ft/mile (5)	Surface Roughness Type (6)	Kb (7)	Time-Area Relation (8)
1S	0.013	1650	0.313	34.32	A	0.034	Urban
2S	0.015	1765	0.334	39.07	A	0.034	Urban
22S	0.002	1100	0.208	52.80	A	0.040	Urban
9AS	0.043	3040	0.576	34.32	A	0.031	Urban
23S	0.005	1220	0.231	49.10	A	0.037	Urban
12S	0.011	2700	0.511	26.40	A	0.035	Urban
11S	0.009	1260	0.239	38.54	A	0.035	Urban
16S	0.033	4870	0.922	42.24	A	0.032	Urban
15S	0.010	1946	0.369	43.30	A	0.035	Urban
19AS	0.028	1480	0.280	42.24	A	0.032	Urban
19BS	0.026	2650	0.502	41.18	A	0.032	Urban
19C	0.020	1590	0.301	41.18	A	0.033	Urban
20S	0.002	300	0.057	52.80	A	0.039	Urban
18S	0.010	1960	0.371	41.71	A	0.035	Urban
26S	0.003	750	0.142	40.13	A	0.038	Urban

Table 19

Summary of Clark unit hydrograph input parameters

Subbasin ID (1)	Tc hours (2)	R hours (3)
1S	0.388	0.606
2S	0.338	0.505
22S	0.300	0.956
9AS	0.554	0.743
23S	0.288	0.589
12S	0.608	1.628
11S	0.325	0.496
16S	0.758	1.783
15S	0.333	0.680
19AS	0.317	0.286
19BS	0.475	0.747
19C	0.338	0.398
20S	0.129	0.133
18S	0.338	0.692
26S	0.233	0.423

Channel Routing

Channel routing was simulated in the original design using the Kinematic Wave option of HEC-1. The modeling results were inspected for the effectiveness of this routing method in regard to attenuation of the runoff hydrograph through a storm drain. The results show that for several routing operations, the peak discharge was reduced with the maximum reduction being 1 cfs, but only one routing operation resulted in lagging (one time step) of the hydrograph. Based on the original modeling results all routing operations are eliminated.

Results

Peak discharge and runoff volume results from the HEC-1 model are compared to the results from the original 24-hour model in Table 20. In general, the 6-hour FCDMC method peak discharge and runoff volume results are lower than those of the original model. Rational Method results for each subbasin are compared in Table 21. In general, the Rational Method results are very similar. The primary difference

Table 20

Comparison of HEC-1 modeling results for the 2-year storm

	Drainage Area		Rainfall Excess		Runoff Volume		Peak Discharge		Unit Discharge	
HEC-1 ID	Original sq. miles	Updated sq. miles	Original inches	Updated inches	Original acre-ft	Updated acre-ft	Original cfs	Updated cfs	Original cfs/sq. mi.	Updated cfs/sq. mi.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1S	0.013	0.013	0.69	0.44	0.5	0.3	5	3	400	240
2S	0.015	0.015	0.59	0.60	0.5	0.5	6	5	414	342
22S	0.002	0.002	0.81	0.45	0.1	0.0	1	0	625	0
22C	0.029	0.029	0.65	0.52	1.0	0.8	12	9	420	314
9AS	0.043	0.043	0.64	0.50	1.4	1.1	16	9	376	210
23S	0.005	0.005	0.81	0.60	0.2	0.1	2	2	426	444
23C	0.076	0.076	0.65	0.51	2.6	2.1	30	19	395	250
12S	0.011	0.011	0.81	0.44	0.5	0.3	5	1	459	92
11S	0.009	0.009	0.81	0.62	0.4	0.3	5	3	543	326
11C	0.096	0.096	0.69	0.51	3.5	2.6	39	24	406	250
16S	0.033	0.033	0.75	0.44	1.3	0.8	14	3	419	90
15S	0.010	0.010	0.69	0.64	0.4	0.3	4	3	385	297
15C	0.140	0.140	0.70	0.50	5.2	3.7	56	29	401	208
19AS	0.028	0.028	0.69	0.48	1.0	0.7	12	11	432	396
19BS	0.026	0.026	0.69	0.48	1.0	0.7	11	6	426	233
19AB	0.054	0.054	0.69	0.48	2.0	1.4	23	16	429	299
19C	0.019	0.020	0.64	0.48	0.7	0.5	8	6	412	305
19CC	0.073	0.073	0.68	0.48	2.6	1.9	31	23	425	314
20S	0.002	0.002	0.64	0.62	0.1	0.1	1	1	435	435
18S	0.010	0.010	0.81	0.66	0.4	0.3	5	3	526	300
18C	0.225	0.225	0.70	0.56	8.3	6.7	91	55	405	244
26S	0.004	0.003	0.81	0.62	0.2	0.1	2	1	500	294
26C	0.229	0.229	0.70	0.50	8.5	6.1	92	56	402	245

Table 21

Comparison of Rational Method results

Drainage Basin ID (1)	Drainage Area acres (2)	Time of Concentration Reported minutes (3)	Time of Concentration Calculated minutes (4)	Intensity Reported in/hr (5)	Intensity Calculated in/hr (6)	Weighted Runoff Coefficient (7)	2-Year Peak Discharge Reported cfs (8)	2-Year Peak Discharge Calculated cfs (9)
DA1	3.62	4.8	10.0	2.30	2.64	0.61	5.1	5.8
DA1A	0.83	9.0	15.7	2.30	2.34	0.80	1.5	1.6
DA1B	3.52	10.9	17.0	2.23	2.19	0.61	4.8	4.7
DA2A	9.09	11.1	15.9	2.22	2.31	0.56	11.3	11.8
DA2	0.27	4.0	10.0	2.30	2.64	0.80	0.5	0.6
DA22	1.02	6.2	11.2	2.30	3.05	0.80	1.9	2.5
DA3	1.11	3.2	10.0	2.30	2.64	0.80	2.0	2.3
DA4	0.71	4.0	10.0	2.30	2.64	0.64	1.0	1.2
DA23	1.06	7.1	12.4	2.30	2.81	0.80	2.0	2.4
DA5-8 &9A	24.58	18.5	23.3	1.78	1.71	0.61	26.7	25.7
DA9B1-9B5	2.79	18.5	22.4	1.78	1.77	0.84	4.2	4.1
DA10A	0.73	1.7	10.0	2.30	2.64	0.87	1.5	1.7
DA23A	1.14	2.8	10.0	2.30	2.64	0.80	2.3	2.4
DA10B	1	2.2	10.0	2.30	2.64	0.84	2.1	2.2
DA10C	1.63	3.5	10.0	2.30	2.64	0.67	2.5	2.9
DA23B	0.29	1.9	10.0	2.30	2.64	0.80	0.5	0.6
DA12-13	6.96	22.1	28.2	1.62	1.48	0.79	8.9	8.1
DA11	0.99	5.1	10.3	2.30	3.26	0.70	1.6	2.3
DA14	2.13	8.7	15.5	2.30	2.36	0.77	3.8	3.9
DA15	2.61	2.8	10.0	2.30	2.64	0.88	3.3	6.1
DA24	1.6	11.8	27.6	2.17	1.50	0.71	2.8	1.7
DA16-17	21.38	22.2	30.1	1.62	1.40	0.69	23.6	20.6
DA17A	0.1	0.6	10.0	2.30	2.64	0.80	0.2	0.2
DA25	2.34	7.5	12.7	2.30	2.76	0.85	4.6	5.5
DA18A	2.51	5.5	10.4	2.30	3.23	0.69	4.0	5.6
DA26	0.86	4.6	10.0	2.30	2.64	0.80	1.6	1.8
DA18B	0.69	4.1	10.0	2.30	2.64	0.80	1.3	1.5

Table 21

Comparison of Rational Method results

Drainage Basin ID (1)	Drainage Area acres (2)	Time of Concentration Reported minutes (3)	Time of Concentration Calculated minutes (4)	Intensity Reported in/hr (5)	Intensity Calculated in/hr (6)	Weighted Runoff Coefficient (7)	2-Year Peak Discharge Reported cfs (8)	2-Year Peak Discharge Calculated cfs (9)
DA19B1	0.5	5.1	11.4	2.30	3.01	0.80	0.9	1.2
DA19A	17.79	9.1	13.0	2.30	2.71	0.67	27.5	32.3
DA19B	16.04	16.4	20.1	1.89	1.92	0.68	20.5	21.0
DA19C	3.19	8.2	13.3	2.30	2.66	0.67	4.9	5.7
DA19D	8.43	8.4	12.9	2.30	2.73	0.56	10.9	12.9
DA19E	0.39	1.7	10.0	2.30	2.64	0.59	0.5	0.6
DA19F	0.59	6.8	14.3	2.30	2.51	0.80	1.1	1.2
DA20	1.56	4.0	12.0	2.30	2.89	0.57	2.0	2.6
DA19G	0.71	1.5	10.0	2.30	2.64	0.83	1.4	1.6
DA21	0.61	2.6	10.0	2.30	2.64	0.81	1.1	1.3
DA27	0.86	4.7	10.0	2.30	2.64	0.80	1.6	1.8

Reference: Hydrology Testing

STANTEC CONSULTING INC.

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Water Resources Engineer
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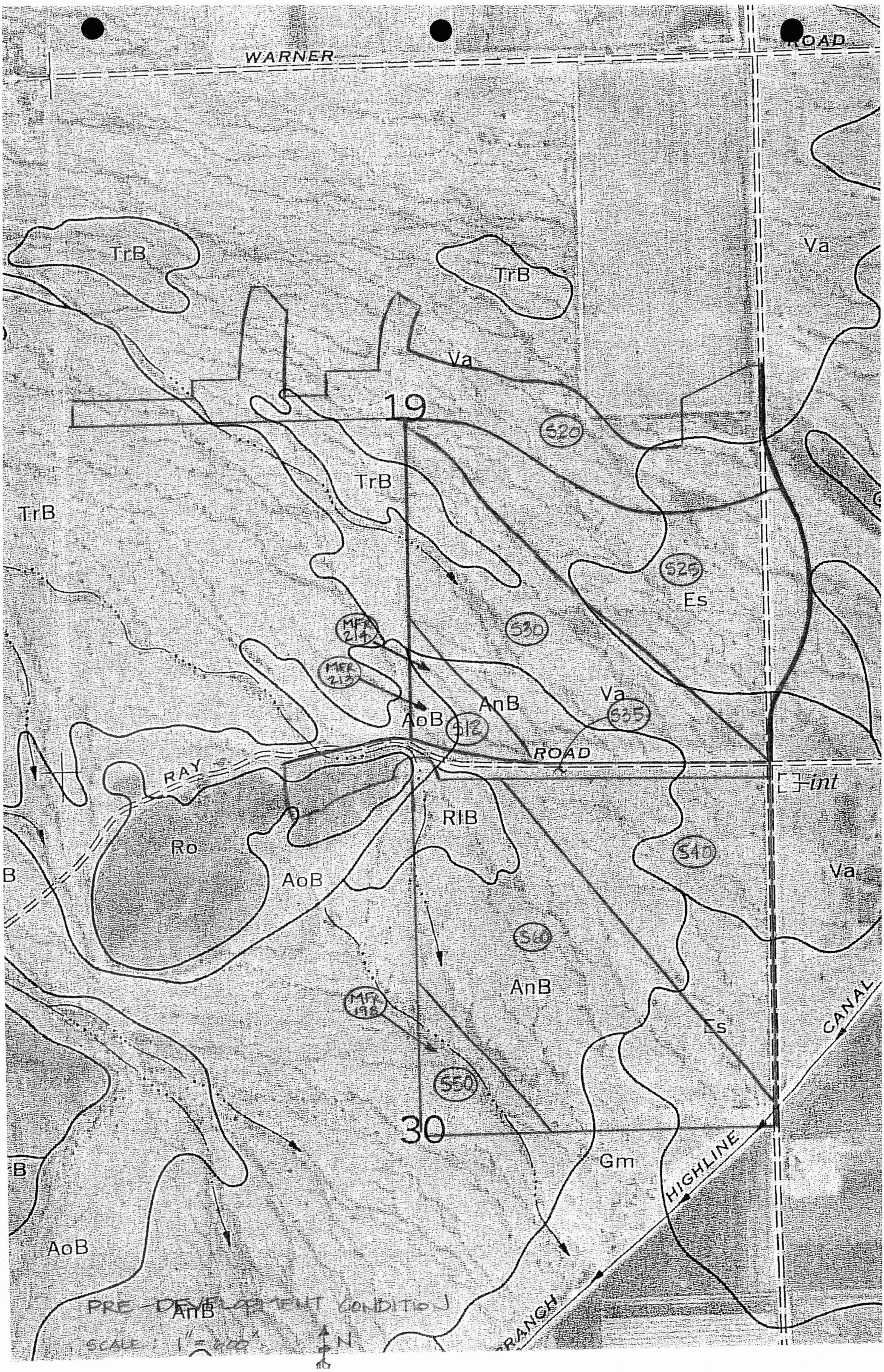
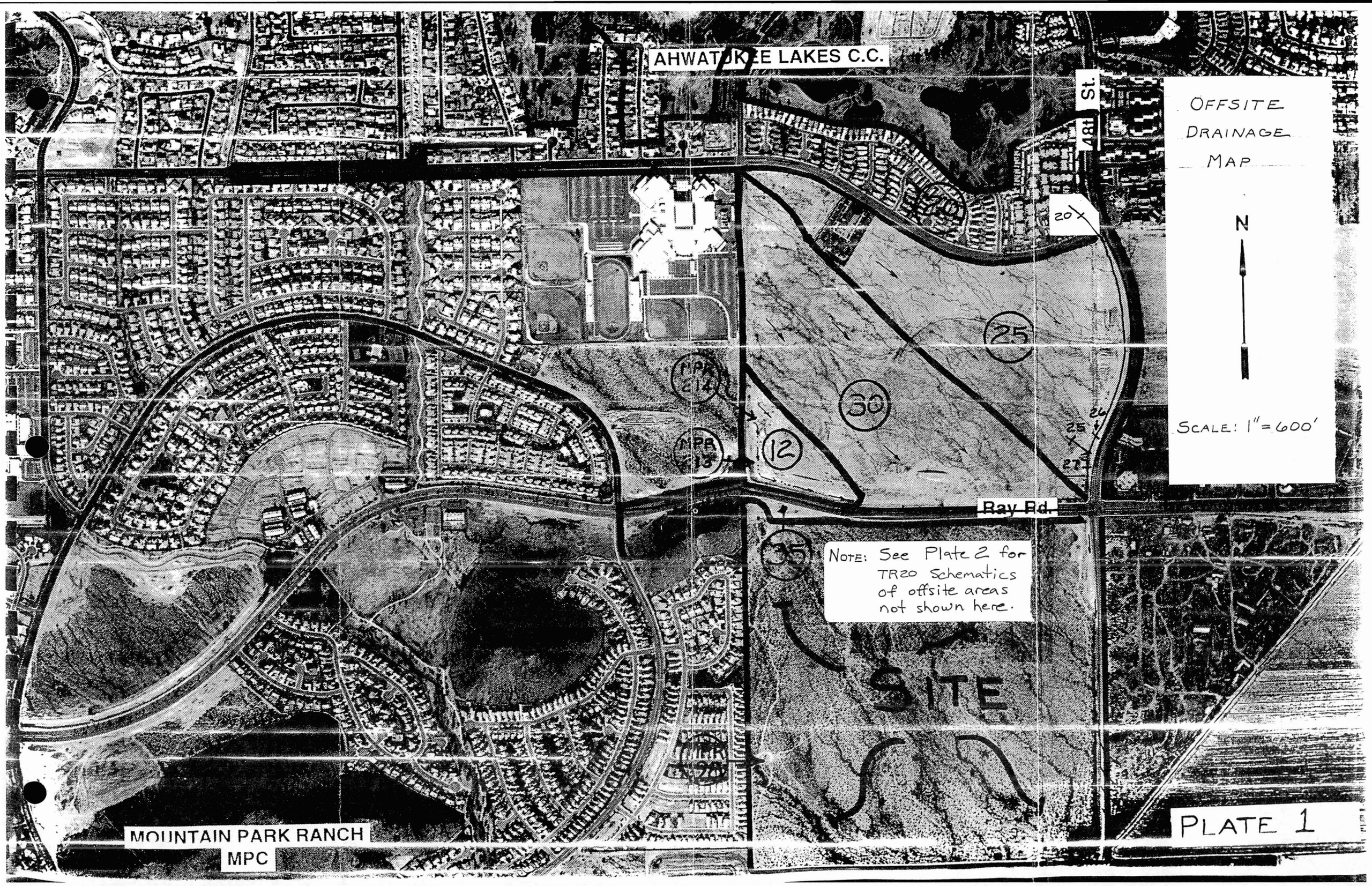
m document2

APPENDIX A

Silverado Ridge


WARNER
ROAD
TrB
TrB
Va
Va
19
520
TrB
TrB
525
Es
530
MFK 214
MFK 213
AnB
Va
535
AoB
512
ROAD
RAY
int
RIB
Ro
540
Va
AoB
560
AnB
MFK 198
Es
CANAL
550
30
Gm
HIGHLINE
AoB
AnB
PRE-DEVELOPMENT CONDITION
SCALE: 1" = 600'
N
BRANCH


AHWATUKEE LAKES C.C.
OFFSITE DRAINAGE MAP
N
SCALE: 1" = 600'
48th St.
20
25
30
12
35
NPR 214
NPR 213
26
25
27
Ray Rd.
NOTE: See Plate 2 for TR20 Schematics of offsite areas not shown here.
SITE
MOUNTAIN PARK RANCH
MPC
PLATE 1

Soils Worksheet

Soils compostition and corresponding natural condition Green & Ampt rainfall loss parameters for each subbasin for pre-development conditions

S12

Soil Class	...	AnB	AoB	Va
Sub-Area (acres)	...	3.2	2.6	0.6
XKSAT (bare ground)	...	0.40	0.40	0.40
RTIMP (rock)	...	0%	0%	0%
IA (natural only)	...	0.35	0.35	0.35

XKSAT log avg (bare ground) =	**0.40**	
PSIF =	**3.95**	
DTHETA (Dry) =	**0.35**	
DTHETA (Normal) =	**0.25**	
RTIMP avg. =	**0.00**	**%**
Veg. Cover avg. =	**10**	**%**
IA avg. =	**0.35**	

Total Sub Basin Area in sq. miles = 0.0100

S20

Soil Class	...	Es	TrB	Va
Sub-Area (acres)	...	9.6	6.4	48.0
XKSAT (bare ground)	...	0.25	0.10	0.40
RTIMP (rock)	...	0%	0%	0%
IA (natural only)	...	0.35	0.35	0.35

XKSAT log avg (bare ground) =	**0.32**	
PSIF =	**4.40**	
DTHETA (Dry) =	**0.35**	
DTHETA (Normal) =	**0.25**	
RTIMP avg. =	**0.00**	**%**
Veg. Cover avg. =	**10**	**%**
IA avg. =	**0.35**	

Total Sub Basin Area in sq. miles = 0.1000

S25

Soil Class	...	Es	Va
Sub-Area (acres)	...	38.4	25.6
XKSAT (bare ground)	...	0.25	0.40
RTIMP (rock)	...	0%	0%
IA (natural only)	...	0.35	0.35

XKSAT log avg (bare ground) =	**0.30**	
PSIF =	**4.50**	
DTHETA (Dry) =	**0.35**	
DTHETA (Normal) =	**0.25**	
RTIMP avg. =	**0.00**	**%**
Veg. Cover avg. =	**10**	**%**
IA avg. =	**0.35**	

Total Sub Basin Area in sq. miles = 0.1000

Soils Worksheet

Soils compostition and corresponding natural condition Green & Ampt rainfall loss parameters for each subbasin for pre-development conditions

S30

Soil Class	...	AnB	TrB	Va
Sub-Area (acres)	...	5.8	2.9	49.0
XKSAT (bare ground)	...	0.40	0.10	0.40
RTIMP (rock)	...	0%	0%	0%
IA (natural only)	...	0.35	0.35	0.35

XKSAT log avg (bare ground) =	**0.37**	
PSIF =	**4.15**	
DTHETA (Dry) =	**0.35**	
DTHETA (Normal) =	**0.25**	
RTIMP avg. =	**0.00**	**%**
Veg. Cover avg. =	**10**	**%**
IA avg. =	**0.35**	

Total Sub Basin Area in sq. miles = 0.0900

S35

Soil Class	...	AnB	AoB	RlB	Ro	Va
Sub-Area (acres)	...	1.0	1.9	0.3	2.6	0.6
XKSAT (bare ground)	...	0.40	0.40	0.40	0.25	0.40
RTIMP (rock)	...	0%	0%	0%	0%	0%
IA (natural only)	...	0.35	0.35	0.35	0.35	0.35

XKSAT log avg (bare ground) =	**0.33**	
PSIF =	**4.35**	
DTHETA (Dry) =	**0.35**	
DTHETA (Normal) =	**0.25**	
RTIMP avg. =	**0.00**	**%**
Veg. Cover avg. =	**10**	**%**
IA avg. =	**0.35**	

Total Sub Basin Area in sq. miles = 0.0100

S40

Soil Class	...	AnB	Va	Es
Sub-Area (acres)	...	25.6	19.2	19.2
XKSAT (bare ground)	...	0.40	0.40	0.25
RTIMP (rock)	...	0%	0%	0%
IA (natural only)	...	0.35	0.35	0.35

XKSAT log avg (bare ground) =	**0.35**	
PSIF =	**4.25**	
DTHETA (Dry) =	**0.35**	
DTHETA (Normal) =	**0.25**	
RTIMP avg. =	**0.00**	**%**
Veg. Cover avg. =	**10**	**%**
IA avg. =	**0.35**	

Total Sub Basin Area in sq. miles = 0.1000

Soils Worksheet

Soils compostition and corresponding natural condition Green & Ampt rainfall loss parameters for each subbasin for pre-development conditions

S50

Soil Class	...	AnB
Sub-Area (acres)	...	25.6
XKSAT (bare ground)	...	0.40
RTIMP (rock)	...	0%
IA (natural only)	...	0.35

XKSAT log avg (bare ground) =	**0.40**	
PSIF =	**3.95**	
DTHETA (Dry) =	**0.35**	
DTHETA (Normal) =	**0.25**	
RTIMP avg. =	**0.00**	**%**
Veg. Cover avg. =	**10**	**%**
IA avg. =	**0.35**	

Total Sub Basin Area in sq. miles = 0.0400

S60

Soil Class	...	AnB	AoB	Es	Gm	RIB	Ro
Sub-Area (acres)	...	42.2	3.5	7.0	7.0	7.0	3.5
XKSAT (bare ground)	...	0.40	0.40	0.25	0.25	0.40	0.25
RTIMP (rock)	...	0%	0%	0%	0%	0%	0%
IA (natural only)	...	0.35	0.35	0.35	0.35	0.35	0.35

XKSAT log avg (bare ground) =	**0.36**	
PSIF =	**4.20**	
DTHETA (Dry) =	**0.35**	
DTHETA (Normal) =	**0.25**	
RTIMP avg. =	**0.00**	**%**
Veg. Cover avg. =	**10**	**%**
IA avg. =	**0.35**	

Total Sub Basin Area in sq. miles = 0.1100

Land Use Worksheet

Worksheet
Land use composition and corresponding rainfall loss characteristics for each subbasin
Pre-development condition

S12

Land Use Class	...	OPEN
Natural or Developed	...	N
Sub-Area (acres)	...	6.4
Base RTIMP (Dev.)	...	---
Veg. Cover (Developed)	...	---
IA (Developed)	...	---

Natural Area	**=**	**100.00**	**%**
Developed Area	**=**	**0.00**	**%**
RTIMP (Dev.) avg.	**=**	**0.00**	**%**
Veg Cover (Dev.) avg.	**=**	**0.00**	**%**
IA (Dev.) avg.	**=**	**0.00**	

Total Sub Basin Area in sq. miles = 0.0100

S20

Land Use Class	...	C	MDR	MFR
Natural or Developed	...	D	D	D
Sub-Area (acres)	...	6.4	44.8	12.8
Base RTIMP (Dev.)	...	80%	30%	45%
Veg. Cover (Developed)	...	15%	35%	28%
IA (Developed)	...	0.10	0.25	0.25

Natural Area	**=**	**0.00**	**%**
Developed Area	**=**	**100.00**	**%**
RTIMP (Dev.) avg.	**=**	**38.00**	**%**
Veg Cover (Dev.) avg.	**=**	**31.50**	**%**
IA (Dev.) avg.	**=**	**0.24**	

Total Sub Basin Area in sq. miles = 0.1000

S25

Land Use Class	...	C	OPEN
Natural or Developed	...	D	N
Sub-Area (acres)	...	3.2	60.8
Base RTIMP (Dev.)	...	80%	---
Veg. Cover (Developed)	...	15%	---
IA (Developed)	...	0.10	---

Natural Area	**=**	**95.00**	**%**
Developed Area	**=**	**5.00**	**%**
RTIMP (Dev.) avg.	**=**	**80.00**	**%**
Veg Cover (Dev.) avg.	**=**	**15.00**	**%**
IA (Dev.) avg.	**=**	**0.10**	

Total Sub Basin Area in sq. miles = 0.1000

Land Use Worksheet

Worksheet
Land use composition and corresponding rainfall loss characteristics for each subbasin
Pre-development condition

S30

Land Use Class	...	OPEN
Natural or Developed	...	N
Sub-Area (acres)	...	57.6
Base RTIMP (Dev.)	...	---
Veg. Cover (Developed)	...	---
IA (Developed)	...	---

Natural Area	**=**	**100.00**	**%**
Developed Area	**=**	**0.00**	**%**
RTIMP (Dev.) avg.	**=**	**0.00**	**%**
Veg Cover (Dev.) avg.	**=**	**0.00**	**%**
IA (Dev.) avg.	**=**	**0.00**	

Total Sub Basin Area in sq. miles = 0.0900

S35

Land Use Class	...	C
Natural or Developed	...	D
Sub-Area (acres)	...	6.4
Base RTIMP (Dev.)	...	80%
Veg. Cover (Developed)	...	15%
IA (Developed)	...	0.10

Natural Area	**=**	**0.00**	**%**
Developed Area	**=**	**100.00**	**%**
RTIMP (Dev.) avg.	**=**	**80.00**	**%**
Veg Cover (Dev.) avg.	**=**	**15.00**	**%**
IA (Dev.) avg.	**=**	**0.10**	

Total Sub Basin Area in sq. miles = 0.0100

S40

Land Use Class	...	OPEN
Natural or Developed	...	N
Sub-Area (acres)	...	64.0
Base RTIMP (Dev.)	...	---
Veg. Cover (Developed)	...	---
IA (Developed)	...	---

Natural Area	**=**	**100.00**	**%**
Developed Area	**=**	**0.00**	**%**
RTIMP (Dev.) avg.	**=**	**0.00**	**%**
Veg Cover (Dev.) avg.	**=**	**0.00**	**%**
IA (Dev.) avg.	**=**	**0.00**	

Total Sub Basin Area in sq. miles = 0.1000

Land Use Worksheet

Worksheet
Land use composition and corresponding rainfall loss characteristics for each subbasin
Pre-development condition

S50

Land Use Class	...	OPEN
Natural or Developed	...	N
Sub-Area (acres)	...	25.6
Base RTIMP (Dev.)	...	---
Veg. Cover (Developed)	...	---
IA (Developed)	...	---

Natural Area	**=**	**100.00**	**%**
Developed Area	**=**	**0.00**	**%**
RTIMP (Dev.) avg.	**=**	**0.00**	**%**
Veg Cover (Dev.) avg.	**=**	**0.00**	**%**
IA (Dev.) avg.	**=**	**0.00**	

Total Sub Basin Area in sq. miles = 0.0400

S60

Land Use Class	...	OPEN
Natural or Developed	...	N
Sub-Area (acres)	...	70.4
Base RTIMP (Dev.)	...	---
Veg. Cover (Developed)	...	---
IA (Developed)	...	---

Natural Area	**=**	**100.00**	**%**
Developed Area	**=**	**0.00**	**%**
RTIMP (Dev.) avg.	**=**	**0.00**	**%**
Veg Cover (Dev.) avg.	**=**	**0.00**	**%**
IA (Dev.) avg.	**=**	**0.00**	

Total Sub Basin Area in sq. miles = 0.1100

Table A-1

Green & Ampt rainfall loss parameters for each subbasin

Sub-basin ID	Total sq. mi.	Area Natural %	Urban %	IA, in inches			RTIMP, in %			Vegetation Cover, in %			XKSAT Bare Ground in/hr	PSIF inches	DTHETA			XKSAT Corrected for Veg. in/hr
				Natural	Urban	Weighted	Natural	Urban	Total	Natural	Urban	Weighted			Natural dry	Urban normal	Weighted	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
S12	0.0100	100.0	0.0	0.35	0.00	0.35	0	0	0	10	0	10	0.40	3.95	0.35	0.25	0.35	0.40
S20	0.1000	0.0	100.0	0.35	0.24	0.24	0	38	38	10	32	32	0.32	4.40	0.35	0.25	0.25	0.40
S25	0.1000	95.0	5.0	0.35	0.10	0.34	0	80	4	10	15	10	0.30	4.50	0.35	0.25	0.35	0.30
S30	0.0900	100.0	0.0	0.35	0.00	0.35	0	0	0	10	0	10	0.37	4.15	0.35	0.25	0.35	0.37
S35	0.0100	0.0	100.0	0.35	0.10	0.10	0	80	80	10	15	15	0.33	4.35	0.35	0.25	0.25	0.35
S40	0.1000	100.0	0.0	0.35	0.00	0.35	0	0	0	10	0	10	0.35	4.25	0.35	0.25	0.35	0.35
S50	0.0400	100.0	0.0	0.35	0.00	0.35	0	0	0	10	0	10	0.40	3.95	0.35	0.25	0.35	0.40
S60	0.1100	100.0	0.0	0.35	0.00	0.35	0	0	0	10	0	10	0.36	4.20	0.35	0.25	0.35	0.36

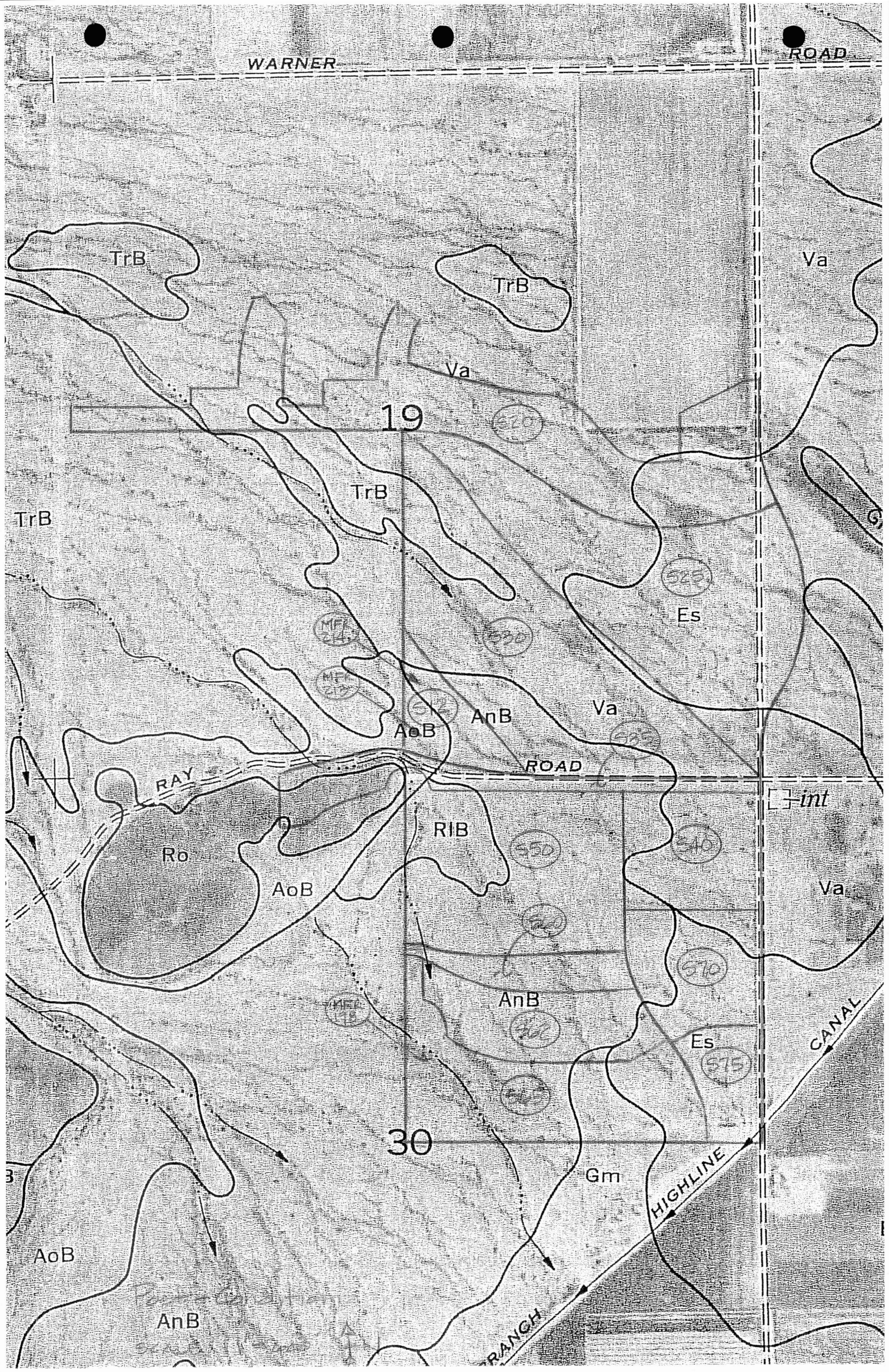
IA composite: (7) = [(5)*(3) + (6)*(4)]/100

RTIMP total: (10) = (8) + [1 - (8)/100] * (4) * (9)/100

Vegetation Cover composite: (13) = [(11)*(3) + (12)*(4)]/100

DTHETA composite: (18) = [(16)*(3) + (17)*(4)]/100

XKSAT Corrected: (19) = (14)*[(13)/100 * 1.111 + 0.889] where (13) > 10 and (14) < 1.2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ROAD
TrB
TrB
Va
Va
19
TrB
TrB
Es
Va
AnB
AoB
ROAD
RAY
int
RlB
Ro
AoB
Va
AnB
Es
CANAL
30
Gm
HIGHLINE
AoB
AnB
RANCH

Soils Worksheet

Soils compostition and corresponding natural condition Green & Ampt rainfall loss parameters for each subbasin for post-development conditions

S12

Soil Class ...	AnB	AoB	Va
Sub-Area (acres) ...	3.2	2.6	0.6
XKSAT (bare ground) ...	0.40	0.40	0.40
RTIMP (rock) ...	0%	0%	0%
IA (natural only) ...	0.35	0.35	0.35

XKSAT log avg (bare ground) =	**0.40**	
PSIF =	**3.95**	
DTHETA (Dry) =	**0.35**	
DTHETA (Normal) =	**0.25**	
RTIMP avg. =	**0.00**	**%**
Veg. Cover avg. =	**10**	**%**
IA avg. =	**0.35**	

Total Sub Basin Area in sq. miles = 0.0100

S20

Soil Class ...	Es	TrB	Va
Sub-Area (acres) ...	9.6	6.4	48.0
XKSAT (bare ground) ...	0.25	0.10	0.40
RTIMP (rock) ...	0%	0%	0%
IA (natural only) ...	0.35	0.35	0.35

XKSAT log avg (bare ground) =	**0.32**	
PSIF =	**4.40**	
DTHETA (Dry) =	**0.35**	
DTHETA (Normal) =	**0.25**	
RTIMP avg. =	**0.00**	**%**
Veg. Cover avg. =	**10**	**%**
IA avg. =	**0.35**	

Total Sub Basin Area in sq. miles = 0.1000

S25

Soil Class ...	Es	Va
Sub-Area (acres) ...	38.4	25.6
XKSAT (bare ground) ...	0.25	0.40
RTIMP (rock) ...	0%	0%
IA (natural only) ...	0.35	0.35

XKSAT log avg (bare ground) =	**0.30**	
PSIF =	**4.50**	
DTHETA (Dry) =	**0.35**	
DTHETA (Normal) =	**0.25**	
RTIMP avg. =	**0.00**	**%**
Veg. Cover avg. =	**10**	**%**
IA avg. =	**0.35**	

Total Sub Basin Area in sq. miles = 0.1000

Soils Worksheet

Soils compostition and corresponding natural condition Green & Ampt rainfall loss parameters for each subbasin for post-development conditions

S30

Soil Class	...	AnB	TrB	Va
Sub-Area (acres)	...	5.8	2.9	49.0
XKSAT (bare ground)	...	0.40	0.10	0.40
RTIMP (rock)	...	0%	0%	0%
IA (natural only)	...	0.35	0.35	0.35

XKSAT log avg (bare ground) =	**0.37**	
PSIF =	**4.15**	
DTHETA (Dry) =	**0.35**	
DTHETA (Normal) =	**0.25**	
RTIMP avg. =	**0.00**	**%**
Veg. Cover avg. =	**10**	**%**
IA avg. =	**0.35**	

Total Sub Basin Area in sq. miles = 0.0900

S35

Soil Class	...	AnB	AoB	RIB	Ro	Va
Sub-Area (acres)	...	1.0	1.9	0.3	2.6	0.6
XKSAT (bare ground)	...	0.40	0.40	0.40	0.25	0.40
RTIMP (rock)	...	0%	0%	0%	0%	0%
IA (natural only)	...	0.35	0.35	0.35	0.35	0.35

XKSAT log avg (bare ground) =	**0.33**	
PSIF =	**4.35**	
DTHETA (Dry) =	**0.35**	
DTHETA (Normal) =	**0.25**	
RTIMP avg. =	**0.00**	**%**
Veg. Cover avg. =	**10**	**%**
IA avg. =	**0.35**	

Total Sub Basin Area in sq. miles = 0.0100

S40

Soil Class	...	AnB	Va
Sub-Area (acres)	...	15.4	3.8
XKSAT (bare ground)	...	0.40	0.40
RTIMP (rock)	...	0%	0%
IA (natural only)	...	0.35	0.35

XKSAT log avg (bare ground) =	**0.40**	
PSIF =	**3.95**	
DTHETA (Dry) =	**0.35**	
DTHETA (Normal) =	**0.25**	
RTIMP avg. =	**0.00**	**%**
Veg. Cover avg. =	**10**	**%**
IA avg. =	**0.35**	

Total Sub Basin Area in sq. miles = 0.0300

Soils Worksheet

Soils compostition and corresponding natural condition Green & Ampt rainfall loss parameters for each subbasin for post-development conditions

S50

Soil Class ...	AnB	AoB	RIB	Ro
Sub-Area (acres) ...	26.9	1.9	7.7	1.9
XKSAT (bare ground) ...	0.40	0.40	0.40	0.25
RTIMP (rock) ...	0%	0%	0%	0%
IA (natural only) ...	0.35	0.35	0.35	0.35

XKSAT log avg (bare ground) =	**0.39**	
PSIF =	**4.00**	
DTHETA (Dry) =	**0.35**	
DTHETA (Normal) =	**0.25**	
RTIMP avg. =	**0.00**	**%**
Veg. Cover avg. =	**10**	**%**
IA avg. =	**0.35**	

Total Sub Basin Area in sq. miles = 0.0600

S60

Soil Class ...	AnB
Sub-Area (acres) ...	6.4
XKSAT (bare ground) ...	0.40
RTIMP (rock) ...	0%
IA (natural only) ...	0.35

XKSAT log avg (bare ground) =	**0.40**	
PSIF =	**3.95**	
DTHETA (Dry) =	**0.35**	
DTHETA (Normal) =	**0.25**	
RTIMP avg. =	**0.00**	**%**
Veg. Cover avg. =	**10**	**%**
IA avg. =	**0.35**	

Total Sub Basin Area in sq. miles = 0.0100

S62

Soil Class ...	AnB	Es	Gm
Sub-Area (acres) ...	16.3	1.9	1.0
XKSAT (bare ground) ...	0.40	0.25	0.25
RTIMP (rock) ...	0%	0%	0%
IA (natural only) ...	0.35	0.35	0.35

XKSAT log avg (bare ground) =	**0.37**	
PSIF =	**4.15**	
DTHETA (Dry) =	**0.35**	
DTHETA (Normal) =	**0.25**	
RTIMP avg. =	**0.00**	**%**
Veg. Cover avg. =	**10**	**%**
IA avg. =	**0.35**	

Total Sub Basin Area in sq. miles = 0.0300

Soils Worksheet

Soils compostition and corresponding natural condition Green & Ampt rainfall loss parameters for each subbasin for post-development conditions

S65

Soil Class	...	AnB	Es	Gm
Sub-Area (acres)	...	19.2	6.4	6.4
XKSAT (bare ground)	...	0.40	0.25	0.25
RTIMP (rock)	...	0%	0%	0%
IA (natural only)	...	0.35	0.35	0.35

XKSAT log avg (bare ground) =	**0.33**	
PSIF =	**4.35**	
DTHETA (Dry) =	**0.35**	
DTHETA (Normal) =	**0.25**	
RTIMP avg. =	**0.00**	**%**
Veg. Cover avg. =	**10**	**%**
IA avg. =	**0.35**	

Total Sub Basin Area in sq. miles = 0.0500

S70

Soil Class	...	AnB	Es	Va
Sub-Area (acres)	...	5.1	17.9	2.6
XKSAT (bare ground)	...	0.40	0.25	0.40
RTIMP (rock)	...	0%	0%	0%
IA (natural only)	...	0.35	0.35	0.35

XKSAT log avg (bare ground) =	**0.29**	
PSIF =	**4.55**	
DTHETA (Dry) =	**0.35**	
DTHETA (Normal) =	**0.25**	
RTIMP avg. =	**0.00**	**%**
Veg. Cover avg. =	**10**	**%**
IA avg. =	**0.35**	

Total Sub Basin Area in sq. miles = 0.0400

S75

Soil Class	...	Es	Va
Sub-Area (acres)	...	11.5	1.3
XKSAT (bare ground)	...	0.25	0.40
RTIMP (rock)	...	0%	0%
IA (natural only)	...	0.35	0.35

XKSAT log avg (bare ground) =	**0.26**	
PSIF =	**4.70**	
DTHETA (Dry) =	**0.35**	
DTHETA (Normal) =	**0.25**	
RTIMP avg. =	**0.00**	**%**
Veg. Cover avg. =	**10**	**%**
IA avg. =	**0.35**	

Total Sub Basin Area in sq. miles = 0.0200

Land Use Worksheet

Worksheet
Land use composition and corresponding rainfall loss characteristics for each subbasin
Post-development condition

S12

Land Use Class	...	OPEN
Natural or Developed	...	N
Sub-Area (acres)	...	6.4
Base RTIMP (Dev.)	...	---
Veg. Cover (Developed)	...	---
IA (Developed)	...	---

Natural Area	**=**	**100.00**	**%**
Developed Area	**=**	**0.00**	**%**
RTIMP (Dev.) avg.	**=**	**0.00**	**%**
Veg Cover (Dev.) avg.	**=**	**0.00**	**%**
IA (Dev.) avg.	**=**	**0.00**	

Total Sub Basin Area in sq. miles = 0.0100

S20

Land Use Class	...	C	MDR	MFR
Natural or Developed	...	D	D	D
Sub-Area (acres)	...	6.4	44.8	12.8
Base RTIMP (Dev.)	...	80%	30%	45%
Veg. Cover (Developed)	...	15%	35%	28%
IA (Developed)	...	0.10	0.25	0.25

Natural Area	**=**	**0.00**	**%**
Developed Area	**=**	**100.00**	**%**
RTIMP (Dev.) avg.	**=**	**38.00**	**%**
Veg Cover (Dev.) avg.	**=**	**31.50**	**%**
IA (Dev.) avg.	**=**	**0.24**	

Total Sub Basin Area in sq. miles = 0.1000

S25

Land Use Class	...	C	OPEN
Natural or Developed	...	D	N
Sub-Area (acres)	...	3.2	60.8
Base RTIMP (Dev.)	...	80%	---
Veg. Cover (Developed)	...	15%	---
IA (Developed)	...	0.10	---

Natural Area	**=**	**95.00**	**%**
Developed Area	**=**	**5.00**	**%**
RTIMP (Dev.) avg.	**=**	**80.00**	**%**
Veg Cover (Dev.) avg.	**=**	**15.00**	**%**
IA (Dev.) avg.	**=**	**0.10**	

Total Sub Basin Area in sq. miles = 0.1000

Land Use Worksheet

Worksheet
Land use composition and corresponding rainfall loss characteristics for each subbasin
Post-development condition

S30

Land Use Class	...	OPEN
Natural or Developed	...	N
Sub-Area (acres)	...	57.6
Base RTIMP (Dev.)	...	---
Veg. Cover (Developed)	...	---
IA (Developed)	...	---

Natural Area	**=**	**100.00**	**%**
Developed Area	**=**	**0.00**	**%**
RTIMP (Dev.) avg.	**=**	**0.00**	**%**
Veg Cover (Dev.) avg.	**=**	**0.00**	**%**
IA (Dev.) avg.	**=**	**0.00**	

Total Sub Basin Area in sq. miles = 0.0900

S35

Land Use Class	...	C
Natural or Developed	...	D
Sub-Area (acres)	...	6.4
Base RTIMP (Dev.)	...	80%
Veg. Cover (Developed)	...	15%
IA (Developed)	...	0.10

Natural Area	**=**	**0.00**	**%**
Developed Area	**=**	**100.00**	**%**
RTIMP (Dev.) avg.	**=**	**80.00**	**%**
Veg Cover (Dev.) avg.	**=**	**15.00**	**%**
IA (Dev.) avg.	**=**	**0.10**	

Total Sub Basin Area in sq. miles = 0.0100

S40

Land Use Class	...	C
Natural or Developed	...	D
Sub-Area (acres)	...	19.2
Base RTIMP (Dev.)	...	80%
Veg. Cover (Developed)	...	15%
IA (Developed)	...	0.10

Natural Area	**=**	**0.00**	**%**
Developed Area	**=**	**100.00**	**%**
RTIMP (Dev.) avg.	**=**	**80.00**	**%**
Veg Cover (Dev.) avg.	**=**	**15.00**	**%**
IA (Dev.) avg.	**=**	**0.10**	

Total Sub Basin Area in sq. miles = 0.0300

Land Use Worksheet

Worksheet
Land use composition and corresponding rainfall loss characteristics for each subbasin
Post-development condition

S50

Land Use Class	...	MDR
Natural or Developed	...	D
Sub-Area (acres)	...	38.4
Base RTIMP (Dev.)	...	30%
Veg. Cover (Developed)	...	35%
IA (Developed)	...	0.25

Natural Area	**=**	**0.00**	**%**
Developed Area	**=**	**100.00**	**%**
RTIMP (Dev.) avg.	**=**	**30.00**	**%**
Veg Cover (Dev.) avg.	**=**	**35.00**	**%**
IA (Dev.) avg.	**=**	**0.25**	

Total Sub Basin Area in sq. miles = 0.0600

S60

Land Use Class	...	MDR
Natural or Developed	...	D
Sub-Area (acres)	...	6.4
Base RTIMP (Dev.)	...	30%
Veg. Cover (Developed)	...	35%
IA (Developed)	...	0.25

Natural Area	**=**	**0.00**	**%**
Developed Area	**=**	**100.00**	**%**
RTIMP (Dev.) avg.	**=**	**30.00**	**%**
Veg Cover (Dev.) avg.	**=**	**35.00**	**%**
IA (Dev.) avg.	**=**	**0.25**	

Total Sub Basin Area in sq. miles = 0.0100

S62

Land Use Class	...	MDR
Natural or Developed	...	D
Sub-Area (acres)	...	19.2
Base RTIMP (Dev.)	...	30%
Veg. Cover (Developed)	...	35%
IA (Developed)	...	0.25

Natural Area	**=**	**0.00**	**%**
Developed Area	**=**	**100.00**	**%**
RTIMP (Dev.) avg.	**=**	**30.00**	**%**
Veg Cover (Dev.) avg.	**=**	**35.00**	**%**
IA (Dev.) avg.	**=**	**0.25**	

Total Sub Basin Area in sq. miles = 0.0300

Land Use Worksheet

Worksheet
Land use composition and corresponding rainfall loss characteristics for each subbasin
Post-development condition

S65

Land Use Class	...	MDR
Natural or Developed	...	D
Sub-Area (acres)	...	32.0
Base RTIMP (Dev.)	...	30%
Veg. Cover (Developed)	...	35%
IA (Developed)	...	0.25

Natural Area	**=**	**0.00**	**%**
Developed Area	**=**	**100.00**	**%**
RTIMP (Dev.) avg.	**=**	**30.00**	**%**
Veg Cover (Dev.) avg.	**=**	**35.00**	**%**
IA (Dev.) avg.	**=**	**0.25**	

Total Sub Basin Area in sq. miles = 0.0500

S70

Land Use Class	...	MDR
Natural or Developed	...	D
Sub-Area (acres)	...	25.6
Base RTIMP (Dev.)	...	30%
Veg. Cover (Developed)	...	35%
IA (Developed)	...	0.25

Natural Area	**=**	**0.00**	**%**
Developed Area	**=**	**100.00**	**%**
RTIMP (Dev.) avg.	**=**	**30.00**	**%**
Veg Cover (Dev.) avg.	**=**	**35.00**	**%**
IA (Dev.) avg.	**=**	**0.25**	

Total Sub Basin Area in sq. miles = 0.0400

S75

Land Use Class	...	PARK	C
Natural or Developed	...	D	D
Sub-Area (acres)	...	11.5	1.3
Base RTIMP (Dev.)	...	0%	80%
Veg. Cover (Developed)	...	90%	15%
IA (Developed)	...	0.02	0.10

Natural Area	**=**	**0.00**	**%**
Developed Area	**=**	**100.00**	**%**
RTIMP (Dev.) avg.	**=**	**8.00**	**%**
Veg Cover (Dev.) avg.	**=**	**82.50**	**%**
IA (Dev.) avg.	**=**	**0.03**	

Total Sub Basin Area in sq. miles = 0.0200

Table A-2

Green & Ampt rainfall loss parameters for each subbasin

Sub-basin ID (1)	Total sq. mi. (2)	Area Natural % (3)	Urban % (4)	IA, in inches Natural (5)	IA, in inches Urban (6)	IA, in inches Weighted (7)	RTIMP, in % Natural (8)	RTIMP, in % Urban (9)	RTIMP, in % Total (10)	Vegetation Cover, in % Natural (11)	Vegetation Cover, in % Urban (12)	Vegetation Cover, in % Weighted (13)	XKSAT Bare Ground in/hr (14)	PSIF inches (15)	DTHETA Natural dry (16)	DTHETA Urban normal (17)	DTHETA Weighted (18)	XKSAT Corrected for Veg. in/hr (19)
S12	0.0100	100.0	0.0	0.35	0.00	0.35	0	0	0	10	0	10	0.40	3.95	0.35	0.25	0.35	0.40
S20	0.1000	0.0	100.0	0.35	0.24	0.24	0	38	38	10	32	32	0.32	4.40	0.35	0.25	0.25	0.40
S25	0.1000	95.0	5.0	0.35	0.10	0.34	0	80	4	10	15	10	0.30	4.50	0.35	0.25	0.35	0.30
S30	0.0900	100.0	0.0	0.35	0.00	0.35	0	0	0	10	0	10	0.37	4.15	0.35	0.25	0.35	0.37
S35	0.0100	0.0	100.0	0.35	0.10	0.10	0	80	80	10	15	15	0.33	4.35	0.35	0.25	0.25	0.35
S40	0.0300	0.0	100.0	0.35	0.10	0.10	0	80	80	10	15	15	0.40	3.95	0.35	0.25	0.25	0.42
S50	0.0600	0.0	100.0	0.35	0.25	0.25	0	30	30	10	35	35	0.39	4.00	0.35	0.25	0.25	0.50
S60	0.0100	0.0	100.0	0.35	0.25	0.25	0	30	30	10	35	35	0.40	3.95	0.35	0.25	0.25	0.51
S62	0.0300	0.0	100.0	0.35	0.25	0.25	0	30	30	10	35	35	0.37	4.15	0.35	0.25	0.25	0.47
S65	0.0500	0.0	100.0	0.35	0.25	0.25	0	30	30	10	35	35	0.33	4.35	0.35	0.25	0.25	0.42
S70	0.0400	0.0	100.0	0.35	0.25	0.25	0	30	30	10	35	35	0.29	4.55	0.35	0.25	0.25	0.37
S75	0.0200	0.0	100.0	0.35	0.03	0.03	0	8	8	10	83	83	0.26	4.70	0.35	0.25	0.25	0.47

IA composite: (7) = [(5)*(3) + (6)*(4)]/100

RTIMP total: (10) = (8) + [1 - (8)/100] * (4) * (9)/100

Vegetation Cover composite: (13) = [(11)*(3) + (12)*(4)]/100

DTHETA composite: (18) = [(16)*(3) + (17)*(4)]/100

XKSAT Corrected: (19) = (14)*[(13)/100 * 1.111 + 0.889] where (13) > 10 and (14) < 1.2

APPENDIX B

12th Street Storm Drain

Table B-1

Depth-Duration-Frequency Table

	Rainfall Depth, in inches					
Duration	**2-YR**	**5-YR**	**10-YR**	**25-YR**	**50-YR**	**100-YR**
5 MIN	0.32	0.41	0.48	0.58	0.65	0.72
10 MIN	0.47	0.63	0.73	0.88	0.99	1.11
15 MIN	0.58	0.78	0.92	1.12	1.27	1.42
30 MIN	0.76	1.05	1.24	1.51	1.72	1.92
1 HOUR	0.93	1.30	1.54	1.88	2.14	2.40
2 HOUR	1.02	1.42	1.69	2.07	2.35	2.64
3 HOUR	1.08	1.51	1.80	2.19	2.50	2.80
6 HOUR	1.20	1.67	1.99	2.43	2.76	3.10
12 HOUR	1.32	1.85	2.21	2.69	3.07	3.45
24 HOUR	1.44	2.03	2.42	2.96	3.38	3.80

Land Use Worksheet

Worksheet
Land use composition and corresponding rainfall loss characteristics for each subbasin
Pre-development condition

1S

Land Use Class	...	MDR
Natural or Developed	...	D
Sub-Area (acres)	...	8.0
Base RTIMP (Dev.)	...	30%
Veg. Cover (Developed)	...	35%
IA (Developed)	...	0.25

Natural Area	**=**	**0.00**	**%**
Developed Area	**=**	**100.00**	**%**
RTIMP (Dev.) avg.	**=**	**30.00**	**%**
Veg Cover (Dev.) avg.	**=**	**35.00**	**%**
IA (Dev.) avg.	**=**	**0.25**	

Total Sub Basin Area in sq. miles = 0.0125

2S

Land Use Class	...	MDR	MFR
Natural or Developed	...	D	D
Sub-Area (acres)	...	0.5	8.9
Base RTIMP (Dev.)	...	30%	45%
Veg. Cover (Developed)	...	35%	28%
IA (Developed)	...	0.25	0.25

Natural Area	**=**	**0.00**	**%**
Developed Area	**=**	**100.00**	**%**
RTIMP (Dev.) avg.	**=**	**44.25**	**%**
Veg Cover (Dev.) avg.	**=**	**27.88**	**%**
IA (Dev.) avg.	**=**	**0.25**	

Total Sub Basin Area in sq. miles = 0.0146

22S

Land Use Class	...	MDR
Natural or Developed	...	D
Sub-Area (acres)	...	1.0
Base RTIMP (Dev.)	...	30%
Veg. Cover (Developed)	...	35%
IA (Developed)	...	0.25

Natural Area	**=**	**0.00**	**%**
Developed Area	**=**	**100.00**	**%**
RTIMP (Dev.) avg.	**=**	**30.00**	**%**
Veg Cover (Dev.) avg.	**=**	**35.00**	**%**
IA (Dev.) avg.	**=**	**0.25**	

Total Sub Basin Area in sq. miles = 0.0016

Land Use Worksheet

Worksheet
Land use composition and corresponding rainfall loss characteristics for each subbasin
Pre-development condition

9AS

Land Use Class	...	C	MDR
Natural or Developed	...	D	D
Sub-Area (acres)	...	2.7	24.7
Base RTIMP (Dev.)	...	80%	30%
Veg. Cover (Developed)	...	15%	35%
IA (Developed)	...	0.10	0.25

Natural Area	**=**	**0.00**	**%**
Developed Area	**=**	**100.00**	**%**
RTIMP (Dev.) avg.	**=**	**35.00**	**%**
Veg Cover (Dev.) avg.	**=**	**33.00**	**%**
IA (Dev.) avg.	**=**	**0.24**	

Total Sub Basin Area in sq. miles = 0.0428

23S

Land Use Class	...	C	LDR	MDR
Natural or Developed	...	D	D	D
Sub-Area (acres)	...	0.9	0.3	1.7
Base RTIMP (Dev.)	...	80%	15%	30%
Veg. Cover (Developed)	...	15%	43%	35%
IA (Developed)	...	0.10	0.30	0.25

Natural Area	**=**	**0.00**	**%**
Developed Area	**=**	**100.00**	**%**
RTIMP (Dev.) avg.	**=**	**43.50**	**%**
Veg Cover (Dev.) avg.	**=**	**29.75**	**%**
IA (Dev.) avg.	**=**	**0.21**	

Total Sub Basin Area in sq. miles = 0.0045

12S

Land Use Class	...	MDR
Natural or Developed	...	D
Sub-Area (acres)	...	7.0
Base RTIMP (Dev.)	...	30%
Veg. Cover (Developed)	...	35%
IA (Developed)	...	0.25

Natural Area	**=**	**0.00**	**%**
Developed Area	**=**	**100.00**	**%**
RTIMP (Dev.) avg.	**=**	**30.00**	**%**
Veg Cover (Dev.) avg.	**=**	**35.00**	**%**
IA (Dev.) avg.	**=**	**0.25**	

Total Sub Basin Area in sq. miles = 0.0109

Land Use Worksheet

Worksheet
Land use composition and corresponding rainfall loss characteristics for each subbasin
Pre-development condition

11S

Land Use Class	...	C	MDR
Natural or Developed	...	D	D
Sub-Area (acres)	...	1.8	4.1
Base RTIMP (Dev.)	...	80%	30%
Veg. Cover (Developed)	...	15%	35%
IA (Developed)	...	0.10	0.25

Natural Area	**=**	**0.00**	**%**
Developed Area	**=**	**100.00**	**%**
RTIMP (Dev.) avg.	**=**	**45.00**	**%**
Veg Cover (Dev.) avg.	**=**	**29.00**	**%**
IA (Dev.) avg.	**=**	**0.21**	

Total Sub Basin Area in sq. miles = 0.0092

16S

Land Use Class	...	LDR	MDR	MFR	VLDR
Natural or Developed	...	D	D	D	D
Sub-Area (acres)	...	6.4	5.3	8.6	1.1
Base RTIMP (Dev.)	...	15%	30%	45%	5%
Veg. Cover (Developed)	...	43%	35%	28%	29%
IA (Developed)	...	0.30	0.25	0.25	0.30

Natural Area	**=**	**0.00**	**%**
Developed Area	**=**	**100.00**	**%**
RTIMP (Dev.) avg.	**=**	**30.25**	**%**
Veg Cover (Dev.) avg.	**=**	**33.93**	**%**
IA (Dev.) avg.	**=**	**0.27**	

Total Sub Basin Area in sq. miles = 0.0334

15S

Land Use Class	...	C	MDR	MFR
Natural or Developed	...	D	D	D
Sub-Area (acres)	...	1.6	3.2	1.6
Base RTIMP (Dev.)	...	80%	30%	45%
Veg. Cover (Developed)	...	15%	35%	28%
IA (Developed)	...	0.10	0.25	0.25

Natural Area	**=**	**0.00**	**%**
Developed Area	**=**	**100.00**	**%**
RTIMP (Dev.) avg.	**=**	**46.25**	**%**
Veg Cover (Dev.) avg.	**=**	**28.13**	**%**
IA (Dev.) avg.	**=**	**0.21**	

Total Sub Basin Area in sq. miles = 0.0101

Land Use Worksheet

Worksheet
Land use composition and corresponding rainfall loss characteristics for each subbasin
Pre-development condition

19AS

Land Use Class	...	MDR	MFR
Natural or Developed	...	D	D
Sub-Area (acres)	...	133.4	44.5
Base RTIMP (Dev.)	...	30%	45%
Veg. Cover (Developed)	...	35%	28%
IA (Developed)	...	0.25	0.25

Natural Area	**=**	**0.00**	**%**
Developed Area	**=**	**100.00**	**%**
RTIMP (Dev.) avg.	**=**	**33.75**	**%**
Veg Cover (Dev.) avg.	**=**	**33.13**	**%**
IA (Dev.) avg.	**=**	**0.25**	

Total Sub Basin Area in sq. miles = 0.2780

19BS

Land Use Class	...	MDR	MFR
Natural or Developed	...	D	D
Sub-Area (acres)	...	12.4	4.1
Base RTIMP (Dev.)	...	30%	45%
Veg. Cover (Developed)	...	35%	28%
IA (Developed)	...	0.25	0.25

Natural Area	**=**	**0.00**	**%**
Developed Area	**=**	**100.00**	**%**
RTIMP (Dev.) avg.	**=**	**33.75**	**%**
Veg Cover (Dev.) avg.	**=**	**33.13**	**%**
IA (Dev.) avg.	**=**	**0.25**	

Total Sub Basin Area in sq. miles = 0.0258

19C

Land Use Class	...	MDR	MFR
Natural or Developed	...	D	D
Sub-Area (acres)	...	10.1	2.5
Base RTIMP (Dev.)	...	30%	45%
Veg. Cover (Developed)	...	35%	28%
IA (Developed)	...	0.25	0.25

Natural Area	**=**	**0.00**	**%**
Developed Area	**=**	**100.00**	**%**
RTIMP (Dev.) avg.	**=**	**33.00**	**%**
Veg Cover (Dev.) avg.	**=**	**33.50**	**%**
IA (Dev.) avg.	**=**	**0.25**	

Total Sub Basin Area in sq. miles = 0.0197

Land Use Worksheet

Worksheet
Land use composition and corresponding rainfall loss characteristics for each subbasin
Pre-development condition

20S

Land Use Class	...	MFR
Natural or Developed	...	D
Sub-Area (acres)	...	1.5
Base RTIMP (Dev.)	...	45%
Veg. Cover (Developed)	...	28%
IA (Developed)	...	0.25

Natural Area	**=**	**0.00**	**%**
Developed Area	**=**	**100.00**	**%**
RTIMP (Dev.) avg.	**=**	**45.00**	**%**
Veg Cover (Dev.) avg.	**=**	**27.50**	**%**
IA (Dev.) avg.	**=**	**0.25**	

Total Sub Basin Area in sq. miles = 0.0023

18S

Land Use Class	...	C	MFR
Natural or Developed	...	D	D
Sub-Area (acres)	...	0.6	5.8
Base RTIMP (Dev.)	...	80%	45%
Veg. Cover (Developed)	...	15%	28%
IA (Developed)	...	0.10	0.25

Natural Area	**=**	**0.00**	**%**
Developed Area	**=**	**100.00**	**%**
RTIMP (Dev.) avg.	**=**	**48.50**	**%**
Veg Cover (Dev.) avg.	**=**	**26.25**	**%**
IA (Dev.) avg.	**=**	**0.24**	

Total Sub Basin Area in sq. miles = 0.0100

26S

Land Use Class	...	MFR
Natural or Developed	...	D
Sub-Area (acres)	...	2.2
Base RTIMP (Dev.)	...	45%
Veg. Cover (Developed)	...	28%
IA (Developed)	...	0.25

Natural Area	**=**	**0.00**	**%**
Developed Area	**=**	**100.00**	**%**
RTIMP (Dev.) avg.	**=**	**45.00**	**%**
Veg Cover (Dev.) avg.	**=**	**27.50**	**%**
IA (Dev.) avg.	**=**	**0.25**	

Total Sub Basin Area in sq. miles = 0.0034

Table B-2

Green & Ampt rainfall loss parameters for each subbasin

Sub-basin ID (1)	Total sq. mi. (2)	Area Natural % (3)	Urban % (4)	IA, in inches Natural (5)	IA, in inches Urban (6)	IA, in inches Weighted (7)	RTIMP, in % Natural (8)	RTIMP, in % Urban (9)	RTIMP, in % Total (10)	Vegetation Cover, in % Natural (11)	Vegetation Cover, in % Urban (12)	Vegetation Cover, in % Weighted (13)	XKSAT Bare Ground in/hr (14)	PSIF inches (15)	DTHETA Natural dry (16)	DTHETA Urban normal (17)	DTHETA Weighted (18)	XKSAT Corrected for Veg. in/hr (19)
1S	0.0125	0.0	100.0	0.35	0.25	0.25	0	30	30	10	35	35	0.40	3.95	0.35	0.25	0.25	0.51
2S	0.0146	0.0	100.0	0.35	0.25	0.25	0	44	44	10	28	28	0.40	3.95	0.35	0.25	0.25	0.48
22S	0.0016	0.0	100.0	0.35	0.25	0.25	0	30	30	10	35	35	0.40	3.95	0.35	0.25	0.25	0.51
9AS	0.0428	0.0	100.0	0.35	0.24	0.24	0	35	35	10	33	33	0.40	3.95	0.35	0.25	0.25	0.50
23S	0.0045	0.0	100.0	0.35	0.21	0.21	0	44	44	10	30	30	0.40	3.95	0.35	0.25	0.25	0.49
12S	0.0109	0.0	100.0	0.35	0.25	0.25	0	30	30	10	35	35	0.40	3.95	0.35	0.25	0.25	0.51
11S	0.0092	0.0	100.0	0.35	0.21	0.21	0	45	45	10	29	29	0.40	3.95	0.35	0.25	0.25	0.48
16S	0.0334	0.0	100.0	0.35	0.27	0.27	0	30	30	10	34	34	0.40	3.95	0.35	0.25	0.25	0.51
15S	0.0101	0.0	100.0	0.35	0.21	0.21	0	46	46	10	28	28	0.40	3.95	0.35	0.25	0.25	0.48
19AS	0.0278	0.0	100.0	0.35	0.25	0.25	0	34	34	10	33	33	0.40	3.95	0.35	0.25	0.25	0.50
19BS	0.0258	0.0	100.0	0.35	0.25	0.25	0	34	34	10	33	33	0.40	3.95	0.35	0.25	0.25	0.50
19C	0.0197	0.0	100.0	0.35	0.25	0.25	0	33	33	10	34	34	0.40	3.95	0.35	0.25	0.25	0.50
20S	0.0023	0.0	100.0	0.35	0.25	0.25	0	45	45	10	28	28	0.40	3.95	0.35	0.25	0.25	0.48
18S	0.0100	0.0	100.0	0.35	0.24	0.24	0	49	49	10	26	26	0.40	3.95	0.35	0.25	0.25	0.47
26S	0.0034	0.0	100.0	0.35	0.25	0.25	0	45	45	10	28	28	0.40	3.95	0.35	0.25	0.25	0.48

IA composite: (7) = [(5)*(3) + (6)*(4)]/100

RTIMP total: (10) = (8) + [1 - (8)/100] * (4) * (9)/100

Vegetation Cover composite: (13) = [(11)*(3) + (12)*(4)]/100

DTHETA composite: (18) = [(16)*(3) + (17)*(4)]/100

XKSAT Corrected: (19) = (14)*[(13)/100 * 1.111 + 0.889] where (13) > 10 and (14) < 1.2

Table B-3

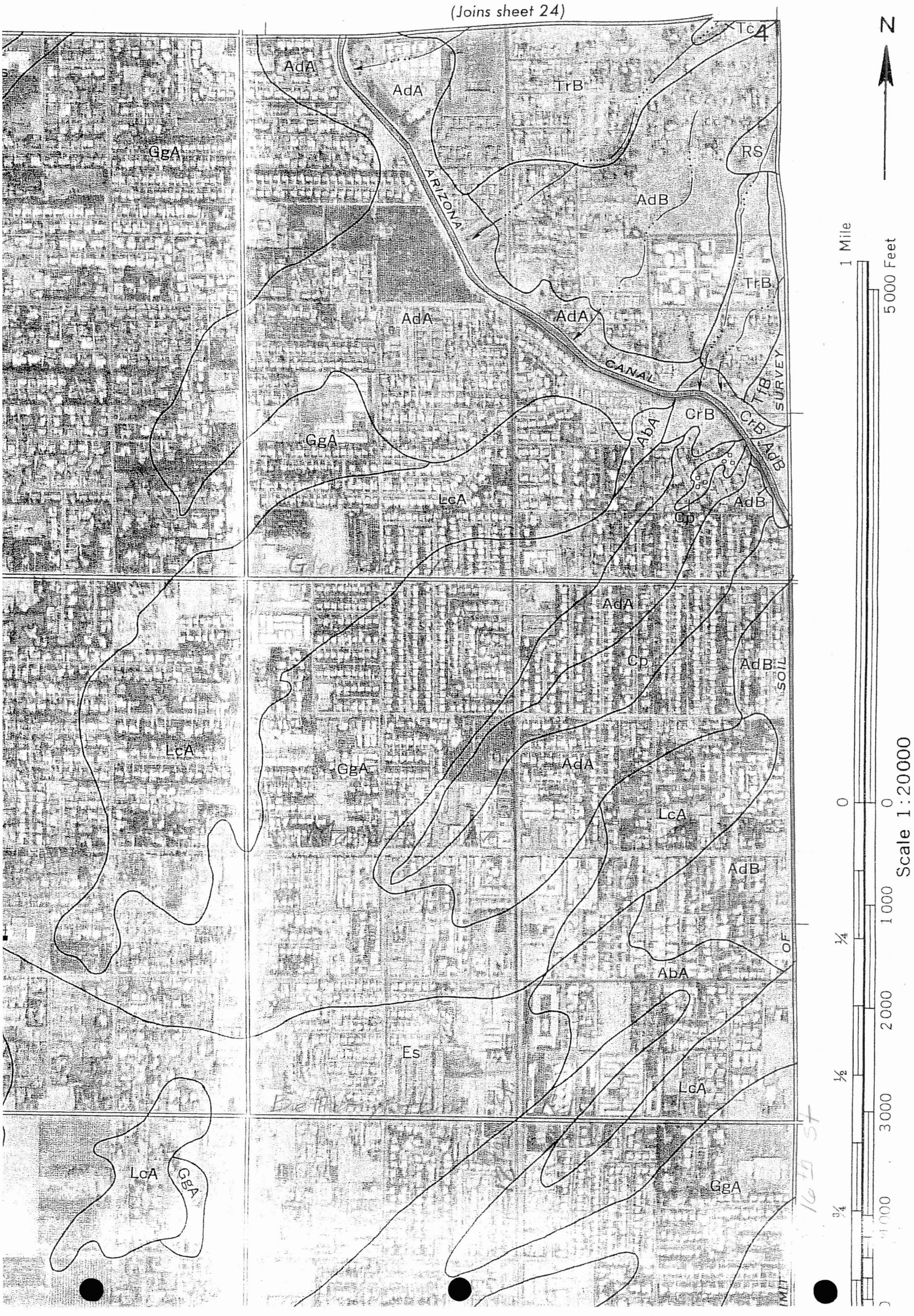
Summary of Rational Method parameters and results

Catch Basin ID (1)	Drainage Basin ID (2)	Drainage Area acres (3)	Flow Path Length feet (4)	Flow Path Length miles (5)	Flow Path Slope ft/ft (6)	Flow Path Slope ft/mile (7)	Kb (8)	Assumed Tc minutes (9)	Calculated Intensity in/hr (10)	Calculated Tc minutes (11)	Weighted Runoff Coefficient (12)	2-Year Peak Discharge cfs (13)
CB1	DA1	3.62	925	0.175	0.0127	67.1	0.037	10.0	2.64	10.0	0.61	6
CB2	DA1A	0.83	1400	0.265	0.0071	37.5	0.041	15.7	2.34	15.7	0.80	2
CB3	DA1B	3.52	1650	0.313	0.0065	34.3	0.037	17.0	2.19	17.0	0.61	5
CB4-5	DA2A	9.09	1765	0.334	0.0074	39.1	0.034	15.9	2.31	15.9	0.56	12
CB6	DA2	0.27	710	0.134	0.0100	52.8	0.044	10.0	2.64	10.0	0.80	1
CB7	DA22	1.02	1100	0.208	0.0100	52.8	0.040	11.2	3.05	11.2	0.80	2
CB8	DA3	1.11	530	0.100	0.0082	43.3	0.040	10.0	2.64	10.0	0.80	2
CB9	DA4	0.71	710	0.134	0.0100	52.8	0.041	10.0	2.64	10.0	0.64	1
CB10	DA23	1.06	1220	0.231	0.0093	49.1	0.040	12.4	2.81	12.4	0.80	2
CB11	DA5-8 &9A	24.58	3040	0.576	0.0065	34.3	0.031	23.3	1.71	23.3	0.61	26
CB12	DA9B1-9B5	2.79	1770	0.335	0.0040	21.1	0.037	22.4	1.77	22.4	0.84	4
CB13	DA10A	0.73	250	0.047	0.0058	30.6	0.041	10.0	2.64	10.0	0.87	2
CB14	DA23A	1.14	480	0.091	0.0090	47.5	0.040	10.0	2.64	10.0	0.80	2
CB15	DA10B	1.00	350	0.066	0.0073	38.5	0.040	10.0	2.64	10.0	0.84	2
CB16	DA10C	1.63	550	0.104	0.0073	38.5	0.039	10.0	2.64	10.0	0.67	3
CB17	DA23B	0.29	320	0.061	0.0090	47.5	0.043	10.0	2.64	10.0	0.80	1
CB18-19	DA12-13	6.96	3020	0.572	0.0050	26.4	0.035	28.1	1.48	28.2	0.79	8
CB20	DA11	0.99	810	0.153	0.0073	38.5	0.040	10.3	3.26	10.3	0.70	2
CB21	DA14	2.13	1190	0.225	0.0050	26.4	0.038	15.5	2.36	15.5	0.77	4
CB22	DA15	2.61	450	0.085	0.0077	40.7	0.037	10.0	2.64	10.0	0.88	6
CB23	DA24	1.60	3780	0.716	0.0090	47.5	0.039	27.6	1.50	27.6	0.71	2
CB24-25	DA16-17	21.38	4870	0.922	0.0080	42.2	0.032	30.1	1.40	30.1	0.69	21
CB26	DA17A	0.10	105	0.020	0.0110	58.1	0.046	10.0	2.64	10.0	0.80	0
CB27	DA25	2.34	1220	0.231	0.0080	42.2	0.038	12.7	2.76	12.7	0.85	5
CB28	DA18A	2.51	850	0.161	0.0070	37.0	0.038	10.4	3.23	10.4	0.69	6
CB29	DA26	0.86	740	0.140	0.0076	40.1	0.040	10.0	2.64	10.0	0.80	2
CB30	DA18B	0.69	680	0.129	0.0085	44.9	0.041	10.0	2.64	10.0	0.80	1

Table B-3

Summary of Rational Method parameters and results

Catch Basin ID (1)	Drainage Basin ID (2)	Drainage Area acres (3)	Flow Path Length feet (4)	Flow Path Length miles (5)	Flow Path Slope ft/ft (6)	Flow Path Slope ft/mile (7)	Kb (8)	Assumed Tc minutes (9)	Calculated Intensity in/hr (10)	Calculated Tc minutes (11)	Weighted Runoff Coefficient (12)	2-Year Peak Discharge cfs (13)
CB1R	DA19B1	0.50	700	0.133	0.0050	26.4	0.042	11.4	3.01	11.4	0.80	1
CB2R-3R	DA19A	17.79	1480	0.280	0.0080	42.2	0.032	13.0	2.71	13.0	0.67	32
CB4R	DA19B	16.04	2650	0.502	0.0078	41.2	0.032	20.1	1.92	20.1	0.68	21
CB5R	DA19C	3.19	1370	0.259	0.0084	44.4	0.037	13.3	2.66	13.3	0.67	6
CB6R-7R	DA19D	8.43	1350	0.256	0.0078	41.2	0.034	12.9	2.73	12.9	0.56	13
CB8R	DA19E	0.39	220	0.042	0.0040	21.1	0.043	10.0	2.64	10.0	0.59	1
CB9R	DA19F	0.59	850	0.161	0.0040	21.1	0.041	14.3	2.51	14.3	0.80	1
CB10R	DA20	1.56	300	0.057	0.0010	5.3	0.039	12.0	2.89	12.0	0.57	3
CB31	DA19G	0.71	240	0.045	0.0080	42.2	0.041	10.0	2.64	10.0	0.83	2
CB32	DA21	0.61	400	0.076	0.0070	37.0	0.041	10.0	2.64	10.0	0.81	1
CB33	DA27	0.86	750	0.142	0.0076	40.1	0.040	10.0	2.64	10.0	0.80	2


37
(Joins sheet 24)
N
Tc
AdA
TrB
GgA
RS
AdB
ARIZONA
CANAL
TrB
AdA
AdA
TrB
SURVEY
CrB
CrB
AbA
AdB
GgA
LcA
AdB
Cp
AdA
Cp
AdB
SOIL
LcA
GgA
AdA
LcA
AdB
OF
AbA
Es
LcA
LcA
GgA
GgA
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
¼
½
¾

Stantec

Project: HYDROLOGY MANUAL Project Number: 82000042

Notes: Testing & Verification Scale:

Page 1 of Page(s)

Computed By: mcg Date: Checked By: Date:

AGUA FRIA TRIB. AT YOUNGTOWN

1. DRAINAGE AREA IS 0.13 SQUARE MILES
2. LAND USE IS MEDIUM DENSITY RESIDENTIAL
3. GAGE DATA : 09513700
   - PERIOD OF RECORD IS 13-YEARS
   - THIS GAGE IS NOT LISTED IN THE USGS "BASIN CHARACTERISTICS REPORTS
   - FLOOD FREQUENCY ANALYSIS PERFORMED BY GVS

RETURN PERIOD YEARS	PEAK DISCHARGE CFS	RATIO OF 100-YEAR %
100	190	
50	126	
25	83	
10	48	25.2
5	31	16.3
2	16	8.4

4. EVENT SIMULATION PERFORMED BY GVS

	MEASURED			SIMULATED	
EVENT	RAINFALL INCHES	RUNOFF INCHES	PEAK Q CFS	RUNOFF INCHES	PEAK Q CFS
16 OCT 64	1.76	0.87	73	1.03	44
5 Sept 70	2.92	1.20	40.5	1.39	31

5. HEC-1 MODELING PERFORMED BY GVS
   - 6-HOUR RAINFALL DEPTHS

RETURN PERIOD YEARS	RAINFALL DEPTH INCHES
100	3.22
50	2.86
25	2.50
10	2.04
5	1.70
2	1.19

Stantec

Project: Project Number:

Notes: Scale:

Page 2 of Page(s)

Computed By: Date: Checked By: Date:

- WATERSHED PARAMETERS

			New
AREA	=	0.13 SQ. MILES	0.13
IA	=	0.15 INCHES	0.25
DTHETA	=	0.22	0.25
PSIF	=	5.1 INCHES	5.2
XKSAT	=	0.27 INCHES/HOUR	0.27
RTIMP	=	25%	30%
L	=	1.023 MILES	1.023
S	=	5.8 FT/MILE	5.8
K_b	=	0.028	~~0.03~~ 0.028
TIME-AREA	=	URBAN	Urban

- RESULTS

RETURN PERIOD YEARS	RAINFALL EXCESS INCHES	T_c HOURS	R HOURS	PEAK Q CFS	RATIO OF 100-YEAR %
100	2.12	0.77	0.90	114	
50	1.81	0.83	0.99	90	
25	1.51	0.93	1.12	68	
10	1.12	1.08	1.32	43	37.7
5	0.87	1.20	1.48	30	26.3
2	0.52	1.40	1.75	15	13.2

New

100	1.95	~~0.82~~ 0.775	~~0.96~~ 0.908	~~98~~ 103	
50	1.67 8	~~0.90~~ 0.850	~~1.07~~ 1.006	~~77~~ 81	
25	1.39	~~1.00~~ 0.946	~~1.21~~ 1.133	~~57~~ 60	
10	1.05	~~1.18~~ 1.117	~~1.45~~ 1.363	~~36~~ 39	37.9
5	0.83	~~1.37~~ 1.296	~~1.71~~ 1.607	~~25~~ 26	25.2
2	0.49	1.50	1.89	13	12.6

T_c longer than the duration of rainfall excess

FROM: SOIL SURVEY OF MARICOPA CO., CENTRAL PART (SCS, 1977)

9-5137. Agua Fria River tributary at Youngtown, Ariz.

Location.--Lat 33°34'47", long 112°18'02", on line between secs.19 and 30, T.3 N., R.1 E., on Peoria Avenue at Oregon Street in Youngtown, 3.7 miles west of Peoria.

Drainage area.--0.13 sq mi.

Records available.--March 1961 to September 1968 (discontinued).

Gage.--Water-stage recorder and Cipolletti weir. Altitude of gage is 1,130 ft (from topographic map).

Average discharge.--7 years, 0.017 cfs (12 acre-ft per year).

Extremes.--Maximum discharge during year, 7.8 cfs Mar. 9 (gage height, 0.66 ft); no flow for most of year. 1961-68: Maximum discharge, 73 cfs Oct. 16, 1964 (gage height, 2.30 ft), from rating curve extended above 13 cfs on basis of Cipolletti weir formula; no flow for most of the time each year.

Remarks.--Records good except those for Oct. 3, Dec. 13-20, Jan. 19 to Feb. 12, Mar. 1-7, which are poor. No storage or diversion above station.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	.19	0	0	0	0	0	0
3	.19	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	.06	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	.35	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	.32	0	0	0	0	0	0
9	0	0	0	0	.02	.63	0	0	0	0	0	0
10	0	0	0	0	.06	.32	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	.41	0	0	0	0	0	0	0
13	0	0	0	0	.16	0	0	0	0	0	0	0
14	0	0	0	0	.29	0	0	0	0	0	0	0
15	0	0	2.2	0	0	0	0	0	0	0	0	0
16	0	0	.02	0	0	0	0	0	0	0	0	0
17	0	0	.04	0	0	0	0	0	0	0	0	0
18	0	0	.37	0	0	0	0	0	0	0	0	0
19	0	0	1.5	0	0	0	0	0	0	0	0	0
20	0	0	.04	0	0	0	0	0	0	0	0	0
21	0	.25	0	0	0	0	0	0	0	0	0	0
22	0	.03	0	0	0	0	0	0	0	.02	0	0
23	0	0	0	0	0	0	0	0	0	.09	0	0
24	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
26	0	.11	0	0	0	0	0	0	0	0	0	0
27	0	0	0	.08	0	0	0	0	0	0	0	0
28	0	.08	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	------	0	0	0	0	0	0	0
31	0	------	0	0	------	0	------	0	------	.02	0	------
TOTAL	0.19	0.47	4.17	0.08	0.94	1.46	0	0	0	0.54	0	0
MEAN	.006	.016	.13	.003	.032	.047	0	0	0	.017	0	0
MAX	.19	.25	2.2	.08	.41	.63	0	0	0	.35	0	0
MIN	0	0	0	0	0	0	0	0	0	0	0	0
AC-FT	.4	.9	8.3	.2	1.9	2.9	0	0	0	1.1	0	0

CAL YR 1967	TOTAL 5.82	MEAN .016	MAX 2.2	MIN 0	AC-FT 12
WTR YR 1968	TOTAL 7.85	MEAN .021	MAX 2.2	MIN 0	AC-FT 16

Peak discharge (base, 7 cfs).--Mar. 9 (0830) 7.8 cfs (0.66 ft).

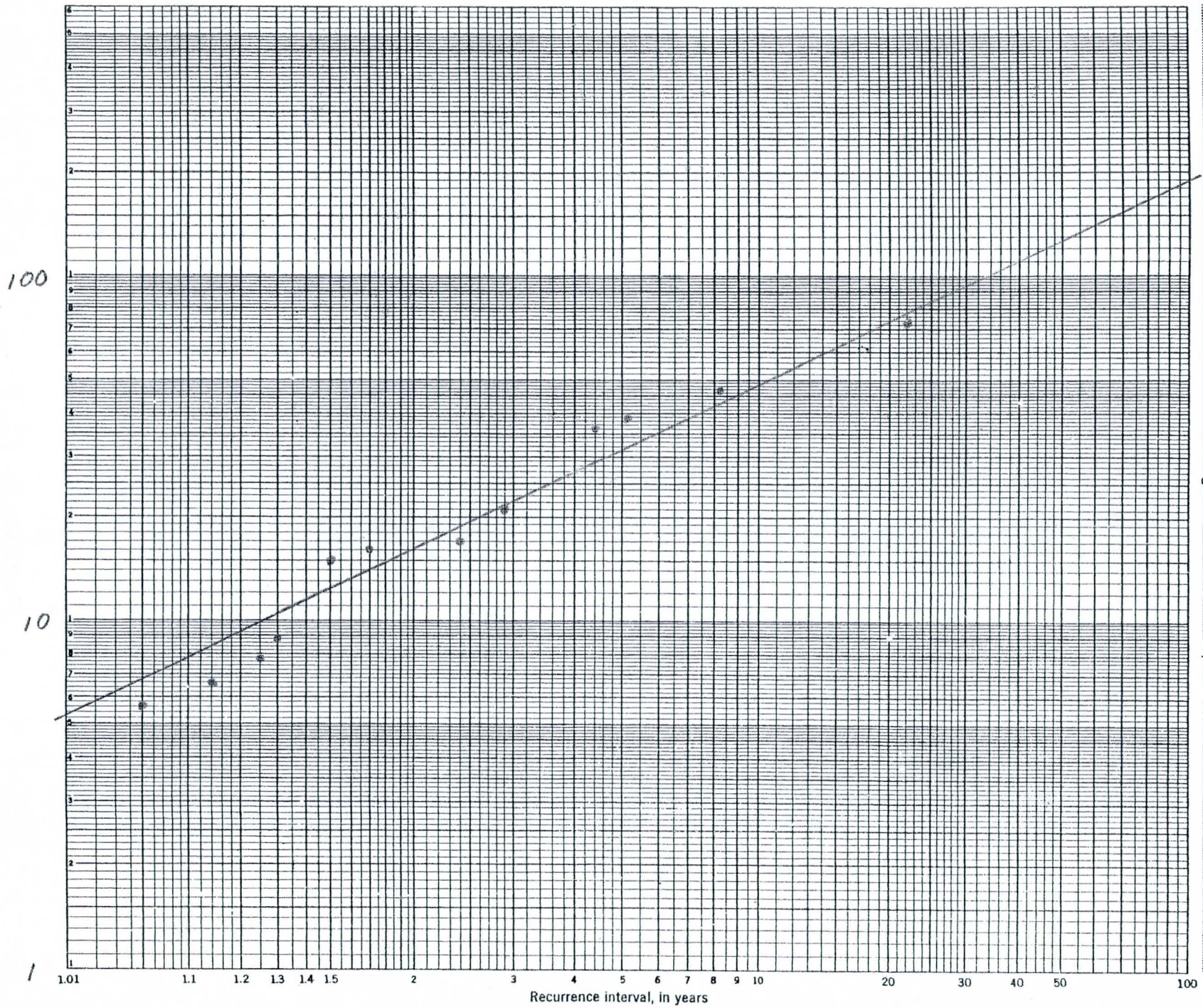
9-179b
Extreme log data plot
April 1955

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

File

Magnitude and frequency of Agua Fria R. trib. @ Youngstown AZ on

Drainage area 113 sq. mi. Period 1961 - 1973



Sheet No. ____ of ____ Sheets. Prepared by G.V.S. Date 15 Mar 82 Checked by ____ Date ____

GPO 859-404

Rainfall Data

Primary Zone Number: **7** Latitude: **0.0** Elevation: **0**

Short Duration Zone Number: **8** Longitude: **0.0**

	Point Values (in)					
Duration	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
5 MIN	0.32	0.41	0.47	0.56	0.63	0.70
10 MIN	0.48	0.62	0.72	0.86	0.96	1.07
15 MIN	0.58	0.77	0.91	1.09	1.23	1.37
30 MIN	0.77	1.04	1.22	1.47	1.67	1.86
1 HOUR	0.93	1.28	1.51	1.83	2.08	2.33
2 HOUR	1.01	1.40	1.65	2.01	2.29	2.57
3 HOUR	1.06	1.47	1.75	2.13	2.43	2.72
6 HOUR	1.16	1.62	1.93	2.30	2.59	3.02
12 HOUR	1.25	1.78	2.14	2.63	3.01	3.38
24 HOUR	1.34	1.95	2.35	2.90	3.33	3.75

SCALE
1" = 600'
GAGE

```
1*****************************************                    *****************************************
 *                                       *                    *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *    U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN   1998               *                    *    HYDROLOGIC ENGINEERING CENTER      *
 *            VERSION 4.1                *                    *          609 SECOND STREET            *
 *                                       *                    *       DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   20MAR02  TIME  10:29:57   *                    *           (916) 756-1104              *
 *                                       *                    *                                       *
 *****************************************                    *****************************************

                                        X     X  XXXXXXX   XXXXX          X
                                        X     X  X        X     X        XX
                                        X     X  X        X               X
                                        XXXXXXX  XXXX     X        XXXXX  X
                                        X     X  X        X               X
                                        X     X  X        X     X         X
                                        X     X  XXXXXXX   XXXXX         XXX

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                          HEC-1 INPUT                                          PAGE  1

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

        1           ID    Hydrology Manual Update - Edition 3
        2           ID    Flood Control District of Maricopa County/City of Phoenix
        3           ID
        4           ID    Multiple Frequency Ratio Test Watershed 1:
        5           ID    Agua Fria River Tributary at Youngstown
        6           ID          100-Year, 6-Hour Storm
        7           ID          Green & Ampt Rainfall Losses
        8           ID          Clark Unit Hydrograph
        9           ID
       10           ID       File:  AFT100-6.ih1     Date:  03-18-02
       11           ID
       12           ID   ********************************************************************
       13           IT      2                    800
       14           IO      3
                    *

       15           KK     AFT
       16           KM   Subbasin
       17           KM
       18           KM      The Clark Unit Hydrograph is used for this basin.
       19           KM          The Urban time-area relation is used for this basin.
       20           KM
       21           KM      Time of Concentration for this sub-basin is based on the following:
       22           KM          6-Hour Rainfall, Pattern No.  1.00
       23           KM          An rainfall areal reduction factor of 0.998
       24           KM
       25           KM       EXCESS RAINFALL VALUES EXCEEDED IN 5-MINUTE INTERVALS
       26           KM     5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
       27           KM   .42 .41 .41 .13 .10 .09 .04 .04 .04 .02 .02 .02 .01 .01 .01 .01 .01 .01
       28           KM
       29           KM          L=   1.023 miles, S=    6 feet/mile, Kb= .03
       30           KM
       31           BA   0.130
       32           IN      15
       33           KM   Rainfall depth of  3.02 was spacially reduced as shown by the PB record.
       34           KM   An areal reduction coefficient of 0.998 is used.
       35           PB    3.01
       36           PC   0.000   0.008   0.016   0.025   0.033   0.041.  0.050   0.058   0.066   0.074
       37           PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
       38           PC   0.962   0.972   0.983   0.991   1.000
       39           LG    0.25    0.25    5.20    0.27   30.00
       40           UC   0.775   0.908
       41           UA       0       5      16      30      65      77      84      90      94      97
       42           UA     100
                    *
       43           ZZ
1*****************************************                    *****************************************
 *                                       *                    *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *    U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN   1998               *                    *    HYDROLOGIC ENGINEERING CENTER      *
 *            VERSION 4.1                *                    *          609 SECOND STREET            *
 *                                       *                    *       DAVIS, CALIFORNIA 95616         *
```

```
*  RUN DATE   20MAR02  TIME  10:29:57   *                                                    *          (916) 756-1104          *
*                                       *                                                    *                                  *
*****************************************                                                    ************************************
```

Hydrology Manual Update - Edition 3
Flood Control District of Maricopa County/City of Phoenix

Multiple Frequency Ratio Test Watershed 1:
Agua Fria River Tributary at Youngstown
100-Year, 6-Hour Storm
Green & Ampt Rainfall Losses
Clark Unit Hydrograph

File: AFT100-6.ih1 Date: 03-18-02

```
                    ********************************************************************

 14 IO          OUTPUT CONTROL VARIABLES
                      IPRNT           3  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN           2  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ         800  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      2    0  ENDING DATE
                     NDTIME        0238  ENDING TIME
                      ICENT          19  CENTURY MARK

                 COMPUTATION INTERVAL    0.03 HOURS
                      TOTAL TIME BASE   26.63 HOURS

         ENGLISH UNITS
              DRAINAGE AREA          SQUARE MILES
              PRECIPITATION DEPTH    INCHES
              LENGTH, ELEVATION      FEET
              FLOW                   CUBIC FEET PER SECOND
              STORAGE VOLUME         ACRE-FEET
              SURFACE AREA           ACRES
              TEMPERATURE            DEGREES FAHRENHEIT


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


           **************
           *            *
 15 KK     *       AFT  *
           *            *
           **************
                    Subbasin

                       The Clark Unit Hydrograph is used for this basin.
                           The Urban time-area relation is used for this basin.

                       Time of Concentration for this sub-basin is based on the following:
                           6-Hour Rainfall, Pattern No.  1.00
                           An rainfall areal reduction factor of 0.998

                        EXCESS RAINFALL VALUES EXCEEDED IN 5-MINUTE INTERVALS
                         5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
                       .42 .41 .41 .13 .10 .09 .04 .04 .04 .02 .02 .02 .01 .01 .01 .01 .01 .01

                             L=   1.023 miles, S=    6 feet/mile, Kb= .03

                    Rainfall depth of  3.02 was spacially reduced as shown by the PB record.
                    An areal reduction coefficient of 0.998 is used.

 32 IN          TIME DATA FOR INPUT TIME SERIES
                      JXMIN          15  TIME INTERVAL IN MINUTES
                     JXDATE      1    0  STARTING DATE
                     JXTIME           0  STARTING TIME

              SUBBASIN RUNOFF DATA

 31 BA          SUBBASIN CHARACTERISTICS
                      TAREA        0.13  SUBBASIN AREA

                PRECIPITATION DATA

 35 PB                STORM        3.01  BASIN TOTAL PRECIPITATION

 36 PI            INCREMENTAL PRECIPITATION PATTERN
```

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02
0.02	0.02	0.04	0.06	0.06	0.06	0.06	0.06	0.06	0.06
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

39 LG GREEN AND AMPT LOSS RATE

STRTL	0.25	STARTING LOSS
DTH	0.25	MOISTURE DEFICIT
PSIF	5.20	WETTING FRONT SUCTION
XKSAT	0.27	HYDRAULIC CONDUCTIVITY
RTIMP	30.00	PERCENT IMPERVIOUS AREA

40 UC CLARK UNITGRAPH

TC	0.77	TIME OF CONCENTRATION
R	0.91	STORAGE COEFFICIENT

41 UA ACCUMULATED-AREA VS. TIME, 11 ORDINATES

0.0	5.0	16.0	30.0	65.0	77.0	84.0	90.0	94.0	97.0
100.0									

***

UNIT HYDROGRAPH PARAMETERS
CLARK TC= 0.77 HR, R= 0.91 HR
SNYDER TP= 0.53 HR, CP= 0.38

UNIT HYDROGRAPH
154 END-OF-PERIOD ORDINATES

1.	3.	6.	9.	13.	18.	23.	32.	44.	53.
57.	60.	61.	61.	62.	62.	62.	61.	60.	59.
58.	57.	57.	55.	53.	52.	50.	48.	46.	44.
43.	41.	40.	38.	37.	36.	34.	33.	32.	31.
30.	29.	28.	27.	26.	25.	24.	23.	22.	21.
21.	20.	19.	18.	18.	17.	17.	16.	15.	15.
14.	14.	13.	13.	12.	12.	11.	11.	11.	10.
10.	10.	9.	9.	9.	8.	8.	8.	7.	7.
7.	7.	6.	6.	6.	6.	5.	5.	5.	5.
5.	5.	4.	4.	4.	4.	4.	4.	4.	3.
3.	3.	3.	3.	3.	3.	3.	3.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	0.	0.						

*** *** *** *** ***

HYDROGRAPH AT STATION AFT

TOTAL RAINFALL = 3.01, TOTAL LOSS = 1.06, TOTAL EXCESS = 1.95

	PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	26.63-HR
+	(CFS)	(HR)	(CFS)			
+	103.	4.40	26.	7.	6.	6.
			(INCHES) 1.893	1.942	1.942	1.942
			(AC-FT) 13.	13.	13.	13.

CUMULATIVE AREA = 0.13 SQ MI

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	AFT	103.	4.40	26.	7.	6.	0.13		

*** NORMAL END OF HEC-1 ***

```
1*****************************************                                    *****************************************
 *                                       *                                    *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                    *    U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN   1998               *                                    *    HYDROLOGIC ENGINEERING CENTER      *
 *            VERSION 4.1                *                                    *          609 SECOND STREET            *
 *                                       *                                    *       DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   20MAR02  TIME  10:30:07   *                                    *           (916) 756-1104              *
 *                                       *                                    *                                       *
 *****************************************                                    *****************************************


                                        X     X  XXXXXXX   XXXXX           X
                                        X     X  X        X     X         XX
                                        X     X  X        X               X
                                        XXXXXXX  XXXX     X        XXXXX  X
                                        X     X  X        X               X
                                        X     X  X        X     X         X
                                        X     X  XXXXXXX   XXXXX         XXX


          THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

          THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
          THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
          NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
          DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
          KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                                HEC-1 INPUT                                                    PAGE  1

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

           1          ID    Hydrology Manual Update - Edition 3
           2          ID    Flood Control District of Maricopa County/City of Phoenix
           3          ID
           4          ID    Multiple Frequency Ratio Test Watershed 1:
           5          ID    Agua Fria River Tributary at Youngstown
           6          ID           50-Year, 6-Hour Storm
           7          ID           Green & Ampt Rainfall Losses
           8          ID           Clark Unit Hydrograph
           9          ID
          10          ID       File:   AFT50-6.ih1     Date:  03-18-02
          11          ID
          12          ID   ********************************************************************
          13          IT       2                    800
          14          IO       3
                      *

          15          KK     AFT
          16          KM   Subbasin
          17          KM
          18          KM      The Clark Unit Hydrograph is used for this basin.
          19          KM          The Urban time-area relation is used for this basin.
          20          KM
          21          KM      Time of Concentration for this sub-basin is based on the following:
          22          KM          6-Hour Rainfall, Pattern No.  1.00
          23          KM          An rainfall areal reduction factor of 0.998
          24          KM
          25          KM       EXCESS RAINFALL VALUES EXCEEDED IN 5-MINUTE INTERVALS
          26          KM     5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
          27          KM   .37 .36 .36 .11 .08 .06 .03 .03 .03 .02 .02 .02 .01 .01 .01 .01 .01 .01
          28          KM
          29          KM          L=   1.023 miles, S=    6 feet/mile, Kb= .03
          30          KM
          31          BA   0.130
          32          IN      15
          33          KM   Rainfall depth of  2.69 was spacially reduced as shown by the PB record.
          34          KM   An areal reduction coefficient of 0.998 is used.
          35          PB    2.69
          36          PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
          37          PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
          38          PC   0.962   0.972   0.983   0.991   1.000
          39          LG    0.25    0.25    5.20    0.27   30.00
          40          UC   0.850   1.006
          41          UA       0       5      16      30      65      77      84      90      94      97
          42          UA     100
                      *
          43          ZZ
1*****************************************                                    *****************************************
 *                                       *                                    *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                    *    U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN   1998               *                                    *    HYDROLOGIC ENGINEERING CENTER      *
 *            VERSION 4.1                *                                    *          609 SECOND STREET            *
 *                                       *                                    *       DAVIS, CALIFORNIA 95616         *
```

```
*  RUN DATE   20MAR02  TIME  10:30:07   *                                                    *          (916) 756-1104          *
*                                       *                                                    *                                  *
*****************************************                                                    ************************************
```

Hydrology Manual Update - Edition 3
Flood Control District of Maricopa County/City of Phoenix

Multiple Frequency Ratio Test Watershed 1:
Agua Fria River Tributary at Youngstown
50-Year, 6-Hour Storm
Green & Ampt Rainfall Losses
Clark Unit Hydrograph

File: AFT50-6.ih1 Date: 03-18-02

```
                    ********************************************************************

 14 IO          OUTPUT CONTROL VARIABLES
                      IPRNT          3  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN          2  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ        800  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      2    0  ENDING DATE
                     NDTIME       0238  ENDING TIME
                      ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL    0.03 HOURS
                      TOTAL TIME BASE   26.63 HOURS

        ENGLISH UNITS
             DRAINAGE AREA          SQUARE MILES
             PRECIPITATION DEPTH    INCHES
             LENGTH, ELEVATION      FEET
             FLOW                   CUBIC FEET PER SECOND
             STORAGE VOLUME         ACRE-FEET
             SURFACE AREA           ACRES
             TEMPERATURE            DEGREES FAHRENHEIT


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


           **************
           *            *
 15 KK     *       AFT  *
           *            *
           **************
                    Subbasin

                       The Clark Unit Hydrograph is used for this basin.
                           The Urban time-area relation is used for this basin.

                       Time of Concentration for this sub-basin is based on the following:
                           6-Hour Rainfall, Pattern No.  1.00
                           An rainfall areal reduction factor of 0.998

                        EXCESS RAINFALL VALUES EXCEEDED IN 5-MINUTE INTERVALS
                      5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
                    .37 .36 .36 .11 .08 .06 .03 .03 .03 .02 .02 .02 .01 .01 .01 .01 .01 .01

                           L=   1.023 miles, S=    6 feet/mile, Kb= .03

                    Rainfall depth of  2.69 was spacially reduced as shown by the PB record.
                    An areal reduction coefficient of 0.998 is used.

 32 IN          TIME DATA FOR INPUT TIME SERIES
                      JXMIN         15  TIME INTERVAL IN MINUTES
                     JXDATE      1    0  STARTING DATE
                     JXTIME           0  STARTING TIME

             SUBBASIN RUNOFF DATA

 31 BA          SUBBASIN CHARACTERISTICS
                      TAREA       0.13  SUBBASIN AREA

             PRECIPITATION DATA

 35 PB                STORM       2.69  BASIN TOTAL PRECIPITATION

 36 PI            INCREMENTAL PRECIPITATION PATTERN
```

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02
0.02	0.02	0.04	0.06	0.06	0.06	0.06	0.06	0.06	0.06
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

```
39 LG          GREEN AND AMPT LOSS RATE
                    STRTL        0.25  STARTING LOSS
                      DTH        0.25  MOISTURE DEFICIT
                     PSIF        5.20  WETTING FRONT SUCTION
                    XKSAT        0.27  HYDRAULIC CONDUCTIVITY
                    RTIMP       30.00  PERCENT IMPERVIOUS AREA

40 UC          CLARK UNITGRAPH
                       TC        0.85  TIME OF CONCENTRATION
                        R        1.01  STORAGE COEFFICIENT

41 UA          ACCUMULATED-AREA VS. TIME,  11 ORDINATES
                    0.0       5.0      16.0      30.0      65.0      77.0      84.0      90.0      94.0      97.0
                  100.0
```

***

UNIT HYDROGRAPH PARAMETERS
CLARK TC= 0.85 HR, R= 1.01 HR
SNYDER TP= 0.59 HR, CP= 0.38

UNIT HYDROGRAPH
171 END-OF-PERIOD ORDINATES

1.	2.	4.	7.	11.	14.	18.	23.	32.	42.
49.	52.	54.	55.	55.	56.	56.	56.	56.	55.
54.	54.	53.	52.	51.	50.	49.	47.	46.	44.
43.	42.	40.	39.	38.	36.	35.	34.	33.	32.
31.	30.	29.	28.	27.	26.	25.	24.	24.	23.
22.	21.	21.	20.	19.	19.	18.	18.	17.	16.
16.	15.	15.	14.	14.	13.	13.	13.	12.	12.
11.	11.	11.	10.	10.	10.	9.	9.	9.	8.
8.	8.	8.	7.	7.	7.	7.	7.	6.	6.
6.	6.	6.	5.	5.	5.	5.	5.	5.	4.
4.	4.	4.	4.	4.	4.	3.	3.	3.	3.
3.	3.	3.	3.	3.	3.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	0.	0.	0.	0.	0.
0.									

*** *** *** *** ***

HYDROGRAPH AT STATION AFT

TOTAL RAINFALL = 2.69, TOTAL LOSS = 1.01, TOTAL EXCESS = 1.68

	PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	26.63-HR
+	(CFS)	(HR)					
			(CFS)				
+	81.	4.43		23.	6.	5.	5.
			(INCHES)	1.619	1.669	1.669	1.669
			(AC-FT)	11.	12.	12.	12.

CUMULATIVE AREA = 0.13 SQ MI

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	AFT	81.	4.43	23.	6.	5.	0.13		

*** NORMAL END OF HEC-1 ***

```
1*****************************************                    *****************************************
 *                                       *                    *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *    U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN   1998               *                    *    HYDROLOGIC ENGINEERING CENTER      *
 *           VERSION 4.1                 *                    *          609 SECOND STREET            *
 *                                       *                    *       DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   20MAR02  TIME  10:30:21   *                    *           (916) 756-1104              *
 *                                       *                    *                                       *
 *****************************************                    *****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X               X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
1                                          HEC-1 INPUT                                                    PAGE  1

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

           1          ID    Hydrology Manual Update - Edition 3
           2          ID    Flood Control District of Maricopa County/City of Phoenix
           3          ID
           4          ID    Multiple Frequency Ratio Test Watershed 1:
           5          ID    Agua Fria River Tributary at Youngstown
           6          ID            25-Year, 6-Hour Storm
           7          ID            Green & Ampt Rainfall Losses
           8          ID            Clark Unit Hydrograph
           9          ID
          10          ID       File:   AFT25-6.ih1     Date:  03-18-02
          11          ID
          12          ID   ********************************************************************
          13          IT       2                     800
          14          IO       3
                      *

          15          KK     AFT
          16          KM   Subbasin
          17          KM
          18          KM      The Clark Unit Hydrograph is used for this basin.
          19          KM          The Urban time-area relation is used for this basin.
          20          KM
          21          KM      Time of Concentration for this sub-basin is based on the following:
          22          KM          6-Hour Rainfall, Pattern No.  1.00
          23          KM          An rainfall areal reduction factor of 0.998
          24          KM
          25          KM       EXCESS RAINFALL VALUES EXCEEDED IN 5-MINUTE INTERVALS
          26          KM     5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
          27          KM   .32 .31 .31 .08 .05 .04 .02 .02 .02 .02 .02 .02 .00 .00 .00 .00 .00 .00
          28          KM
          29          KM          L=   1.023 miles, S=    6 feet/mile, Kb= .03
          30          KM
          31          BA   0.130
          32          IN      15
          33          KM   Rainfall depth of  2.36 was spacially reduced as shown by the PB record.
          34          KM   An areal reduction coefficient of 0.998 is used.
          35          PB    2.36
          36          KM   The following PC record used a 6-hour rainfall with Pattern No.  1.00
          37          PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
          38          PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
          39          PC   0.962   0.972   0.983   0.991   1.000
          40          LG    0.25    0.25    5.20    0.27   30.00
          41          UC   0.946   1.133
          42          UA       0       5      16      30      65      77      84      90      94      97
          43          UA     100
                      *
          44          ZZ
1*****************************************                    *****************************************
 *                                       *                    *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *    U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN   1998               *                    *    HYDROLOGIC ENGINEERING CENTER      *
 *           VERSION 4.1                 *                    *          609 SECOND STREET            *
```

```
*                                        *                                          *       DAVIS, CALIFORNIA 95616       *
*  RUN DATE   20MAR02  TIME  10:30:21    *                                          *           (916) 756-1104            *
*                                        *                                          *                                     *
******************************************                                          *************************************
```

Hydrology Manual Update - Edition 3
Flood Control District of Maricopa County/City of Phoenix

Multiple Frequency Ratio Test Watershed 1:
Agua Fria River Tributary at Youngstown
25-Year, 6-Hour Storm
Green & Ampt Rainfall Losses
Clark Unit Hydrograph

File: AFT25-6.ih1 Date: 03-18-02

```
                    ********************************************************************

 14 IO          OUTPUT CONTROL VARIABLES
                      IPRNT          3  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN          2  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1   0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ        800  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      2   0  ENDING DATE
                     NDTIME       0238  ENDING TIME
                      ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL    0.03 HOURS
                      TOTAL TIME BASE   26.63 HOURS

          ENGLISH UNITS
               DRAINAGE AREA          SQUARE MILES
               PRECIPITATION DEPTH    INCHES
               LENGTH, ELEVATION      FEET
               FLOW                   CUBIC FEET PER SECOND
               STORAGE VOLUME         ACRE-FEET
               SURFACE AREA           ACRES
               TEMPERATURE            DEGREES FAHRENHEIT


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


            **************
            *            *
 15 KK      *       AFT  *
            *            *
            **************
                    Subbasin

                       The Clark Unit Hydrograph is used for this basin.
                           The Urban time-area relation is used for this basin.

                       Time of Concentration for this sub-basin is based on the following:
                           6-Hour Rainfall, Pattern No.  1.00
                           An rainfall areal reduction factor of 0.998

                        EXCESS RAINFALL VALUES EXCEEDED IN 5-MINUTE INTERVALS
                      5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
                    .32 .31 .31 .08 .05 .04 .02 .02 .02 .02 .02 .02 .00 .00 .00 .00 .00 .00

                           L=   1.023 miles, S=    6 feet/mile, Kb= .03

                    Rainfall depth of  2.36 was spacially reduced as shown by the PB record.
                    An areal reduction coefficient of 0.998 is used.
                    The following PC record used a 6-hour rainfall with Pattern No.  1.00

 32 IN          TIME DATA FOR INPUT TIME SERIES
                       JXMIN         15  TIME INTERVAL IN MINUTES
                      JXDATE      1   0  STARTING DATE
                      JXTIME          0  STARTING TIME

               SUBBASIN RUNOFF DATA

 31 BA          SUBBASIN CHARACTERISTICS
                       TAREA       0.13  SUBBASIN AREA

                PRECIPITATION DATA

 36 PB                 STORM       2.36  BASIN TOTAL PRECIPITATION
```

36 PI INCREMENTAL PRECIPITATION PATTERN

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02
0.02	0.02	0.04	0.06	0.06	0.06	0.06	0.06	0.06	0.06
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

40 LG GREEN AND AMPT LOSS RATE

STRTL	0.25	STARTING LOSS
DTH	0.25	MOISTURE DEFICIT
PSIF	5.20	WETTING FRONT SUCTION
XKSAT	0.27	HYDRAULIC CONDUCTIVITY
RTIMP	30.00	PERCENT IMPERVIOUS AREA

41 UC CLARK UNITGRAPH

TC	0.95	TIME OF CONCENTRATION
R	1.13	STORAGE COEFFICIENT

42 UA ACCUMULATED-AREA VS. TIME, 11 ORDINATES

0.0	5.0	16.0	30.0	65.0	77.0	84.0	90.0	94.0	97.0
100.0									

***

UNIT HYDROGRAPH PARAMETERS
CLARK TC= 0.95 HR, R= 1.13 HR
SNYDER TP= 0.66 HR, CP= 0.38

UNIT HYDROGRAPH
192 END-OF-PERIOD ORDINATES

1.	2.	3.	5.	8.	11.	14.	17.	21.	28.
37.	43.	45.	47.	48.	49.	49.	50.	50.	50.
50.	49.	49.	48.	48.	47.	46.	46.	45.	44.
43.	41.	40.	39.	38.	37.	36.	35.	34.	33.
32.	31.	30.	29.	28.	27.	27.	26.	25.	24.
24.	23.	22.	22.	21.	20.	20.	19.	19.	18.
18.	17.	17.	16.	16.	15.	15.	14.	14.	14.
13.	13.	12.	12.	12.	11.	11.	11.	10.	10.
10.	9.	9.	9.	9.	8.	8.	8.	8.	7.
7.	7.	7.	7.	6.	6.	6.	6.	6.	6.
5.	5.	5.	5.	5.	5.	5.	4.	4.	4.
4.	4.	4.	4.	4.	3.	3.	3.	3.	3.
3.	3.	3.	3.	3.	3.	3.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.								

*** *** *** *** ***

HYDROGRAPH AT STATION AFT

TOTAL RAINFALL = 2.36, TOTAL LOSS = 0.97, TOTAL EXCESS = 1.39

	PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	26.63-HR
+	(CFS)	(HR)					
			(CFS)				
+	60.	4.50		19.	5.	4.	4.
			(INCHES)	1.332	1.385	1.385	1.385
			(AC-FT)	9.	10.	10.	10.

CUMULATIVE AREA = 0.13 SQ MI

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+										

```
          HYDROGRAPH AT
+                         AFT       60.    4.50          19.          5.          4.       0.13

*** NORMAL END OF HEC-1 ***
```

```
1*****************************************                    *****************************************
 *                                       *                    *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *    U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN   1998               *                    *    HYDROLOGIC ENGINEERING CENTER      *
 *            VERSION 4.1                *                    *          609 SECOND STREET            *
 *                                       *                    *       DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   20MAR02  TIME  10:30:32   *                    *           (916) 756-1104              *
 *                                       *                    *                                       *
*****************************************                    *****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X        XXXXX X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX        XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
1                                          HEC-1 INPUT                                          PAGE  1

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

         1          ID    Hydrology Manual Update - Edition 3
         2          ID    Flood Control District of Maricopa County/City of Phoenix
         3          ID
         4          ID    Multiple Frequency Ratio Test Watershed 1:
         5          ID    Agua Fria River Tributary at Youngstown
         6          ID            10-Year, 6-Hour Storm
         7          ID            Green & Ampt Rainfall Losses
         8          ID            Clark Unit Hydrograph
         9          ID
        10          ID       File:   AFT10-6.ih1     Date:  03-18-02
        11          ID
        12          ID   ********************************************************************
        13          IT       2                    800
        14          IO       3
                    *

        15          KK     AFT
        16          KM   Subbasin
        17          KM
        18          KM      The Clark Unit Hydrograph is used for this basin.
        19          KM          The Urban time-area relation is used for this basin.
        20          KM
        21          KM      Time of Concentration for this sub-basin is based on the following:
        22          KM          6-Hour Rainfall, Pattern No.  1.00
        23          KM          An rainfall areal reduction factor of 0.998
        24          KM
        25          KM       EXCESS RAINFALL VALUES EXCEEDED IN 5-MINUTE INTERVALS
        26          KM     5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
        27          KM   .25 .24 .24 .05 .03 .03 .02 .02 .02 .02 .02 .01 .00 .00 .00 .00 .00 .00
        28          KM
        29          KM          L=   1.023 miles, S=    6 feet/mile, Kb= .03
        30          KM
        31          BA   0.130
        32          IN      15
        33          KM   Rainfall depth of  1.93 was spacially reduced as shown by the PB record.
        34          KM   An areal reduction coefficient of 0.998 is used.
        35          PB    1.93
        36          PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
        37          PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
        38          PC   0.962   0.972   0.983   0.991   1.000
        39          LG    0.25    0.25    5.20    0.27   30.00
        40          UC   1.117   1.363
        41          UA       0       5      16      30      65      77      84      90      94      97
        42          UA     100
                    *
        43          ZZ
```

```
1*****************************************                    *****************************************
 *                                       *                    *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *    U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN   1998               *                    *    HYDROLOGIC ENGINEERING CENTER      *
 *            VERSION 4.1                *                    *          609 SECOND STREET            *
 *                                       *                    *       DAVIS, CALIFORNIA 95616         *
```

```
Hydrology Manual Update - Edition 3
   Flood Control District of Maricopa County/City of Phoenix

   Multiple Frequency Ratio Test Watershed 1:
   Agua Fria River Tributary at Youngstown
           10-Year, 6-Hour Storm
           Green & Ampt Rainfall Losses
           Clark Unit Hydrograph

      File:   AFT10-6.ih1     Date:  03-18-02

*********************************************************************

 14 IO          OUTPUT CONTROL VARIABLES
                      IPRNT          3  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN          2  MINUTES IN COMPUTATION INTERVAL
                      IDATE     1    0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ        800  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE     2    0  ENDING DATE
                     NDTIME       0238  ENDING TIME
                      ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL    0.03 HOURS
                      TOTAL TIME BASE   26.63 HOURS

         ENGLISH UNITS
              DRAINAGE AREA          SQUARE MILES
              PRECIPITATION DEPTH    INCHES
              LENGTH, ELEVATION      FEET
              FLOW                   CUBIC FEET PER SECOND
              STORAGE VOLUME         ACRE-FEET
              SURFACE AREA           ACRES
              TEMPERATURE            DEGREES FAHRENHEIT


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


           **************
           *            *
 15 KK     *       AFT  *
           *            *
           **************
                      Subbasin

                         The Clark Unit Hydrograph is used for this basin.
                             The Urban time-area relation is used for this basin.

                         Time of Concentration for this sub-basin is based on the following:
                             6-Hour Rainfall, Pattern No.  1.00
                             An rainfall areal reduction factor of 0.998

                          EXCESS RAINFALL VALUES EXCEEDED IN 5-MINUTE INTERVALS
                        5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
                      .25 .24 .24 .05 .03 .03 .02 .02 .02 .02 .02 .01 .00 .00 .00 .00 .00 .00

                             L=   1.023 miles, S=    6 feet/mile, Kb= .03

                      Rainfall depth of  1.93 was spacially reduced as shown by the PB record.
                      An areal reduction coefficient of 0.998 is used.

 32 IN          TIME DATA FOR INPUT TIME SERIES
                      JXMIN         15  TIME INTERVAL IN MINUTES
                     JXDATE     1    0  STARTING DATE
                     JXTIME          0  STARTING TIME

              SUBBASIN RUNOFF DATA

 31 BA          SUBBASIN CHARACTERISTICS
                      TAREA       0.13  SUBBASIN AREA

                PRECIPITATION DATA

 35 PB                STORM       1.93  BASIN TOTAL PRECIPITATION

 36 PI            INCREMENTAL PRECIPITATION PATTERN
```

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02
0.02	0.02	0.04	0.06	0.06	0.06	0.06	0.06	0.06	0.06
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

39 LG GREEN AND AMPT LOSS RATE

STRTL	0.25	STARTING LOSS
DTH	0.25	MOISTURE DEFICIT
PSIF	5.20	WETTING FRONT SUCTION
XKSAT	0.27	HYDRAULIC CONDUCTIVITY
RTIMP	30.00	PERCENT IMPERVIOUS AREA

40 UC CLARK UNITGRAPH

TC	1.12	TIME OF CONCENTRATION
R	1.36	STORAGE COEFFICIENT

41 UA ACCUMULATED-AREA VS. TIME, 11 ORDINATES

0.0	5.0	16.0	30.0	65.0	77.0	84.0	90.0	94.0	97.0
100.0									

***

UNIT HYDROGRAPH PARAMETERS
CLARK TC= 1.12 HR, R= 1.36 HR
SNYDER TP= 0.79 HR, CP= 0.38

UNIT HYDROGRAPH
231 END-OF-PERIOD ORDINATES

0.	1.	2.	3.	5.	7.	9.	11.	13.	16.
20.	25.	31.	35.	38.	39.	40.	41.	41.	41.
41.	41.	42.	42.	41.	41.	41.	40.	40.	40.
39.	39.	38.	38.	37.	36.	35.	34.	34.	33.
32.	31.	30.	30.	29.	28.	28.	27.	26.	26.
25.	24.	24.	23.	23.	22.	22.	21.	21.	20.
20.	19.	19.	18.	18.	17.	17.	17.	16.	16.
15.	15.	15.	14.	14.	14.	13.	13.	13.	12.
12.	12.	11.	11.	11.	11.	10.	10.	10.	10.
9.	9.	9.	9.	9.	8.	8.	8.	8.	8.
7.	7.	7.	7.	7.	7.	6.	6.	6.	6.
6.	6.	6.	5.	5.	5.	5.	5.	5.	5.
5.	4.	4.	4.	4.	4.	4.	4.	4.	4.
4.	3.	3.	3.	3.	3.	3.	3.	3.	3.
3.	3.	3.	3.	3.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.									

*** *** *** *** ***

HYDROGRAPH AT STATION AFT

TOTAL RAINFALL = 1.93, TOTAL LOSS = 0.88, TOTAL EXCESS = 1.05

	PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	26.63-HR
+	39.	4.63	(CFS)	14.	4.	3.	3.
			(INCHES)	0.989	1.045	1.045	1.045
			(AC-FT)	7.	7.	7.	7.

CUMULATIVE AREA = 0.13 SQ MI

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE

				6-HOUR	24-HOUR	72-HOUR	
+ HYDROGRAPH AT	AFT	39.	4.63	14.	4.	3.	0.13

*** NORMAL END OF HEC-1 ***

```
1*****************************************                    *****************************************
 *                                       *                    *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *    U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN   1998               *                    *    HYDROLOGIC ENGINEERING CENTER      *
 *            VERSION 4.1                *                    *          609 SECOND STREET            *
 *                                       *                    *       DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   20MAR02  TIME  10:30:44   *                    *           (916) 756-1104              *
 *                                       *                    *                                       *
 *****************************************                    *****************************************

                                          X     X  XXXXXXX   XXXXX           X
                                          X     X  X        X     X         XX
                                          X     X  X        X                X
                                          XXXXXXX  XXXX     X        XXXXX   X
                                          X     X  X        X                X
                                          X     X  X        X     X          X
                                          X     X  XXXXXXX   XXXXX         XXX


          THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

          THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
          THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
          NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
          DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
          KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                                   HEC-1 INPUT                                                    PAGE  1

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

           1          ID    Hydrology Manual Update - Edition 3
           2          ID    Flood Control District of Maricopa County/City of Phoenix
           3          ID
           4          ID    Multiple Frequency Ratio Test Watershed 1:
           5          ID    Agua Fria River Tributary at Youngstown
           6          ID           5-Year, 6-Hour Storm
           7          ID           Green & Ampt Rainfall Losses
           8          ID           Clark Unit Hydrograph
           9          ID
          10          ID       File:    AFT5-6.ih1     Date:  03-18-02
          11          ID
          12          ID   ***********************************************************************
          13          IT       2                    800
          14          IO       3
                      *

          15          KK     AFT
          16          KM   Subbasin
          17          KM
          18          KM      The Clark Unit Hydrograph is used for this basin.
          19          KM          The Urban time-area relation is used for this basin.
          20          KM
          21          KM      Time of Concentration for this sub-basin is based on the following:
          22          KM          6-Hour Rainfall, Pattern No.  1.00
          23          KM          An rainfall areal reduction factor of 0.998
          24          KM
          25          KM       EXCESS RAINFALL VALUES EXCEEDED IN 5-MINUTE INTERVALS
          26          KM     5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
          27          KM   .20 .19 .18 .03 .02 .02 .01 .01 .01 .01 .01 .01 .00 .00 .00 .00 .00 .00
          28          KM
          29          KM          L=   1.023 miles, S=    6 feet/mile, Kb= .03
          30          KM
          31          BA   0.130
          32          IN      15
          33          KM   Rainfall depth of  1.62 was spacially reduced as shown by the PB record.
          34          KM   An areal reduction coefficient of 0.998 is used.
          35          PB    1.62
          36          PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
          37          PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
          38          PC   0.962   0.972   0.983   0.991   1.000
          39          LG    0.25    0.25    5.20    0.27   30.00
          40          UC   1.296   1.607
          41          UA       0       5      16      30      65      77      84      90      94      97
          42          UA     100
                      *
          43          ZZ
1*****************************************                    *****************************************
 *                                       *                    *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *    U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN   1998               *                    *    HYDROLOGIC ENGINEERING CENTER      *
 *            VERSION 4.1                *                    *          609 SECOND STREET            *
 *                                       *                    *       DAVIS, CALIFORNIA 95616         *
```

```
*  RUN DATE   20MAR02  TIME  10:30:44   *                                                    *            (916) 756-1104            *
*                                       *                                                    *                                      *
*****************************************                                                    ****************************************


                          Hydrology Manual Update - Edition 3
                             Flood Control District of Maricopa County/City of Phoenix

                             Multiple Frequency Ratio Test Watershed 1:
                             Agua Fria River Tributary at Youngstown
                                     5-Year, 6-Hour Storm
                                     Green & Ampt Rainfall Losses
                                     Clark Unit Hydrograph

                                File:    AFT5-6.ih1     Date:  03-18-02

                          ********************************************************************

 14 IO          OUTPUT CONTROL VARIABLES
                      IPRNT           3  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN           2  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ         800  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      2    0  ENDING DATE
                     NDTIME        0238  ENDING TIME
                      ICENT          19  CENTURY MARK

                  COMPUTATION INTERVAL    0.03 HOURS
                       TOTAL TIME BASE   26.63 HOURS

          ENGLISH UNITS
               DRAINAGE AREA          SQUARE MILES
               PRECIPITATION DEPTH    INCHES
               LENGTH, ELEVATION      FEET
               FLOW                   CUBIC FEET PER SECOND
               STORAGE VOLUME         ACRE-FEET
               SURFACE AREA           ACRES
               TEMPERATURE            DEGREES FAHRENHEIT


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


            **************
            *            *
 15 KK      *       AFT  *
            *            *
            **************
                          Subbasin

                             The Clark Unit Hydrograph is used for this basin.
                                 The Urban time-area relation is used for this basin.

                             Time of Concentration for this sub-basin is based on the following:
                                 6-Hour Rainfall, Pattern No.  1.00
                                 An rainfall areal reduction factor of 0.998

                              EXCESS RAINFALL VALUES EXCEEDED IN 5-MINUTE INTERVALS
                            5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
                          .20 .19 .18 .03 .02 .02 .01 .01 .01 .01 .01 .01 .00 .00 .00 .00 .00 .00

                                 L=   1.023 miles, S=    6 feet/mile, Kb= .03

                          Rainfall depth of  1.62 was spacially reduced as shown by the PB record.
                          An areal reduction coefficient of 0.998 is used.

 32 IN          TIME DATA FOR INPUT TIME SERIES
                      JXMIN          15  TIME INTERVAL IN MINUTES
                     JXDATE      1    0  STARTING DATE
                     JXTIME           0  STARTING TIME

               SUBBASIN RUNOFF DATA

 31 BA          SUBBASIN CHARACTERISTICS
                      TAREA        0.13  SUBBASIN AREA

                PRECIPITATION DATA

 35 PB                STORM        1.62  BASIN TOTAL PRECIPITATION

 36 PI            INCREMENTAL PRECIPITATION PATTERN
```

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02
0.02	0.02	0.04	0.06	0.06	0.06	0.06	0.06	0.06	0.06
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

```
39 LG          GREEN AND AMPT LOSS RATE
                    STRTL        0.25  STARTING LOSS
                      DTH        0.25  MOISTURE DEFICIT
                     PSIF        5.20  WETTING FRONT SUCTION
                    XKSAT        0.27  HYDRAULIC CONDUCTIVITY
                    RTIMP       30.00  PERCENT IMPERVIOUS AREA

40 UC          CLARK UNITGRAPH
                       TC        1.30  TIME OF CONCENTRATION
                        R        1.61  STORAGE COEFFICIENT

41 UA          ACCUMULATED-AREA VS. TIME,  11 ORDINATES
                    0.0       5.0      16.0      30.0      65.0      77.0      84.0      90.0      94.0      97.0
                  100.0
```

***

UNIT HYDROGRAPH PARAMETERS
CLARK TC= 1.30 HR, R= 1.61 HR
SNYDER TP= 0.93 HR, CP= 0.38

UNIT HYDROGRAPH
272 END-OF-PERIOD ORDINATES

0.	1.	2.	2.	3.	5.	6.	8.	9.	11.
12.	14.	18.	22.	26.	30.	32.	33.	33.	34.
35.	35.	35.	35.	35.	35.	35.	35.	35.	35.
35.	35.	34.	34.	34.	33.	33.	33.	33.	32.
31.	31.	30.	29.	29.	28.	28.	27.	27.	26.
26.	25.	24.	24.	23.	23.	23.	22.	22.	21.
21.	20.	20.	19.	19.	19.	18.	18.	18.	17.
17.	16.	16.	16.	16.	15.	15.	15.	14.	14.
14.	13.	13.	13.	13.	12.	12.	12.	12.	11.
11.	11.	11.	10.	10.	10.	10.	10.	9.	9.
9.	9.	9.	8.	8.	8.	8.	8.	8.	7.
7.	7.	7.	7.	7.	7.	6.	6.	6.	6.
6.	6.	6.	6.	5.	5.	5.	5.	5.	5.
5.	5.	5.	5.	4.	4.	4.	4.	4.	4.
4.	4.	4.	4.	4.	4.	3.	3.	3.	3.
3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
3.	3.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	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.	0.	0.	0.	0.	0.	0.
0.	0.								

*** *** *** *** ***

HYDROGRAPH AT STATION AFT

TOTAL RAINFALL = 1.62, TOTAL LOSS = 0.79, TOTAL EXCESS = 0.83

	PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
				6-HR	24-HR	72-HR	26.63-HR
+	(CFS)	(HR)					
			(CFS)				
+	26.	4.77		11.	3.	3.	3.
			(INCHES)	0.766	0.824	0.824	0.824
			(AC-FT)	5.	6.	6.	6.

CUMULATIVE AREA = 0.13 SQ MI

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND

TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	AFT	26.	4.77	11.	3.	3.	0.13		

*** NORMAL END OF HEC-1 ***

```
1*****************************************                    *****************************************
 *                                       *                    *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *    U.S. ARMY CORPS OF ENGINEERS       *
 *             JUN   1998                *                    *    HYDROLOGIC ENGINEERING CENTER      *
 *           VERSION 4.1                 *                    *          609 SECOND STREET            *
 *                                       *                    *       DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   20MAR02  TIME  10:30:53   *                    *           (916) 756-1104              *
 *                                       *                    *                                       *
 *****************************************                    *****************************************

                                        X     X  XXXXXXX   XXXXX           X
                                        X     X  X      .  X     X         XX
                                        X     X  X        X                X
                                        XXXXXXX  XXXX     X        XXXXX   X
                                        X     X  X        X                X
                                        X     X  X        X     X          X
                                        X     X  XXXXXXX   XXXXX          XXX


          THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

          THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
          THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
          NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
          DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
          KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                                   HEC-1 INPUT                                                    PAGE  1

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

           1          ID    Hydrology Manual Update - Edition 3
           2          ID    Flood Control District of Maricopa County/City of Phoenix
           3          ID
           4          ID    Multiple Frequency Ratio Test Watershed 1:
           5          ID    Agua Fria River Tributary at Youngstown
           6          ID            2-Year, 6-Hour Storm
           7          ID            Green & Ampt Rainfall Losses
           8          ID            Clark Unit Hydrograph
           9          ID
          10          ID       File:    AFT2-6.ih1     Date:  03-18-02
          11          ID
          12          ID   ***********************************************************************
          13          IT       2                     800
          14          IO       3
                      *

          15          KK     AFT
          16          KM   Subbasin
          17          KM
          18          KM      The Clark Unit Hydrograph is used for this basin.
          19          KM          The Urban time-area relation is used for this basin.
          20          KM
          21          KM      Time of Concentration for this sub-basin is based on the following:
          22          KM          6-Hour Rainfall, Pattern No.  1.00
          23          KM          An rainfall areal reduction factor of 0.998
          24          KM
          25          KM       EXCESS RAINFALL VALUES EXCEEDED IN 5-MINUTE INTERVALS
          26          KM     5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
          27          KM   .12 .11 .08 .02 .02 .02 .01 .01 .01 .01 .01 .01 .00 .00 .00 .00 .00 .00
          28          KM
          29          KM          L=   1.023 miles, S=    6 feet/mile, Kb= .03
          30          KM
          31          BA   0.130
          32          IN     15
          33          KM   Rainfall depth of  1.16 was spacially reduced as shown by the PB record.
          34          KM   An areal reduction coefficient of 0.998 is used.
          35          PB    1.16
          36          PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
          37          PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
          38          PC   0.962   0.972   0.983   0.991   1.000
          39          LG    0.25    0.25    5.20    0.27   30.00
          40          UC   1.500   1.891
          41          UA       0       5      16      30      65      77      84      90      94      97
          42          UA     100
                      *
          43          ZZ
1*****************************************                    *****************************************
 *                                       *                    *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *    U.S. ARMY CORPS OF ENGINEERS       *
 *             JUN   1998                *                    *    HYDROLOGIC ENGINEERING CENTER      *
 *           VERSION 4.1                 *                    *          609 SECOND STREET            *
 *                                       *                    *       DAVIS, CALIFORNIA 95616         *
```

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Hydrology Manual Update - Edition 3
   Flood Control District of Maricopa County/City of Phoenix

   Multiple Frequency Ratio Test Watershed 1:
   Agua Fria River Tributary at Youngstown
           2-Year, 6-Hour Storm
           Green & Ampt Rainfall Losses
           Clark Unit Hydrograph

      File:    AFT2-6.ih1     Date:  03-18-02

 ********************************************************************

 14 IO          OUTPUT CONTROL VARIABLES
                      IPRNT           3  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN           2  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ         800  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      2    0  ENDING DATE
                     NDTIME        0238  ENDING TIME
                      ICENT          19  CENTURY MARK

                 COMPUTATION INTERVAL    0.03 HOURS
                      TOTAL TIME BASE   26.63 HOURS

         ENGLISH UNITS
              DRAINAGE AREA          SQUARE MILES
              PRECIPITATION DEPTH    INCHES
              LENGTH, ELEVATION      FEET
              FLOW                   CUBIC FEET PER SECOND
              STORAGE VOLUME         ACRE-FEET
              SURFACE AREA           ACRES
              TEMPERATURE            DEGREES FAHRENHEIT


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


           **************
           *            *
 15 KK     *       AFT  *
           *            *
           **************
                         Subbasin

                            The Clark Unit Hydrograph is used for this basin.
                                The Urban time-area relation is used for this basin.

                            Time of Concentration for this sub-basin is based on the following:
                                6-Hour Rainfall, Pattern No.  1.00
                                An rainfall areal reduction factor of 0.998

                             EXCESS RAINFALL VALUES EXCEEDED IN 5-MINUTE INTERVALS
                          5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
                         .12 .11 .08 .02 .02 .02 .01 .01 .01 .01 .01 .01 .00 .00 .00 .00 .00 .00

                                L=   1.023 miles, S=    6 feet/mile, Kb= .03

                         Rainfall depth of  1.16 was spacially reduced as shown by the PB record.
                         An areal reduction coefficient of 0.998 is used.

 32 IN          TIME DATA FOR INPUT TIME SERIES
                      JXMIN          15  TIME INTERVAL IN MINUTES
                     JXDATE      1    0  STARTING DATE
                     JXTIME           0  STARTING TIME

              SUBBASIN RUNOFF DATA

 31 BA          SUBBASIN CHARACTERISTICS
                      TAREA        0.13  SUBBASIN AREA

                PRECIPITATION DATA

 35 PB                STORM        1.16  BASIN TOTAL PRECIPITATION

 36 PI            INCREMENTAL PRECIPITATION PATTERN
```

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02
0.02	0.02	0.04	0.06	0.06	0.06	0.06	0.06	0.06	0.06
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

```
39 LG          GREEN AND AMPT LOSS RATE
                     STRTL        0.25  STARTING LOSS
                       DTH        0.25  MOISTURE DEFICIT
                      PSIF        5.20  WETTING FRONT SUCTION
                     XKSAT        0.27  HYDRAULIC CONDUCTIVITY
                     RTIMP       30.00  PERCENT IMPERVIOUS AREA

40 UC          CLARK UNITGRAPH
                        TC        1.50  TIME OF CONCENTRATION
                         R        1.89  STORAGE COEFFICIENT

41 UA          ACCUMULATED-AREA VS. TIME,  11 ORDINATES
                     0.0       5.0      16.0      30.0      65.0      77.0      84.0      90.0      94.0      97.0
                   100.0
```

***

UNIT HYDROGRAPH PARAMETERS
CLARK TC= 1.50 HR, R= 1.89 HR
SNYDER TP= 1.08 HR, CP= 0.37

UNIT HYDROGRAPH
300 END-OF-PERIOD ORDINATES
VOLUME = 0.99

0.	1.	1.	2.	2.	3.	4.	5.	6.	7.
9.	10.	11.	13.	15.	18.	22.	25.	26.	27.
28.	29.	29.	29.	30.	30.	30.	30.	30.	30.
30.	30.	30.	30.	30.	30.	30.	29.	29.	29.
29.	28.	28.	28.	28.	28.	27.	27.	26.	26.
25.	25.	24.	24.	23.	23.	23.	22.	22.	22.
21.	21.	20.	20.	20.	19.	19.	19.	18.	18.
18.	17.	17.	17.	17.	16.	16.	16.	15.	15.
15.	15.	14.	14.	14.	14.	13.	13.	13.	13.
12.	12.	12.	12.	12.	11.	11.	11.	11.	11.
10.	10.	10.	10.	10.	10.	9.	9.	9.	9.
9.	9.	8.	8.	8.	8.	8.	8.	8.	7.
7.	7.	7.	7.	7.	7.	7.	6.	6.	6.
6.	6.	6.	6.	6.	6.	6.	5.	5.	5.
5.	5.	5.	5.	5.	5.	5.	5.	4.	4.
4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
4.	4.	4.	3.	3.	3.	3.	3.	3.	3.
3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
3.	3.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	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.	0.	0.	0.

*** *** *** *** ***

HYDROGRAPH AT STATION AFT

TOTAL RAINFALL = 1.16, TOTAL LOSS = 0.67, TOTAL EXCESS = 0.49

	PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
				6-HR	24-HR	72-HR	26.63-HR
+	(CFS)	(HR)					
			(CFS)				
+	13.	4.90		6.	2.	2.	2.
			(INCHES)	0.441	0.489	0.489	0.489
			(AC-FT)	3.	3.	3.	3.

CUMULATIVE AREA = 0.13 SQ MI

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	AFT	13.	4.90	6.	2.	2.	0.13		

*** NORMAL END OF HEC-1 ***

Agua Fria River Trib. @ Youngstown

A = 0.13 sm

Urban

Q_{100} = 103 cfs

Q_{50} = 81 cfs

Q_{25} = 60 cfs

Q_{10} = 39 cfs

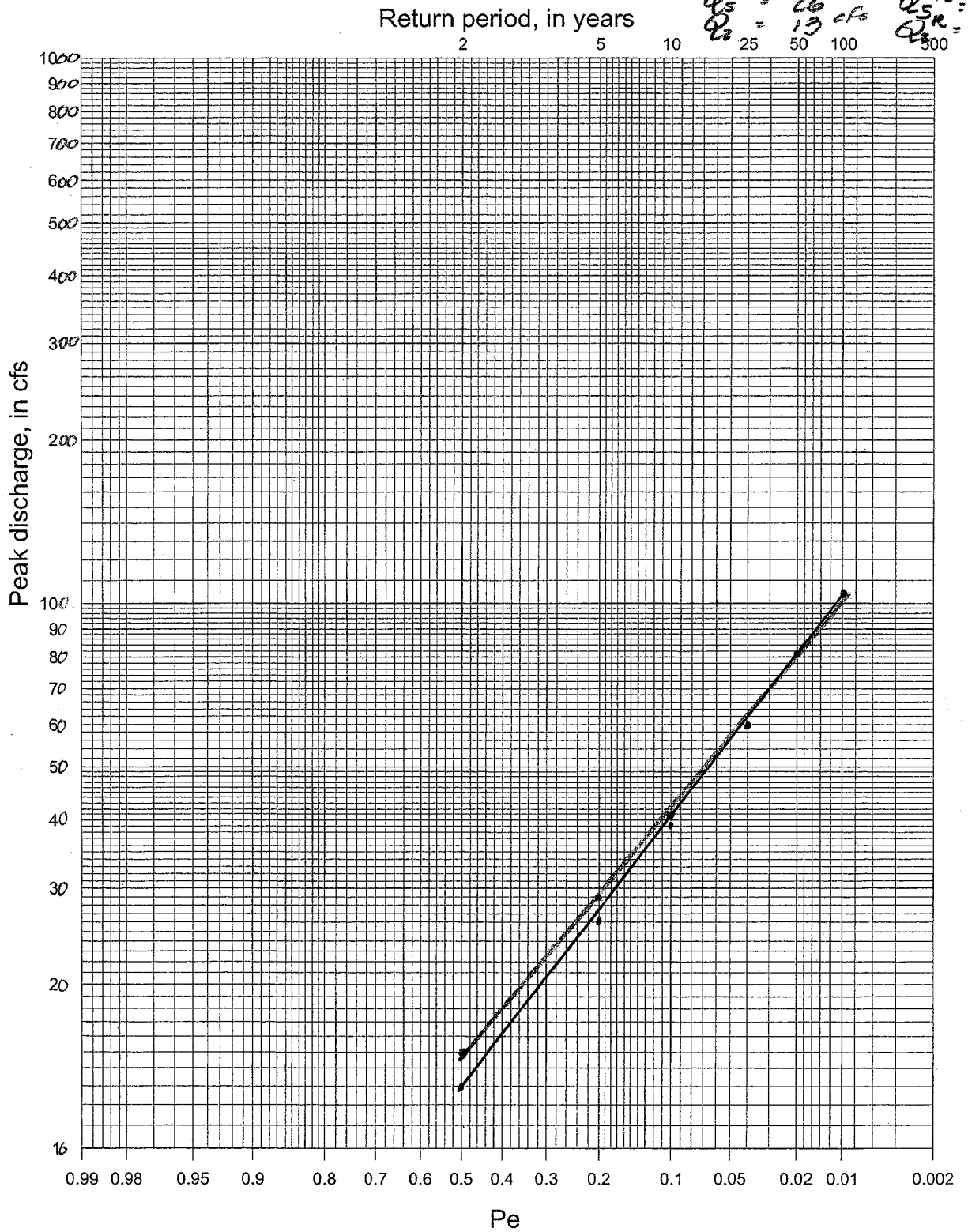
Q_5 = 26 cfs

Q_2 = 13 cfs

Q_{10}^R = 41 cfs

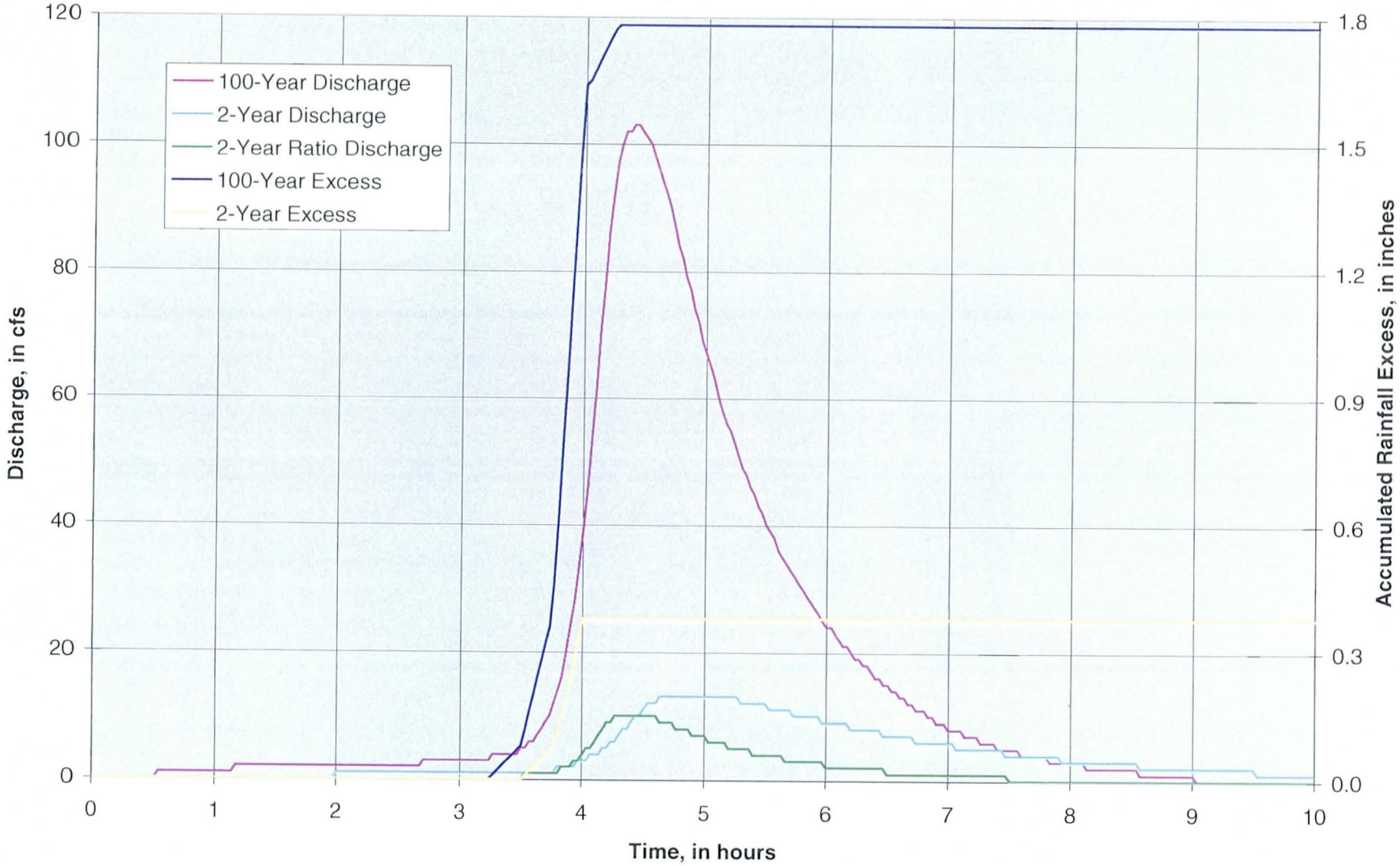
Q_{5R} = 29 cfs

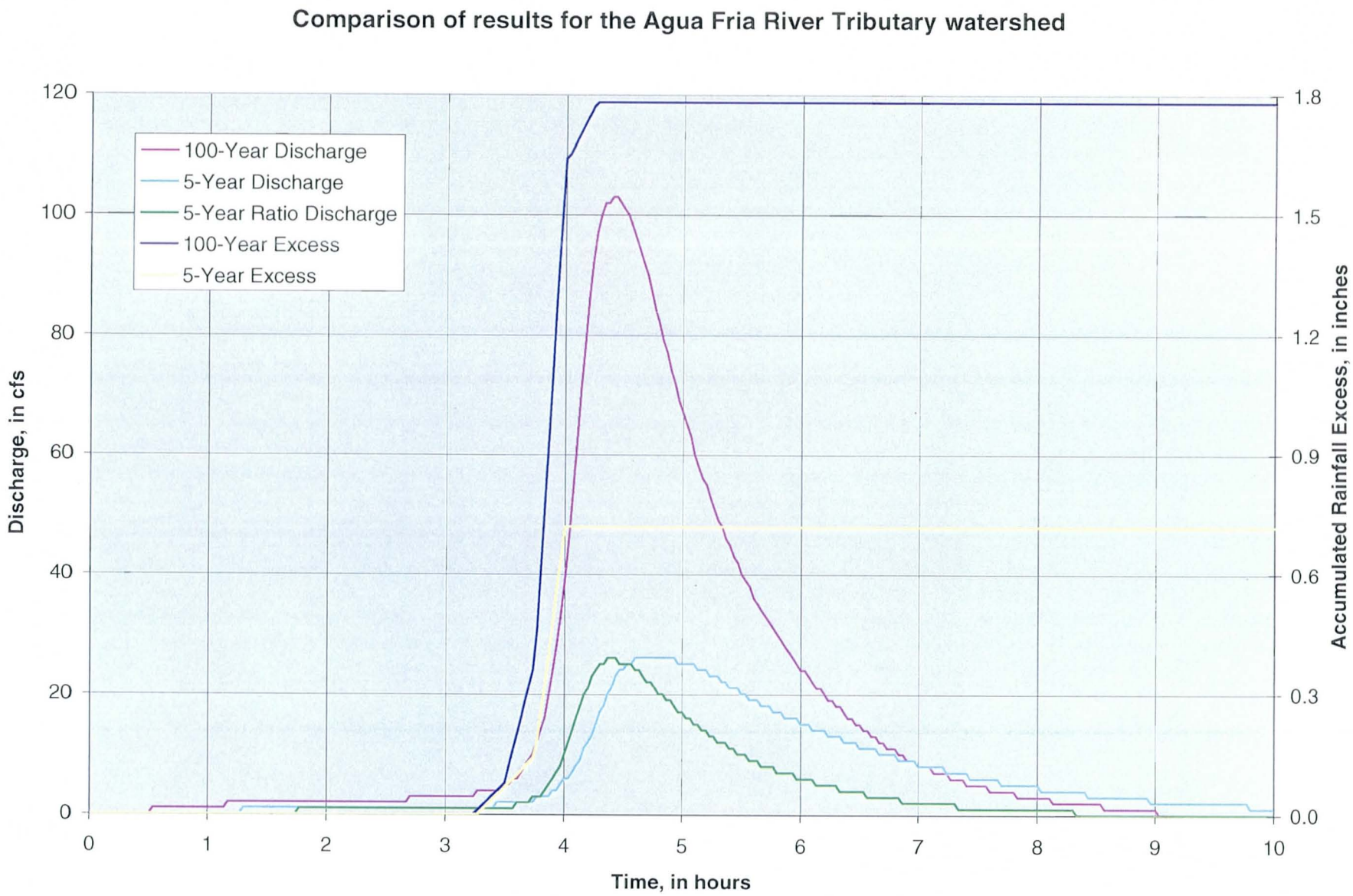
Q_{2R} = 15 cfs



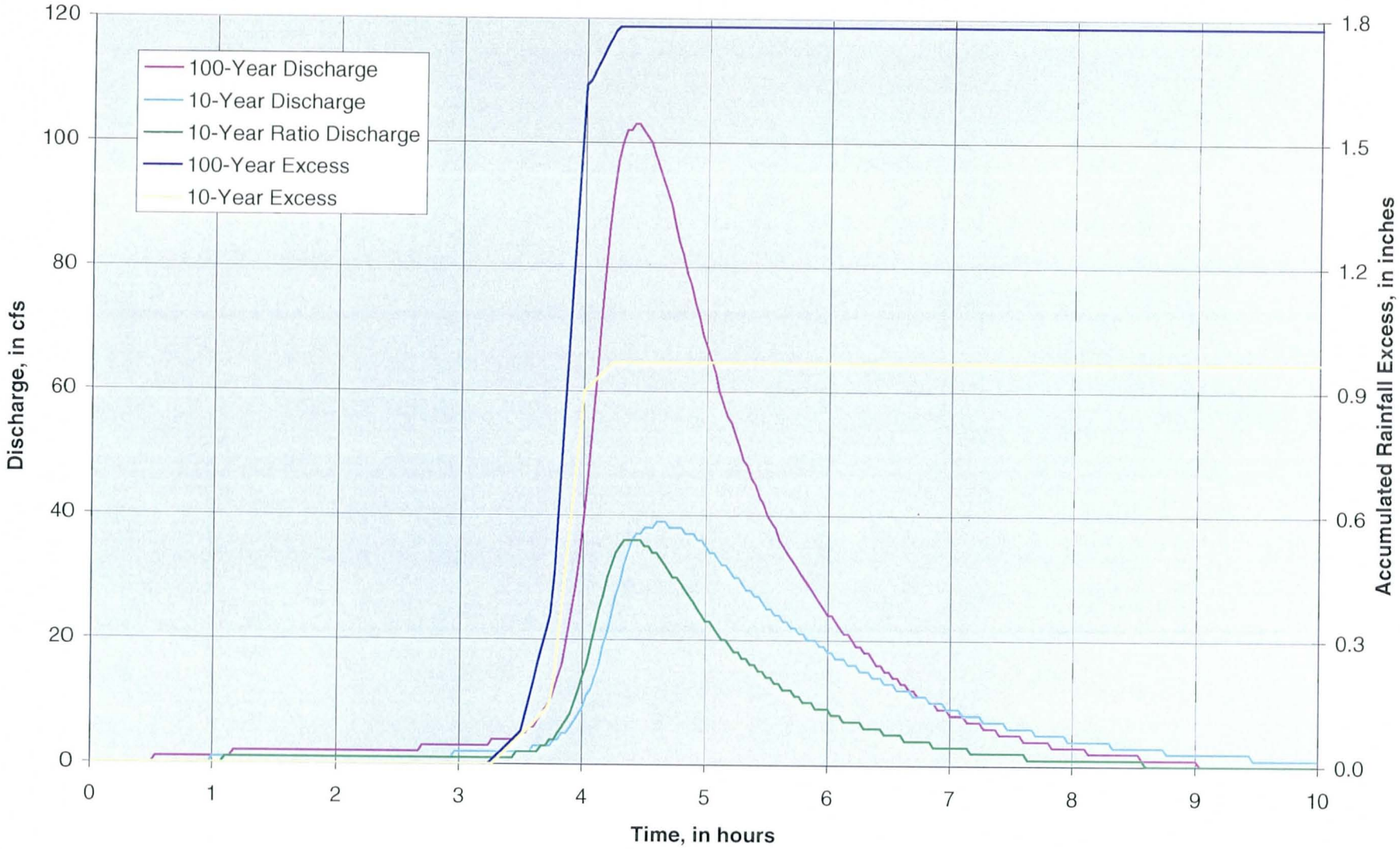
2 cycle log-normal paper

Comparison of results for the Agua Fria River Tributary watershed




Comparison of results for the Agua Fria River Tributary watershed
100-Year Discharge
5-Year Discharge
5-Year Ratio Discharge
100-Year Excess
5-Year Excess
Discharge, in cfs
Accumulated Rainfall Excess, in inches
Time, in hours
0
20
40
60
80
100
120
0.0
0.3
0.6
0.9
1.2
1.5
1.8
0
1
2
3
4
5
6
7
8
9
10

Comparison of results for the Agua Fria River Tributary watershed



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Project: Project Number:

Notes: Scale:

Page 4 of Page(s)

Computed By: Date: Checked By: Date:

SALT RIVER TRIB. AT SOUTH MOUNTAIN

1. DRAINAGE AREA IS 1.75 SQUARE MILES
2. LAND USE IS NATURAL

3. GAGE DATA : 09512200
   - PERIOD OF RECORD IS 39 YEARS (1961 - 1999)
   - LP3 PEAK DISCHARGE ESTIMATES BY USGS BASED ON 34 YEARS OF RECORD (1961 - 1994) POSSIBLY EXCLUDING THE 8 JAN. 93 DISCHARGE OF 9,200 CFS.

RETURN PERIOD YEARS	LP3 PEAK DISCHARGE CFS	RATIO TO 100-YEAR %
100	2,260	
50	1,500	
25	925	
10	420	18.6
5	191	8.5
2	37	1.6

   - FLOOD FREQUENCY ANALYSIS PERFORMED BY GVS FOR PERIOD OF RECORD FROM 1961 TO 1986. DATA DID NOT PLOT AS STRAIGHT LINE USING EITHER LEV OR GUMBEL DISTRIBUTIONS.

4. EVENT SIMULATION
   - POSSIBLE EVENT SIMULATION USING 15 AUG 90 STORM W/ PEAK DISCHARGE OF 1,210 CFS

5. HEC-1 MODELING PERFORMED BY GVS
   - 6-HOUR RAINFALL DEPTHS

RETURN PERIOD YEARS	RAINFALL DEPTH INCHES
100	3.22
50	2.86
25	2.50
10	2.04
5	1.70
2	1.19

Stantec

Project: Project Number:

Notes: Scale:

Page 5 of Page(s)

Computed By: Date: Checked By: Date:

- WATERSHED PARAMETERS

			New
AREA	=	1.75 SQ. MILES	1.75
IA	=	0.20 INCHES	~~0.30~~ 0.35
DTHETA	=	0.35	~~0.25~~ 0.35
PSIF	=	4.50 INCHES	4.50
XKSAT	=	0.40 IN/HR	~~0.57~~ 0.30
RTIMP	=	54 %	42
L	=	2.12 MILES	2.12
S	=	506 FT/MI ⇒ 303 FT/MI	303
K_b	=	0.074	~~0.07~~ 0.0738
TIME AREA	=	NATURAL	Natural

- RESULTS

RETURN PERIOD YEARS	T_c HOURS	R HOURS	PEAK DISCHARGE CFS	RATIO OF 100-YEAR %
100	0.52	0.24	2,600	
10	0.70	0.33	1,190	45.8

New

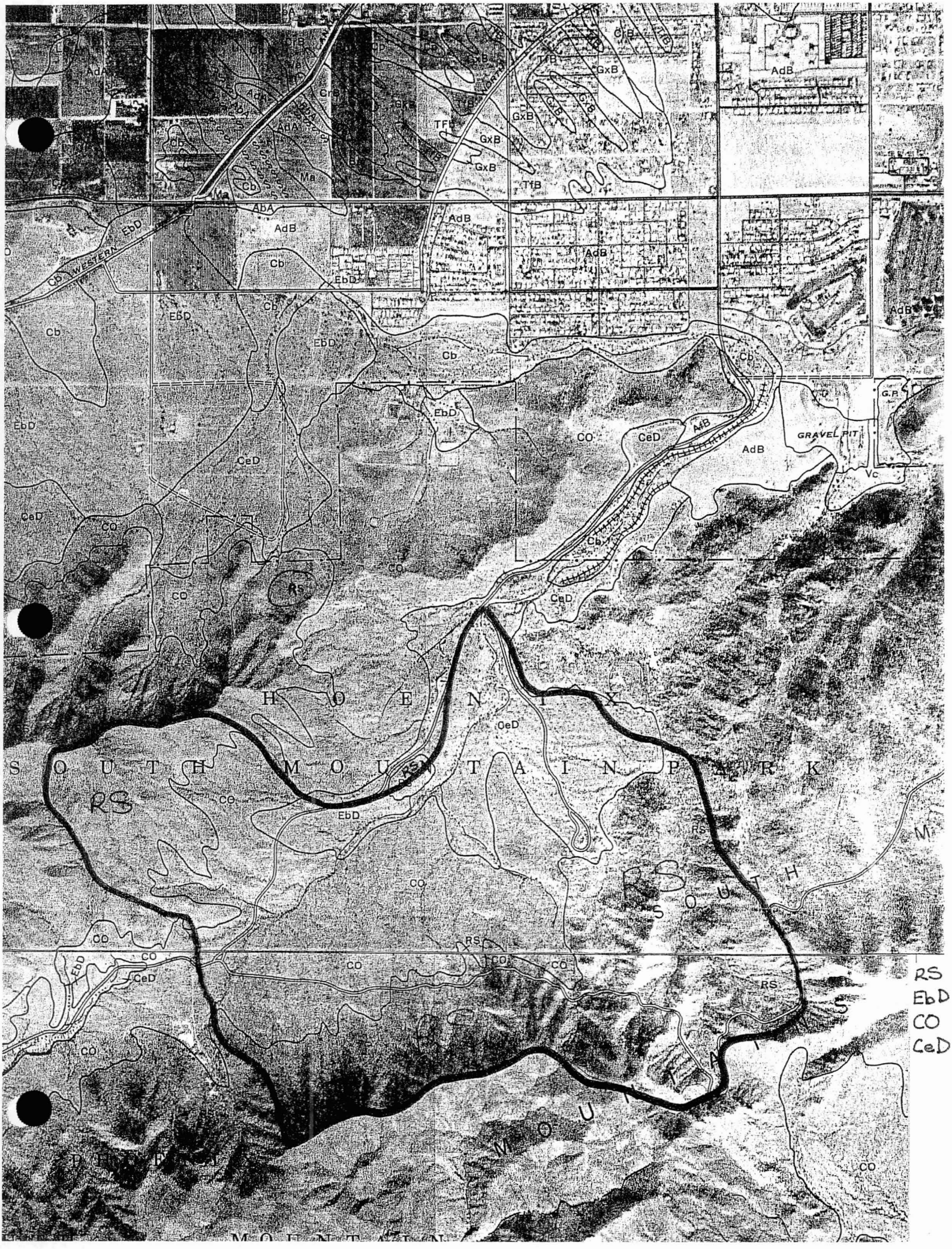
100	~~0.49~~ 0.496	~~0.21~~ 0.225	~~2982~~ 2,868		
50	~~0.51~~ 0.538	~~0.23~~ 0.246	~~2466~~ 2,349		
25	~~0.56~~ 0.596	~~0.28~~ 0.276	~~1951~~ 1,827		
10	~~0.65~~ 0.704	~~0.31~~ 0.332	~~1309~~ 1,192		41.6
5	~~0.76~~ 0.829	~~0.36~~ 0.399	~~883~~ 779		27.2
2	~~1.04~~ 1.150	~~0.51~~ 0.573	~~381~~ 319		11.1

Salt River Trib @ South Mountain

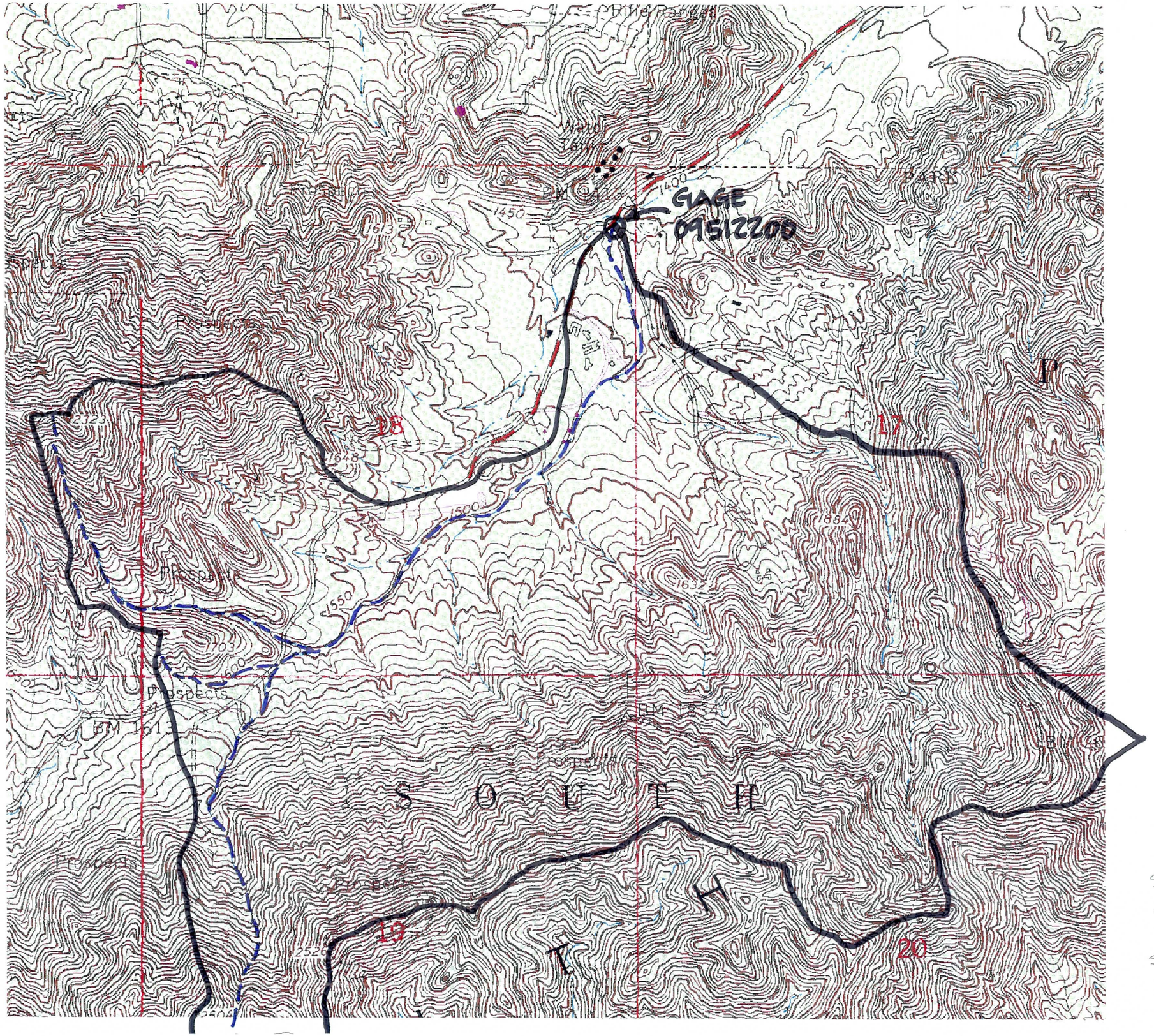
Flood Control District of Maricopa County
EXAMPLE1 - Single Storm, 6 Hr, Green Ampt, Clark, Normal Depth
Rainfall Data

Primary Zone Number:	**7**	Latitude:	**0.0**	Elevation:	**0**
Short Duration Zone Number:	**8**	Longitude:	**0.0**		

	Point Values (in)					
Duration	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
5 MIN	0.30	0.44	0.54	0.67	0.77	0.88
10 MIN	0.45	0.67	0.82	1.03	1.19	1.34
15 MIN	0.54	0.84	1.04	1.31	1.52	1.72
30 MIN	0.72	1.13	1.40	1.77	2.05	2.33
1 HOUR	0.87	1.40	1.75	2.21	2.56	2.92
2 HOUR	1.00	1.54	1.89	2.37	2.74	3.11
3 HOUR	1.08	1.63	1.99	2.48	2.86	3.23
6 HOUR	1.23	1.80	2.17	2.68	3.08	3.47
12 HOUR	1.42	1.96	2.33	2.83	3.22	3.61
24 HOUR	1.61	2.13	2.48	2.98	3.37	3.75


SOUTH MOUNTAIN PARK
HONEY
SOUTH MOUNTAINS
WESTERN
GRAVEL PIT
G.P.
AdA
AdB
AbA
Ma
Cb
EbD
CeD
CO
RS
GxB
TfB
TFB
Vc
OeD

RS
EbD
CO
CeD



SALT RIVER TRIPS,
AT S. MNT. PARK

SCALE: 1" = 1,000'

09512200 SALT RIVER TRIBUTARY IN SOUTH MOUNTAIN PARK, AT PHOENIX, AZ

LOCATION.--Lat 33°20'49", long 112°05'03", in NE$^1/_4$NE$^1/_4$ sec.18, T.1 S., R.3 E., Maricopa County, Hydrologic Unit 15060106, in South Mountain Park, on left bank 7.4 mi south of Phoenix main post office.

DRAINAGE AREA.--1.75 mi^2.

PERIOD OF RECORD.--January 1961 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,405.20 ft above sea level.

REMARKS.--No estimated daily discharges. Records fair. No storage or diversion above station.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 9,200 ft^3/s Jan. 8, 1993; no flow for most of each year.

Annual peak discharges

Water year	Date	Annual peak discharge (ft^3/s)	Discharge codes	Water year	Date	Annual peak discharge (ft^3/s)	Discharge codes
1961	07-22-61	370		1978	12-29-77	86	
1962	00-00-62	0		1979	00-00-79	0	
1963	00-00-63	0		1980	00-00-80	0	
1964	10-19-63	530		1981	00-00-81	0	
1965	09-04-65	670		1982	10-01-81	133	
1966	08-18-66	194		1983	11-30-82	44	
1967	09-03-67	12.0		1984	07-27-84	644	
1968	07-30-68	81		1985	07-16-85	7.0	ES
1969	00-00-69	0		1986	00-00-86	0	
1970	09-05-70	77		1987	00-00-87	0	
1971	00-00-71	0		1988	11-01-87	94	
1972	08-12-72	2.0		1989	10-14-88	9.2	
1973	11-11-72	147		1990	08-15-90	1,210	
1974	03-20-74	114		1991	09-05-91	171	
1975	10-29-74	3.5		1992	10-27-91	232	
1976	09-23-76	70		1993	00-00-93	0	
1977	10-23-76	5.0		1994	10-06-93	44	

Discharge rating table developed October 1989

Gage height (ft)	Discharge (ft^3/s)	Gage height (ft)	Discharge (ft^3/s)
4.0	72	8.0	262
5.0	122	9.0	357
6.0	172	10.0	792
7.0	222	10.4	1,340

Basin characteristics

Main channel slope (ft/mi)	Stream length (mi)	Mean basin elevation (ft)	Forested area (percent)	Soil index	Mean annual precipitation (in)	Rainfall intensity, 24-hour 2-year (in)	Rainfall intensity, 24-hour 50-year (in)
244	2.1	1,730	0.0	1.0	9.0	1.6	3.6

09512200 SALT RIVER TRIBUTARY IN SOUTH MOUNTAIN PARK, AT PHOENIX, AZ--Continued

MEAN MONTHLY AND ANNUAL DISCHARGES 1961-92, 1994-96

MONTH	MAXIMUM (FT3/S)	MINIMUM (FT3/S)	MEAN (FT3/S)	STANDARD DEVIATION (FT3/S)	COEFFICIENT OF VARIATION	PERCENT OF ANNUAL RUNOFF
OCTOBER	0.26	0.00	0.02	[illegible]	[illegible]	13.1
NOVEMBER	0.22	0.00	0.01	0.05	3.4	8.7
DECEMBER	0.12	0.00	0.01	0.02	4.0	[illegible]
JANUARY	0.14	0.00	0.00	0.02	5.5	[illegible]
FEBRUARY	0.08	0.00	0.00	0.01	5.9	[illegible]
MARCH	0.07	0.00	0.00	0.01	4.6	[illegible]
APRIL	0.00	0.00	0.00	0.00		[illegible]
MAY	0.00	0.00	0.00	0.00		0.0
JUNE	0.01	0.00	0.00	0.00	5.9	0.2
JULY	0.84	0.00	0.03	0.15	4.4	21.5
AUGUST	1.2	0.00	0.05	0.21	4.2	32.2
SEPTEMBER	0.27	0.00	0.02	0.06	2.8	15.0
ANNUAL	0.10	0.00	0.01	0.02	[illegible]	100

MAGNITUDE AND PROBABILITY OF ANNUAL LOW FLOW BASED ON PERIOD OF RECORD 1962-92, 1995-96

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND NON-EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	20 5%	50 2%	100# 1%
1	49	32	21	9.9	4.5	0.75
3	17	11	7.1	3.4	1.6	0.27
7	7.1	4.7	3.0	1.5	0.68	0.12
14						
30						
60						
90						
120						
183						

MAGNITUDE AND PROBABILITY OF INSTANTANEOUS PEAK FLOW BASED ON PERIOD OF RECORD 1961-94

DISCHARGE, IN FT3/S, FOR INDICATED RECURRENCE INTERVAL IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
2 50%	5 20%	10 10%	25 4%	50 2%	100 1%
37	191	420	925	1,500	2,260

WEIGHTED SKEW (LOGS)= -0.39
MEAN (LOGS)= 1.50
STANDARD DEV. (LOGS)= 0.91

MAGNITUDE AND PROBABILITY OF ANNUAL HIGH FLOW BASED ON PERIOD OF RECORD 1961-92, 1994-96

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	25 4%	50 2%	100# 1%
1						
3						
7						
15	0.06	0.33	0.70	1.4	2.3	3.4
30	0.03	0.18	0.37	0.75	1.2	1.7
60	0.01	0.10	0.21	0.43	0.66	0.99
90	0.00	0.07	0.14	0.28	0.41	0.60

DURATION TABLE OF DAILY MEAN FLOW FOR PERIOD OF RECORD 1961-92, 1994-96

DISCHARGE, IN FT3/S, WHICH WAS EQUALED OR EXCEEDED FOR INDICATED PERCENT OF TIME																
1%	5%	10%	15%	20%	30%	40%	50%	60%	70%	80%	90%	95%	98%	99%	99.5%	99.9%
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Reliability of values in column is uncertain, and potential errors are large.

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1****************************************                                    ****************************************
 *                                      *                                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                    *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                                    *    HYDROLOGIC ENGINEERING CENTER     *
 *            VERSION 4.1               *                                    *          609 SECOND STREET           *
 *                                      *                                    *       DAVIS, CALIFORNIA 95616        *
 * RUN DATE   20MAR02  TIME  11:02:56   *                                    *           (916) 756-1104             *
 *                                      *                                    *                                      *
****************************************                                    ****************************************


                                        X     X  XXXXXXX   XXXXX           X
                                        X     X  X        X     X         XX
                                        X     X  X        X                X
                                        XXXXXXX  XXXX     X        XXXXX   X
                                        X     X  X        X                X
                                        X     X  X        X     X          X
                                        X     X  XXXXXXX   XXXXX         XXX


THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                                HEC-1 INPUT                                                    PAGE  1

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

        1           ID    Hydrology Manual Update - Edition 3
        2           ID    Flood Control District of Maricopa County/City of Phoenix
        3           ID
        4           ID    Multiple Frequency Ratio Test Watershed 2:
        5           ID    Salt River Tributary at South Mountain
        6           ID            100-Year, 6-Hour Storm
        7           ID            Green & Ampt Rainfall Losses
        8           ID            Clark Unit Hydrograph
        9           ID
       10           ID       File:  SRT100-6.ih1     Date:  03-18-02
       11           ID
       12           ID   ********************************************************************
       13           IT       2                    800
       14           IO       3
                    *

       15           KK     SRT
       16           KM   Subbasin
       17           KM
       18           KM      The Clark Unit Hydrograph is used for this basin.
       19           KM          The Natural time-area relation is used for this basin.
       20           KM
       21           KM      Time of Concentration for this sub-basin is based on the following:
       22           KM          6-Hour Rainfall, Pattern No.  1.73
       23           KM          An rainfall areal reduction factor of 0.982
       24           KM
       25           KM       EXCESS RAINFALL VALUES EXCEEDED IN 5-MINUTE INTERVALS
       26           KM     5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
       27           KM   .30 .30 .30 .18 .16 .16 .11 .10 .10 .04 .04 .04 .03 .02 .02 .02 .02 .02
       28           KM
       29           KM          L=   2.120 miles, S=  309 feet/mile, Kb= .07
       30           KM
       31           BA   1.750
       32           IN      15
       33           KM   Rainfall depth of  3.47 was spacially reduced as shown by the PB record.
       34           KM   An areal reduction coefficient of 0.982 is used.
       35           PB    3.41
       36           PC   0.000   0.009   0.016   0.025   0.034   0.042   0.051   0.059   0.067   0.075
       37           PC   0.087   0.100   0.119   0.156   0.242   0.431   0.732   0.857   0.908   0.941
       38           PC   0.953   0.965   0.977   0.989   1.000
       39           LG    0.35    0.35    4.50    0.30   38.50
       40           UC   0.496   0.225
       41           UA       0       3       5       8      12      20      43      75      90      96
       42           UA     100
                    *
       43           ZZ
1****************************************                                    ****************************************
 *                                      *                                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                    *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                                    *    HYDROLOGIC ENGINEERING CENTER     *
 *            VERSION 4.1               *                                    *          609 SECOND STREET           *
 *                                      *                                    *       DAVIS, CALIFORNIA 95616        *
```

```
*  RUN DATE   20MAR02  TIME  11:02:56   *                                                    *          (916) 756-1104          *
*                                       *                                                    *                                  *
*****************************************                                                    ************************************
```

Hydrology Manual Update - Edition 3
Flood Control District of Maricopa County/City of Phoenix

Multiple Frequency Ratio Test Watershed 2:
Salt River Tributary at South Mountain
100-Year, 6-Hour Storm
Green & Ampt Rainfall Losses
Clark Unit Hydrograph

File: SRT100-6.ihl Date: 03-18-02

****

```
 14 IO          OUTPUT CONTROL VARIABLES
                      IPRNT           3  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN           2  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ         800  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      2    0  ENDING DATE
                     NDTIME        0238  ENDING TIME
                      ICENT          19  CENTURY MARK

                 COMPUTATION INTERVAL    0.03 HOURS
                      TOTAL TIME BASE   26.63 HOURS

         ENGLISH UNITS
              DRAINAGE AREA          SQUARE MILES
              PRECIPITATION DEPTH    INCHES
              LENGTH, ELEVATION      FEET
              FLOW                   CUBIC FEET PER SECOND
              STORAGE VOLUME         ACRE-FEET
              SURFACE AREA           ACRES
              TEMPERATURE            DEGREES FAHRENHEIT


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


           **************
           *            *
 15 KK     *       SRT  *
           *            *
           **************
```

Subbasin

The Clark Unit Hydrograph is used for this basin.
The Natural time-area relation is used for this basin.

Time of Concentration for this sub-basin is based on the following:
6-Hour Rainfall, Pattern No. 1.73
An rainfall areal reduction factor of 0.982

EXCESS RAINFALL VALUES EXCEEDED IN 5-MINUTE INTERVALS

5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90
.30	.30	.30	.18	.16	.16	.11	.10	.10	.04	.04	.04	.03	.02	.02	.02	.02	.02

L= 2.120 miles, S= 309 feet/mile, Kb= .07

Rainfall depth of 3.47 was spacially reduced as shown by the PB record.
An areal reduction coefficient of 0.982 is used.

```
 32 IN          TIME DATA FOR INPUT TIME SERIES
                       JXMIN          15  TIME INTERVAL IN MINUTES
                      JXDATE      1    0  STARTING DATE
                      JXTIME           0  STARTING TIME

              SUBBASIN RUNOFF DATA

 31 BA          SUBBASIN CHARACTERISTICS
                      TAREA        1.75  SUBBASIN AREA

                PRECIPITATION DATA

 35 PB                STORM        3.41  BASIN TOTAL PRECIPITATION

 36 PI            INCREMENTAL PRECIPITATION PATTERN
```

```
                0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.01      0.01      0.01
                0.01      0.01      0.01      0.01      0.01      0.03      0.03      0.03      0.03      0.03
                0.03      0.03      0.03      0.04      0.04      0.04      0.04      0.04      0.04      0.04
                0.02      0.02      0.02      0.02      0.02      0.02      0.02      0.01      0.01      0.01
                0.01      0.01      0.01      0.01      0.01      0.00      0.00      0.00      0.00      0.00
                0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00

39 LG         GREEN AND AMPT LOSS RATE
                    STRTL        0.35  STARTING LOSS
                      DTH        0.35  MOISTURE DEFICIT
                     PSIF        4.50  WETTING FRONT SUCTION
                    XKSAT        0.30  HYDRAULIC CONDUCTIVITY
                    RTIMP       38.50  PERCENT IMPERVIOUS AREA

40 UC         CLARK UNITGRAPH
                       TC        0.50  TIME OF CONCENTRATION
                        R        0.22  STORAGE COEFFICIENT

41 UA         ACCUMULATED-AREA VS. TIME,  11 ORDINATES
                    0.0       3.0       5.0       8.0      12.0      20.0      43.0      75.0      90.0      96.0
                  100.0

                                                  ***

                                          UNIT HYDROGRAPH PARAMETERS
                                   CLARK   TC=  0.50 HR,       R=  0.22 HR
                                  SNYDER   TP=  0.40 HR,      CP=  0.98

                                          UNIT HYDROGRAPH
                                     46 END-OF-PERIOD ORDINATES
              47.      127.      180.      234.      305.      384.      522.      833.     1347.     2035.
            2604.     2813.     2741.     2533.     2314.     2050.     1767.     1523.     1313.     1132.
             976.      841.      725.      625.      539.      465.      401.      345.      298.      257.
             221.      191.      164.      142.      122.      105.       91.       78.       67.       58.
              50.       43.       37.       32.       28.       24.

    ***             ***             ***             ***             ***

                     HYDROGRAPH AT STATION      SRT

   TOTAL RAINFALL =    3.41, TOTAL LOSS =    1.22, TOTAL EXCESS =    2.19

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     26.63-HR
+   (CFS)       (HR)
                          (CFS)
+    2868.      4.30                409.        103.         93.          93.
                        (INCHES)    2.173       2.182       2.182        2.182
                        (AC-FT)     203.        204.        204.         204.

                        CUMULATIVE AREA =    1.75 SQ MI

1
                                          RUNOFF SUMMARY
                                   FLOW IN CUBIC FEET PER SECOND
                                TIME IN HOURS,  AREA IN SQUARE MILES

                                     PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM    TIME OF
        OPERATION       STATION      FLOW    PEAK                                          AREA      STAGE     MAX STAGE
+                                                        6-HOUR      24-HOUR     72-HOUR

        HYDROGRAPH AT
+                          SRT      2868.    4.30         409.        103.         93.       1.75

 *** NORMAL END OF HEC-1 ***
```

```
1*****************************************                                    *************************************
 *                                       *                                    *                                   *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                    *    U.S. ARMY CORPS OF ENGINEERS   *
 *              JUN   1998               *                                    *    HYDROLOGIC ENGINEERING CENTER  *
 *           VERSION 4.1                 *                                    *          609 SECOND STREET        *
 *                                       *                                    *       DAVIS, CALIFORNIA 95616     *
 *  RUN DATE   20MAR02  TIME  11:03:18   *                                    *           (916) 756-1104          *
 *                                       *                                    *                                   *
*****************************************                                    *************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X               X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
1                                                HEC-1 INPUT                                                    PAGE  1

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

        1           ID   Hydrology Manual Update - Edition 3
        2           ID    Flood Control District of Maricopa County/City of Phoenix
        3           ID
        4           ID    Multiple Frequency Ratio Test Watershed 2:
        5           ID    Salt River Tributary at South Mountain
        6           ID            50-Year, 6-Hour Storm
        7           ID            Green & Ampt Rainfall Losses
        8           ID            Clark Unit Hydrograph
        9           ID
       10           ID       File:   SRT50-6.ih1     Date:  03-18-02
       11           ID
       12           ID   ********************************************************************
       13           IT       2                    800
       14           IO       3
                    *

       15           KK     SRT
       16           KM   Subbasin
       17           KM
       18           KM      The Clark Unit Hydrograph is used for this basin.
       19           KM          The Natural time-area relation is used for this basin.
       20           KM
       21           KM      Time of Concentration for this sub-basin is based on the following:
       22           KM          6-Hour Rainfall, Pattern No.  1.73
       23           KM          An rainfall areal reduction factor of 0.982
       24           KM
       25           KM       EXCESS RAINFALL VALUES EXCEEDED IN 5-MINUTE INTERVALS
       26           KM     5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
       27           KM   .26 .26 .26 .15 .13 .13 .09 .09 .09 .04 .04 .04 .02 .02 .02 .02 .02 .02
       28           KM
       29           KM          L=   2.120 miles, S=  309 feet/mile, Kb= .07
       30           KM
       31           BA   1.750
       32           IN      15
       33           KM   Rainfall depth of  3.08 was spacially reduced as shown by the PB record.
       34           KM   An areal reduction coefficient of 0.982 is used.
       35           PB    3.02
       36           PC   0.000   0.009   0.016   0.025   0.034   0.042   0.051   0.059   0.067   0.075
       37           PC   0.087   0.100   0.119   0.156   0.242   0.431   0.732   0.857   0.908   0.941
       38           PC   0.953   0.965   0.977   0.989   1.000
       39           LG    0.35    0.35    4.50    0.30   38.50
       40           UC   0.538   0.246
       41           UA       0       3       5       8      12      20      43      75      90      96
       42           UA     100
                    *
       43           ZZ
```


```
1*****************************************                                    *************************************
 *                                       *                                    *                                   *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                    *    U.S. ARMY CORPS OF ENGINEERS   *
 *              JUN   1998               *                                    *    HYDROLOGIC ENGINEERING CENTER  *
 *           VERSION 4.1                 *                                    *          609 SECOND STREET        *
 *                                       *                                    *       DAVIS, CALIFORNIA 95616     *
```

```
*  RUN DATE   20MAR02  TIME  11:03:18   *                                                    *            (916) 756-1104            *
*                                       *                                                    *                                      *
*****************************************                                                    ****************************************


                          Hydrology Manual Update - Edition 3
                             Flood Control District of Maricopa County/City of Phoenix

                             Multiple Frequency Ratio Test Watershed 2:
                             Salt River Tributary at South Mountain
                                     50-Year, 6-Hour Storm
                                     Green & Ampt Rainfall Losses
                                     Clark Unit Hydrograph

                                File:   SRT50-6.ih1     Date:  03-18-02

                        ***********************************************************************

 14 IO          OUTPUT CONTROL VARIABLES
                      IPRNT           3  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN           2  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ         800  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      2    0  ENDING DATE
                     NDTIME        0238  ENDING TIME
                     ICENT           19  CENTURY MARK

                  COMPUTATION INTERVAL    0.03 HOURS
                       TOTAL TIME BASE   26.63 HOURS

         ENGLISH UNITS
              DRAINAGE AREA          SQUARE MILES
              PRECIPITATION DEPTH    INCHES
              LENGTH, ELEVATION      FEET
              FLOW                   CUBIC FEET PER SECOND
              STORAGE VOLUME         ACRE-FEET
              SURFACE AREA           ACRES
              TEMPERATURE            DEGREES FAHRENHEIT


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


            **************
            *            *
 15 KK      *       SRT  *
            *            *
            **************
                          Subbasin

                             The Clark Unit Hydrograph is used for this basin.
                                 The Natural time-area relation is used for this basin.

                             Time of Concentration for this sub-basin is based on the following:
                                 6-Hour Rainfall, Pattern No.  1.73
                                 An rainfall areal reduction factor of 0.982

                              EXCESS RAINFALL VALUES EXCEEDED IN 5-MINUTE INTERVALS
                            5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
                          .26 .26 .26 .15 .13 .13 .09 .09 .09 .04 .04 .04 .02 .02 .02 .02 .02 .02

                                 L=   2.120 miles, S=  309 feet/mile, Kb= .07

                          Rainfall depth of  3.08 was spacially reduced as shown by the PB record.
                          An areal reduction coefficient of 0.982 is used.

 32 IN          TIME DATA FOR INPUT TIME SERIES
                      JXMIN          15  TIME INTERVAL IN MINUTES
                     JXDATE      1    0  STARTING DATE
                     JXTIME           0  STARTING TIME

              SUBBASIN RUNOFF DATA

 31 BA          SUBBASIN CHARACTERISTICS
                      TAREA        1.75  SUBBASIN AREA

                PRECIPITATION DATA

 35 PB                STORM        3.02  BASIN TOTAL PRECIPITATION

 36 PI            INCREMENTAL PRECIPITATION PATTERN
```

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.03	0.03	0.03	0.03	0.03
0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04
0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

```
39 LG          GREEN AND AMPT LOSS RATE
                     STRTL        0.35  STARTING LOSS
                       DTH        0.35  MOISTURE DEFICIT
                      PSIF        4.50  WETTING FRONT SUCTION
                     XKSAT        0.30  HYDRAULIC CONDUCTIVITY
                     RTIMP       38.50  PERCENT IMPERVIOUS AREA

40 UC          CLARK UNITGRAPH
                        TC        0.54  TIME OF CONCENTRATION
                         R        0.25  STORAGE COEFFICIENT

41 UA          ACCUMULATED-AREA VS. TIME,  11 ORDINATES
                     0.0       3.0       5.0       8.0      12.0      20.0      43.0      75.0      90.0      96.0
                   100.0
```

***

UNIT HYDROGRAPH PARAMETERS
CLARK TC= 0.54 HR, R= 0.25 HR
SNYDER TP= 0.44 HR, CP= 0.98

UNIT HYDROGRAPH
50 END-OF-PERIOD ORDINATES

40.	110.	157.	201.	254.	317.	413.	549.	878.	1403.
1996.	2436.	2583.	2525.	2352.	2174.	1959.	1717.	1500.	1309.
1143.	998.	871.	761.	664.	580.	506.	442.	386.	337.
294.	257.	224.	196.	171.	149.	130.	114.	99.	87.
76.	66.	58.	50.	44.	38.	34.	29.	26.	22.

*** *** *** *** ***

HYDROGRAPH AT STATION SRT

TOTAL RAINFALL = 3.02, TOTAL LOSS = 1.16, TOTAL EXCESS = 1.86

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	26.63-HR
2349.	4.33	(CFS)	347.	87.	79.	79.
		(INCHES)	1.846	1.855	1.855	1.855
		(AC-FT)	172.	173.	173.	173.

CUMULATIVE AREA = 1.75 SQ MI

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	SRT	2349.	4.33	347.	87.	79.	1.75		

*** NORMAL END OF HEC-1 ***

```
1*****************************************                    *****************************************
 *                                       *                    *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *    U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN   1998               *                    *    HYDROLOGIC ENGINEERING CENTER      *
 *            VERSION 4.1                *                    *          609 SECOND STREET            *
 *                                       *                    *       DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   20MAR02  TIME  11:04:32   *                    *           (916) 756-1104              *
 *                                       *                    *                                       *
 *****************************************                    *****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X               X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

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

             1          ID    Hydrology Manual Update - Edition 3
             2          ID    Flood Control District of Maricopa County/City of Phoenix
             3          ID
             4          ID    Multiple Frequency Ratio Test Watershed 1:
             5          ID    Salt River Tributary at South Mountain
             6          ID          25-Year, 6-Hour Storm
             7          ID          Green & Ampt Rainfall Losses
             8          ID          Clark Unit Hydrograph
             9          ID
            10          ID       File:   SRT25-6.ih1     Date:  03-18-02
            11          ID
            12          ID   ********************************************************************
            13          IT       2                    800
            14          IO       3
                        *

            15          KK     SRT
            16          KM   Subbasin
            17          KM
            18          KM      The Clark Unit Hydrograph is used for this basin.
            19          KM          The Natural time-area relation is used for this basin.
            20          KM
            21          KM      Time of Concentration for this sub-basin is based on the following:
            22          KM          6-Hour Rainfall, Pattern No.  1.73
            23          KM          An rainfall areal reduction factor of 0.982
            24          KM
            25          KM       EXCESS RAINFALL VALUES EXCEEDED IN 5-MINUTE INTERVALS
            26          KM     5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
            27          KM   .22 .22 .22 .12 .10 .09 .07 .07 .07 .03 .03 .03 .02 .02 .02 .01 .01 .01
            28          KM
            29          KM          L=   2.120 miles, S=  309 feet/mile, Kb= .07
            30          KM
            31          BA   1.750
            32          IN      15
            33          KM   Rainfall depth of  2.68 was spacially reduced as shown by the PB record.
            34          KM   An areal reduction coefficient of 0.982 is used.
            35          PB    2.63
            36          PC   0.000   0.009   0.016   0.025   0.034   0.042   0.051   0.059   0.067   0.075
            37          PC   0.087   0.100   0.119   0.156   0.242   0.431   0.732   0.857   0.908   0.941
            38          PC   0.953   0.965   0.977   0.989   1.000
            39          LG    0.35    0.35    4.50    0.30   38.50
            40          UC   0.596   0.276
            41          UA       0       3       5       8      12      20      43      75      90      96
            42          UA     100
                        *
            43          ZZ
```

```
1*****************************************                    *****************************************
 *                                       *                    *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *    U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN   1998               *                    *    HYDROLOGIC ENGINEERING CENTER      *
 *            VERSION 4.1                *                    *          609 SECOND STREET            *
 *                                       *                    *       DAVIS, CALIFORNIA 95616         *
```

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                    Hydrology Manual Update - Edition 3
                       Flood Control District of Maricopa County/City of Phoenix

                       Multiple Frequency Ratio Test Watershed 1:
                       Salt River Tributary at South Mountain
                              25-Year, 6-Hour Storm
                              Green & Ampt Rainfall Losses
                              Clark Unit Hydrograph

                          File:   SRT25-6.ih1     Date:  03-18-02

                  ************************************************************************

 14 IO          OUTPUT CONTROL VARIABLES
                      IPRNT           3  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN           2  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ         800  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      2    0  ENDING DATE
                     NDTIME        0238  ENDING TIME
                     ICENT           19  CENTURY MARK

                  COMPUTATION INTERVAL    0.03 HOURS
                       TOTAL TIME BASE   26.63 HOURS

         ENGLISH UNITS
              DRAINAGE AREA          SQUARE MILES
              PRECIPITATION DEPTH    INCHES
              LENGTH, ELEVATION      FEET
              FLOW                   CUBIC FEET PER SECOND
              STORAGE VOLUME         ACRE-FEET
              SURFACE AREA           ACRES
              TEMPERATURE            DEGREES FAHRENHEIT


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


           **************
           *            *
 15 KK     *       SRT  *
           *            *
           **************
                  Subbasin

                     The Clark Unit Hydrograph is used for this basin.
                         The Natural time-area relation is used for this basin.

                     Time of Concentration for this sub-basin is based on the following:
                         6-Hour Rainfall, Pattern No.  1.73
                         An rainfall areal reduction factor of 0.982

                      EXCESS RAINFALL VALUES EXCEEDED IN 5-MINUTE INTERVALS
                       5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
                     .22 .22 .22 .12 .10 .09 .07 .07 .07 .03 .03 .03 .02 .02 .02 .01 .01 .01

                          L=   2.120 miles, S=  309 feet/mile, Kb= .07

                  Rainfall depth of  2.68 was spacially reduced as shown by the PB record.
                  An areal reduction coefficient of 0.982 is used.

 32 IN          TIME DATA FOR INPUT TIME SERIES
                      JXMIN          15  TIME INTERVAL IN MINUTES
                     JXDATE      1    0  STARTING DATE
                     JXTIME           0  STARTING TIME

              SUBBASIN RUNOFF DATA

 31 BA          SUBBASIN CHARACTERISTICS
                      TAREA        1.75  SUBBASIN AREA

              PRECIPITATION DATA

 35 PB                STORM        2.63  BASIN TOTAL PRECIPITATION

 36 PI            INCREMENTAL PRECIPITATION PATTERN
```

```
                0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.01      0.01      0.01
                0.01      0.01      0.01      0.01      0.01      0.03      0.03      0.03      0.03      0.03
                0.03      0.03      0.03      0.04      0.04      0.04      0.04      0.04      0.04      0.04
                0.02      0.02      0.02      0.02      0.02      0.02      0.02      0.01      0.01      0.01
                0.01      0.01      0.01      0.01      0.01      0.00      0.00      0.00      0.00      0.00
                0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00

 39 LG          GREEN AND AMPT LOSS RATE
                      STRTL        0.35  STARTING LOSS
                        DTH        0.35  MOISTURE DEFICIT
                       PSIF        4.50  WETTING FRONT SUCTION
                      XKSAT        0.30  HYDRAULIC CONDUCTIVITY
                      RTIMP       38.50  PERCENT IMPERVIOUS AREA

 40 UC          CLARK UNITGRAPH
                         TC        0.60  TIME OF CONCENTRATION
                          R        0.28  STORAGE COEFFICIENT

 41 UA          ACCUMULATED-AREA VS. TIME,  11 ORDINATES
                      0.0       3.0       5.0       8.0      12.0      20.0      43.0      75.0      90.0      96.0
                    100.0

                                                  ***

                                          UNIT HYDROGRAPH PARAMETERS
                                   CLARK   TC=  0.60 HR,       R=  0.28 HR
                                  SNYDER   TP=  0.48 HR,      CP=  0.95

                                          UNIT HYDROGRAPH
                                   56 END-OF-PERIOD ORDINATES
              32.       91.      132.      165.      205.      253.      307.      395.      526.      810.
            1240.     1719.     2125.     2301.     2295.     2193.     2053.     1902.     1724.     1527.
            1353.     1199.     1063.      942.      834.      739.      655.      581.      514.      456.
             404.      358.      317.      281.      249.      221.      196.      173.      154.      136.
             121.      107.       95.       84.       74.       66.       58.       52.       46.       41.
              36.       32.       28.       25.       22.       20.

    ***             ***             ***             ***             ***

                      HYDROGRAPH AT STATION      SRT

    TOTAL RAINFALL =    2.63, TOTAL LOSS =    1.10, TOTAL EXCESS =    1.53

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR     26.63-HR
+   (CFS)        (HR)
                          (CFS)
+    1827.       4.37                285.         72.         65.         65.
                         (INCHES)    1.516       1.524       1.524       1.524
                         (AC-FT)     141.        142.        142.        142.

                      CUMULATIVE AREA =    1.75 SQ MI

1
                                          RUNOFF SUMMARY
                                   FLOW IN CUBIC FEET PER SECOND
                                TIME IN HOURS,  AREA IN SQUARE MILES

                                     PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
         OPERATION       STATION     FLOW    PEAK                                          AREA      STAGE     MAX STAGE
+                                                        6-HOUR     24-HOUR     72-HOUR

         HYDROGRAPH AT
+                          SRT      1827.    4.37         285.         72.         65.       1.75

 *** NORMAL END OF HEC-1 ***
```

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1*****************************************                    *****************************************
 *                                       *                    *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *    U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN   1998               *                    *    HYDROLOGIC ENGINEERING CENTER      *
 *           VERSION 4.1                 *                    *          609 SECOND STREET            *
 *                                       *                    *       DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   20MAR02  TIME  11:04:46   *                    *           (916) 756-1104              *
 *                                       *                    *                                       *
*****************************************                    *****************************************


                                        X     X  XXXXXXX   XXXXX           X
                                        X     X  X        X     X         XX
                                        X     X  X        X                X
                                        XXXXXXX  XXXX     X        XXXXX   X
                                        X     X  X        X                X
                                        X     X  X        X     X          X
                                        X     X  XXXXXXX   XXXXX          XXX


THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                          HEC-1 INPUT                                          PAGE  1

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

        1           ID    Hydrology Manual Update - Edition 3
        2           ID    Flood Control District of Maricopa County/City of Phoenix
        3           ID
        4           ID    Multiple Frequency Ratio Test Watershed 2:
        5           ID    Salt River Tributary at South Mountain
        6           ID          10-Year, 6-Hour Storm
        7           ID          Green & Ampt Rainfall Losses
        8           ID          Clark Unit Hydrograph
        9           ID
       10           ID       File:   SRT10-6.ihl     Date:  03-18-02
       11           ID
       12           ID  ********************************************************************
       13           IT       2                    800
       14           IO       3
                    *

       15           KK     SRT
       16           KM   Subbasin
       17           KM
       18           KM      The Clark Unit Hydrograph is used for this basin.
       19           KM          The Natural time-area relation is used for this basin.
       20           KM
       21           KM      Time of Concentration for this sub-basin is based on the following:
       22           KM          6-Hour Rainfall, Pattern No.  1.73
       23           KM          An rainfall areal reduction factor of 0.982
       24           KM
       25           KM       EXCESS RAINFALL VALUES EXCEEDED IN 5-MINUTE INTERVALS
       26           KM     5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
       27           KM   .17 .17 .16 .08 .06 .06 .05 .05 .05 .03 .03 .03 .02 .02 .02 .01 .01 .01
       28           KM
       29           KM          L=   2.120 miles, S=  309 feet/mile, Kb= .07
       30           KM
       31           BA   1.750
       32           IN      15
       33           KM   Rainfall depth of  2.17 was spacially reduced as shown by the PB record.
       34           KM   An areal reduction coefficient of 0.982 is used.
       35           PB    2.13
       36           KM   The following PC record used a 6-hour rainfall with Pattern No.  1.73
       37           PC   0.000   0.009   0.016   0.025   0.034   0.042   0.051   0.059   0.067   0.075
       38           PC   0.087   0.100   0.119   0.156   0.242   0.431   0.732   0.857   0.908   0.941
       39           PC   0.953   0.965   0.977   0.989   1.000
       40           LG    0.35    0.35    4.50    0.30   38.50
       41           UC   0.704   0.332
       42           UA       0       3       5       8      12      20      43      75      90      96
       43           UA     100
                    *
       44           ZZ
1*****************************************                    *****************************************
 *                                       *                    *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *    U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN   1998               *                    *    HYDROLOGIC ENGINEERING CENTER      *
 *           VERSION 4.1                 *                    *          609 SECOND STREET            *
```

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*                                        *                                          *       DAVIS, CALIFORNIA 95616       *
*  RUN DATE   20MAR02  TIME  11:04:46    *                                          *           (916) 756-1104            *
*                                        *                                          *                                     *
******************************************                                          *************************************
```

Hydrology Manual Update - Edition 3
Flood Control District of Maricopa County/City of Phoenix

Multiple Frequency Ratio Test Watershed 1:
Salt River Tributary at South Mountain
10-Year, 6-Hour Storm
Green & Ampt Rainfall Losses
Clark Unit Hydrograph

File: SRT10-6.ih1 Date: 03-18-02

```
                    ********************************************************************

 14 IO          OUTPUT CONTROL VARIABLES
                      IPRNT           3  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN           2  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ         800  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      2    0  ENDING DATE
                     NDTIME        0238  ENDING TIME
                      ICENT          19  CENTURY MARK

                 COMPUTATION INTERVAL    0.03 HOURS
                      TOTAL TIME BASE   26.63 HOURS

          ENGLISH UNITS
               DRAINAGE AREA          SQUARE MILES
               PRECIPITATION DEPTH    INCHES
               LENGTH, ELEVATION      FEET
               FLOW                   CUBIC FEET PER SECOND
               STORAGE VOLUME         ACRE-FEET
               SURFACE AREA           ACRES
               TEMPERATURE            DEGREES FAHRENHEIT


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


            **************
            *            *
 15 KK      *       SRT  *
            *            *
            **************
                    Subbasin

                       The Clark Unit Hydrograph is used for this basin.
                           The Natural time-area relation is used for this basin.

                       Time of Concentration for this sub-basin is based on the following:
                           6-Hour Rainfall, Pattern No.  1.73
                           An rainfall areal reduction factor of 0.982

                        EXCESS RAINFALL VALUES EXCEEDED IN 5-MINUTE INTERVALS
                      5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
                    .17 .17 .16 .08 .06 .06 .05 .05 .05 .03 .03 .03 .02 .02 .02 .01 .01 .01

                           L=   2.120 miles, S=  309 feet/mile, Kb= .07

                    Rainfall depth of  2.17 was spacially reduced as shown by the PB record.
                    An areal reduction coefficient of 0.982 is used.
                    The following PC record used a 6-hour rainfall with Pattern No.  1.73

 32 IN          TIME DATA FOR INPUT TIME SERIES
                      JXMIN          15  TIME INTERVAL IN MINUTES
                     JXDATE      1    0  STARTING DATE
                     JXTIME           0  STARTING TIME

             SUBBASIN RUNOFF DATA

 31 BA          SUBBASIN CHARACTERISTICS
                      TAREA        1.75  SUBBASIN AREA

             PRECIPITATION DATA

 36 PB                STORM        2.13  BASIN TOTAL PRECIPITATION
```

```
36 PI            INCREMENTAL PRECIPITATION PATTERN
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.01      0.01      0.01
                   0.01      0.01      0.01      0.01      0.01      0.03      0.03      0.03      0.03      0.03
                   0.03      0.03      0.03      0.04      0.04      0.04      0.04      0.04      0.04      0.04
                   0.02      0.02      0.02      0.02      0.02      0.02      0.02      0.01      0.01      0.01
                   0.01      0.01      0.01      0.01      0.01      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00

40 LG            GREEN AND AMPT LOSS RATE
                      STRTL        0.35  STARTING LOSS
                        DTH        0.35  MOISTURE DEFICIT
                       PSIF        4.50  WETTING FRONT SUCTION
                      XKSAT        0.30  HYDRAULIC CONDUCTIVITY
                      RTIMP       38.50  PERCENT IMPERVIOUS AREA

41 UC            CLARK UNITGRAPH
                         TC        0.70  TIME OF CONCENTRATION
                          R        0.33  STORAGE COEFFICIENT

42 UA            ACCUMULATED-AREA VS. TIME,  11 ORDINATES
                       0.0       3.0       5.0       8.0      12.0      20.0      43.0      75.0      90.0      96.0
                     100.0

                                                  ***

                                              UNIT HYDROGRAPH PARAMETERS
                                       CLARK   TC=  0.70 HR,        R=  0.33 HR
                                      SNYDER   TP=  0.57 HR,       CP=  0.95

                                              UNIT HYDROGRAPH
                                        67 END-OF-PERIOD ORDINATES
                 23.       67.      100.      122.      147.      177.      211.      250.      304.      384.
                521.      759.     1062.     1405.     1733.     1900.     1941.     1909.     1819.     1722.
               1618.     1498.     1359.     1229.     1111.     1005.      909.      822.      743.      672.
                608.      550.      497.      450.      407.      368.      333.      301.      272.      246.
                223.      201.      182.      165.      149.      135.      122.      110.      100.       90.
                 81.       74.       67.       60.       55.       49.       45.       40.       36.       33.
                 30.       27.       24.       22.       20.       18.       16.

     ***            ***            ***            ***            ***

                        HYDROGRAPH AT STATION      SRT

    TOTAL RAINFALL =    2.13, TOTAL LOSS =    1.02, TOTAL EXCESS =    1.11

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
+   (CFS)       (HR)                     6-HR       24-HR       72-HR     26.63-HR
                                        (CFS)
+    1192.      4.47                     207.         52.         47.         47.
                                     (INCHES)      1.098       1.106       1.106       1.106
                                      (AC-FT)       102.        103.        103.        103.

                        CUMULATIVE AREA =    1.75 SQ MI

1
                                              RUNOFF SUMMARY
                                       FLOW IN CUBIC FEET PER SECOND
                                     TIME IN HOURS,  AREA IN SQUARE MILES

                                          PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION         FLOW    PEAK                                          AREA      STAGE     MAX STAGE
+                                                              6-HOUR      24-HOUR     72-HOUR

          HYDROGRAPH AT
+                            SRT         1192.    4.47         207.         52.         47.       1.75

*** NORMAL END OF HEC-1 ***
```

```
1*****************************************                    *****************************************
 *                                       *                    *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *    U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN   1998               *                    *    HYDROLOGIC ENGINEERING CENTER      *
 *           VERSION 4.1                 *                    *          609 SECOND STREET            *
 *                                       *                    *       DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   20MAR02  TIME  11:04:56   *                    *          (916) 756-1104               *
 *                                       *                    *                                       *
*****************************************                    *****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X               X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
1                                                HEC-1 INPUT                                                    PAGE  1

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

           1          ID    Hydrology Manual Update - Edition 3
           2          ID    Flood Control District of Maricopa County/City of Phoenix
           3          ID
           4          ID    Multiple Frequency Ratio Test Watershed 1:
           5          ID    Salt River Tributary at South Mountain
           6          ID            5-Year, 6-Hour Storm
           7          ID            Green & Ampt Rainfall Losses
           8          ID            Clark Unit Hydrograph
           9          ID
          10          ID       File:    SRT5-6.ih1     Date:  03-18-02
          11          ID
          12          ID   ***********************************************************************
          13          IT       2                     800
          14          IO       3
                      *

          15          KK     SRT
          16          KM   Subbasin
          17          KM
          18          KM      The Clark Unit Hydrograph is used for this basin.
          19          KM          The Natural time-area relation is used for this basin.
          20          KM
          21          KM      Time of Concentration for this sub-basin is based on the following:
          22          KM          6-Hour Rainfall, Pattern No.  1.73
          23          KM          An rainfall areal reduction factor of 0.982
          24          KM
          25          KM       EXCESS RAINFALL VALUES EXCEEDED IN 5-MINUTE INTERVALS
          26          KM     5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
          27          KM   .13 .13 .12 .05 .05 .05 .03 .03 .03 .02 .02 .02 .01 .01 .01 .01 .01 .01
          28          KM
          29          KM          L=   2.120 miles, S=  309 feet/mile, Kb= .07
          30          KM
          31          BA   1.750
          32          IN      15
          33          KM   Rainfall depth of  1.80 was spacially reduced as shown by the PB record.
          34          KM   An areal reduction coefficient of 0.982 is used.
          35          PB    1.77
          36          PC   0.000   0.009   0.016   0.025   0.034   0.042   0.051   0.059   0.067   0.075
          37          PC   0.087   0.100   0.119   0.156   0.242   0.431   0.732   0.857   0.908   0.941
          38          PC   0.953   0.965   0.977   0.989   1.000
          39          LG    0.35    0.35    4.50    0.30   38.50
          40          UC   0.829   0.399
          41          UA       0       3       5       8      12      20      43      75      90      96
          42          UA     100
                      *
          43          ZZ
```

```
1*****************************************                    *****************************************
 *                                       *                    *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *    U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN   1998               *                    *    HYDROLOGIC ENGINEERING CENTER      *
 *           VERSION 4.1                 *                    *          609 SECOND STREET            *
 *                                       *                    *       DAVIS, CALIFORNIA 95616         *
```

Hydrology Manual Update - Edition 3
Flood Control District of Maricopa County/City of Phoenix

Multiple Frequency Ratio Test Watershed 1:
Salt River Tributary at South Mountain
5-Year, 6-Hour Storm
Green & Ampt Rainfall Losses
Clark Unit Hydrograph

File: SRT5-6.ih1 Date: 03-18-02

****

```
 14 IO          OUTPUT CONTROL VARIABLES
                      IPRNT           3  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN           2  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ         800  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      2    0  ENDING DATE
                     NDTIME        0238  ENDING TIME
                      ICENT          19  CENTURY MARK

                 COMPUTATION INTERVAL    0.03 HOURS
                      TOTAL TIME BASE   26.63 HOURS

         ENGLISH UNITS
              DRAINAGE AREA          SQUARE MILES
              PRECIPITATION DEPTH    INCHES
              LENGTH, ELEVATION      FEET
              FLOW                   CUBIC FEET PER SECOND
              STORAGE VOLUME         ACRE-FEET
              SURFACE AREA           ACRES
              TEMPERATURE            DEGREES FAHRENHEIT
```

*** ***

```
           **************
           *            *
 15 KK     *       SRT  *
           *            *
           **************
                      Subbasin

                        The Clark Unit Hydrograph is used for this basin.
                           The Natural time-area relation is used for this basin.

                        Time of Concentration for this sub-basin is based on the following:
                            6-Hour Rainfall, Pattern No.  1.73
                            An rainfall areal reduction factor of 0.982

                         EXCESS RAINFALL VALUES EXCEEDED IN 5-MINUTE INTERVALS
                       5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
                     .13 .13 .12 .05 .05 .05 .03 .03 .03 .02 .02 .02 .01 .01 .01 .01 .01 .01

                            L=   2.120 miles, S=  309 feet/mile, Kb= .07

                      Rainfall depth of  1.80 was spacially reduced as shown by the PB record.
                      An areal reduction coefficient of 0.982 is used.

 32 IN          TIME DATA FOR INPUT TIME SERIES
                      JXMIN          15  TIME INTERVAL IN MINUTES
                     JXDATE      1    0  STARTING DATE
                     JXTIME           0  STARTING TIME

              SUBBASIN RUNOFF DATA

 31 BA          SUBBASIN CHARACTERISTICS
                      TAREA        1.75  SUBBASIN AREA

              PRECIPITATION DATA

 35 PB                STORM        1.77  BASIN TOTAL PRECIPITATION

 36 PI            INCREMENTAL PRECIPITATION PATTERN
```

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.03	0.03	0.03	0.03	0.03
0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04
0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

```
39 LG          GREEN AND AMPT LOSS RATE
                     STRTL        0.35  STARTING LOSS
                       DTH        0.35  MOISTURE DEFICIT
                      PSIF        4.50  WETTING FRONT SUCTION
                     XKSAT        0.30  HYDRAULIC CONDUCTIVITY
                     RTIMP       38.50  PERCENT IMPERVIOUS AREA

40 UC          CLARK UNITGRAPH
                        TC        0.83  TIME OF CONCENTRATION
                         R        0.40  STORAGE COEFFICIENT

41 UA          ACCUMULATED-AREA VS. TIME,  11 ORDINATES
                     0.0       3.0       5.0       8.0      12.0      20.0      43.0      75.0      90.0      96.0
                   100.0
```

***

UNIT HYDROGRAPH PARAMETERS
CLARK TC= 0.83 HR, R= 0.40 HR
SNYDER TP= 0.68 HR, CP= 0.95

UNIT HYDROGRAPH
80 END-OF-PERIOD ORDINATES

16.	48.	74.	93.	107.	126.	149.	172.	200.	229.
277.	342.	448.	628.	833.	1070.	1334.	1522.	1602.	1632.
1611.	1547.	1482.	1411.	1339.	1250.	1150.	1058.	973.	895.
823.	757.	696.	641.	589.	542.	498.	459.	422.	388.
357.	328.	302.	278.	255.	235.	216.	199.	183.	168.
155.	142.	131.	120.	111.	102.	94.	86.	79.	73.
67.	62.	57.	52.	48.	44.	41.	37.	34.	32.
29.	27.	25.	23.	21.	19.	18.	16.	15.	14.

*** *** *** *** ***

HYDROGRAPH AT STATION SRT

TOTAL RAINFALL = 1.77, TOTAL LOSS = 0.94, TOTAL EXCESS = 0.83

	PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	26.63-HR
+	779.	4.57	(CFS)	155.	39.	35.	35.
			(INCHES)	0.821	0.829	0.829	0.829
			(AC-FT)	77.	77.	77.	77.

CUMULATIVE AREA = 1.75 SQ MI

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	SRT	779.	4.57	155.	39.	35.	1.75		

*** NORMAL END OF HEC-1 ***

```
1****************************************                                    ****************************************
 *                                      *                                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                    *   U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN   1998              *                                    *   HYDROLOGIC ENGINEERING CENTER      *
 *           VERSION 4.1                *                                    *         609 SECOND STREET            *
 *                                      *                                    *      DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   20MAR02  TIME  11:05:05  *                                    *          (916) 756-1104              *
 *                                      *                                    *                                      *
 ****************************************                                    ****************************************


                                        X     X  XXXXXXX   XXXXX           X
                                        X     X  X        X     X         XX
                                        X     X  X        X                X
                                        XXXXXXX  XXXX     X        XXXXX   X
                                        X     X  X        X                X
                                        X     X  X        X     X          X
                                        X     X  XXXXXXX   XXXXX          XXX


THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                                HEC-1 INPUT                                                    PAGE  1

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

         1          ID    Hydrology Manual Update - Edition 3
         2          ID    Flood Control District of Maricopa County/City of Phoenix
         3          ID
         4          ID    Multiple Frequency Ratio Test Watershed 1:
         5          ID    Salt River Tributary at South Mountain
         6          ID          2-Year, 6-Hour Storm
         7          ID          Green & Ampt Rainfall Losses
         8          ID          Clark Unit Hydrograph
         9          ID
        10          ID       File:    SRT2-6.ih1     Date:  03-18-02
        11          ID
        12          ID   ********************************************************************
        13          IT       2                    800
        14          IO       3
                    *

        15          KK     SRT
        16          KM   Subbasin
        17          KM
        18          KM      The Clark Unit Hydrograph is used for this basin.
        19          KM          The Natural time-area relation is used for this basin.
        20          KM
        21          KM      Time of Concentration for this sub-basin is based on the following:
        22          KM          6-Hour Rainfall, Pattern No.  1.73
        23          KM          An rainfall areal reduction factor of 0.982
        24          KM
        25          KM       EXCESS RAINFALL VALUES EXCEEDED IN 5-MINUTE INTERVALS
        26          KM     5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
        27          KM   .06 .05 .05 .03 .03 .03 .02 .02 .02 .01 .01 .01 .01 .01 .01 .01 .01 .01
        28          KM
        29          KM          L=   2.120 miles, S=  309 feet/mile, Kb= .07
        30          KM
        31          BA   1.750
        32          IN      15
        33          KM   Rainfall depth of  1.23 was spacially reduced as shown by the PB record.
        34          KM   An areal reduction coefficient of 0.982 is used.
        35          PB    1.21
        36          PC   0.000   0.009   0.016   0.025   0.034   0.042   0.051   0.059   0.067   0.075
        37          PC   0.087   0.100   0.119   0.156   0.242   0.431   0.732   0.857   0.908   0.941
        38          PC   0.953   0.965   0.977   0.989   1.000
        39          LG    0.35    0.35    4.50    0.30   38.50
        40          UC   1.150   0.573
        41          UA       0       3       5       8      12      20      43      75      90      96
        42          UA     100
                    *
        43          ZZ
1****************************************                                    ****************************************
 *                                      *                                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                    *   U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN   1998              *                                    *   HYDROLOGIC ENGINEERING CENTER      *
 *           VERSION 4.1                *                                    *         609 SECOND STREET            *
 *                                      *                                    *      DAVIS, CALIFORNIA 95616         *
```

Hydrology Manual Update - Edition 3
Flood Control District of Maricopa County/City of Phoenix

Multiple Frequency Ratio Test Watershed 1:
Salt River Tributary at South Mountain
2-Year, 6-Hour Storm
Green & Ampt Rainfall Losses
Clark Unit Hydrograph

File: SRT2-6.ih1 Date: 03-18-02

****

```
 14 IO          OUTPUT CONTROL VARIABLES
                     IPRNT          3  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                      NMIN          2  MINUTES IN COMPUTATION INTERVAL
                     IDATE      1    0  STARTING DATE
                     ITIME       0000  STARTING TIME
                        NQ        800  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE      2    0  ENDING DATE
                    NDTIME       0238  ENDING TIME
                     ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL    0.03 HOURS
                      TOTAL TIME BASE   26.63 HOURS

         ENGLISH UNITS
              DRAINAGE AREA          SQUARE MILES
              PRECIPITATION DEPTH    INCHES
              LENGTH, ELEVATION      FEET
              FLOW                   CUBIC FEET PER SECOND
              STORAGE VOLUME         ACRE-FEET
              SURFACE AREA           ACRES
              TEMPERATURE            DEGREES FAHRENHEIT
```

*** ***

```
           **************
           *            *
 15 KK     *       SRT  *
           *            *
           **************
```

Subbasin

The Clark Unit Hydrograph is used for this basin.
The Natural time-area relation is used for this basin.

Time of Concentration for this sub-basin is based on the following:
6-Hour Rainfall, Pattern No. 1.73
An rainfall areal reduction factor of 0.982

EXCESS RAINFALL VALUES EXCEEDED IN 5-MINUTE INTERVALS

5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90
.06	.05	.05	.03	.03	.03	.02	.02	.02	.01	.01	.01	.01	.01	.01	.01	.01	.01

L= 2.120 miles, S= 309 feet/mile, Kb= .07

Rainfall depth of 1.23 was spacially reduced as shown by the PB record.
An areal reduction coefficient of 0.982 is used.

```
 32 IN          TIME DATA FOR INPUT TIME SERIES
                     JXMIN         15  TIME INTERVAL IN MINUTES
                    JXDATE      1    0  STARTING DATE
                    JXTIME           0  STARTING TIME

              SUBBASIN RUNOFF DATA

 31 BA          SUBBASIN CHARACTERISTICS
                     TAREA       1.75  SUBBASIN AREA

                PRECIPITATION DATA

 35 PB                STORM       1.21  BASIN TOTAL PRECIPITATION

 36 PI            INCREMENTAL PRECIPITATION PATTERN
```

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.03	0.03	0.03	0.03	0.03
0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04
0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

```
39 LG          GREEN AND AMPT LOSS RATE
                     STRTL        0.35  STARTING LOSS
                       DTH        0.35  MOISTURE DEFICIT
                      PSIF        4.50  WETTING FRONT SUCTION
                     XKSAT        0.30  HYDRAULIC CONDUCTIVITY
                     RTIMP       38.50  PERCENT IMPERVIOUS AREA

40 UC          CLARK UNITGRAPH
                        TC        1.15  TIME OF CONCENTRATION
                         R        0.57  STORAGE COEFFICIENT

41 UA          ACCUMULATED-AREA VS. TIME,  11 ORDINATES
                     0.0       3.0       5.0       8.0      12.0      20.0      43.0      75.0      90.0      96.0
                   100.0
```

***

UNIT HYDROGRAPH PARAMETERS
CLARK TC= 1.15 HR, R= 0.57 HR
SNYDER TP= 0.94 HR, CP= 0.93

UNIT HYDROGRAPH
113 END-OF-PERIOD ORDINATES

8.	25.	40.	53.	62.	70.	77.	87.	99.	110.
122.	136.	151.	167.	193.	226.	258.	319.	418.	522.
628.	753.	888.	1015.	1095.	1124.	1143.	1152.	1135.	1104.
1075.	1043.	1006.	971.	933.	886.	836.	789.	744.	702.
662.	625.	590.	556.	525.	495.	467.	441.	416.	392.
370.	349.	329.	311.	293.	277.	261.	246.	232.	219.
207.	195.	184.	174.	164.	155.	146.	138.	130.	123.
116.	109.	103.	97.	92.	86.	82.	77.	73.	68.
65.	61.	57.	54.	51.	48.	46.	43.	41.	38.
36.	34.	32.	30.	29.	27.	25.	24.	23.	21.
20.	19.	18.	17.	16.	15.	14.	13.	13.	12.
11.	11.	10.							

*** *** *** *** ***

HYDROGRAPH AT STATION SRT

TOTAL RAINFALL = 1.21, TOTAL LOSS = 0.74, TOTAL EXCESS = 0.47

	PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	26.63-HR
+	319.	4.83	(CFS)	87.	22.	20.	20.
			(INCHES)	0.461	0.471	0.471	0.471
			(AC-FT)	43.	44.	44.	44.

CUMULATIVE AREA = 1.75 SQ MI

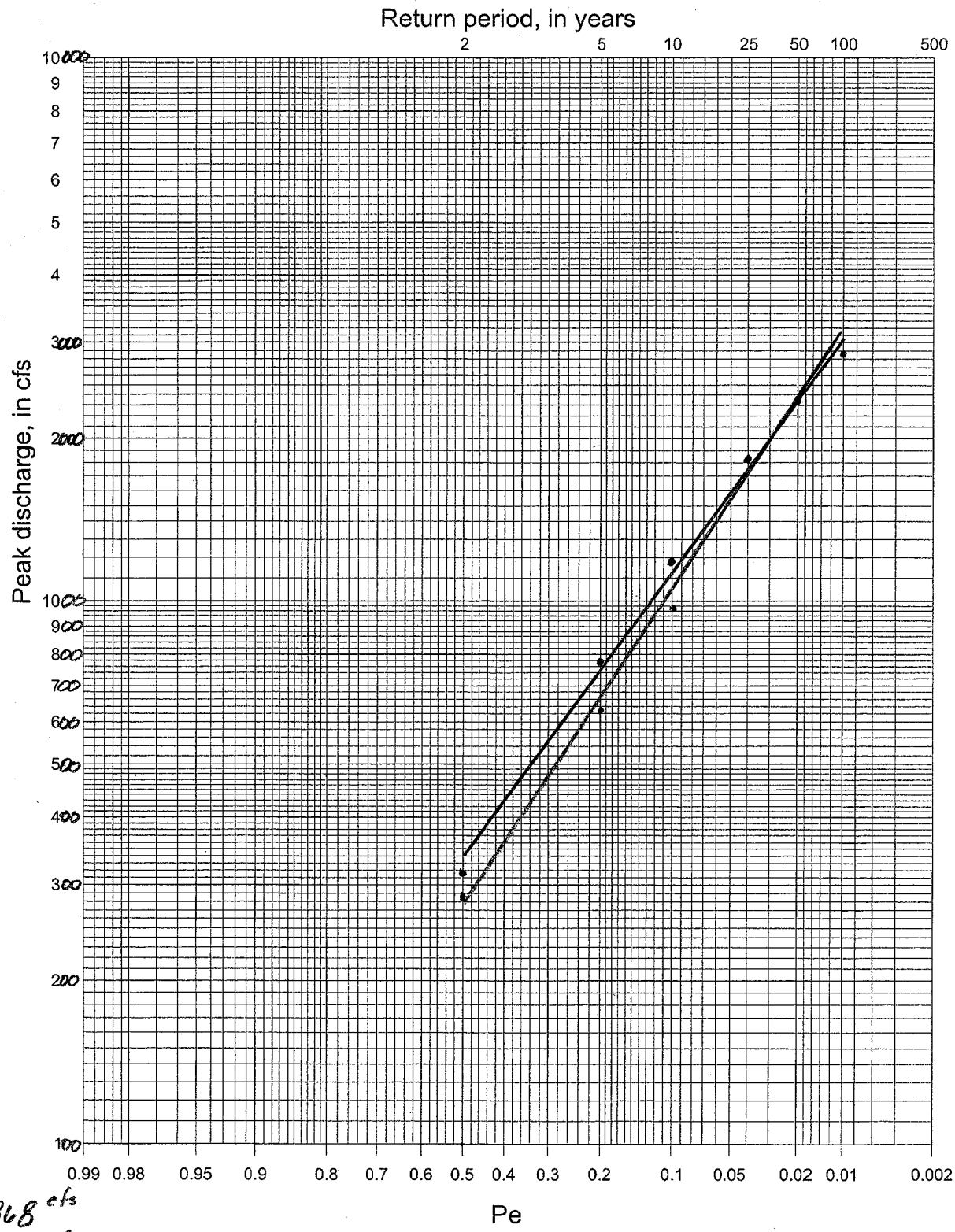
1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	SRT	319.	4.83	87.	22.	20.	1.75		

*** NORMAL END OF HEC-1 ***

Salt River Trib @ South Mountain Park
A = 1.75 sm
Natural



2 cycle log-normal paper

Q_{100} = 2,868 cfs
Q_{50} = 2,349 cfs
Q_{25} = 1,827 cfs
Q_{10} = 1,192 cfs Q_{10}^{R} = 975 cfs
Q_5 = 779 cfs Q_5^{R} = 631 cfs
Q_2 = 319 cfs Q_2^{R} = 287 cfs

Stantec

Project: Project Number:

Notes: Scale:

Page of Page(s)

Computed By: Date: Checked By: Date:

TUCSON ARROYO @ VINE AVENUE

1. Drainage Area is 8.69 square miles (Area decreased to current area by flood control diversions in 1956)
2. Land use is mixed but predominantly residential
3. Gage Data : 09483000
   - Period of record is ? years (40)
   - LP3 based on 25-years of record (1956-81)

Return Period years	Estimated Discharge cfs	Ratio of 100-year %
100	4,890	
50	3,920	
25	3,090	
10	2,150	44.0
5	1,540	31.5
2	842	17.2

4. Event Simulation performed by GVS
   - 12 Aug 1972

Peak Q recorded is 2,950 cfs
Peak Q estimated is 2,070 "
Rainfall depth is inches
Rainfall excess is inches
T_c = hrs
R_c = hrs

Stantec

Project: Project Number:

Notes: Scale:

Page of Page(s)

Computed By: Date: Checked By: Date:

5. HEC-1 modeling performed by GVS

- 6-Hour rainfall

Return Period years	Point Depth inches
100	3.60
50	3.23
25	2.86
10	2.38
5	2.03
2	1.53

- Watershed parameters

			New
Area	=	8.12 square miles	8.12
IA	=	0.20 inches	0.22
DTHETA	=	0.25	0.25
PSIF	=	4.3 inches	4.80
XKSAT	=	0.26 in/hr	0.32
RTIMP	=	20.2%	40.0
L	=	6.18 miles	6.18
S	=	37.7 ft/mi	37.7
K_b	=	0.0168	0.03 → 0.0168
Time Area	=	Urban	Urban

- Results

Return Period years	Rainfall Excess inches	T_c hours	R hours	Peak Discharge cfs	Ratio to 100-year %
100	1.97	0.93	0.45	7,520	
50	1.69	1.00	0.48	6,260	
25	1.37	1.12	0.54	4,790	
10	1.02	1.30	0.64	3,180	42.3
5	0.77	1.40	0.70	2,240	29.8
2	0.42	1.45	0.73	1,130	15.0

Stantec

Project: Project Number:

Notes: Scale:

Page of Page(s)

Computed By: Date: / / Checked By: Date: / /

· Comparison to flood frequency analyses

Return Period Years	SLA[1] (1987) Discharge cfs	SLA[1] (1987) Ratio %	COE[2] (1974) Discharge cfs	COE[2] (1974) Ratio %	GVS[3] (1989) Discharge cfs	GVS[3] (1989) Ratio %
100	4,901		11,500		7,600	
50	3,990		8,400		5,300	
25	3,201		5,500		3,600	
10	2,266	46.2	3,400	29.6	2,200	28.9
2	885	18.1	880	7.7	800	10.5

Notes:
1. Log normal distribution
2. Log pearson type 3 w/ 16 years of data
3. Log-extreme value w/ 26 years of data

Stantec

Project: _____ Project Number: _____

Notes: _____ Scale: _____

Page ____ of ____ Page(s)

Computed By: _____ Date: / / Checked By: _____ Date: / /

New

Return Period Years	Rainfall Excess Inches	Tc Hours	R Hours	Peak Discharge cfs	Ratio to 100-Year %
100	2.14	~~1.35~~ 0.896	~~0.67~~ 0.426	~~5938~~ 7,846	
50	1.84	~~1.48~~ 0.972	~~0.74~~ 0.467	~~4796~~ 6,446	
25	1.56	~~1.50~~ 1.058	~~0.76~~ 0.513	~~3992~~ 5,179	
10	1.19	~~1.50~~ 1.229	~~0.76~~ 0.605	~~3008~~ 3,564	45.4
5	0.94	~~1.50~~ 1.408	~~0.76~~ 0.704	~~2284~~ 2,483	31.6
2	0.61	~~1.50~~ 1.500	~~0.76~~ 0.756	~~1401~~ 1,442	18.4
		1.857	0.957	1,242	15.8

Flood Control District of Maricopa County
EXAMPLE1 - Single Storm, 6 Hr, Green Ampt, Clark, Normal Depth
Rainfall Data

Primary Zone Number:	**7**	Latitude:	**0.0**	Elevation:	**0**
Short Duration Zone Number:	**8**	Longitude:	**0.0**		

	Point Values (in)					
Duration	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
5 MIN	0.41	0.50	0.56	0.65	0.72	0.79
10 MIN	0.62	0.76	0.85	0.99	1.10	1.21
15 MIN	0.75	0.94	1.07	1.26	1.41	1.56
30 MIN	1.00	1.26	1.44	1.70	1.91	2.11
1 HOUR	1.22	1.55	1.79	2.12	2.38	2.64
2 HOUR	1.33	1.72	1.99	2.37	2.67	2.96
3 HOUR	1.40	1.83	2.12	2.53	2.86	3.17
6 HOUR	1.54	2.08	2.37	2.85	3.21	3.58
12 HOUR	1.68	2.26	2.65	3.20	3.62	4.05
24 HOUR	1.82	2.48	2.93	3.55	4.03	4.51

09483000 TUCSON ARROYO AT VINE AVENUE, TUCSON, AZ--Continued

MEAN MONTHLY AND ANNUAL DISCHARGES 1957-81

MONTH	MAXIMUM (FT3/S)	MINIMUM (FT3/S)	MEAN (FT3/S)	STANDARD DEVIATION (FT3/S)	COEFFICIENT OF VARIATION	PERCENT OF ANNUAL RUNOFF
OCTOBER	8.7	0.00	0.81	1.7	2.1	7.8
NOVEMBER	4.4	0.00	0.43	0.82	1.9	4.2
DECEMBER	8.5	0.00	0.79	1.8	2.2	7.5
JANUARY	3.8	0.00	0.56	0.94	1.7	5.4
FEBRUARY	3.8	0.00	0.50	0.94	1.9	4.8
MARCH	2.0	0.00	0.36	0.57	1.6	3.5
APRIL	0.69	0.00	0.09	0.15	1.8	0.8
MAY	1.0	0.00	0.07	0.19	2.8	0.7
JUNE	1.3	0.00	0.10	0.24	2.5	1.0
JULY	12	0.00	2.8	2.9	1.0	26.4
AUGUST	15	0.00	2.9	3.7	1.3	27.8
SEPTEMBER	5.7	0.00	1.1	1.5	1.4	10.2
ANNUAL	1.8	0.12	0.88	0.45	0.51	100

MAGNITUDE AND PROBABILITY OF ANNUAL LOW FLOW BASED ON PERIOD OF RECORD 1958-81

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND NON-EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	20# 5%	50# 2%	100# 1%
1						
3						
7						
14						
30						
60	0.00	0.00	0.00	0.00	0.00	0.00
90	0.00	0.00	0.00	0.00	0.00	0.00
120	0.09	0.00	0.00	0.00	0.00	0.00
183	0.26	0.08	0.03	0.00	0.00	0.00

MAGNITUDE AND PROBABILITY OF INSTANTANEOUS PEAK FLOW BASED ON PERIOD OF RECORD 1956-81

DISCHARGE, IN FT3/S, FOR INDICATED RECURRENCE INTERVAL IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
2 50%	5 20%	10 10%	25 4%	50 2%	100# 1%
842	1,540	2,150	3,090	3,920	4,890

WEIGHTED SKEW (LOGS) = 0.20
MEAN (LOGS) = 2.93
STANDARD DEV. (LOGS) = 0.31

MAGNITUDE AND PROBABILITY OF ANNUAL HIGH FLOW BASED ON PERIOD OF RECORD 1957-81

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	25# 4%	50# 2%	100# 1%
1	79	153	216	316	404	506
3	31	58	81	116	147	181
7	14	27	38	54	68	83
15	8.1	15	21	30	37	45
30	5.1	9.2	12	16	20	23
60	3.1	5.4	7.0	9.1	11	12
90	2.3	3.9	5.1	6.5	7.5	8.5

DURATION TABLE OF DAILY MEAN FLOW FOR PERIOD OF RECORD 1957-81

DISCHARGE, IN FT3/S, WHICH WAS EQUALED OR EXCEEDED FOR INDICATED PERCENT OF TIME																	
1%	5%	10%	15%	20%	30%	40%	50%	60%	70%	80%	90%	95%	98%	99%	99.5%	99.9%
23	1.2	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Reliability of values in column is uncertain, and potential errors are large.

NOTE: We are currently loading Water Quality Data for the entire nation. This information will be unavailable thru 2/8/2002.

Peak Streamflow for the Nation

USGS 09483000 TUCSON ARROYO AT VINE AVE, AT TUCSON, AZ.

Available data for this site Station home page GO

Pima County, Arizona
Hydrologic Unit Code 15050301
Latitude 32°13'00", Longitude 110°56'54" NAD27
Drainage area 8.20 square miles
Gage datum 2,411.90 feet above sea level NGVD29

Output formats

- Table
- Graph
- Tab-separated file
- WATSTORE formatted file
- Reselect output format

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1940	Aug. 13, 1940	9.20	2,700[7,C,E]
1943	Sep. 24, 1943	9.20	2,700[7,C,E]
1944	Jul. 22, 1944	6.43	676[C]
1945	Jul. 28, 1945	6.98	877[C]
1946	Aug. 3, 1946	6.90	850[C]
1947	Nov. 24, 1946	4.42	149[C]
1948	Jul. 24, 1948	9.90	4,100[C]
1949	Sep. 28, 1949	5.56	364[C]
1950	Jul. 30, 1950	7.40	1,160[C]
1951	Aug. 2, 1951	6.43	676[C]
1952	Aug. 15, 1952	8.04	1,780[C]
1953	Jul. 14, 1953	9.40	3,240[C]
1954	Jul. 20, 1954	7.96	1,970[C]
1955	Jul. 31, 1955	7.95	1,960[C]
1956	Aug. 26, 1956	5.38	364[C]
1957	Jul. 17, 1957	6.29	716[C]
1962	Sep. 26, 1962	7.62	1,060[C]
1963	Sep. 3, 1963	4.76	208[C]
1964	Aug. 12, 1964	7.64	1,060[C]
1965	Jul. 16, 1965	6.85	1,220[C]
1966	Sep. 13, 1966	5.96	593[C]
1967	May 24, 1967	5.30	350[C]
1968	Aug. 19, 1968	6.16	644[C]
1969	Aug. 1, 1969	6.52	800[C]
1970	Jul. 20, 1970	7.76	1,550[C]
1971	Jul. 19, 1971	9.63	2,930[C]
1972	Aug. 12, 1972	9.65	2,950[C]
1973	Oct. 18, 1972	6.35	720[C]
1974	Jul. 18, 1974	5.24	332[C]
1975	Jul. 25, 1975	6.44	760[C]
1976	Sep. 4, 1976	5.62	446[C]
1977	Sep. 10, 1977	7.96	1,480[C]

1958	Sep. 11, 1958	6.40	860[C]	1978	Oct. 6, 1977	6.45	764[C]
1959	Aug. 20, 1959	8.52	2,540[C]	1979	Oct. 21, 1978	7.05	1,040[C]
1960	Aug. 20, 1960	5.67	609[C]	1980	Aug. 13, 1980	6.57	816[C]
1961	Aug. 22, 1961	10.35	5,000[5,C]	1981	Jun. 25, 1981	6.41	746[C]

Peak Streamflow Qualification Codes.

- 5 -- Discharge affected to unknown degree by Regulation or Diversion
- 7 -- Discharge is an Historic Peak
- C -- All or part of the record affected by Urbanization, Mining, Agricultural changes, Channelization, or other
- E -- Only Annual Maximum Peak available for this year

Questions about data h2oteam@usgs.gov
Feedback on this website egs-w_support_nwisweb@usgs.gov

Return to top of page

Surface Water for USA: Peak Streamflow
http://water.usgs.gov/nwis/peak?

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5.82 0.97

09483000 TUCSON ARROYO AT VINE AVENUE, TUCSON, AZ

LOCATION.--Lat 32°13'00", long 110°56'54", SW$^1/_4$NE$^1/_4$ sec.18, T.14 S., R.14 E., Pima County, Hydrologic Unit 15050301, on right bank at Vine Avenue in Tucson, 0.2 mi downstream from Arroyo Chico.

DRAINAGE AREA.--8.2 mi^2 since June 1956. Prior to August 1945, 27.0 mi^2. See WSP 1733 for history of progressive reduction of drainage area by flood-control diversion structures.

REMARKS.--A flood-control project, at upper end of natural basin, diverts runoff from 3.6 mi into Lakeside Reservoir (Atterbury), which is in Pantano Wash drainage area. Another flood-control project diverts runoff from 15.2 mi near the upper end of basin into a flood-control detention reservoir in SE$^1/_4$ sec.29, T.14 S., R.14 E., from which reservoir water is released to Julian Wash, which enters Santa Cruz River upstream from Tucson Arroyo. Since October 1969, all flow past the station is published.

Annual peak discharges

Water year	Date	Annual peak discharge (ft^3/s)	Discharge codes	Water year	Date	Annual peak discharge (ft^3/s)	Discharge codes
1956	08-26-56	364	C	1970	07-20-70	1,550	C
1957	07-17-57	716	C	1971	07-19-71	2,930	C
1959	08-20-59	2,540	C	1972	08-12-72	2,950	C
1960	08-20-60	609	C	1973	10-18-72	720	C
1961	08-22-61	[1]5,000	UR,C	1974	07-18-74	332	C
1962	09-26-62	1,060	C	1975	07-25-75	760	C
1963	09-03-63	208	C	1976	09-04-76	446	C
1964	08-12-64	1,060	C	1977	09-10-77	1,480	C
1965	07-16-65	1,220	C	1978	10-06-77	764	C
1966	09-13-66	593	C	1979	10-21-78	1,040	C
1967	05-24-67	350	C	1980	08-13-80	816	C
1968	08-19-68	644	C	1981	06-25-81	746	C
1969	08-01-69	800	C				

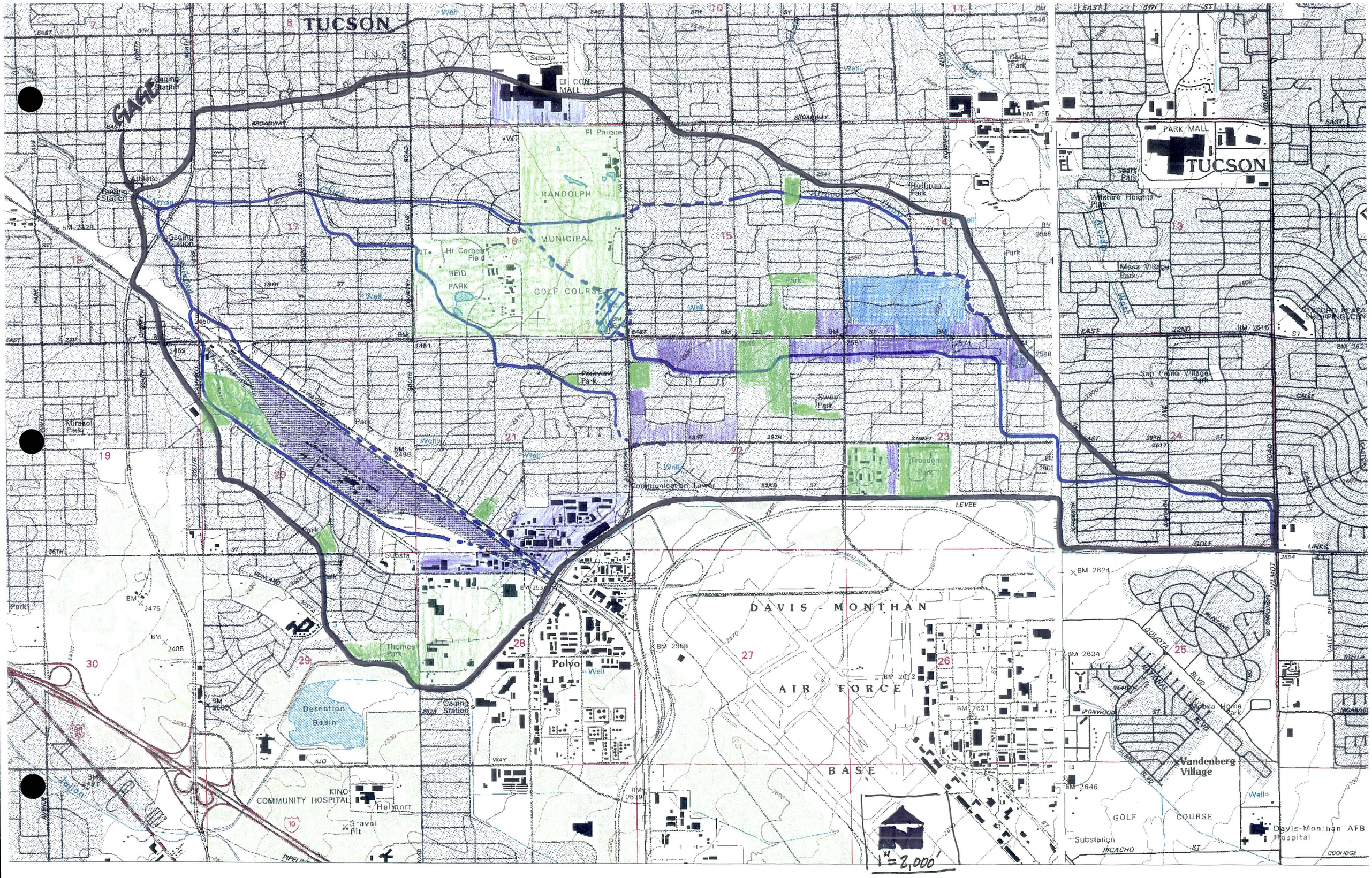
[1]Highest since 1940.

Discharge rating table developed October 1992

Gage height (ft)	Discharge (ft^3/s)	Gage height (ft)	Discharge (ft^3/s)
2.0	73	7.0	9,600
2.5	263	8.0	14,000
3.0	570	9.0	19,400
4.0	1,700	10.0	25,000
5.0	3,550	11.0	32,500
6.0	6,100	12.0	40,000

Basin characteristics

Main channel slope (ft/mi)	Stream length (mi)	Mean basin elevation (ft)	Forested area (percent)	Soil index	Mean annual precipitation (in)	Rainfall intensity, 24-hour 2-year (in)	Rainfall intensity, 24-hour 50-year (in)
37.0	5.5	2,510	0.0	1.0	11.0	1.8	3.9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BROADWAY
El Parque
RANDOLPH
MUNICIPAL
GOLF COURSE
Hi Corbett Field
REID PARK
Athletic
Gaging Station
Murphy Park
Parkview Park
Swan Park
Freedom Park
Communication Tower
LEVEE
Hollman Park
Park
PARK MALL
TUCSON
Sears Park
Wilshire Heights Park
Mesa Village Park
San Carlos Village Park
Substa
Thomas Park
Detention Basin
Polvo
Well
DAVIS - MONTHAN
AIR FORCE
BASE
Gaging Station
KINO COMMUNITY HOSPITAL
Helmart
Gravel Pit
Mobile Home Park
Vandenberg Village
GOLF COURSE
Substation
Davis-Monthan AFB Hospital
1" = 2,000'

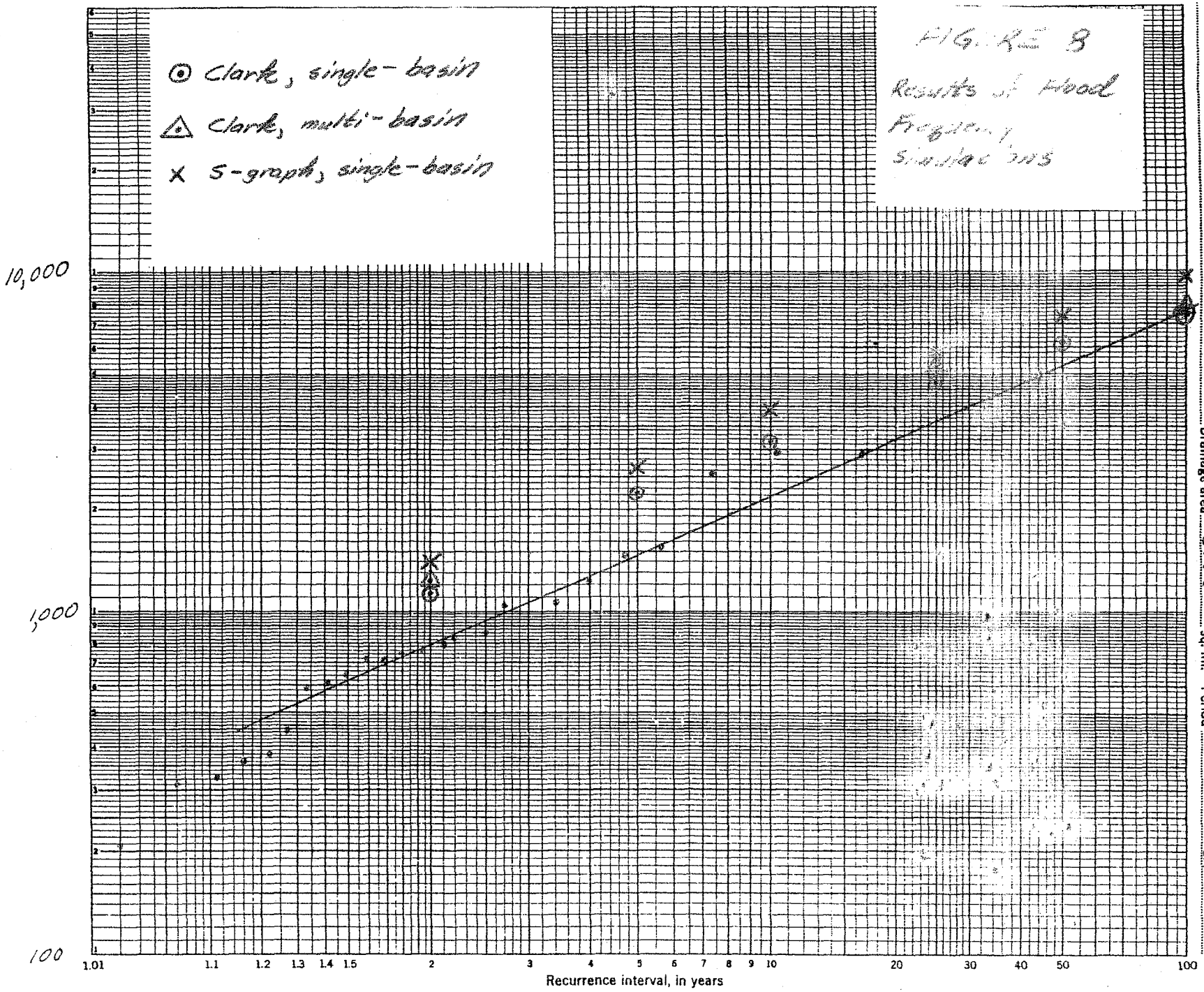
9-179b
Extreme log data plot
April 1955

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

Magnitude and frequency of Tucson Arroyo @ Vine Ave. Drainage area 8.2 sq. mi. Period 1956 - 1981 on

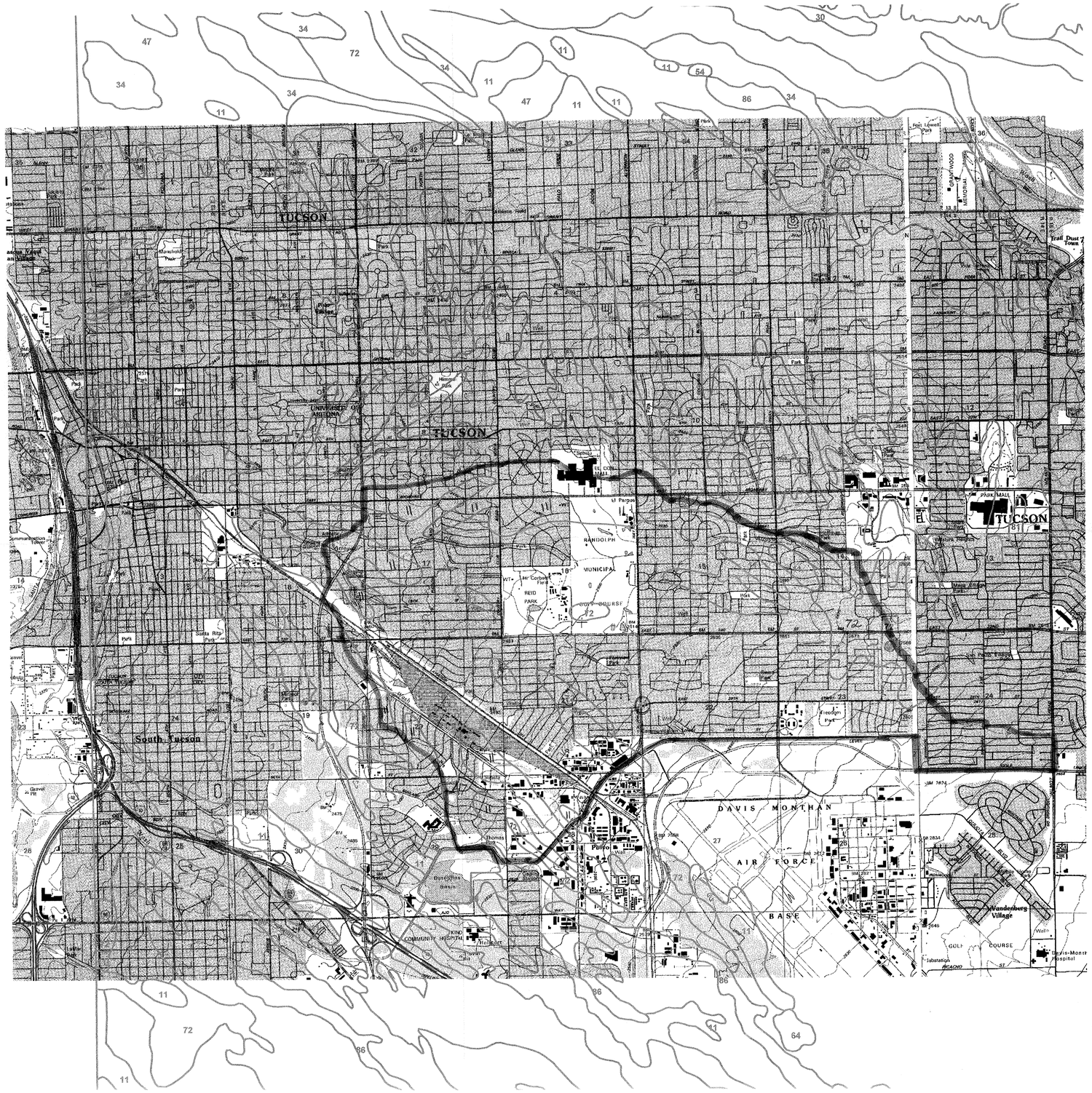
Sheet 25

File



Sheet No. ____ of ____ Sheets. Prepared by ____ Date ____ Checked by ____ Date ____

GPO 859-404



11-8510
47-1085
72-5

Soil Properties

Newsoil.shp

1 ALTAR-SASABE COMPLEX, 1 TO 8 PERCENT SLOPES
10 CARALAMPI EXTREMELY GRAVELLY SANDY LOAM, 15 TO 45 PERCENT SLOPES
11 CAVE SOILS AND URBAN LAND, 0 TO 8 PERCENT SLOPES
12 CELLAR-LAMPSHIRE-ROCK OUTCROP COMPLEX, 15 TO 60 PERCENT SLOPES
13 CELLAR-LEHMANS COMPLEX, 5 TO 25 PERCENT SLOPES
14 CELLAR-ROCK OUTCROP COMPLEX, 30 TO 65 PERCENT SLOPES
15 CHIMENEA-CELLAR-ROCK OUTCROP COMPLEX, 15 TO 50 PERCENT SLOPES
16 CHIMENEA VERY GRAVELLY FINE SANDY LOAM, 5 TO 15 PERCENT SLOPES
17 CHIRICAHUA-LAMPSHIRE COMPLEX, 5 TO 15 PERCENT SLOPES
18 COMBATE GRAVELLY LOAMY COARSE SAND, 2 TO 8 PERCENT SLOPES
19 COMORO SANDY LOAM, 0 TO 2 PERCENT SLOPES
2 ANKLAM-CELLAR-ROCK OUTCROP COMPLEX, 15 TO 55 PERCENT SLOPES
20 CORTARO-ROCK OUTCROP-FARAWAY COMPLEX, 15 TO 45 PERCENT SLOPES
21 DATELAND-DENURE ASSOCIATION, 1 TO 3 PERCENT SLOPES
22 DELNORTE-STAGECOACH COMPLEX, 1 TO 20 PERCENT SLOPES
23 DELORO-ANDRADA COMPLEX, 5 TO 35 PERCENT SLOPES
24 DELORO-ROCK OUTCROP COMPLEX, 15 TO 60 PERCENT SLOPES
25 DELORO-SCHRAP ASSOCIATION, 1 TO 8 PERCENT SLOPES
26 DENURE GRAVELLY SANDY LOAM, 1 TO 5 PERCENT SLOPES
27 DIASPAR SANDY LOAM, 1 TO 5 PERCENT SLOPES
28 FAR-SPUDROCK-ROCK OUTCROP COMPLEX, 35 TO 85 PERCENT SLOPES
29 GLENDALE-BUCKLEBAR COMPLEX, 0 TO 3 PERCENT SLOPES
3 ANTHONY FINE SANDY LOAM, 0 TO 3 PERCENT SLOPES
30 GLENDALE SILT LOAM, 0 TO 3 PERCENT SLOPES
31 GRAHAM-PANTAK COMPLEX, 2 TO 15 PERCENT SLOPES
32 GRAHAM-PANTAK-ROCK OUTCROP COMPLEX, 15 TO 45 PERCENT SLOPES
33 GUEST FINE SANDY LOAM, 0 TO 1 PERCENT SLOPES
34 HANTZ LOAM, 0 TO 1 PERCENT SLOPES
35 HAYHOOK SANDY LOAM, 1 TO 5 PERCENT SLOPES
36 HAYHOOK-SAHUARITA COMPLEX, 1 TO 5 PERCENT SLOPES
37 KEYSTO EXTREMELY GRAVELLY FINE SANDY LOAM, 2 TO 8 PERCENT SLOPES
38 LAJITAS-DELTHORNY-ROCK OUTCROP COMPLEX, 25 TO 60 PERCENT SLOPES
39 LAMPSHIRE-PANTAK-ROCK OUTCROP COMPLEX, 25 TO 60 PERCENT SLOPES
4 ARIVACA VERY COBBLY LOAM, 2 TO 15 PERCENT SLOPES
40 LAMPSHIRE-ROMERO-ROCK OUTCROP COMPLEX, 10 TO 65 PERCENT SLOPES
41 LEHMANS-DELTHORNY-LAJITAS COMPLEX, 15 TO 50 PERCENT SLOPES
42 MABRAY-DELORO-ROCK OUTCROP COMPLEX, 20 TO 65 PERCENT SLOPES
43 MOHALL GRAVELLY FINE SANDY LOAM, 1 TO 5 PERCENT SLOPES
44 MOHALL LOAM, 0 TO 2 PERCENT SLOPES
45 MOHALL-PAHAKA COMPLEX, 1 TO 3 PERCENT SLOPES
46 MOHALL-TRIX COMPLEX, 0 TO 1 PERCENT SLOPES
47 MOHAVE SOILS AND URBAN LAND, 1 TO 8 PERCENT SLOPES
48 NAHDA-PINALENO COMPLEX, 2 TO 8 PERCENT SLOPES
49 NAHDA-STAGECOACH COMPLEX, 1 TO 15 PERCENT SLOPES
5 ARIZO-RIVERWASH COMPLEX, 0 TO 3 PERCENT SLOPES
50 NAHDA VERY COBBLY LOAM, 2 TO 8 PERCENT SLOPES
51 NOLAM-TOMBSTONE COMPLEX, 8 TO 30 PERCENT SLOPES
52 ORACLE-ROMERO-ROCK OUTCROP COMPLEX, 5 TO 35 PERCENT SLOPES
53 PAHAKA FINE SANDY LOAM, 1 TO 5 PERCENT SLOPES
54 PALOS VERDES-JAYNES COMPLEX, 2 TO 8 PERCENT SLOPES
55 PALOS VERDES-SAHUARITA COMPLEX, 2 TO 8 PERCENT SLOPES
56 PANTAK-DELORO COMPLEX, 8 TO 35 PERCENT SLOPES
57 PANTAK-ROCK OUTCROP COMPLEX, 25 TO 50 PERCENT SLOPES
58 PANTANO-GRANOLITE COMPLEX, 5 TO 25 PERCENT SLOPES
59 PANTANO-ROCK OUTCROP COMPLEX, 25 TO 60 PERCENT SLOPES
6 BERNARDINO-TOMBSTONE ASSOCIATION, 5 TO 16 PERCENT SLOPES
60 PINALENO-STAGECOACH COMPLEX, 5 TO 16 PERCENT SLOPES
61 PINALENO-STAGECOACH-PALOS VERDES COMPLEX, 10 TO 35 PERCENT SLOPES
62 PINALENO VERY COBBLY SANDY LOAM, 1 TO 8 PERCENT SLOPES
63 PINAMT-MOMOLI COMPLEX, 1 TO 10 PERCENT SLOPES
64 PITS, DUMPS
65 POWERLINE-KIMROSE FAMILY COMLEX, 10 TO 35 PERCENT SLOPES
66 REDINGTON VERY GRAVELLY FINE SAND, 3 TO 50 PERCENT SLOPES
67 REDO VERY GRAVELLY SAND, 15 TO 50 PERCENT SLOPES
68 RIVEROAD AND COMORO SOILS, 0 TO 2 PERCENT SLOPES
69 ROMERO-LAMPSHIRE-ROCK OUTCROP COMPLEX, 15 TO 65 PERCENT SLOPES
7 BERNARDINO-WHITE HOUSE COMPLEX, 1 TO 15 PERCENT SLOPES
70 ROMERO-ORACLE COMPLEX, 25 TO 60 PERCENT SLOPES
71 SAGUARO-ROCK OUTCROP COMPLEX, 15 TO 45 PERCENT SLOPES
72 SAHUARITA SOILS, MOHAVE SOILS AND URBAN LAND, 1 TO 5 PERCENT SLOPES
73 SASABE-CARALAMPI COMPLEX, 1 TO 15 PERCENT SLOPES
74 SCHRAP VERY CHANNERY LOAM, 5 TO 30 PERCENT SLOPES
75 SPUDROCK-BORIANA COMPLEX, 10 TO 35 PERCENT SLOPES
76 SPUDROCK-FAR-ROCK OUTCROP COMPLEX, 25 TO 65 PERCENT SLOPES
77 SPUDROCK-LEMMON COMPLEX, 15 TO 45 PERCENT SLOPES
78 STAGECOACH-SAHUARITA ASSOCIATION, 1 TO 8 PERCENT SLOPES
79 TOMBSTONE VERY GRAVELLY LOAM, 15 TO 50 PERCENT SLOPES
8 BUCKLEBAR-SAHUARITA COMPLEX, 0 TO 3 PERCENT SLOPES
80 TUBAC COMPLEX, 0 TO 2 PERCENT SLOPES
81 TUBAC GRAVELLY LOAM, 1 TO 8 PERCENT SLOPES
82 TUBAC SANDY LOAM, 0 TO 2 PERCENT SLOPES
83 VECONT CLAY LOAM, 0 TO 1 PERCENT SLOPES
84 WHITE HOUSE-CARALAMPI COMPLEX, 5 TO 25 PERCENT SLOPES
85 WHITE HOUSE GRAVELLY LOAM, 1 TO 8 PERCENT SLOPES
86 YAQUI FINE SANDY LOAM, 1 TO 3 PERCENT SLOPES
87 WATER
9 CARALAMPI VERY GRAVELLY SANDY LOAM, 5 TO 15 PERCENT SLOPES

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1****************************************                                    ****************************************
 *                                      *                                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                    *    U.S. ARMY CORPS OF ENGINEERS      *
 *             JUN   1998               *                                    *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                *                                    *          609 SECOND STREET           *
 *                                      *                                    *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   21MAR02  TIME  08:49:02  *                                    *           (916) 756-1104             *
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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                          HEC-1 INPUT                                                    PAGE  1

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

        1           ID    Hydrology Manual Update - Edition 3
        2           ID    Flood Control District of Maricopa County/City of Phoenix
        3           ID
        4           ID    Multiple Frequency Ratio Test Watershed 3:
        5           ID    Tuscon Arroyo
        6           ID            100-Year, 6-Hour Storm
        7           ID            Green & Ampt Rainfall Losses
        8           ID            Clark Unit Hydrograph
        9           ID
       10           ID       File:  TA100-6.ihl      Date:  03-18-02
       11           ID
       12           ID   ********************************************************************
       13           IT       2                    800
       14           IO       3
                    *

       15           KK      TA
       16           KM   Subbasin
       17           KM
       18           KM     The Clark Unit Hydrograph is used for this basin.
       19           KM         The Urban time-area relation is used for this basin.
       20           KM
       21           KM     Time of Concentration for this sub-basin is based on the following:
       22           KM         6-Hour Rainfall, Pattern No.  2.61
       23           KM         An rainfall areal reduction factor of 0.948
       24           KM
       25           KM      EXCESS RAINFALL VALUES EXCEEDED IN 5-MINUTE INTERVALS
       26           KM     5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
       27           KM   .21 .21 .21 .17 .16 .16 .12 .12 .12 .05 .05 .05 .05 .05 .04 .02 .02 .02
       28           KM
       29           KM         L=   6.180 miles, S=   38 feet/mile, Kb= .02
       30           KM
       31           BA   8.120
       32           IN     15
       33           KM   Rainfall depth of  3.58 was spacially reduced as shown by the PB record.
       34           KM   An areal reduction coefficient of 0.948 is used.
       35           PB    3.39
       36           PC   0.000   0.013   0.018   0.028   0.043   0.055   0.066   0.078   0.090   0.102
       37           PC   0.116   0.132   0.154   0.199   0.284   0.464   0.679   0.812   0.880   0.922
       38           PC   0.948   0.961   0.974   0.987   1.000
       39           LG    0.22    0.25    4.80    0.32   40.00
       40           UC   0.896   0.426
       41           UA       0       5      16      30      65      77      84      90      94      97
       42           UA     100
                    *
       43           ZZ
1****************************************                                    ****************************************
 *                                      *                                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                    *    U.S. ARMY CORPS OF ENGINEERS      *
 *             JUN   1998               *                                    *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                *                                    *          609 SECOND STREET           *
 *                                      *                                    *       DAVIS, CALIFORNIA 95616        *
```

```
*  RUN DATE   21MAR02  TIME  08:49:02   *                                                    *            (916) 756-1104            *
*                                       *                                                    *                                      *
*****************************************                                                    ****************************************


                          Hydrology Manual Update - Edition 3
                             Flood Control District of Maricopa County/City of Phoenix

                             Multiple Frequency Ratio Test Watershed 3:
                             Tuscon Arroyo
                                     100-Year, 6-Hour Storm
                                     Green & Ampt Rainfall Losses
                                     Clark Unit Hydrograph

                                File:  TA100-6.ihl      Date:  03-18-02

                         ***********************************************************************

 14 IO          OUTPUT CONTROL VARIABLES
                      IPRNT           3  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN           2  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ         800  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      2    0  ENDING DATE
                     NDTIME        0238  ENDING TIME
                     ICENT           19  CENTURY MARK

                 COMPUTATION INTERVAL    0.03 HOURS
                      TOTAL TIME BASE   26.63 HOURS

         ENGLISH UNITS
              DRAINAGE AREA          SQUARE MILES
              PRECIPITATION DEPTH    INCHES
              LENGTH, ELEVATION      FEET
              FLOW                   CUBIC FEET PER SECOND
              STORAGE VOLUME         ACRE-FEET
              SURFACE AREA           ACRES
              TEMPERATURE            DEGREES FAHRENHEIT


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


           **************
           *            *
 15 KK     *        TA  *
           *            *
           **************
                         Subbasin

                            The Clark Unit Hydrograph is used for this basin.
                                The Urban time-area relation is used for this basin.

                            Time of Concentration for this sub-basin is based on the following:
                                6-Hour Rainfall, Pattern No.  2.61
                                An rainfall areal reduction factor of 0.948

                             EXCESS RAINFALL VALUES EXCEEDED IN 5-MINUTE INTERVALS
                           5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
                         .21 .21 .21 .17 .16 .16 .12 .12 .12 .05 .05 .05 .05 .05 .04 .02 .02 .02

                                L=   6.180 miles, S=   38 feet/mile, Kb= .02

                         Rainfall depth of  3.58 was spacially reduced as shown by the PB record.
                         An areal reduction coefficient of 0.948 is used.

 32 IN          TIME DATA FOR INPUT TIME SERIES
                      JXMIN          15  TIME INTERVAL IN MINUTES
                     JXDATE      1    0  STARTING DATE
                     JXTIME           0  STARTING TIME

              SUBBASIN RUNOFF DATA

 31 BA          SUBBASIN CHARACTERISTICS
                      TAREA        8.12  SUBBASIN AREA

                PRECIPITATION DATA

 35 PB                STORM        3.39  BASIN TOTAL PRECIPITATION

 36 PI            INCREMENTAL PRECIPITATION PATTERN
```

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02
0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

```
39 LG          GREEN AND AMPT LOSS RATE
                     STRTL        0.22  STARTING LOSS
                       DTH        0.25  MOISTURE DEFICIT
                      PSIF        4.80  WETTING FRONT SUCTION
                     XKSAT        0.32  HYDRAULIC CONDUCTIVITY
                     RTIMP       40.00  PERCENT IMPERVIOUS AREA

40 UC          CLARK UNITGRAPH
                        TC        0.90  TIME OF CONCENTRATION
                         R        0.43  STORAGE COEFFICIENT

41 UA          ACCUMULATED-AREA VS. TIME,  11 ORDINATES
                     0.0       5.0      16.0      30.0      65.0      77.0      84.0      90.0      94.0      97.0
                   100.0
```

***

UNIT HYDROGRAPH PARAMETERS

CLARK TC= 0.90 HR, R= 0.43 HR

SNYDER TP= 0.44 HR, CP= 0.52

UNIT HYDROGRAPH

80 END-OF-PERIOD ORDINATES

110.	322.	559.	911.	1326.	1752.	2212.	2662.	3511.	4758.
5816.	6287.	6342.	6331.	6211.	6052.	5885.	5709.	5535.	5331.
5105.	4886.	4661.	4443.	4240.	4053.	3872.	3639.	3365.	3111.
2877.	2660.	2460.	2275.	2103.	1945.	1799.	1663.	1538.	1422.
1315.	1216.	1124.	1040.	961.	889.	822.	760.	703.	650.
601.	556.	514.	475.	439.	406.	376.	347.	321.	297.
275.	254.	235.	217.	201.	186.	172.	159.	147.	136.
126.	116.	107.	99.	92.	85.	79.	73.	67.	62.

*** *** *** *** ***

HYDROGRAPH AT STATION TA

TOTAL RAINFALL = 3.39, TOTAL LOSS = 1.21, TOTAL EXCESS = 2.18

	PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
				6-HR	24-HR	72-HR	26.63-HR
+	(CFS)	(HR)	(CFS)				
+	7846.	4.43		1872.	473.	426.	426.
			(INCHES)	2.144	2.167	2.167	2.167
			(AC-FT)	928.	938.	938.	938.

CUMULATIVE AREA = 8.12 SQ MI

1

RUNOFF SUMMARY

FLOW IN CUBIC FEET PER SECOND

TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	TA	7846.	4.43	1872.	473.	426.	8.12		

*** NORMAL END OF HEC-1 ***

```
1****************************************                                    ****************************************
 *                                      *                                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                    *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                                    *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                *                                    *          609 SECOND STREET           *
 *                                      *                                    *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   21MAR02  TIME  08:49:13  *                                    *           (916) 756-1104             *
 *                                      *                                    *                                      *
 ****************************************                                    ****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X               X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
1                                                HEC-1 INPUT                                                    PAGE  1

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

            1           ID    Hydrology Manual Update - Edition 3
            2           ID    Flood Control District of Maricopa County/City of Phoenix
            3           ID
            4           ID    Multiple Frequency Ratio Test Watershed 3:
            5           ID    Tuscon Arroyo
            6           ID            50-Year, 6-Hour Storm
            7           ID            Green & Ampt Rainfall Losses
            8           ID            Clark Unit Hydrograph
            9           ID
           10           ID       File:  TA50-6.ih1       Date:  03-18-02
           11           ID
           12           ID   ***********************************************************************
           13           IT       2                     800
           14           IO       3
                        *

           15           KK      TA
           16           KM   Subbasin
           17           KM
           18           KM      The Clark Unit Hydrograph is used for this basin.
           19           KM          The Urban time-area relation is used for this basin.
           20           KM
           21           KM      Time of Concentration for this sub-basin is based on the following:
           22           KM          6-Hour Rainfall, Pattern No.  2.61
           23           KM          An rainfall areal reduction factor of 0.948
           24           KM
           25           KM       EXCESS RAINFALL VALUES EXCEEDED IN 5-MINUTE INTERVALS
           26           KM     5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
           27           KM   .18 .18 .18 .14 .14 .14 .10 .10 .10 .04 .04 .04 .04 .04 .03 .02 .02 .02
           28           KM
           29           KM          L=   6.180 miles, S=   38 feet/mile, Kb= .02
           30           KM
           31           BA   8.120
           32           IN      15
           33           KM   Rainfall depth of  3.21 was spacially reduced as shown by the PB record.
           34           KM   An areal reduction coefficient of 0.948 is used.
           35           PB    3.04
           36           PC   0.000   0.013   0.018   0.028   0.043   0.055   0.066   0.078   0.090   0.102
           37           PC   0.116   0.132   0.154   0.199   0.284   0.464   0.679   0.812   0.880   0.922
           38           PC   0.948   0.961   0.974   0.987   1.000
           39           LG    0.22    0.25    4.80    0.32   40.00
           40           UC   0.972   0.467
           41           UA       0       5      16      30      65      77      84      90      94      97
           42           UA     100
                        *
           43           ZZ
```

```
1****************************************                                    ****************************************
 *                                      *                                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                    *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                                    *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                *                                    *          609 SECOND STREET           *
 *                                      *                                    *       DAVIS, CALIFORNIA 95616        *
```

```
*  RUN DATE   21MAR02  TIME  08:49:13   *                                                    *            (916) 756-1104            *
*                                       *                                                    *                                      *
*****************************************                                                    ****************************************


                          Hydrology Manual Update - Edition 3
                             Flood Control District of Maricopa County/City of Phoenix

                             Multiple Frequency Ratio Test Watershed 3:
                             Tuscon Arroyo
                                     50-Year, 6-Hour Storm
                                     Green & Ampt Rainfall Losses
                                     Clark Unit Hydrograph

                                File:  TA50-6.ih1       Date:  03-18-02

                         ***********************************************************************

 14 IO          OUTPUT CONTROL VARIABLES
                      IPRNT           3  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN           2  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ         800  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      2    0  ENDING DATE
                     NDTIME        0238  ENDING TIME
                     ICENT          19  CENTURY MARK

                  COMPUTATION INTERVAL    0.03 HOURS
                       TOTAL TIME BASE   26.63 HOURS

         ENGLISH UNITS
              DRAINAGE AREA          SQUARE MILES
              PRECIPITATION DEPTH    INCHES
              LENGTH, ELEVATION      FEET
              FLOW                   CUBIC FEET PER SECOND
              STORAGE VOLUME         ACRE-FEET
              SURFACE AREA           ACRES
              TEMPERATURE            DEGREES FAHRENHEIT


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


           **************
           *            *
 15 KK     *        TA  *
           *            *
           **************
                          Subbasin

                             The Clark Unit Hydrograph is used for this basin.
                                 The Urban time-area relation is used for this basin.

                             Time of Concentration for this sub-basin is based on the following:
                                 6-Hour Rainfall, Pattern No.  2.61
                                 An rainfall areal reduction factor of 0.948

                              EXCESS RAINFALL VALUES EXCEEDED IN 5-MINUTE INTERVALS
                            5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
                          .18 .18 .18 .14 .14 .14 .10 .10 .10 .04 .04 .04 .04 .04 .03 .02 .02 .02

                                 L=   6.180 miles, S=   38 feet/mile, Kb= .02

                          Rainfall depth of  3.21 was spacially reduced as shown by the PB record.
                          An areal reduction coefficient of 0.948 is used.

 32 IN          TIME DATA FOR INPUT TIME SERIES
                      JXMIN          15  TIME INTERVAL IN MINUTES
                     JXDATE      1    0  STARTING DATE
                     JXTIME           0  STARTING TIME

              SUBBASIN RUNOFF DATA

 31 BA          SUBBASIN CHARACTERISTICS
                      TAREA        8.12  SUBBASIN AREA

                PRECIPITATION DATA

 35 PB                STORM        3.04  BASIN TOTAL PRECIPITATION

 36 PI            INCREMENTAL PRECIPITATION PATTERN
```

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02
0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

```
39 LG          GREEN AND AMPT LOSS RATE
                     STRTL        0.22  STARTING LOSS
                       DTH        0.25  MOISTURE DEFICIT
                      PSIF        4.80  WETTING FRONT SUCTION
                     XKSAT        0.32  HYDRAULIC CONDUCTIVITY
                     RTIMP       40.00  PERCENT IMPERVIOUS AREA

40 UC          CLARK UNITGRAPH
                        TC        0.97  TIME OF CONCENTRATION
                         R        0.47  STORAGE COEFFICIENT

41 UA          ACCUMULATED-AREA VS. TIME,  11 ORDINATES
                     0.0       5.0      16.0      30.0      65.0      77.0      84.0      90.0      94.0      97.0
                   100.0

                                                  ***

                                          UNIT HYDROGRAPH PARAMETERS
                                   CLARK   TC=  0.97 HR,       R=  0.47 HR
                                 SNYDER   TP=  0.48 HR,      CP=  0.52

                                          UNIT HYDROGRAPH
                                   88 END-OF-PERIOD ORDINATES
              93.      272.      449.      724.     1083.     1426.     1802.     2198.     2665.     3490.
            4550.     5393.     5751.     5800.     5807.     5721.     5587.     5453.     5309.     5166.
            5011.     4830.     4645.     4461.     4271.     4089.     3918.     3760.     3612.     3428.
            3200.     2980.     2774.     2583.     2405.     2239.     2085.     1941.     1808.     1683.
            1567.     1459.     1359.     1265.     1178.     1097.     1021.      951.      885.      824.
             767.      714.      665.      619.      577.      537.      500.      465.      433.      404.
             376.      350.      326.      303.      282.      263.      245.      228.      212.      198.
             184.      171.      159.      148.      138.      129.      120.      112.      104.       97.
              90.       84.       78.       73.       68.       63.       59.       55.

    ***            ***            ***            ***            ***

                     HYDROGRAPH AT STATION       TA

   TOTAL RAINFALL =    3.04, TOTAL LOSS =    1.16, TOTAL EXCESS =    1.88

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     26.63-HR
+   (CFS)        (HR)
                            (CFS)
+    6446.       4.50                1613.        408.        368.        368.
                         (INCHES)   1.846       1.870       1.870       1.870
                         (AC-FT)     800.        810.        810.        810.

                     CUMULATIVE AREA =    8.12 SQ MI

1
                                          RUNOFF SUMMARY
                                   FLOW IN CUBIC FEET PER SECOND
                                TIME IN HOURS,  AREA IN SQUARE MILES

                                     PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
         OPERATION       STATION     FLOW    PEAK                                          AREA      STAGE     MAX STAGE
+                                                          6-HOUR     24-HOUR     72-HOUR

         HYDROGRAPH AT
+                           TA       6446.   4.50         1613.        408.        368.       8.12

 *** NORMAL END OF HEC-1 ***
```

```
1****************************************                                    ****************************************
 *                                      *                                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                    *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                                    *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                *                                    *          609 SECOND STREET           *
 *                                      *                                    *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   21MAR02  TIME  08:49:24  *                                    *           (916) 756-1104             *
 *                                      *                                    *                                      *
 ****************************************                                    ****************************************

                                        X     X  XXXXXXX   XXXXX           X
                                        X     X  X        X     X         XX
                                        X     X  X        X                X
                                        XXXXXXX  XXXX     X        XXXXX   X
                                        X     X  X        X                X
                                        X     X  X        X     X          X
                                        X     X  XXXXXXX   XXXXX          XXX

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                                HEC-1 INPUT                                                    PAGE  1

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

            1           ID    Hydrology Manual Update - Edition 3
            2           ID    Flood Control District of Maricopa County/City of Phoenix
            3           ID
            4           ID    Multiple Frequency Ratio Test Watershed 3:
            5           ID    Tuscon Arroyo
            6           ID            25-Year, 6-Hour Storm
            7           ID            Green & Ampt Rainfall Losses
            8           ID            Clark Unit Hydrograph
            9           ID
           10           ID       File:  TA25-6.ih1       Date:  03-18-02
           11           ID
           12           ID   ********************************************************************
           13           IT       2                     800
           14           IO       3
                        *

           15           KK      TA
           16           KM   Subbasin
           17           KM
           18           KM      The Clark Unit Hydrograph is used for this basin.
           19           KM          The Urban time-area relation is used for this basin.
           20           KM
           21           KM      Time of Concentration for this sub-basin is based on the following:
           22           KM          6-Hour Rainfall, Pattern No.  2.61
           23           KM          An rainfall areal reduction factor of 0.948
           24           KM
           25           KM       EXCESS RAINFALL VALUES EXCEEDED IN 5-MINUTE INTERVALS
           26           KM     5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
           27           KM   .16 .16 .15 .12 .12 .11 .09 .08 .08 .03 .03 .03 .03 .03 .03 .02 .02 .02
           28           KM
           29           KM          L=   6.180 miles, S=   38 feet/mile, Kb= .02
           30           KM
           31           BA   8.120
           32           IN      15
           33           KM   Rainfall depth of  2.85 was spacially reduced as shown by the PB record.
           34           KM   An areal reduction coefficient of 0.948 is used.
           35           PB    2.70
           36           PC   0.000   0.013   0.018   0.028   0.043   0.055   0.066   0.078   0.090   0.102
           37           PC   0.116   0.132   0.154   0.199   0.284   0.464   0.679   0.812   0.880   0.922
           38           PC   0.948   0.961   0.974   0.987   1.000
           39           LG    0.22    0.25    4.80    0.32   40.00
           40           UC   1.058   0.513
           41           UA       0       5      16      30      65      77      84      90      94      97
           42           UA     100
                        *
           43           ZZ
1****************************************                                    ****************************************
 *                                      *                                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                    *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                                    *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                *                                    *          609 SECOND STREET           *
 *                                      *                                    *       DAVIS, CALIFORNIA 95616        *
```

```
*  RUN DATE   21MAR02  TIME  08:49:24   *                                                    *          (916) 756-1104          *
*                                       *                                                    *                                  *
*****************************************                                                    ************************************
```

Hydrology Manual Update - Edition 3
Flood Control District of Maricopa County/City of Phoenix

Multiple Frequency Ratio Test Watershed 3:
Tuscon Arroyo
25-Year, 6-Hour Storm
Green & Ampt Rainfall Losses
Clark Unit Hydrograph

File: TA25-6.ih1 Date: 03-18-02

```
                    ********************************************************************

 14 IO          OUTPUT CONTROL VARIABLES
                      IPRNT           3  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN           2  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ         800  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      2    0  ENDING DATE
                     NDTIME        0238  ENDING TIME
                     ICENT           19  CENTURY MARK

                 COMPUTATION INTERVAL    0.03 HOURS
                      TOTAL TIME BASE   26.63 HOURS

         ENGLISH UNITS
              DRAINAGE AREA          SQUARE MILES
              PRECIPITATION DEPTH    INCHES
              LENGTH, ELEVATION      FEET
              FLOW                   CUBIC FEET PER SECOND
              STORAGE VOLUME         ACRE-FEET
              SURFACE AREA           ACRES
              TEMPERATURE            DEGREES FAHRENHEIT


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


            **************
            *            *
 15 KK      *        TA  *
            *            *
            **************
                    Subbasin

                       The Clark Unit Hydrograph is used for this basin.
                           The Urban time-area relation is used for this basin.

                       Time of Concentration for this sub-basin is based on the following:
                           6-Hour Rainfall, Pattern No.  2.61
                           An rainfall areal reduction factor of 0.948

                        EXCESS RAINFALL VALUES EXCEEDED IN 5-MINUTE INTERVALS
                     5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
                   .16 .16 .15 .12 .12 .11 .09 .08 .08 .03 .03 .03 .03 .03 .03 .02 .02 .02

                           L=   6.180 miles, S=   38 feet/mile, Kb= .02

                    Rainfall depth of  2.85 was spacially reduced as shown by the PB record.
                    An areal reduction coefficient of 0.948 is used.

 32 IN          TIME DATA FOR INPUT TIME SERIES
                      JXMIN          15  TIME INTERVAL IN MINUTES
                     JXDATE      1    0  STARTING DATE
                     JXTIME           0  STARTING TIME

              SUBBASIN RUNOFF DATA

 31 BA          SUBBASIN CHARACTERISTICS
                      TAREA        8.12  SUBBASIN AREA

              PRECIPITATION DATA

 35 PB                STORM        2.70  BASIN TOTAL PRECIPITATION

 36 PI            INCREMENTAL PRECIPITATION PATTERN
```

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02
0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

```
39 LG          GREEN AND AMPT LOSS RATE
                     STRTL        0.22  STARTING LOSS
                       DTH        0.25  MOISTURE DEFICIT
                      PSIF        4.80  WETTING FRONT SUCTION
                     XKSAT        0.32  HYDRAULIC CONDUCTIVITY
                     RTIMP       40.00  PERCENT IMPERVIOUS AREA

40 UC          CLARK UNITGRAPH
                        TC        1.06  TIME OF CONCENTRATION
                         R        0.51  STORAGE COEFFICIENT

41 UA          ACCUMULATED-AREA VS. TIME,  11 ORDINATES
                     0.0       5.0      16.0      30.0      65.0      77.0      84.0      90.0      94.0      97.0
                   100.0
```

***

UNIT HYDROGRAPH PARAMETERS

CLARK TC= 1.06 HR, R= 0.51 HR

SNYDER TP= 0.53 HR, CP= 0.52

UNIT HYDROGRAPH

96 END-OF-PERIOD ORDINATES

78.	229.	370.	580.	870.	1158.	1459.	1787.	2111.	2571.
3329.	4211.	4928.	5241.	5285.	5317.	5268.	5155.	5048.	4934.
4811.	4695.	4563.	4407.	4254.	4102.	3943.	3789.	3644.	3508.
3381.	3249.	3079.	2886.	2704.	2534.	2374.	2225.	2085.	1954.
1831.	1715.	1608.	1506.	1412.	1323.	1239.	1161.	1088.	1020.
956.	896.	839.	786.	737.	691.	647.	606.	568.	532.
499.	468.	438.	411.	385.	360.	338.	317.	297.	278.
260.	244.	229.	214.	201.	188.	176.	165.	155.	145.
136.	127.	119.	112.	105.	98.	92.	86.	81.	76.
71.	67.	62.	58.	55.	51.				

*** *** *** *** ***

HYDROGRAPH AT STATION TA

TOTAL RAINFALL = 2.70, TOTAL LOSS = 1.10, TOTAL EXCESS = 1.60

	PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	26.63-HR
+	(CFS)	(HR)					
			(CFS)				
+	5179.	4.53		1367.	347.	313.	313.
			(INCHES)	1.566	1.589	1.589	1.589
			(AC-FT)	678.	688.	688.	688.

CUMULATIVE AREA = 8.12 SQ MI

1

RUNOFF SUMMARY

FLOW IN CUBIC FEET PER SECOND

TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	TA	5179.	4.53	1367.	347.	313.	8.12		

*** NORMAL END OF HEC-1 ***

```
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *              JUN   1998               *
 *           VERSION 4.1                 *
 *                                       *
 *  RUN DATE   21MAR02  TIME  08:49:33   *
 *                                       *
 *****************************************
```

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

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X               X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
1                                   HEC-1 INPUT                                   PAGE  1

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

             1          ID    Hydrology Manual Update - Edition 3
             2          ID    Flood Control District of Maricopa County/City of Phoenix
             3          ID
             4          ID    Multiple Frequency Ratio Test Watershed 3:
             5          ID    Tuscon Arroyo
             6          ID            10-Year, 6-Hour Storm
             7          ID            Green & Ampt Rainfall Losses
             8          ID            Clark Unit Hydrograph
             9          ID
            10          ID       File:  TA10-6.ihl       Date:  03-18-02
            11          ID
            12          ID   ********************************************************************
            13          IT       2                     800
            14          IO       3
                        *

            15          KK      TA
            16          KM   Subbasin
            17          KM
            18          KM      The Clark Unit Hydrograph is used for this basin.
            19          KM          The Urban time-area relation is used for this basin.
            20          KM
            21          KM      Time of Concentration for this sub-basin is based on the following:
            22          KM          6-Hour Rainfall, Pattern No.  2.61
            23          KM          An rainfall areal reduction factor of 0.948
            24          KM
            25          KM       EXCESS RAINFALL VALUES EXCEEDED IN 5-MINUTE INTERVALS
            26          KM     5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
            27          KM   .12 .12 .12 .09 .08 .08 .06 .06 .06 .03 .03 .02 .02 .02 .02 .01 .01 .01
            28          KM
            29          KM          L=   6.180 miles, S=   38 feet/mile, Kb= .02
            30          KM
            31          BA   8.120
            32          IN      15
            33          KM   Rainfall depth of  2.37 was spacially reduced as shown by the PB record.
            34          KM   An areal reduction coefficient of 0.948 is used.
            35          PB    2.25
            36          PC   0.000   0.013   0.018   0.028   0.043   0.055   0.066   0.078   0.090   0.102
            37          PC   0.116   0.132   0.154   0.199   0.284   0.464   0.679   0.812   0.880   0.922
            38          PC   0.948   0.961   0.974   0.987   1.000
            39          LG    0.22    0.25    4.80    0.32   40.00
            40          UC   1.229   0.605
            41          UA       0       5      16      30      65      77      84      90      94      97
            42          UA     100
                        *
            43          ZZ
```


```
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *              JUN   1998               *
 *           VERSION 4.1                 *
 *                                       *
```

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*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
```

Hydrology Manual Update - Edition 3
Flood Control District of Maricopa County/City of Phoenix

Multiple Frequency Ratio Test Watershed 3:
Tuscon Arroyo
10-Year, 6-Hour Storm
Green & Ampt Rainfall Losses
Clark Unit Hydrograph

File: TA10-6.ih1 Date: 03-18-02

****

```
14 IO          OUTPUT CONTROL VARIABLES
                     IPRNT          3  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE

   IT          HYDROGRAPH TIME DATA
                      NMIN          2  MINUTES IN COMPUTATION INTERVAL
                     IDATE      1   0  STARTING DATE
                     ITIME       0000  STARTING TIME
                        NQ        800  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE      2   0  ENDING DATE
                    NDTIME       0238  ENDING TIME
                    ICENT          19  CENTURY MARK

                 COMPUTATION INTERVAL    0.03 HOURS
                      TOTAL TIME BASE   26.63 HOURS

        ENGLISH UNITS
             DRAINAGE AREA          SQUARE MILES
             PRECIPITATION DEPTH    INCHES
             LENGTH, ELEVATION      FEET
             FLOW                   CUBIC FEET PER SECOND
             STORAGE VOLUME         ACRE-FEET
             SURFACE AREA           ACRES
             TEMPERATURE            DEGREES FAHRENHEIT
```

*** ***

```
          **************
          *            *
15 KK     *        TA  *
          *            *
          **************
```

Subbasin

The Clark Unit Hydrograph is used for this basin.
The Urban time-area relation is used for this basin.

Time of Concentration for this sub-basin is based on the following:
6-Hour Rainfall, Pattern No. 2.61
An rainfall areal reduction factor of 0.948

EXCESS RAINFALL VALUES EXCEEDED IN 5-MINUTE INTERVALS

5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90
.12	.12	.12	.09	.08	.08	.06	.06	.06	.03	.03	.02	.02	.02	.02	.01	.01	.01

L= 6.180 miles, S= 38 feet/mile, Kb= .02

Rainfall depth of 2.37 was spacially reduced as shown by the PB record.
An areal reduction coefficient of 0.948 is used.

```
32 IN          TIME DATA FOR INPUT TIME SERIES
                     JXMIN         15  TIME INTERVAL IN MINUTES
                    JXDATE      1   0  STARTING DATE
                    JXTIME          0  STARTING TIME

             SUBBASIN RUNOFF DATA

31 BA          SUBBASIN CHARACTERISTICS
                     TAREA       8.12  SUBBASIN AREA

               PRECIPITATION DATA

35 PB                STORM       2.25  BASIN TOTAL PRECIPITATION

36 PI            INCREMENTAL PRECIPITATION PATTERN
```

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02
0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

```
39 LG          GREEN AND AMPT LOSS RATE
                     STRTL        0.22  STARTING LOSS
                       DTH        0.25  MOISTURE DEFICIT
                      PSIF        4.80  WETTING FRONT SUCTION
                     XKSAT        0.32  HYDRAULIC CONDUCTIVITY
                     RTIMP       40.00  PERCENT IMPERVIOUS AREA

40 UC          CLARK UNITGRAPH
                        TC        1.23  TIME OF CONCENTRATION
                         R        0.61  STORAGE COEFFICIENT

41 UA          ACCUMULATED-AREA VS. TIME,  11 ORDINATES
                     0.0       5.0      16.0      30.0      65.0      77.0      84.0      90.0      94.0      97.0
                   100.0
```

***

UNIT HYDROGRAPH PARAMETERS
CLARK TC= 1.23 HR, R= 0.61 HR
SNYDER TP= 0.62 HR, CP= 0.52

UNIT HYDROGRAPH
113 END-OF-PERIOD ORDINATES

57.	168.	274.	395.	578.	798.	1007.	1226.	1468.	1709.
1937.	2379.	3037.	3674.	4211.	4456.	4492.	4525.	4525.	4467.
4387.	4312.	4231.	4143.	4058.	3973.	3870.	3754.	3644.	3534.
3419.	3304.	3196.	3093.	2996.	2904.	2812.	2691.	2547.	2410.
2281.	2159.	2043.	1933.	1830.	1732.	1639.	1551.	1468.	1389.
1315.	1244.	1177.	1114.	1055.	998.	944.	894.	846.	801.
758.	717.	679.	642.	608.	575.	544.	515.	488.	461.
437.	413.	391.	370.	350.	331.	314.	297.	281.	266.
252.	238.	225.	213.	202.	191.	181.	171.	162.	153.
145.	137.	130.	123.	116.	110.	104.	99.	93.	88.
84.	79.	75.	71.	67.	63.	60.	57.	54.	51.
48.	46.	43.							

*** *** *** *** ***

HYDROGRAPH AT STATION TA

TOTAL RAINFALL = 2.25, TOTAL LOSS = 1.02, TOTAL EXCESS = 1.23

	PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	26.63-HR
+	3564.	4.63	(CFS)	1045.	267.	241.	241.
			(INCHES)	1.196	1.223	1.223	1.223
			(AC-FT)	518.	529.	529.	529.

CUMULATIVE AREA = 8.12 SQ MI

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	TA	3564.	4.63	1045.	267.	241.	8.12		

*** NORMAL END OF HEC-1 ***

```
1*****************************************                    *****************************************
 *                                       *                    *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *    U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN   1998               *                    *    HYDROLOGIC ENGINEERING CENTER      *
 *           VERSION 4.1                 *                    *          609 SECOND STREET            *
 *                                       *                    *       DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   21MAR02  TIME  08:49:44   *                    *           (916) 756-1104              *
 *                                       *                    *                                       *
 *****************************************                    *****************************************

                                        X     X  XXXXXXX   XXXXX           X
                                        X     X  X        X     X         XX
                                        X     X  X        X                X
                                        XXXXXXX  XXXX     X        XXXXX   X
                                        X     X  X        X                X
                                        X     X  X        X     X          X
                                        X     X  XXXXXXX   XXXXX          XXX

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                                HEC-1 INPUT                                                PAGE  1

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

         1          ID    Hydrology Manual Update - Edition 3
         2          ID    Flood Control District of Maricopa County/City of Phoenix
         3          ID
         4          ID    Multiple Frequency Ratio Test Watershed 3:
         5          ID    Tuscon Arroyo
         6          ID            5-Year, 6-Hour Storm
         7          ID            Green & Ampt Rainfall Losses
         8          ID            Clark Unit Hydrograph
         9          ID
        10          ID       File:  TA5-6.ih1        Date:  03-18-02
        11          ID
        12          ID   ********************************************************************
        13          IT       2                     800
        14          IO       3
                    *

        15          KK      TA
        16          KM   Subbasin
        17          KM
        18          KM      The Clark Unit Hydrograph is used for this basin.
        19          KM          The Urban time-area relation is used for this basin.
        20          KM
        21          KM      Time of Concentration for this sub-basin is based on the following:
        22          KM          6-Hour Rainfall, Pattern No.  2.61
        23          KM          An rainfall areal reduction factor of 0.948
        24          KM
        25          KM       EXCESS RAINFALL VALUES EXCEEDED IN 5-MINUTE INTERVALS
        26          KM     5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
        27          KM   .10 .10 .09 .07 .06 .05 .05 .05 .05 .02 .02 .02 .02 .02 .02 .01 .01 .01
        28          KM
        29          KM          L=   6.180 miles, S=   38 feet/mile, Kb= .02
        30          KM
        31          BA   8.120
        32          IN      15
        33          KM   Rainfall depth of  2.03 was spacially reduced as shown by the PB record.
        34          KM   An areal reduction coefficient of 0.948 is used.
        35          PB    1.92
        36          PC   0.000   0.013   0.018   0.028   0.043   0.055   0.066   0.078   0.090   0.102
        37          PC   0.116   0.132   0.154   0.199   0.284   0.464   0.679   0.812   0.880   0.922
        38          PC   0.948   0.961   0.974   0.987   1.000
        39          LG    0.22    0.25    4.80    0.32   40.00
        40          UC   1.408   0.704
        41          UA       0       5      16      30      65      77      84      90      94      97
        42          UA     100
                    *
        43          ZZ
1*****************************************                    *****************************************
 *                                       *                    *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *    U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN   1998               *                    *    HYDROLOGIC ENGINEERING CENTER      *
 *           VERSION 4.1                 *                    *          609 SECOND STREET            *
 *                                       *                    *       DAVIS, CALIFORNIA 95616         *
```

```
                    Hydrology Manual Update - Edition 3
                       Flood Control District of Maricopa County/City of Phoenix

                       Multiple Frequency Ratio Test Watershed 3:
                       Tuscon Arroyo
                              5-Year, 6-Hour Storm
                              Green & Ampt Rainfall Losses
                              Clark Unit Hydrograph

                          File:  TA5-6.ih1        Date:  03-18-02

                    ********************************************************************

 14 IO          OUTPUT CONTROL VARIABLES
                      IPRNT           3  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN           2  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ         800  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      2    0  ENDING DATE
                     NDTIME        0238  ENDING TIME
                     ICENT           19  CENTURY MARK

                  COMPUTATION INTERVAL    0.03 HOURS
                       TOTAL TIME BASE   26.63 HOURS

         ENGLISH UNITS
              DRAINAGE AREA          SQUARE MILES
              PRECIPITATION DEPTH    INCHES
              LENGTH, ELEVATION      FEET
              FLOW                   CUBIC FEET PER SECOND
              STORAGE VOLUME         ACRE-FEET
              SURFACE AREA           ACRES
              TEMPERATURE            DEGREES FAHRENHEIT


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


           **************
           *            *
 15 KK     *        TA  *
           *            *
           **************
                    Subbasin

                       The Clark Unit Hydrograph is used for this basin.
                           The Urban time-area relation is used for this basin.

                       Time of Concentration for this sub-basin is based on the following:
                           6-Hour Rainfall, Pattern No.  2.61
                           An rainfall areal reduction factor of 0.948

                        EXCESS RAINFALL VALUES EXCEEDED IN 5-MINUTE INTERVALS
                      5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
                    .10 .10 .09 .07 .06 .05 .05 .05 .05 .02 .02 .02 .02 .02 .02 .01 .01 .01

                           L=   6.180 miles, S=   38 feet/mile, Kb= .02

                    Rainfall depth of  2.03 was spacially reduced as shown by the PB record.
                    An areal reduction coefficient of 0.948 is used.

 32 IN          TIME DATA FOR INPUT TIME SERIES
                      JXMIN          15  TIME INTERVAL IN MINUTES
                     JXDATE      1    0  STARTING DATE
                     JXTIME           0  STARTING TIME

              SUBBASIN RUNOFF DATA

 31 BA          SUBBASIN CHARACTERISTICS
                      TAREA        8.12  SUBBASIN AREA

              PRECIPITATION DATA

 35 PB                STORM        1.92  BASIN TOTAL PRECIPITATION

 36 PI            INCREMENTAL PRECIPITATION PATTERN
```

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02
0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

```
39 LG          GREEN AND AMPT LOSS RATE
                    STRTL        0.22  STARTING LOSS
                      DTH        0.25  MOISTURE DEFICIT
                     PSIF        4.80  WETTING FRONT SUCTION
                    XKSAT        0.32  HYDRAULIC CONDUCTIVITY
                    RTIMP       40.00  PERCENT IMPERVIOUS AREA

40 UC          CLARK UNITGRAPH
                       TC        1.41  TIME OF CONCENTRATION
                        R        0.70  STORAGE COEFFICIENT

41 UA          ACCUMULATED-AREA VS. TIME,  11 ORDINATES
                    0.0       5.0      16.0      30.0      65.0      77.0      84.0      90.0      94.0      97.0
                  100.0
```

***

UNIT HYDROGRAPH PARAMETERS
CLARK TC= 1.41 HR, R= 0.70 HR
SNYDER TP= 0.72 HR, CP= 0.52

UNIT HYDROGRAPH
131 END-OF-PERIOD ORDINATES

43.	127.	207.	284.	397.	556.	720.	876.	1039.	1220.
1405.	1581.	1808.	2205.	2706.	3183.	3618.	3835.	3864.	3892.
3918.	3906.	3851.	3793.	3738.	3680.	3616.	3552.	3491.	3425.
3346.	3260.	3178.	3098.	3013.	2925.	2842.	2762.	2686.	2613.
2544.	2478.	2395.	2291.	2185.	2084.	1987.	1895.	1808.	1724.
1644.	1568.	1496.	1427.	1361.	1298.	1238.	1180.	1126.	1074.
1024.	977.	932.	888.	847.	808.	771.	735.	701.	669.
638.	608.	580.	553.	528.	503.	480.	458.	437.	416.
397.	379.	361.	345.	329.	313.	299.	285.	272.	259.
247.	236.	225.	215.	205.	195.	186.	178.	169.	162.
154.	147.	140.	134.	127.	122.	116.	111.	105.	101.
96.	92.	87.	83.	79.	76.	72.	69.	66.	63.
60.	57.	54.	52.	49.	47.	45.	43.	41.	39.
37.									

*** *** *** *** ***

HYDROGRAPH AT STATION TA

TOTAL RAINFALL = 1.92, TOTAL LOSS = 0.96, TOTAL EXCESS = 0.96

	PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	26.63-HR
+	2483.	4.73	(CFS)	812.	209.	189.	189.
			(INCHES)	0.930	0.959	0.959	0.959
			(AC-FT)	403.	415.	415.	415.

CUMULATIVE AREA = 8.12 SQ MI

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	TA	2483.	4.73	812.	209.	189.	8.12		

*** NORMAL END OF HEC-1 ***

```
1****************************************                                    ****************************************
 *                                      *                                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                    *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                                    *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                *                                    *          609 SECOND STREET           *
 *                                      *                                    *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   21MAR02  TIME  08:49:55  *                                    *           (916) 756-1104             *
 *                                      *                                    *                                      *
 ****************************************                                    ****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X               X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
1                                                HEC-1 INPUT                                                    PAGE  1

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

            1           ID    Hydrology Manual Update - Edition 3
            2           ID    Flood Control District of Maricopa County/City of Phoenix
            3           ID
            4           ID    Multiple Frequency Ratio Test Watershed 3:
            5           ID    Tuscon Arroyo
            6           ID            2-Year, 6-Hour Storm
            7           ID            Green & Ampt Rainfall Losses
            8           ID            Clark Unit Hydrograph
            9           ID
           10           ID       File:  TA2-6.ih1        Date:  03-18-02
           11           ID
           12           ID   ********************************************************************
           13           IT       2                     800
           14           IO       3
                        *

           15           KK      TA
           16           KM   Subbasin
           17           KM
           18           KM      The Clark Unit Hydrograph is used for this basin.
           19           KM          The Urban time-area relation is used for this basin.
           20           KM
           21           KM      Time of Concentration for this sub-basin is based on the following:
           22           KM          6-Hour Rainfall, Pattern No.  2.61
           23           KM          An rainfall areal reduction factor of 0.948
           24           KM
           25           KM       EXCESS RAINFALL VALUES EXCEEDED IN 5-MINUTE INTERVALS
           26           KM     5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
           27           KM   .06 .06 .05 .04 .03 .03 .03 .03 .03 .02 .02 .02 .01 .01 .01 .01 .01 .01
           28           KM
           29           KM          L=   6.180 miles, S=   38 feet/mile, Kb= .02
           30           KM
           31           BA   8.120
           32           IN     15
           33           KM   Rainfall depth of  1.54 was spacially reduced as shown by the PB record.
           34           KM   An areal reduction coefficient of 0.948 is used.
           35           PB    1.46
           36           PC   0.000   0.013   0.018   0.028   0.043   0.055   0.066   0.078   0.090   0.102
           37           PC   0.116   0.132   0.154   0.199   0.284   0.464   0.679   0.812   0.880   0.922
           38           PC   0.948   0.961   0.974   0.987   1.000
           39           LG    0.22    0.25    4.80    0.32   40.00
           40           UC   1.500   0.755
           41           UA       0       5      16      30      65      77      84      90      94      97
           42           UA     100
                        *
           43           ZZ
1****************************************                                    ****************************************
 *                                      *                                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                    *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                                    *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                *                                    *          609 SECOND STREET           *
 *                                      *                                    *       DAVIS, CALIFORNIA 95616        *
```

Hydrology Manual Update - Edition 3
Flood Control District of Maricopa County/City of Phoenix

Multiple Frequency Ratio Test Watershed 3:
Tuscon Arroyo
2-Year, 6-Hour Storm
Green & Ampt Rainfall Losses
Clark Unit Hydrograph

File: TA2-6.ihl Date: 03-18-02

****

```
14 IO          OUTPUT CONTROL VARIABLES
                     IPRNT          3  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE

   IT          HYDROGRAPH TIME DATA
                      NMIN          2  MINUTES IN COMPUTATION INTERVAL
                     IDATE      1   0  STARTING DATE
                     ITIME       0000  STARTING TIME
                        NQ        800  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE      2   0  ENDING DATE
                    NDTIME       0238  ENDING TIME
                     ICENT         19  CENTURY MARK

              COMPUTATION INTERVAL    0.03 HOURS
                   TOTAL TIME BASE   26.63 HOURS

        ENGLISH UNITS
             DRAINAGE AREA          SQUARE MILES
             PRECIPITATION DEPTH    INCHES
             LENGTH, ELEVATION      FEET
             FLOW                   CUBIC FEET PER SECOND
             STORAGE VOLUME         ACRE-FEET
             SURFACE AREA           ACRES
             TEMPERATURE            DEGREES FAHRENHEIT
```

*** ***

```
          **************
          *            *
15 KK     *        TA  *
          *            *
          **************
```

Subbasin

The Clark Unit Hydrograph is used for this basin.
The Urban time-area relation is used for this basin.

Time of Concentration for this sub-basin is based on the following:
6-Hour Rainfall, Pattern No. 2.61
An rainfall areal reduction factor of 0.948

EXCESS RAINFALL VALUES EXCEEDED IN 5-MINUTE INTERVALS

5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90
.06	.06	.05	.04	.03	.03	.03	.03	.03	.02	.02	.02	.01	.01	.01	.01	.01	.01

L= 6.180 miles, S= 38 feet/mile, Kb= .02

Rainfall depth of 1.54 was spacially reduced as shown by the PB record.
An areal reduction coefficient of 0.948 is used.

```
32 IN          TIME DATA FOR INPUT TIME SERIES
                     JXMIN         15  TIME INTERVAL IN MINUTES
                    JXDATE      1   0  STARTING DATE
                    JXTIME          0  STARTING TIME

             SUBBASIN RUNOFF DATA

31 BA          SUBBASIN CHARACTERISTICS
                     TAREA       8.12  SUBBASIN AREA

               PRECIPITATION DATA

35 PB                STORM       1.46  BASIN TOTAL PRECIPITATION

36 PI            INCREMENTAL PRECIPITATION PATTERN
```

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02
0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

```
39 LG          GREEN AND AMPT LOSS RATE
                    STRTL        0.22  STARTING LOSS
                      DTH        0.25  MOISTURE DEFICIT
                     PSIF        4.80  WETTING FRONT SUCTION
                    XKSAT        0.32  HYDRAULIC CONDUCTIVITY
                    RTIMP       40.00  PERCENT IMPERVIOUS AREA

40 UC          CLARK UNITGRAPH
                       TC        1.50  TIME OF CONCENTRATION
                        R        0.76  STORAGE COEFFICIENT

41 UA          ACCUMULATED-AREA VS. TIME,  11 ORDINATES
                    0.0       5.0      16.0      30.0      65.0      77.0      84.0      90.0      94.0      97.0
                  100.0
```

***

UNIT HYDROGRAPH PARAMETERS
CLARK TC= 1.50 HR, R= 0.76 HR
SNYDER TP= 0.76 HR, CP= 0.51

UNIT HYDROGRAPH
140 END-OF-PERIOD ORDINATES

38.	112.	182.	250.	337.	466.	612.	751.	885.	1035.
1202.	1361.	1514.	1739.	2113.	2549.	2967.	3367.	3577.	3603.
3629.	3653.	3657.	3624.	3573.	3524.	3478.	3426.	3368.	3313.
3261.	3203.	3132.	3057.	2986.	2917.	2844.	2766.	2692.	2621.
2553.	2488.	2426.	2366.	2309.	2232.	2136.	2044.	1955.	1871.
1790.	1713.	1639.	1568.	1500.	1435.	1373.	1314.	1257.	1203.
1151.	1101.	1054.	1008.	965.	923.	883.	845.	808.	774.
740.	708.	678.	648.	620.	594.	568.	543.	520.	497.
476.	455.	436.	417.	399.	382.	365.	349.	334.	320.
306.	293.	280.	268.	256.	245.	235.	225.	215.	206.
197.	188.	180.	172.	165.	158.	151.	144.	138.	132.
127.	121.	116.	111.	106.	101.	97.	93.	89.	85.
81.	78.	74.	71.	68.	65.	62.	60.	57.	55.
52.	50.	48.	46.	44.	42.	40.	38.	37.	35.

*** *** *** *** ***

HYDROGRAPH AT STATION TA

TOTAL RAINFALL = 1.46, TOTAL LOSS = 0.84, TOTAL EXCESS = 0.62

	PEAK FLOW (CFS)	TIME (HR)	MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	26.63-HR
+	1442.	4.77	(CFS) 522.	136.	122.	122.
			(INCHES) 0.597	0.621	0.621	0.621
			(AC-FT) 259.	269.	269.	269.

CUMULATIVE AREA = 8.12 SQ MI

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	TA	1442.	4.77	522.	136.	122.	8.12		

*** NORMAL END OF HEC-1 ***

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*              JUN   1998               *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   21MAR02  TIME  08:50:05   *
*                                       *
*****************************************
```

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

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X               X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


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

  1           ID    Hydrology Manual Update - Edition 3
  2           ID    Flood Control District of Maricopa County/City of Phoenix
  3           ID
  4           ID    Multiple Frequency Ratio Test Watershed 3:
  5           ID    Tuscon Arroyo
  6           ID            2-Year, 6-Hour Storm
  7           ID            Green & Ampt Rainfall Losses
  8           ID            Clark Unit Hydrograph
  9           ID
 10           ID       File:  TA2A-6.ih1       Date:  03-18-02
 11           ID
 12           ID   ***********************************************************************
 13           IT       2                    800
 14           IO       3
              *

 15           KK      TA
 16           KM   Subbasin
 17           KM
 18           KM      The Clark Unit Hydrograph is used for this basin.
 19           KM          The Urban time-area relation is used for this basin.
 20           KM
 21           KM      Time of Concentration for this sub-basin is based on the following:
 22           KM          6-Hour Rainfall, Pattern No.  2.61
 23           KM          An rainfall areal reduction factor of 0.948
 24           KM
 25           KM       EXCESS RAINFALL VALUES EXCEEDED IN 5-MINUTE INTERVALS
 26           KM     5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
 27           KM   .06 .06 .05 .04 .03 .03 .03 .03 .03 .02 .02 .02 .01 .01 .01 .01 .01 .01
 28           KM
 29           KM          L=   6.180 miles, S=   38 feet/mile, Kb= .02
 30           KM
 31           BA   8.120
 32           IN      15
 33           KM   Rainfall depth of  1.54 was spacially reduced as shown by the PB record.
 34           KM   An areal reduction coefficient of 0.948 is used.
 35           PB    1.46
 36           PC   0.000   0.013   0.018   0.028   0.043   0.055   0.066   0.078   0.090   0.102
 37           PC   0.116   0.132   0.154   0.199   0.284   0.464   0.679   0.812   0.880   0.922
 38           PC   0.948   0.961   0.974   0.987   1.000
 39           LG    0.22    0.25    4.80    0.32   40.00
 40           UC   1.857   0.957
 41           UA       0       5      16      30      65      77      84      90      94      97
 42           UA     100
              *
 43           ZZ
```


```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*              JUN   1998               *
*            VERSION 4.1                *
*                                       *
```

```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
```

```
*  RUN DATE   21MAR02  TIME  08:50:05   *                                                    *          (916) 756-1104          *
*                                       *                                                    *                                  *
*****************************************                                                    ************************************


                          Hydrology Manual Update - Edition 3
                             Flood Control District of Maricopa County/City of Phoenix

                             Multiple Frequency Ratio Test Watershed 3:
                             Tuscon Arroyo
                                     2-Year, 6-Hour Storm
                                     Green & Ampt Rainfall Losses
                                     Clark Unit Hydrograph

                                File:  TA2A-6.ih1       Date:  03-18-02

                        ***********************************************************************

 14 IO          OUTPUT CONTROL VARIABLES
                      IPRNT           3  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN           2  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ         800  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      2    0  ENDING DATE
                     NDTIME        0238  ENDING TIME
                      ICENT          19  CENTURY MARK

                  COMPUTATION INTERVAL    0.03 HOURS
                       TOTAL TIME BASE   26.63 HOURS

         ENGLISH UNITS
              DRAINAGE AREA          SQUARE MILES
              PRECIPITATION DEPTH    INCHES
              LENGTH, ELEVATION      FEET
              FLOW                   CUBIC FEET PER SECOND
              STORAGE VOLUME         ACRE-FEET
              SURFACE AREA           ACRES
              TEMPERATURE            DEGREES FAHRENHEIT


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


           **************
           *            *
 15 KK     *        TA  *
           *            *
           **************
                         Subbasin

                            The Clark Unit Hydrograph is used for this basin.
                                The Urban time-area relation is used for this basin.

                            Time of Concentration for this sub-basin is based on the following:
                                6-Hour Rainfall, Pattern No.  2.61
                                An rainfall areal reduction factor of 0.948

                             EXCESS RAINFALL VALUES EXCEEDED IN 5-MINUTE INTERVALS
                           5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
                         .06 .06 .05 .04 .03 .03 .03 .03 .03 .02 .02 .02 .01 .01 .01 .01 .01 .01

                                L=   6.180 miles, S=   38 feet/mile, Kb= .02

                         Rainfall depth of  1.54 was spacially reduced as shown by the PB record.
                         An areal reduction coefficient of 0.948 is used.

 32 IN          TIME DATA FOR INPUT TIME SERIES
                      JXMIN          15  TIME INTERVAL IN MINUTES
                     JXDATE      1    0  STARTING DATE
                     JXTIME           0  STARTING TIME

              SUBBASIN RUNOFF DATA

 31 BA          SUBBASIN CHARACTERISTICS
                      TAREA        8.12  SUBBASIN AREA

                PRECIPITATION DATA

 35 PB                STORM        1.46  BASIN TOTAL PRECIPITATION

 36 PI            INCREMENTAL PRECIPITATION PATTERN
```

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02
0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

```
39 LG          GREEN AND AMPT LOSS RATE
                     STRTL        0.22  STARTING LOSS
                       DTH        0.25  MOISTURE DEFICIT
                      PSIF        4.80  WETTING FRONT SUCTION
                     XKSAT        0.32  HYDRAULIC CONDUCTIVITY
                     RTIMP       40.00  PERCENT IMPERVIOUS AREA

40 UC          CLARK UNITGRAPH
                        TC        1.86  TIME OF CONCENTRATION
                         R        0.96  STORAGE COEFFICIENT

41 UA          ACCUMULATED-AREA VS. TIME,  11 ORDINATES
                     0.0       5.0      16.0      30.0      65.0      77.0      84.0      90.0      94.0      97.0
                   100.0

                                                  ***

                                          UNIT HYDROGRAPH PARAMETERS
                                   CLARK   TC=  1.86 HR,       R=  0.96 HR
                                  SNYDER   TP=  0.95 HR,      CP=  0.51

                                          UNIT HYDROGRAPH
                                   177 END-OF-PERIOD ORDINATES
              24.       72.      117.      162.      205.      258.      339.      434.      525.      613.
             699.      794.      900.     1004.     1105.     1202.     1325.     1546.     1831.     2107.
            2373.     2629.     2798.     2850.     2868.     2886.     2903.     2916.     2904.     2873.
            2842.     2812.     2784.     2753.     2719.     2684.     2650.     2617.     2585.     2545.
            2497.     2450.     2405.     2361.     2317.     2269.     2220.     2173.     2128.     2084.
            2042.     2001.     1961.     1923.     1886.     1846.     1794.     1732.     1673.     1616.
            1560.     1507.     1455.     1405.     1357.     1311.     1266.     1223.     1181.     1140.
            1101.     1064.     1027.      992.      958.      925.      894.      863.      833.      805.
             777.      751.      725.      700.      676.      653.      631.      609.      588.      568.
             549.      530.      512.      494.      477.      461.      445.      430.      415.      401.
             387.      374.      361.      349.      337.      325.      314.      303.      293.      283.
             273.      264.      255.      246.      238.      230.      222.      214.      207.      200.
             193.      186.      180.      174.      168.      162.      157.      151.      146.      141.
             136.      132.      127.      123.      118.      114.      111.      107.      103.      100.
              96.       93.       90.       87.       84.       81.       78.       75.       73.       70.
              68.       66.       63.       61.       59.       57.       55.       53.       51.       50.
              48.       46.       45.       43.       42.       40.       39.       38.       36.       35.
              34.       33.       32.       30.       29.       28.       27.

   ***            ***            ***            ***            ***

                     HYDROGRAPH AT STATION       TA

   TOTAL RAINFALL =    1.46, TOTAL LOSS =    0.84, TOTAL EXCESS =    0.62

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR      26.63-HR
+   (CFS)        (HR)
                                   (CFS)
+    1242.       4.97                512.         136.         122.         122.
                              (INCHES)       0.587        0.621        0.621        0.621
                               (AC-FT)        254.         269.         269.         269.

                     CUMULATIVE AREA =    8.12 SQ MI

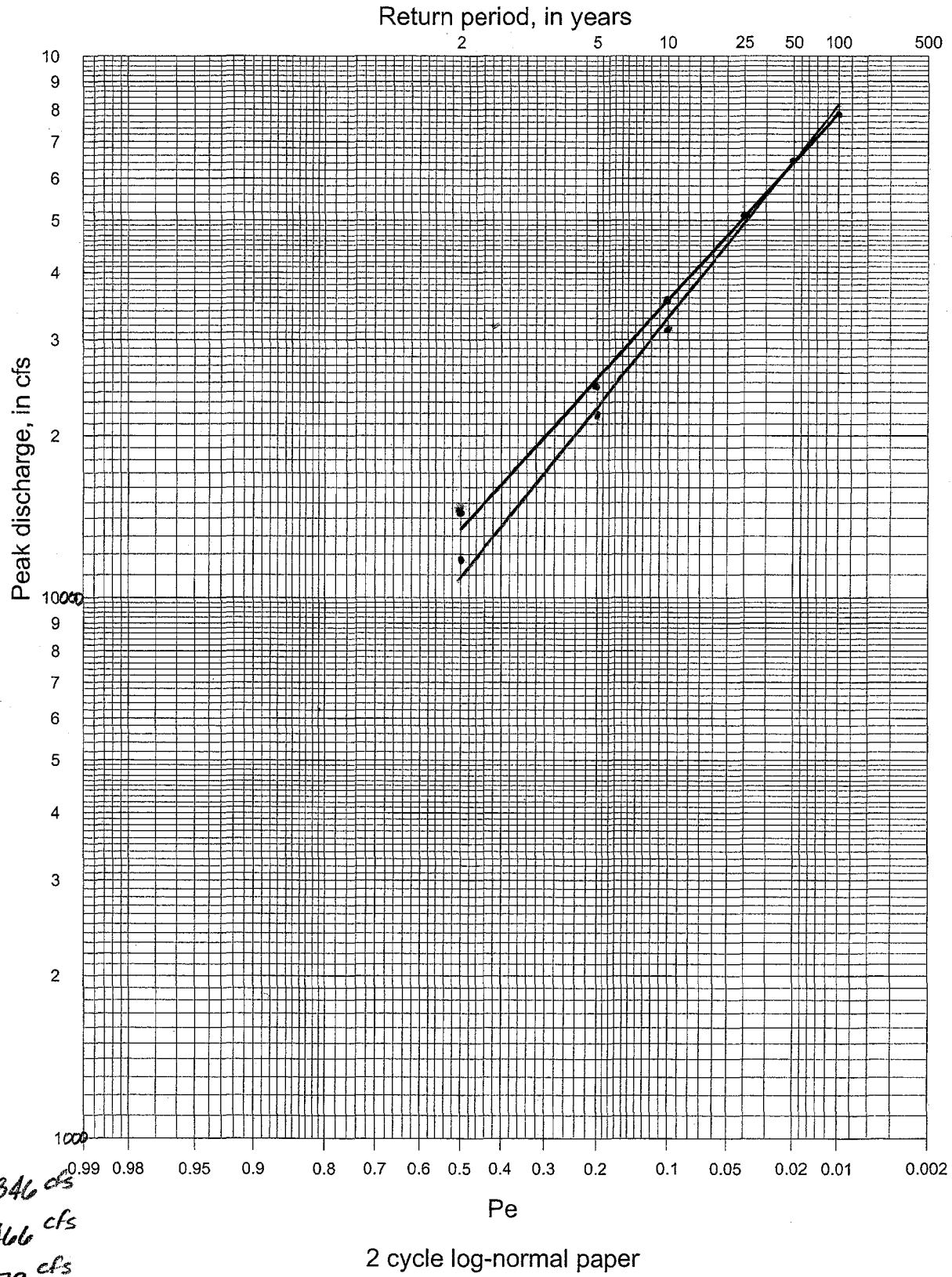
1
                                          RUNOFF SUMMARY
                                   FLOW IN CUBIC FEET PER SECOND
                                TIME IN HOURS,  AREA IN SQUARE MILES

                                     PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
        OPERATION        STATION     FLOW    PEAK                                          AREA      STAGE     MAX STAGE
+                                                          6-HOUR      24-HOUR     72-HOUR

        HYDROGRAPH AT
+                            TA      1242.    4.97          512.         136.         122.       8.12
```

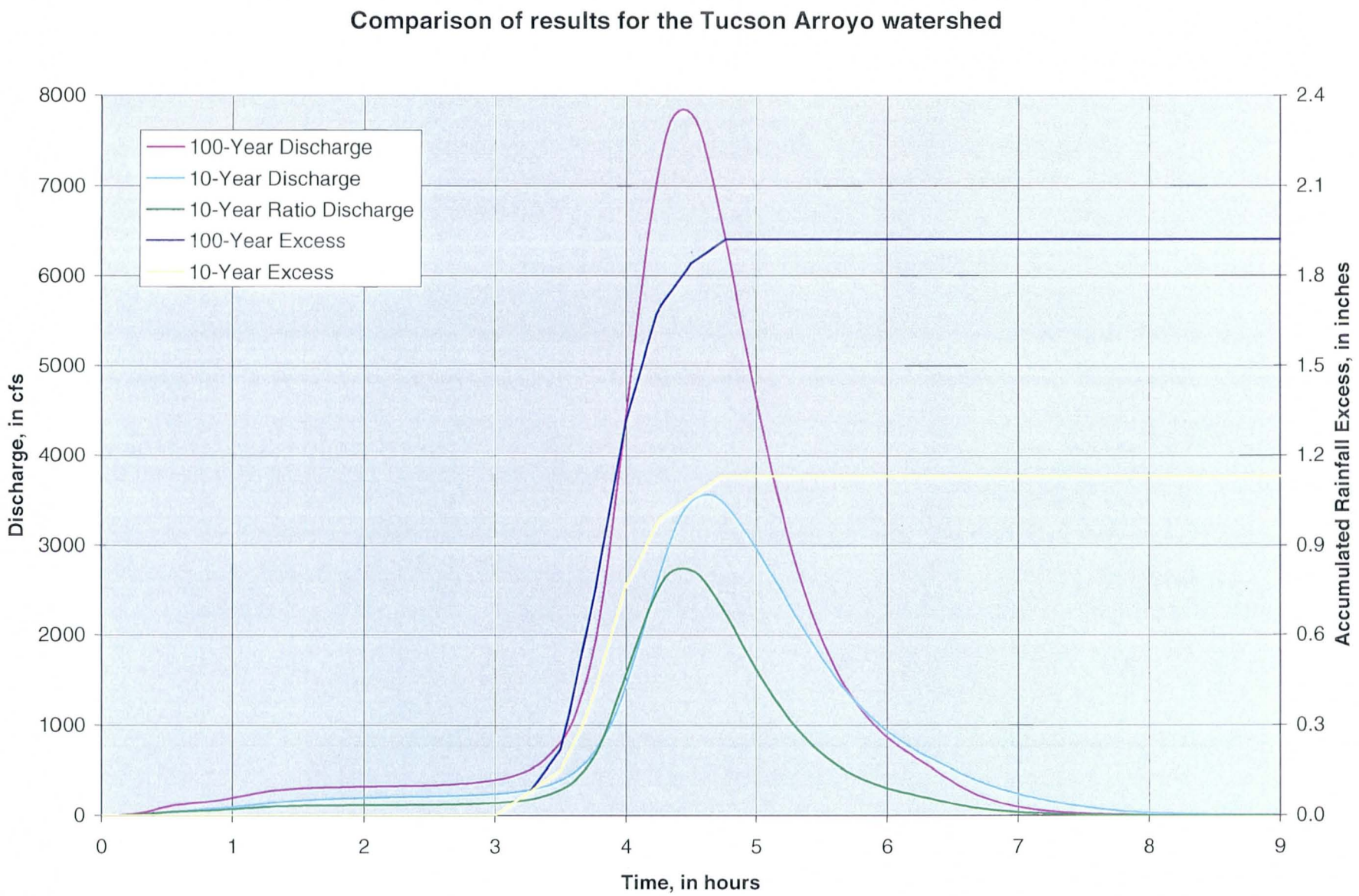
*** NORMAL END OF HEC-1 ***

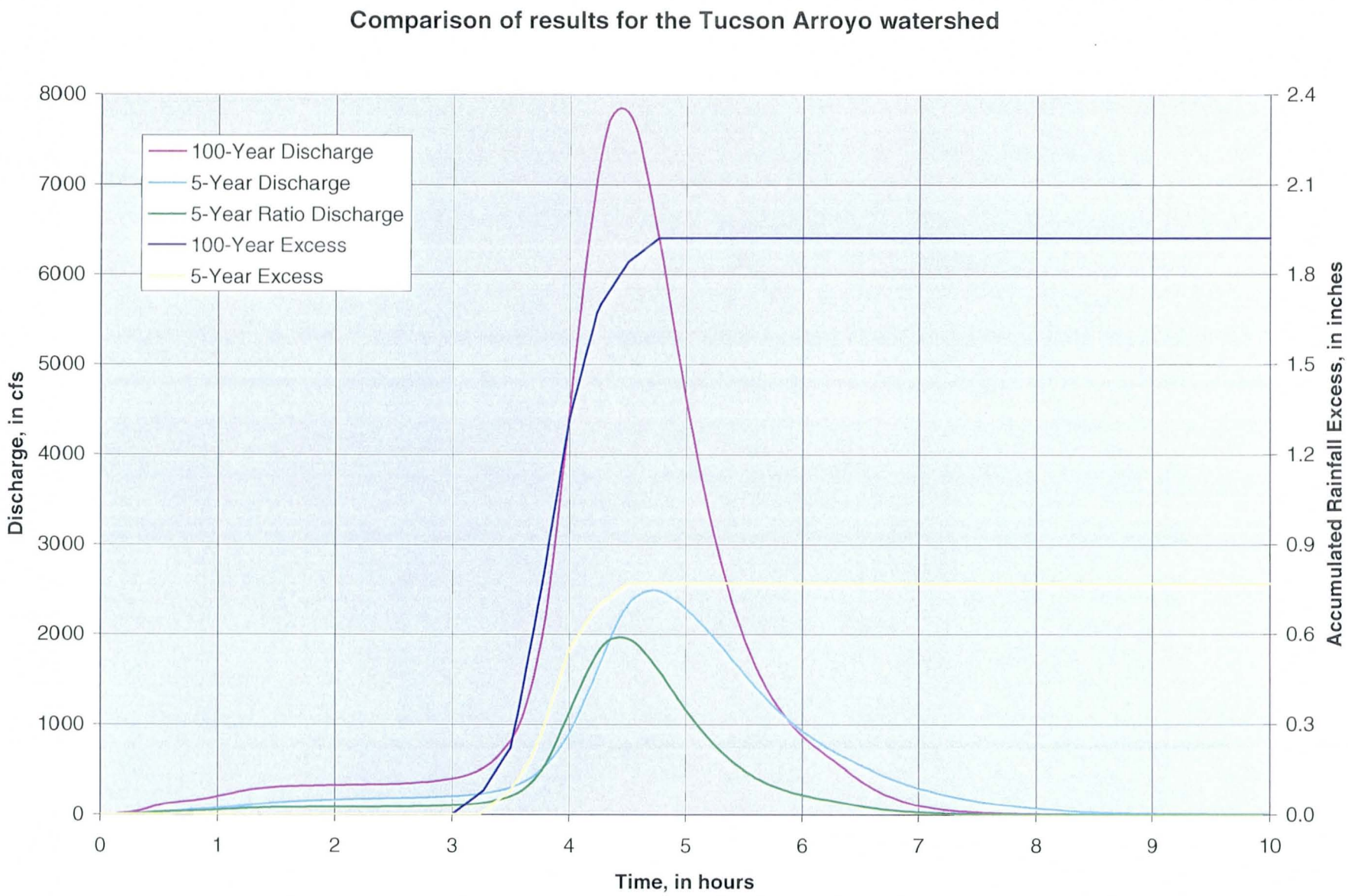
Tuscon Arroyo
A = 8.12 sm
Urban

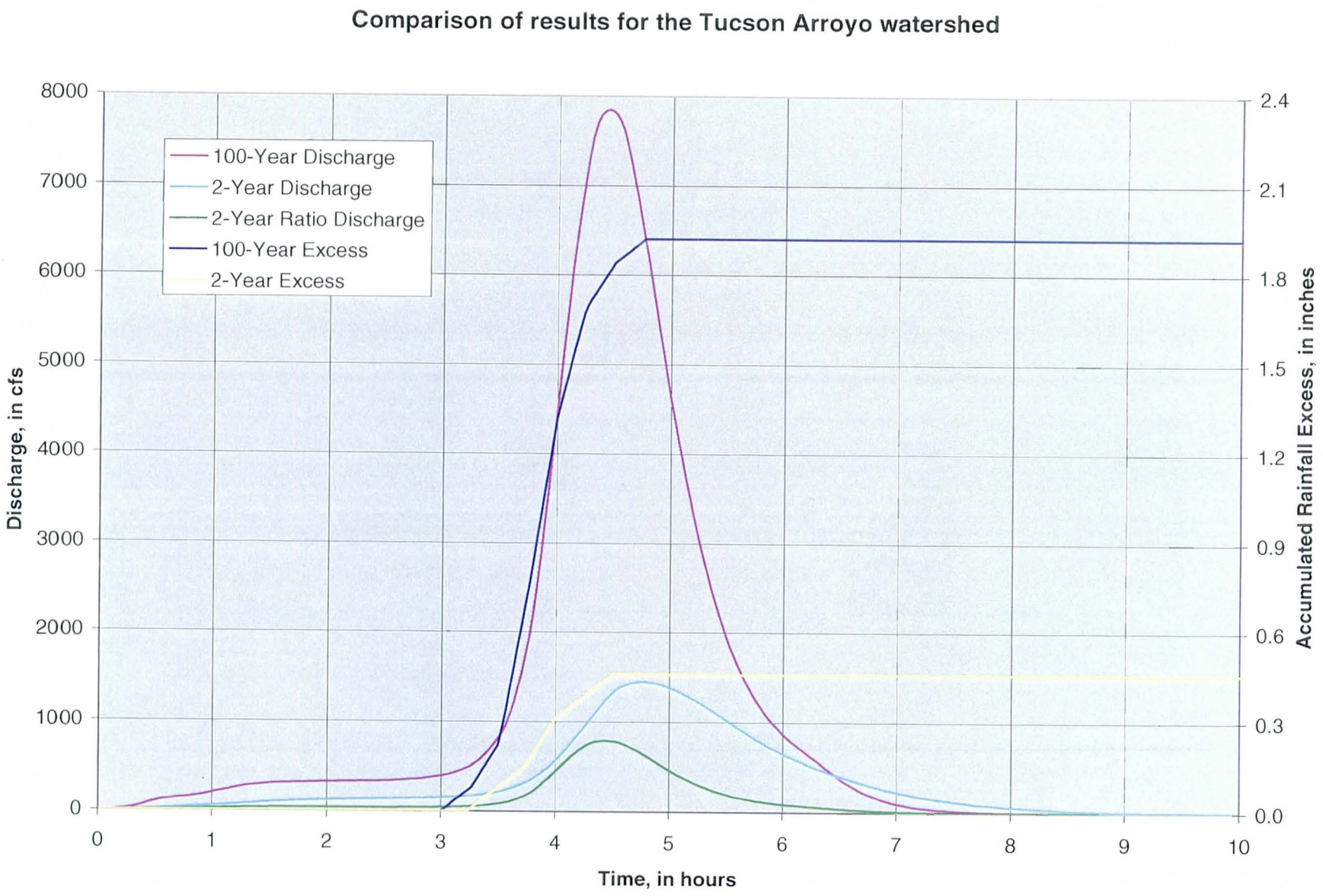


2 cycle log-normal paper

Q_{100} = 7,846 cfs
Q_{50} = 6,466 cfs
[illegible] = 5,179 cfs
Q_{10} = 3,564 cfs Q_{10}^{R} = 3,138 cfs
Q_5 = 2,483 cfs Q_5^{R} = 2,197 cfs
Q_2 = 1,442 cfs Q_2^{R} = 1,177 cfs


Comparison of results for the Tucson Arroyo watershed
100-Year Discharge
10-Year Discharge
10-Year Ratio Discharge
100-Year Excess
10-Year Excess
Discharge, in cfs
Accumulated Rainfall Excess, in inches
Time, in hours
8000
7000
6000
5000
4000
3000
2000
1000
0
2.4
2.1
1.8
1.5
1.2
0.9
0.6
0.3
0.0
0
1
2
3
4
5
6
7
8
9


Comparison of results for the Tucson Arroyo watershed
100-Year Discharge
5-Year Discharge
5-Year Ratio Discharge
100-Year Excess
5-Year Excess
Discharge, in cfs
Accumulated Rainfall Excess, in inches
Time, in hours
8000
7000
6000
5000
4000
3000
2000
1000
0
2.4
2.1
1.8
1.5
1.2
0.9
0.6
0.3
0.0
0
1
2
3
4
5
6
7
8
9
10


Comparison of results for the Tucson Arroyo watershed
100-Year Discharge
2-Year Discharge
2-Year Ratio Discharge
100-Year Excess
2-Year Excess
Discharge, in cfs
Accumulated Rainfall Excess, in inches
Time, in hours
8000
7000
6000
5000
4000
3000
2000
1000
0
2.4
2.1
1.8
1.5
1.2
0.9
0.6
0.3
0.0
0
1
2
3
4
5
6
7
8
9
10

Stantec

Project: _____ Project Number: _____

Notes: _____ Scale: _____

_____ Page ___ of ___ Page(s)

Computed By: _____ Date: / / Checked By: _____ Date: / /

HARTMAN & FLYING "E" WASHES

1. DRAINAGE AREA IS 7.24 SQ. MILES FOR HARTMAN
   DRAINAGE AREA IS 10.73 SQ MILES FOR FLYING "E"
2. LAND USE IS PARTIALLY DEVELOPED W/ SINGLE FAMILY VERY LOW DENSITY RESIDENTIAL

3. GAGE DATA: 09515800 HARTMAN WASH

   - DRAINAGE AREA IS 5.57 SQ. MILES
   - PERIOD OF RECORD IS 33 YEARS

RETURN PERIOD YEARS	PEAK DISCHARGE CFS	RATIO TO 100-YEAR %
100	7,100	
50	4,910	
25	3,230	
10	1,660	23.4
5	869	12.2
2	239	3.4

4. EVENT SIMULATION PERFORMED BY MCG

   SEPT 97 (TROPICAL STORM NORA)

	RAINFALL INCHES	RUNOFF MEASURED CFS	RUNOFF SIMULATED CFS
HARTMAN	4.16	1,240	1,350
FLYING "E"	4.13	1,130	1,160

5. HEC-1 MODELING PERFORMED BY CVL / BLACK & VEATCH
   - 100-YEAR, 24-HOUR MULTIPLE BASIN MODEL
   - SCS TYPE II RAINFALL DISTRIBUTION
   - GREEN & AMPT RAINFALL LOSSES
   - S-GRAPH

Stantec

Project: _____ Project Number: _____

Notes: _____ Scale: _____

_____ Page ___ of ___ Page(s)

Computed By: _____ Date: / / Checked By: _____ Date: / /

- 24-HOUR RAINFALL DEPTHS

RETURN PERIOD YEARS	RAINFALL DEPTH INCHES
100	4.20
50	3.74
25	3.28
10	2.68
5	2.25
2	1.60

- RESULTS

WASH	RETURN PERIOD YEARS	PEAK DISCHARGE CFS	RATIO OF 100-YEAR %
HARTMAN	100	3,802	
	50	3,250	
	25	2,749	
	10	1,983	52.2
	5		
	2		
FLYING "E"	100	7,820	
	50	6,410	
	25	5,260	
	10	3,719	47.6
	5		
	2		

Stantec

Project: _____ Project Number: _____

Notes: _____ Scale: _____

Page ___ of ___ Page(s)

Computed By: _____ Date: / / Checked By: _____ Date: / /

Area	~~5.55~~	5.548
IA	~~0.30~~	0.35
D theta	~~0.25~~	0.37
PSIF	5.3	
XKSAT	~~0.38~~	0.20
RTIMP	~~5.00~~	0
K_b	~~0.02~~	0.061
L	6.364	
S	83.3	
~~TA~~	~~Urban~~	natural
K_n	0.02	100-year & 50-year
	0.025	25-year & 10-year
	0.03	5-year & 2-year

L_{ca} = 3.0 miles

Return Period Years	Rainfall Excess Inches	Tc Hours	R Hours	Peak Q cfs	Ratio to 100-year %
100	~~1.20~~	~~0.87~~	~~0.52~~	~~3548~~	
50	~~0.95~~	~~0.99~~	~~0.61~~	~~2570~~	
25	~~0.71~~	~~1.19~~	~~0.74~~	~~1660~~	
10	~~0.40~~	~~1.50~~	~~0.96~~	~~757~~	
5	~~0.22~~	~~1.50~~	~~0.96~~	~~389~~	
2	~~0.07~~	~~1.00~~	~~0.61~~	~~121~~	

Return Period Years	Rainfall Excess Inches	Lag Minutes	Peak Discharge cfs	Ratio to 100-year %
100	1.33	38.1	4,712	
50	1.07	38.1	3,872	
25	0.81	47.7	2,593	
10	0.48	47.7	1,601	34.0
5	0.27	57.2	790	16.8
2	0.02	57.2	70	1.5

09515800 HARTMAN WASH NEAR WICKENBURG, AZ

LOCATION.--Lat 33°57'46", long 112°49'40", in SE$^1/_4$ sec.12, T.7 N., R.6 W., Maricopa County, Hydrologic Unit 15070103, at U.S. Highway 60, 5.7 mi west of Wickenburg.
DRAINAGE AREA.--5.57 mi^2.

Annual peak discharges

Water year	Date	Annual peak discharge (ft^3/s)	Discharge codes	Water year	Date	Annual peak discharge (ft^3/s)	Discharge codes
1964	08-23-64	1,840		1976	09-25-76	400	ES
1965	09-04-65	50		1977	09-27-77	320	ES
1966	09-13-66	150		1978	01-17-78	60	ES
1967	08-14-67	2,600		1979	11-11-78	150	ES
1968	12-19-67	360		1983	03-00-83	1,300	
1969	08-00-69	5.0	ES	1991	00-00-91	4.0	
1970	09-05-70	1,600		1992	05-28-92	943	
1971	08-19-71	1,000		1993	00-00-93	0	
1972	09-03-72	0.5	ES	1994	00-00-94	0	
1973	10-07-72	300	ES	1995	08-14-95	779	
1974	07-30-74	35	ES	1996	09-11-96	45	
1975	07-13-75	100					

Discharge rating table developed October 1995

Gage height (ft)	Discharge (ft^3/s)	Gage height (ft)	Discharge (ft^3/s)
4.0	599	9.0	3,190
5.0	1,050	10.0	3,850
6.0	1,510	11.0	4,540
7.0	2,040	12.0	5,260
8.0	2,600	13.0	6,000

Magnitude and probability of instantaneous peak flow based on period of record 1964-79, 1983, 1991-96

Discharge, in ft^3/s, for indicated recurrence interval in years, and exceedance probability, in percent					
2 50%	5 20%	10 10%	25 4%	50† 2%	100† 1%
239	869	1,660	3,230	4,910	7,100
Weighted skew	(logs) =	-0.20			
Mean	(logs) =	2.36			
Standard dev.	(logs) =	0.69			

† Reliability of values in column is uncertain, and potential errors are large.

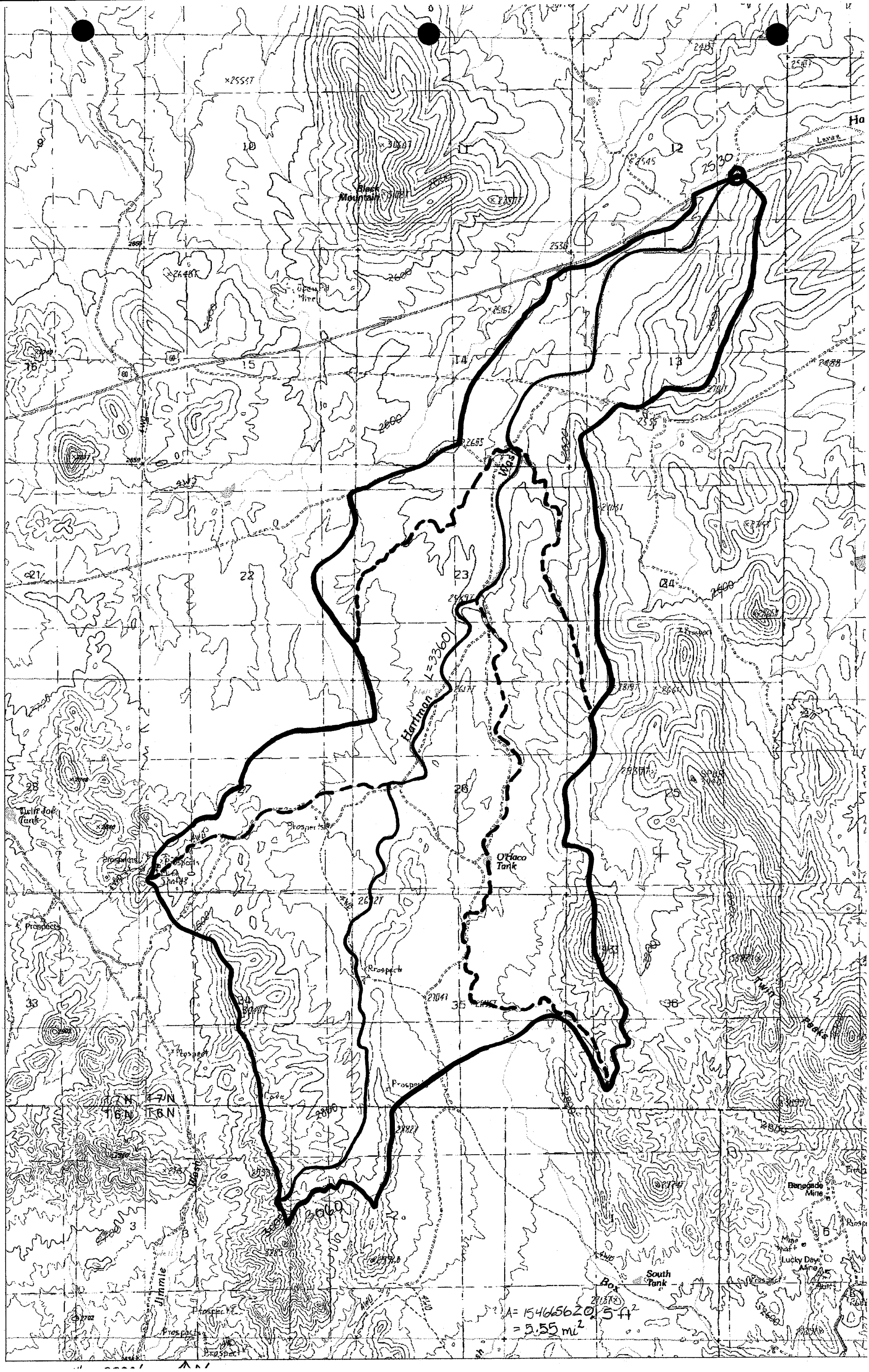
Hartman & Flying "E" Washes

Flood Control District of Maricopa County
EXAMPLE1 - Single Storm, 6 Hr, Green Ampt, Clark, Normal Depth
Rainfall Data

Primary Zone Number: **7** Latitude: **0.0** Elevation: **0**

Short Duration Zone Number: **8** Longitude: **0.0**

	Point Values (in)					
Duration	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
5 MIN	0.38	0.47	0.53	0.62	0.69	0.76
10 MIN	0.57	0.71	0.81	0.95	1.06	1.17
15 MIN	0.70	0.89	1.02	1.21	1.36	1.50
30 MIN	0.92	1.19	1.37	1.63	1.84	2.04
1 HOUR	1.13	1.47	1.70	2.03	2.29	2.55
2 HOUR	1.22	1.61	1.87	2.25	2.54	2.83
3 HOUR	1.28	1.70	1.99	2.39	2.70	3.01
6 HOUR	1.39	1.88	2.20	2.65	3.02	3.37
12 HOUR	1.50	2.06	2.44	2.96	3.37	3.77
24 HOUR	1.60	2.24	2.67	3.26	3.72	4.18


Black Mountain
Open Pit Mine
Harlman
O'Haco Tank
Twiff Joe Tank
Prospects
Prospect
Jimmie
Twin Peaks
Renegade Mine
Lucky Days Mine
South Tank
Box
T7N
T6N
T6N
A= 15466620.5 ft²
= 5.55 mi²

Black
Mountain

```
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *              JUN   1998               *
 *            VERSION 4.1                *
 *                                       *
 *  RUN DATE   21MAR02  TIME  11:48:20   *
 *                                       *
 *****************************************
```

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

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X               X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


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

  1           ID    Hydrology Manual Update - Edition 3
  2           ID    Flood Control District of Maricopa County/City of Phoenix
  3           ID
  4           ID    Multiple Frequency Ratio Test Watershed 5:
  5           ID    Hartman Wash at Wickenburg
  6           ID            100-Year, 6-Hour Storm
  7           ID            Green & Ampt Rainfall Losses
  8           ID            S-graph - Desert/rangeland
  9           ID
 10           ID       File:  HW100-6.ih1      Date:  03-18-02
 11           ID
 12           ID   ***********************************************************************
 13           IT       2                      800
 14           IO       3
              *

 15           KK      HW
 16           KM   Subbasin
 17           KM
 18           KM      The Desert/Rangeland S-Graph is used for this basin.
 19           KM     The following parameters were provided for this basin:
 20           KM          L=      6.4  Lca=      3.0   S=   83.3  Kn= .020  LAG=  38.1
 21           BA   5.548
 22           IN      15
 23           KM   Rainfall depth of  3.37 was spacially reduced as shown by the PB record.
 24           KM   An areal reduction coefficient of 0.958 is used.
 25           PB    3.23
 26           PC   0.000   0.011   0.018   0.027   0.039   0.050   0.061   0.071   0.082   0.093
 27           PC   0.106   0.120   0.142   0.186   0.272   0.459   0.685   0.821   0.887   0.928
 28           PC   0.948   0.962   0.974   0.988   1.000
 29           LG    0.35    0.37    5.30    0.20    0.00
 30           UI     490     490     490     490    1056    1454    1910    2350    2754    3099
 31           UI    3453    3793    4113    4343    4436    4696    4696    4696    4618    4428
 32           UI    4338    4041    3589    3393    2991    2764    2538    2307    2125    1910
 33           UI    1755    1585    1468    1342    1190    1094     984     924     868     751
 34           UI     751     644     519     519     519     459     335     335     335     335
 35           UI     335     335     136     119     119     119     119     119     119     119
 36           UI     119     119     119     119     119     119     119     119     119     119
 37           UI       0       0       0       0       0       0       0       0       0       0
 38           UI       0       0       0       0       0       0       0       0       0       0
              *
 39           ZZ
```


```
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *              JUN   1998               *
 *            VERSION 4.1                *
 *                                       *
 *  RUN DATE   21MAR02  TIME  11:48:20   *
 *                                       *
 *****************************************
```

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

```
                    Hydrology Manual Update - Edition 3
                       Flood Control District of Maricopa County/City of Phoenix

                       Multiple Frequency Ratio Test Watershed 5:
                       Hartman Wash at Wickenburg
                               100-Year, 6-Hour Storm
                               Green & Ampt Rainfall Losses
                               S-graph - Desert/rangeland

                          File:  HW100-6.ih1      Date:  03-18-02

                  ********************************************************************

14 IO          OUTPUT CONTROL VARIABLES
                     IPRNT           3  PRINT CONTROL
                     IPLOT           0  PLOT CONTROL
                     QSCAL          0.  HYDROGRAPH PLOT SCALE

   IT          HYDROGRAPH TIME DATA
                      NMIN           2  MINUTES IN COMPUTATION INTERVAL
                     IDATE      1    0  STARTING DATE
                     ITIME        0000  STARTING TIME
                        NQ         800  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE      2    0  ENDING DATE
                    NDTIME        0238  ENDING TIME
                    ICENT          19  CENTURY MARK

               COMPUTATION INTERVAL    0.03 HOURS
                    TOTAL TIME BASE   26.63 HOURS

        ENGLISH UNITS
             DRAINAGE AREA          SQUARE MILES
             PRECIPITATION DEPTH    INCHES
             LENGTH, ELEVATION      FEET
             FLOW                   CUBIC FEET PER SECOND
             STORAGE VOLUME         ACRE-FEET
             SURFACE AREA           ACRES
             TEMPERATURE            DEGREES FAHRENHEIT


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


          **************
          *            *
15 KK     *        HW  *
          *            *
          **************
                    Subbasin

                       The Desert/Rangeland S-Graph is used for this basin.
                      The following parameters were provided for this basin:
                           L=      6.4  Lca=      3.0   S=   83.3  Kn= .020  LAG=  38.1
                    Rainfall depth of  3.37 was spacially reduced as shown by the PB record.
                    An areal reduction coefficient of 0.958 is used.

22 IN          TIME DATA FOR INPUT TIME SERIES
                     JXMIN          15  TIME INTERVAL IN MINUTES
                    JXDATE      1    0  STARTING DATE
                    JXTIME           0  STARTING TIME

             SUBBASIN RUNOFF DATA

21 BA          SUBBASIN CHARACTERISTICS
                     TAREA        5.55  SUBBASIN AREA

               PRECIPITATION DATA

25 PB                STORM        3.23  BASIN TOTAL PRECIPITATION

26 PI            INCREMENTAL PRECIPITATION PATTERN
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01
                   0.01      0.01      0.01      0.01      0.01      0.02      0.02      0.02      0.02      0.02
                   0.02      0.02      0.03      0.03      0.03      0.03      0.03      0.03      0.03      0.03
                   0.02      0.02      0.02      0.02      0.02      0.02      0.02      0.01      0.01      0.01
                   0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01
```

```
                0.01      0.01      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00

29 LG        GREEN AND AMPT LOSS RATE
                STRTL        0.35  STARTING LOSS
                  DTH        0.37  MOISTURE DEFICIT
                 PSIF        5.30  WETTING FRONT SUCTION
                XKSAT        0.20  HYDRAULIC CONDUCTIVITY
                RTIMP        0.00  PERCENT IMPERVIOUS AREA

29 UI        INPUT UNITGRAPH,  70 ORDINATES,  VOLUME = 1.00
               490.0     490.0     490.0     490.0    1056.0    1454.0    1910.0    2350.0    2754.0    3099.0
              3453.0    3793.0    4113.0    4343.0    4436.0    4696.0    4696.0    4696.0    4618.0    4428.0
              4338.0    4041.0    3589.0    3393.0    2991.0    2764.0    2538.0    2307.0    2125.0    1910.0
              1755.0    1585.0    1468.0    1342.0    1190.0    1094.0     984.0     924.0     868.0     751.0
               751.0     644.0     519.0     519.0     519.0     459.0     335.0     335.0     335.0     335.0
               335.0     335.0     136.0     119.0     119.0     119.0     119.0     119.0     119.0     119.0
               119.0     119.0     119.0     119.0     119.0     119.0     119.0     119.0     119.0     119.0

                                                   ***

   ***          ***          ***          ***          ***

                    HYDROGRAPH AT STATION       HW

  TOTAL RAINFALL =    3.23, TOTAL LOSS =    1.90, TOTAL EXCESS =    1.33

 PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     26.63-HR
+  (CFS)       (HR)
                          (CFS)
+   4712.      4.43                794.        199.        179.         179.
                         (INCHES)   1.331       1.331       1.331        1.331
                         (AC-FT)    394.        394.        394.         394.

                    CUMULATIVE AREA =    5.55 SQ MI

1
                                          RUNOFF SUMMARY
                                     FLOW IN CUBIC FEET PER SECOND
                                   TIME IN HOURS,  AREA IN SQUARE MILES

                                   PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
        OPERATION       STATION    FLOW    PEAK                                           AREA      STAGE     MAX STAGE
+                                                      6-HOUR     24-HOUR     72-HOUR

        HYDROGRAPH AT
+                          HW      4712.   4.43         794.        199.        179.       5.55

*** NORMAL END OF HEC-1 ***
```

```
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *              JUN   1998               *
 *           VERSION 4.1                 *
 *                                       *
 *  RUN DATE   21MAR02  TIME  11:48:30   *
 *                                       *
 *****************************************
```

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

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X               X
XXXXXXX  XXXX     X       XXXXX   X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
1                                   HEC-1 INPUT                                   PAGE  1

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

         1          ID    Hydrology Manual Update - Edition 3
         2          ID    Flood Control District of Maricopa County/City of Phoenix
         3          ID
         4          ID    Multiple Frequency Ratio Test Watershed 5:
         5          ID    Hartman Wash at Wickenburg
         6          ID            50-Year, 6-Hour Storm
         7          ID            Green & Ampt Rainfall Losses
         8          ID            S-graph - Desert/rangeland
         9          ID
        10          ID       File:  HW50-6.ih1       Date:  03-18-02
        11          ID
        12          ID   ********************************************************************
        13          IT       2                    800
        14          IO       3
                    *

        15          KK      HW
        16          KM   Subbasin
        17          KM
        18          KM      The Desert/Rangeland S-Graph is used for this basin.
        19          KM     The following parameters were provided for this basin:
        20          KM          L=      6.6  Lca=      3.0   S=   83.3  Kn= .020  LAG=  38.1
        21          BA   5.548
        22          IN      15
        23          KM   Rainfall depth of  3.02 was spacially reduced as shown by the PB record.
        24          KM   An areal reduction coefficient of 0.958 is used.
        25          PB    2.89
        26          PC   0.000   0.011   0.018   0.027   0.039   0.050   0.061   0.071   0.082   0.093
        27          PC   0.106   0.120   0.142   0.186   0.272   0.459   0.685   0.821   0.887   0.928
        28          PC   0.948   0.962   0.974   0.988   1.000
        29          LG    0.35    0.37    5.30    0.20    0.00
        30          UI     490     490     490     490    1056    1454    1910    2350    2754    3099
        31          UI    3453    3793    4113    4343    4436    4696    4696    4696    4618    4428
        32          UI    4338    4041    3589    3393    2991    2764    2538    2307    2125    1910
        33          UI    1755    1585    1468    1342    1190    1094     984     924     868     751
        34          UI     751     644     519     519     519     459     335     335     335     335
        35          UI     335     335     136     119     119     119     119     119     119     119
        36          UI     119     119     119     119     119     119     119     119     119     119
        37          UI       0       0       0       0       0       0       0       0       0       0
        38          UI       0       0       0       0       0       0       0       0       0       0
                    *
        39          ZZ
```


```
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *              JUN   1998               *
 *           VERSION 4.1                 *
 *                                       *
 *  RUN DATE   21MAR02  TIME  11:48:30   *
 *                                       *
 *****************************************
```

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

```
                    Hydrology Manual Update - Edition 3
                       Flood Control District of Maricopa County/City of Phoenix

                       Multiple Frequency Ratio Test Watershed 5:
                       Hartman Wash at Wickenburg
                               50-Year, 6-Hour Storm
                               Green & Ampt Rainfall Losses
                               S-graph - Desert/rangeland

                          File:  HW50-6.ih1       Date:  03-18-02

                  ********************************************************************

14 IO          OUTPUT CONTROL VARIABLES
                     IPRNT           3  PRINT CONTROL
                     IPLOT           0  PLOT CONTROL
                     QSCAL          0.  HYDROGRAPH PLOT SCALE

   IT          HYDROGRAPH TIME DATA
                      NMIN           2  MINUTES IN COMPUTATION INTERVAL
                     IDATE      1    0  STARTING DATE
                     ITIME        0000  STARTING TIME
                        NQ         800  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE      2    0  ENDING DATE
                    NDTIME        0238  ENDING TIME
                    ICENT          19  CENTURY MARK

               COMPUTATION INTERVAL    0.03 HOURS
                    TOTAL TIME BASE   26.63 HOURS

        ENGLISH UNITS
             DRAINAGE AREA          SQUARE MILES
             PRECIPITATION DEPTH    INCHES
             LENGTH, ELEVATION      FEET
             FLOW                   CUBIC FEET PER SECOND
             STORAGE VOLUME         ACRE-FEET
             SURFACE AREA           ACRES
             TEMPERATURE            DEGREES FAHRENHEIT


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


          **************
          *            *
15 KK     *        HW  *
          *            *
          **************
                  Subbasin

                     The Desert/Rangeland S-Graph is used for this basin.
                    The following parameters were provided for this basin:
                         L=      6.6  Lca=      3.0   S=   83.3  Kn= .020  LAG=  38.1
                  Rainfall depth of  3.02 was spacially reduced as shown by the PB record.
                  An areal reduction coefficient of 0.958 is used.

22 IN          TIME DATA FOR INPUT TIME SERIES
                     JXMIN          15  TIME INTERVAL IN MINUTES
                    JXDATE      1    0  STARTING DATE
                    JXTIME           0  STARTING TIME

             SUBBASIN RUNOFF DATA

21 BA          SUBBASIN CHARACTERISTICS
                    TAREA        5.55  SUBBASIN AREA

               PRECIPITATION DATA

25 PB               STORM        2.89  BASIN TOTAL PRECIPITATION

26 PI            INCREMENTAL PRECIPITATION PATTERN
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01
                   0.01      0.01      0.01      0.01      0.01      0.02      0.02      0.02      0.02      0.02
                   0.02      0.02      0.03      0.03      0.03      0.03      0.03      0.03      0.03      0.03
                   0.02      0.02      0.02      0.02      0.02      0.02      0.02      0.01      0.01      0.01
                   0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01
```

0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

```
29 LG          GREEN AND AMPT LOSS RATE
                     STRTL        0.35  STARTING LOSS
                       DTH        0.37  MOISTURE DEFICIT
                      PSIF        5.30  WETTING FRONT SUCTION
                     XKSAT        0.20  HYDRAULIC CONDUCTIVITY
                     RTIMP        0.00  PERCENT IMPERVIOUS AREA

29 UI          INPUT UNITGRAPH,  70 ORDINATES,  VOLUME = 1.00
                   490.0     490.0     490.0     490.0    1056.0    1454.0    1910.0    2350.0    2754.0    3099.0
                  3453.0    3793.0    4113.0    4343.0    4436.0    4696.0    4696.0    4696.0    4618.0    4428.0
                  4338.0    4041.0    3589.0    3393.0    2991.0    2764.0    2538.0    2307.0    2125.0    1910.0
                  1755.0    1585.0    1468.0    1342.0    1190.0    1094.0     984.0     924.0     868.0     751.0
                   751.0     644.0     519.0     519.0     519.0     459.0     335.0     335.0     335.0     335.0
                   335.0     335.0     136.0     119.0     119.0     119.0     119.0     119.0     119.0     119.0
                   119.0     119.0     119.0     119.0     119.0     119.0     119.0     119.0     119.0     119.0
                                                                    ***

   ***            ***            ***            ***            ***

                     HYDROGRAPH AT STATION       HW

   TOTAL RAINFALL =    2.89, TOTAL LOSS =    1.82, TOTAL EXCESS =    1.07

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR      26.63-HR
+   (CFS)        (HR)
                              (CFS)
+    3872.       4.43                639.         160.         144.         144.
                          (INCHES)  1.071        1.071        1.071        1.071
                          (AC-FT)   317.         317.         317.         317.

                     CUMULATIVE AREA =    5.55 SQ MI

1
                                          RUNOFF SUMMARY
                                     FLOW IN CUBIC FEET PER SECOND
                                  TIME IN HOURS,  AREA IN SQUARE MILES

                                   PEAK   TIME OF    AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
        OPERATION       STATION    FLOW    PEAK                                          AREA      STAGE     MAX STAGE
+                                                        6-HOUR     24-HOUR     72-HOUR

        HYDROGRAPH AT
+                          HW      3872.   4.43          639.        160.        144.       5.55

*** NORMAL END OF HEC-1 ***
```

```
1*****************************************                    *****************************************
 *                                       *                    *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *    U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN   1998               *                    *    HYDROLOGIC ENGINEERING CENTER      *
 *            VERSION 4.1                *                    *          609 SECOND STREET            *
 *                                       *                    *       DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   21MAR02  TIME  11:48:42   *                    *           (916) 756-1104              *
 *                                       *                    *                                       *
 *****************************************                    *****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X               X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
1                                          HEC-1 INPUT                                                PAGE  1

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

         1          ID    Hydrology Manual Update - Edition 3
         2          ID    Flood Control District of Maricopa County/City of Phoenix
         3          ID
         4          ID    Multiple Frequency Ratio Test Watershed 5:
         5          ID    Hartman Wash at Wickenburg
         6          ID            25-Year, 6-Hour Storm
         7          ID            Green & Ampt Rainfall Losses
         8          ID            S-graph - Desert/rangeland
         9          ID
        10          ID       File:  HW25-6.ih1       Date:  03-18-02
        11          ID
        12          ID   ***********************************************************************
        13          IT       2                     800
        14          IO       3
                    *

        15          KK      HW
        16          KM   Subbasin
        17          KM
        18          KM      The Desert/Rangeland S-Graph is used for this basin.
        19          KM     The following parameters were provided for this basin:
        20          KM          L=      6.4  Lca=      3.0   S=   83.3  Kn= .025  LAG=  47.7
        21          BA   5.548
        22          IN      15
        23          KM   Rainfall depth of  2.66 was spacially reduced as shown by the PB record.
        24          KM   An areal reduction coefficient of 0.958 is used.
        25          PB    2.55
        26          PC   0.000   0.011   0.018   0.027   0.039   0.050   0.061   0.071   0.082   0.093
        27          PC   0.106   0.120   0.142   0.186   0.272   0.459   0.685   0.821   0.887   0.928
        28          PC   0.948   0.962   0.974   0.988   1.000
        29          LG    0.35    0.37    5.30    0.20    0.00
        30          UI     392     392     392     392     392     774    1127    1373    1601    1895
        31          UI    2161    2405    2654    2769    3110    3272    3442    3545    3572    3757
        32          UI    3757    3757    3757    3641    3526    3504    3322    3032    2794    2710
        33          UI    2413    2268    2109    1973    1837    1701    1570    1478    1387    1238
        34          UI    1200    1073    1070     875     875     799     739     739     649     601
        35          UI     601     586     415     415     415     415     415     282     268     268
        36          UI     268     268     268     268     268     112      95      95      95      95
        37          UI      95      95      95      95      95      95      95      95      95      95
        38          UI      95      95      95      95      95      95      95       0       0       0
        39          UI       0       0       0       0       0       0       0       0       0       0
                    *
        40          ZZ
```


```
1*****************************************                    *****************************************
 *                                       *                    *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *    U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN   1998               *                    *    HYDROLOGIC ENGINEERING CENTER      *
 *            VERSION 4.1                *                    *          609 SECOND STREET            *
 *                                       *                    *       DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   21MAR02  TIME  11:48:42   *                    *           (916) 756-1104              *
 *                                       *                    *                                       *
 *****************************************                    *****************************************
```

```
                    Hydrology Manual Update - Edition 3
                       Flood Control District of Maricopa County/City of Phoenix

                       Multiple Frequency Ratio Test Watershed 5:
                       Hartman Wash at Wickenburg
                               25-Year, 6-Hour Storm
                               Green & Ampt Rainfall Losses
                               S-graph - Desert/rangeland

                          File:  HW25-6.ih1       Date:  03-18-02

                  ********************************************************************

14 IO          OUTPUT CONTROL VARIABLES
                     IPRNT           3  PRINT CONTROL
                     IPLOT           0  PLOT CONTROL
                     QSCAL          0.  HYDROGRAPH PLOT SCALE

   IT          HYDROGRAPH TIME DATA
                      NMIN           2  MINUTES IN COMPUTATION INTERVAL
                     IDATE      1    0  STARTING DATE
                     ITIME        0000  STARTING TIME
                        NQ         800  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE      2    0  ENDING DATE
                    NDTIME        0238  ENDING TIME
                     ICENT          19  CENTURY MARK

                 COMPUTATION INTERVAL    0.03 HOURS
                      TOTAL TIME BASE   26.63 HOURS

        ENGLISH UNITS
             DRAINAGE AREA          SQUARE MILES
             PRECIPITATION DEPTH    INCHES
             LENGTH, ELEVATION      FEET
             FLOW                   CUBIC FEET PER SECOND
             STORAGE VOLUME         ACRE-FEET
             SURFACE AREA           ACRES
             TEMPERATURE            DEGREES FAHRENHEIT


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


          **************
          *            *
15 KK     *        HW  *
          *            *
          **************
                    Subbasin

                       The Desert/Rangeland S-Graph is used for this basin.
                      The following parameters were provided for this basin:
                           L=      6.4  Lca=      3.0   S=   83.3  Kn= .025  LAG=  47.7
                    Rainfall depth of  2.66 was spacially reduced as shown by the PB record.
                    An areal reduction coefficient of 0.958 is used.

22 IN          TIME DATA FOR INPUT TIME SERIES
                     JXMIN          15  TIME INTERVAL IN MINUTES
                    JXDATE      1    0  STARTING DATE
                    JXTIME           0  STARTING TIME

             SUBBASIN RUNOFF DATA

21 BA          SUBBASIN CHARACTERISTICS
                     TAREA        5.55  SUBBASIN AREA

               PRECIPITATION DATA

25 PB                STORM        2.55  BASIN TOTAL PRECIPITATION

26 PI            INCREMENTAL PRECIPITATION PATTERN
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01
                   0.01      0.01      0.01      0.01      0.01      0.02      0.02      0.02      0.02      0.02
                   0.02      0.02      0.03      0.03      0.03      0.03      0.03      0.03      0.03      0.03
                   0.02      0.02      0.02      0.02      0.02      0.02      0.02      0.01      0.01      0.01
```

0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

```
29 LG          GREEN AND AMPT LOSS RATE
                    STRTL        0.35  STARTING LOSS
                      DTH        0.37  MOISTURE DEFICIT
                     PSIF        5.30  WETTING FRONT SUCTION
                    XKSAT        0.20  HYDRAULIC CONDUCTIVITY
                    RTIMP        0.00  PERCENT IMPERVIOUS AREA

29 UI          INPUT UNITGRAPH,  87 ORDINATES,  VOLUME = 1.00
                   392.0     392.0     392.0     392.0     392.0     774.0    1127.0    1373.0    1601.0    1895.0
                  2161.0    2405.0    2654.0    2769.0    3110.0    3272.0    3442.0    3545.0    3572.0    3757.0
                  3757.0    3757.0    3757.0    3641.0    3526.0    3504.0    3322.0    3032.0    2794.0    2710.0
                  2413.0    2268.0    2109.0    1973.0    1837.0    1701.0    1570.0    1478.0    1387.0    1238.0
                  1200.0    1073.0    1070.0     875.0     875.0     799.0     739.0     739.0     649.0     601.0
                   601.0     586.0     415.0     415.0     415.0     415.0     415.0     282.0     268.0     268.0
                   268.0     268.0     268.0     268.0     268.0     112.0      95.0      95.0      95.0      95.0
                    95.0      95.0      95.0      95.0      95.0      95.0      95.0      95.0      95.0      95.0
                    95.0      95.0      95.0      95.0      95.0      95.0      95.0
                                                                  ***

     ***            ***            ***            ***            ***

                      HYDROGRAPH AT STATION       HW

   TOTAL RAINFALL =    2.55, TOTAL LOSS =    1.74, TOTAL EXCESS =    0.81

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     26.63-HR
+   (CFS)       (HR)
                            (CFS)
+    2593.      4.60                484.        121.        109.        109.
                          (INCHES)  0.811       0.811       0.811       0.811
                          (AC-FT)   240.        240.        240.        240.

                      CUMULATIVE AREA =    5.55 SQ MI

1
                                          RUNOFF SUMMARY
                                     FLOW IN CUBIC FEET PER SECOND
                                  TIME IN HOURS,  AREA IN SQUARE MILES

                                   PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
        OPERATION       STATION    FLOW    PEAK                                           AREA      STAGE     MAX STAGE
+                                                        6-HOUR     24-HOUR     72-HOUR

        HYDROGRAPH AT
+                          HW      2593.   4.60          484.        121.        109.       5.55

*** NORMAL END OF HEC-1 ***
```

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*              JUN   1998               *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   21MAR02  TIME  11:48:50   *
*                                       *
*****************************************
```

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

```
X     X  XXXXXXX   XXXXX           X
X     X  X        X     X         XX
X     X  X        X                X
XXXXXXX  XXXX     X        XXXXX   X
X     X  X        X                X
X     X  X        X     X          X
X     X  XXXXXXX   XXXXX          XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


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

  1           ID    Hydrology Manual Update - Edition 3
  2           ID    Flood Control District of Maricopa County/City of Phoenix
  3           ID
  4           ID    Multiple Frequency Ratio Test Watershed 5:
  5           ID    Hartman Wash at Wickenburg
  6           ID          10-Year, 6-Hour Storm
  7           ID          Green & Ampt Rainfall Losses
  8           ID          S-graph - Desert/rangeland
  9           ID
 10           ID       File:  HW10-6.ih1       Date:  03-18-02
 11           ID
 12           ID   ***********************************************************************
 13           IT       2                     800
 14           IO       3
              *

 15           KK      HW
 16           KM   Subbasin
 17           KM
 18           KM      The Desert/Rangeland S-Graph is used for this basin.
 19           KM     The following parameters were provided for this basin:
 20           KM          L=      6.4  Lca=      3.0   S=   83.3  Kn= .025  LAG=  47.7
 21           BA   5.548
 22           IN      15
 23           KM   Rainfall depth of  2.20 was spacially reduced as shown by the PB record.
 24           KM   An areal reduction coefficient of 0.958 is used.
 25           PB    2.11
 26           PC   0.000   0.011   0.018   0.027   0.039   0.050   0.061   0.071   0.082   0.093
 27           PC   0.106   0.120   0.142   0.186   0.272   0.459   0.685   0.821   0.887   0.928
 28           PC   0.948   0.962   0.974   0.988   1.000
 29           LG    0.35    0.37    5.30    0.20    0.00
 30           UI     392     392     392     392     392     774    1127    1373    1601    1895
 31           UI    2161    2405    2654    2769    3110    3272    3442    3545    3572    3757
 32           UI    3757    3757    3757    3641    3526    3504    3322    3032    2794    2710
 33           UI    2413    2268    2109    1973    1837    1701    1570    1478    1387    1238
 34           UI    1200    1073    1070     875     875     799     739     739     649     601
 35           UI     601     586     415     415     415     415     415     282     268     268
 36           UI     268     268     268     268     268     112      95      95      95      95
 37           UI      95      95      95      95      95      95      95      95      95      95
 38           UI      95      95      95      95      95      95      95       0       0       0
 39           UI       0       0       0       0       0       0       0       0       0       0
              *
 40           ZZ
```


```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*              JUN   1998               *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   21MAR02  TIME  11:48:50   *
*                                       *
*****************************************
```

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

```
                    Hydrology Manual Update - Edition 3
                       Flood Control District of Maricopa County/City of Phoenix

                       Multiple Frequency Ratio Test Watershed 5:
                       Hartman Wash at Wickenburg
                               10-Year, 6-Hour Storm
                               Green & Ampt Rainfall Losses
                               S-graph - Desert/rangeland

                          File:  HW10-6.ih1       Date:  03-18-02

                  ********************************************************************

14 IO          OUTPUT CONTROL VARIABLES
                     IPRNT           3  PRINT CONTROL
                     IPLOT           0  PLOT CONTROL
                     QSCAL          0.  HYDROGRAPH PLOT SCALE

   IT          HYDROGRAPH TIME DATA
                      NMIN           2  MINUTES IN COMPUTATION INTERVAL
                     IDATE      1    0  STARTING DATE
                     ITIME        0000  STARTING TIME
                        NQ         800  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE      2    0  ENDING DATE
                    NDTIME        0238  ENDING TIME
                     ICENT          19  CENTURY MARK

                 COMPUTATION INTERVAL    0.03 HOURS
                      TOTAL TIME BASE   26.63 HOURS

        ENGLISH UNITS
             DRAINAGE AREA          SQUARE MILES
             PRECIPITATION DEPTH    INCHES
             LENGTH, ELEVATION      FEET
             FLOW                   CUBIC FEET PER SECOND
             STORAGE VOLUME         ACRE-FEET
             SURFACE AREA           ACRES
             TEMPERATURE            DEGREES FAHRENHEIT


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


          **************
          *            *
15 KK     *        HW  *
          *            *
          **************
                  Subbasin

                     The Desert/Rangeland S-Graph is used for this basin.
                    The following parameters were provided for this basin:
                         L=      6.4  Lca=      3.0   S=   83.3  Kn= .025  LAG=  47.7
                  Rainfall depth of  2.20 was spacially reduced as shown by the PB record.
                  An areal reduction coefficient of 0.958 is used.

22 IN          TIME DATA FOR INPUT TIME SERIES
                     JXMIN          15  TIME INTERVAL IN MINUTES
                    JXDATE      1    0  STARTING DATE
                    JXTIME           0  STARTING TIME

             SUBBASIN RUNOFF DATA

21 BA          SUBBASIN CHARACTERISTICS
                     TAREA        5.55  SUBBASIN AREA

               PRECIPITATION DATA

25 PB                STORM        2.11  BASIN TOTAL PRECIPITATION

26 PI            INCREMENTAL PRECIPITATION PATTERN
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                   0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01
                   0.01      0.01      0.01      0.01      0.01      0.02      0.02      0.02      0.02      0.02
                   0.02      0.02      0.03      0.03      0.03      0.03      0.03      0.03      0.03      0.03
                   0.02      0.02      0.02      0.02      0.02      0.02      0.02      0.01      0.01      0.01
```

```
                0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01
                0.01      0.01      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00

29 LG        GREEN AND AMPT LOSS RATE
                STRTL        0.35  STARTING LOSS
                  DTH        0.37  MOISTURE DEFICIT
                 PSIF        5.30  WETTING FRONT SUCTION
                XKSAT        0.20  HYDRAULIC CONDUCTIVITY
                RTIMP        0.00  PERCENT IMPERVIOUS AREA

29 UI        INPUT UNITGRAPH,  87 ORDINATES,  VOLUME = 1.00
              392.0     392.0     392.0     392.0     392.0     774.0    1127.0    1373.0    1601.0    1895.0
             2161.0    2405.0    2654.0    2769.0    3110.0    3272.0    3442.0    3545.0    3572.0    3757.0
             3757.0    3757.0    3757.0    3641.0    3526.0    3504.0    3322.0    3032.0    2794.0    2710.0
             2413.0    2268.0    2109.0    1973.0    1837.0    1701.0    1570.0    1478.0    1387.0    1238.0
             1200.0    1073.0    1070.0     875.0     875.0     799.0     739.0     739.0     649.0     601.0
              601.0     586.0     415.0     415.0     415.0     415.0     415.0     282.0     268.0     268.0
              268.0     268.0     268.0     268.0     268.0     112.0      95.0      95.0      95.0      95.0
               95.0      95.0      95.0      95.0      95.0      95.0      95.0      95.0      95.0      95.0
               95.0      95.0      95.0      95.0      95.0      95.0      95.0

                                                      ***

    ***          ***          ***          ***          ***

                    HYDROGRAPH AT STATION       HW

   TOTAL RAINFALL =    2.11, TOTAL LOSS =    1.63, TOTAL EXCESS =    0.48

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     26.63-HR
+   (CFS)       (HR)
                          (CFS)
+   1601.       4.60                283.         71.         64.          64.
                         (INCHES)   0.475       0.475       0.475        0.475
                         (AC-FT)    141.        141.        141.         141.

                    CUMULATIVE AREA =    5.55 SQ MI

1
                                          RUNOFF SUMMARY
                                     FLOW IN CUBIC FEET PER SECOND
                                   TIME IN HOURS,  AREA IN SQUARE MILES

                                   PEAK   TIME OF    AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
        OPERATION       STATION    FLOW    PEAK                                          AREA      STAGE     MAX STAGE
+                                                     6-HOUR     24-HOUR     72-HOUR

        HYDROGRAPH AT
+                          HW      1601.   4.60        283.        71.         64.       5.55

*** NORMAL END OF HEC-1 ***
```

```
1*****************************************                    *****************************************
 *                                       *                    *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *    U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN   1998               *                    *    HYDROLOGIC ENGINEERING CENTER      *
 *           VERSION 4.1                 *                    *          609 SECOND STREET            *
 *                                       *                    *       DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   21MAR02  TIME  11:49:00   *                    *           (916) 756-1104              *
 *                                       *                    *                                       *
 *****************************************                    *****************************************

                                        X     X  XXXXXXX   XXXXX           X
                                        X     X  X        X     X         XX
                                        X     X  X        X                X
                                        XXXXXXX  XXXX     X        XXXXX   X
                                        X     X  X        X                X
                                        X     X  X        X     X          X
                                        X     X  XXXXXXX   XXXXX          XXX

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                                HEC-1 INPUT                                                PAGE  1

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

         1          ID    Hydrology Manual Update - Edition 3
         2          ID    Flood Control District of Maricopa County/City of Phoenix
         3          ID
         4          ID    Multiple Frequency Ratio Test Watershed 5:
         5          ID    Hartman Wash at Wickenburg
         6          ID            5-Year, 6-Hour Storm
         7          ID            Green & Ampt Rainfall Losses
         8          ID            S-graph - Desert/rangeland
         9          ID
        10          ID       File:  HW5-6.ihl        Date:  03-18-02
        11          ID
        12          ID   ***********************************************************************
        13          IT       2                     800
        14          IO       3
                    *

        15          KK      HW
        16          KM   Subbasin
        17          KM
        18          KM      The Desert/Rangeland S-Graph is used for this basin.
        19          KM     The following parameters were provided for this basin:
        20          KM          L=      6.4  Lca=      3.0   S=   83.3  Kn= .030  LAG=  57.2
        21          BA   5.548
        22          IN      15
        23          KM   Rainfall depth of  1.88 was spacially reduced as shown by the PB record.
        24          KM   An areal reduction coefficient of 0.958 is used.
        25          PB    1.80
        26          PC   0.000   0.011   0.018   0.027   0.039   0.050   0.061   0.071   0.082   0.093
        27          PC   0.106   0.120   0.142   0.186   0.272   0.459   0.685   0.821   0.887   0.928
        28          PC   0.948   0.962   0.974   0.988   1.000
        29          LG    0.35    0.37    5.30    0.20    0.00
        30          UI     327     327     327     327     327     327     586     939     985    1273
        31          UI    1405    1582    1789    1954    2111    2305    2286    2655    2716    2842
        32          UI    2898    2964    3037    3130    3130    3130    3130    3115    3005    2925
        33          UI    2947    2783    2650    2447    2280    2255    2027    1926    1801    1704
        34          UI    1611    1530    1418    1344    1273    1177    1156    1007    1002     914
        35          UI     894     825     729     729     676     616     616     616     503     501
        36          UI     501     501     393     346     346     346     346     346     286     224
        37          UI     224     224     224     224     224     224     224     224      96      80
        38          UI      80      80      80      80      79      80      80      80      80      79
        39          UI      80      80      80      80      80      79      80      80      80      80
        40          UI      79      80      80      80      80       0       0       0       0       0
        41          UI       0       0       0       0       0       0       0       0       0       0
                    *
        42          ZZ
1*****************************************                    *****************************************
 *                                       *                    *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *    U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN   1998               *                    *    HYDROLOGIC ENGINEERING CENTER      *
 *           VERSION 4.1                 *                    *          609 SECOND STREET            *
 *                                       *                    *       DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   21MAR02  TIME  11:49:00   *                    *           (916) 756-1104              *
```

```
*                                        *                                                    *                                        *
*****************************************                                                    *****************************************


                          Hydrology Manual Update - Edition 3
                             Flood Control District of Maricopa County/City of Phoenix

                             Multiple Frequency Ratio Test Watershed 5:
                             Hartman Wash at Wickenburg
                                     5-Year, 6-Hour Storm
                                     Green & Ampt Rainfall Losses
                                     S-graph - Desert/rangeland

                                File:  HW5-6.ih1        Date:  03-18-02

                        ********************************************************************

 14 IO          OUTPUT CONTROL VARIABLES
                      IPRNT           3  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN           2  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ         800  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      2    0  ENDING DATE
                     NDTIME        0238  ENDING TIME
                      ICENT          19  CENTURY MARK

                 COMPUTATION INTERVAL    0.03 HOURS
                      TOTAL TIME BASE   26.63 HOURS

         ENGLISH UNITS
              DRAINAGE AREA          SQUARE MILES
              PRECIPITATION DEPTH    INCHES
              LENGTH, ELEVATION      FEET
              FLOW                   CUBIC FEET PER SECOND
              STORAGE VOLUME         ACRE-FEET
              SURFACE AREA           ACRES
              TEMPERATURE            DEGREES FAHRENHEIT


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


           **************
           *            *
 15 KK     *        HW  *
           *            *
           **************
                         Subbasin

                            The Desert/Rangeland S-Graph is used for this basin.
                           The following parameters were provided for this basin:
                                 L=      6.4  Lca=      3.0   S=   83.3  Kn= .030  LAG=  57.2
                         Rainfall depth of  1.88 was spacially reduced as shown by the PB record.
                         An areal reduction coefficient of 0.958 is used.

 22 IN          TIME DATA FOR INPUT TIME SERIES
                      JXMIN          15  TIME INTERVAL IN MINUTES
                     JXDATE      1    0  STARTING DATE
                     JXTIME           0  STARTING TIME

              SUBBASIN RUNOFF DATA

 21 BA          SUBBASIN CHARACTERISTICS
                      TAREA        5.55  SUBBASIN AREA

              PRECIPITATION DATA

 25 PB                STORM        1.80  BASIN TOTAL PRECIPITATION

 26 PI            INCREMENTAL PRECIPITATION PATTERN
                    0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                    0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                    0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                    0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                    0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                    0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                    0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                    0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                    0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                    0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01
                    0.01      0.01      0.01      0.01      0.01      0.02      0.02      0.02      0.02      0.02
```

0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

```
29 LG          GREEN AND AMPT LOSS RATE
                    STRTL        0.35  STARTING LOSS
                      DTH        0.37  MOISTURE DEFICIT
                     PSIF        5.30  WETTING FRONT SUCTION
                    XKSAT        0.20  HYDRAULIC CONDUCTIVITY
                    RTIMP        0.00  PERCENT IMPERVIOUS AREA

29 UI          INPUT UNITGRAPH, 105 ORDINATES,  VOLUME = 1.00
                   327.0     327.0     327.0     327.0     327.0     327.0     586.0     939.0     985.0    1273.0
                  1405.0    1582.0    1789.0    1954.0    2111.0    2305.0    2286.0    2655.0    2716.0    2842.0
                  2898.0    2964.0    3037.0    3130.0    3130.0    3130.0    3130.0    3115.0    3005.0    2925.0
                  2947.0    2783.0    2650.0    2447.0    2280.0    2255.0    2027.0    1926.0    1801.0    1704.0
                  1611.0    1530.0    1418.0    1344.0    1273.0    1177.0    1156.0    1007.0    1002.0     914.0
                   894.0     825.0     729.0     729.0     676.0     616.0     616.0     616.0     503.0     501.0
                   501.0     501.0     393.0     346.0     346.0     346.0     346.0     346.0     286.0     224.0
                   224.0     224.0     224.0     224.0     224.0     224.0     224.0     224.0      96.0      80.0
                    80.0      80.0      80.0      80.0      79.0      80.0      80.0      80.0      80.0      79.0
                    80.0      80.0      80.0      80.0      80.0      79.0      80.0      80.0      80.0      80.0
                    79.0      80.0      80.0      80.0      80.0
                                                                   ***

     ***            ***            ***            ***            ***

                        HYDROGRAPH AT STATION       HW

   TOTAL RAINFALL =    1.80, TOTAL LOSS =    1.53, TOTAL EXCESS =    0.27

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR     26.63-HR
+   (CFS)       (HR)
                          (CFS)
+    790.       4.77                158.         40.         36.          36.
                        (INCHES)   0.266       0.266       0.266        0.266
                        (AC-FT)     79.         79.         79.          79.

                        CUMULATIVE AREA =    5.55 SQ MI

1
                                          RUNOFF SUMMARY
                                     FLOW IN CUBIC FEET PER SECOND
                                  TIME IN HOURS,  AREA IN SQUARE MILES

                                     PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
        OPERATION        STATION     FLOW    PEAK                                           AREA      STAGE     MAX STAGE
+                                                          6-HOUR     24-HOUR     72-HOUR

        HYDROGRAPH AT
+                          HW        790.    4.77          158.         40.         36.      5.55

*** NORMAL END OF HEC-1 ***
```

```
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *              JUN   1998               *
 *            VERSION 4.1                *
 *                                       *
 *  RUN DATE   21MAR02  TIME  11:49:10   *
 *                                       *
 *****************************************
```

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

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X               X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

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

  1           ID    Hydrology Manual Update - Edition 3
  2           ID    Flood Control District of Maricopa County/City of Phoenix
  3           ID
  4           ID    Multiple Frequency Ratio Test Watershed 5:
  5           ID    Hartman Wash at Wickenburg
  6           ID            2-Year, 6-Hour Storm
  7           ID            Green & Ampt Rainfall Losses
  8           ID            S-graph - Desert/rangeland
  9           ID
 10           ID       File:  HW2-6.ih1        Date:  03-18-02
 11           ID
 12           ID   ********************************************************************
 13           IT       2                    800
 14           IO       3
              *

 15           KK      HW
 16           KM   Subbasin
 17           KM
 18           KM      The Desert/Rangeland S-Graph is used for this basin.
 19           KM     The following parameters were provided for this basin:
 20           KM          L=      6.4  Lca=      3.0   S=   83.3  Kn= .030  LAG=  57.2
 21           BA   5.548
 22           IN      15
 23           KM   Rainfall depth of  1.39 was spacially reduced as shown by the PB record.
 24           KM   An areal reduction coefficient of 0.958 is used.
 25           PB    1.33
 26           PC   0.000   0.011   0.018   0.027   0.039   0.050   0.061   0.071   0.082   0.093
 27           PC   0.106   0.120   0.142   0.186   0.272   0.459   0.685   0.821   0.887   0.928
 28           PC   0.948   0.962   0.974   0.988   1.000
 29           LG    0.35    0.37    5.30    0.20    0.00
 30           UI     327     327     327     327     327     327     586     939     985    1273
 31           UI    1405    1582    1789    1954    2111    2305    2286    2655    2716    2842
 32           UI    2898    2964    3037    3130    3130    3130    3130    3115    3005    2925
 33           UI    2947    2783    2650    2447    2280    2255    2027    1926    1801    1704
 34           UI    1611    1530    1418    1344    1273    1177    1156    1007    1002     914
 35           UI     894     825     729     729     676     616     616     616     503     501
 36           UI     501     501     393     346     346     346     346     346     286     224
 37           UI     224     224     224     224     224     224     224     224      96      80
 38           UI      80      80      80      80      79      80      80      80      80      79
 39           UI      80      80      80      80      80      79      80      80      80      80
 40           UI      79      80      80      80      80       0       0       0       0       0
 41           UI       0       0       0       0       0       0       0       0       0       0
              *
 42           ZZ
```


```
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *              JUN   1998               *
 *            VERSION 4.1                *
 *                                       *
 *  RUN DATE   21MAR02  TIME  11:49:10   *
```

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

```
*                                        *                                                    *                                        *
*****************************************                                                    *****************************************


                          Hydrology Manual Update - Edition 3
                             Flood Control District of Maricopa County/City of Phoenix

                             Multiple Frequency Ratio Test Watershed 5:
                             Hartman Wash at Wickenburg
                                     2-Year, 6-Hour Storm
                                     Green & Ampt Rainfall Losses
                                     S-graph - Desert/rangeland

                                File:  HW2-6.ih1        Date:  03-18-02

                        ***********************************************************************

 14 IO          OUTPUT CONTROL VARIABLES
                      IPRNT           3  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN           2  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ         800  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      2    0  ENDING DATE
                     NDTIME        0238  ENDING TIME
                      ICENT          19  CENTURY MARK

                 COMPUTATION INTERVAL    0.03 HOURS
                      TOTAL TIME BASE   26.63 HOURS

        ENGLISH UNITS
             DRAINAGE AREA          SQUARE MILES
             PRECIPITATION DEPTH    INCHES
             LENGTH, ELEVATION      FEET
             FLOW                   CUBIC FEET PER SECOND
             STORAGE VOLUME         ACRE-FEET
             SURFACE AREA           ACRES
             TEMPERATURE            DEGREES FAHRENHEIT


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


          **************
          *            *
 15 KK    *        HW  *
          *            *
          **************
                        Subbasin

                          The Desert/Rangeland S-Graph is used for this basin.
                         The following parameters were provided for this basin:
                              L=      6.4  Lca=      3.0   S=   83.3  Kn= .030  LAG=  57.2
                        Rainfall depth of  1.39 was spacially reduced as shown by the PB record.
                        An areal reduction coefficient of 0.958 is used.

 22 IN          TIME DATA FOR INPUT TIME SERIES
                      JXMIN          15  TIME INTERVAL IN MINUTES
                     JXDATE      1    0  STARTING DATE
                     JXTIME           0  STARTING TIME

             SUBBASIN RUNOFF DATA

 21 BA          SUBBASIN CHARACTERISTICS
                      TAREA        5.55  SUBBASIN AREA

                PRECIPITATION DATA

 25 PB                STORM        1.33  BASIN TOTAL PRECIPITATION

 26 PI            INCREMENTAL PRECIPITATION PATTERN
                    0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                    0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                    0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                    0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                    0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                    0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                    0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                    0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                    0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                    0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01
                    0.01      0.01      0.01      0.01      0.01      0.02      0.02      0.02      0.02      0.02
```

0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

29 LG GREEN AND AMPT LOSS RATE

STRTL	0.35	STARTING LOSS
DTH	0.37	MOISTURE DEFICIT
PSIF	5.30	WETTING FRONT SUCTION
XKSAT	0.20	HYDRAULIC CONDUCTIVITY
RTIMP	0.00	PERCENT IMPERVIOUS AREA

29 UI INPUT UNITGRAPH, 105 ORDINATES, VOLUME = 1.00

327.0	327.0	327.0	327.0	327.0	327.0	586.0	939.0	985.0	1273.0
1405.0	1582.0	1789.0	1954.0	2111.0	2305.0	2286.0	2655.0	2716.0	2842.0
2898.0	2964.0	3037.0	3130.0	3130.0	3130.0	3130.0	3115.0	3005.0	2925.0
2947.0	2783.0	2650.0	2447.0	2280.0	2255.0	2027.0	1926.0	1801.0	1704.0
1611.0	1530.0	1418.0	1344.0	1273.0	1177.0	1156.0	1007.0	1002.0	914.0
894.0	825.0	729.0	729.0	676.0	616.0	616.0	616.0	503.0	501.0
501.0	501.0	393.0	346.0	346.0	346.0	346.0	346.0	286.0	224.0
224.0	224.0	224.0	224.0	224.0	224.0	224.0	224.0	96.0	80.0
80.0	80.0	80.0	80.0	79.0	80.0	80.0	80.0	80.0	79.0
80.0	80.0	80.0	80.0	80.0	79.0	80.0	80.0	80.0	80.0
79.0	80.0	80.0	80.0	80.0					

***

*** *** *** *** ***

HYDROGRAPH AT STATION HW

TOTAL RAINFALL = 1.33, TOTAL LOSS = 1.31, TOTAL EXCESS = 0.02

	PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	26.63-HR
+	(CFS)	(HR)					
			(CFS)				
+	70.	4.77		13.	3.	3.	3.
			(INCHES)	0.022	0.022	0.022	0.022
			(AC-FT)	7.	7.	7.	7.

CUMULATIVE AREA = 5.55 SQ MI

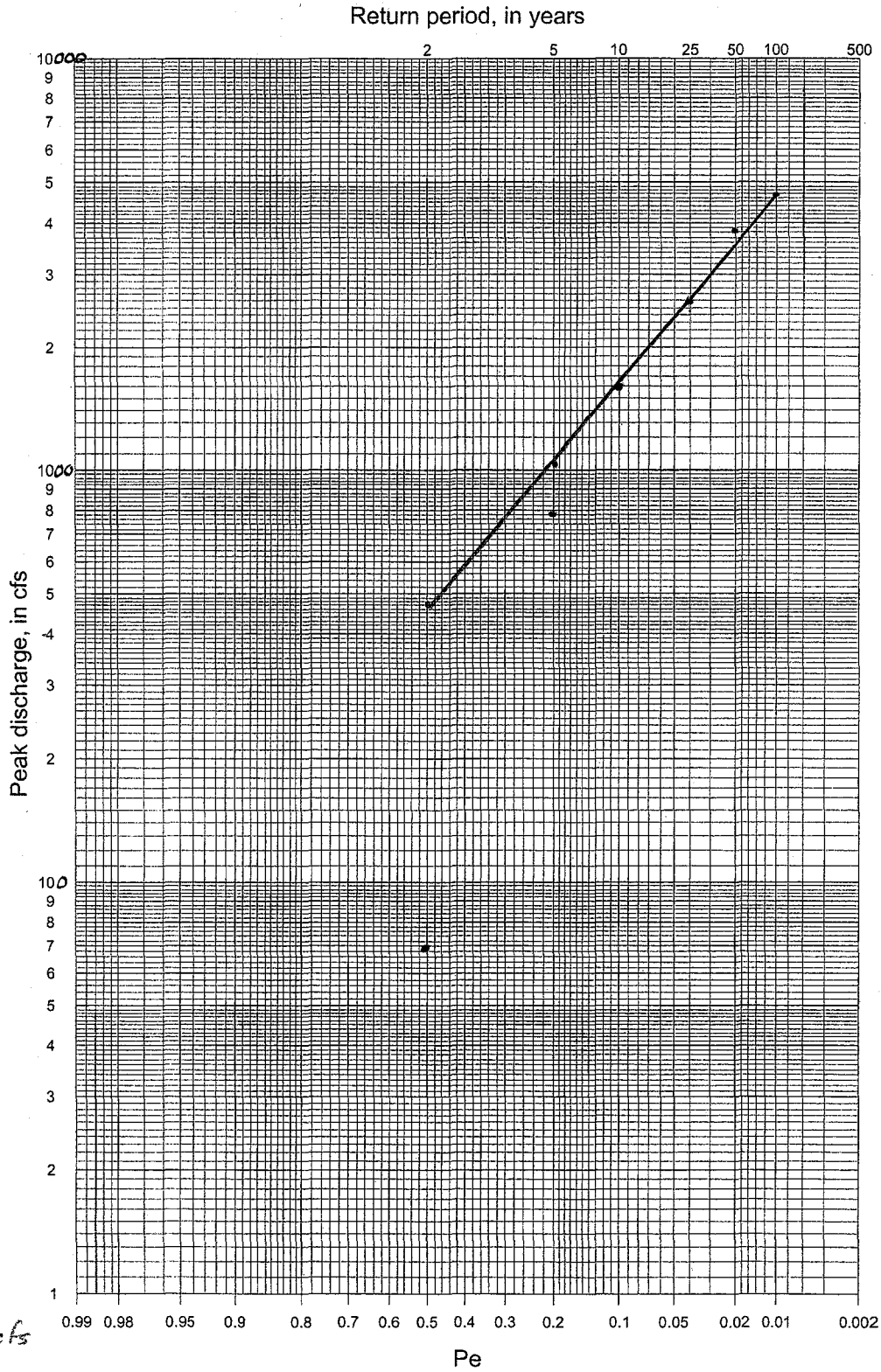
1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	HW	70.	4.77	13.	3.	3.	5.55		

*** NORMAL END OF HEC-1 ***

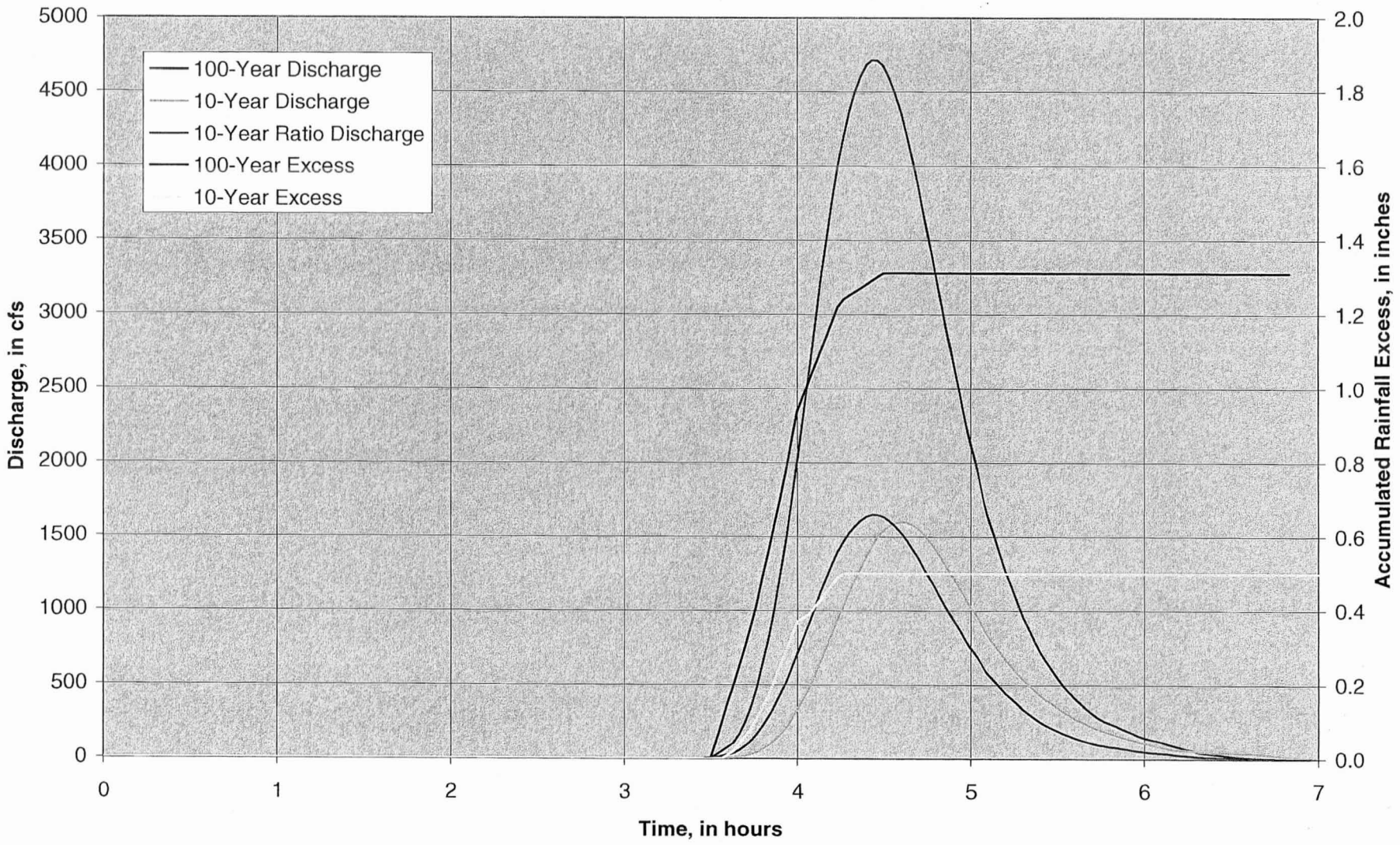
Hartman Wash
A = 5.548 sm
Natural



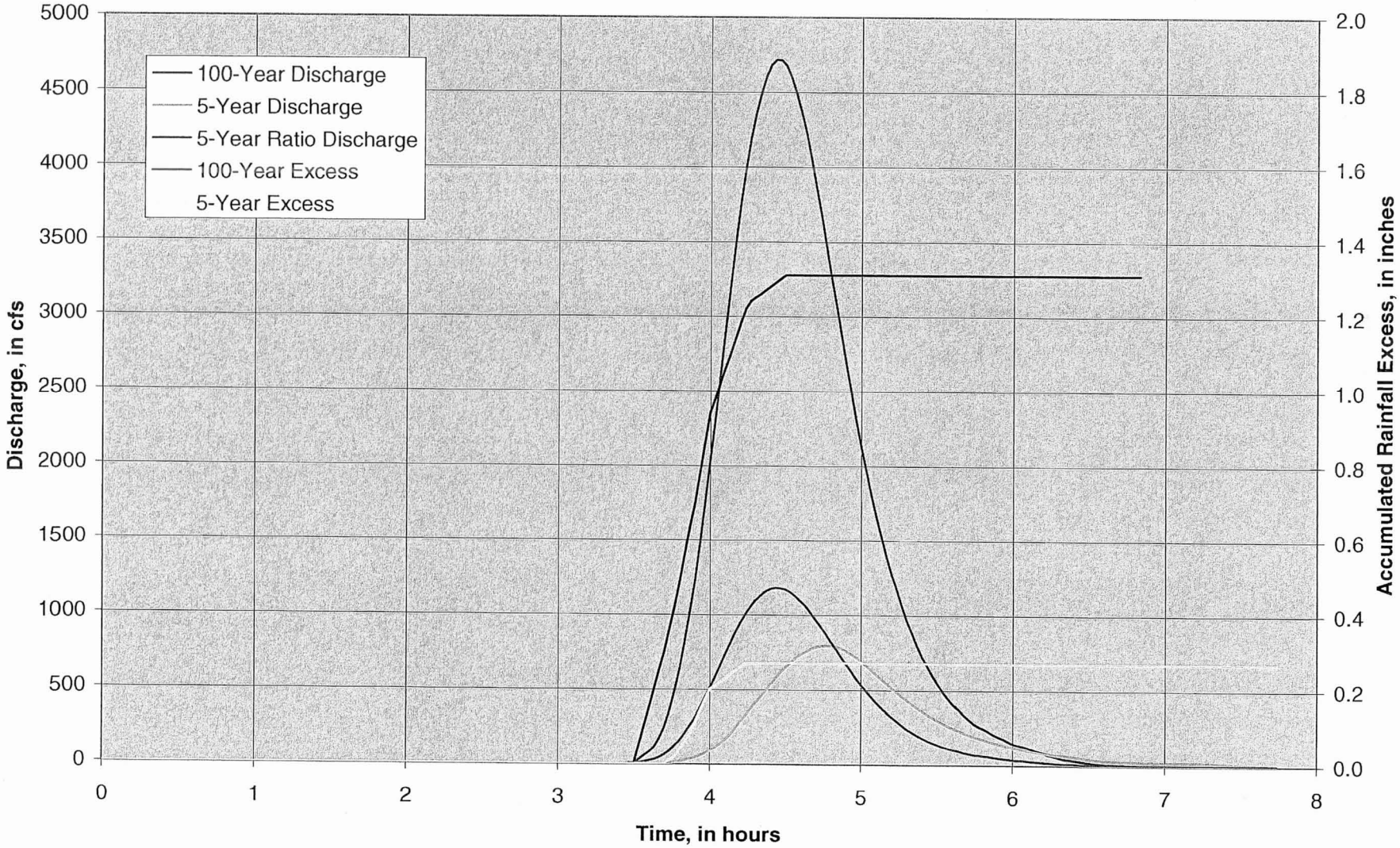
3 1/2 cycle log-normal paper

Q_{100} = 4,712 cfs
= 3,872 cfs
Q_{25} = 2,593 cfs
Q_{10} = 1,601 cfs Q_{10}^{R} = 1,602 cfs
Q_5 = 790 cfs Q_5^{R} = 1,036 cfs
Q_2 = 70 cfs Q_2^{R} = 471 cfs

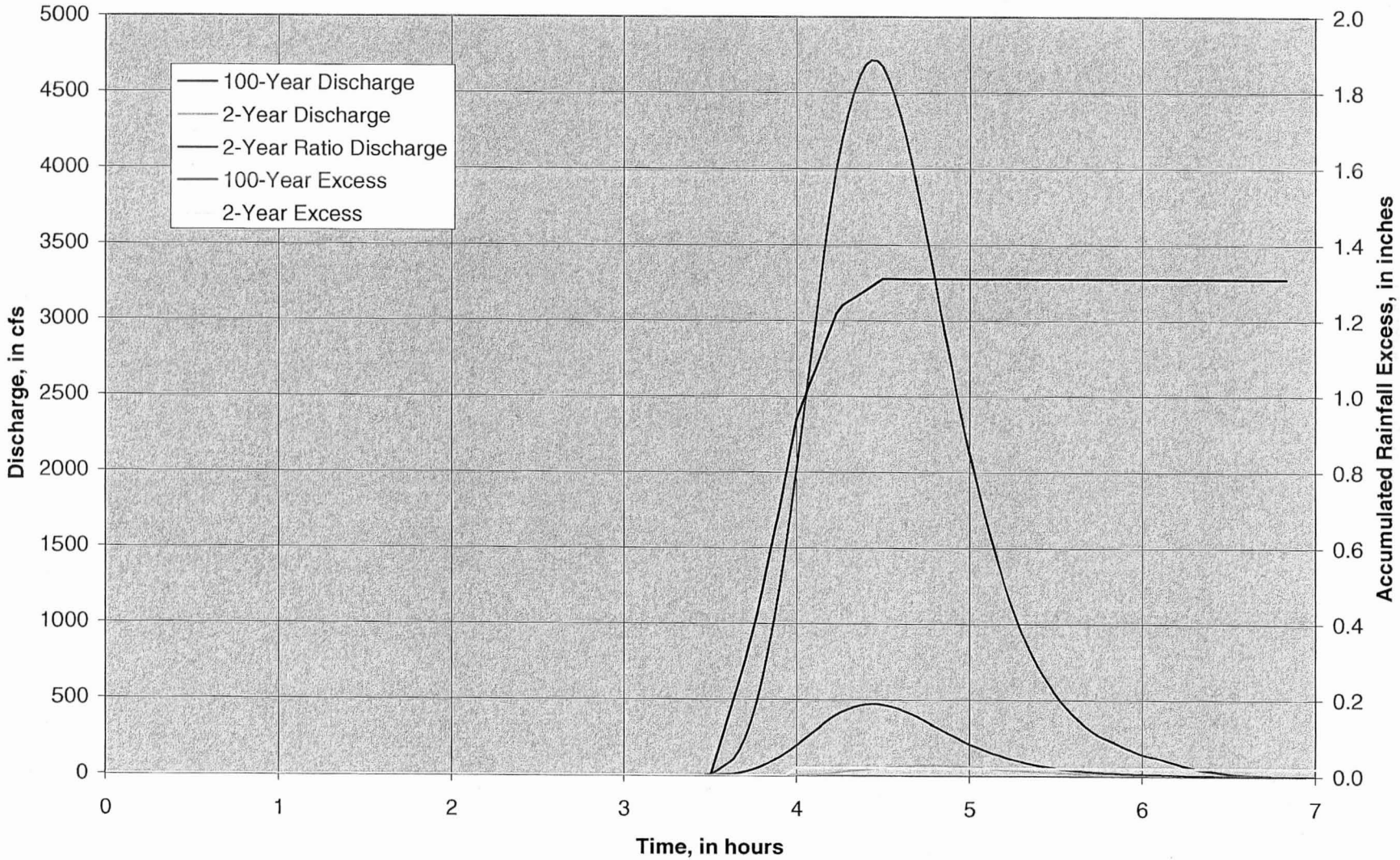
Comparison of results for the Hartman Wash watershed



Comparison of results for the Hartman Wash watershed



Comparison of results for the Hartman Wash watershed



Stantec

Project: Project Number:

Notes: Scale:

Page of Page(s)

Computed By: Date: Checked By: Date:

CAVE CREEK ABOVE CAREFREE HIGHWAY

Lat 33° 48' 11"
Long 112° 00' 43"

1. DRAINAGE AREA IS 124 SQ. MILES
2. LAND USE IS UNDEVELOPED
3. GAGE DATA : 09512300

RETURN PERIOD YEARS	PEAK DISCHARGE CFS	RATIO OF 100-YEAR %
100	21,500	
50	16,400	
25	12,000	
10	7,360	34.2
5	4,580	21.3
2	1,780	8.3

4. EVENT SIMULATION : NONE

5 HEC-1 MODELING BY GVSCE
- 100-YEAR, 24-HOUR MULTIPLE BASIN MODEL
- RAINFALL LOSSES BY GREEN & AMPT
- UNIT HYDROGRAPH BY S-GRAPH & Clark

RETURN PERIOD YEARS	PEAK DISCHARGE CFS	RATIO OF 100-YEAR %
100	33,771	
~~10~~	~~16,184~~	~~47.9~~

New

Using ratios for all subbasins

100	33 771			
50	28 299			
25	23 242			
10	17 132	50.7 %	10,444	(31%)
5	12 847	38.0 %	7,063	(21%)
2	6615	19.6 %	2,165	(6.4%)

*** O U T P U T D A T A ***

REVISED JUNE 1988 TO UPDATE COMPUTATION OF SHORT-DURATION VALUES

PRECIPITATION FREQUENCY VALUES FOR UPPER CAVE CREEK FPD
PRIMARY ZONE NUMBER= 7
SHORT-DURATION ZONE NUMBER= 8

POINT VALUES

RETURN PERIOD

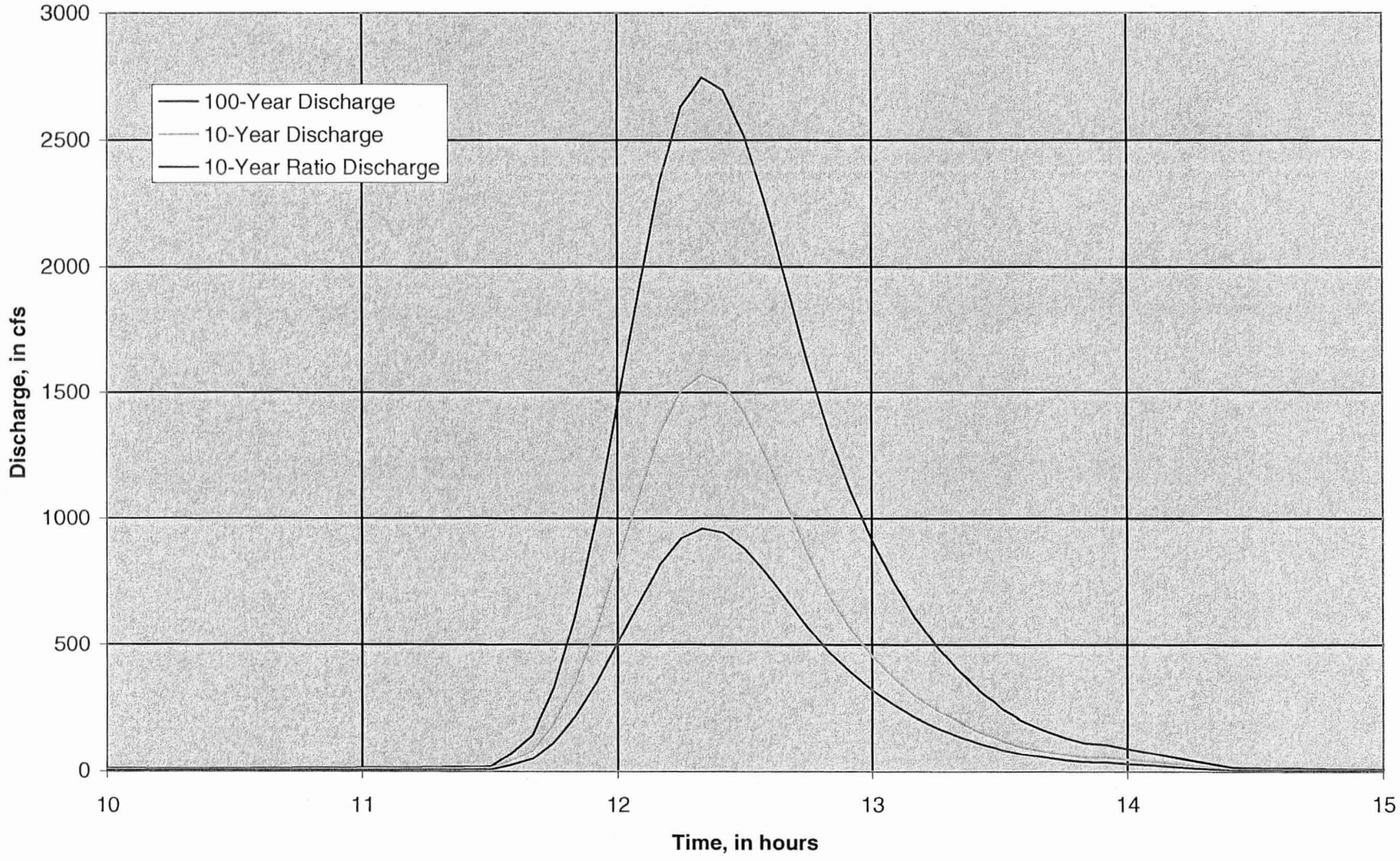
DURATION	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR	500-YR	
5-MIN	.37	.46	.51	.60	.67	.73	.88	5-MIN
10-MIN	.56	.69	.78	.91	1.02	1.12	1.36	10-MIN
15-MIN	.68	.86	.98	1.16	1.30	1.44	1.76	15-MIN
30-MIN	.90	1.15	1.32	1.57	1.76	1.95	2.39	30-MIN
1-HR	1.10	1.42	1.64	1.95	2.20	2.44	2.99	1-HR
2-HR	1.28	1.65	1.91	2.27	2.55	2.83	3.47	2-HR
3-HR	1.41	1.81	2.09	2.48	2.78	3.09	3.79	3-HR
6-HR	1.64	2.10	2.42	2.88	3.23	3.58	4.39	6-HR
12-HR	1.96	2.51	2.90	3.44	3.86	4.28	5.25	12-HR
24-HR	2.28	2.92	3.37	4.00	4.49	4.98	6.11	24-HR

* IF YOUR SITE IS IN ARIZONA OR NEW MEXICO, PLEASE CONSULT THE FOLLOWING PAPER FOR REVISED DEPTH-AREA VALUES:
DEPTH-AREA RATIOS IN THE SEMI-ARID SOUTHWEST UNITED STATES
NOAA TECHNICAL MEMORANDUM NWS HYDRO-40
ZEHR AND MYERS
AUGUST 1984

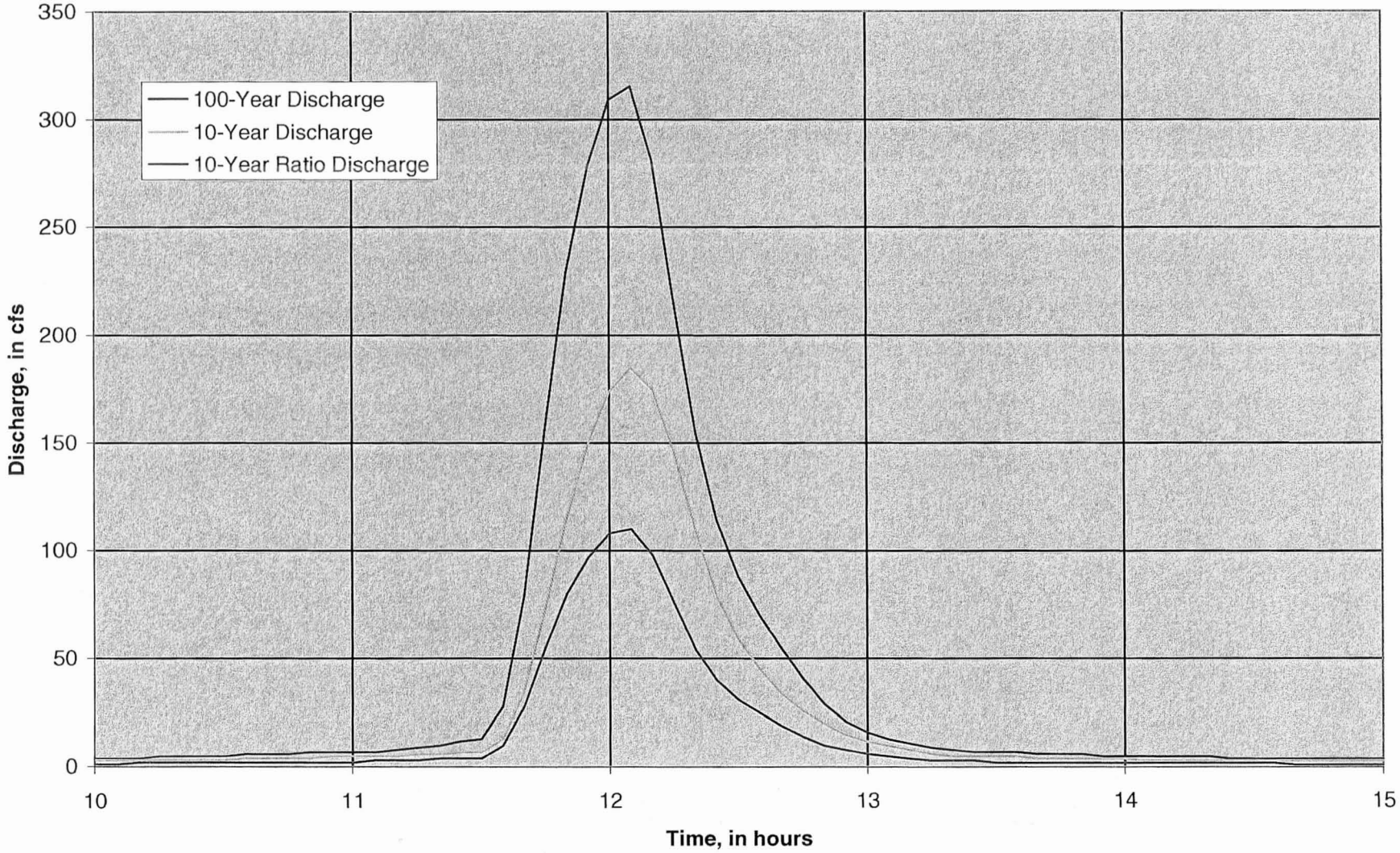
INPUT DATA

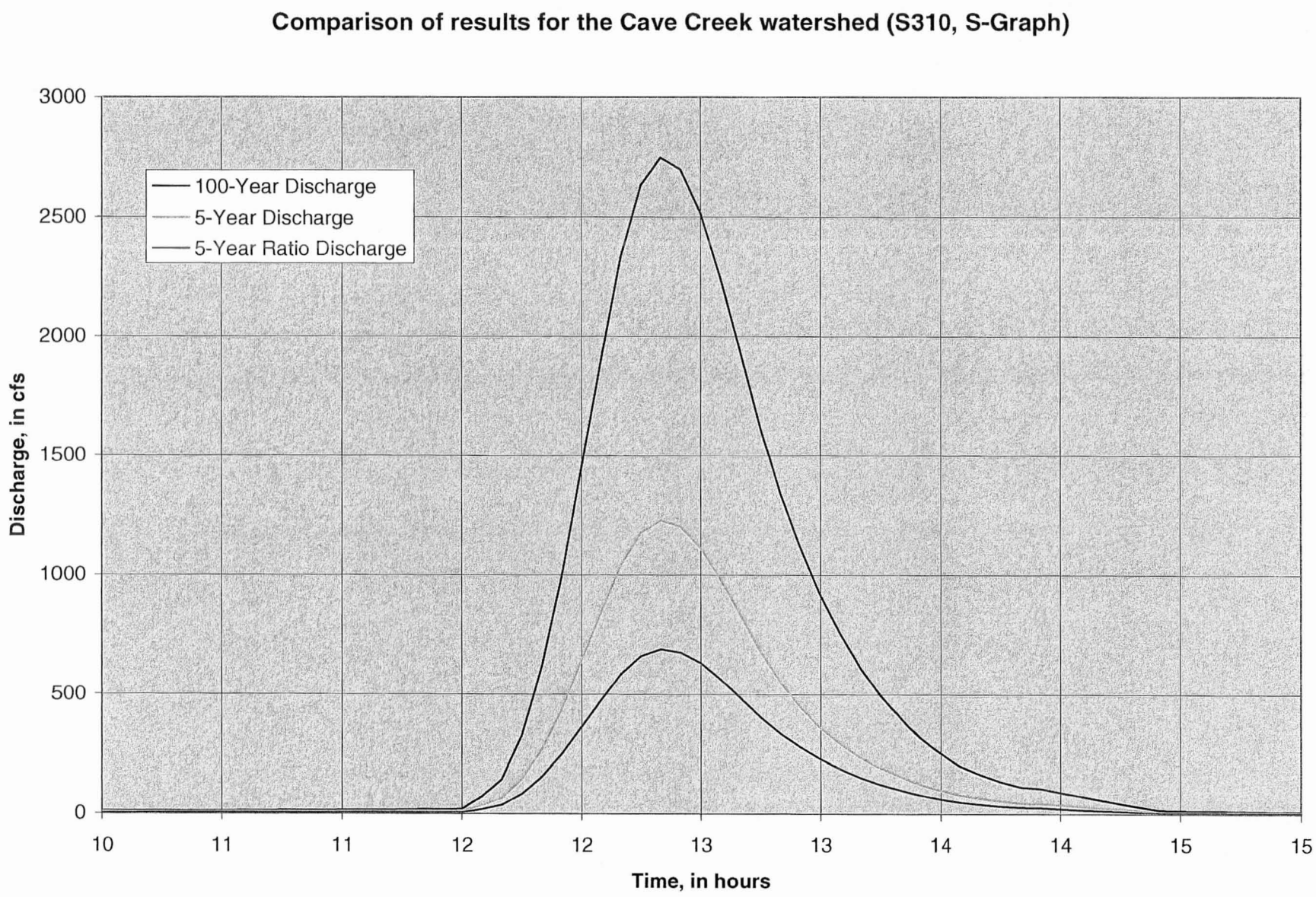
PROJECT NAME=UPPER CAVE CREEK FPD
ZONE= 7 SHORT-DURATION ZONE= 8
LATITUDE= .00 LONGITUDE= 100.00 ELEVATION= 0
2-YR, 6-HR PCPN= 1.64 100-YR, 6-HR PCPN= 3.58
2-YR, 24-HR PCPN= 2.28 100-YR, 24-HR PCPN= 4.98

Comparison of results for the Cave Creek watershed (S310, S-Graph)

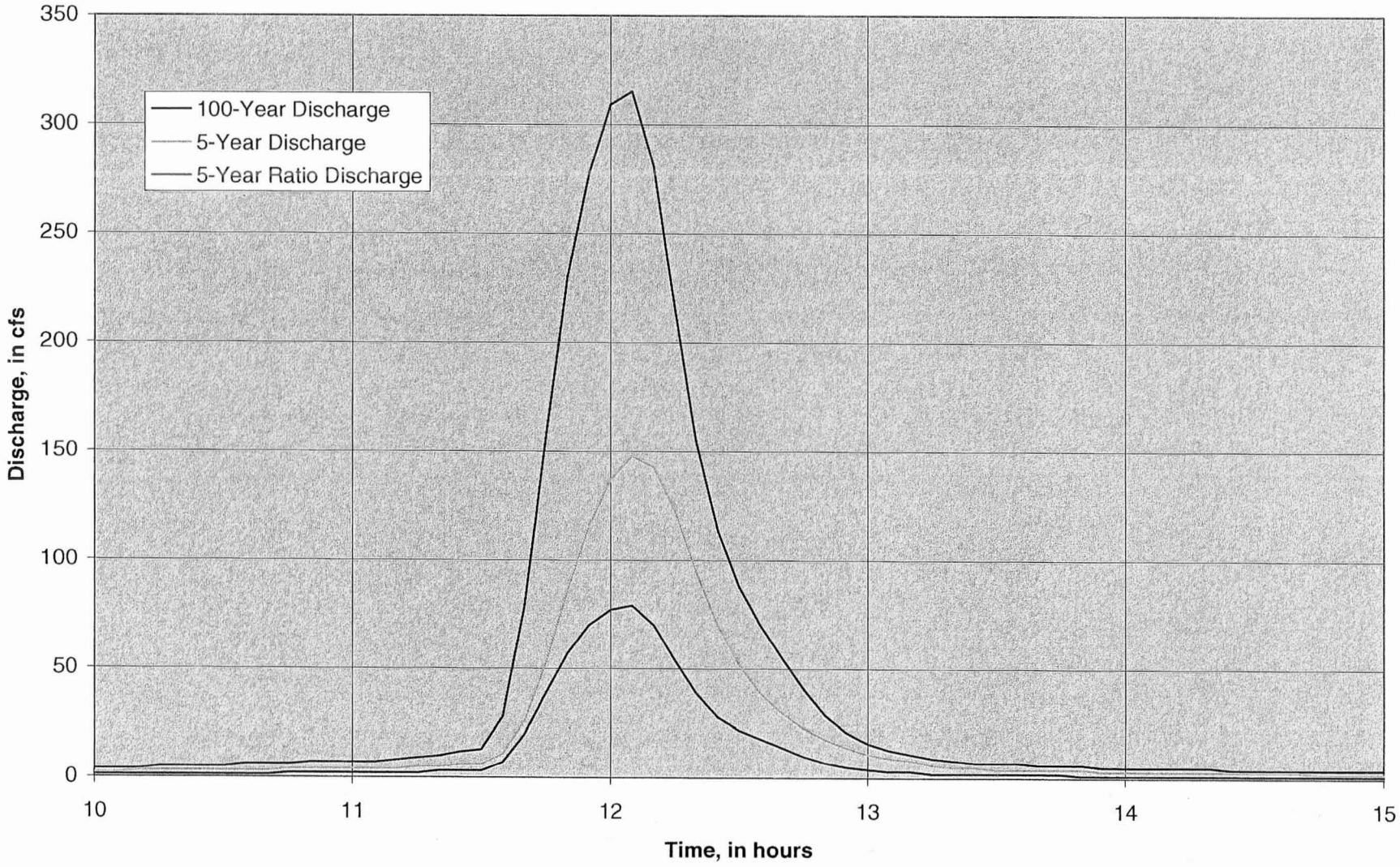


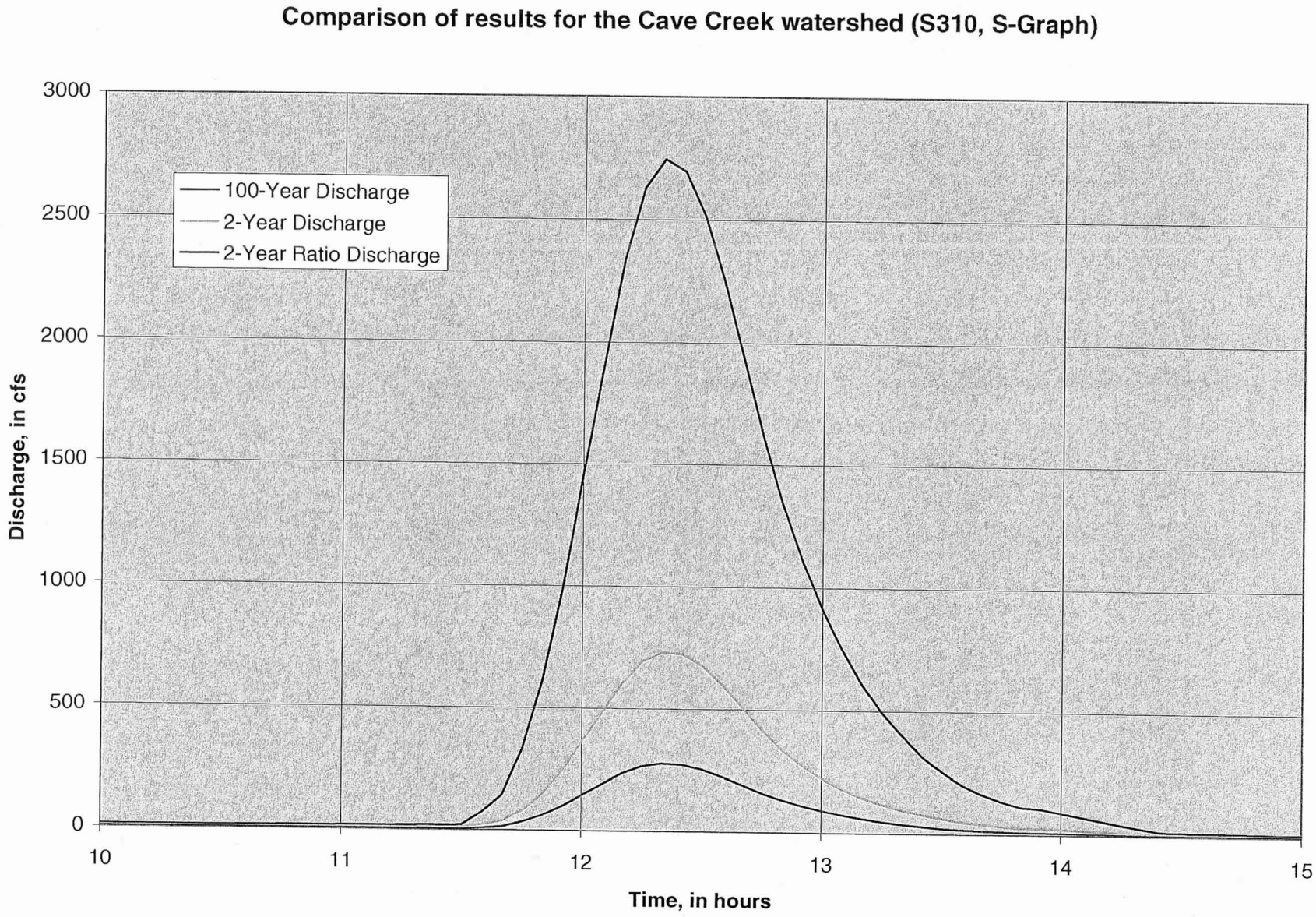
Comparison of results for the Cave Creek watershed (S350, Clark)



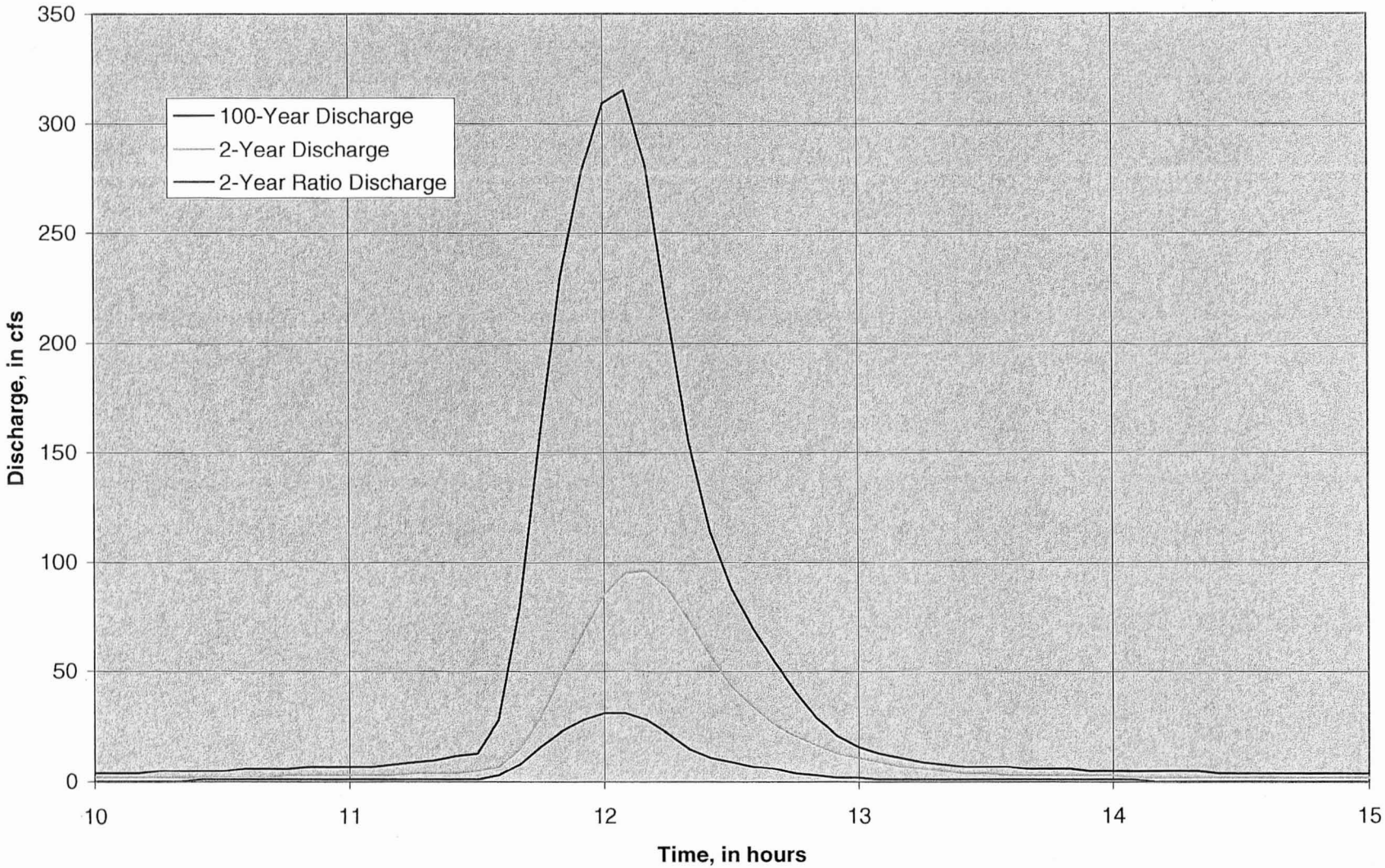

Comparison of results for the Cave Creek watershed (S310, S-Graph)
100-Year Discharge
5-Year Discharge
5-Year Ratio Discharge
Discharge, in cfs
3000
2500
2000
1500
1000
500
0
10
11
11
12
12
13
13
14
14
15
15
Time, in hours

Comparison of results for the Cave Creek watershed (S350, Clark)




Comparison of results for the Cave Creek watershed (S310, S-Graph)
100-Year Discharge
2-Year Discharge
2-Year Ratio Discharge
Discharge, in cfs
3000
2500
2000
1500
1000
500
0
10
11
12
13
14
15
Time, in hours

Comparison of results for the Cave Creek watershed (S350, Clark)



Comparison of results for the Maryvale ADMP of the 100- and 10-year full models to the 10-year ratio model with a ratio of 0.35

HEC-1 ID	Drainage Area sq. miles	100-Year Q cfs	100-Year Tp hours	10-Year Q cfs	10-Year Tp hours	10-Year Ratio Q cfs	10-Year Ratio Tp hours
7-32	0.25	371	4.25	178	4.42	130	4.25
D7-32	0.25	56	4.00	47	4.25	38	4.25
RET7	0.25	371	4.25	178	4.42	119	4.42
D67TB	0.25	197	4.25	94	4.42	63	4.42
DTB67	0.25	175	4.25	84	4.42	56	4.42
RTB1	0.25	165	4.50	75	4.75	47	4.67
12-31	1.02	1163	4.42	458	4.58	407	4.42
D1231W	1.02	744	4.42	293	4.58	260	4.42
D1231S	1.02	419	4.42	165	4.58	146	4.42
CTB1	1.27	545	4.42	224	4.67	169	4.50
STB1S	1.27	245	4.42	91	4.67	65	4.50
STB1W	1.27	300	4.42	132	4.67	104	4.50
RTB2	1.27	293	4.58	129	4.92	101	4.75
D1231W	1.02	744	4.42	293	4.58	260	4.42
S75AW	1.02	414	4.42	151	4.58	132	4.42
S75AS	1.02	330	4.42	142	4.58	128	4.42
R75A	1.02	324	4.50	139	4.75	124	4.58
CTB75	1.27	604	4.58	263	4.83	219	4.67
D75TB	1.27	278	4.58	121	4.83	101	4.67
DTB75	1.27	326	4.58	142	4.83	118	4.67
RTB3	1.27	321	4.67	139	5.00	114	4.83
2-31	0.29	181	4.42	57	4.75	63	4.42
D231W	0.29	139	4.42	44	4.75	49	4.42
D231S	0.29	42	4.42	13	4.75	15	4.42
R1131S	0.29	37	5.08	11	5.92	11	5.50
11-31	1.00	714	4.58	319	4.67	250	4.58
S75AW	1.02	414	4.42	151	4.58	132	4.42
R1131W	1.02	379	4.75	124	5.25	91	5.17
C11-31	2.55	958	4.75	318	5.08	276	4.92
D1131W	2.55	671	4.75	219	5.08	193	4.92
D1131S	2.55	287	4.75	94	5.08	83	4.92
CTB2	2.55	578	4.75	223	5.08	188	4.92
STB2S	2.55	194	4.75	67	5.08	55	4.92
STB2W	2.55	384	4.75	156	5.08	133	4.92
RTB4	2.55	378	4.83	153	5.25	131	5.08
D1131W	2.55	671	4.75	219	5.08	193	4.92
R83A	2.55	666	4.83	219	5.17	192	5.08
CTB83	2.55	1044	4.83	372	5.17	323	5.08
D83TB	2.55	522	4.83	186	5.17	162	5.08
DTB83	2.55	522	4.83	186	5.17	162	5.08
10-31	0.11	91	4.50	34	4.75	32	4.50
CADOT1	2.67	587	4.83	210	5.17	181	5.00
ADOT1S	2.67	587	4.83	210	5.17	181	5.00
ADOT1W	2.67	0	0.00	0	0.00	0	0.00