FREQUENCY ANALYSES
OF
USGS GAUGE DATA
(Scottsdale Alluvial Fan)

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By the FCDMC

Hydrology
Scottsdale Alluvial Fan

The purpose of this study was to review the results of the hydrolgy for the Flood Insurance Study of the alluvial fan flooding hazards in the Scottsdale area. We decided that the best way to evaluate these results were to compare them with U S Geological Survey Streamflow data, results of other studies, and by doing a similiar study using the methodology described in the Hydrologic Design Manual for Maricopa County, Arizona. Because of the work involved and the fact that only streams 5 and 6 affect the area within the unincorporated county, we decided to do the comparison only on these streams rather than for the entire study. If the results from our assessment compared with those from the Flood Insurance Study, for these areas, we could then assume that the entire study was reasonable. If they disagreed, we would assume that the hydrology for the entire Flood Insurance Study would need to be reevaluated.

Per FEMA's Contractors Study Guidelines, the first requirement in developing hydrology, is the use of U S Geological Survey data and performing Log Pearson III analysis. Based on this, we performed Log Pearson III analysis for the U S Geological Survey gaged streamflow sites in Maricopa County, where regulation is not a major factor. From this analysis table 1 was developed, showing the drainage area, the period of record, and the 100-year discharge, which had been determined by the Log Pearson III analysis, both in CFS and CFS/SQ. MI., for each of the gaged sites. This data was then plotted as CFS/SQ. MI. versus drainage area as shown on figure 1. Lines were then drawn through this plotted data showing MAXIMUM and AVERAGE expected values. These are shown on figure 1. We then designated those streamflow stations with physical characteristics that may be somewhat similiar to streams 5 and 6. A line was then drawn through the average of the values for these sites as shown on figure 2. This analysis of streamflow data should give a reasonable guide for 100-year discharges developed from other methods, such as, rainfall runoff models for areas within Maricopa County.

Our next step was to look at the analysis performed by Water Resources Associates, Inc., September 25, 1989, "Concept Drainage Study, Paradise Valley Fan Terrace, Part of Peripheral Areas C and D". Figures 3 and 4 were taken from that report. They compare the results of their study with other studies, one of which is a study by Eychaner of the U S Geological Survey. Figure 5 shows the results of the Water Resources Associates, Inc. study and the results of our data analysis. From this, it can be seen that their results and the results of the U S Geological Survey study compared well with our analysis of the streamflow data.

We then developed a rainfall runoff model for streams 5 and 6 using the methodology described and recommended in the Hydrologic Design Manual for Maricopa County. This methodology includes using the HEC-1 computer model with the Green and Ampt method used to estimate rainfall losses, the S-graph method for unit hydrograph, and a 24-hour, 100-year storm with SCS type II rainfall distribution. We also ran the model using the rainfall that was used in the Flood Insurance study, a 24-hour, 100-year, storm with SCS type IIA rainfall distribution. The results from both of these were then plotted along with the results from figure 5. These plots are shown on figure 6. Comparison on figure 6 indicate that the results from the rainfall runoff analysis seem to be reasonable based on the analysis of the data and the previous studies.

The values obtained from the report, received for review, for the Flood Insurance Study were then plotted and compared with these other results. This is shown in figure 7 and table 2. This indicates that the results from the Flood Insurance Study, approach or exceed, the results of the vary highest values determined from any of the streamflow data. They also greatly exceed the results from the other studies including the rainfall runoff model developed using the Hydrologic Design Manual for Maricopa County

The highest value for a streamflow station in Maricopa County, from the Log Pearson III analysis, was for the Salt River Tributary in South Mountain Park, Station No. 9 on table 1. A physical comparison was made between the drainage basin for the Salt River Tributary and for streams 5 and 6. Figures 8 and 9 show these basins outlined on topographic maps and figures 10 and 11 show photographs of the areas. From these, it can be seen that the Salt River Tributary is a nearly square basin with very steep sides while Streams 5 and 6 are long narrow basins with no side drainage. In fact, streams 5 and 6 resemble a mesa that is sloping. From this comparison you would expect the runoff from the Salt River Tributary to be considerably greater than that for streams 5 and 6.

Our conclusion from this study is that the 100-year discharges determined for the Flood Insurance study are extremeny high, probably two to three times what would be expected. We would expect results in the same range as what are determined using the Hydrologic Design Manual for Maricopa County with the SCS type II rainfall distribution. We thus believe, that based on this analysis, a carefull review of the methods used for the Flood Insurance Study should be made for the entire basin. We strongly feel that the results of rainfall runoff modeling must be compared with streamflow data from similiar type drainage basins, to insure that the best results are obtained.

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

ID NO.	STATION NO.	NAME	D.A. MI2	RECORD PERIOD	100-YEAR DISCHARGE CFS/MI2	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 NR 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

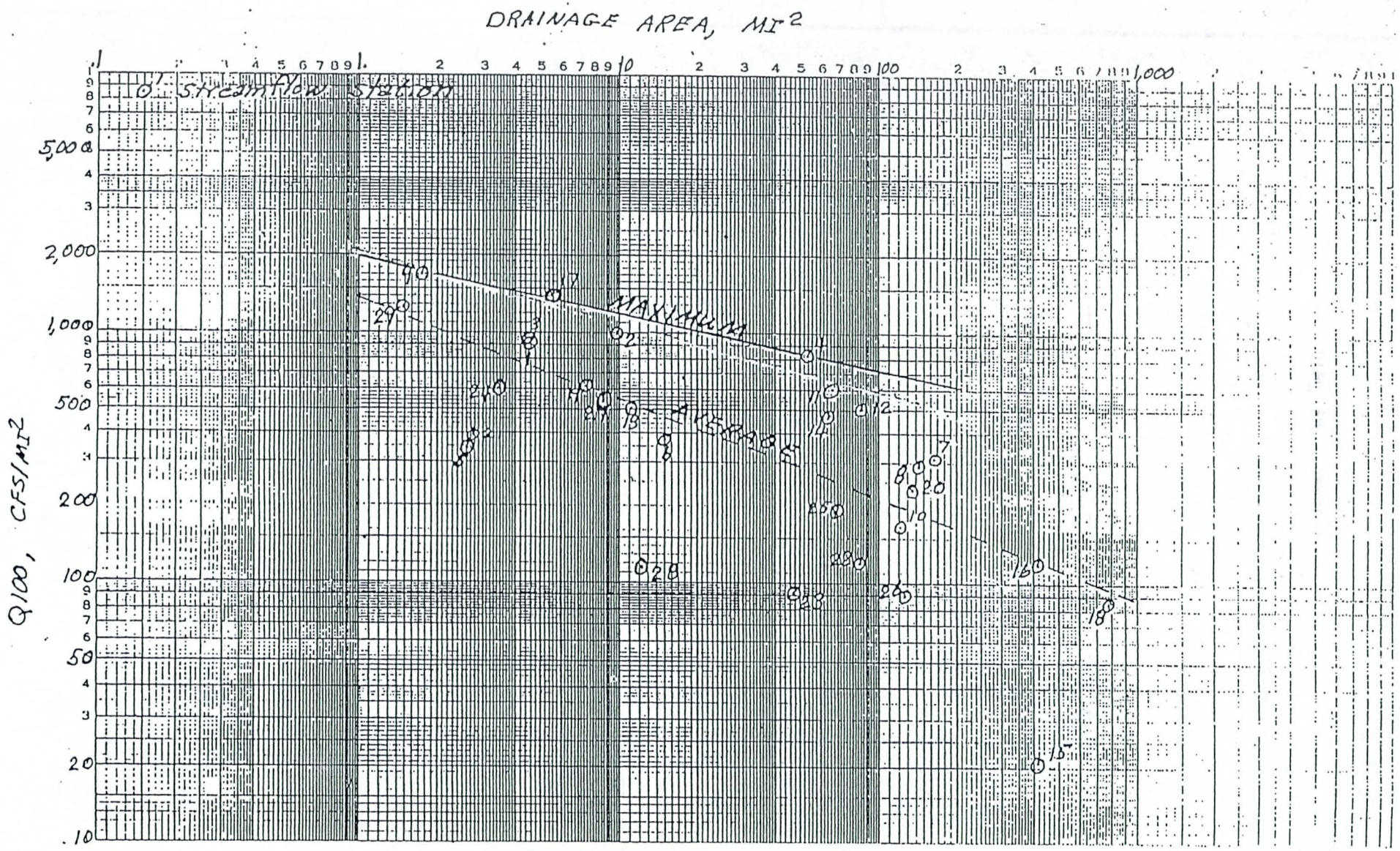


Figure 1.- Plot of 100-year discharge, from Log Pearson III Analysis, for Streamflow Stations in Maricopa County.

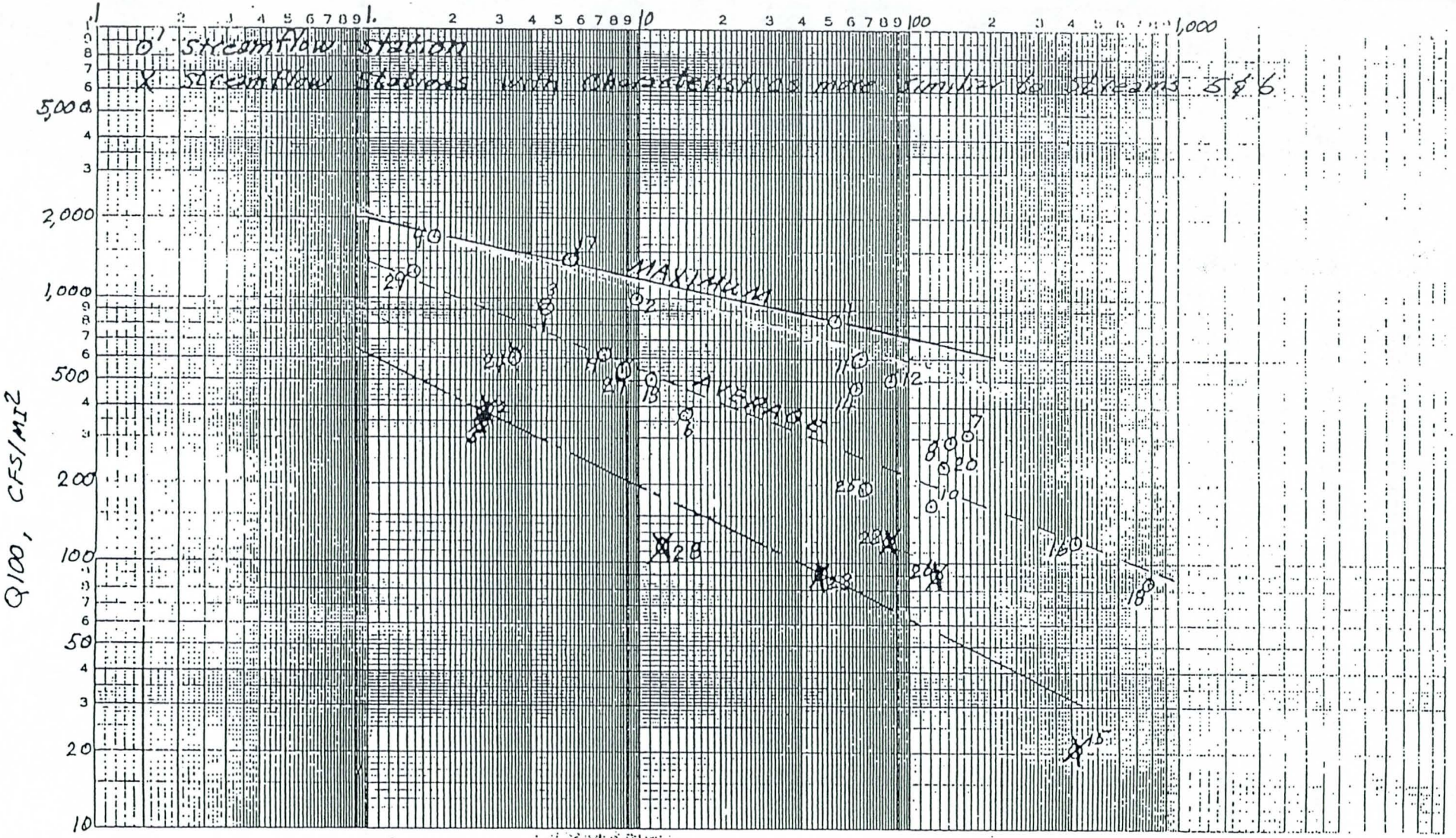


Figure 2.- Plot of 100-year discharges, showing stations more similar to streams 5 and 6.

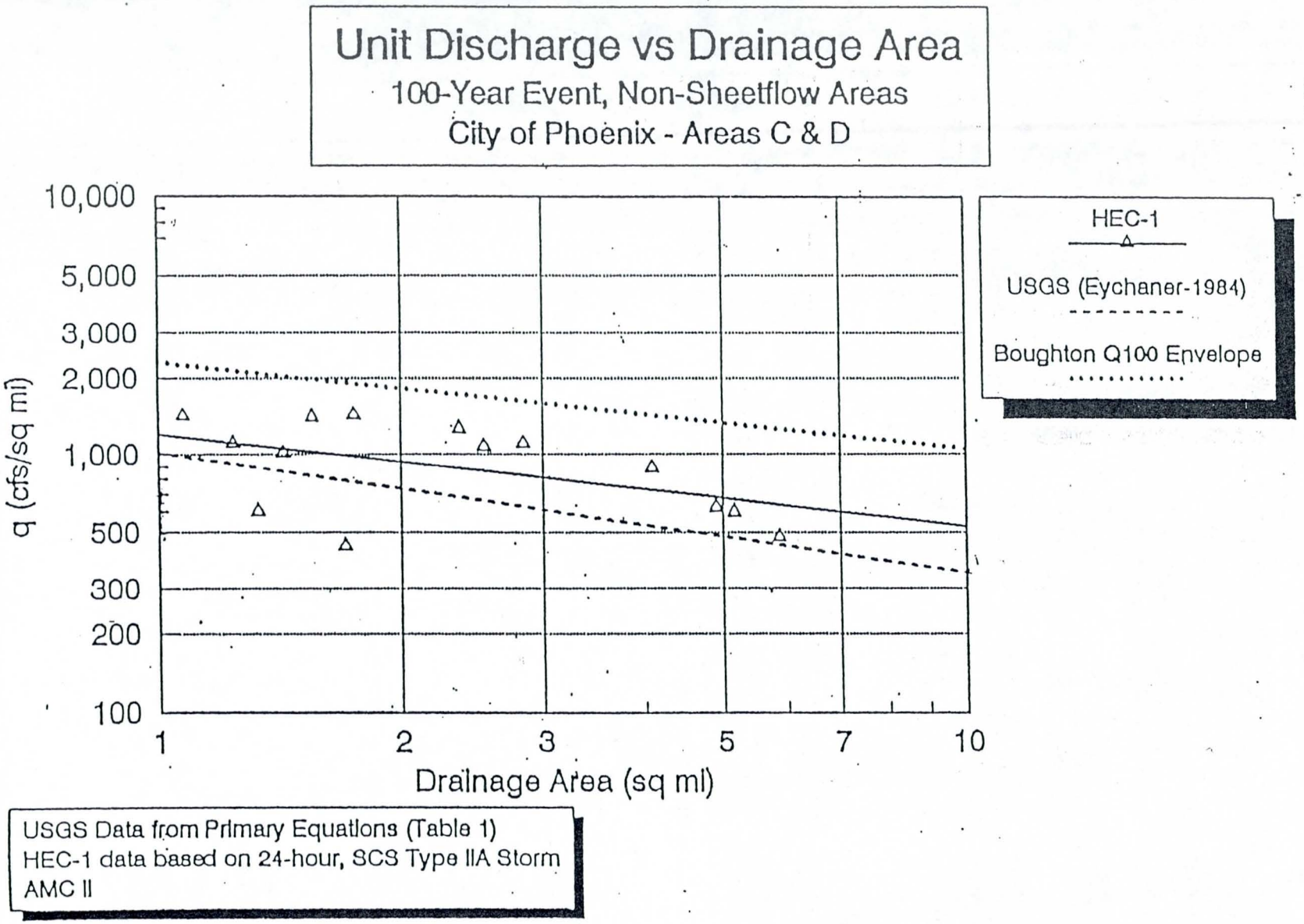
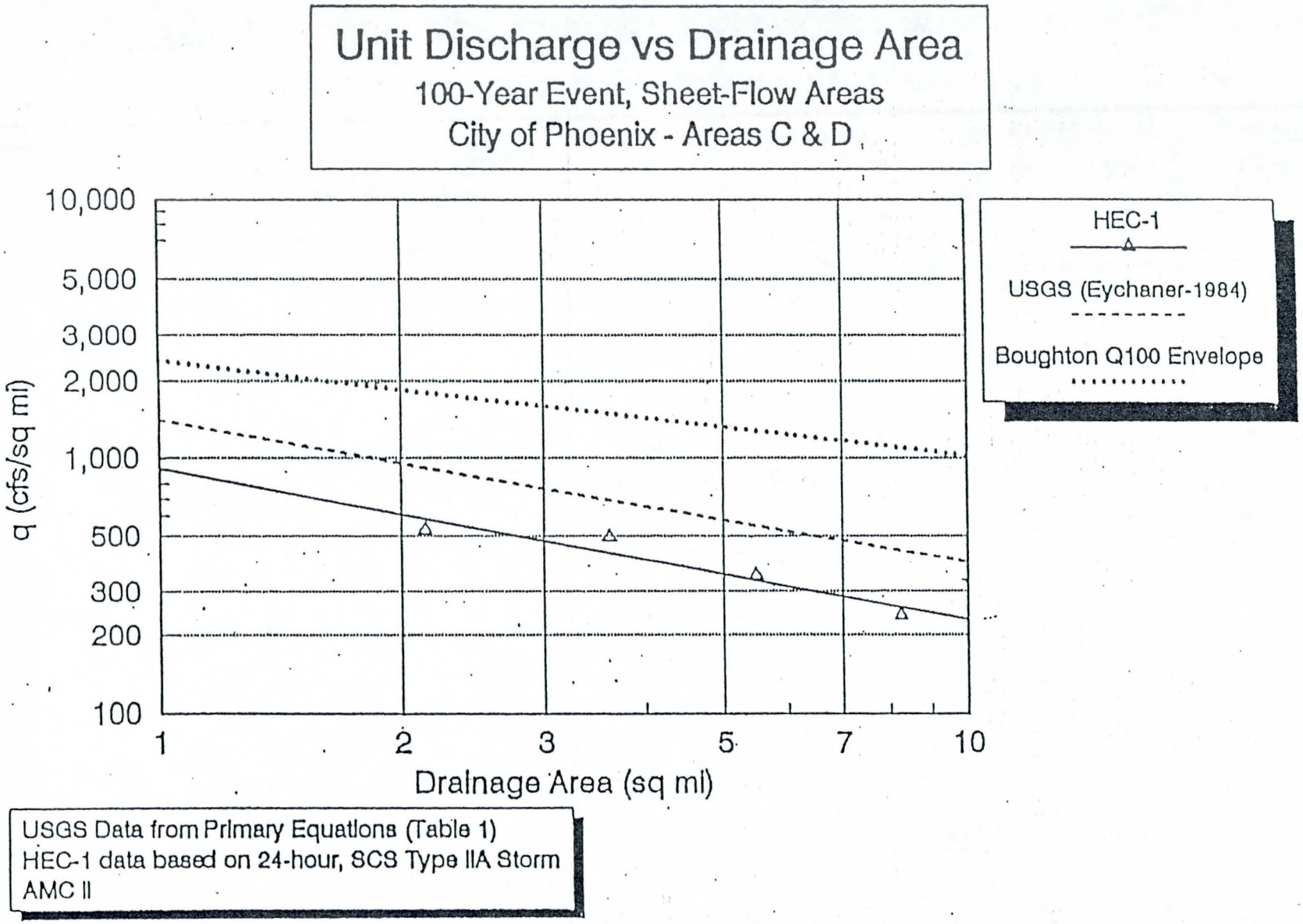


Figure 3.- Plot of 100-year discharge determined by Water Resources Associates, Inc, Compared with other studies for non-sheetflow areas.



Water Resources Associates, Inc.	UNIT DISCHARGE VS. DRAINAGE AREA 100-YEAR EVENT SHEETFLOW AREAS	FIGURE 3.11
PROJECT NO AC00060 DRAWN BY RLW DATE 9/25/89 CHECKED BY JJH		

Figure 4.— Plot of 100-year discharge determined by Water Resources Associates, Inc, Compared with other studies for sheetflow areas.

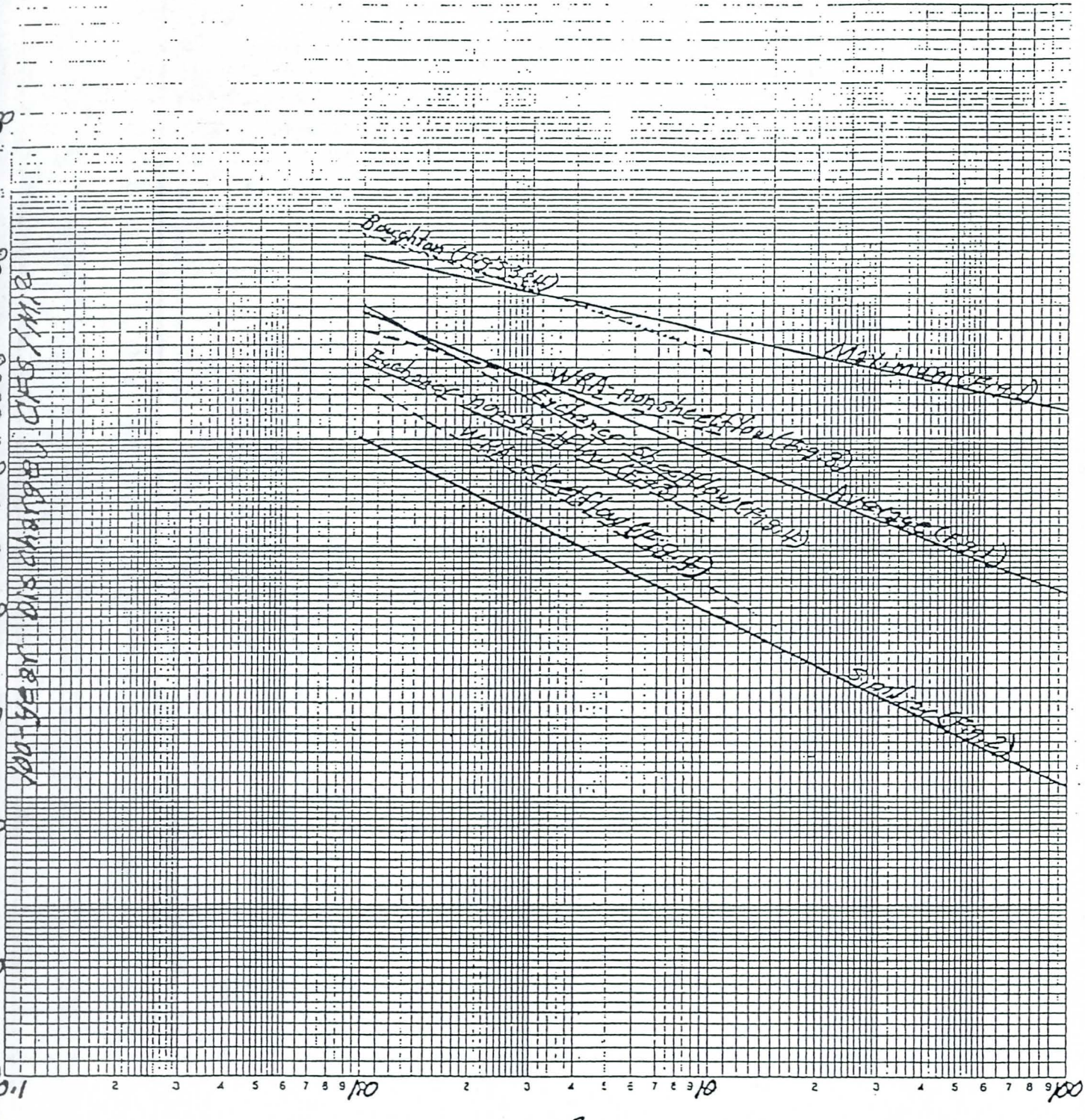


Figure 5.- Comparison of results shown on figures 1–4.

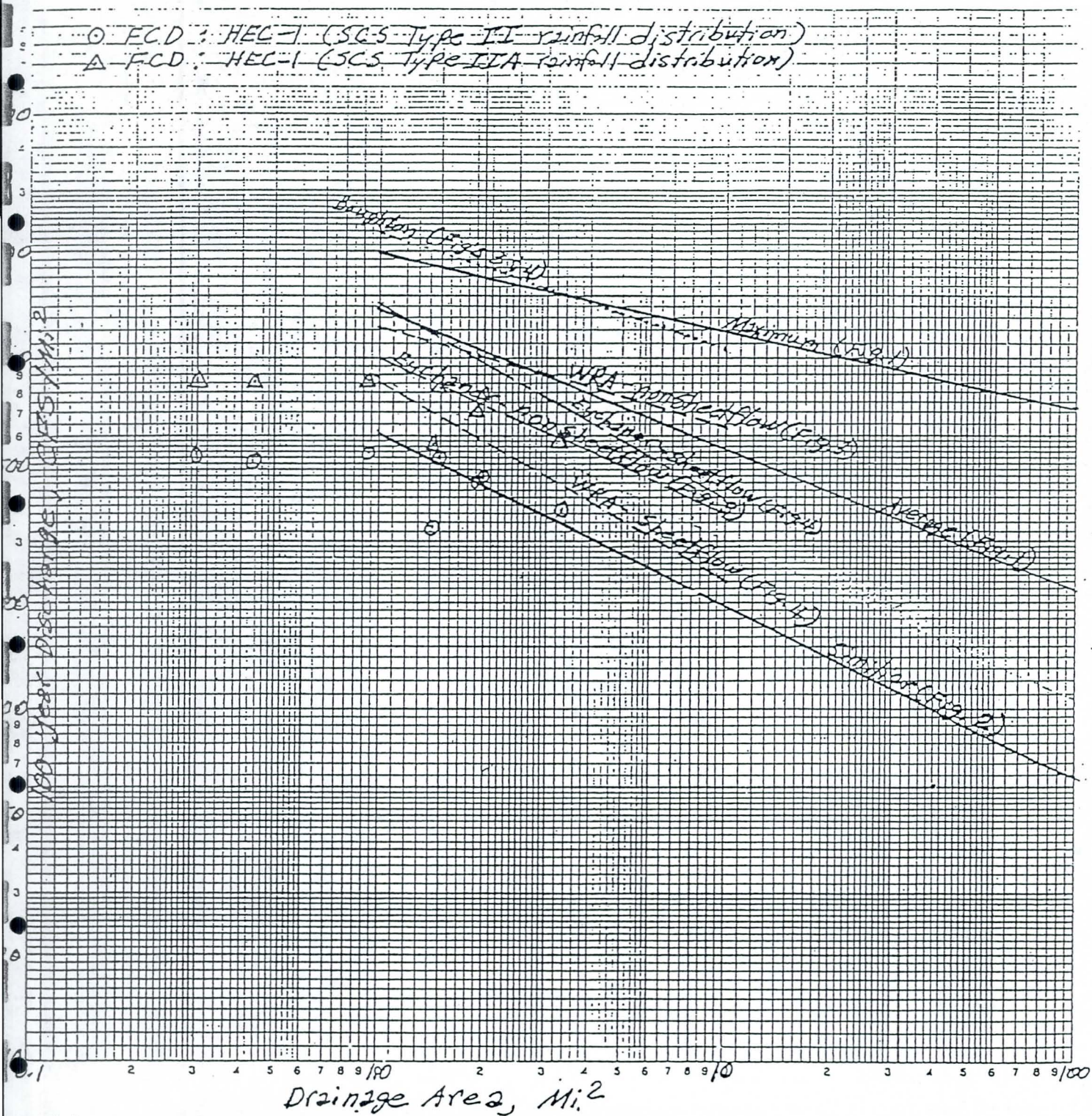


Figure 6:- Comparison of FCD Rainfall Runoff model results with results from Streamflow data and Water Resources Associates, Inc. study.

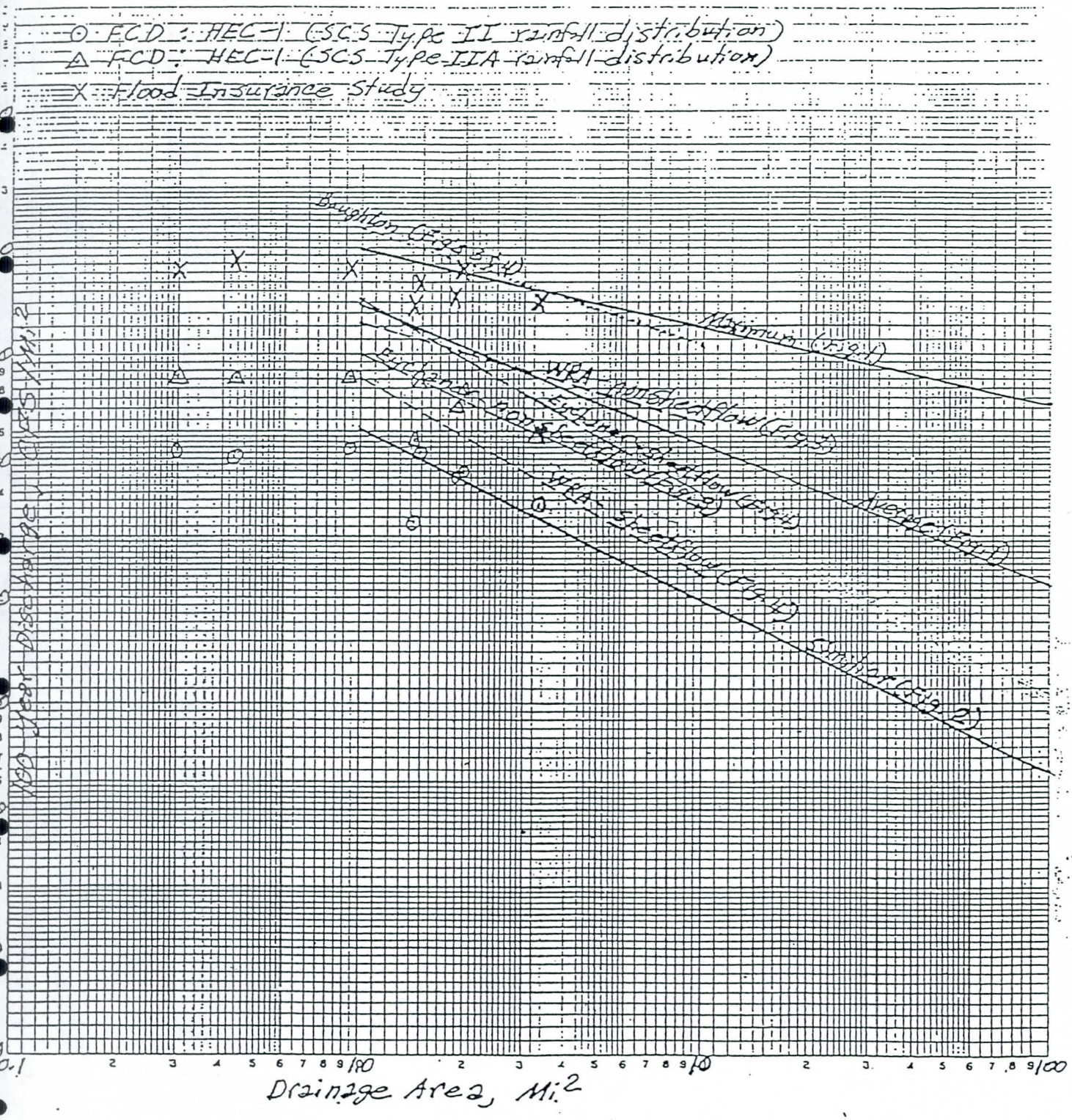


Figure 7.- Comparison of 100-year discharges from Flood Insurance Study with the Streamflow data Analysis, Water Resources Associates, Inc. Study and Flood Control District study.

Table 2. Comparison of results by each study method.

100-Year Discharges, in CFS/Sq. Mi.

Basin	D. A. Sq. Mi.	Sheet Flow		Non Sheet Flow	
		Eychaner	WRA, Inc	Eychaner	WRA, Inc
1380	0.93	1,500	890	1,010	1,230
1390N	1.49	1,140	680	830	1,090
1390S	.43				
1430	1.43	1,180	700	840	1,100
1440	1.89	990	600	760	1,020
1441	3.32	730	440	600	860
1470	.30				
1475	1.99	970	580	740	1,000

Table 2. Continued.

100-Year Discharge, in CFS/Sq. Mi.

Basin	Log Pearson III		MCFCD		Flood Insurance Study
	Average All Sta.	Average Similiar Sta.	Type II Rainfall	TypeIIA Rainfall	
1380	1,400	640	540	860	1,770
1390N	1,170	510	520	840	1,600
1390S			510	860	1,860
1430	1,190	520	330	570	1,370
1440	1,070	460	440	710	1,470
1441	850	340	370	610	1,400
1470			530	870	1,730
1475	1,040	450	460	800	1,740

EXHIBIT 4: APEXES ASSOCIATED WITH DRAINAGE BASINS

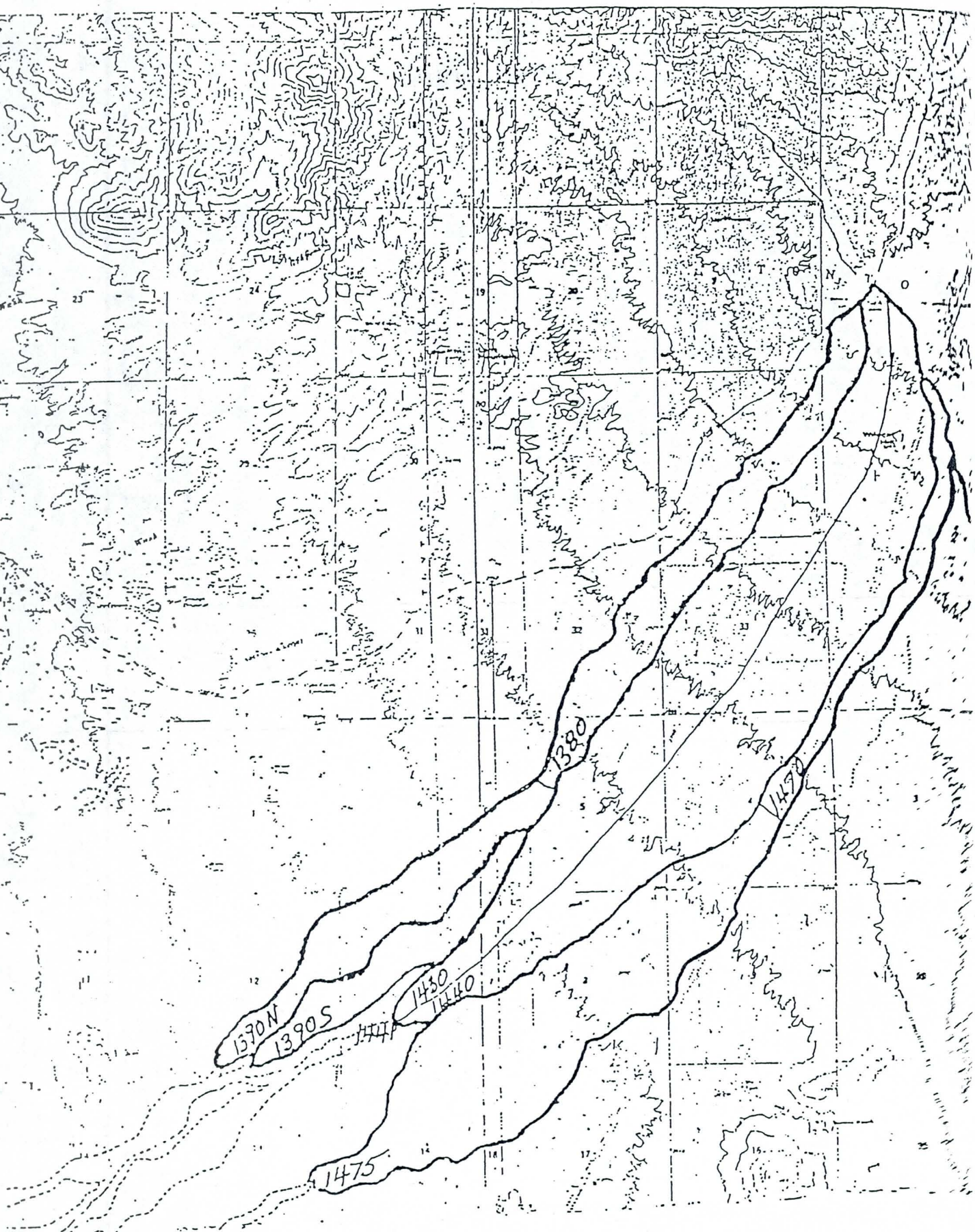
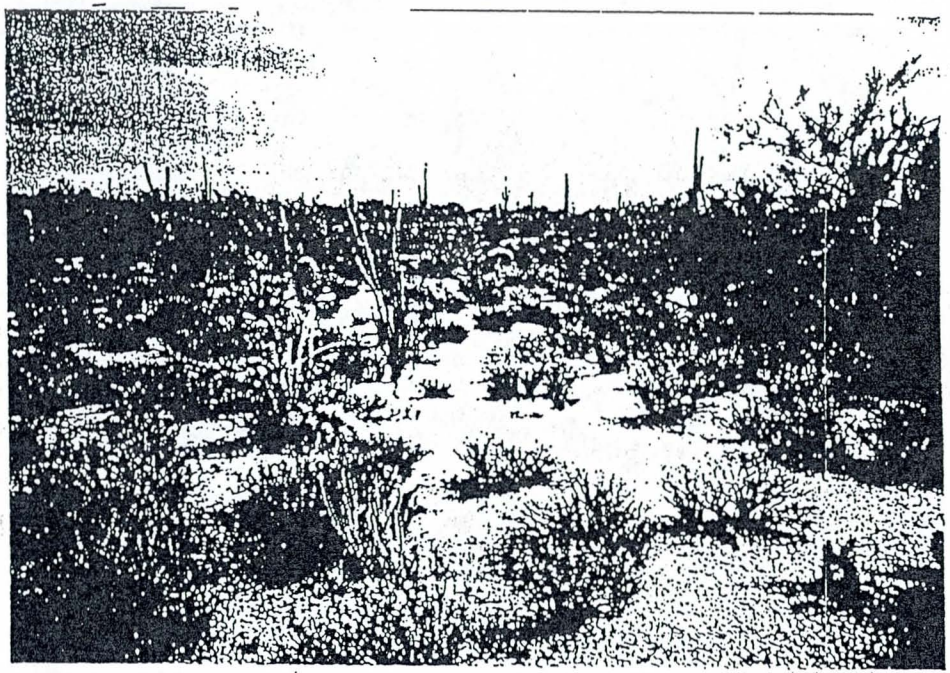


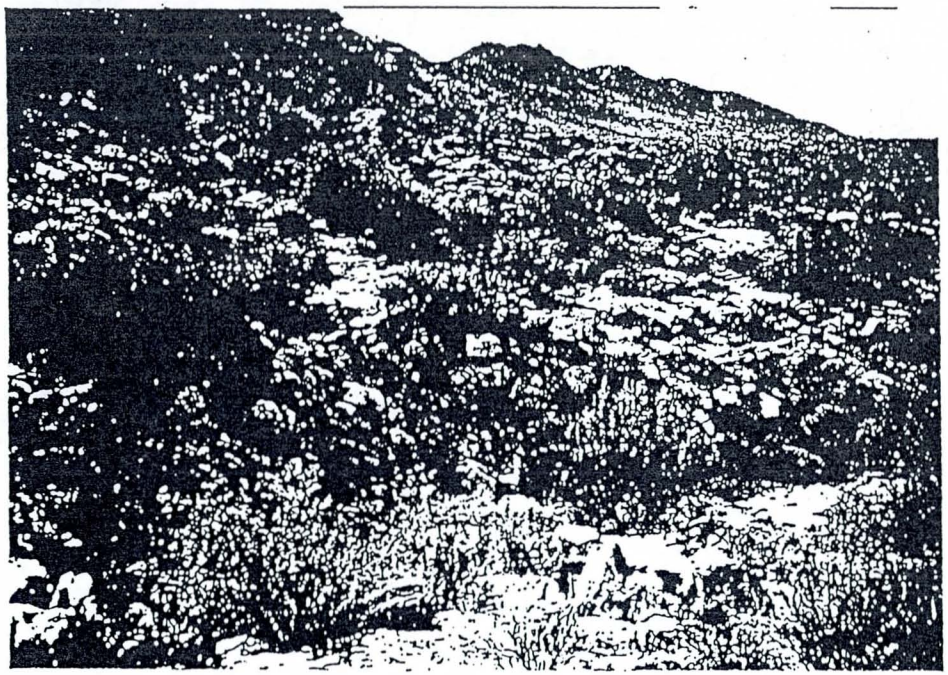
Figure 8.— Streams 5 and 6, Drainage basins.

Figure 9. – Salt River Tributary in South Mountain Park, Drainage basin.

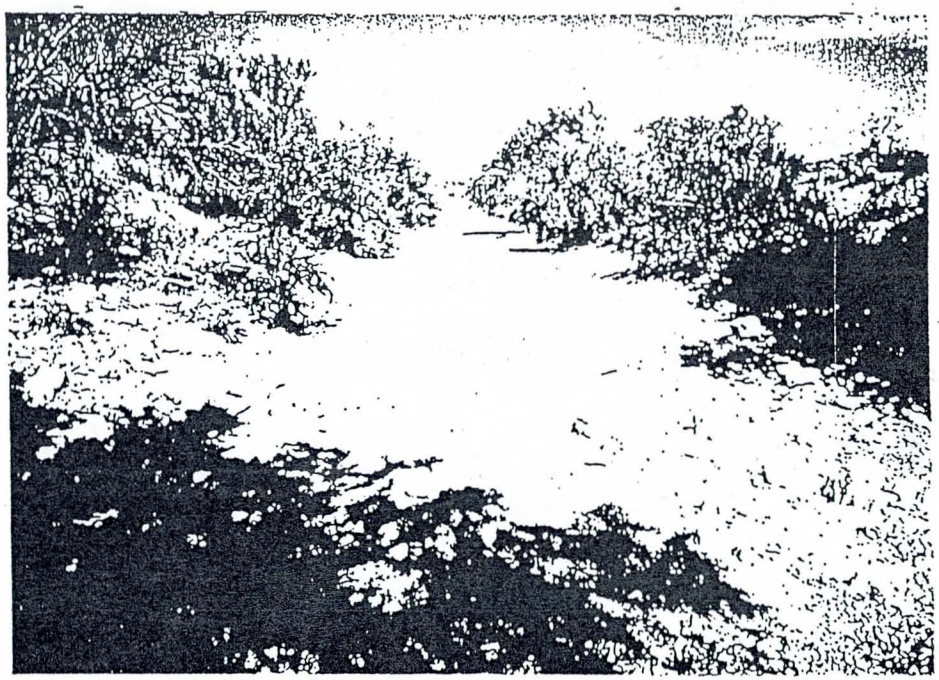


Looking (east) upstream through the basin

Figure 10. - SCOTTSDALE ALLUVIAL FAN



Looking upstream along the east side of the basin



Looking downstream in the channel at the lower end of the basin

Figure 11. - SOUTH MOUNTAIN TRIBUTARY