HYDROLOGIC ANALYSIS OF THE HASSAYAMPA RIVER IN MARICOPA COUNTY, ARIZONA

For

FEDERAL EMERGENCY MANAGEMENT AGENCY

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CBA

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For

FEDERAL EMERGENCY MANAGEMENT AGENCY

Registered Professional Engineer (Civil)
CERTIFICATE
20327
JAMES M.
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Date Signed 5-2-88
ARIZONA, U.S.A.

CBA File No. 04856-07-74
May 2, 1988
JHN00098.74R

FIMA CONTRACT NO. EMW-88-C-2603

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1.0 Introduction

Cella Barr Associates (CBA) has been contracted by the Federal Emergency Management Agency (FEMA) to perform a detailed Flood Insurance Re-Study of the Hassayampa River in Maricopa County, Arizona. The study reach extends for approximately 52.8 stream miles from the Yavapai County line at Wickenburg downstream to the confluence with the Gila River, located approximately 40 miles west of Phoenix, Arizona (Figure 1 and Figure 2). The study reach includes the incorporated Town of Wickenburg, Arizona near the upstream limit. The results of this study will supersede the existing hydrology which was prepared as part of the original Flood Insurance Study for the Hassayampa River through the Town of Wickenburg (Reference 6).

The purpose of this report is to estimate the 100-year peak discharges which will occur along the study reach for use in this Flood Insurance Re-Study. Proposed peak discharges for the 100-year event are summarized in Table 2. These discharges are proposed for use in determining water surface elevations, floodway boundaries, and flood zones as a part of the completion of the next work phase. Based on criteria provided by FEMA for this re-study, hydraulic evaluations will be limited to the 100-year event.

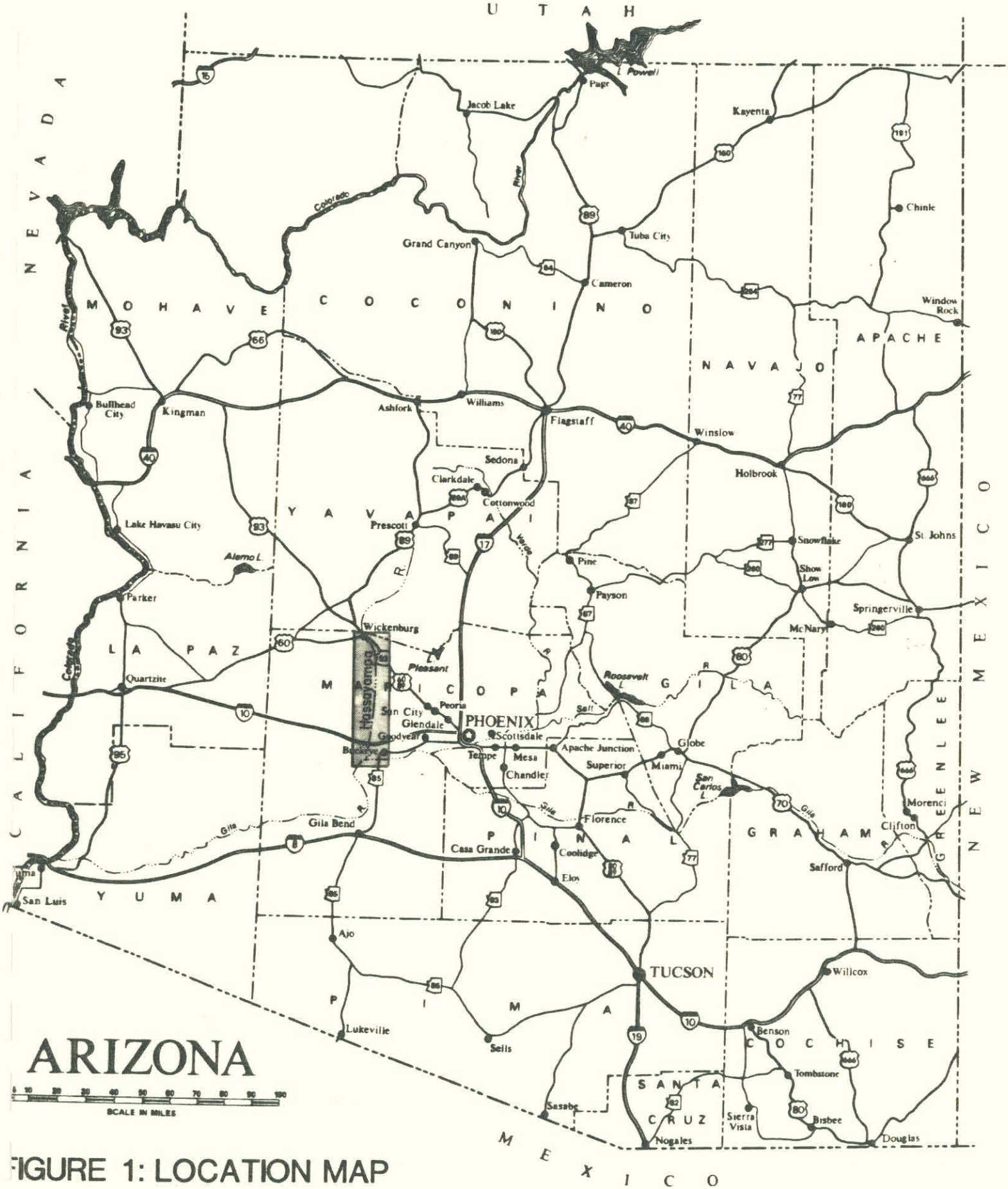

FIGURE 1: LOCATION MAP

HASSAYAMPA RIVER (MARICOPA CO.)
FLOOD INSURANCE STUDY

DENOTES AREA OF STUDY

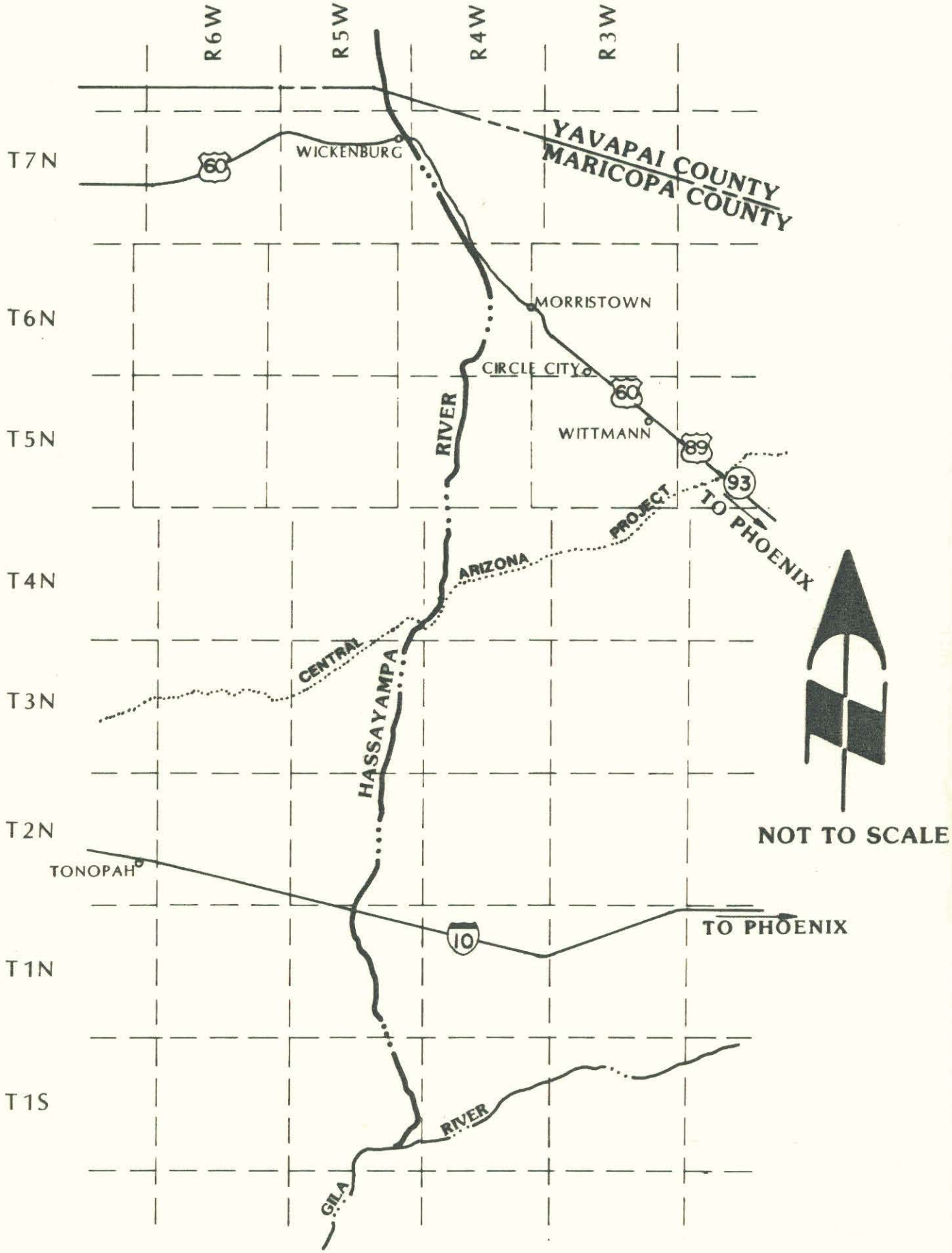

FIGURE 2: VICINITY MAP
HASSAYAMPA RIVER

2.0 Watershed Description

The Hassayampa River watershed encompasses a contributing drainage area of approximately 560 square miles at the upstream limit of study (Yavapai County Line), increasing to an area of approximately 1,480 square miles at the downstream study limit (confluence with the Gila River). The overall watershed and primary sub-watershed areas are represented on Figure 3 of this report.

The upper portion of the drainage basin is bounded by the Weaver Mountains to the north and the Bradshaw Mountains to the northeast and east. Within the Town of Wickenburg, the Hassayampa River is joined by Sols Wash which provides runoff contributions from a 146 square mile drainage basin extending upstream to the northwest into the Date Creek Mountains.

The lower drainage basin is an elongated basin with several minor contributing watersheds paralleling the Hassayampa River. There is one significant tributary watershed, however, that provides a major runoff contribution to the lower drainage basin for the Hassayampa River, that being the Hassayampa Plain that extends northwesterly into the Vulture Mountains, bordering the adjacent Centennial Wash watershed on the west and south. The approximate 353 square miles of the Hassayampa Plain is drained primarily by Jackrabbit Wash, which has its confluence with the Hassayampa River approximately 13 miles upstream of the Gila River.

Headwaters for the Hassayampa River originate at an elevation of about 7,800 feet (Bradshaw Mountains) and elevations become variably lower to an elevation of about 800 feet at the confluence with the Gila River. The resulting average stream slopes vary from 1.0 to 4.0 percent in the upper one-third of the watershed to 0.5 percent in the lower two-thirds.

The overall watershed climate is primarily semi-arid desert with an annual precipitation varying from 17 inches in the Bradshaw Mountains (upper watershed) to 11 inches at Wickenburg and 7 inches at the lower limit of the watershed. Precipitation occurs predominantly in the late summer and winter. The summer rains are initiated by moist air derived from the Gulf of Mexico which produces moderate to intense afternoon and evening thunderstorms (Reference 16). Winter precipitation, however, originates from the Pacific Ocean and is normally less severe.

The topography within the watershed consists of a combination of mountains, hills, alluvial fans and desert plains. The soils of the plains and alluvial fans are predominantly gravelly, sandy loams. In mountains and hilly areas, the soils are generally very shallow underlain by rock outcrops of granite and volcanics. (References 12 and 13).

There are marked differences in vegetation within relatively short distances because of a wide variation in soils, elevation, precipitation and temperature, particularly within the upper watershed. Typical desert vegetation types found at the lower elevations include: creosote brush, palo verde, scattered grasses and several varieties of cacti. The intermediate elevations are characterized by: grasses, chaparral and mountain brush. The higher elevations include: juniper and pine. In general, vegetation tends to be denser along and adjacent to stream courses, and a moderate cover of annual grasses usually develops following winter rains.

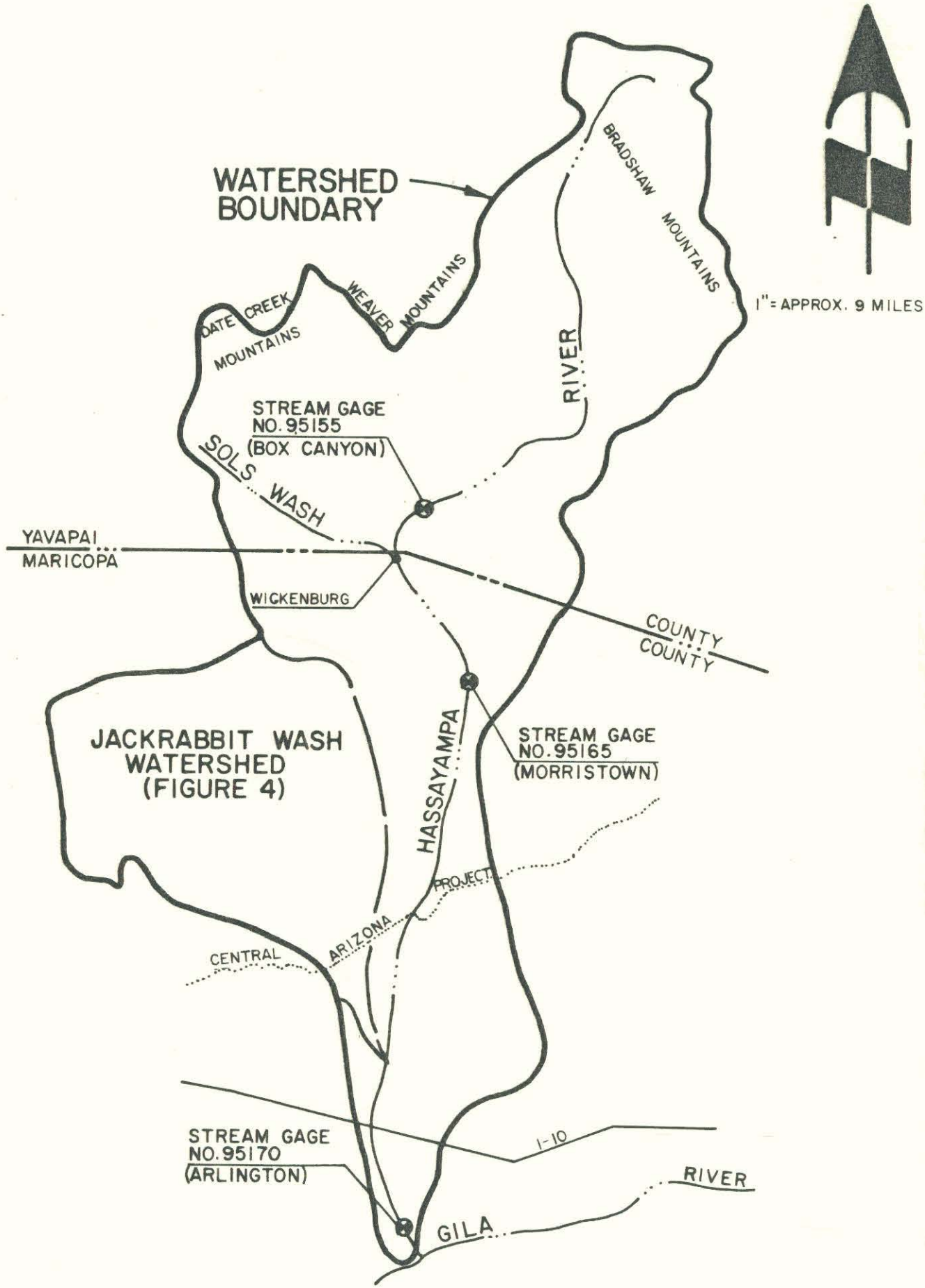

FIGURE 3: DRAINAGE AREA MAP—HASSAYAMPA RIVER

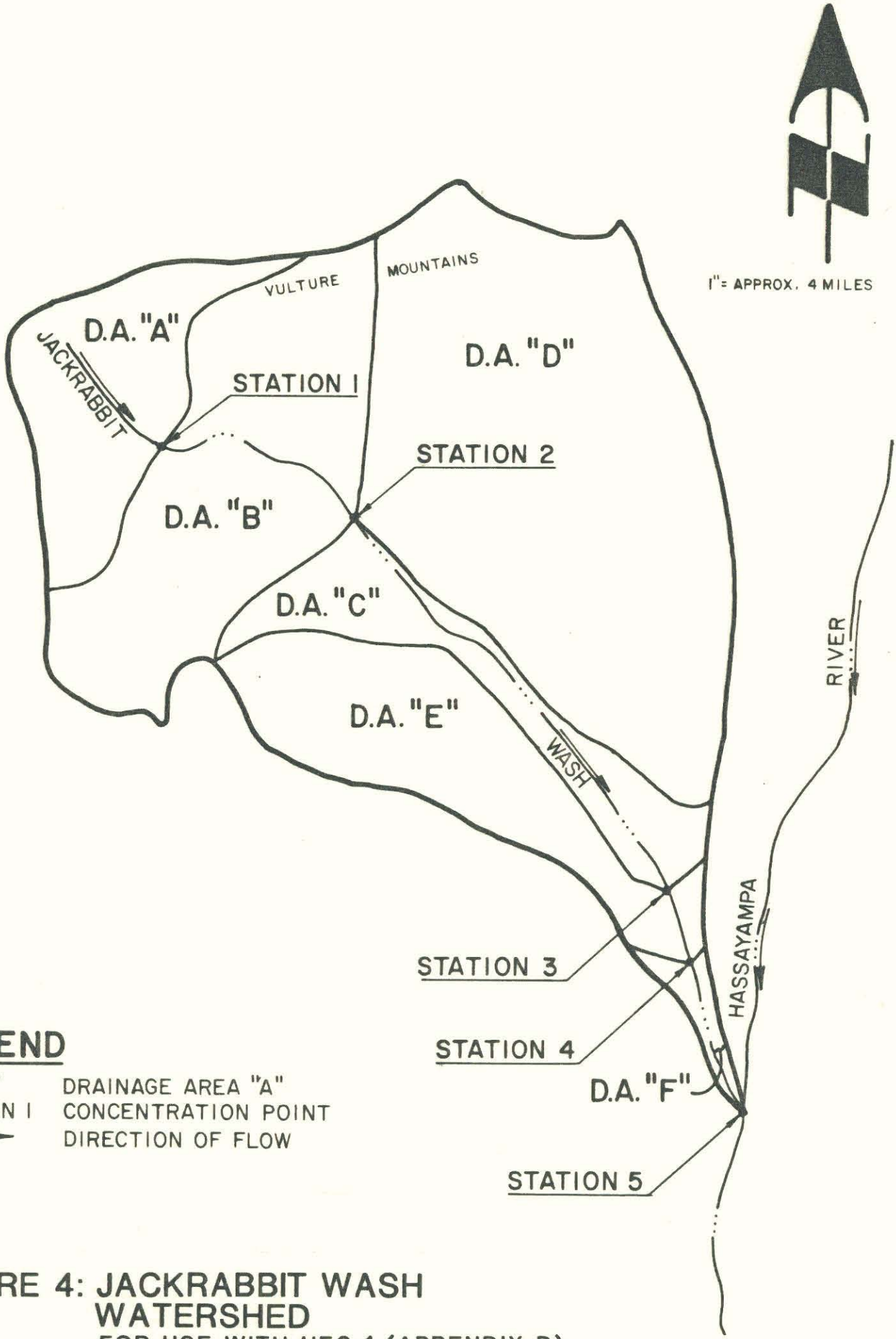

FIGURE 4: JACKRABBIT WASH WATERSHED
FOR USE WITH HEC-1 (APPENDIX D)

3.0 Previous Studies

Flood Insurance Studies have been prepared for the Hassayampa River and Sols Wash within the Town of Wickenburg, along with hydrologic design studies at Wickenburg and several downstream locations. These studies are referenced in the bibliography and results presented in Table 1 for comparison with the results of this study.

4.0 Hydrologic Analysis

Historic stream gage data for the Hassayampa River exists at three locations and was utilized to perform a Log-Pearson Type III statistical analysis in accordance with FEMA guidelines and Reference 9. U.S.G.S. stream gage station 95155 (Box Canyon) is located 5.5 miles upstream of Wickenburg and has forty-one (41) years of recorded data. U.S.G.S. stream gage station 95165 (Morristown) is located 7.0 miles downstream from Wickenburg and has thirty (30) years of recorded data. The final U.S.G.S. stream gage station 95170 (Arlington) is located 1.8 miles upstream from the Hassayampa River's confluence with the Gila River and has twenty-two (22) years of recorded data. The graphic locations of these three (3) stream gage stations are depicted on Figure 3. The results of the Log-Pearson Type III analyses for each of these stream gage stations are presented in Table 1 and Appendices A thru C.

At stream gage station 95155 (Box Canyon) a 100-year peak discharge of 57,100 cfs is obtained when treating the years 1925, 1927 and 1937 as historical events per gage station records, as furnished by the U.S.G.S and per criteria set forth in Reference 9. The adopted 100-year peak discharge for the Town of Wickenburg per the current, official Flood Insurance Study is 71,000 cfs. When applying the FEMA's Guidelines and Specifications for Study Contractors (Reference 17), Chapter 2, Page 7, paragraph 2 to this difference, it was determined that the previously established discharge of 71,000 cfs should be adopted (retained) as it falls within the 75 and 25 percent confidence limits of the new estimate of 57,100 cfs. The adopted value of 71,000 cfs does not appear to be unreasonable when the hypothetical 57,100 cfs at Box Canyon is routed to the Town of Wickenburg and combined with FEMA's adopted 100-year peak discharge of 15,000 cfs for Sols Wash (reference 8); however, it may be somewhat conservative in representing the Hassayampa River within the Town of Wickenburg upstream of the Sols Wash confluence. In any case, based on FEMA criteria, the

100-year discharge of 71,000 cfs for the Hassayampa River at Wickenburg represented per the previous Flood Insurance Study will be adopted for the re-study at this location. Other available hydrology studies applicable to this location (References 2, 3, 6, and 7) also concur with this value as shown on Table 1.

At gaging station 95165 (Morristown), previous studies by the U.S. Bureau of Reclamation estimated a peak discharge of 54,000 cfs based on 17 years of record (Reference 4), and P.R.C. Toups obtained 85,000 cfs based on 25 years of record (Reference 3). CBA has estimated a peak discharge of 61,600 cfs based on a Log-Pearson Type III statistical analysis of 30 years of record for this re-study. Due to the significant difference between this value and P.R.C. Toups' study, CBA re-analyzed the P.R.C. Toups' input data for 25 years of record using the updated version of the Flood Flow Frequency computer model provided by the U.S. Army Corps of Engineers. This re-analysis of the P.R.C. Toups' data yielded a 100-year discharge value of 59,000 cfs. Hence, a 100-year discharge value of 61,600 cfs proposed for the Flood Insurance Re-Study compares favorably with existing studies and is based on more years of available record.

At gaging station 95170 (Arlington) a 100-year peak discharge of 74,100 cfs was estimated from a Log-Pearson Type III analysis of 22 years of available record. This value compares favorably with a value of 82,000 cfs obtained by a study performed by the U.S. Bureau of Reclamation (Reference 4) when considering that the earlier study was performed in 1976, based on evaluations of a limited period of record of 11 years. Thus, a 100-year peak discharge of 74,100 cfs is proposed to be adopted for use in the re-study at this location.

The statistical analyses for the three (3) stream gage sites at Box Canyon, Morristown, and Arlington provide the framework for establishing appropriate discharges to use along the entire study reach for the Hassayampa River. Respective 100-year discharges of

71,000 cfs, 61,600 cfs, and 74,100 cfs will be adopted at these point locations (with Box Canyon being transferred to Wickenburg). For stream reaches located between these three (3) sites, 100-year discharges have been derived based on interpolation. This interpolation has simply included an attenuation rate on a "per stream mile" basis as a means of estimating discharges between stream gage sites. Use of this method alone is considered to be acceptable in assessing the channel reach between Wickenburg and Morristown due to the relatively minor and somewhat homogeneous lateral contribution of tributary watersheds along this reach in consideration of the size of the upstream Hassayampa River watershed as a whole. This method of interpolation could also be utilized alone for the channel reach between the Morristown and Arlington gage sites were it not for the significant point contribution of runoff induced by the Jackrabbit Wash watershed (Figures 3 and 4). The point contribution of Jackrabbit Wash results in a discharge which is greater at Arlington (74,100 cfs) than the discharge at Morristown (61,600 cfs) even though the general tendency is for the discharge to attenuate between these sites.

Hence, in order to establish an attenuation rate for the reach of the Hassayampa River extending between the Morristown and Arlington gage sites, it first became necessary to estimate the point increase in flood discharge induced by Jackrabbit Wash during the passage of the flood peak for the Hassayampa River. This was accomplished by the following procedure:

1. Travel times for the primary Hassayampa River channel were estimated from the watershed headwaters to Jackrabbit Wash. This was accomplished via a thorough field investigation of the overall watershed, performed to determine characteristic reaches and typical channel cross-sections. The typical channel cross-sections were hydraulically rated using the Manning equation for assumed, incremental discharges based on location specific empirical estimates. The hydraulic ratings

produced flow velocities which were applied to reach lengths to estimate travel times. Using this method, a travel time of 16.1 hours was estimated for the 100-year discharge along the Hassayampa River at the Jackrabbit Wash confluence.

2. A travel time for the primary Jackrabbit Wash channel was estimated at the Hassayampa River confluence using the same procedure identified above.

3. A HEC-1 analysis (Appendix D) was performed for the Jackrabbit Wash watershed (Figure 4) to estimate the magnitude of the 100-year flood peak generated by said watershed at the Hassayampa River confluence. A 24-hour storm was determined to produce the greatest flood peak. Relevant HEC-1 parameters used in the analysis included the SCS Type II rainfall distribution, SCS dimensionless unit hydrograph, SCS CN method for calculating Tlag, and runoff curve numbers for semi-arid range and forest conditions (Reference 18). This analysis produced a 100-year peak discharge of 28,338 cfs.

4. A simplified triangular hydrograph (Figure 5) was developed for the Jackrabbit Wash 100-year discharge, using the travel time derived per Task 2 as the time to peak (Tp), the peak discharge of 28,338 cfs derived per the HEC-1 analysis, and a time of recession (Tr) equivalent to 5/3 times Tp.

5. The Jackrabbit Wash discharge at the Hassayampa River time to peak of 16.1 hours was read from the simplified triangular hydrograph. This value represented the point contribution of Jackrabbit Wash to the 100-year flood peak of the Hassayampa River at the confluence of these two streams. The estimated point contribution value was 15,600 cfs.

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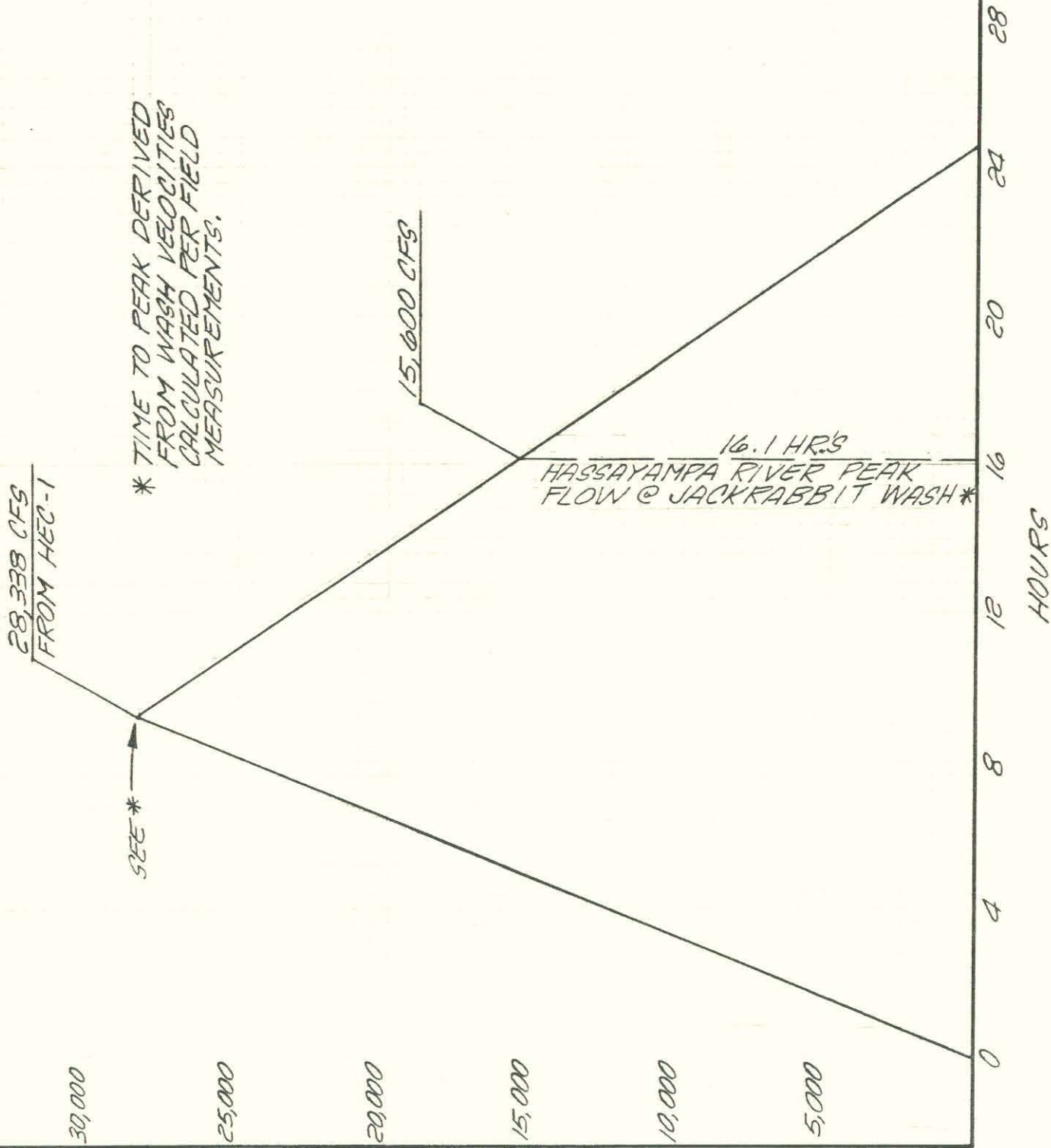
SUBJECT JACKRABBIT WASH @ HASSAYAMPA RIVER CBA #04856-07-74

FIGURE 5: SIMPLIFIED TRIANGULAR HYDROGRAPH



PREPARED BY JCC DATE 4/6/88 CHECKED BY JHN SHEET NO. — OF — FIGURE # 5

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6. The Jackrabbit Wash point contribution of 15,600 cfs was subtracted from the Arlington peak discharge of 74,100 cfs to yield 58,500 cfs. This value (58,500 cfs) represents a probable 100-year discharge which would occur at Arlington in the absence of any contributions from Jackrabbit Wash. Based on the uniformity of watershed contributions to the Hassayampa River between Morristown and Arlington which would exist were if not for the point contribution of Jackrabbit Wash, an attenuation rate of 82 cfs per stream mile was adopted for this reach based on interpolation between the Morristown discharge (61,600 cfs) and the Arlington discharge (58,500 cfs), assuming no Jackrabbit Wash contribution.

7. Discharges were derived for the stream reach between Morristown and Arlington by attenuating the Morristown discharge uniformily downstream to the Jackrabbit Wash confluence (Figure 6). At this location, 15,600 cfs was added to the Hassayampa River flow. Downstream of Jackrabbit Wash, the increased flow was attenuated at the same rate to Arlington.

Use of the above procedure yielded 100-year discharges for the Hassayampa River of 75,000 cfs downstream of the Jackrabbit Wash confluence and 59,400 cfs upstream of the Jackrabbit Wash confluence.

At the location of the Granite Reef Aqueduct, roughly 17-miles downstream of Morristown, a 100-year discharge of 60,100 cfs is proposed. This compares favorably with the value of 50,700 cfs estimated by the U.S. Bureau of Reclamation at this location (Reference 4).

Table 2 of this report provides 100-year discharges proposed for adoption for this Flood Insurance Re-Study at several key locations along the study reach of the Hassayampa River.

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SUBJECT Q_{100} ON HASSAYAMPA RIVER @ JACKRABBIT WASH CBA #04856-07-74

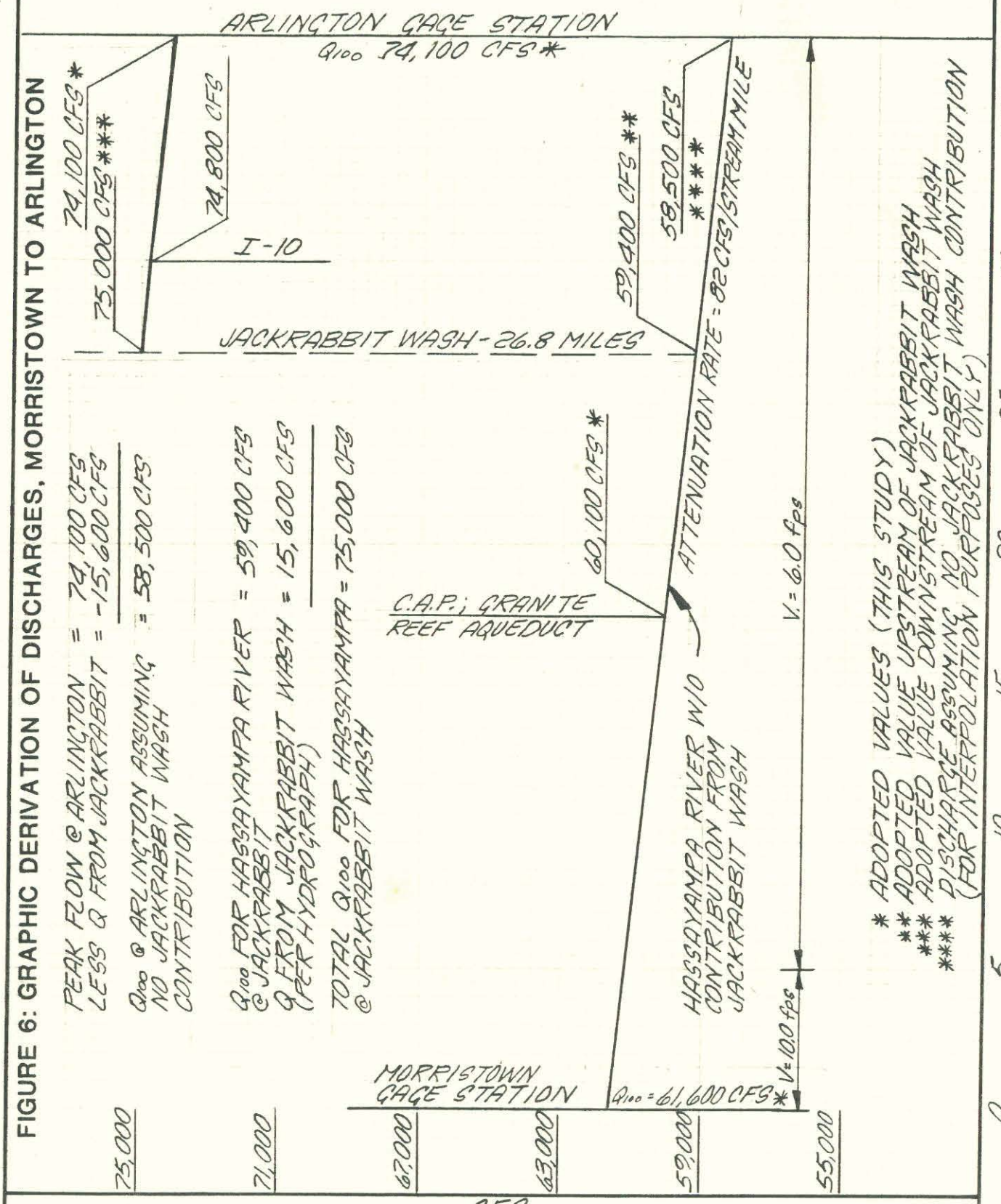

FIGURE 6: GRAPHIC DERIVATION OF DISCHARGES, MORRISTOWN TO ARLINGTON

PREPARED BY JCC DATE 4/6/88 CHECKED BY JHN SHEET NO. — OF — FIGURE # 6

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TABLE 1
COMPARISON OF DISCHARGES

Location	Study Report	Peak Discharge (cfs) 100-Year	Remarks
Sols Wash at Hassayampa River	FEMA (1977)	24,000	Prepared by U.S. Army Corps of Engineers
Sols Wash at Hassayampa River	PRC Toups (1981)	14,700	Prepared for Town of Wickenburg
Sols Wash at Hassayampa River	FEMA (1985)	15,000	Prepared by Cella Barr Associates, Flood Insurance Re-Study
Hassayampa River at Gage Station 95155 (Box Canyon)	U.S. Army C.O.E. (1972)	77,000	
Hassayampa River at Gage Station 95155 (Box Canyon)	U.S. Army C.O.E. (1975)	77,000	Used Flood Frequency curve from Indian Bend Wash
Hassayampa River at Gage Station 95155 (Box Canyon)	U.S. Bureau of Rec. (1976)	67,000	Log-Pearson Type III, 30 years of record, (Disregarded historical years 1925, 1927 & 1937)
Hassayampa River at Gage Station 95155 (Box Canyon)	PRC Toups (1981)	71,000	Log-Pearson Type III, 38 years of record, (Years 1925, 1927 & 1937 included as systematic record)
Hassayampa River at Gage Station 95155 (Box Canyon)	CBA (This study)	57,100	Log-Pearson Type III, 41 years of record, (Years 1925, 1927 & 1937 treated as historical)

TABLE 1
COMPARISON OF DISCHARGES

Location	Study Report	Peak Discharge (cfs) 100-Year	Remarks
Hassayampa River at Town of Wickenburg	U.S. Army C.O.E. (1972)	71,000	
Hassayampa River at Town of Wickenburg	U.S. Army C.O.E. (1975)	71,000	
Hassayampa River at Town of Wickenburg	FEMA (1977)	71,000	Official Flood Insurance Study Discharge
Hassayampa River at Town of Wickenburg	Toups (1981)	71,000	
Hassayampa River at Town of Wickenburg	CBA (This study)	71,000	To Be Adopted For This Study Based On FEMA Confidence Limit Criteria
Hassayampa River at Gage Station 95165 (Morristown)	U.S. Bureau of Rec. (1976)	54,000	Log-Pearson Type III, 17 Years of Record
Hassayampa River at Gage Station 95165 (Morristown)	PRC Toups	85,000	Log-Pearson Type III, 25 Years of Record
Hassayampa River at Gage Station 95165 (Morristown)	CBA (This Study)	61,600	Log-Pearson Type III, 30 years of record

TABLE 1
COMPARISON OF DISCHARGES

Location	Study Report	Peak Discharge (cfs) 100-Year	Remarks
Hassayampa River at Granite Reef Aqueduct (CAP Siphon)	U.S. Bureau of Rec. (1976)	50,700	
Hassayampa River at Granite Reef Aqueduct (CAP Siphon)	CBA (This Study)	60,100	
Hassayampa River Upstream of Jackrabbit Wash	CBA (This Study)	59,400	
Hassayampa River Downstream of Jackrabbit Wash	CBA (This Study)	75,000	
Hassayampa River at Gage Station 95170 (Arlington)	U.S. Bureau or Rec. (1976)	82,000	Log-Pearson Type III, 11 Years of Record
Hassayampa River at Gage Station 95170 (Arlington)	CBA (This Study)	74,100	Log-Pearson Type III, 22 Years of Record

TABLE 2

100-YEAR DISCHARGES AT KEY LOCATIONS ALONG HASSAYAMPA RIVER IN MARICOPA COUNTY, ARIZONA PROPOSED FOR ADOPTION FOR FLOOD INSURANCE RE-STUDY

Location	100-Year Discharge (cfs)
Town of Wickenburg	71,000
Stream Gage Station 95165 (Morristown)	61,600
Granite Reef Aqueduct	60,100
Above Jackrabbit Wash	59,400
Below Jackrabbit Wash	75,000
Interstate 10	74,800
Stream Gage Station 95170 (Arlington, Old U.S. Hwy 80)	74,100
Confluence with Gila River	74,000

ATTENUATION RATE OF 0.5 cfs / RIVER mile.

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1) U.S. Army Corps of Engineers, "Flood Plain Information Study for Maricopa County, Arizona, Volume IV, Wickenburg Report", December 1965.

2) U.S. Army Corps of Engineers, "Flood Plain Information, Hassayampa River, Vicinity of Wickenburg, Arizona", April 1972.

3) PRC Toups, "Hydrology Report, Sols Wash, Town of Wickenburg," January 6, 1981.

4) U.S. Bureau of Reclamation, "Hassayampa River Siphon Crossing", September 1976.

5) U.S. Soil Conservation Service, "Watershed Work Plan, Wickenburg Watershed, Maricopa and Yavapai Counties, Arizona," December 1974.

6) Federal Emergency Management Agency, "Flood Insurance Study, Town of Wickenburg, Arizona," July 1977.

7) U.S. Army Corps of Engineers, "Hydrology for Flood Insurance Studies, Wickenburg and Vicinity, Maricopa and Yavapai Counties, Arizona", November 1975.

8) Federal Emergency Management Agency, "Hydrologic Analysis of Sols Wash, Incorporated Town of Wickenburg, Arizona", November 1985.

9) U.S. Water Resources Council, "Guidelines for Determining Flood Flow Frequency, Bulletin #17B of the Hydrology Committee", September 1981.

10) U.S. Army Corps of Engineers, "HEC-1 Flood Hydrograph Package", January 1985.

11) Arizona Highway Department, Bridge Division, March, 1969, Hydrologic Design for Highway Drainage in Arizona.

12) Soil Conservation Service, 1976, Soil Survey of Yavapai County, Arizona: U.S. Department of Agriculture.

13) Soil Conservation Service, 1973, General Soil Map of Maricopa County, Arizona: U.S. Department of Agriculture.

14) U.S. Department of Interior, Geological Survey, 7-1/2 Minute Series Topographic Maps: Wilhoit, Groom Creek, Poland Junction, Date, Weaver Peak, Peeples Valley, Walnut Grove, Battleship Butte, Battle Flat, O'Neill Pass, Yarnell, Wagoner, Minnehaha,

Crown King, Congress SW, Flores, Sam Powell Peak, Morgan Butte, Copperopolis, Wickenburg, Red Picacho, Wickenburg SW, Wittman, White Tank Mountains NW, White Tank Mountains NE, White Tank Mountains SE, Wintersburg, Buckeye NW, Valencia, Arlington, and Hassayampa, Maricopa and Yavapai Counties, Arizona.

15) U.S. Department of Interior, Geological Survey, 15 Minute Series Topographic Maps: Aguila, Vulture Mountains, Big Horn Mountains, Belmont Mountains, White Tank Mountains, Maricopa and Yavapai Counties, Arizona.

16) Sellers, W.D. and Hill, R.H., 1974, Arizona Climate 1931-1972: The University of Arizona Press, Tucson, Arizona, p.554.

17) Federal Emergency Management Agency, Flood Insurance Study "Guidelines and Specifications for Study Contractors", September, 1985.

18) American Society of Agricultural Engineers, Paper No. 73-209, "Runoff Curve Numbers for Semi-Arid Range and Forest Conditions", by Donald E. Woodward, Hydraulic Engineer, Soil Conservation Service.

APPENDIX A

Log-Pearson Type III
Results for Gage Station 95155
(Box Canyon)

FINAL RESULTS

-PLOTTING POSITIONS- 09515500 HASSAYAMPA RIVER @ BOX CANYON

.....EVENTS ANALYZED.....				...ORDERED EVENTS...			
MON	DAY	YEAR	FLOW,CFS	RANK	WATER YEAR	FLOW,CFS	WEIBULL PLOT POS
3	3	1938	10000.	1	1970	58000.	0.0169
6	11	1946	1710.	2	1927H	27100.	0.0339
8	8	1947	2300.	3	1951	27000.	0.0508
6	5	1948	5600.	4	1925H	25500.	0.0678
9	26	1949	2910.	5	1980	24900.	0.0847
10	18	1949	5500.	6	1937H	22000.	0.1017
8	29	1951	27000.	7	1978	16000.	0.1228
12	30	1951	1590.	8	1968	11200.	0.1479
7	18	1953	865.	9	1958	10600.	0.1731
3	23	1954	3090.	10	1938	10000.	0.1983
7	23	1955	8840.	11	1979	9640.	0.2235
8	18	1956	1210.	12	1965	9060.	0.2487
8	10	1957	1980.	13	1955	8840.	0.2738
9	5	1958	10600.	14	1948	5600.	0.2990
8	24	1959	5110.	15	1974	5560.	0.3242
12	26	1959	3210.	16	1950	5500.	0.3494
8	19	1961	1150.	17	1959	5110.	0.3746
9	21	1962	1510.	18	1969	4630.	0.3998
8	17	1963	2150.	19	1976	4560.	0.4249
7	14	1964	1230.	20	1966	4110.	0.4501
9	2	1965	9060.	21	1982	3940.	0.4753
12	22	1965	4110.	22	1960	3210.	0.5005
12	7	1966	1740.	23	1954	3090.	0.5257
12	19	1967	11200.	24	1949	2910.	0.5508
9	13	1969	4630.	25	1973	2600.	0.5760
9	5	1970	58000.	26	1947	2300.	0.6012
8	25	1971	556.	27	1963	2150.	0.6264
8	27	1972	800.	28	1957	1980.	0.6516
10	7	1972	2600.	29	1967	1740.	0.6768
7	20	1974	5560.	30	1946	1710.	0.7019
7	28	1975	154.	31	1952	1590.	0.7271
2	9	1976	4560.	32	1962	1510.	0.7523
8	15	1977	315.	33	1964	1230.	0.7775
3	2	1978	16000.	34	1956	1210.	0.8027
3	28	1979	9640.	35	1961	1150.	0.8278
2	19	1980	24900.	36	1953	865.	0.8530
7	10	1981	698.	37	1972	800.	0.8782
3	15	1982	3940.	38	1981	698.	0.9034
9	19	1925	25500.	39	1971	556.	0.9286
2	16	1927	27100.	40	1977	315.	0.9538
2	7	1937	22000.	41	1975	154.	0.9789

NOTE- PLOTTING POSITIONS BASED ON-HISTORIC PERIOD (H) = 58
NUMBER OF HISTORIC EVENTS PLUS HIGH OUTLIERS(Z) = 6
WEIGHTING FACTOR FOR SYSTEMATIC EVENTS (W) = 1.4657

-OUTLIER TESTS -

LOW OUTLIER TEST

BASED ON 38 EVENTS, 10 PERCENT OUTLIER TEST VALUE K(N) = 2.661

0 LOW OUTLIER(S) IDENTIFIED BELOW TEST VALUE OF 115.9

HIGH OUTLIER TEST

BASED ON 38 EVENTS, 10 PERCENT OUTLIER TEST VALUE K(N) = 2.661

3 HIGH OUTLIER(S) IDENTIFIED ABOVE TEST VALUE OF 89460.
OR INPUT BASE OF 22000.

NOTE - COLLECTION OF HISTORICAL INFORMATION AND COMPARISONS WITH SIMILAR DATA SETS SHOULD BE EXPLORED IF NOT INCORPORATED IN THIS ANALYSIS.

STATISTICS AND FREQUENCY CURVE ADJUSTED FOR 3 HIGH OUTLIER(S)
AND 3 HISTORIC EVENT(S)

-SKEW WEIGHTING -

BASED ON 58 EVENTS, MEAN-SQUARE ERROR OF STATION SKEW = 0.096
DEFAULT OR INPUT MEAN-SQUARE ERROR OF GENERALIZED SKEW = 0.302

FINAL RESULTS
-FREQUENCY CURVE- 09515500 HASSAYAMPA RIVER @ BOX CANYON

FLOW, CFS COMPUTED	FLOW, CFS EXPECTED PROBABILITY	EXCEEDANCE PROBABILITY	CONFIDENCE LIMITS 0.05 LIMIT	CONFIDENCE LIMITS 0.95 LIMIT
108000.	140000.	0.002	264000.	57000.
76100.	93000.	0.005	174000.	42300.
57100.	66900.	0.010	123000.	32900.
41600.	46800.	0.020	83600.	25000.
29100.	31700.	0.040	54600.	18300.
16600.	17500.	0.100	28100.	11100.
9760.	10000.	0.200	15200.	6800.
3440.	3440.	0.500	4850.	2450.
1180.	1150.	0.800	1690.	760.
666.	632.	0.900	1000.	392.
413.	379.	0.950	653.	222.
166.	138.	0.990	294.	74.

FREQUENCY CURVE STATISTICS		STATISTICS BASED ON	
MEAN LOGARITHM	3.5281	HISTORIC EVENTS	3
STANDARD DEVIATION	0.5454	HIGH OUTLIERS	3
COMPUTED SKEW	-0.1145	LOW OUTLIERS	0
GENERALIZED SKEW	-0.1000	ZERO OR MISSING	0
ADOPTED SKEW	-0.1000	SYSTEMATIC EVENTS	38
		HISTORIC PERIOD	58

APPENDIX B

Log-Pearson Type III
Results for Gage Station 95165
(Morristown)

```
*********************************
* FLOOD FLOW FREQUENCY ANALYSIS *
* VERSION DATE  --  DEC 10, 1990 *
* AFTER BULLETIN 17B, SEPT 1981 *
*********************************
```

```
**TITLE CARD(S)**
TT   FLOOD FLOW FREQUENCY ANALYSIS PROGRAM
TT   FITTING THE LOG-PEARSON TYPE III DIST
TT    STREAM GAGE @ MORRISTOWN

**STATION IDENTIFICATION**
ID    09516500 HASSAYAMPA RIVER @ MORRISTOWN

**GENERALIZED SKEW**
     ISTN   GGMSE    SKEW
GS   9516   0.000   -0.10

**SYSTEMATIC EVENTS**
     30 EVENTS TO BE ANALYZED

**END OF INPUT DATA**
ED ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++-
```

FINAL RESULTS

-PLOTTING POSITIONS- 09516500 HASSAYAMPA RIVER @ MORRISTOWN

.....EVENTS ANALYZED.....				...ORDERED EVENTS...			
MON	DAY	YEAR	FLOW,CFS	RANK	WATER YEAR	FLOW,CFS	WEIBULL PLOT POS
9	6	1939	6200.	1	1970	47500.	0.0323
2	1	1940	160.	2	1984	26700.	0.0645
3	2	1941	6100.	3	1978	18000.	0.0968
8	5	1942	100.	4	1980	17000.	0.1290
8	3	1943	7700.	5	1979	9600.	0.1613
8	9	1944	3520.	6	1965	9280.	0.1935
8	2	1945	2200.	7	1943	7700.	0.2258
9	17	1946	2310.	8	1939	6200.	0.2581
8	8	1947	6000.	9	1941	6100.	0.2903
7	12	1964	4000.	10	1947	6000.	0.3226
9	2	1965	9280.	11	1968	4800.	0.3548
9	13	1966	3210.	12	1981	4800.	0.3871
9	1	1967	1150.	13	1964	4000.	0.4194
12	19	1967	4800.	14	1944	3520.	0.4516
9	13	1969	650.	15	1966	3210.	0.4839
9	5	1970	47500.	16	1983	2520.	0.5161
8	18	1971	2000.	17	1946	2310.	0.5484
8	27	1972	700.	18	1945	2200.	0.5806
10	7	1972	2000.	19	1973	2000.	0.6129
7	20	1974	650.	20	1971	2000.	0.6452
7	29	1975	50.	21	1977	1600.	0.6774
2	9	1976	800.	22	1967	1150.	0.7097
8	15	1977	1600.	23	1985	645.	0.7419

*	12	16	1978	9600.	*	25	1972	700.	0.8065	*
*	2	20	1980	17000.	*	26	1969	650.	0.8387	*
*	7	10	1981	4800.	*	27	1974	650.	0.8710	*
*	3	3	1983	2520.	*	28	1940	160.	0.9032	*
*	9	10	1984	26700.	*	29	1942	100.	0.9355	*
*	12	28	1984	848.	*	30	1975	50.	0.9677	*

****

-OUTLIER TESTS -

LOW OUTLIER TEST

BASED ON 30 EVENTS, 10 PERCENT OUTLIER TEST VALUE K(N) = 2.563

0 LOW OUTLIER(S) IDENTIFIED BELOW TEST VALUE OF 44.0

HIGH OUTLIER TEST

BASED ON 30 EVENTS, 10 PERCENT OUTLIER TEST VALUE K(N) = 2.563

0 HIGH OUTLIER(S) IDENTIFIED ABOVE TEST VALUE OF 142873.

-SKEW WEIGHTING -

BASED ON 30 EVENTS, MEAN-SQUARE ERROR OF STATION SKEW = 0.220
DEFAULT OR INPUT MEAN-SQUARE ERROR OF GENERALIZED SKEW = 0.302

FINAL RESULTS

-FREQUENCY CURVE- 09516500 HASSAYAMPA RIVER @ MORRISTOWN

.....FLOW,CFS.....			...CONFIDENCE LIMITS...	
COMPUTED	EXPECTED PROBABILITY	EXCEEDANCE PROBABILITY	0.05 LIMIT	0.95 LIMIT
110000.	148000.	0.002	356000.	49600.
80700.	102000.	0.005	241000.	38000.
61600.	74600.	0.010	172000.	30100.
45200.	52500.	0.020	118000.	23100.
31600.	35300.	0.040	75700.	16900.
17500.	18700.	0.100	37000.	9990.
9660.	10000.	0.200	18300.	5820.
2790.	2790.	0.500	4550.	1720.
692.	660.	0.800	1140.	369.
314.	285.	0.900	558.	144.
159.	135.	0.950	306.	63.
40.	28.	0.990	95.	12.

FREQUENCY CURVE STATISTICS		STATISTICS BASED ON	
MEAN LOGARITHM	3.3993	HISTORIC EVENTS	0
STANDARD DEVIATION	0.6850	HIGH OUTLIERS	0
COMPUTED SKEW	-0.5878	LOW OUTLIERS	0
GENERALIZED SKEW	-0.1000	ZERO OR MISSING	0

APPENDIX C

Log-Pearson Type III
Results for Gage Station 95170
(Arlington)

```
*********************************
* FLOOD FLOW FREQUENCY ANALYSIS *
* VERSION DATE  --  DEC 10, 1981 *
* AFTER BULLETIN 17B, SEPT 1981  *
*********************************
```

```
**TITLE CARD(S)**
TT   FLOOD FLOW FREQUENCY ANALYSIS PROGRAM
TT   FITTING THE LOG-PEARSON TYPE III DIST
TT    STREAM GAGE @ ARLINGTON

**STATION IDENTIFICATION**
ID    0951700 HASSAYAMPA RIVER @ ARLINGTON

**GENERALIZED SKEW**
     ISTN   GGMSE    SKEW
GS   9516   0.000   -0.10

**SYSTEMATIC EVENTS**
     22 EVENTS TO BE ANALYZED

**END OF INPUT DATA**
ED ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
```

FINAL RESULTS

-PLOTTING POSITIONS- 0951700 HASSAYAMPA RIVER @ ARLINGTON

.....EVENTS ANALYZED.....				..... ORDERED EVENTS			
MON	DAY	YEAR	FLOW,CFS	RANK	WATER YEAR	FLOW,CFS	WEIBULL PLOT POS
9	11	1961	50.	1	1970	39000.	0.0435
9	6	1962	470.	2	1978	20000.	0.0870
8	8	1963	1930.	3	1976	13000.	0.1304
8	14	1964	6500.	4	1973	12300.	0.1739
2	7	1965	3000.	5	1980	11200.	0.2174
12	10	1965	1600.	6	1964	6500.	0.2609
9	5	1967	5270.	7	1967	5270.	0.3043
12	20	1967	4000.	8	1977	4300.	0.3478
9	15	1969	500.	9	1968	4000.	0.3913
9	5	1970	39000.	10	1979	3300.	0.4348
8	11	1971	1230.	11	1983	3300.	0.4783
8	12	1972	225.	12	1965	3000.	0.5217
10	7	1972	12300.	13	1984	2850.	0.5652
9	20	1974	250.	14	1963	1930.	0.6087
9	26	1976	13000.	15	1966	1600.	0.6522
10	24	1976	4300.	16	1971	1230.	0.6957
3	2	1978	20000.	17	1969	500.	0.7391
11	11	1978	3300.	18	1962	470.	0.7826
2	20	1980	11200.	19	1965	372.	0.8261
9	30	1983	3300.	20	1974	250.	0.8696
9	2	1984	2850.	21	1972	225.	0.9130
12	28	1984	372.	22	1961	50.	0.9565

-OUTLIER TESTS -

LOW OUTLIER TEST

BASED ON 22 EVENTS, 10 PERCENT OUTLIER TEST VALUE K(N) = 2.429

0 LOW OUTLIER(S) IDENTIFIED BELOW TEST VALUE OF 40.8

HIGH OUTLIER TEST

BASED ON 22 EVENTS, 10 PERCENT OUTLIER TEST VALUE K(N) = 2.429

0 HIGH OUTLIER(S) IDENTIFIED ABOVE TEST VALUE OF 126898.

-SKEW WEIGHTING -

BASED ON 22 EVENTS, MEAN-SQUARE ERROR OF STATION SKEW = 0.270
DEFAULT OR INPUT MEAN-SQUARE ERROR OF GENERALIZED SKEW = 0.302

FINAL RESULTS
-FREQUENCY CURVE- 0951700 HASSAYAMPA RIVER @ ARLINGTON

FLOW, CFS COMPUTED	FLOW, CFS EXPECTED PROBABILITY	EXCEEDANCE PROBABILITY	CONFIDENCE LIMITS 0.05 LIMIT	CONFIDENCE LIMITS 0.95 LIMIT
147000.	242000.	0.002	704000.	54400.
102000.	150000.	0.005	435000.	40000.
74100.	101000.	0.010	288000.	30700.
52000.	66100.	0.020	182000.	22800.
34600.	41200.	0.040	108000.	16100.
17900.	19800.	0.100	46800.	9070.
9340.	9860.	0.200	21000.	5050.
2470.	2470.	0.500	4530.	1360.
582.	544.	0.800	1070.	262.
260.	227.	0.900	520.	97.
131.	105.	0.950	286.	40.
34.	20.	0.990	92.	7.

FREQUENCY CURVE STATISTICS		STATISTICS BASED ON	
MEAN LOGARITHM	3.3570	HISTORIC EVENTS	0
STANDARD DEVIATION	0.7190	HIGH OUTLIERS	0
COMPUTED SKEW	-0.4934	LOW OUTLIERS	0
GENERALIZED SKEW	-0.1000	ZERO OR MISSING	0
ADOPTED SKEW	-0.3000	SYSTEMATIC EVENTS	22

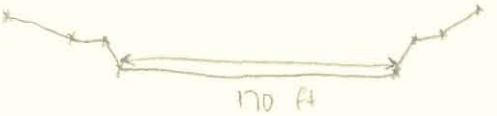
FINAL RESULTS
-FREQUENCY PLOT - 0951700 HASSAYAMPA RIVER @ ARLINGTON
BASED ON COMPUTED VALUES, FLOW IN CUBIC FEET PER SECOND

APPENDIX D

HEC-1 Input & Output Data

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
  1           ID        JACKRABBIT WASH
              *DIAGRAM
  2           IT       30 24FEB88    0000      200
  3           IO        3        0
  4           IN      120 24FEB88    0000

  5           KK        1   SUB-BASIN A
  6           KM     SCS DIMENSIONLESS UNIT HYDROGRAPH
  7           KM     RAINFALL DISTRIBUTION  SCS TYPE II
  8           KM     AREAL REDUCTION OF 0.92 HAS BEEN APPLIED
  9           KM                SUB-BASIN "A"
 10           BA     43.0
 11           PB        0
 12           PC      0.0     0.08     0.21     0.34     0.53     0.80     2.73     3.44     3.70     3.86
 13           PC     4.03     4.12     4.20
 14           LS    0.469       81
 15           UD     7.88

 16           KK        2  ROUTE A TO B
 17           RS        1     2100       -1
 18           RC    0.075      .04     .075    33350     .003
 19           RX        0       90       95      100      325      326      350      400
 20           RY     2107     2106     2104     2100     2100     2104     2106     2107

 21           KK        2  SUB-BASIN "B"
 22           BA     73.0
 23           LS    0.469       81
 24           UD     7.14

 25           KK        2  COMBINE A&B
 26           HC        2

 27           KK        3  ROUTE A+B TO C
 28           RS        1     2000       -1
 29           RC    0.075      .04    0.075    79200     .008
 30           RX        0       90       95      100      325      326      350      400
 31           RY     2007     2006     2004     2000     2000     2004     2006     2007

 32           KK        3  SUB-BASIN "C"
 33           BA     33.0
 34           LS    0.469       81
 35           UD    12.97

 36           KK        3  SUB-BASIN "D"
 37           BA    145.4
 38           LS    0.469       81
 39           UD    12.96

 40           KK        3  COMBINE C&D WITH A+B
 41           HC        3
```

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

  42          KK        4  ROUTE A+B+C+D TO E
  43          RS        1    1388       -1
  44          RC     .075    .045     .075    15500     .006
  45          RX        0      25       26       30      200      205      206      210
  46          RY     1398    1394     1394     1388     1388     1394     1394     1398

  47          KK        4  SUB-BASIN "E"
  48          BA     53.6
  49          LS    0.469      81
  50          UD    11.78

  51          KK        4  COMBINE E WITH A+B+C+D
  52          HC        2

  53          KK        5  ROUTE A+B+C+D+E TO F
  54          RS        1    1300       -1
  55          RC    0.075   0.045    0.075    26050     .008
  56          RX        0      25       26       30      200      205      206      210
  57          RY     1308    1307     1306     1300     1300     1306     1307     1308

  58          KK        5  SUB-BASIN "F"
  59          BA      4.5
  60          LS    0.469      81
  61          UD     4.23

  62          KK        5  COMBINE F TO A+B+C+D+E
  63          HC        2
  64          ZZ
```



* CN 81
* Routing Method used is = Modified Pulse

```
                 SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE        (V) ROUTING            (--->) DIVERSION
  NO.        (.) CONNECTOR          (<---) RETURN OF DIVERTED FLOW
   5              1
                  V
                  V
  16              2
                  .
                  .
  21              .            2
                  .            .
                  .            .
  25              2............
                  V
                  V
  27              3
                  .
                  .
  32              .            3
                  .            .
                  .            .
  36              .            .            3
                  .            .            .
                  .            .            .
  40              3........................
                  V
                  V
  42              4
                  .
                  .
  47              .            4
                  .            .
                  .            .
  51              4............
                  V
                  V
  53              5
                  .
                  .
  58              .            5
                  .            .
                  .            .
  62              5............
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*             FEBRUARY 1981            *
*           REVISED 30 OCT 81          *
*                                      *
*RUN DATE THU. APR 21 1988 TIME 10:14:32*
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*  THE HYDROLOGIC ENGINEERING CENTER   *
*          609 SECOND STREET           *
*        DAVIS, CALIFORNIA 95616       *
*  (916) 440-3285 OR (FTS) 448-3285    *
*                                      *
****************************************
```

```
                          JACKRABBIT WASH

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

    IT          HYDROGRAPH TIME DATA
                       NMIN          30  MINUTES IN COMPUTATION INTERVAL
                      IDATE    24FEB88  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ        200  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE    28FEB88  ENDING DATE
                     NDTIME       0330  ENDING TIME

                 COMPUTATION INTERVAL    0.50 HOURS
                      TOTAL TIME BASE   99.50 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


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

            **************
            *            *
  5 KK      *     1      *        SUB-BASIN A
            *            *
            **************
                            SCS DIMENSIONLESS UNIT HYDROGRAPH
                            RAINFALL DISTRIBUTION  SCS TYPE II
                            AREAL REDUCTION OF 0.92 HAS BEEN APPLIED
                                       SUB-BASIN "A"

  4 IN          TIME DATA FOR INPUT TIME SERIES
                      JXMIN         120  TIME INTERVAL IN MINUTES
                     JXDATE    24FEB88  STARTING DATE
                     JXTIME           0  STARTING TIME

             SUBBASIN RUNOFF DATA

 10 BA          SUBBASIN CHARACTERISTICS
                      TAREA       43.00  SUBBASIN AREA
```

```
                PRECIPITATION DATA

 11 PB                STORM        4.20  BASIN TOTAL PRECIPITATION

 12 PI              INCREMENTAL PRECIPITATION PATTERN
                      0.02      0.02      0.02      0.02      0.03      0.03      0.03      0.03      0.03      0.03
                      0.03      0.03      0.05      0.05      0.05      0.05      0.07      0.07      0.07      0.07
                      0.48      0.48      0.48      0.48      0.18      0.18      0.18      0.18      0.06      0.06
                      0.06      0.07      0.04      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      0.02

 14 LS           SCS LOSS RATE
                      STRTL        0.47  INITIAL ABSTRACTION
                     CRVNBR       81.00  CURVE NUMBER
                      RTIMP        0.00  PERCENT IMPERVIOUS AREA

 15 UD           SCS DIMENSIONLESS UNITGRAPH
                       TLAG        7.88  LAG

                                                    ***

                                                UNIT HYDROGRAPH
                                           81 END-OF-PERIOD ORDINATES
              47.       118.       228.       361.       508.       697.       917.      1168.      1461.      1748.
            1999.      2202.      2375.      2470.      2535.      2551.      2543.      2519.      2424.      2322.
            2212.      2089.      1956.      1799.      1622.      1434.      1276.      1136.      1026.       927.
             835.       756.       688.       631.       573.       518.       471.       424.       377.       345.
             313.       282.       256.       233.       209.       189.       171.       154.       138.       126.
             114.       103.        94.        85.        77.        70.        63.        57.        51.        47.
              42.        38.        35.        31.        28.        26.        24.        23.        21.        19.
              17.        15.        13.        11.        10.         8.         7.         5.         4.         2.
               0.

     ***              ***              ***              ***              ***
                        HYDROGRAPH AT STATION        1

      TOTAL RAINFALL =  4.20, TOTAL LOSS =  1.91, TOTAL EXCESS =  2.29

PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
  (CFS)       (HR)                     6-HR        24-HR        72-HR     99.50-HR
   4655.     20.50          (CFS)     4390.        2531.        883.         639.
                          (INCHES)    0.949        2.189       2.291        2.291
                           (AC-FT)    2177.        5019.       5254.        5254.

                         CUMULATIVE AREA =   43.00 SQ MI


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

            **************
            *            *
 16 KK      *         2  *        ROUTE A TO B
            *            *
            **************

               HYDROGRAPH ROUTING DATA

 17 RS           STORAGE ROUTING
                      NSTPS            1  NUMBER OF SUBREACHES
                       ITYP         2100  TYPE OF INITIAL CONDITION ELEV
                     RSVRIC        -1.00  INITIAL CONDITION
                          X         0.00 WORKING R AND D COEFFICIENT

 18 RC           NORMAL DEPTH CHANNEL ROUTING
                        ANL        0.076  LEFT OVERBANK N-VALUE
```

ANCH	0.040	MAIN CHANNEL N-VALUE
ANR	0.075	RIGHT OVERBANK N-VALUE
PLNTH	33350.	REACH LENGTH
SEL	0.0030	ENERGY SLOPE
ELMAX	0.0	MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

CROSS-SECTION DATA

		--- LEFT OVERBANK ---		+ ------ MAIN CHANNEL		------ +	--- RIGHT OVERBANK ---	
20 RY	ELEVATION	2107.00	2106.00	2104.00	2100.00	2100.00	2104.00	2106.00	2107.00
19 RX	DISTANCE	0.00	90.00	95.00	100.00	325.00	326.00	350.00	400.00

***

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE	0.00	63.54	127.24	191.10	255.11	319.27	383.60	448.07	512.71	577.50
OUTFLOW	0.00	86.85	275.50	541.07	873.26	1265.67	1713.77	2214.11	2763.91	3360.89
ELEVATION	2100.00	2100.37	2100.74	2101.11	2101.47	2101.84	2102.21	2102.58	2102.95	2103.32
STORAGE	642.44	707.56	773.69	841.32	910.46	981.11	1053.26	1130.25	1221.25	1326.80
OUTFLOW	4003.11	4690.70	5433.01	6219.89	7051.08	7926.30	8845.26	9800.69	10813.66	11890.36
ELEVATION	2103.68	2104.05	2104.42	2104.79	2105.16	2105.53	2105.89	2106.26	2106.63	2107.00

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

HYDROGRAPH AT STATION 2

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	99.50-HR
4511.	22.00	(CFS)	4242.	2469.	883.	639.
		(INCHES)	0.917	2.135	2.290	2.291
		(AC-FT)	2103.	4897.	5251.	5253.

PEAK STORAGE (AC-FT)	TIME (HR)	MAXIMUM AVERAGE STORAGE 6-HR	24-HR	72-HR	99.50-HR
691.	22.00	665.	460.	184.	133.

PEAK STAGE (FEET)	TIME (HR)	MAXIMUM AVERAGE STAGE 6-HR	24-HR	72-HR	99.50-HR
2103.96	22.00	2103.81	2102.64	2101.06	2100.77

CUMULATIVE AREA = 43.00 SQ MI

*** ***

```
            **************
            *            *
21 KK       *     2      *      SUB-BASIN "B"
            *            *
            **************
```

SUBBASIN RUNOFF DATA

22 BA SUBBASIN CHARACTERISTICS

TAREA 73.00 SUBBASIN AREA

PRECIPITATION DATA

11 PB STORM 4.20 BASIN TOTAL PRECIPITATION

12 PI INCREMENTAL PRECIPITATION PATTERN

0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03
0.03	0.03	0.05	0.05	0.05	0.05	0.07	0.07	0.07	0.07
0.48	0.48	0.48	0.48	0.18	0.18	0.18	0.18	0.06	0.06
0.06	0.07	0.04	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	0.02		

```
23 LS          SCS LOSS RATE
                    STRTL        0.47  INITIAL ABSTRACTION
                   CRVNBR       81.00  CURVE NUMBER
                    RTIMP        0.00  PERCENT IMPERVIOUS AREA

24 UD          SCS DIMENSIONLESS UNITGRAPH
                    TLAG        7.14  LAG

                                                    ***

                                                UNIT HYDROGRAPH
                                            73 END-OF-PERIOD ORDINATES
            97.      261.      490.      781.     1126.     1525.     2041.     2617.     3218.     3734.
          4145.     4472.     4666.     4747.     4765.     4733.     4581.     4378.     4152.     3901.
          3623.     3300.     2923.     2559.     2236.     1998.     1784.     1591.     1427.     1284.
          1166.     1049.      941.      844.      747.      667.      603.      538.      483.      434.
           386.      346.      310.      275.      246.      222.      198.      178.      161.      143.
           129.      116.      103.       93.       83.       73.       66.       60.       53.       49.
            45.       41.       37.       34.       30.       26.       22.       19.       16.       13.
             9.        6.        3.

   ***            ***            ***            ***            ***
                    HYDROGRAPH AT STATION        2

   TOTAL RAINFALL =  4.20, TOTAL LOSS =  1.91, TOTAL EXCESS =  2.29

PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
  (CFS)       (HR)                   6-HR       24-HR       72-HR     99.50-HR
  8471.     19.50          (CFS)    7908.       4350.       1499.       1085.
                         (INCHES)   1.007       2.216       2.291       2.291
                          (AC-FT)   3921.       8628.       8919.       8919.

                    CUMULATIVE AREA =   73.00 SQ MI
```

116 cfs/sqmile at Gap

*** ***

```
            **************
            *            *
25 KK       *        2   *      COMBINE A&B
            *            *
            **************

26 HC          HYDROGRAPH COMBINATION
                   ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                    ***

   ***            ***            ***            ***            ***
                    HYDROGRAPH AT STATION        2

PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
  (CFS)       (HR)                   6-HR       24-HR       72-HR     99.50-HR
  12679.    20.50          (CFS)   11867.       6774.       2381.       1723.
                         (INCHES)   0.951       2.172       2.290       2.291
                          (AC-FT)   5884.      13437.      14170.      14172.

                    CUMULATIVE AREA =  116.00 SQ MI
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24 hr. 59 cfs/sqmile
6 hr 102 cfs/sqmile

109 cfs/sqmile combined Gap

*** ***

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            **************
            *            *
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27 KK      *          3  *        ROUTE A+B TO C
           *             *
           **************

              HYDROGRAPH ROUTING DATA

28 RS           STORAGE ROUTING
                     NSTPS            1  NUMBER OF SUBREACHES
                      ITYP         2000  TYPE OF INITIAL CONDITION Elev
                    RSVRIC        -1.00  INITIAL CONDITION
                         X         0.00 WORKING R AND D COEFFICIENT

29 RC           NORMAL DEPTH CHANNEL ROUTING
                       ANL        0.075  LEFT OVERBANK N-VALUE
                      ANCH        0.040  MAIN CHANNEL N-VALUE
                       ANR        0.075  RIGHT OVERBANK N-VALUE
                     RLNTH       79200.  REACH LENGTH
                       SEL       0.0080  ENERGY SLOPE
                     ELMAX          0.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                   CROSS-SECTION DATA
                        --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
31 RY        ELEVATION   2007.00   2006.00   2004.00   2000.00   2000.00   2004.00   2006.00   2007.00
30 RX        DISTANCE       0.00     90.00     95.00    100.00    325.00    326.00    350.00    400.00

                                                  ***

                                   COMPUTED STORAGE-OUTFLOW-ELEVATION DATA
          STORAGE        0.00    150.90    302.18    453.82    605.83    758.22    910.97   1064.09   1217.59   1371.45
          OUTFLOW        0.00    141.82    449.89    883.57   1426.02   2066.83   2798.57   3615.62   4513.45   5488.31
        ELEVATION     2000.00   2000.37   2000.74   2001.11   2001.47   2001.84   2002.21   2002.58   2002.95   2003.32
          STORAGE     1525.69   1680.32   1837.36   1997.98   2162.17   2329.94   2501.29   2684.12   2900.24   3150.91
          OUTFLOW     6537.05   7659.88   8872.07  10157.04  11514.37  12943.59  14444.25  16004.46  17658.63  19416.88
        ELEVATION     2003.68   2004.05   2004.42   2004.79   2005.16   2005.53   2005.89   2006.26   2006.63   2007.00

   ***            ***            ***            ***            ***
                     HYDROGRAPH AT STATION        3

PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
  (CFS)       (HR)                   6-HR       24-HR       72-HR     99.50-HR
  11984.     22.00        (CFS)    11243.      6560.       2376.       1722.
                       (INCHES)     0.901      2.103       2.286       2.289
                        (AC-FT)     5575.     13012.      14140.      14163.  103 cfs/sq mi

PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
  (AC-FT)     (HR)                   6-HR       24-HR       72-HR     99.50-HR
   2217.     22.00                  2129.       1472.        613.        447.

PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
  (FEET)      (HR)                   6-HR       24-HR       72-HR     99.50-HR
 2005.28     22.00                2005.08     2003.54     2001.48     2001.08

                       CUMULATIVE AREA =  116.00 SQ MI

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

           **************
           *            *
32 KK      *          3  *        SUB-BASIN "C"
           *            *
           **************

              SUBBASIN RUNOFF DATA
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33 BA          SUBBASIN CHARACTERISTICS
                    TAREA        33.00  SUBBASIN AREA

               PRECIPITATION DATA

11 PB               STORM         4.20  BASIN TOTAL PRECIPITATION

12 PI            INCREMENTAL PRECIPITATION PATTERN
                   0.02      0.02      0.02      0.02      0.03      0.03      0.03      0.03      0.03      0.03
                   0.03      0.03      0.05      0.05      0.05      0.05      0.07      0.07      0.07      0.07
                   0.48      0.48      0.48      0.48      0.18      0.18      0.18      0.18      0.06      0.06
                   0.06      0.07      0.04      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      0.02

34 LS          SCS LOSS RATE
                    STRTL         0.47  INITIAL ABSTRACTION
                   CRVNBR        81.00  CURVE NUMBER
                    RTIMP         0.00  PERCENT IMPERVIOUS AREA

35 UD          SCS DIMENSIONLESS UNITGRAPH
                     TLAG        12.97  LAG

                                                    ***

                                                UNIT HYDROGRAPH
                                          132 END-OF-PERIOD ORDINATES
          14.       27.       48.       79.      111.      150.      191.      233.      288.      342.
         405.      478.      551.      634.      721.      806.      879.      952.     1013.     1064.
        1114.     1145.     1172.     1195.     1199.     1204.     1203.     1199.     1194.     1169.
        1141.     1113.     1081.     1049.     1014.      978.      941.      896.      850.      801.
         747.      692.      644.      598.      553.      521.      489.      459.      432.      404.
         380.      358.      336.      319.      302.      286.      269.      252.      238.      225.
         211.      197.      183.      172.      163.      154.      145.      136.      127.      120.
         114.      107.      100.       93.       88.       83.       78.       73.       68.       64.
          61.       57.       54.       50.       47.       45.       42.       40.       37.       35.
          33.       31.       29.       27.       26.       24.       23.       21.       20.       19.
          18.       17.       16.       15.       14.       13.       13.       12.       11.       11.
          10.       10.        9.        9.        8.        8.        7.        7.        6.        6.
           5.        5.        4.        4.        3.        3.        2.        2.        1.        1.
           1.        0.

   ***            ***            ***            ***            ***
                    HYDROGRAPH AT STATION        3

     TOTAL RAINFALL =  4.20, TOTAL LOSS =  1.91, TOTAL EXCESS =  2.29

PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
  (CFS)       (HR)                  6-HR       24-HR       72-HR     99.50-HR
   2457.     26.50        (CFS)    2397.       1721.        678.         490.
                        (INCHES)   0.675       1.940       2.291        2.291
                         (AC-FT)   1189.       3414.       4031.        4032.

                       CUMULATIVE AREA =   33.00 SQ MI


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

            **************
            *            *
36 KK       *     3      *      SUB-BASIN "D"
            *            *
            **************

               SUBBASIN RUNOFF DATA
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37 BA          SUBBASIN CHARACTERISTICS
                     TAREA       145.40  SUBBASIN AREA

               PRECIPITATION DATA

11 PB                STORM        4.20  BASIN TOTAL PRECIPITATION

12 PI            INCREMENTAL PRECIPITATION PATTERN
                   0.02      0.02      0.02      0.02      0.03      0.03      0.03      0.03      0.03      0.03
                   0.03      0.03      0.05      0.05      0.05      0.05      0.07      0.07      0.07      0.07
                   0.48      0.48      0.48      0.48      0.18      0.18      0.18      0.18      0.06      0.06
                   0.06      0.07      0.04      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      0.02

38 LS          SCS LOSS RATE
                     STRTL        0.47  INITIAL ABSTRACTION
                    CRVNBR       81.00  CURVE NUMBER
                     RTIMP        0.00  PERCENT IMPERVIOUS AREA

39 UD          SCS DIMENSIONLESS UNITGRAPH
                      TLAG       12.96  LAG

                                                    ***

                                                UNIT HYDROGRAPH
                                          132 END-OF-PERIOD ORDINATES
              60.       121.       210.       351.       492.       661.       842.      1028.      1270.      1511.
            1787.      2109.      2431.      2801.      3183.      3557.      3879.      4201.      4472.      4693.
            4915.      5049.      5170.      5268.      5288.      5308.      5305.      5285.      5265.      5150.
            5030.      4903.      4762.      4621.      4467.      4306.      4145.      3943.      3742.      3526.
            3285.      3043.      2831.      2630.      2434.      2293.      2152.      2020.      1899.      1778.
            1674.      1573.      1477.      1404.      1330.      1257.      1183.      1110.      1048.       987.
             927.       867.       806.       758.       717.       677.       637.       597.       560.       529.
             499.       469.       439.       409.       387.       365.       342.       320.       298.       281.
             266.       251.       236.       221.       208.       197.       185.       174.       163.       153.
             145.       137.       129.       121.       113.       106.       100.        94.        88.        82.
              77.        73.        69.        65.        61.        58.        55.        53.        50.        48.
              46.        43.        41.        38.        36.        34.        31.        29.        26.        24.
              22.        20.        18.        16.        14.        12.        10.         8.         6.         4.
               2.         0.

    ***            ***            ***            ***            ***
                     HYDROGRAPH AT STATION        3

     TOTAL RAINFALL =  4.20, TOTAL LOSS =  1.91, TOTAL EXCESS =  2.29

PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
  (CFS)       (HR)                   6-HR       24-HR       72-HR     99.50-HR
  10830.     26.00        (CFS)    10569.      7586.       2985.        2160.
                        (INCHES)    0.676      1.940       2.291        2.291
                         (AC-FT)    5241.     15047.      17763.       17764.

                      CUMULATIVE AREA =  145.40 SQ MI


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

            **************
            *            *
40 KK       *        3   *       COMBINE C&D WITH A+B
            *            *
            **************

41 HC          HYDROGRAPH COMBINATION
                     ICOMP          3  NUMBER OF HYDROGRAPHS TO COMBINE
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*** *** *** *** ***

HYDROGRAPH AT STATION 3

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	99.50-HR
23928.	23.50	(CFS)	23179.	15831.	6039.	4373.
		(INCHES)	0.732	2.000	2.288	2.290
		(AC-FT)	11494.	31401.	35932.	35959.

CUMULATIVE AREA = 294.40 SQ MI

*** ***

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            **************
            *            *
 42 KK      *     4      *      ROUTE A+B+C+D TO E
            *            *
            **************
```

HYDROGRAPH ROUTING DATA

```
 43 RS        STORAGE ROUTING
                    NSTPS          1  NUMBER OF SUBREACHES
                     ITYP       1388  TYPE OF INITIAL CONDITION ELEV
                    RSVRIC      -1.00  INITIAL CONDITION
                         X       0.00 WORKING R AND D COEFFICIENT

 44 RC        NORMAL DEPTH CHANNEL ROUTING
                      ANL      0.075  LEFT OVERBANK N-VALUE
                     ANCH      0.045  MAIN CHANNEL N-VALUE
                      ANR      0.075  RIGHT OVERBANK N-VALUE
                    RLNTH     15500.  REACH LENGTH
                      SEL     0.0060  ENERGY SLOPE
                    ELMAX        0.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION
```

CROSS-SECTION DATA

		--- LEFT OVERBANK ---		+ ------ MAIN CHANNEL -------			+ --- RIGHT OVERBANK ---		
46 RY	ELEVATION	1398.00	1394.00	1394.00	1388.00	1388.00	1394.00	1394.00	1398.00
45 RX	DISTANCE	0.00	25.00	26.00	30.00	200.00	205.00	206.00	210.00

***

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE	0.00	31.91	63.97	96.18	128.53	161.04	193.69	226.48	259.43	292.53
OUTFLOW	0.00	149.40	473.72	929.99	1500.35	2173.73	2942.26	3799.95	4742.01	5764.47
ELEVATION	1388.00	1388.53	1389.05	1389.58	1390.11	1390.63	1391.16	1391.68	1392.21	1392.74
STORAGE	325.77	359.16	393.02	427.71	463.10	499.22	536.04	573.59	611.84	650.81
OUTFLOW	6863.99	8037.66	9308.91	10674.28	12117.48	13638.01	15235.39	16909.17	18659.01	20484.57
ELEVATION	1393.26	1393.79	1394.32	1394.84	1395.37	1395.89	1396.42	1396.95	1397.47	1398.00

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

HYDROGRAPH AT STATION 4

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	99.50-HR
23925.	24.00	(CFS)	23173.	15820.	6037.	4373.
		(INCHES)	0.732	1.998	2.288	2.290
		(AC-FT)	11491.	31378.	35925.	35956.

PEAK STORAGE (AC-FT)	TIME (HR)	MAXIMUM AVERAGE STORAGE 6-HR	24-HR	72-HR	99.50-HR

```
   724.     24.00                    708.        542.        241.        175.

PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
  (FEET)      (HR)                    6-HR        24-HR       72-HR     99.50-HR
 1398.99     24.00                 1398.78     1396.43     1391.80     1390.76

                        CUMULATIVE AREA =  294.40 SQ MI


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

            **************
            *            +
 47 KK      *         4  +       SUB-BASIN "E"
            *            +
            **************

              SUBBASIN RUNOFF DATA

 48 BA          SUBBASIN CHARACTERISTICS
                      TAREA       53.60  SUBBASIN AREA

                PRECIPITATION DATA

 11 PB                STORM        4.20  BASIN TOTAL PRECIPITATION

 12 PI            INCREMENTAL PRECIPITATION PATTERN
                     0.02      0.02      0.02      0.02      0.03      0.03      0.03      0.03      0.03      0.03
                     0.03      0.03      0.05      0.05      0.05      0.05      0.07      0.07      0.07      0.07
                     0.48      0.48      0.48      0.48      0.18      0.18      0.18      0.18      0.06      0.06
                     0.06      0.07      0.04      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      0.02

 49 LS          SCS LOSS RATE
                      STRTL        0.47  INITIAL ABSTRACTION
                     CRVNBR       81.00  CURVE NUMBER
                      RTIMP        0.00  PERCENT IMPERVIOUS AREA

 50 UD          SCS DIMENSIONLESS UNITGRAPH
                       TLAG       11.78  LAG

                                                  ***

                                              UNIT HYDROGRAPH
                                         120 END-OF-PERIOD ORDINATES
              27.       54.      102.      164.      230.      311.      391.      493.      600.      721.
             864.     1007.     1176.     1346.     1501.     1644.     1781.     1879.     1977.     2042.
            2096.     2134.     2143.     2152.     2144.     2135.     2102.     2049.     1994.     1931.
            1868.     1799.     1728.     1651.     1561.     1472.     1366.     1259.     1160.     1071.
             984.      921.      859.      802.      749.      697.      653.      608.      574.      541.
             509.      476.      444.      417.      390.      363.      336.      312.      294.      276.
             258.      240.      224.      211.      198.      184.      171.      160.      150.      140.
             130.      120.      113.      106.       99.       93.       86.       81.       76.       71.
              66.       62.       58.       55.       51.       47.       44.       41.       39.       36.
              33.       31.       29.       28.       26.       24.       23.       22.       21.       20.
              19.       17.       16.       15.       14.       13.       12.       11.       10.        9.
               8.        7.        7.        6.        5.        4.        3.        2.        1.        0.

     ***            ***            ***            ***            ***
                     HYDROGRAPH AT STATION        4

     TOTAL RAINFALL =  4.20, TOTAL LOSS =  1.91, TOTAL EXCESS =  2.29

PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
  (CFS)       (HR)                    6-HR        24-HR       72-HR     99.50-HR
```

```
 4301.     25.00        (CFS)     4178.       2886.       1101.        796.
                     (INCHES)     0.725       2.003       2.291       2.291
                      (AC-FT)     2072.       5725.       6549.       6549.

                      CUMULATIVE AREA =   53.60 SQ MI


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

          **************
          *            *
 51 KK    *         4  *       COMBINE E WITH A+B+C+D
          *            *
          **************

 52 HC          HYDROGRAPH COMBINATION
                     ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                          ***

    ***             ***             ***             ***             ***
                       HYDROGRAPH AT STATION        4

PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
  (CFS)       (HR)                  6-HR       24-HR       72-HR     99.50-HR
  28179.     24.00        (CFS)    27330.      18703.       7137.       5169.
                     (INCHES)     0.730       1.999       2.288       2.290
                      (AC-FT)    13552.      37097.      42471.      42505.

                      CUMULATIVE AREA =  348.00 SQ MI


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

          **************
          *            *
 53 KK    *         5  *       ROUTE A+B+C+D+E TO F
          *            *
          **************

            HYDROGRAPH ROUTING DATA

 54 RS          STORAGE ROUTING
                     NSTPS           1  NUMBER OF SUBREACHES
                      ITYP        1300  TYPE OF INITIAL CONDITION ELEV
                    RSVRIC       -1.00  INITIAL CONDITION
                         X        0.00 WORKING R AND D COEFFICIENT

 55 RC          NORMAL DEPTH CHANNEL ROUTING
                       ANL       0.075  LEFT OVERBANK N-VALUE
                      ANCH       0.045  MAIN CHANNEL N-VALUE
                       ANR       0.075  RIGHT OVERBANK N-VALUE
                     RLNTH      26050.  REACH LENGTH
                       SEL      0.0080  ENERGY SLOPE
                     ELMAX         0.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                   CROSS-SECTION DATA
                        --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------ + --- RIGHT OVERBANK ---
 57 RY        ELEVATION   1308.00   1307.00   1306.00   1300.00   1300.00   1306.00   1307.00   1308.00
 56 RX        DISTANCE       0.00     25.00     26.00     30.00    200.00    205.00    206.00    210.00

                                                          ***

                                COMPUTED STORAGE-OUTFLOW RELATIONSHIP ----
```

STORAGE	0.00	42.89	85.93	129.13	172.50	216.02	259.70	303.54	347.54	391.70
OUTFLOW	0.00	118.96	377.31	740.88	1195.53	1732.46	2345.45	3029.76	3781.56	4597.73
ELEVATION	1300.00	1300.42	1300.84	1301.26	1301.68	1302.11	1302.53	1302.95	1303.37	1303.79
STORAGE	436.01	480.49	525.12	569.92	614.87	660.00	705.33	751.08	799.35	850.69
OUTFLOW	5475.60	6412.88	7407.55	8457.84	9562.15	10748.39	11999.88	13306.28	14670.47	16096.37
ELEVATION	1304.21	1304.63	1305.05	1305.47	1305.89	1306.32	1306.74	1307.16	1307.58	1308.00

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HYDROGRAPH AT STATION 5

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	99.50-HR
28126.	24.50	(CFS)	27276.	18671.	7134.	5168.
		(INCHES)	0.729	1.995	2.287	2.290
		(AC-FT)	13525.	37034.	42451.	42499.

PEAK STORAGE (AC-FT)	TIME (HR)	MAXIMUM AVERAGE STORAGE 6-HR	24-HR	72-HR	99.50-HR
1284.	24.50	1253.	942.	419.	305.

PEAK STAGE (FEET)	TIME (HR)	MAXIMUM AVERAGE STAGE 6-HR	24-HR	72-HR	99.50-HR
1311.55	24.50	1311.30	1308.70	1303.92	1302.86

CUMULATIVE AREA = 348.00 SQ MI

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*            *
*     5      *      SUB-BASIN "F"
*            *
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58 KK

SUBBASIN RUNOFF DATA

59 BA

SUBBASIN CHARACTERISTICS

TAREA	4.50	SUBBASIN AREA

PRECIPITATION DATA

11 PB

STORM	4.20	BASIN TOTAL PRECIPITATION

12 PI

INCREMENTAL PRECIPITATION PATTERN

0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03
0.03	0.03	0.05	0.05	0.05	0.05	0.07	0.07	0.07	0.07
0.48	0.48	0.48	0.48	0.18	0.18	0.18	0.18	0.06	0.06
0.06	0.07	0.04	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	0.02		

60 LS

SCS LOSS RATE

STRTL	0.47	INITIAL ABSTRACTION
CRVNBR	81.00	CURVE NUMBER
RTIMP	0.00	PERCENT IMPERVIOUS AREA

61 UD

SCS DIMENSIONLESS UNITGRAPH

TLAG	4.23	LAG

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UNIT HYDROGRAPH
44 END-OF-PERIOD ORDINATES

18.	59.	112.	186.	282.	374.	441.	478.	485.	476.
442.	402.	354.	294.	236.	194.	161.	134.	[illegible]	[illegible]

80.	66.	55.	46.	38.	32.	26.	22.	18.	15.
13.	11.	9.	7.	6.	5.	5.	4.	3.	3.
2.	2.	1.	0.						

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

HYDROGRAPH AT STATION 5

TOTAL RAINFALL = 4.20, TOTAL LOSS = 1.91, TOTAL EXCESS = 2.29

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	99.50-HR
747.	16.50	(CFS)	634.	276.	92.	67.
		(INCHES)	1.309	2.282	2.291	2.291
		(AC-FT)	314.	548.	550.	550.

CUMULATIVE AREA = 4.50 SQ MI

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            **************
            *            *
 62 KK      *     5      *      COMBINE F TO A+B+C+D+E
            *            *
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63 HC HYDROGRAPH COMBINATION

ICOMP 2 NUMBER OF HYDROGRAPHS TO COMBINE

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HYDROGRAPH AT STATION 5

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	99.50-HR
28338.	24.50	(CFS)	27476.	18839.	7225.	5235.
		(INCHES)	0.725	1.988	2.287	2.290
		(AC-FT)	13624.	37367.	42993.	43049.

CUMULATIVE AREA = 352.50 SQ MI

80.39 cfs/sq mi F Cr

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	1	4655.	20.50	4390.	2531.	883.	43.00		
ROUTED TO	2	4511.	22.00	4242.	2469.	883.	43.00	2103.96	22.00
HYDROGRAPH AT	2	8471.	19.50	7908.	4350.	1499.	73.00		
2 COMBINED AT	2	12679.	20.50	11867.	6774.	2381.	116.00		
ROUTED TO	3	11984.	22.00	11243.	6560.	2376.	116.00	2005.28	22.00
HYDROGRAPH AT	3	2457.	26.50	2397.	1721.	678.	33.00		
HYDROGRAPH AT	3	10830.	26.00	10569.	7586.	2985.	145.40		
3 COMBINED AT	3	23928.	23.50	23179.	15831.	6039.	294.40		
ROUTED TO	4	23925.	24.00	23173.	15820.	6037.	294.40	1398.99	24.00
HYDROGRAPH AT	4	4301.	25.00	4178.	2886.	1101.	53.60		
2 COMBINED AT	4	28179.	24.00	27330.	18703.	7137.	348.00		
ROUTED TO	5	28126.	24.50	27276.	18671.	7134.	348.00	1311.55	24.50
HYDROGRAPH AT	5	747.	16.50	634.	276.	92.	4.50		
2 COMBINED AT	5	28338.	24.50	27476.	18839.	7225.	352.50		

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