HYDROLOGY REPORT
INCLUDING APPROVAL LETTERS

FOR

FLOOD INSURANCE STUDY
NEW RIVER
FROM NEW RIVER DAM TO ROCK SPRINGS
MARICOPA COUNTY, ARIZONA

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4550 NORTH 12TH STREET
PHOENIX, ARIZONA 85014
TELEPHONE (602) 264-6831

ATTACHMENT 8

HYDROLOGY REPORT
INCLUDING APPROVAL LETTERS

FOR

FLOOD INSURANCE STUDY
NEW RIVER
FROM NEW RIVER DAM TO ROCK SPRINGS
MARICOPA COUNTY, ARIZONA

OCTOBER, 1987

JOB 1090-01
CVL-4-0056

Rec'd-
4-1-87
CVL

Federal Emergency Management Agency

Washington, D.C. 20472

MAR 30 1987

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Ashok C. Patel, P.E.
Senior Vice President
Coe and Van Loo Consulting Engineers, Inc.
4550 North 12th Street
Phoenix, Arizona 85014

Dear Mr. Patel:

This is in response to your letter dated February 2, 1987, to the Federal Emergency Management Agency (FEMA). In this letter you requested that FEMA review the report entitled "Hydrology Report for New River Upstream of New River Dam" dated January 21, 1987, prepared by Coe and Van Loo Consulting Engineers, Inc. (CVL), and confirm your understanding of the FEMA requirements for the level of detail to be used in the analysis of areas previously studied by approximate methods in the Flood Insurance Study (FIS).

In a report entitled "Hydrology Part 2, Gila River Basin, Phoenix, Arizona and Vicinity," dated 1982, the U.S. Army Corps of Engineers (COE) presented an analysis of the impacts of the New River Dam on the peak discharges of the 100-year recurrence interval flood along the New River downstream of the dam. Included in this report was a determination of the peak inflow discharge of the 100-year flood upstream of the dam. Our review indicates that the 100-year discharge at the New River Dam inflow obtained from the HEC-1 rainfall-runoff computer model contained in the CVL report agrees well with the COE value. Therefore, it is felt that the peak discharge values for the 10-, 50-, 100-, and 500-year floods in the subject reach as reported by CVL are appropriate for use in the hydraulic analysis of the New River in the 26 mile reach upstream of the New River Dam. Please note that our review indicates a slight discrepancy between the discharge values reported in the summary of discharges on Table 5 of the CVL report and the HEC-1 printout. The discharges contained in the HEC-1 printout should be used in the hydraulic analysis.

You also inquired if the 10-, 50-, and 500-year recurrence interval profiles are required in addition to the 100-year recurrence interval profile. For a detailed study of the referenced New River reach we recommend that the 10-, 50-, and 500-year profiles also be determined. This determination must be based on a hydraulic computer model which computes water-surface profiles considering the effects of backwater and structures. In addition, an equal conveyance loss floodway should be determined.

We have discussed the development potential along the New River with our regional office in San Francisco and the Maricopa County Flood Control District, and believe this level of detail study will be adequate to meet the future needs of the county by providing the county with additional tools for use in the administration of sound floodplain management practices.

Should you have any questions regarding this matter, please do not hesitate to contact Mr. Philip Myers of my staff in Washington, D.C., at (202) 646-2755.

Sincerely,

John L. Matticks
Chief, Risk Studies Division
Federal Insurance Administration

cc: Mr. Dan Sagramoso, P.E.
Floodplain Administrator
Flood Control District of Maricopa County
Mr. George L. Campbell, Chairman
Maricopa County Board of Supervisors
Mr. James Morris, P.E.
National Flood Insurance Program
Arizona Department of Water Resources

HYDROLOGY REPORT
FOR
NEW RIVER UPSTREAM OF NEW RIVER DAM

January 21, 1987

Prepared For:
Federal Emergency Management Agency
Risk Studies Division
Federal Insurance Administration
500 C Street, SW Room 422
Washington, D.C. 20472

Submitted By:
Coe & Van Loo Consulting Engineers, Inc.
4550 North 12th Street
Phoenix, AZ 85014
(602) 264-6831

on behalf of:
Maricopa County Flood Control District
3335 W. Durango
Phoenix, AZ 85009
(602) 262-1501

Job #1090-01
CVL #4/26/2

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February 2, 1987

Mr. John Matticks, Acting Chief
Federal Emergency Management Agency (FEMA)
Risk Studies Division
Federal Insurance Administration
500 C Street, SW Room 422
Washington, D.C. 20472

Attn: Mr. Philip Myers

CERTIFIED MAIL

Re: New River FIS
New River Upstream of New River Dam (26 Miles)
Maricopa County, AZ (Community No. 040037)

Gentlemen:

As you are aware, Coe and Van Loo Consulting Engineers, Inc., (CVL) has been retained by the Flood Control District of Maricopa County (FCDMC) to perform a detailed study of New River for the referenced reach.

The referenced reach has currently been designated as Zone "A" on the FIRM Panels 040037-0175A, 0400A, 0425A, and 0635A, dated July 2, 1979.

It is the intent of FCDMC to study in detail, per FEMA Guidelines, the referenced reach including:

1. Prepare detailed hydrologic analysis.
2. Prepare new topographic mapping.
3. Perform hydraulic analysis to establish 100-year floodplain and floodzone.
4. Submit above data and report to your office for review and approval.

We are therefore submitting a copy of detailed hydrologic study for your review and approval.

It is our understanding, in accordance with the recent guidelines, that for those study areas currently defined as Zone "A" by approximate methods and any future new study areas, FEMA requires the 100-year floodplain and floodway delineations. Flood profiles for the 10-, 50- and 500-year sotrms, however, are no longer required. We respectfully request that our understanding of these requirements be confirmed by your office.

Should you need any further information on the documents submitted herewith, please do not hesitate to call.

Very truly yours,

COE & VAN LOO
Consulting Engineers, Inc.

Ashok C. Patel, P.E., L.S.
Senior Vice President

ACP/ls
2/30/62

Enclosure

CC: Ray Lenaburg, FEMA Region IX
Dan Sagramoso, FCDMC
Dave Johnson, FCDMC
Doug Plasencia, FCDMC

CVL

TABLE OF CONTENTS

INTRODUCTION

STUDY LOCATION

PREVIOUS STUDIES

CURRENT STUDY
- Log-Pearson Type III Analysis
- Comparisions with Similar Watersheds
- Flood Estimates from Precipitation

RESULTS AND RECOMMENDATIONS

BIBLIOGRAPHY

FIGURES

1. Location Map

2. Watershed Map

TABLES

1. Annual maximum discharges (cfs) for New River near Rock Springs and for New River at New River.
2. Statistical parameters determined from log-Pearson Type 3 analysis of annual maximum flows of New River near Rock Springs and at New River.
3. Estimated flows (cfs) from log-Pearson Type 3 analysis for New River near Rock Springs and at New River.
4. 24 hour precipitation values (inches).
5. Discharge values obtained from rainfall-runoff model of New River drainage basin.

APPENDIX

1. Discharge-Frequency Curves

2. Sub-basin Characteristics

3. HEC-1 Computer Printouts

INTRODUCTION

An accurate estimate of the potential for flood damage is a key element in a effective flood damage abatement program. Provided with an estimate of the potential discharge at a site for a given return period, it is possible to perform a backwater analysis and thereby determine the area which would be subjected to flooding by that discharge. In order for municipalities to qualify for the Federal flood insurance program, the Federal Emergency Management Agency (FEMA) requires that such an analysis be conducted and floodways and floodplains be delineated through these areas.

This report relates the results of a study undertaken by the Flood Control District of Maricopa County (FCDMC) to determine the estimated 100-year discharge at points along the New River watercourse in central Arizona. The peak discharge for the 500 year event has also been developed. This study has been submitted to FEMA by the study contractor, Coe & Van Loo Consulting Engineers, Inc., (CVL) for their review and approval. It is proposed that these discharges be used in the determination of water surface elevations in accordance with the FEMA Guidelines and Specifications.

CVL has been contracted with FCDMC to perform a Flood Insurance Study of New River upstream of New River Dam (See Location Map, Figure 1).

STUDY LOCATION

New River is located in north central Maricopa County, Arizona. From its headwaters in the New River Mountains, it flows generally southwest approximately 40 miles to its confluence with Skunk Creek. New River Dam is located about 9 miles upstream from this confluence. The New River drainage basin above the dam site has an areal extent of 170 square miles, the upper 40 per cent of which are mountainous. Stream gradients decrease from 370 feet per

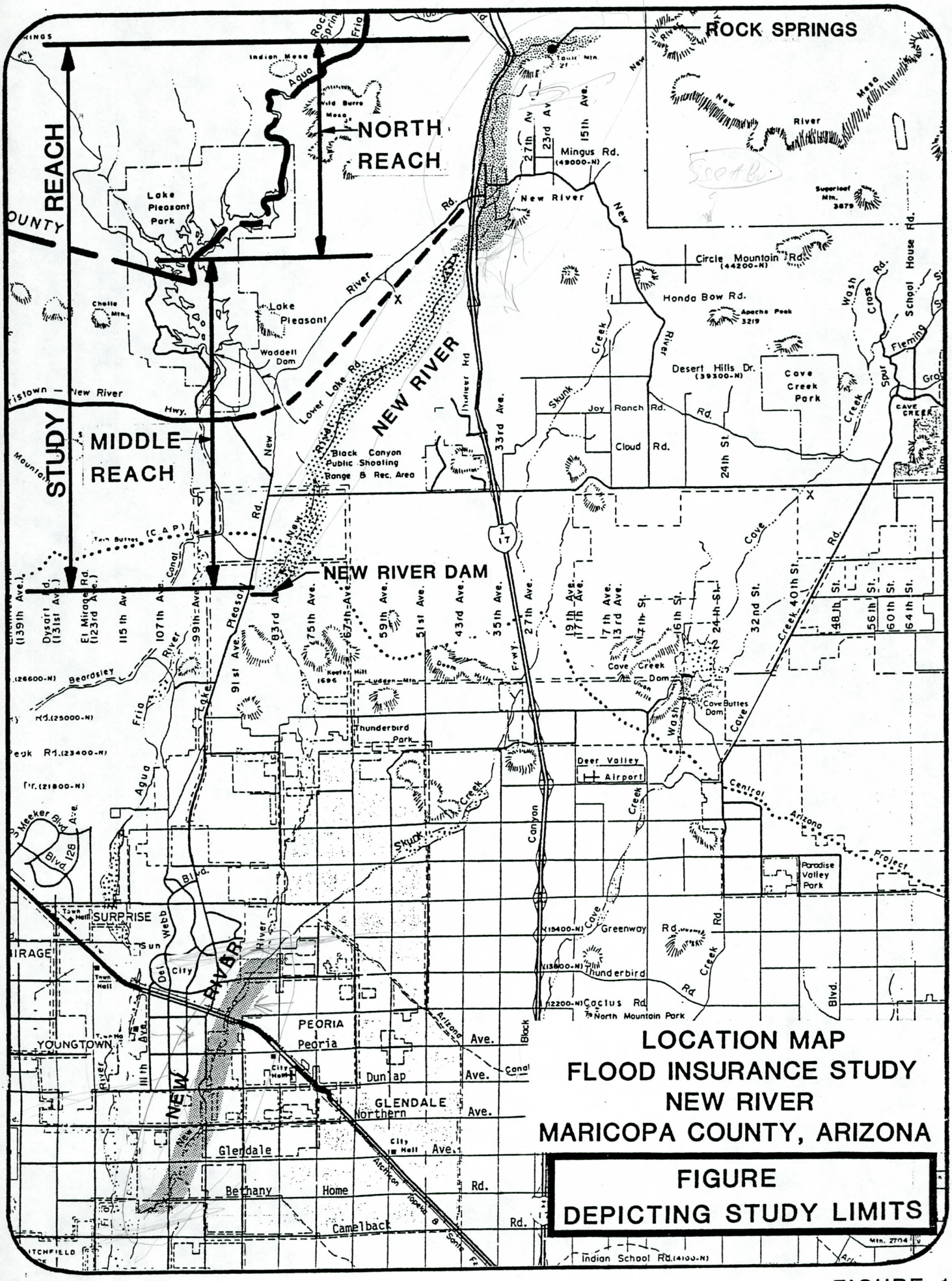

ROCK SPRINGS
NORTH REACH
MIDDLE REACH
STUDY REACH
NEW RIVER DAM
NEW RIVER
Lake Pleasant Park
Lake Pleasant
Waddell Dam
Black Canyon Public Shooting Range & Rec. Area
Mingus Rd.
Circle Mountain Rd.
Honda Bow Rd.
Desert Hills Dr.
Cave Creek Park
Joy Ranch Rd.
Cloud Rd.
Thunderbird Park
Deer Valley Airport
Paradise Valley Park
Greenway Rd.
Thunderbird Rd.
Cactus Rd.
North Mountain Park
SURPRISE
YOUNGTOWN
PEORIA
GLENDALE
Peoria Ave.
Dunlap Ave.
Northern Ave.
Glendale Ave.
Bethany Home Rd.
Camelback Rd.
Indian School Rd.
Beardsley
Dysart Rd.
El Mirage Rd.
Cave Buttes Dam
Cave Creek Dam
Central Arizona Project Canal
Arizona Canal
Black Canyon Freeway
Skunk Creek
Cave Creek
Agua Fria River
Lower Lake Rd.
Thunderbird Rd.
Fleming Spur
Cave Creek Wash
Cross Rd.
School House Rd.
Indian Mesa
Wild Burro Mesa
Cholla Mtn.
Tonto Mtn.
Sugarloaf Mtn. 3879
Apache Peak 3219
Kaiser Hill 1696
Ludden Mtn.
Twin Buttes (C.A.P.)
Meeker Blvd.
Sun City
Del Webb Blvd.
Town Hall
City Hall
Santa Fe
Arizona Canal
Canal
Rd.
Blvd.
Ave.
St.
I-17
LOCATION MAP
FLOOD INSURANCE STUDY
NEW RIVER
MARICOPA COUNTY, ARIZONA
FIGURE
DEPICTING STUDY LIMITS

FIGURE 1

mile in this area to nearly 10 feet per mile in the broad plain between the community of New River and the dam site.

The climate in this locale is primarily semi-desert with the annual precipitation averaging about 11 inches and occuring predominantly in the summer or winter months. The summer storms are associated with moist air masses that enter the state from the Gulf of Mexico producing moderate to intense afternoon and evening thundershowers. Winter precipitation originates from the Pacific Ocean is is generally much less severe.

PREVIOUS STUDIES

Estimates of the 100-year flood (20,750 cfs) and Standard Project Flood (SPF) (45,000 cfs) at New River were given in a U.S. Army Corps of Engineers (COE) Floodplain Information Study in 1967 (Ref. 1). After the 1970 flooding event at New River (19,500 cfs), it was felt by local floodplain administrators that the existing 100-year estimate was inaccurate. As part of the design work for New River Dam, estimates of the 100-year (53,000 cfs) and SPF (76,000 cfs) at the dam site were developed by the COE in 1974 (Ref. 2). Rather than completing an exhaustive study or adjusting the hydrograph at the dam site for the change in watershed area and other watershed characteristics, the 100-year discharge estimate at the dam site was merely transposed to the community of New River and an interim floodplain delineation was established based upon the 1974 COE hydrology.

CURRENT STUDY

Log-Pearson Type III Analysis

A statistical analysis of the recorded flows for New River near Rock Springs and for New River at the community of New River was conducted as set forth in

Bulletin 17B (Ref. 3). The drainage area for the former gage is 67.3 square miles and that for the latter, located approximately 6.5 miles downstream, is 83.3 square miles. The annual maximum recorded flows for these two stations are presented in Table 1. The statistical parameters determined in this analysis are presented in Table 2. The estimated discharges with return periods of 10, 50, 100 and 500 years are presented in Table 3. The discharge-frequency curves (Plates 1, 2) developed from this analysis are provided in Appendix 1.

It should be noted that records exist for both of these stations for the twenty-one year period extending from 1962-82, and that in only 5 of these years is the flow at New River less than it is at the station near Rock Springs. However, the log-Pearson analysis indicates that the 100-year flood event at the community of New River is 18,000 cfs less than at the station near Rock Springs, a not too plausible estimate. This apparent misestimation is due to the fact that the standard deviation and the weighted skew are much larger for the station near Rock Springs than for the station at the community of New River.

TABLE 1. Annual maximum discharges (cfs) for New River near Rock Springs and for New River near community of New River.

Year	near Rock Springs	near Community of New River
1961	--	325
1962	1050	1430
1963	765	4620
1964	4900	4380
1965	1510	1990
1966	4020	4180
1967	425	1420
1968	10600	12600
1969	1530	1310
1970	18600	19500
1971	6320	5090
1972	231	525
1973	1550	4250
1974	68	49
1975	1570	2280
1976	3230	7050
1977	4	805
1978	13600	18000
1979	6530	5560
1980	9350	14900
1981	35	0
1982	1760	2510
1983	12500	--
1984	692	--

Table 2. Statistical parameters determined from log-Pearson Type 3 analysis of annual maximum flows of New River near Rock Springs near community of New River.

	near Rock Springs	near Community of New River
Length of record	23 years	22 years
Length of record used in final analysis*	22 years	20 years
Mean of log of flows	3.2122	3.4398
Standard deviation	0.7986	0.5418
Weighted Skew	-0.5	-0.2

*After deletion of zero flow data and low/high outliers.

Table 3. Estimated flows (cfs) from log-Pearson Type 3 analysis for New River near Rock Springs and near the Community of New River.

	10 year	50 year	100 year	500 year
near Rock Springs	15256	42800	59325	108516
near Community of New River	13329	31160	41692	73854

Comparisons with similar watershed

Due to the paucity of stream gage data in this area and the dissimilarities in watersheds and climatological conditions, comparisons with other watersheds were not thought to be of any great worth and therefore were not made.

Flood estimates from precipitation

A rainfall-runoff model of the New River drainage basin was created using the HEC-1 Flood Hydrograph Package (Ref. 4). Precipitation excess was determined using the Soil Conservation Service Curve Number method. For this modeling effort it was assumed that the t-year flood resulted from the t-year rainfall event. A complete description of the modeling process follows.

The New River drainage basin above New River Dam can be broadly divided into two topographic regions: the upper portion (above community of New River) which is a rugged mountainous region with steep channel slopes, and the lower portion which is a flat desert plain with very braided channels and mild channel slopes. The upper portion of the basin (see Figure 2, Watershed Map) was divided into 21 sub-basins and unit hydrographs were developed from the Corps of Engineers (COE) Phoenix Mountain S-hydrography (Ref. 2) for each of these sub-basins. The lower portion was divided into 33 sub-basins. Inasmuch as sheetflow is the dominant form of runoff in this area, most of these sub-basins were modeled using the kinematic wave option of HEC-1. Where this was determined not to be the appropriate methodology, unit hydrographs were developed from the COE Phoenix Valley S-hydrograph (Ref. 2). Appendix 2 contains a summarized listing of the more important sub-basin characteristics.

Area adjusted 100-year rainfall values for 6-, 12-, and 24-hour storm were determined for both the upper and loer basins using NOAA Atlas 2 (Ref. 5). It was assumed that these rainfall events had Type II storm distributions.

The model was calibrated by adjusting the curve numbers of the sub-basins so that the peak discharge at New River Dam matched the COE 1974 estimate at that site. The 24-hour storm was used for this calibration procedure.

As an indication of the validity of this modeling effort it is worth noting that the curve numbers used agree with those recommended by the Arizona Highway Department (Ref. 6), and that the timing of the peak discharge at the dam site closely matches the time of peak discharge generated by the COE study (Ref. 2).

After the calibration procedure, the model was run again for the 6- and 12-hour storms in order to determine if these events generated higher peak discharges. As expected, the 24-hour storm resulted in the highest peak discharge. The model was then run using 10-, 50- and 500-year, 24-hour precipitation values in order to obtain estimates of the floods with those return intervals. These precipitation values for both the upper and lower drainages are presented in Table 4.

The 500-year, 24-hour precipitation values were obtained by: 1) converting the partial-duration series rainfall values with return periods of 2-, 5- and 10-years to annual series values, 2) plotting these values along with the 25-, 50-, and 100-year values on extreme-value probability paper, and 3) extrapolating the 500-year value from this plot.

Table 4. 24 hour precipitation values (inches).

Return Period	Upper Basin	Lower Basin
10 Years	3.50	3.00
50 Years	4.45	4.10
100 Years	4.95	4.40
500 Years	6.32	5.78

Reduction factor of 0.94 used for upper and lower basins.

Table 5. Discharge values obtained from rainfall-runoff model of New River drainage basin.

Return Period	at Community of New River	at New River Dam
10 Years	20645 cfs	29270 cfs
50 Years	28420 cfs	49025 cfs
100 Years	32480 cfs	55560 cfs
500 Years	47110 cfs	84125 cfs

RESULTS AND RECOMMENDATIONS

A copy of the HEC-1 model inputs and outputs for the 100 year rainfall event is presented in Appendix 3. Results of the model runs for the 10, 50, 100 and 500 year storms are presented in Table 5.

It is recommended that the discharge values determined in this study be adopted by FEMA for the purpose of Flood Insurance Study.

BIBLIOGRAPHY

1. Flood Plain Information Study for Maricopa County, Arizona, Volume V, New River Report, Corps of Engineers, U.S. Army, Los Angeles, April 1967.

2. Gila River Basin, New River and Phoenix City Streams, Arizona, Design Memorandum No. 2, Hydrology, Part 1, U.S. Army Engineer District, Los Angeles, Corps of Engineers, October 1974.

3. Guidelines for Determining Flood Flow Frequencies, Bulletin 17B of the Hydrology Subcommittee, Interagency Advisory Committee on Water Data, March 1982.

4. HEC-1 Flood Hydrograph Package, User's Manual, Hydrologic Engineering Center, U.S. Army Corps of Engineers, January 1985.

5. Precipitation-Frequency ATlas of the Western United States, NOAA Atlas 2, Volume VIII-Arizona, National Weather Service, 1973.

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

7. Gila River Basin, New River and Phoenix City Streams, Arizona, Design Memorandum 3, General Design Memorandum - Phase I, Plan Formulation, U.S. Army Engineer District, Los Angeles, Corps of Engineers, July 1976.

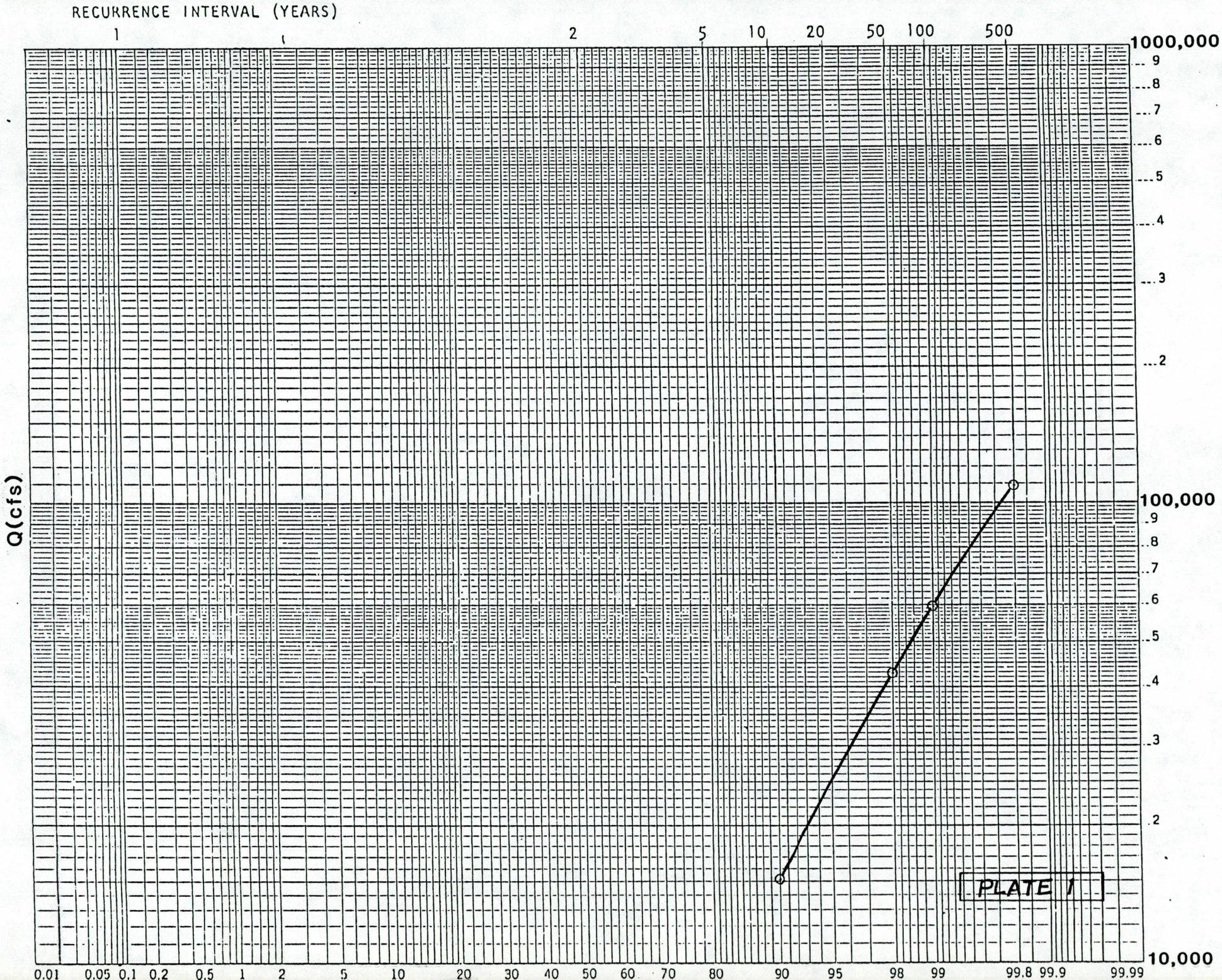
8. Gila River Basin, Phoenix, Arizona and Vicinity (including New River), Skunk Creek and the New and Agua Fria Rivers, Design Memorandum No. 3, General Design Memorandum - Phase II, Project Design - Part 4, May 1986.

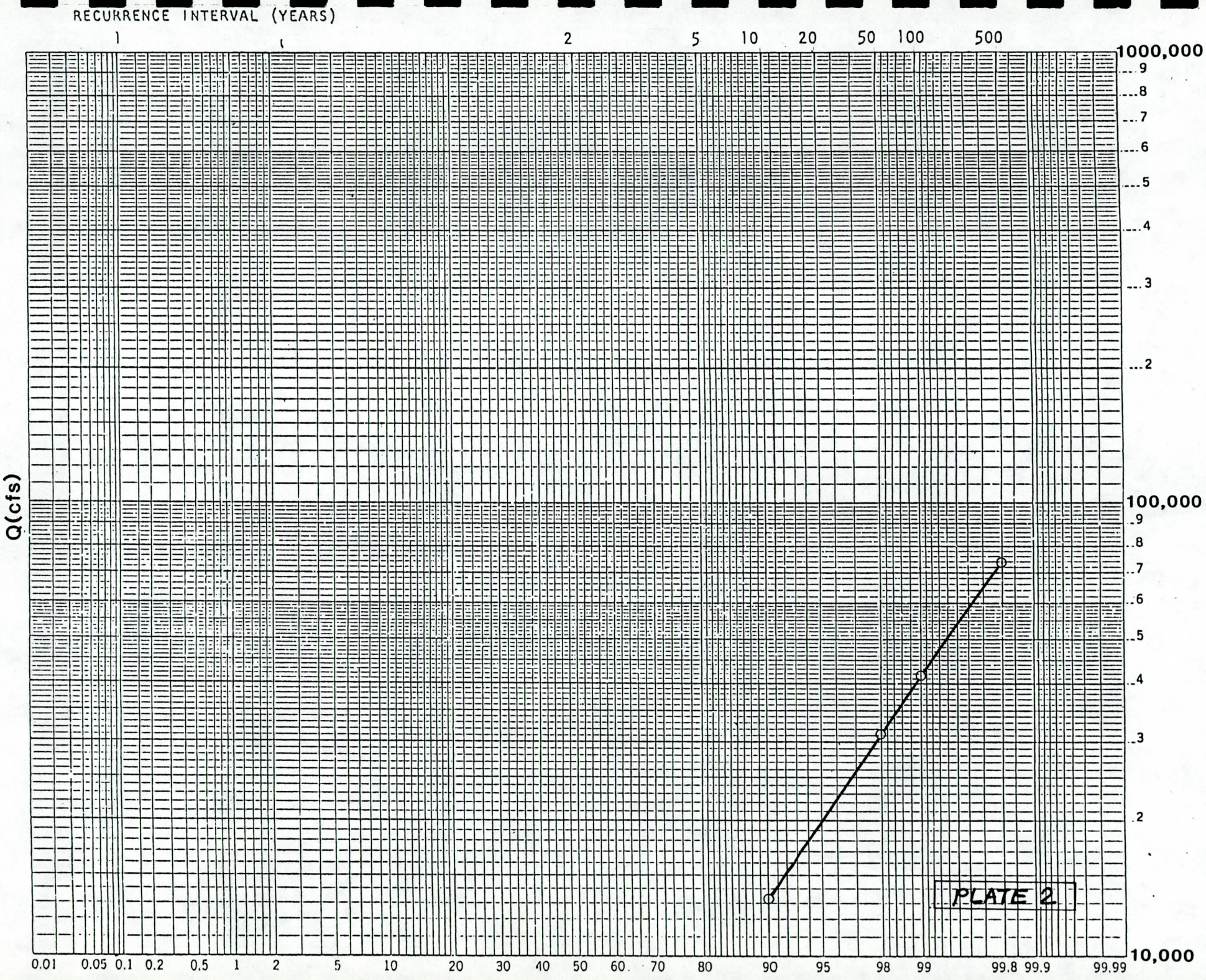
A P P E N D I X 1

Frequency Discharge Curves

Job #1090-01
CVL #4/26/2

FREQUENCY CURVE FOR NEW RIVER
NEAR COMMUNITY OF ROCK SPRINGS




FREQUENCY CURVE FOR NEW RIVER
AT COMMUNITY OF NEW RIVER
RECURRENCE INTERVAL (YEARS)
1
2
5
10
20
50
100
500
Q(cfs)
1000,000
100,000
10,000
0.01
0.05
0.1
0.2
0.5
1
2
5
10
20
30
40
50
60
70
80
90
95
98
99
99.8
99.9
99.99
PLATE 2

APPENDIX 2

Sub-basin Characteristics

Job #1090-01
CVL #4/26/2

Sub-basin Characteristics

AREA NO.	AREA (mi^2)	MAX. ELEV. (feet)	MIN. ELEV. (feet)	CURVE NUMBER	LAG (hrs)
Upper Drainage					
1a	15.78	4950	3305	90	1.30
1b	4.27	5320	3305	90	.96
1c	6.88	4990	3305	90	1.00
2a	9.18	4525	3050	90	.97
2b	2.54	5360	3050	90	.74
2c	1.67	4240	3050	90	.50
2d	2.13	4260	2970	90	.68
2e	1.23	4280	2970	90	.45
2f	.30	3650	2910	90	.21
2g	1.71	4420	2910	90	.75
2h	3.16	4575	2910	90	.76
2i	3.02	4640	2820	90	.62
2j	.96	3955	2820	90	.41
2k	2.35	4170	2820	90	.61
2l	5.39	4150	2460	90	.87
2m	6.17	3910	2460	90	.78
2n	4.20	3280	2300	90	.84
3a	7.87	2315	1990	85	1.50
3b	8.29	2750	1990	85	1.06
3c	1.02	2285	1980	90	.71
3d	.22	2200	1980	90	.32
Lower Drainage					
1e	14.13	2880	1720	89	.64
2e	17.63	1720	1475	89	1.39
3e	4.35	1620	1390	89	.85
4e	.23	1453	1390	87	**
1w	6.57	2440	1740	89	1.15
2w	7.90	2560	1710	89	.97
3w	1.29	2080	1760	87	**
4w	4.14	1970	1780	88	.91
5w	.70	1780	1630	87	**
6w	.71	1790	1640	87	**
7w	1.47	1840	1590	87	**
8w	1.37	1900	1640	88	**
9w	6.68	2160	1630	89	.70
10w	.93	2250	1620	88	**
11w	.45	1785	1615	88	**
12w	.42	1715	1590	88	**
13w	.52	1730	1590	88	**
14w	.22	1670	1580	88	**
15w	.87	1775	1560	88	**
16w	.79	1680	1550	87	**
17w	.38	1645	1540	88	**

Job #1090-01
CVL #4/26/2

Sub-basin Characteristics (cont.)

AREA NO.	AREA (mi^2)	MAX. ELEV. (feet)	MIN. ELEV. (feet)	CURVE NUMBER	LAG (hrs)
18w	.75	1775	1570	88	**
19w	.90	1725	1570	88	**
20w	.52	1570	1510	88	**
21w	.09	1575	1515	87	**
22w	.34	1600	1490	88	**
23w	.66	1640	1470	88	**
24w	1.16	1640	1450	88	**
25w	1.81	1665	1470	87	**
26w	.51	1565	1440	88	**
27w	.47	1520	1435	88	**
28w	1.52	1930	1390	88	**

** Sub-basin modeledusing kinematic wave option; lag time is not an input parameter for this methodology.

A P P E N D I X 3

HEC-1 Computer Printouts

Job #1090-01
CVL #4/26/2

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1*************************************
*                                   *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*            FEBRUARY 1981          *
*          REVISED 04 NOV 81        *
*                                   *
*FRI, JAN 30 1987      TIME 15:54:37 *
*                                   *
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*************************************
*                                   *
*    U.S. ARMY CORPS OF ENGINEERS   *
*  THE HYDROLOGIC ENGINEERING CENTER *
*          609 SECOND STREET        *
*       DAVIS, CALIFORNIA 95616     *
*  (916) 440-3285 OR (FTS) 448-3285 *
*                                   *
*************************************
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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
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100-YR FLOOD ANALYSIS

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. SEE SEPTEMBER 1981 INPUT DESCRIPTION FOR NEW DEFINITIONS.

1 HEC-1 INPUT PAGE 1

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

               *DIAGRAM
*** FREE ***
    1          ID   NEW RIVER HYDROLOGY
    2          IT       5  4DEC85    0100          5DEC85    0130
    3          IN      30  4DEC85    0100
    4          IO       5

    5          KK   SUB1A
    6          KM   UPPER SUB-BASIN OF NEW RIVER WATERSHED
    7          BA   15.78
               *  AVERAGE 100 YEAR 24 HOUR PRECIPITATION = 4.95"
               *  AREAL REDUCTION FACTOR FOR 77 SQUARE MILES = .94
    8          PB    4.65
    9          PC    0.00     0.02     0.05     0.07     0.10     0.13     0.16     0.19     0.22     0.26
   10          PC    0.29     0.33     0.37     0.41     0.46     0.51     0.56     0.62     0.68     0.76
   11          PC    0.84     0.95     1.09     1.31     3.08     3.41     3.59     3.71     3.81     3.89
   12          PC    3.97     4.03     4.09     4.14     4.19     4.24     4.28     4.32     4.35     4.39
   13          PC    4.42     4.46     4.48     4.52     4.54     4.57     4.59     4.62     4.65     4.65
   14          UI    0.00     317.     644.     871.    1469.    1911.    2814.    3535.    4299.    5293.
   15          UI   5465.    5655.    6267.    6267.    6267.    6267.    5702.    4651.    4385.    4148.
   16          UI   3708.    3242.    3091.    2954.    2925.    2159.    2075.    1996.    1924.    1554.
   17          UI   1457.    1410.    1365.    1323.    1283.    1246.    1211.    1003.     817.     795.
   18          UI    775.     773.     756.     421.     405.     396.     387.     378.     370.     363.
   19          UI    219.     216.     211.     207.     203.     200.     196.     192.     189.     186.
   20          UI    183.     179.      96.      95.      93.      92.      90.      89.      88.      86.
   21          UI     85.      84.      83.      47.     0.0
```

```
 22          LS        0       90

 23          KK    SUB1B
 24          BA     4.27
 25          LS        0       90
 26          UI      0.0      142.     288.     513.     805.    1216.    1600.    2021.    2058.    2320.
 27          UI    2320.     2320.    1993.    1662.    1535.    1298.    1160.    1090.     959.     774.
 28          UI     734.      641.     541.     517.     495.     475.     456.     397.     301.     291.
 29          UI     281.      245.     148.     143.     140.     139.     135.      79.      77.      75.
 30          UI      73.       71.      70.      68.      66.      64.      35.      34.      34.      33.
 31          UI      32.       32.      31.       1.     0.0
 32          KK    SUB1C
 33          BA     6.88
 34          LS        0       90
 35          UI      0.0      210.     427.     729.    1127.    1736.    2283.    2942.    3218.    3311.
 36          UI    3552.     3552.    3552.    2678.    2479.    2322.    1870.    1756.    1656.    1439.
 37          UI    1183.     1125.    1001.     833.     798.     765.     735.     707.     694.     468.
 38          UI     453.      438.     424.     302.     224.     218.     211.     206.     206.     121.
 39          UI     118.      115.     115.     112.     110.     107.     105.     102.      54.      53.
 40          UI      52.       51.      50.      49.      48.      47.      38.      0.
 41          KK     ADD1
 42          HC        3
```



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

 43          KK      RT1
 44          KM    ROUTE TO BOTTOM OF SUB 2A
 45          KM    ASSUME VELOCITY=10 FPS
 46          RM        1     0.35     0.20

 47          KK    SUB2A
 48          BA     9.18
 49          UI      0.0      296.     601.    1057.    1651.    2510.    3301.    4199.    4280.    4903.
 50          UI    4903.     4903.    4455.    3573.    3308.    2896.    2495.    2343.    2199.    1664.
 51          UI    1578.     1501.    1140.    1112.    1064.    1021.     981.     978.     648.     625.
 52          UI     604.      584.     396.     308.     299.     290.     282.     254.     186.     166.
 53          UI     161.      157.     153.     150.     146.     143.      76.      74.      73.      71.
 54          UI      70.       68.      67.      66.      62.     0.0      0.0
 55          LS        0       90

 56          KK    SUB2B
 57          KM    LONG CANYON
 58          BA     2.54
 59          LS        0       90        2
 60          UI      0.0      128.     288.     556.     948.    1371.    1659.    1667.    1788.    1708.
 61          UI    1301.     1182.     931.     856.     735.     587.     536.     419.     395.     374.
 62          UI     355.      297.     229.     219.     188.     113.     109.     105.      98.      60.
 63          UI      58.       56.      55.      53.      51.      44.      27.      26.      25.      25.
 64          UI      24.       22.       0.      0.0
 65          KK    SUB2C
 66          KM    LITTLE GRAPEVINE CANYON
 67          BA     1.67
 68          UI      0.0      155.     451.     976.    1518.    1643.    1724.    1252.    1017.     828.
 69          UI     636.      516.     396.     364.     340.     224.     209.     128.     104.     100.
 70          UI      58.       55.      53.      50.      41.      26.      25.      24.      21.     0.0
```

```
 71          LS        0       90        1

 72          KK     ADD2
 73          HC        4

 74          KK      RT2
 75          KM    ASSUME VELOCITY=8 FPS
 76          RM        1      .21      .20

 77          KK     SUB2D
 78          BA     2.13
 79          LS        0       90
 80          UI      0.0     120.     283.     560.     939.    1332.    1473.    1609.    1609.    1286.
 81          UI    1091.     893.     780.     676.     529.     473.     374.     352.     332.     329.
 82          UI     212.     202.     192.     114.      99.      95.      92.      54.      53.      52.
 83          UI      51.      49.      47.      25.      24.      23.      23.      22.      21.       3.
 84          UI      0.0
1                                                HEC-1 INPUT                                          PAGE  3

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

 85          KK     SUB2E
 86          BA     1.23
 87          LS        0       90
 88          UI      0.0     135.     437.     922.    1293.    1411.    1195.     895.     692.     533.
 89          UI     414.     319.     292.     240.     177.     135.      87.      85.      48.      46.
 90          UI      45.      43.      21.      21.      20.      19.       2.     0.0

 91          KK     ADD3
 92          HC        3

 93          KK      RT3
 94          KM    ASSUME VELOCITY=10 FPS
 95          RM        1      .08      .20

 96          KK     SUB2F
 97          BA     0.30
 98          LS        0       90
 99          UI      0.0     153.     580.     638.     382.     212.     149.      94.      44.      28.
100          UI      21.      13.      10.       1.      0.0

101          KK     SUB2G
102          BA     1.71
103          LS        0       90
104          UI      0.0      83.     184.     353.     605.     853.    1094.    1096.    1177.    1177.
105          UI    1177.     876.     792.     655.     576.     528.     395.     370.     298.     266.
106          UI     252.     239.     230.     154.     147.     141.      94.      73.      70.      68.
107          UI      55.      41.      39.      38.      37.      36.      35.      18.      18.      17.
108          UI      17.      16.      16.      13.      0.0

109          KK     SUB2H
110          KM    ROBBERS ROOST CANYON
111          BA     3.16
112          LS        0       90
113          UI      0.0     148.     324.     616.    1061.    1496.    1936.    1973.    2128.    2128.
114          UI    1707.    1464.    1256.    1065.    1035.     731.     684.     594.     492.     465.
115          UI     442.     420.     345.     273.     261.     232.     135.     130.     130.     125.
116          UI      72.      70.      68.      68.      66.      64.      62.      32.      32.      31.
117          UI      30.      29.      29.      22.      0.0
```

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118          KK    ADD4
119          HC       4

120          KK     RT4
121          KM   ASSUME  VELOCITY=9 FPS
122          RM       1      .19      .20

123          KK   SUB2I
124          BA    3.02
125          LS       0       90
126          UI     0.0     200.     504.    1036.    1698.    2337.    2378.    2528.    2156.    1729.
127          UI   1400.    1212.     989.     810.     659.     568.     531.     499.     377.     317.
128          UI    297.     161.     153.     146.     113.      83.      80.      78.      77.      74.
129          UI     38.      37.      36.      35.      34.      14.     0.0
1                                                HEC-1 INPUT                                          PAGE  4

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

130          KK   SUB2J
131          BA    0.96
132          LS       0       90
133          UI     0.0     121.     415.     870.    1122.    1189.     851.     651.     513.     379.
134          UI    277.     249.     208.     149.     108.      72.      64.      39.      37.      35.
135          UI     29.      18.      17.      16.       4.     0.0

136          KK   SUB2K
137          BA    2.35
138          LS       0       90
139          UI     0.0     163.     417.     865.    1410.    1796.    2022.    2022.    1608.    1351.
140          UI   1043.     972.     685.     631.     472.     442.     413.     370.     261.     247.
141          UI    177.     125.     119.     107.      68.      68.      65.      62.      60.      31.
142          UI     30.      29.      28.      27.      13.     0.0

143          KK    ADD5
144          HC       4

145          KK     RT5
146          KM   ASSUME  VELOCITY=9 FPS
147          RM       1      .65      .20

148          KK   SUB2L
149          BA    5.39
150          LS       0       90
151          UI     0.0     207.     419.     809.    1306.    1908.    2576.    2945.    2995.    3211.
152          UI   3211.    2754.    2280.    2109.    1682.    1566.    1498.    1095.    1033.     933.
153          UI    753.     716.     683.     653.     625.     483.     410.     395.     392.     206.
154          UI    199.     193.     187.     181.     109.     106.     103.     100.      97.      95.
155          UI     92.      91.      49.      48.      46.      45.      44.      43.      43.      16.
156          UI     0.0

157          KK   SUB2M
158          BA    6.17
159          LS       0       90
160          UI     0.0     279.     602.    1136.    1969.    2775.    3620.    3749.    4066.    4066.
161          UI   3483.    2859.    2538.    2080.    1925.    1637.    1335.    1254.     949.     909.
162          UI    862.     820.     778.     532.     509.     489.     342.     254.     245.     236.
163          UI    213.     137.     133.     128.     125.     121.     119.     118.      62.      60.
164          UI     59.      57.      56.      54.      39.     0.0
```

```
165          KK    ADD6
166          HC       3

167          KK     RT6
168          KM   ASSUME VELOCITY=8 FPS
169          RM       1      .48      .20

170          KK   SUB2N
171          BA    4.20
172          LS       0       90
173          UI     0.0     172.     357.     683.    1132.    1632.    2173.    2307.    2602.    2602.
174          UI   2602.    1946.    1777.    1536.    1311.    1220.    1026.     854.     805.     623.
175          UI    587.     558.     532.     509.     402.     333.     320.     307.     167.     161.
1                                              HEC-1 INPUT                                                PAGE  5

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

176          UI    155.     150.     131.      89.      87.      85.      82.      80.      78.      76.
177          UI     40.      39.      38.      37.      36.      35.      35.      18.     0.0

178          KK    ADD7
179          HC       2

180          KK     RT7
181          KM   ROUTE TO 1/4 MILE ABOVE I-10
182          KM   ASSUME VELOCITY= 7 FPS
183          RM       1     1.20      .25

184          KK   SUB3A
185          BA    7.87
186          UI     0.0     126.     255.     348.     500.     711.     913.    1256.    1528.    1813.
187          UI   2111.    2447.    2595.    2326.    2709.    2709.    2709.    2709.    2709.    2069.
188          UI   1963.    1867.    1780.    1604.    1410.    1353.    1300.    1251.    1179.     926.
189          UI    894.     865.     838.     730.     640.     621.     604.     587.     572.     557.
190          UI    543.     531.     529.     359.     351.     343.     336.     328.     321.     259.
191          UI    173.     170.     167.     164.     161.     158.     157.     155.     111.      93.
192          UI     91.      90.      88.      87.      85.      84.      83.      81.      80.      79.
193          UI     78.      42.      41.      41.      40.      40.      39.      39.      38.      38.
194          UI     37.      37.      36.      36.      26.     0.0
195          LS       0      85        1

196          KK   SUB3B
197          BA    8.29
198          LS       0      85        1
199          UI     0.0     229.     464.     750.    1136.    1795.    2361.    2967.    3547.    3602.
200          UI   4012.    4012.    4012.    3835.    2987.    2781.    2618.    2116.    1995.    1887.
201          UI   1735.    1356.    1293.    1235.     979.     922.     886.     852.     821.     792.
202          UI    751.     527.     511.     495.     480.     376.     255.     248.     241.     235.
203          UI    229.     191.     135.     132.     129.     126.     123.     121.     118.     116.
204          UI    138.      62.      60.      59.      58.      57.      56.      55.      54.      53.
205          UI     29.     0.0

206          KK    ADD8
207          HC       3

208          KK     RT8
209          KM   ROUTE TO I-10
210          RM       1      .11      .20
```

```
211          KK   SUB3C
212          BA    1.02
213          LS       0      90
214          UI     0.0     53.    122.    237.    402.    578.    648.    735.    735.    666.
215          UI    523.    459.    374.    365.    253.    236.    201.    168.    159.    150.
216          UI    147.     97.     92.     88.     55.     46.     45.     44.     25.     24.
217          UI     23.     23.     22.     21.     20.     11.     11.     10.     10.     10.
218          UI     10.     0.0
```



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

219          KK   SUB3D
220          BA     .22
221          LS       0      90
222          UI     0.0     49.    187.    330.    342.    232.    165.    111.     80.     68.
223          UI     45.     28.     21.     12.     11.     10.      5.      5.      3.    0.0

224          KK    ADD9
225          HC       3
226          KO       1       2

227          KK   ROUT5
             *  ASSUME 10 FPS
228          RM       1     .58     .20

229          KK   SUB4W
             *  100 YEAR 24 HOUR AVERAGE PRECIPITATION = 4.40"
             *  REDUCTION FACTOR FOR 90 SQUARE MILES = .94
230          PB    4.14
231          PC    0.00    0.02    0.04    0.06    0.09    0.12    0.14    0.17    0.20    0.23
232          PC    0.26    0.29    0.33    0.37    0.41    0.45    0.50    0.55    0.61    0.68
233          PC    0.75    0.85    0.97    1.17    2.74    3.04    3.20    3.30    3.39    3.46
234          PC    3.53    3.59    3.64    3.69    3.73    3.77    3.81    3.85    3.87    3.91
235          PC    3.94    3.97    3.99    4.02    4.04    4.07    4.09    4.11    4.14    4.14
236          BA    4.29
237          LS       0      88
238          UI     0.0     88.    325.    748.    941.   1251.   1511.   1792.   2134.   2316.
239          UI   2933.   2933.   2933.   2910.   1901.   1770.   1301.   1117.   1053.    996.
240          UI    436.    425.    416.    311.    256.    210.    219.     76.     60.     58.
241          UI     56.     54.     53.     23.     0.0

242          KK     ADD
243          HC       2

244          KK   SUB5W
245          BA    0.70
246          LS       0      87
247          UK    750.   0.010    0.15     100
248          RK  16500.   0.009   0.035             TRAP      50       5     YES

249          KK   SUB6W
250          BA    0.71
251          LS       0      87       0       0      87       0
252          UK    800.   0.015    0.15      80
253          UK   5000.   0.010    0.15      20
254          RK   9550.   0.009   0.035             TRAP      30       3      NO

255          KK     ADD
```

```
 256          HC        2
1                                   HEC-1 INPUT                                                          PAGE  7

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

 257          KK   SUB25W
 258          BA     1.81
 259          LS        0       87
 260          UK     650.    0.010     0.15      100
 261          RK   20000.    0.008    0.035              TRAP      60        6      YES

 262          KK   SUB1E
 263          BA    14.13
 264          LS        0       89        0
 265          UI      0.0     674.    2954.    4819.    6769.    8745.   11042.   13524.   14281.   14118.
 266          UI    9092.    7153.    5394.    4962.    2427.    2073.    1583.    1130.    1075.     320.
 267          UI     287.     273.     260.     106.      0.0

 268          KK   SUB2E
 269          BA    17.63
 270          LS        0       89        0
 271          UK    3500.     .010      .15      100
 272          RK    7500.     .010     .035      3.0     TRAP     100        8       NO
 273          RK    38200     .007     .035              TRAP     100       10      YES

 274          KK     ADD
 275          HC        2

 276          KK   SUB29W
 277          BA     1.05
 278          LS        0       87        0
 279          UK     700.     .008     0.15     100.
 280          RK    9555.     .006    0.035              TRAP     100       10      YES

 281          KK   ROUT29
 282          RK    9500.     .006     .035              TRAP     100       10       NO

 283          KK   SUB1W
 284          BA     6.57
 285          LS        0       89
 286          UI      0.0      80.     296.     555.    1062.    1166.    1475.    1718.    1983.    2257.
 287          UI    2616.    2858.    3256.    3539.    3539.    3539.    3855.    2354.    2220.    2100.
 288          UI    1495.    1361.    1298.    1240.    1187.     530.     510.     495.     404.     319.
 289          UI     308.     269.     253.     211.      75.      73.      71.      69.      67.      65.
 290          UI      64.      44.      0.0

 291          KK   SUB2W
 292          BA     7.90
 293          LS        0       89
 294          UI      0.0     142.     525.    1227.    1536.    2044.    2473.    2928.    3471.    3929.
 295          UI    4518.    5063.    5063.    5063.    4528.    3222.    3014.    2087.    1917.    1814.
 296          UI    1721.     765.     756.     723.     592.     446.     384.     376.     244.     106.
 297          UI     103.      99.      96.      93.      90.      19.      0.0
1                                   HEC-1 INPUT                                                          PAGE  8

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

 298          KK     ADD9
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299          HC       2

300          KK   SUB8W
301          BA    1.37
302          LS       0      88       0       0      88       0
303          UK   1300.    .010    0.15      80
304          UK   6000.    .010    0.15      20
305          RK  13325.    .008    .035             TRAP      30       2     YES

306          KK   SUB9W
307          BA    6.68
308          LS       0      89
309          UI     0.0    248.    919.   1969.   2575.   3285.   4120.   4837.   5947.   5947.
310          UI   5769.   3786.   3456.   1937.   2115.   1428.    893.    853.    531.    452.
311          UI    420.    126.    120.    114.    110.     82.    0.0

312          KK   ADD10
313          HC       2

314          KK   SUB10W
315          BA    0.93
316          LS       0      88       0       0      88       0
317          UK   5000.    .034    0.15      50
318          UK   1100.    .016    0.15      50
319          RK   7040.    .016    .035             TRAP      30       2      NO
320          RK    900.    .007    .035             TRAP      30       6     YES

321          KK   SUB11W
322          BA    0.45
323          LS       0      88
324          UK    700.    .034    0.15     100
325          RK   8550.    .016    .035             TRAP      30       2      NO
326          RK   1400.    .007    .035             TRAP      40       3     YES

327          KK   SUB12W
328          BA    0.42
329          LS       0      88
330          UK     700    .017    0.15     100
331          RK   8550.    .008    .035             TRAP      30       2      NO

332          KK   ADD11
333          HC       2

334          KK   SUB13W
335          BA    0.52
336          LS       0      88
337          UK   4500.    .013    0.15     100
338          RK   4020.    .008    .035             TRAP      50       5     YES
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

339          KK   SUB3W
340          BA    1.29
341          LS       0      87
342          UK    1000    .020     .15     100
343          RK  14800.    .020   0.035             TRAP      50       2      NO

344          KK   SUB7W
```

```
 345          BA    1.47
 346          LS       0      87
 347          UK     950.    .017     .15     100
 348          RK   19600    .010    .035             TRAP      50       2      YES

 349          KK   ADD12
 350          HC       2

 351          KK   ROUT14
 352          RK    2890    .008    .035             TRAP      50       5       NO

 353          KK   SUB14W
 354          BA    0.22
 355          LS       0      88
 356          UK     600    .013    0.15     100
 357          RK   5030.    .013   0.035             TRAP      30       3       NO
 358          RK   3020.    .008   0.035             TRAP      50       5      YES

 359          KK   SUB15W
 360          BA    0.87
 361          LS       0      88
 362          UK     900.    .012    0.15     100
 363          RK  14080.    .012   0.035             TRAP      30       3       NO
 364          RK   3020.    .008   0.035             TRAP      50       5      YES

 365          KK   SUB16W
 366          BA    0.79
 367          LS       0      87
 368          UK     800.    .017    0.15     100
 369          RK  11820.    .017   0.035             TRAP      30       3       NO
 370          RK   1810.    .008   0.035             TRAP      50       5       NO

 371          KK   ADD16
 372          HC       2

 373          KK   SUB17W
 374          BA    0.38
 375          LS       0      88
 376          UK     800.   0.011    0.15     100
 377          RK   5610.    .011   0.035             TRAP      30       3       NO
 378          RK   2715.    .009   0.035             TRAP      50       5      YES
```



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

 379          KK   SUB21W
 380          BA    0.09
 381          LS       0      87
 382          UK    2500.   0.010    0.15     100
 383          RK   3270.    .006   0.035             TRAP      50       5      YES

 384          KK   SUB18W
 385          BA    0.75
 386          LS       0      88
 387          UK     900.   0.012    0.15     100
 388          RK  14830.    .012   0.035             TRAP      30       3       NO

 389          KK   SUB19W
 390          BA    0.90
```

```
391          LS        0       88
392          UK     700.    0.010     0.15      100
393          RK    9430.    0.010    0.035              TRAP      30        3      NO

394          KK     ADD13
395          HC         2

396          KK   SUB20W
397          BA      0.52
398          LS         0       88
399          UK    1100.    0.012     0.15      100
400          RK    7040.    0.012    0.035              TRAP      30        3     YES

401          KKADD20&21
402          HC         2

403          KK   ROUT20
404          RK    2260.     .006    0.035              TRAP      50        5

405          KK   SUB22W
406          BA      0.34
407          LS         0       88        0        0       88        0
408          UK    2500.     .012     0.15       40
409          UK     700.     .012     0.15       60
410          RK    5000.     .012     .035              TRAP      30        3      NO

411          KK      ADD
412          HC         2

413          KK   ROUT22
414          RK    2515.     .006    0.035              TRAP      50        5

415          KK   SUB23W
416          BA      0.66
417          LS         0       88        0        0       88        0
418          UK    3000.    0.012     0.15       40
419          UK     700.    0.012     0.15       60
420          RK    8800.    0.012    0.035              TRAP      40        4      NO
421          RK    2260.     .006    0.035              TRAP      50        5     YES
```



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

422          KK   SUB24W
423          BA      1.16
424          LS         0       88        0        0       88        0
425          UK    3000.     .012     0.15       40
426          UK     1100     .012     0.15       60
427          RK    8420.     .012    0.035              TRAP      30        3      NO
428          RK    3520.     .006    0.035              TRAP      50        5     YES

429          KK   SUB26W
430          BA      0.51
431          LS         0       88        0        0       88        0
432          UK    4500.   0.0107     0.15       60
433          UK     600.    0.011     0.15       40
434          RK    4525.    0.011    0.035              TRAP      30        5      NO
435          RK    1255.     .006    0.035              TRAP      60        6     YES
```

```
436          KK   SUB27W
437          BA     0.47
438          LS        0       88
439          UK     700.   0.0108     0.15      100
440          RK    5030.   0.0108    0.035             TRAP      30        5      NO
441          RK    9800.     .006    0.035             TRAP     100       10     YES

442          KK   SUB28W
443          BA     1.52
444          LS        0       88
445          UK    1100.    0.011     0.15      100
446          RK    9800.    0.011    0.035             TRAP      30        5      NO

447          KK   ADD14
448          HC        2

449          KK   SUB4E
450          BA     0.23
451          LS        0       87        0       .
452          UK     400.     .006     0.15     100.
453          RK    7290.     .006    0.035             TRAP     100       10      NO

454          KK   ROUT4E
455          RK    1635.     .006    0.035             TRAP     100       10      NO

456          KK   SUB3E
457          BA     4.35
458          LS        0       89        0
459          UI      0.0      105.     390.     880.   1136.   1457.   1782.   2119.   2539.   2951.
460          UI    3207.     3207.    3240.    2082.   1927.   1355.   1206.   1133.    828.    490.
461          UI     465.      401.     283.     241.    239.    100.     66.     64.     61.     59.
462          UI      57.        5.      0.0
```



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

463          KK ADDLAST
464          HC        4
465          KO        1        2
466          ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
INPUT
 LINE      (V) ROUTING          (--->) DIVERSION
  NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED FLOW

   5       SUB1A
              .
              .
  23          .        SUB1B
              .           .
              .           .
  32          .           .        SUB1C
              .           .           .
              .           .           .
  41        ADD1.......................
              V
              V
  43         RT1
```

```
 47          SUB2A
                 .
 56              .      SUB2B
                 .         .
 65              .         .        SUB2C
                 .         .           .
 72      ADD2....................................
            V
            V
 74      RT2
                 .
 77          SUB2D
                 .
 85              .      SUB2E
                 .         .
 91      ADD3.......................
            V
            V
 93      RT3
                 .
 96          SUB2F
                 .
101              .      SUB2G
                 .         .
109              .         .        SUB2H
                 .         .           .
118      ADD4....................................
            V
            V
120      RT4
                 .
123          SUB2I
                 .
130              .      SUB2J
                 .         .
136              .         .        SUB2K
                 .         .           .
143      ADD5....................................
            V
            V
145      RT5
                 .
148          SUB2L
```

```
                .          .
                .          .
157             .          .        SUB2M
                .          .          .
                .          .          .
165          ADD6.......................
                V
                V
167           RT6
                .
                .
170             .        SUB2N
                .          .
                .          .
178          ADD7............
                V
                V
180           RT7
                .
                .
184             .        SUB3A
                .          .
                .          .
196             .          .        SUB3B
                .          .          .
                .          .          .
206          ADD8.......................
                V
                V
208           RT8
                .
                .
211             .        SUB3C
                .          .
                .          .
219             .          .        SUB3D
                .          .          .
                .          .          .
224          ADD9.......................
                V
                V
227         ROUT5
                .
                .
229             .        SUB4W
                .          .
                .          .
242           ADD............
                V
                V
244         SUB5W ***
                .
                .
249             .        SUB6W
                .          .
                .          .
255           ADD............
                V
                V
257        SUB25W ***
```

```
262          .        SUB1E
             .           V
             .           V
268          .        SUB2E ***
             .           .
             .           .
274        ADD.............
             V
             V
276     SUB29W ***
             V
             V
281     ROUT29
             .
             .
283          .        SUB1W
             .           .
             .           .
291          .           .        SUB2W
             .           .           .
             .           .           .
298          .         ADD9.............
             .           V
             .           V
300          .        SUB8W ***
             .           .
             .           .
306          .           .        SUB9W
             .           .           .
             .           .           .
312          .        ADD10............
             .           V
             .           V
314          .       SUB10W ***
             .           V
             .           V
321          .       SUB11W ***
             .           .
             .           .
327          .           .       SUB12W
             .           .           .
             .           .           .
332          .        ADD11............
             .           V
             .           V
334          .       SUB13W ***
             .           .
             .           .
339          .           .        SUB3W
             .           .           V
             .           .           V
344          .           .        SUB7W ***
             .           .           .
             .           .           .
349          .        ADD12............
             .           V
             .           V
351          .       ROUT14
```

```
                 V
                 V
353          SUB14W ***
                 V
                 V
359          SUB15W ***
                 .
                 .
365              .        SUB16W
                 .           .
                 .           .
371           ADD16............
                 V
                 V
373          SUB17W ***
                 V
                 V
379          SUB21W ***
                 .
                 .
384              .        SUB18W
                 .           .
                 .           .
389              .           .       SUB19W
                 .           .          .
                 .           .          .
394              .          ADD..........
                 .           V
                 .           V
396              .        SUB20W ***
                 .           .
                 .           .
401       ADD20&21............
                 V
                 V
403          ROUT20
                 .
                 .
405              .        SUB22W
                 .           .
                 .           .
411             ADD..........
                 V
                 V
413          ROUT22
                 V
                 V
415          SUB23W ***
                 V
                 V
422          SUB24W ***
                 V
                 V
429          SUB26W ***
                 V
                 V
436          SUB27W ***
                 .
                 .
442              .        SUB28W
```

```
                 .          .          .
                 .          .          .
  447            .       ADD14.........
                 .          .
                 .          .
  449            .          .       SUB4E
                 .          .          V
                 .          .          V
  454            .          .      ROUT4E
                 .          .          .
                 .          .          .
  456            .          .          .       SUB3E
                 .          .          .         .
                 .          .          .         .
  463       ADDLAST.......................................
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *            FEBRUARY 1981              *
 *          REVISED 04 NOV 81            *
 *                                       *
 *FRI, JAN 30 1987      TIME 15:54:37    *
 *                                       *
 *****************************************
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*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*  THE HYDROLOGIC ENGINEERING CENTER    *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*  (916) 440-3285 OR (FTS) 448-3285     *
*                                       *
*****************************************
```

NEW RIVER HYDROLOGY

```
  4 IO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN           5  MINUTES IN COMPUTATION INTERVAL
                      IDATE      4DEC85  STARTING DATE
                      ITIME        0100  STARTING TIME
                         NQ         295  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      5DEC85  ENDING DATE
                     NDTIME        0130  ENDING TIME

                 COMPUTATION INTERVAL     0.08 HOURS
                      TOTAL TIME BASE    24.50 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
```

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	SUB1A	11518.	12.92	4643.	1475.	1445.	15.78		
HYDROGRAPH AT	SUB1B	3830.	12.58	1267.	401.	393.	4.27		
HYDROGRAPH AT	SUB1C	5973.	12.67	2041.	647.	634.	6.88		
3 COMBINED AT	ADD1	20669.	12.83	7943.	2523.	2472.	26.93		
ROUTED TO	RT1	18988.	13.17	7932.	2510.	2459.	26.93		
HYDROGRAPH AT	SUB2A	8139.	12.67	2725.	863.	846.	9.18		
HYDROGRAPH AT	SUB2B	2697.	12.50	759.	241.	236.	2.54		
HYDROGRAPH AT	SUB2C	2209.	12.33	499.	159.	156.	1.67		
4 COMBINED AT	ADD2	27975.	12.92	11885.	3774.	3697.	40.32		
ROUTED TO	RT2	27335.	13.17	11878.	3762.	3685.	40.32		
HYDROGRAPH AT	SUB2D	2366.	12.42	635.	201.	197.	2.13		
HYDROGRAPH AT	SUB2E	1726.	12.25	367.	117.	114.	1.23		
3 COMBINED AT	ADD3	28944.	13.08	12862.	4080.	3997.	43.68		
ROUTED TO	RT3	28868.	13.17	12861.	4075.	3992.	43.68		
HYDROGRAPH AT	SUB2F	549.	12.08	90.	29.	28.	0.30		
HYDROGRAPH AT	SUB2G	1901.	12.50	554.	176.	172.	1.71		
HYDROGRAPH AT	SUB2H	3268.	12.50	941.	298.	292.	3.16		
4 COMBINED AT	ADD4	31820.	13.17	14427.	4578.	4485.	48.85		
ROUTED TO	RT4	31403.	13.33	14420.	4565.	4472.	48.85		

+	HYDROGRAPH AT	SUB2I	3542.	12.42	900.	286.	280.	3.02
+	HYDROGRAPH AT	SUB2J	1401.	12.25	287.	91.	89.	0.96
+	HYDROGRAPH AT	SUB2K	2811.	12.33	701.	222.	218.	2.35
+	4 COMBINED AT	ADD5	34059.	13.25	16269.	5165.	5059.	55.18
+	ROUTED TO	RT5	30752.	13.83	16180.	5114.	5010.	55.18
+	HYDROGRAPH AT	SUB2L	5134.	12.58	1602.	508.	498.	5.39
+	HYDROGRAPH AT	SUB2M	6294.	12.50	1836.	582.	570.	6.17
+	3 COMBINED AT	ADD6	34781.	13.67	19500.	6204.	6077.	66.74
+	ROUTED TO	RT6	33397.	14.17	19411.	6158.	6032.	66.74
+	HYDROGRAPH AT	SUB2N	4100.	12.50	1249.	396.	388.	4.20
+	2 COMBINED AT	ADD7	34474.	14.08	20575.	6554.	6420.	70.94
+	ROUTED TO	RT7	30260.	15.17	20037.	6420.	6289.	70.94
+	HYDROGRAPH AT	SUB3A	4512.	13.17	2012.	633.	620.	7.87
+	HYDROGRAPH AT	SUB3B	5984.	12.75	2154.	672.	659.	8.29
+	3 COMBINED AT	ADD8	33341.	15.00	23546.	7725.	7568.	87.10
+	ROUTED TO	RT8	33302.	15.17	23535.	7710.	7553.	87.10
+	HYDROGRAPH AT	SUB3C	1095.	12.42	304.	96.	94.	1.02
+	HYDROGRAPH AT	SUB3D	361.	12.17	66.	21.	20.	0.22
+	3 COMBINED AT	ADD9	33444.	15.17	23773.	7828.	7668.	88.34
+	ROUTED TO	ROUT5	32479.	15.67	23505.	7743.	7585.	88.34

+	HYDROGRAPH AT	SUB4W	3827.	12.75	1058.	330.	324.	4.29
+	2 COMBINED AT	ADD	32836.	15.67	24103.	8074.	7909.	92.63
+	HYDROGRAPH AT	SUB5W	32879.	15.83	24188.	8068.	7903.	93.33
+	HYDROGRAPH AT	SUB6W	544.	12.33	153.	48.	47.	0.71
+	2 COMBINED AT	ADD	32951.	15.83	24276.	8116.	7950.	94.04
+	HYDROGRAPH AT	SUB25W	33079.	15.92	24428.	8158.	7991.	95.85
+	HYDROGRAPH AT	SUB1E	16335.	12.50	3670.	1154.	1131.	14.13
+	HYDROGRAPH AT	SUB2E	16767.	13.08	7292.	2284.	2237.	31.76
+	2 COMBINED AT	ADD	37826.	15.75	31125.	10442.	10229.	127.61
+	HYDROGRAPH AT	SUB29W	37895.	15.83	31243.	10467.	10253.	128.66
+	ROUTED TO	ROUT29	37882.	15.92	31224.	10401.	10188.	128.66
+	HYDROGRAPH AT	SUB1W	5197.	13.00	1646.	515.	505.	6.57
+	HYDROGRAPH AT	SUB2W	6936.	12.83	1982.	621.	609.	7.90
+	2 COMBINED AT	ADD9	11952.	12.92	3627.	1137.	1113.	14.47
+	HYDROGRAPH AT	SUB8W	12447.	13.00	3964.	1231.	1206.	15.84
+	HYDROGRAPH AT	SUB9W	7149.	12.58	1689.	531.	520.	6.68
+	2 COMBINED AT	ADD10	17163.	12.83	5644.	1762.	1726.	22.52
+	HYDROGRAPH AT	SUB10W	17570.	12.83	5851.	1825.	1788.	23.45
+	HYDROGRAPH AT	SUB11W	17738.	12.83	5955.	1855.	1818.	23.90
+	HYDROGRAPH AT	SUB12W	436.	12.25	97.	30.	29.	0.42

+	2 COMBINED AT	ADD11	17944.	12.83	6052.	1885.	1847.	24.32
+	HYDROGRAPH AT	SUB13W	18067.	12.83	6163.	1916.	1877.	24.84
+	HYDROGRAPH AT	SUB3W	1171.	12.33	289.	88.	86.	1.29
+	HYDROGRAPH AT	SUB7W	2022.	12.58	614.	187.	183.	2.76
+	2 COMBINED AT	ADD12	19837.	12.83	6772.	2103.	2060.	27.60
+	ROUTED TO	ROUT14	19799.	12.83	6771.	2100.	2057.	27.60
+	HYDROGRAPH AT	SUB14W	19799.	12.92	6821.	2111.	2068.	27.82
+	HYDROGRAPH AT	SUB15W	20258.	12.92	7020.	2168.	2123.	28.69
+	HYDROGRAPH AT	SUB16W	764.	12.33	177.	54.	52.	0.79
+	2 COMBINED AT	ADD16	20616.	12.92	7197.	2221.	2176.	29.48
+	HYDROGRAPH AT	SUB17W	20755.	12.92	7283.	2244.	2198.	29.86
+	HYDROGRAPH AT	SUB21W	20717.	12.92	7302.	2245.	2199.	29.95
+	HYDROGRAPH AT	SUB18W	587.	12.50	172.	52.	51.	0.75
+	HYDROGRAPH AT	SUB19W	898.	12.25	208.	64.	62.	0.90
+	2 COMBINED AT	ADD	1443.	12.33	380.	116.	114.	1.65
+	HYDROGRAPH AT	SUB20W	1862.	12.50	503.	153.	150.	2.17
+	2 COMBINED AT	ADD20&21	21966.	12.92	7802.	2398.	2349.	32.12
+	ROUTED TO	ROUT20	21918.	12.92	7802.	2395.	2346.	32.12
+	HYDROGRAPH AT	SUB22W	279.	12.17	77.	24.	23.	0.34
+	2 COMBINED AT	ADD	22059.	12.92	7877.	2418.	2369.	32.46

+	ROUTED TO	ROUT22	22024.	13.00	7876.	2415.	2366.	32.46
+	HYDROGRAPH AT	SUB23W	22263.	13.00	8018.	2457.	2407.	33.12
+	HYDROGRAPH AT	SUB24W	22666.	13.00	8269.	2531.	2480.	34.28
+	HYDROGRAPH AT	SUB26W	22790.	13.08	8372.	2563.	2511.	34.79
+	HYDROGRAPH AT	SUB27W	22909.	13.17	8532.	2591.	2538.	35.26
+	HYDROGRAPH AT	SUB28W	1242.	12.42	349.	107.	104.	1.52
+	2 COMBINED AT	ADD14	23507.	13.17	8862.	2698.	2643.	36.78
+	HYDROGRAPH AT	SUB4E	159.	12.42	51.	15.	15.	0.23
+	ROUTED TO	ROUT4E	159.	12.58	51.	15.	15.	0.23
+	HYDROGRAPH AT	SUB3E	4189.	12.67	1105.	347.	340.	4.35
+	4 COMBINED AT	ADDLAST	55556.	13.33	40471.	13460.	13186.	170.02

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

Flow in CFS,
Time in hrs,
Area in Sq. Miles

[redacted] - 10-YR STORM

RUNOFF SUMMARY

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	SUB1A	7351.	12.92	2992.	937.	918.	15.78	10-YR	
HYDROGRAPH AT	SUB1B	2448.	12.67	816.	255.	250.	4.27		
HYDROGRAPH AT	SUB1C	3817.	12.67	1315.	411.	403.	6.88		
3 COMBINED AT	ADD1	13222.	12.83	5118.	1604.	1571.	26.93		
ROUTED TO	RT1	12137.	13.17	5110.	1595.	1562.	26.93		
HYDROGRAPH AT	SUB2A	5208.	12.67	1755.	549.	538.	9.18		
HYDROGRAPH AT	SUB2B	1735.	12.50	490.	154.	151.	2.54		
HYDROGRAPH AT	SUB2C	1425.	12.33	322.	101.	99.	1.67		
4 COMBINED AT	ADD2	17867.	12.92	7657.	2399.	2350.	40.32		
ROUTED TO	RT2	17472.	13.17	7652.	2391.	2342.	40.32		
HYDROGRAPH AT	SUB2D	1515.	12.42	409.	128.	125.	2.13		
HYDROGRAPH AT	SUB2E	1109.	12.25	237.	74.	73.	1.23		
3 COMBINED AT	ADD3	18523.	13.17	8285.	2593.	2540.	43.68		
ROUTED TO	RT3	18471.	13.25	8283.	2590.	2537.	43.68		
HYDROGRAPH AT	SUB2F	357.	12.17	58.	18.	18.	0.30		
HYDROGRAPH AT	SUB2G	1216.	12.50	357.	112.	109.	1.71		
HYDROGRAPH AT	SUB2H	2094.	12.50	606.	190.	186.	3.16		
4 COMBINED AT	ADD4	20372.	13.17	9292.	2909.	2850.	48.85		
ROUTED TO	RT4	20089.	13.33	9286.	2900.	2841.	48.85		

+	HYDROGRAPH AT	SUB2I	2277.	12.42	580.	182.	178.	3.02
+	HYDROGRAPH AT	SUB2J	902.	12.25	185.	58.	57.	0.96
+	HYDROGRAPH AT	SUB2K	1799.	12.33	452.	141.	139.	2.35
+	4 COMBINED AT	ADD5	21800.	13.25	10476.	3282.	3215.	55.18
+	ROUTED TO	RT5	19657.	13.83	10404.	3247.	3181.	55.18
+	HYDROGRAPH AT	SUB2L	3287.	12.58	1032.	323.	316.	5.39
+	HYDROGRAPH AT	SUB2M	4029.	12.50	1183.	370.	363.	6.17
+	3 COMBINED AT	ADD6	22266.	13.75	12535.	3940.	3860.	66.74
+	ROUTED TO	RT6	21363.	14.17	12466.	3908.	3829.	66.74
+	HYDROGRAPH AT	SUB2N	2624.	12.58	805.	252.	247.	4.20
+	2 COMBINED AT	ADD7	22050.	14.17	13206.	4160.	4075.	70.94
+	ROUTED TO	RT7	19327.	15.17	12830.	4069.	3986.	70.94
+	HYDROGRAPH AT	SUB3A	2700.	13.17	1220.	381.	373.	7.87
+	HYDROGRAPH AT	SUB3B	3575.	12.83	1310.	405.	397.	8.29
+	3 COMBINED AT	ADD8	21233.	15.08	14925.	4855.	4756.	87.10
+	ROUTED TO	RT8	21203.	15.17	14917.	4845.	4746.	87.10
+	HYDROGRAPH AT	SUB3C	700.	12.50	196.	61.	60.	1.02
+	HYDROGRAPH AT	SUB3D	233.	12.17	42.	13.	13.	0.22
+	3 COMBINED AT	ADD9	21299.	15.17	15062.	4920.	4819.	88.34
+	ROUTED TO	ROUT5	20651.	15.75	14891.	4863.	4763.	88.34

+	HYDROGRAPH AT	SUB4W	2221.	12.83	621.	192.	188.	4.29
+	2 COMBINED AT	ADD	20873.	15.67	15222.	5054.	4951.	92.63
+	HYDROGRAPH AT	SUB5W	20908.	15.83	15261.	5035.	4932.	93.33
+	HYDROGRAPH AT	SUB6W	241.	12.58	84.	27.	26.	0.71
+	2 COMBINED AT	ADD	20956.	15.83	15314.	5061.	4958.	94.04
+	HYDROGRAPH AT	SUB25W	21025.	15.92	15399.	5066.	4962.	95.85
+	HYDROGRAPH AT	SUB1E	9683.	12.50	2187.	679.	665.	14.13
+	HYDROGRAPH AT	SUB2E	7531.	13.25	4031.	1300.	1273.	31.76
+	2 COMBINED AT	ADD	24422.	15.75	19077.	6365.	6236.	127.61
+	HYDROGRAPH AT	SUB29W	24471.	15.92	19158.	6364.	6234.	128.66
+	ROUTED TO	ROUT29	24456.	16.00	19138.	6311.	6182.	128.66
+	HYDROGRAPH AT	SUB1W	3070.	13.00	980.	303.	296.	6.57
+	HYDROGRAPH AT	SUB2W	4104.	12.83	1180.	365.	358.	7.90
+	2 COMBINED AT	ADD9	7068.	12.92	2160.	668.	654.	14.47
+	HYDROGRAPH AT	SUB8W	7413.	13.08	2347.	720.	705.	15.84
+	HYDROGRAPH AT	SUB9W	4239.	12.58	1006.	312.	306.	6.68
+	2 COMBINED AT	ADD10	10397.	12.83	3346.	1031.	1010.	22.52
+	HYDROGRAPH AT	SUB10W	10625.	12.83	3461.	1067.	1045.	23.45
+	HYDROGRAPH AT	SUB11W	10744.	12.83	3521.	1084.	1062.	23.90
+	HYDROGRAPH AT	SUB12W	197.	12.42	56.	17.	17.	0.42

+	2 COMBINED AT	ADD11	10892.	12.83	3577.	1101.	1079.	24.32
+	HYDROGRAPH AT	SUB13W	10890.	12.83	3636.	1118.	1095.	24.84
+	HYDROGRAPH AT	SUB3W	502.	12.58	161.	49.	48.	1.29
+	HYDROGRAPH AT	SUB7W	841.	13.00	334.	104.	102.	2.76
+	2 COMBINED AT	ADD12	11709.	12.83	3967.	1222.	1197.	27.60
+	ROUTED TO	ROUT14	11662.	12.92	3969.	1220.	1195.	27.60
+	HYDROGRAPH AT	SUB14W	11666.	12.92	3997.	1226.	1201.	27.82
+	HYDROGRAPH AT	SUB15W	11905.	13.00	4108.	1258.	1232.	28.69
+	HYDROGRAPH AT	SUB16W	340.	12.50	99.	30.	29.	0.79
+	2 COMBINED AT	ADD16	12139.	13.00	4207.	1288.	1262.	29.48
+	HYDROGRAPH AT	SUB17W	12221.	13.00	4255.	1300.	1274.	29.86
+	HYDROGRAPH AT	SUB21W	12176.	13.08	4264.	1300.	1274.	29.95
+	HYDROGRAPH AT	SUB18W	266.	12.75	97.	30.	29.	0.75
+	HYDROGRAPH AT	SUB19W	407.	12.50	119.	36.	36.	0.90
+	2 COMBINED AT	ADD	651.	12.58	216.	66.	65.	1.65
+	HYDROGRAPH AT	SUB20W	861.	12.67	284.	87.	85.	2.17
+	2 COMBINED AT	ADD20&21	12844.	13.08	4545.	1387.	1359.	32.12
+	ROUTED TO	ROUT2	12843.	13.08	4544.	1385.	1357.	32.12
+	HYDROGRAPH AT	SUB22W	124.	12.33	44.	14.	13.	0.34
+	2 COMBINED AT	ADD	12916.	13.08	4585.	1398.	1370.	32.46

+	ROUTED TO	ROUT22	12870.	13.08	4584.	1396.	1367.	32.46
+	HYDROGRAPH AT	SUB23W	12982.	13.17	4659.	1419.	1390.	33.12
+	HYDROGRAPH AT	SUB24W	13178.	13.17	4794.	1460.	1430.	34.28
+	HYDROGRAPH AT	SUB26W	13226.	13.25	4846.	1477.	1447.	34.79
+	HYDROGRAPH AT	SUB27W	13313.	13.33	4882.	1479.	1448.	35.26
+	HYDROGRAPH AT	SUB28W	568.	12.75	198.	61.	60.	1.52
+	2 COMBINED AT	ADD14	13686.	13.33	5055.	1539.	1508.	36.78
+	HYDROGRAPH AT	SUB4E	71.	12.75	28.	9.	9.	0.23
+	ROUTED TO	ROUT4E	71.	12.83	28.	9.	8.	0.23
+	HYDROGRAPH AT	SUB3E	2469.	12.67	658.	204.	200.	4.35
+	4 COMBINED AT	ADDLAST	29334.	13.58	24325.	8063.	7898.	170.02

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

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RUNOFF SUMMARY

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	SUB1A	10075.	12.92	4071.	1287.	1261.	15.78		
HYDROGRAPH AT	SUB1B	3350.	12.58	1110.	350.	343.	4.27		
HYDROGRAPH AT	SUB1C	5227.	12.67	1789.	564.	553.	6.88		
3 COMBINED AT	ADD1	18091.	12.83	6963.	2202.	2157.	26.93		
ROUTED TO	RT1	16615.	13.17	6953.	2191.	2146.	26.93		
HYDROGRAPH AT	SUB2A	7125.	12.67	2389.	754.	738.	9.18		
HYDROGRAPH AT	SUB2B	2364.	12.50	666.	211.	207.	2.54		
HYDROGRAPH AT	SUB2C	1938.	12.33	438.	139.	136.	1.67		
4 COMBINED AT	ADD2	24474.	12.92	10419.	3294.	3227.	40.32		
ROUTED TO	RT2	23919.	13.17	10413.	3283.	3216.	40.32		
HYDROGRAPH AT	SUB2D	2071.	12.42	556.	176.	172.	2.13		
HYDROGRAPH AT	SUB2E	1513.	12.25	322.	102.	100.	1.23		
3 COMBINED AT	ADD3	25329.	13.17	11275.	3561.	3488.	43.68		
ROUTED TO	RT3	25256.	13.25	11274.	3557.	3484.	43.68		
HYDROGRAPH AT	SUB2F	482.	12.17	79.	25.	24.	0.30		
HYDROGRAPH AT	SUB2G	1664.	12.50	486.	153.	150.	1.71		
HYDROGRAPH AT	SUB2H	2862.	12.50	825.	260.	255.	3.16		
4 COMBINED AT	ADD4	27856.	13.17	12647.	3995.	3914.	48.85		
ROUTED TO	RT4	27485.	13.33	12640.	3984.	3903.	48.85		

50-4R

+	HYDROGRAPH AT	SUB2I	3105.	12.42	789.	249.	244.	3.02
+	HYDROGRAPH AT	SUB2J	1229.	12.25	251.	80.	78.	0.96
+	HYDROGRAPH AT	SUB2K	2461.	12.33	614.	194.	190.	2.35
+	4 COMBINED AT	ADD5	29813.	13.25	14260.	4507.	4415.	55.18
+	ROUTED TO	RT5	26909.	13.83	14177.	4462.	4371.	55.18
+	HYDROGRAPH AT	SUB2L	4495.	12.58	1405.	443.	434.	5.39
+	HYDROGRAPH AT	SUB2M	5510.	12.50	1610.	508.	498.	6.17
+	3 COMBINED AT	ADD6	30436.	13.67	17085.	5414.	5303.	66.74
+	ROUTED TO	RT6	29228.	14.17	17004.	5372.	5263.	66.74
+	HYDROGRAPH AT	SUB2N	3587.	12.50	1095.	346.	339.	4.20
+	2 COMBINED AT	ADD7	30168.	14.08	18020.	5718.	5601.	70.94
+	ROUTED TO	RT7	26470.	15.17	17537.	5599.	5485.	70.94
+	HYDROGRAPH AT	SUB3A	3877.	13.17	1735.	544.	533.	7.87
+	HYDROGRAPH AT	SUB3B	5140.	12.75	1859.	578.	567.	8.29
+	3 COMBINED AT	ADD8	29137.	15.08	20550.	6721.	6584.	87.10
+	ROUTED TO	RT8	29106.	15.17	20538.	6708.	6571.	87.10
+	HYDROGRAPH AT	SUB3C	958.	12.42	266.	84.	82.	1.02
+	HYDROGRAPH AT	SUB3D	317.	12.17	58.	18.	18.	0.22
+	3 COMBINED AT	ADD9	29232.	15.17	20744.	6810.	6671.	88.34
+	ROUTED TO	ROUT5	28375.	15.67	20509.	6735.	6598.	88.34

+	HYDROGRAPH AT	SUB4W	3471.	12.75	960.	299.	293.	4.29
+	2 COMBINED AT	ADD	28703.	15.67	21043.	7035.	6891.	92.63
+	HYDROGRAPH AT	SUB5W	28749.	15.83	21120.	7027.	6884.	93.33
+	HYDROGRAPH AT	SUB6W	475.	12.33	138.	43.	42.	0.71
+	2 COMBINED AT	ADD	28816.	15.83	21201.	7070.	6926.	94.04
+	HYDROGRAPH AT	SUB25W	28922.	15.92	21337.	7106.	6961.	95.85
+	HYDROGRAPH AT	SUB1E	14866.	12.50	3341.	1048.	1026.	14.13
+	HYDROGRAPH AT	SUB2E	14526.	13.08	6566.	2063.	2021.	31.76
+	2 COMBINED AT	ADD	33383.	15.75	27368.	9169.	8982.	127.61
+	HYDROGRAPH AT	SUB29W	33442.	15.83	27475.	9188.	9001.	128.66
+	ROUTED TO	ROUT29	33429.	15.92	27459.	9126.	8939.	128.66
+	HYDROGRAPH AT	SUB1W	4726.	13.00	1498.	468.	458.	6.57
+	HYDROGRAPH AT	SUB2W	6310.	12.83	1804.	564.	552.	7.90
+	2 COMBINED AT	ADD9	10872.	12.92	3302.	1032.	1011.	14.47
+	HYDROGRAPH AT	SUB8W	11328.	13.00	3597.	1114.	1092.	15.84
+	HYDROGRAPH AT	SUB9W	6506.	12.58	1537.	482.	472.	6.68
+	2 COMBINED AT	ADD10	15579.	12.83	5125.	1596.	1564.	22.52
+	HYDROGRAPH AT	SUB10W	15940.	12.83	5312.	1653.	1620.	23.45
+	HYDROGRAPH AT	SUB11W	16086.	12.83	5407.	1681.	1646.	23.90
+	HYDROGRAPH AT	SUB12W	377.	12.25	88.	27.	26.	0.42

+	2 COMBINED AT	ADD11	16281.	12.83	5495.	1707.	1673.	24.32
+	HYDROGRAPH AT	SUB13W	16359.	12.83	5594.	1735.	1700.	24.84
+	HYDROGRAPH AT	SUB3W	998.	12.42	260.	79.	77.	1.29
+	HYDROGRAPH AT	SUB7W	1722.	12.67	551.	168.	165.	2.76
+	2 COMBINED AT	ADD12	17958.	12.83	6141.	1904.	1865.	27.60
+	ROUTED TO	ROUT14	17896.	12.83	6140.	1900.	1862.	27.60
+	HYDROGRAPH AT	SUB14W	17938.	12.92	6185.	1911.	1872.	27.82
+	HYDROGRAPH AT	SUB15W	18338.	12.92	6365.	1961.	1921.	28.69
+	HYDROGRAPH AT	SUB16W	660.	12.33	160.	48.	47.	0.79
+	2 COMBINED AT	ADD16	18677.	12.92	6524.	2010.	1969.	29.48
+	HYDROGRAPH AT	SUB17W	18781.	12.92	6601.	2030.	1989.	29.86
+	HYDROGRAPH AT	SUB21W	18766.	13.00	6618.	2031.	1989.	29.95
+	HYDROGRAPH AT	SUB18W	517.	12.50	155.	47.	46.	0.75
+	HYDROGRAPH AT	SUB19W	787.	12.33	189.	57.	56.	0.90
+	2 COMBINED AT	ADD	1254.	12.42	344.	105.	103.	1.65
+	HYDROGRAPH AT	SUB20W	1640.	12.50	457.	139.	136.	2.17
+	2 COMBINED AT	ADD20&21	19869.	12.92	7074.	2169.	2125.	32.12
+	ROUTED TO	ROUT20	19842.	13.00	7073.	2166.	2122.	32.12
+	HYDROGRAPH AT	SUB22W	241.	12.17	70.	22.	21.	0.34
+	2 COMBINED AT	ADD	19964.	13.00	7140.	2188.	2143.	32.46

+	ROUTED TO	ROUT22	19947.	13.00	7139.	2185.	2140.	32.46
+	HYDROGRAPH AT	SUB23W	20128.	13.00	7266.	2222.	2177.	33.12
+	HYDROGRAPH AT	SUB24W	20517.	13.08	7490.	2289.	2242.	34.28
+	HYDROGRAPH AT	SUB26W	20627.	13.08	7581.	2318.	2271.	34.79
+	HYDROGRAPH AT	SUB27W	20721.	13.25	7693.	2335.	2287.	35.26
+	HYDROGRAPH AT	SUB28W	1087.	12.50	316.	96.	94.	1.52
+	2 COMBINED AT	ADD14	21238.	13.25	7989.	2431.	2381.	36.78
+	HYDROGRAPH AT	SUB4E	139.	12.50	46.	14.	14.	0.23
+	ROUTED TO	ROUT4E	138.	12.67	46.	14.	14.	0.23
+	HYDROGRAPH AT	SUB3E	3808.	12.67	1006.	315.	308.	4.35
+	4 COMBINED AT	ADDLAST	48921.	13.33	35788.	11885.	11643.	170.02

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

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RUNOFF SUMMARY

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	SUB1A	15475.	12.92	6216.	1997.	1956.	15.78		
HYDROGRAPH AT	SUB1B	5148.	12.58	1697.	543.	532.	4.27		
HYDROGRAPH AT	SUB1C	8019.	12.67	2734.	875.	857.	6.88		
3 COMBINED AT	ADD1	27737.	12.83	10636.	3415.	3345.	26.93		
ROUTED TO	RT1	25492.	13.17	10621.	3398.	3329.	26.93		
HYDROGRAPH AT	SUB2A	10922.	12.58	3650.	1168.	1145.	9.18		
HYDROGRAPH AT	SUB2B	3609.	12.50	1015.	326.	319.	2.54		
HYDROGRAPH AT	SUB2C	2951.	12.33	668.	215.	210.	1.67		
4 COMBINED AT	ADD2	37576.	12.92	15915.	5107.	5003.	40.32		
ROUTED TO	RT2	36702.	13.17	15907.	5092.	4988.	40.32		
HYDROGRAPH AT	SUB2D	3172.	12.42	850.	272.	267.	2.13		
HYDROGRAPH AT	SUB2E	2311.	12.25	492.	158.	155.	1.23		
3 COMBINED AT	ADD3	38875.	13.08	17226.	5523.	5410.	43.68		
ROUTED TO	RT3	38771.	13.17	17224.	5516.	5404.	43.68		
HYDROGRAPH AT	SUB2F	733.	12.08	120.	39.	38.	0.30		
HYDROGRAPH AT	SUB2G	2550.	12.50	742.	238.	233.	1.71		
HYDROGRAPH AT	SUB2H	4381.	12.50	1260.	404.	395.	3.16		
4 COMBINED AT	ADD4	42714.	13.08	19321.	6196.	6070.	48.85		
ROUTED TO	RT4	42145.	13.33	19313.	6180.	6054.	48.85		

500-4R

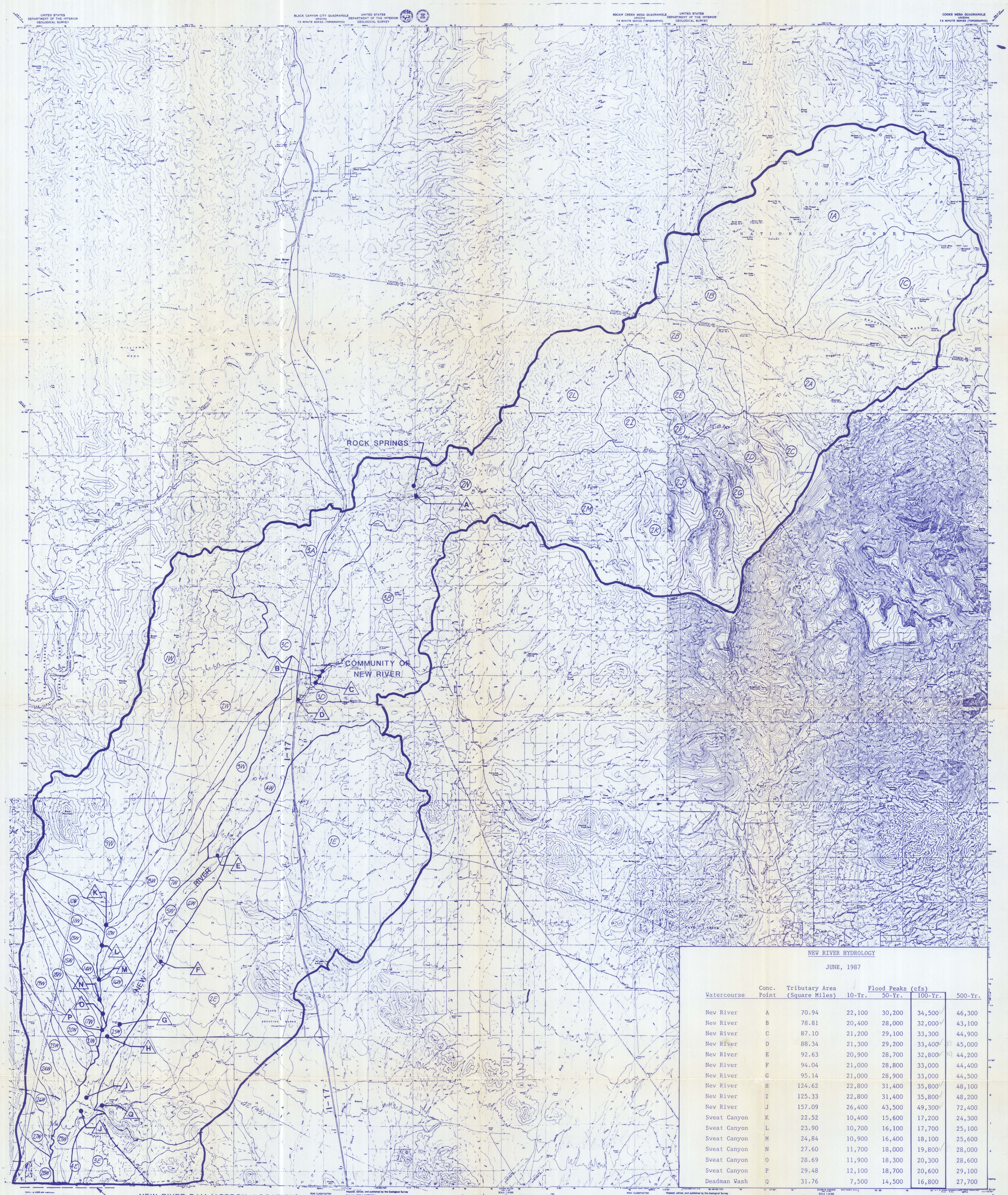
+	HYDROGRAPH AT	SUB2I	4746.	12.33	1206.	387.	379.	3.02
+	HYDROGRAPH AT	SUB2J	1872.	12.25	384.	123.	121.	0.96
+	HYDROGRAPH AT	SUB2K	3771.	12.33	939.	301.	295.	2.35
+	4 COMBINED AT	ADD5	45699.	13.25	21789.	6990.	6848.	55.18
+	ROUTED TO	RT5	41297.	13.83	21678.	6925.	6784.	55.18
+	HYDROGRAPH AT	SUB2L	6885.	12.58	2146.	687.	673.	5.39
+	HYDROGRAPH AT	SUB2M	8441.	12.50	2460.	788.	772.	6.17
+	3 COMBINED AT	ADD6	46701.	13.67	26133.	8400.	8228.	66.74
+	ROUTED TO	RT6	44836.	14.17	26030.	8340.	8170.	66.74
+	HYDROGRAPH AT	SUB2N	5506.	12.50	1673.	536.	525.	4.20
+	2 COMBINED AT	ADD7	46292.	14.08	27596.	8876.	8695.	70.94
+	ROUTED TO	RT7	40689.	15.08	26912.	8702.	8525.	70.94
+	HYDROGRAPH AT	SUB3A	6275.	13.17	2783.	882.	864.	7.87
+	HYDROGRAPH AT	SUB3B	8327.	12.75	2977.	937.	918.	8.29
+	3 COMBINED AT	ADD8	44903.	15.00	31809.	10521.	10306.	87.10
+	ROUTED TO	RT8	44850.	15.08	31791.	10502.	10287.	87.10
+	HYDROGRAPH AT	SUB3C	1470.	12.42	407.	130.	128.	1.02
+	HYDROGRAPH AT	SUB3D	482.	12.17	88.	28.	28.	0.22
+	3 COMBINED AT	ADD9	45041.	15.08	32120.	10660.	10443.	88.34
+	ROUTED TO	ROUT5	43760.	15.67	31764.	10551.	10335.	88.34

+	HYDROGRAPH AT	SUB4W	5419.	12.75	1493.	472.	462.	4.29
+	2 COMBINED AT	ADD	44248.	15.58	32642.	11022.	10797.	92.63
+	HYDROGRAPH AT	SUB5W	44316.	15.75	32753.	11029.	10804.	93.33
+	HYDROGRAPH AT	SUB6W	906.	12.25	222.	69.	68.	0.71
+	2 COMBINED AT	ADD	44410.	15.75	32876.	11098.	10871.	94.04
+	HYDROGRAPH AT	SUB25W	44586.	15.83	33093.	11183.	10954.	95.85
+	HYDROGRAPH AT	SUB1E	22872.	12.50	5142.	1635.	1602.	14.13
+	HYDROGRAPH AT	SUB2E	27693.	12.92	10558.	3289.	3221.	31.76
+	2 COMBINED AT	ADD	50433.	15.67	42800.	14471.	14176.	127.61
+	HYDROGRAPH AT	SUB29W	50519.	15.75	42969.	14517.	14221.	128.66
+	ROUTED TO	ROUT29	50509.	15.83	42945.	14439.	14144.	128.66
+	HYDROGRAPH AT	SUB1W	7309.	12.92	2307.	730.	715.	6.57
+	HYDROGRAPH AT	SUB2W	9758.	12.75	2778.	880.	862.	7.90
+	2 COMBINED AT	ADD9	16763.	12.92	5084.	1611.	1578.	14.47
+	HYDROGRAPH AT	SUB8W	17398.	13.00	5543.	1743.	1707.	15.84
+	HYDROGRAPH AT	SUB9W	10008.	12.58	2366.	752.	737.	6.68
+	2 COMBINED AT	ADD10	24289.	12.75	7900.	2495.	2444.	22.52
+	HYDROGRAPH AT	SUB10W	24890.	12.75	8201.	2587.	2534.	23.45
+	HYDROGRAPH AT	SUB11W	25074.	12.75	8348.	2631.	2577.	23.90
+	HYDROGRAPH AT	SUB12W	709.	12.17	138.	43.	42.	0.42

+	2 COMBINED AT	ADD11	25358.	12.75	8486.	2673.	2618.	24.32
+	HYDROGRAPH AT	SUB13W	25602.	12.83	8649.	2719.	2664.	24.84
+	HYDROGRAPH AT	SUB3W	1946.	12.25	413.	127.	124.	1.29
+	HYDROGRAPH AT	SUB7W	3428.	12.42	890.	271.	266.	2.76
+	2 COMBINED AT	ADD12	28044.	12.75	9533.	2991.	2930.	27.60
+	ROUTED TO	ROUT14	27959.	12.83	9533.	2987.	2926.	27.60
+	HYDROGRAPH AT	SUB14W	28048.	12.83	9605.	3004.	2943.	27.82
+	HYDROGRAPH AT	SUB15W	28632.	12.83	9888.	3086.	3023.	28.69
+	HYDROGRAPH AT	SUB16W	1251.	12.25	253.	78.	76.	0.79
+	2 COMBINED AT	ADD16	29121.	12.83	10141.	3164.	3099.	29.48
+	HYDROGRAPH AT	SUB17W	29273.	12.83	10266.	3198.	3132.	29.86
+	HYDROGRAPH AT	SUB21W	29248.	12.92	10294.	3200.	3135.	29.95
+	HYDROGRAPH AT	SUB18W	966.	12.33	245.	75.	74.	0.75
+	HYDROGRAPH AT	SUB19W	1482.	12.17	295.	91.	89.	0.90
+	2 COMBINED AT	ADD	2377.	12.25	540.	167.	163.	1.65
+	HYDROGRAPH AT	SUB20W	3053.	12.33	718.	221.	216.	2.17
+	2 COMBINED AT	ADD20&21	30921.	12.83	11011.	3421.	3351.	32.12
+	ROUTED TO	ROUT20	30834.	12.83	11012.	3417.	3347.	32.12
+	HYDROGRAPH AT	SUB22W	483.	12.08	111.	34.	34.	0.34
+	2 COMBINED AT	ADD	31036.	12.83	11122.	3451.	3381.	32.46

ROUTED TO +	ROUT22	31022.	12.92	11122.	3447.	3377.	32.46
HYDROGRAPH AT +	SUB23W	31362.	12.92	11332.	3508.	3436.	33.12
HYDROGRAPH AT +	SUB24W	31965.	12.92	11702.	3617.	3543.	34.28
HYDROGRAPH AT +	SUB26W	32167.	13.00	11859.	3664.	3589.	34.79
HYDROGRAPH AT +	SUB27W	32324.	13.08	12039.	3694.	3618.	35.26
HYDROGRAPH AT +	SUB28W	2065.	12.33	498.	153.	150.	1.52
2 COMBINED AT +	ADD14	33113.	13.08	12526.	3847.	3768.	36.78
HYDROGRAPH AT +	SUB4E	268.	12.33	73.	22.	22.	0.23
ROUTED TO +	ROUT4E	264.	12.42	74.	22.	22.	0.23
HYDROGRAPH AT +	SUB3E	5883.	12.67	1548.	491.	481.	4.35
4 COMBINED AT +	ADDLAST	82786.	13.17	56052.	18800.	18416.	170.02

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



NEW RIVER HYDROLOGY

JUNE, 1987

Watercourse	Conc. Point	Tributary Area (Square Miles)	Flood Peaks (cfs) 10-Yr.	50-Yr.	100-Yr.	500-Yr.
New River	A	70.94	22,100	30,200	34,500	46,300
New River	B	78.81	20,400	28,000	32,000	43,100
New River	C	87.10	21,200	29,100	33,300	44,900
New River	D	88.34	21,300	29,200	33,400	45,000
New River	E	92.63	20,900	28,700	32,800	44,200
New River	F	94.04	21,000	28,800	33,000	44,400
New River	G	95.14	21,000	28,900	33,000	44,500
New River	H	124.62	22,800	31,400	35,800	48,100
New River	I	125.33	22,800	31,400	35,800	48,200
New River	J	157.09	26,400	43,500	49,300	72,400
Sweat Canyon	K	22.52	10,400	15,600	17,200	24,300
Sweat Canyon	L	23.90	10,700	16,100	17,700	25,100
Sweat Canyon	M	24,84	10,900	16,400	18,100	25,600
Sweat Canyon	N	27.60	11,700	18,000	19,800	28,000
Sweat Canyon	O	28.69	11,900	18,300	20,300	28,600
Sweat Canyon	P	29.48	12,100	18,700	20,600	29,100
Deadman Wash	Q	31.76	7,500	14,500	16,800	27,700

LEGEND

WATERSHED BOUNDARY

SUBWATERSHED BOUNDARY

(2E) WATERSHED DESIGNATION

(A) CONCENTRATION POINT IDENTIFICATION

WATERSHED MAP

NEW RIVER UPSTREAM OF NEW RIVER DAM

FLOOD INSURANCE STUDY

MARICOPA COUNTY, ARIZONA

JANUARY 1987
REVISED JUNE 1987

COE & VAN LOO
CONSULTING ENGINEERS INC.
PHOENIX
ARIZONA

CVL FILE NO. 1090-01-1 FIGURE 2

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

NEW RIVER
RUNOFF SUMMARY
50-YR.

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	SUB1A	10675.	12.92	4071.	1287.	1261.	15.78		
HYDROGRAPH AT	SUB1B	3350.	12.58	1110.	350.	343.	4.27		
HYDROGRAPH AT	SUB1C	5227.	12.67	1789.	564.	553.	6.88		
3 COMBINED AT	ADD1	18091.	12.83	6963.	2202.	2157.	26.93		
ROUTED TO	RT1	16615.	13.17	6953.	2191.	2146.	26.93		
HYDROGRAPH AT	SUB2A	7125.	12.67	2389.	754.	738.	9.18		
HYDROGRAPH AT	SUB2B	2364.	12.50	666.	211.	207.	2.54		
HYDROGRAPH AT	SUB2C	1938.	12.33	438.	139.	136.	1.67		
4 COMBINED AT	ADD2	24474.	12.92	10419.	3294.	3227.	40.32		
ROUTED TO	RT2	23919.	13.17	10413.	3283.	3216.	40.32		
HYDROGRAPH AT	SUB2D	2071.	12.42	556.	176.	172.	2.13		
HYDROGRAPH AT	SUB2E	1513.	12.25	322.	102.	100.	1.23		
3 COMBINED AT	ADD3	25329.	13.17	11275.	3561.	3488.	43.68		
ROUTED TO	RT3	25256.	13.25	11274.	3557.	3484.	43.68		
HYDROGRAPH AT	SUB2F	482.	12.17	79.	25.	24.	0.30		
HYDROGRAPH AT	SUB2G	1664.	12.50	486.	153.	150.	1.71		
HYDROGRAPH AT	SUB2H	2862.	12.50	825.	260.	255.	3.16		
4 COMBINED AT	ADD4	27856.	13.17	12647.	3995.	3914.	48.85		
ROUTED TO	RT4	27485.	13.33	12646.	3984.	3903.	48.85		
HYDROGRAPH AT	SUB2I	3105.	12.42	789.	249.	244.	3.02		
HYDROGRAPH AT	SUB2J	1229.	12.25	251.	80.	78.	0.96		
HYDROGRAPH AT	SUB2K	2461.	12.33	614.	194.	190.	2.35		
4 COMBINED AT	ADD5	29813.	13.25	14260.	4507.	4415.	55.18		
ROUTED TO	RT5	26909.	13.83	14177.	4462.	4371.	55.18		
HYDROGRAPH AT	SUB2L	4495.	12.58	1405.	443.	434.	5.39		
HYDROGRAPH AT	SUB2M	5510.	12.50	1610.	508.	498.	6.17		
3 COMBINED AT	ADD6	30436.	13.67	17085.	5414.	5303.	66.74		
ROUTED TO	RT6	29228.	14.17	17084.	5372.	5263.	66.74		
HYDROGRAPH AT	SUB2N	3587.	12.50	1095.	346.	339.	4.20		
2 COMBINED AT	ADD7	30168.	14.08	18820.	5718.	5601.	70.94		
ROUTED TO	RT7	26470.	15.17	17537.	5599.	5485.	70.94		
HYDROGRAPH AT	SUB3A	3877.	13.17	1735.	544.	533.	7.87		
2 COMBINED AT	ADD	28002.	15.08	19817.	6143.	6018.	78.81		
HYDROGRAPH AT	SUB3B	5140.	12.75	1859.	578.	567.	8.29		
2 COMBINED AT	ADD8	29137.	15.08	20550.	6721.	6584.	87.10		
ROUTED TO	RT8	29106.	15.17	20538.	6708.	6571.	87.10		
HYDROGRAPH AT	SUB3C	958.	12.42	266.	84.	82.	1.02		
HYDROGRAPH AT	SUB3D	317.	12.17	58.	18.	18.	0.22		
3 COMBINED AT	ADD9	29232.	15.17	20744.	6810.	6671.	88.34		
ROUTED TO	ROUT5	28375.	15.67	20509.	6735.	6598.	88.34		
HYDROGRAPH AT	SUB4W	3471.	12.75	960.	299.	293.	4.29		
2 COMBINED AT	ADD	28703.	15.67	21043.	7035.	6891.	92.63		
HYDROGRAPH AT	SUB5W	28749.	15.83	21128.	7027.	6884.	93.33		
HYDROGRAPH AT	SUB6W	475.	12.33	138.	43.	42.	0.71		
2 COMBINED AT	ADD	28816.	15.83	21201.	7070.	6926.	94.04		
HYDROGRAPH AT	SUB25WN	28879.	15.92	21303.	7101.	6956.	95.14		
ROUTED TO	ROUT25	28862.	16.00	21292.	7094.	6910.	95.14		
HYDROGRAPH AT	SUB1W	4726.	13.00	1498.	468.	458.	6.57		
HYDROGRAPH AT	SUB2W	6310.	12.83	1804.	564.	552.	7.90		
2 COMBINED AT	ADD9	10872.	12.92	3302.	1032.	1011.	14.47		
HYDROGRAPH AT	SUB4W	11328.	13.00	3597.	1114.	1092.	15.84		
HYDROGRAPH AT	SUB5W	6506.	12.58	1537.	482.	472.	6.68		
2 COMBINED AT	ADD10	15579.	12.83	5125.	1596.	1564.	22.52		
HYDROGRAPH AT	SUB10W	15940.	12.83	5312.	1653.	1620.	23.45		
HYDROGRAPH AT	SUB11W	16086.	12.83	5407.	1681.	1646.	23.90		
HYDROGRAPH AT	SUB12W	377.	12.25	88.	27.	26.	0.42		
2 COMBINED AT	ADD11	16281.	12.83	5495.	1707.	1673.	24.32		
HYDROGRAPH AT	SUB13W	16359.	12.83	5594.	1735.	1700.	24.84		
HYDROGRAPH AT	SUB3W	998.	12.42	260.	79.	77.	1.29		
HYDROGRAPH AT	SUB7W	1722.	12.67	551.	168.	165.	2.76		
2 COMBINED AT	ADD12	17958.	12.83	6141.	1904.	1865.	27.60		
ROUTED TO	ROUT14	17896.	12.83	6140.	1900.	1862.	27.60		
HYDROGRAPH AT	SUB14W	17938.	12.92	6185.	1911.	1872.	27.82		
HYDROGRAPH AT	SUB15W	18338.	12.92	6365.	1961.	1921.	28.69		
HYDROGRAPH AT	SUB16W	660.	12.33	160.	48.	47.	0.79		
2 COMBINED AT	ADD16	18677.	12.92	6524.	2010.	1965.	29.48		
2 COMBINED AT	ADD	31391.	15.92	26667.	9063.	8878.	124.62		
HYDROGRAPH AT	SUB25WS	31423.	16.00	26737.	9079.	8893.	125.33		
HYDROGRAPH AT	SUB1E	14866.	12.50	3341.	1048.	1026.	14.13		
HYDROGRAPH AT	SUB2E	14526.	13.08	6586.	2063.	2021.	31.76		
2 COMBINED AT	ADD	43496.	13.25	33224.	11142.	10914.	157.09		
ROUTED TO	ROUT29	43426.	13.25	33196.	11073.	10847.	157.09		
HYDROGRAPH AT	SUB29W	43562.	13.42	33297.	11091.	10865.	158.14		
HYDROGRAPH AT	SUB17W	331.	12.33	79.	24.	23.	0.38		
HYDROGRAPH AT	SUB21W	362.	12.50	97.	29.	29.	0.47		
HYDROGRAPH AT	SUB18W	517.	12.50	155.	47.	46.	0.75		
HYDROGRAPH AT	SUB19W	787.	12.33	189.	57.	56.	0.90		
2 COMBINED AT	ADD	1254.	12.42	344.	105.	103.	1.65		
HYDROGRAPH AT	SUB20W	1640.	12.50	457.	135.	136.	2.17		
2 COMBINED AT	ADD20&21	2003.	12.50	554.	168.	165.	2.64		
ROUTED TO	ROUT20	1991.	12.58	557.	168.	165.	2.64		
HYDROGRAPH AT	SUB22W	241.	12.17	70.	22.	21.	0.34		
2 COMBINED AT	ADD	2158.	12.58	626.	190.	186.	2.98		
ROUTED TO	ROUT22	2143.	12.58	628.	189.	186.	2.98		
HYDROGRAPH AT	SUB23W	2443.	12.67	758.	230.	225.	3.64		
HYDROGRAPH AT	SUB24W	2967.	12.75	990.	301.	295.	4.80		
HYDROGRAPH AT	SUB26W	3108.	12.75	1085.	332.	325.	5.31		
HYDROGRAPH AT	SUB27W	3187.	12.92	1141.	355.	347.	5.78		
2 COMBINED AT	ADD	46133.	13.33	34379.	11446.	11212.	163.92		
HYDROGRAPH AT	SUB28W	1087.	12.50	316.	96.	94.	1.52		
HYDROGRAPH AT	SUB4E	139.	12.50	46.	14.	14.	0.23		
ROUTED TO	ROUT4E	138.	12.67	46.	14.	14.	0.23		
HYDROGRAPH AT	SUB3E	3808.	12.67	1006.	315.	308.	4.35		
4 COMBINED AT	ADDLAST	48521.	13.33	35377.	11871.	11628.	170.82		

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

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

NEW RIVER
RUNOFF SUMMARY
10-YR.

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	SUB1A	7351.	12.92	2992.	937.	918.	15.78		
HYDROGRAPH AT	SUB1B	2448.	12.67	816.	255.	250.	4.27		
HYDROGRAPH AT	SUB1C	3817.	12.67	1315.	411.	403.	6.68		
3 COMBINED AT	ADD1	13222.	12.83	5118.	1604.	1571.	26.93		
ROUTED TO	RT1	12137.	13.17	5110.	1595.	1562.	26.93		
HYDROGRAPH AT	SUB2A	5208.	12.67	1755.	545.	536.	9.18		
HYDROGRAPH AT	SUB2B	1735.	12.50	495.	154.	151.	2.54		
HYDROGRAPH AT	SUB2C	1425.	12.33	322.	101.	99.	1.67		
4 COMBINED AT	ADD2	17867.	12.92	7657.	2399.	2350.	40.32		
ROUTED TO	RT2	17472.	13.17	7652.	2391.	2342.	40.32		
HYDROGRAPH AT	SUB2D	1515.	12.42	409.	128.	125.	2.13		
HYDROGRAPH AT	SUB2E	1109.	12.25	237.	74.	73.	1.23		
3 COMBINED AT	ADD3	18523.	13.17	8285.	2593.	2540.	43.68		
ROUTED TO	RT3	18471.	13.25	8283.	2590.	2537.	43.68		
HYDROGRAPH AT	SUB2F	357.	12.17	58.	18.	18.	0.30		
HYDROGRAPH AT	SUB2G	1216.	12.50	357.	112.	109.	1.71		
HYDROGRAPH AT	SUB2H	2094.	12.50	606.	190.	186.	3.16		
4 COMBINED AT	ADD4	20372.	13.17	9292.	2909.	2850.	48.85		
ROUTED TO	RT4	20089.	13.33	9286.	2905.	2841.	48.85		
HYDROGRAPH AT	SUB2I	2277.	12.42	580.	182.	178.	3.02		
HYDROGRAPH AT	SUB2J	902.	12.25	185.	58.	57.	0.96		
HYDROGRAPH AT	SUB2K	1799.	12.33	452.	141.	139.	2.35		
4 COMBINED AT	ADD5	21800.	13.25	10476.	3282.	3215.	55.18		
ROUTED TO	RT5	19657.	13.83	10404.	3247.	3181.	55.18		
HYDROGRAPH AT	SUB2L	3287.	12.58	1032.	323.	316.	5.39		
HYDROGRAPH AT	SUB2M	4029.	12.50	1183.	370.	363.	6.17		
3 COMBINED AT	ADD6	22266.	13.75	12535.	3940.	3860.	66.74		
ROUTED TO	RT6	21363.	14.17	12466.	3908.	3829.	66.74		
HYDROGRAPH AT	SUB2N	2624.	12.58	805.	252.	247.	4.20		
2 COMBINED AT	ADD7	22050.	14.17	13206.	4160.	4075.	70.94		
ROUTED TO	RT7	19327.	15.17	12830.	4069.	3986.	70.94		
HYDROGRAPH AT	SUB3A	2790.	13.17	1220.	381.	373.	7.87		
2 COMBINED AT	ADD	20406.	15.08	13865.	4450.	4359.	78.81		
HYDROGRAPH AT	SUB3B	3575.	12.83	1310.	405.	397.	8.29		
2 COMBINED AT	ADD8	21233.	15.08	14925.	4855.	4756.	87.10		
ROUTED TO	RT8	21293.	15.17	14917.	4845.	4746.	87.10		
HYDROGRAPH AT	SUB3C	788.	12.50	196.	61.	60.	1.02		
HYDROGRAPH AT	SUB3D	233.	12.17	42.	13.	13.	0.22		
3 COMBINED AT	ADD9	21299.	15.17	15062.	4922.	4819.	88.34		
ROUTED TO	ROUT5	20651.	15.75	14891.	4863.	4763.	88.34		
HYDROGRAPH AT	SUB4W	2221.	12.83	621.	192.	188.	4.29		
2 COMBINED AT	ADD	20873.	15.67	15222.	5054.	4951.	92.63		
HYDROGRAPH AT	SUB5W	23908.	15.83	15261.	5035.	4932.	93.33		
HYDROGRAPH AT	SUB6W	241.	12.58	84.	27.	26.	0.71		
2 COMBINED AT	ADD	20956.	15.83	15314.	5061.	4958.	94.04		
HYDROGRAPH AT	SUB25WN	21008.	15.92	15387.	5071.	4968.	95.14		
ROUTED TO	ROUT25	29991.	16.00	15378.	5032.	4929.	95.14		
HYDROGRAPH AT	SUB1W	3070.	13.00	980.	303.	296.	6.57		
HYDROGRAPH AT	SUB2W	4184.	12.83	1180.	365.	358.	7.90		
2 COMBINED AT	ADD9	7368.	12.92	2160.	668.	654.	14.47		
HYDROGRAPH AT	SUB8W	7413.	13.08	2347.	728.	705.	15.84		
HYDROGRAPH AT	SUB5W	4239.	12.58	1036.	312.	306.	6.68		
2 COMBINED AT	ADD10	10397.	12.83	3346.	1031.	1010.	22.52		
HYDROGRAPH AT	SUB10W	10625.	12.83	3461.	1067.	1045.	23.45		
HYDROGRAPH AT	SUB11W	10744.	12.83	3521.	1384.	1062.	23.90		
HYDROGRAPH AT	SUB12W	197.	12.42	56.	17.	17.	0.42		
2 COMBINED AT	ADD11	10892.	12.83	3577.	1101.	1079.	24.32		
HYDROGRAPH AT	SUB13W	10890.	12.83	3636.	1118.	1095.	24.84		
HYDROGRAPH AT	SUB3W	502.	12.58	161.	49.	48.	1.29		
HYDROGRAPH AT	SUB7W	841.	13.00	334.	104.	102.	2.76		
2 COMBINED AT	ADD12	11709.	12.83	3967.	1222.	1197.	27.60		
ROUTED TO	ROUT14	11662.	12.92	3969.	1220.	1195.	27.60		
HYDROGRAPH AT	SUB14W	11666.	12.92	3997.	1226.	1201.	27.82		
HYDROGRAPH AT	SUB15W	11905.	13.00	4108.	1258.	1232.	28.69		
HYDROGRAPH AT	SUB16W	340.	12.50	99.	30.	29.	0.79		
2 COMBINED AT	ADD16	12139.	13.00	4207.	1288.	1262.	29.48		
2 COMBINED AT	ADD	22614.	15.92	18727.	6320.	6191.	124.62		
HYDROGRAPH AT	SUB25WS	22834.	16.00	18777.	6327.	6198.	125.33		
HYDROGRAPH AT	SUB1E	9683.	12.50	2187.	679.	665.	14.13		
HYDROGRAPH AT	SUB2E	7531.	13.25	4831.	1300.	1273.	31.76		
2 COMBINED AT	ADD	26361.	13.42	22756.	7627.	7471.	157.09		
ROUTED TO	ROUT29	26297.	13.50	22723.	7569.	7415.	157.09		
HYDROGRAPH AT	SUB29W	26385.	13.58	22820.	7570.	7415.	158.14		
HYDROGRAPH AT	SUB17W	173.	12.50	49.	15.	15.	0.38		
HYDROGRAPH AT	SUB21W	187.	12.67	59.	18.	18.	0.47		
HYDROGRAPH AT	SUB18W	266.	12.75	97.	30.	29.	0.75		
HYDROGRAPH AT	SUB19W	407.	12.50	119.	36.	36.	0.90		
2 COMBINED AT	ADD	651.	12.58	216.	66.	65.	1.65		
HYDROGRAPH AT	SUB20W	861.	12.67	284.	87.	85.	2.17		
2 COMBINED AT	ADD20&21	1048.	12.67	343.	105.	103.	2.64		
ROUTED TO	ROUT20	1046.	12.75	343.	105.	103.	2.64		
HYDROGRAPH AT	SUB22W	124.	12.33	44.	14.	13.	0.34		
2 COMBINED AT	ADD	1140.	12.75	385.	118.	116.	2.98		
ROUTED TO	ROUT22	1139.	12.83	384.	118.	115.	2.98		
HYDROGRAPH AT	SUB23W	1298.	12.83	463.	143.	140.	3.64		
HYDROGRAPH AT	SUB24W	1592.	12.92	604.	187.	183.	4.80		
HYDROGRAPH AT	SUB26W	1666.	13.00	660.	206.	202.	5.31		
HYDROGRAPH AT	SUB27W	1659.	13.25	700.	219.	215.	5.78		
2 COMBINED AT	ADD	27879.	13.58	23591.	7789.	7630.	163.92		
HYDROGRAPH AT	SUB28W	568.	12.75	198.	61.	60.	1.52		
HYDROGRAPH AT	SUB4E	71.	12.75	28.	9.	9.	0.23		
ROUTED TO	ROUT4E	71.	12.83	28.	9.	8.	0.23		
HYDROGRAPH AT	SUB3E	2469.	12.67	658.	204.	200.	4.35		
4 COMBINED AT	ADDLAST	29062.	13.58	24678.	8062.	7898.	170.02		

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

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

NEW RIVER
RUNOFF SUMMARY
500-YR.

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	SUB1A	15475.	12.92	6216.	1997.	1956.	15.78		
HYDROGRAPH AT	SUB1B	5148.	12.58	1697.	543.	532.	4.27		
HYDROGRAPH AT	SUB1C	8019.	12.67	2734.	875.	857.	6.88		
3 COMBINED AT	ADD1	27737.	12.83	10636.	3415.	3345.	26.93		
ROUTED TO	RT1	25492.	13.17	10621.	3398.	3329.	26.93		
HYDROGRAPH AT	SUB2A	10922.	12.58	3650.	1168.	1145.	9.18		
HYDROGRAPH AT	SUB2B	3609.	12.50	1015.	326.	319.	2.54		
HYDROGRAPH AT	SUB2C	2951.	12.33	668.	215.	210.	1.67		
4 COMBINED AT	ADD2	37576.	12.92	15915.	5107.	5003.	40.32		
ROUTED TO	RT2	36702.	13.17	15907.	5092.	4988.	40.32		
HYDROGRAPH AT	SUB2D	3172.	12.42	850.	272.	267.	2.13		
HYDROGRAPH AT	SUB2E	2311.	12.25	492.	158.	155.	1.23		
3 COMBINED AT	ADD3	38875.	13.08	17226.	5523.	5410.	43.68		
ROUTED TO	RT3	38771.	13.17	17224.	5516.	5404.	43.68		
HYDROGRAPH AT	SUB2F	733.	12.08	120.	39.	38.	0.30		
HYDROGRAPH AT	SUB2G	2550.	12.50	742.	238.	233.	1.71		
HYDROGRAPH AT	SUB2H	4381.	12.50	1260.	404.	395.	3.16		
4 COMBINED AT	ADD4	42714.	13.08	19321.	6196.	6070.	48.85		
ROUTED TO	RT4	42145.	13.33	19313.	6180.	6054.	48.85		
HYDROGRAPH AT	SUB2I	4746.	12.33	1206.	387.	379.	3.02		
HYDROGRAPH AT	SUB2J	1872.	12.25	384.	123.	121.	0.96		
HYDROGRAPH AT	SUB2K	3771.	12.33	939.	301.	295.	2.35		
4 COMBINED AT	ADD5	45699.	13.25	21789.	6990.	6848.	55.18		
ROUTED TO	RT5	41297.	13.83	21678.	6925.	6784.	55.18		
HYDROGRAPH AT	SUB2L	6885.	12.58	2146.	687.	673.	5.39		
HYDROGRAPH AT	SUB2M	8441.	12.50	2460.	788.	772.	6.17		
3 COMBINED AT	ADD6	46701.	13.67	26133.	8400.	8228.	66.74		
ROUTED TO	RT6	44836.	14.17	26039.	8340.	8170.	66.74		
HYDROGRAPH AT	SUB2N	5506.	12.50	1673.	536.	525.	4.20		
2 COMBINED AT	ADD7	46292.	14.08	27596.	8876.	8695.	70.94		
ROUTED TO	RT7	40689.	15.08	26912.	8702.	8525.	70.94		
HYDROGRAPH AT	SUB3A	6275.	13.17	2783.	882.	864.	7.87		
2 COMBINED AT	ADD	43112.	15.08	29305.	9584.	9389.	78.81		
HYDROGRAPH AT	SUB3B	8327.	12.75	2977.	937.	918.	8.29		
2 COMBINED AT	ADD8	44903.	15.00	31809.	10521.	10306.	87.10		
ROUTED TO	RT8	44850.	15.08	31791.	10502.	10287.	87.10		
HYDROGRAPH AT	SUB3C	1470.	12.42	467.	130.	128.	1.02		
HYDROGRAPH AT	SUB3D	482.	12.17	88.	28.	28.	0.22		
3 COMBINED AT	ADD9	45041.	15.08	32126.	10660.	10443.	88.34		
ROUTED TO	ROUT5	43760.	15.67	31764.	10551.	10335.	88.34		
HYDROGRAPH AT	SUB4W	5419.	12.75	1493.	472.	462.	4.29		
2 COMBINED AT	ADD	44248.	15.58	32642.	11022.	10797.	92.63		
HYDROGRAPH AT	SUB5W	44316.	15.75	32753.	11029.	10824.	93.33		
HYDROGRAPH AT	SUB6W	906.	12.25	222.	69.	68.	0.71		
2 COMBINED AT	ADD	44410.	15.75	32876.	11098.	10871.	94.04		
HYDROGRAPH AT	SUB25WN	44496.	15.83	33012.	11161.	10933.	95.14		
ROUTED TO	ROUT25	44481.	15.92	33001.	11101.	10875.	95.14		
HYDROGRAPH AT	SUB1W	7309.	12.92	2307.	730.	715.	6.57		
HYDROGRAPH AT	SUB2W	9758.	12.75	2778.	880.	862.	7.90		
2 COMBINED AT	ADD9	16763.	12.92	5084.	1611.	1578.	14.47		
HYDROGRAPH AT	SUB8W	17398.	13.00	5543.	1743.	1707.	15.84		
HYDROGRAPH AT	SUB9W	10038.	12.58	2366.	752.	737.	6.68		
2 COMBINED AT	ADD10	24289.	12.75	7980.	2495.	2444.	22.52		
HYDROGRAPH AT	SUB10W	24899.	12.75	8201.	2587.	2534.	23.45		
HYDROGRAPH AT	SUB11W	25074.	12.75	8348.	2631.	2577.	23.90		
HYDROGRAPH AT	SUB12W	709.	12.17	138.	43.	42.	0.42		
2 COMBINED AT	ADD11	25358.	12.75	8486.	2673.	2618.	24.32		
HYDROGRAPH AT	SUB13W	25602.	12.83	8649.	2719.	2664.	24.84		
HYDROGRAPH AT	SUB2W	1946.	12.25	413.	127.	124.	1.29		
HYDROGRAPH AT	SUB3W	3426.	12.42	890.	271.	266.	2.76		
2 COMBINED AT	ADD12	28044.	12.75	9533.	2991.	2930.	27.60		
ROUTED TO	ROUT14	27959.	12.83	9533.	2987.	2926.	27.60		
HYDROGRAPH AT	SUB14W	28048.	12.83	9685.	3004.	2943.	27.82		
HYDROGRAPH AT	SUB15W	28632.	12.83	9888.	3086.	3023.	28.69		
HYDROGRAPH AT	SUB16W	1251.	12.25	253.	78.	76.	0.79		
2 COMBINED AT	ADD16	29121.	12.83	10141.	3164.	3095.	29.48		
2 COMBINED AT	ADD	48139.	15.83	41413.	14265.	13974.	124.62		
HYDROGRAPH AT	SUB25WS	48188.	15.92	41528.	14295.	14003.	125.33		
HYDROGRAPH AT	SUB1E	22872.	12.50	5142.	1635.	1602.	14.13		
HYDROGRAPH AT	SUB2E	27693.	12.92	10558.	3289.	3221.	31.76		
2 COMBINED AT	ADD	72404.	13.08	51939.	17583.	17225.	157.89		
ROUTED TO	ROUT29	72287.	13.08	51938.	17497.	17140.	157.89		
HYDROGRAPH AT	SUB25W	72468.	13.25	52076.	17539.	17181.	158.14		
HYDROGRAPH AT	SUB17W	638.	12.25	124.	38.	37.	0.38		
HYDROGRAPH AT	SUB21W	695.	12.33	156.	47.	46.	0.47		
HYDROGRAPH AT	SUB18W	966.	12.33	245.	75.	74.	3.75		
HYDROGRAPH AT	SUB19W	1482.	12.17	295.	91.	89.	0.90		
2 COMBINED AT	ADD	2377.	12.25	540.	167.	163.	1.65		
HYDROGRAPH AT	SUB20W	3053.	12.33	718.	221.	216.	2.17		
2 COMBINED AT	ADD20&21	3748.	12.33	874.	268.	262.	2.64		
ROUTED TO	ROUT20	3701.	12.42	875.	267.	262.	2.64		
HYDROGRAPH AT	SUB22W	483.	12.08	111.	34.	34.	0.34		
2 COMBINED AT	ADD	4028.	12.42	986.	302.	296.	2.98		
ROUTED TO	ROUT22	3982.	12.42	986.	301.	295.	2.98		
HYDROGRAPH AT	SUB23W	4529.	12.50	1206.	367.	359.	3.64		
HYDROGRAPH AT	SUB24W	5434.	12.50	1574.	481.	471.	4.80		
HYDROGRAPH AT	SUB26W	5708.	12.58	1733.	530.	520.	5.31		
HYDROGRAPH AT	SUB27W	5539.	12.67	1876.	570.	558.	5.78		
2 COMBINED AT	ADD	76711.	13.17	53764.	18108.	17739.	163.92		
HYDROGRAPH AT	SUB28W	2065.	12.33	498.	153.	150.	1.52		
HYDROGRAPH AT	SUB4E	268.	12.33	73.	22.	22.	0.23		
ROUTED TO	ROUT4E	264.	12.42	74.	22.	22.	0.23		
HYDROGRAPH AT	SUB3E	5583.	12.67	1548.	491.	481.	4.35		
4 COMBINED AT	ADDLAST	81188.	13.08	55445.	18775.	18392.	170.62		

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