US Army Corps of Engineers
Hydrologic Engineering Center

Generalized Computer Program

HEC-FFA
Flood Frequency Analysis

User's Manual

May 1992

CPD-13

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14. ABSTRACT

The HEC-FFA software and User's Manual are used to compute flood frequencies in accordance with "Guidelines for Determining Flood Flow Frequencies", Bulletin 17B of the U.S. Water Resources Council (WRC), March 1982. HEC-FFA was formally called HEC-WRC. The name was changed to HEC-FFA, or simply FFA with this release to be more in keeping with other HEC computer program names, and to go back to something closer to its original name. The new program follows the same procedure as HEC-WRC, but many of the routines were re-written in a top-down, structured-program style. HEC-WRC was originally a modification of the computer program FREQFLO written by Leo R. Beard and David Ford (Center for Research in Water Resources, The University of Texas at Austin) under contact to the WRC. The original program (FREQFLO) and documentation may be found in Appendix 13, of Bulletin 17, March 1976. The latest version of the Guidelines (Bulletin 17B) does not contain computer program documentation. The input and output formats of the original program were restructures, a number of improvements and options were added, and a few computation errors were corrected.

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Table of Contents

Foreword

HEC-FFA was formerly called HECWRC. The name was changed to HEC-FFA, or simply FFA, with this release to be more in keeping with other HEC computer program names, and to go back to something closer to its original name. The new program follows the same procedures as HECWRC, but many of the routines were rewritten in a top-down, structured-program style. This was done to ease further improvements and maintenance. Some new capabilities were also added to the program as noted below.

HECWRC was originally a modification of the computer program FREQFLO written by Leo R. Beard and David Ford (Center for Research in Water Resources, the University of Texas at Austin) under contract to the Water Resources Council (WRC). The original program (FREQFLO) and documentation may be found in Appendix 13, Guidelines for Determining Flood Flow Frequencies, WRC, Bulletin 17, March 1976. The latest version of the Guidelines (Bulletin 17B) does not contain computer program documentation. The input and output formats of the original program were restructured, a number of improvements and options were added, and a few computational errors were corrected.

Differences Between HECWRC and HEC-FFA

Change in High-Outlier Specification. Bulletin 17B provides for a historic weighting adjustment for all peaks above a threshold value. HECWRC determined the threshold value as the minimum of the specified high outliers or the historic peak flows. If the minimum specified historic flow determines the threshold, then all systematic flows greater than the threshold, even those that are not designated as outliers, will be adjusted for the historic weighing. FFA differs from HECWRC in that all peaks above a specified threshold (HITHRS) will be adjusted via historic weighing. If a historic peak is less than the specified threshold, then that peak will not be used to estimate the frequency curve except for determining the historic period. If the threshold is not specified, then FFA chooses the threshold as the minimum historic peak as in HECWRC.

Changes in Low-Outlier Specification. The low-outlier test value will be calculated according to Bulletin 17B procedures and will automatically eliminate all peaks below this value, unless otherwise specified. In addition, a low threshold (LOTHRS) base can be specified by the user, and this value will override the base determined by 17B procedures. This differs from HECWRC in that, a lower threshold could be specified, but could not lower the base below the Bulletin 17B low-outlier base. This prevents including a Bulletin 17B computed low outlier in the analysis.

Plotting Positions. In HECWRC, historic records were added to the bottom of the list of systematic records regardless of their chronological order. FFA compares the first historic peak with the first systematic peak, if the historic peak has an earlier date, all the historic peaks are placed before the systematic records in the plotting positions table, otherwise all historic peaks are put at end of the systematic record. This affects only output display; it does not affect the computed frequency curve or the plotting positions.

Conditional Probability Adjustment. In the event of zero-flow years, the preliminary frequency curve now is calculated using preliminary statistics and is printed. The conditional probability adjustment is then made on that curve, then printed out. Thus, the frequency curve always corresponds to the statistics below it. (See test no. 5.) The conditionally adjusted curve is readily apparent because "-1"s fill the expected probability and confidence limit columns.

Input of Frequency Curve Statistics. FFA now allows the user to read in statistics, either with or without flow data, and compute the frequency curve ordinates.

Printer Output Format. An extended character set is now used to build the output tables. If a printer is used without this capability, set the IEXT variable to "1" (see J2 record).

Output to HEC-DSS. Computed frequency curves, confidence limits, and plotting positions can be output to the HEC Data Storage System (HEC-DSS). DSPLAY and other DSS programs may then be used to manipulate and plot the data.

Output to HP Laser Jet. FFA can write the Hewlet Packard printer codes to a file. This file can be printed on a HP Laser Jet Series II (or HP compatible) printer to produce a report quality frequency curve.

FFA Menu Operation. A Menu program was written for FFA similar to ones provided in other HEC software packages. The FFA Menu program carries out the DOS commands to identify files, call the COED editor, execute the programs FFA, DSPLAY, etc., and display the output results using the FGRAPH utility.

FGRAPH Utility. The FFA package includes a utility program that plots the final frequency curve of an analysis to the screen. The FGRAPH utility is limited to screen output only and can be called directly from the FFA Menu.

Use of CD ROM Data. FFA can read a peak flow file generated by the Earth Info HYDRODATA CD ROM package. To use this capability, refer to CD record description in Appendix B and the example in Appendix D.

SECTION 1

INTRODUCTION

1.1 Purpose

This user's manual describes capabilities of, input to, and output from the Flood Frequency Analysis (FFA) program. The manual includes changes that have been made to the program to reflect techniques described in the revised, "Guidelines for Determining Flood Flow Frequency," Bulletin 17B, Water Resource Council, September 1981, hereafter referred to as the Guidelines.

1.2 Computation Methods

The computation methods are basically as described in "Section V, Determination of Frequency Curve," in the Guidelines. A very brief description of how the computer program treats specific conditions follows, along with references to appropriate page or appendix numbers in the Guidelines:

- Graphical Analysis - The data are arrayed and the plotting positions may be computed by the Weibull, median or Hazen formulae (p. 26).
- The Distribution - The log-Pearson Type III distribution is used in the computation of frequency curve (pp. 9, 10).
- Skew Coefficient - The computed skew coefficient is weighted with the input generalized skew coefficient (pp. 10-15).
- Broken Record - A broken record is automatically analyzed as a continuous record (p. 15).
- Incomplete Record - Missing data at the low end is indicated by a negative number (-1) and the conditional probability adjustment is used to determine the frequency curve (p. 15 and Appendix 5).
- Zero Flood Years - Any flood events of zero are automatically deleted and the conditional probability adjustment is used to determine the frequency curve (p. 15 and Appendix 5).

- Outliers - Initially the program calculates the station skew coefficient for the systematic record which is presented under preliminary results in the output. The program then tests for high or low outliers in an order depending on the value of the station skew as discussed on pages 17-19 and shown on the flow chart on page 12-3 of the Guidelines. Basically if the skew is greater than 0.4, tests and adjustments for high outliers and historic peaks are made before testing for low outliers. If the station skew is less than -0.4, tests and adjustments are made for low outliers first. If the skew is between 0.4 and -0.4, tests for both high and low outliers are made based on systematic record statistics before any adjustments are made. (See Figure 1 of this user's manual.)

- Historic Events - Weighted plotting positions and statistics are computed incorporating any input historic events (p. 19 and Appendix 6).

- Confidence Limits - The .05 and .95 confidence limit curves are computed unless other limits are specified (p. 23 and Appendix 9).

- Expected Probability- The frequency curve ordinates are computed with and without the expected probability adjustment (pp. 24, 25 and Appendix 11).

1.3 General Input and Output Information

The input is designed to be flexible, and default values are provided for all decision variables. Any option or nonstandard item activated by the J1 or J2 record will remain in effect for all succeeding station data or until modified by another J1 or J2 record. The only records actually required for a flood frequency analysis at a station are three or more annual flood peaks (QR records) and the end-of-data (ED) record. Input data preparation is described in detail in Appendix B.

The example problems in the next section illustrate input preparation and output. The program output has been arranged to enable the tables to be copied for report purposes. When special conditions are encountered in the analysis, such as historic data, high or low outliers, etc., the preliminary results (based on the systematic data only) are output before the final results.

Output options allow for printing summary tables for multistation applications (Figure 2a and 2b) or to suppress unwanted printout. There is also an option to output statistical summary records for each station analyzed.

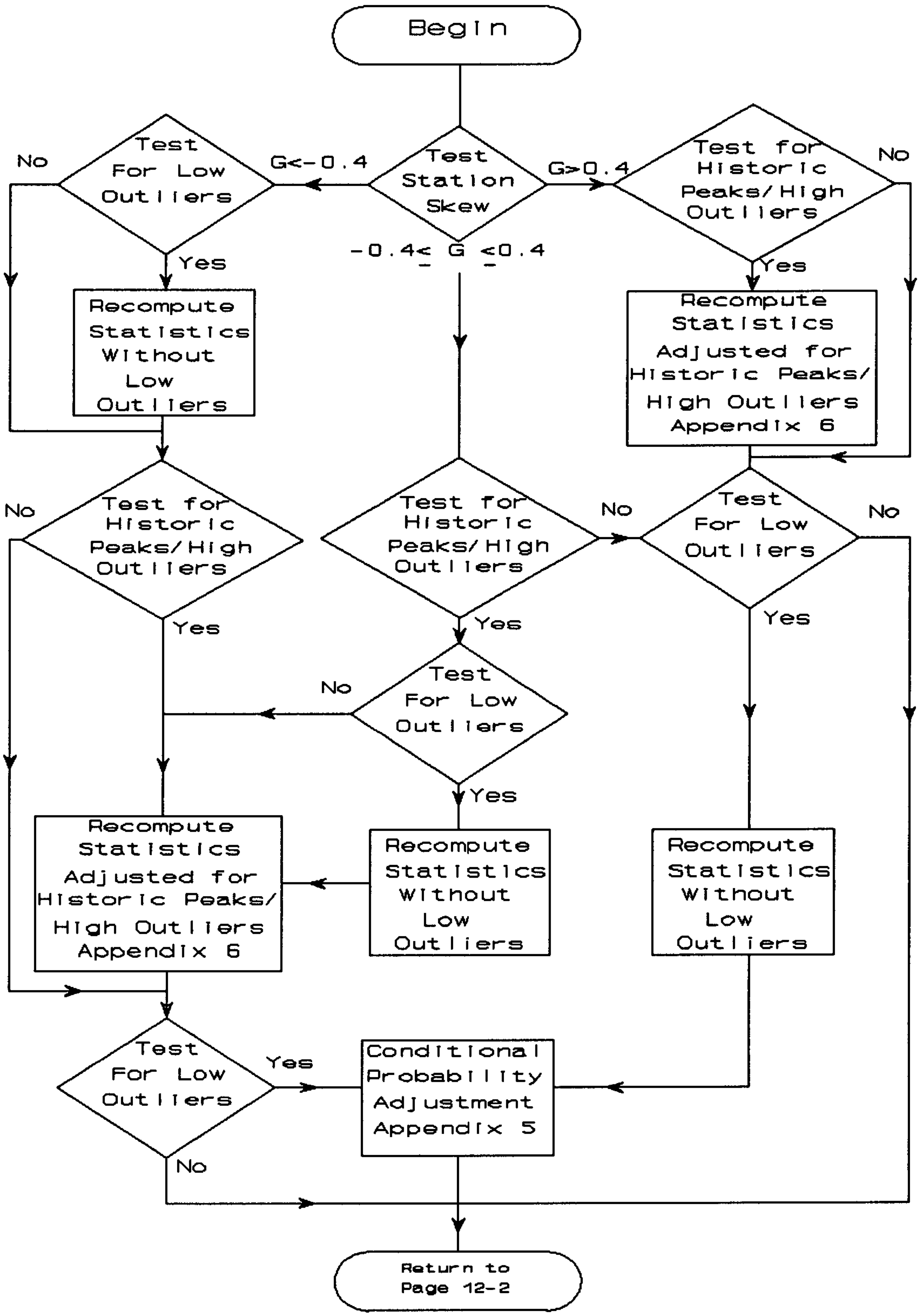


Figure 1. Flow Diagram for Historic and Outlier Adjustment
Note. References to appendix are for appendix in Bulletin 17B

1.4 Proposed Future Development

Planned future capabilities include the ability to (1) treat other durations of flow, such as 1-day, 3-day, etc.; and (2) adjust the statistics of short-record stations with those of long-record stations.

It is requested that any user of this program who finds a deficiency or would recommend desired additional capability notify the Hydrologic Engineering Center.

1.5 Acknowledgments

This, 1991, version of FFA represents the combined efforts of Mark R. Jensen and Harold E. Kubik. This manual was updated by Mark R. Jensen with help from David M. Goldman. The development of FFA was managed by Arlen D. Feldman, Chief of the HEC Research Division. Darryl W. Davis was the Director of the HEC during this time.

The HP Laser Jet plot function added to FFA, was adapted from the subroutine "PLATE", contributed by Mark M. Ziemer, St. Paul District, U.S. Army Corps of Engineers.

This program and manual are dedicated to the memory of Harold E. Kubik for his uncompromising high technical standards, for his in depth understanding of and feeling for statistics, and for his many years of service in the U.S. Army Corps of Engineers at HEC.

TABLE 1. SUMMARY OF STATISTICS -- FINAL RESULTS

STATION NUMBER	STATION NAME AND LOCATION		AREA SQ MI	....YEARS..... RECD	SYST	HIST	MEAN LOG	STD DEV	.......SKEW........ ADOPT	COMP	GENRL	HIST EVENT	OUTLIER HI	LO	ZERO/ MSNG
3735	01-3735 FISHKILL CREEK AT BEACON, NEW YORK	DA		24	24	0	3.368	.246	.70	.730	.60	0	0	0	0
6005	06-6005 FLOYD RIVER AT JAMES, IOWA	DA		39	39	82	3.537	.438	.10	.165	-.30	0	1	0	0
016140	01-6140 BACK CR NEAR JONES SPRINGS, WEST VA			38	38	0	3.741	.231	.60	.624	.50	0	0	1	0
112745	11-2745 ORESTIMBA CREEK NEAR NEWMAN, CA	DA		42	42	0	2.966	.668	-.50	-.568	-.30	0	0	1	6
5925	05-5925 KASKASKIA RIVER AT VANDALIA,ILL	DA		60	60	0	4.116	.274	.20	.399	-.40	0	0	2	0
4765	01-4765 RIDLEY CREEK AT MOYLAN, PA	D		24	24	132	3.120	.284	.90	1.078	.40	1	0	0	0

Figure 2a. Example output of station statistics.

TABLE 2. SUMMARY OF FREQUENCY CURVE ORDINATES -- FINAL RESULTS

STATION NUMBER	STATION NAME AND LOCATION		AREA SQ MI	....YEARS..... RECD	SYST	HIST	............PERCENT CHANCE EXCEEDANCE........... 10.	5.	2.	1.	.5	.2
3735	01-3735 FISHKILL CREEK AT BEACON, NEW YORK	DA		24	24	0	4962	6531	9108	11530	14451	19247
6005	06-6005 FLOYD RIVER AT JAMES, IOWA	DA		39	39	82	12670	18601	28812	38695	50799	70851
016140	01-6140 BACK CR NEAR JONES SPRINGS, WEST VA			38	38	0	11188	14362	19382	23934	29264	37724
112745	11-2745 ORESTIMBA CREEK NEAR NEWMAN, CA	DA		42	42	0	6003	9163	14233	18704	23689	31002
5925	05-5925 KASKASKIA RIVER AT VANDALIA,ILL	DA		60	60	0	29690	38175	51008	62134	74645	93577
4765	01-4765 RIDLEY CREEK AT MOYLAN, PA	D		24	24	132	3162	4440	6743	9103	12165	17635

Figure 2b. Example output of summary of exceedance discharges.

SECTION 2

EXAMPLE PROBLEMS

Flood Frequency Analysis

The input and output for six test examples are provided to illustrate the use of selected options and to assist in verifying the correct execution of the program. A brief description of each test example is provided. In all cases a generalized skew value was assumed.

FFA has the capability to make printer plots, this capability is demonstrated in tests 1,4 and 5. FFA also has the capability to write frequency curves to the HEC Data Storage System, HEC-DSS, (see ZW record, Appendix B). The DSPLAY program is used to produce report quality plots; example plots follow the output for the first five tests. See Appendix C for instructions for use of DSS and DSPLAY with FFA. The HP records are used in the last test (#6) to produce a Hewlet Packard laser jet printer plot. See HP record in Appendix B.

The example problems shown in this section are entitled:

#1 Fitting the Log-Pearson Type III Distribution.

#2 Adjusting for High Outliers.

#3 Testing and Adjusting for a Low Outlier.

#4 Zero Flood Years.

#5 Output Suppression, Confidence Limits and Low Threshold Discharge.

#6 Use of Median Plotting Positions, Alternative Flow Data Format, and Historic Data.

2.1 Test No. 1 - Fitting the Log-Pearson Type III Distribution

The input data for Test 1 are the same as that for Example 1 in Appendix 12, Guidelines for Determining Flood Flow Frequency, Water Resources Council Bulletin 17B, September 1981. Test 1 illustrates the routine computation of a frequency curve.

COMMAND LINE

FFA INPUT=TEST1.DAT OUTPUT=TEST1.OUT PLOT=YES DSSFILE=FFA

(Abbreviated: FFA I=TEST1.DAT O=TEST1.OUT P=Y D=FFA

INPUT

```
TT TEST NO. 1 FLOOD FLOW FREQUENCY ANALYSIS PROGRAM
TT WRC APPENDIX 12, EXAMPLE 1 - FITTING THE LOG-PEARSON TYPE III DIST
TT FISHKILL CREEK AT BEACON, NY
ID 01-3735  FISHKILL CREEK AT BEACON, NEW YORK  DA=190 SQ MI            1945-68
ZW /TEST NO. 1/FISHKILL CREEK/FREQ-FLOW//1945-68/USGS ANNUAL PEAKS/
GS  3735           .6
QR  373503051945    2290
QR  373512271945    1470
QR  373503151947    2220
QR  373503181948    2970
QR  373501011949    3020
QR  373503091950    1210
QR  373504011951    2490
QR  373503121952    3170
QR  373501251953    3220
QR  373509131954    1760
QR  373508201955    8800
QR  373510161955    8280
QR  373504101957    1310
QR  373512211957    2500
QR  373502111959    1960
QR  373504061960    2140
QR  373502261961    4340
QR  373503131962    3060
QR  373503281963    1780
QR  373501261964    1380
QR  373502091965     980
QR  373502151966    1040
QR  373503301967    1580
QR  373503191968    3630
ED
```

OUTPUT

```
*************************************          **************************************
*              FFA                  *          *                                    *
*     FLOOD FREQUENCY ANALYSIS      *          *   U.S. ARMY CORPS OF ENGINEERS     *
*     PROGRAM DATE:  FEB 1982       *          * THE HYDROLOGIC ENGINEERING CENTER  *
*     VERSION/DATE: 10 JAN 1992     *          *         609 SECOND STREET          *
*     RUN  DATE   AND   TIME:       *          *       DAVIS, CALIFORNIA 95616      *
*        10 JAN 92    10:45:36      *          *           (916) 756-1104           *
*                                   *          *                                    *
*************************************          **************************************



 INPUT FILE NAME: TEST1.DAT
OUTPUT FILE NAME: TEST1.OUT
   DSS FILE NAME: FFA


   -----DSS---ZOPEN:  New File Opened,  File: FFA.DSS
                      Unit:  71;  DSS Version: 6-FN

**TITLE RECORD(S)**
TT   TEST NO. 1 FLOOD FLOW FREQUENCY ANALYSIS PROGRAM
TT   WRC APPENDIX 12, EXAMPLE 1 - FITTING THE LOG-PEARSON TYPE III DIST
TT   FISHKILL CREEK AT BEACON, NY

**STATION IDENTIFICATION**
ID   01-3735  FISHKILL CREEK AT BEACON, NEW YORK  DA=190 SQ MI            1945-68

**DSS WRITE PATHNAME**
ZW   /TEST NO. 1/FISHKILL CREEK/FREQ-FLOW//1945-68/USGS ANNUAL PEAKS/

**GENERALIZED SKEW**
     ISTN   GGMSE    SKEW
GS   3735    .000     .60

**SYSTEMATIC EVENTS**
     24 EVENTS TO BE ANALYZED

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

FINAL RESULTS

-PLOTTING POSITIONS- 01-3735 FISHKILL CREEK AT BEACON, NEW YORK

EVENTS ANALYZED				ORDERED EVENTS			
			FLOW		WATER	FLOW	WEIBULL
MON	DAY	YEAR	CFS	RANK	YEAR	CFS	PLOT POS
3	5	1945	2290.	1	1955	8800.	4.00
12	27	1945	1470.	2	1956	8280.	8.00
3	15	1947	2220.	3	1961	4340.	12.00
3	18	1948	2970.	4	1968	3630.	16.00
1	1	1949	3020.	5	1953	3220.	20.00
3	9	1950	1210.	6	1952	3170.	24.00
4	1	1951	2490.	7	1962	3060.	28.00
3	12	1952	3170.	8	1949	3020.	32.00
1	25	1953	3220.	9	1948	2970.	36.00
9	13	1954	1760.	10	1958	2500.	40.00
8	20	1955	8800.	11	1951	2490.	44.00
10	16	1955	8280.	12	1945	2290.	48.00
4	10	1957	1310.	13	1947	2220.	52.00
12	21	1957	2500.	14	1960	2140.	56.00
2	11	1959	1960.	15	1959	1960.	60.00
4	6	1960	2140.	16	1963	1780.	64.00
2	26	1961	4340.	17	1954	1760.	68.00
3	13	1962	3060.	18	1967	1580.	72.00
3	28	1963	1780.	19	1946	1470.	76.00
1	26	1964	1380.	20	1964	1380.	80.00
2	9	1965	980.	21	1957	1310.	84.00
2	15	1966	1040.	22	1950	1210.	88.00
3	30	1967	1580.	23	1966	1040.	92.00
3	19	1968	3630.	24	1965	980.	96.00

-OUTLIER TESTS -

HIGH OUTLIER TEST

BASED ON 24 EVENTS, 10 PERCENT OUTLIER TEST VALUE K(N) = 2.467

0 HIGH OUTLIER(S) IDENTIFIED ABOVE TEST VALUE OF 9425.

LOW OUTLIER TEST

BASED ON 24 EVENTS, 10 PERCENT OUTLIER TEST VALUE K(N) = 2.467

0 LOW OUTLIER(S) IDENTIFIED BELOW TEST VALUE OF 578.7

-SKEW WEIGHING -

BASED ON 24 EVENTS, MEAN-SQUARE ERROR OF STATION SKEW = .277
DEFAULT OR INPUT MEAN-SQUARE ERROR OF GENERALIZED SKEW = .302

FINAL RESULTS

-FREQUENCY CURVE- 01-3735 FISHKILL CREEK AT BEACON, NEW YORK

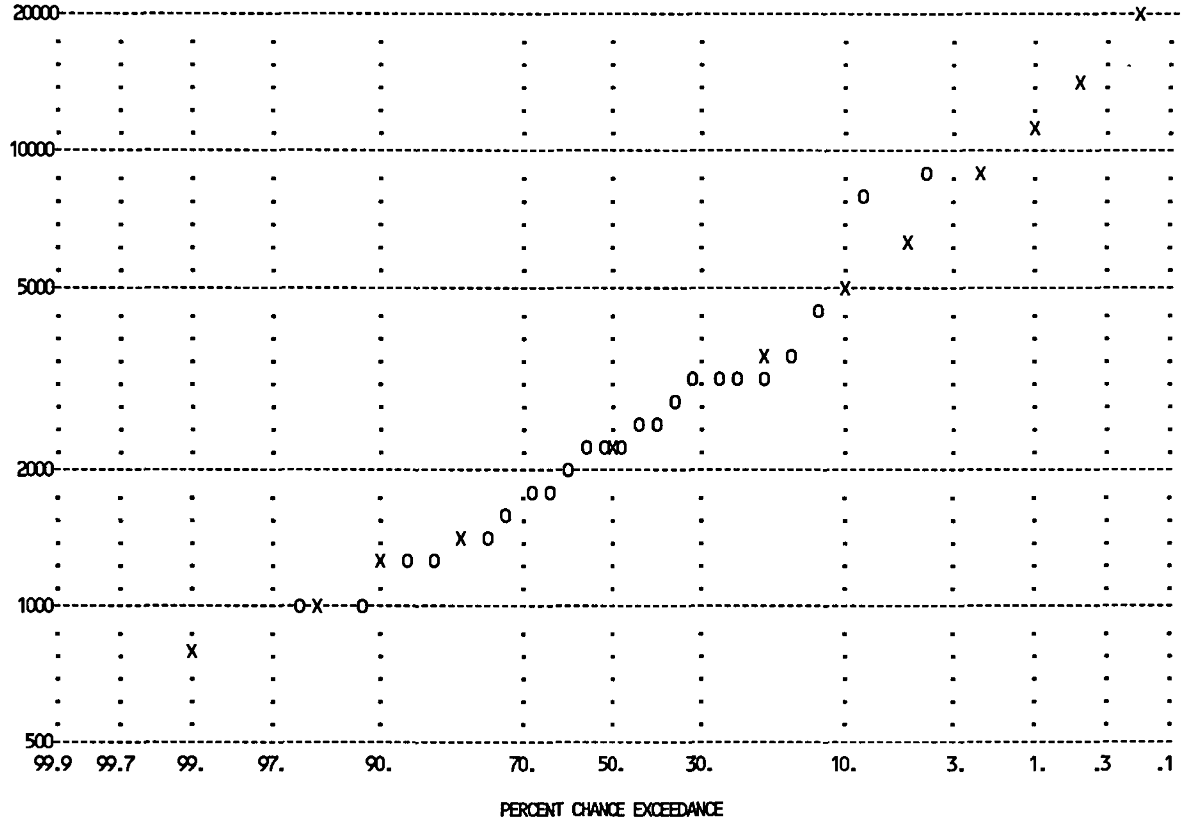
COMPUTED CURVE FLOW IN CFS	EXPECTED PROBABILITY FLOW IN CFS	PERCENT CHANCE EXCEEDANCE	CONFIDENCE LIMITS .05 FLOW IN CFS	CONFIDENCE LIMITS .95 FLOW IN CFS
19200.	28300.	.2	39100.	12300.
14500.	19000.	.5	26900.	9740.
11500.	14100.	1.0	20100.	8080.
9110.	10500.	2.0	14800.	6640.
6530.	7090.	5.0	9680.	5010.
4960.	5210.	10.0	6850.	3950.
3650.	3740.	20.0	4710.	2990.
2190.	2190.	50.0	2650.	1790.
1440.	1420.	80.0	1760.	1110.
1200.	1170.	90.0	1490.	884.
1040.	1010.	95.0	1320.	746.
841.	791.	99.0	1100.	568.

SYSTEMATIC STATISTICS

LOG TRANSFORM: FLOW, CFS		NUMBER OF EVENTS	
MEAN	3.3684	HISTORIC EVENTS	0
STANDARD DEV	.2456	HIGH OUTLIERS	0
COMPUTED SKEW	.7300	LOW OUTLIERS	0
REGIONAL SKEW	.6000	ZERO OR MISSING	0
ADOPTED SKEW	.7000	SYSTEMATIC EVENTS	24

FINAL RESULTS

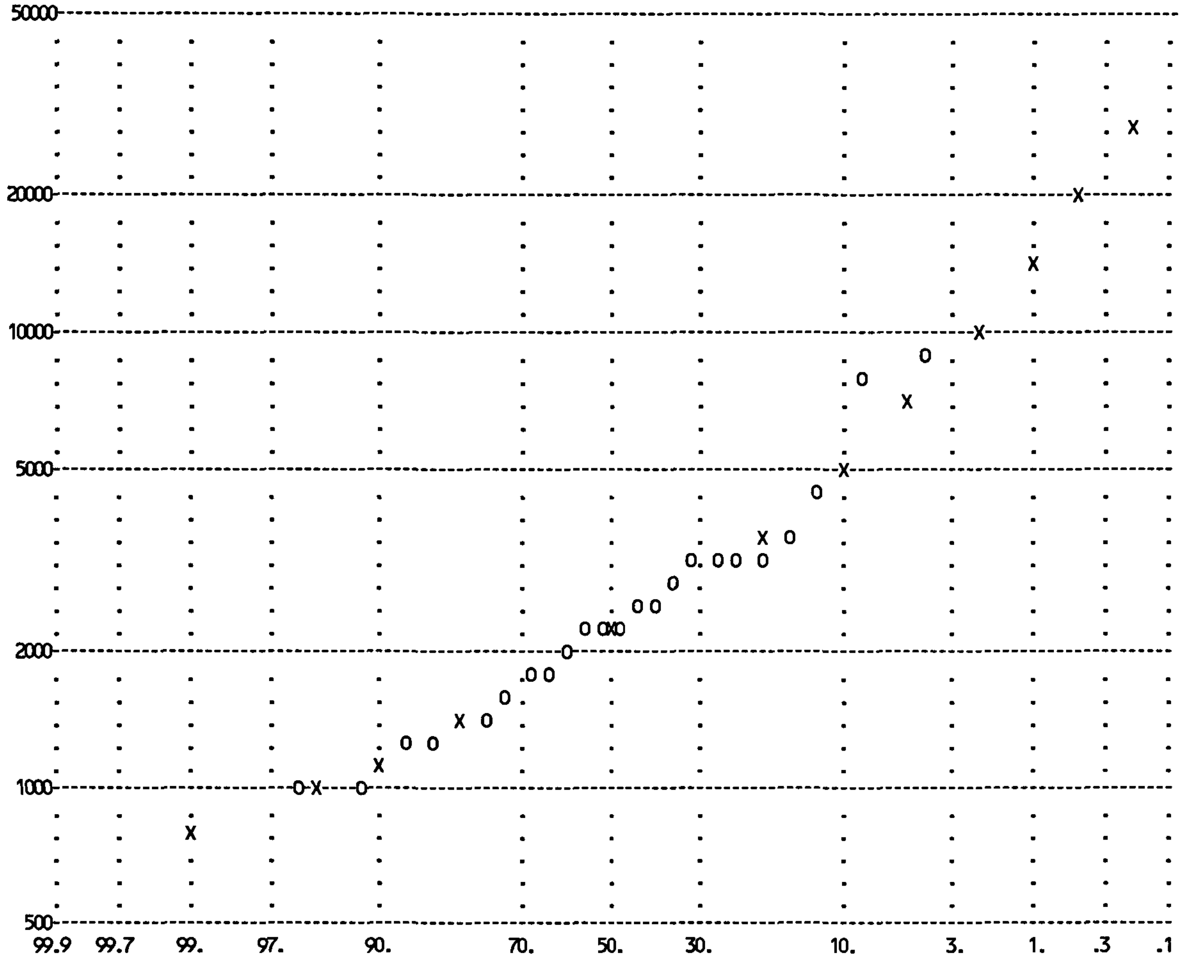
-FREQUENCY PLOT - 01-3735 FISHKILL CREEK AT BEACON, NEW YORK DA=190 SQ MI 1945-68
BASED ON COMPUTED VALUES - FLOW IN CFS



LEGEND - O=OBSERVED VALUE, H=HIGH OUTLIER OR HISTORIC VALUE, L=LOW OUTLIER, Z=ZERO OR MISSING, X=COMPUTED CURVE

FINAL RESULTS

-FREQUENCY PLOT - 01-3735 FISHKILL CREEK AT BEACON, NEW YORK DA=190 SQ MI 1945-68
BASED ON EXPECTED PROBABILITY ADJUSTMENT - FLOW IN CFS

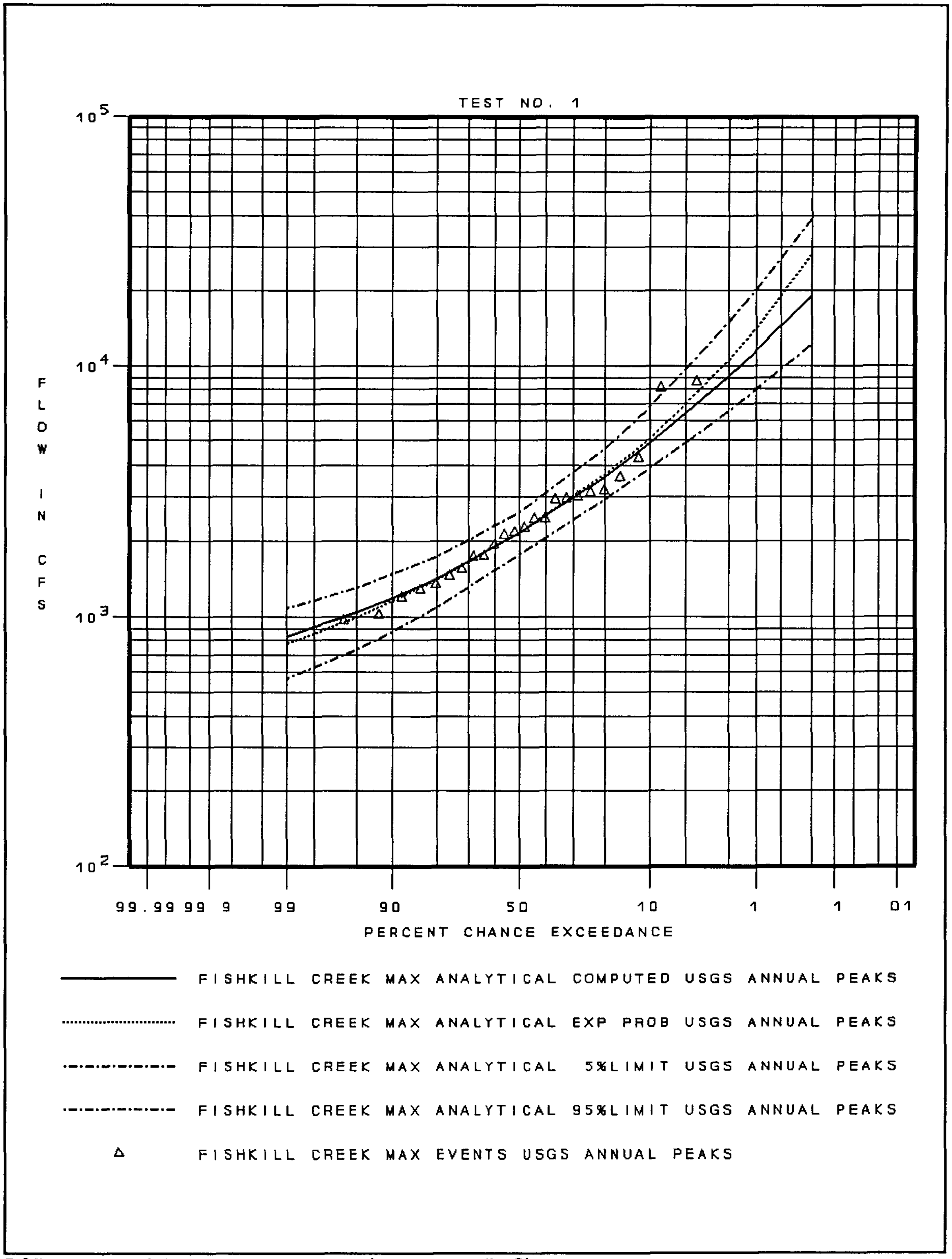


LEGEND - O=OBSERVED VALUE, H=HIGH OUTLIER OR HISTORIC VALUE, L=LOW OUTLIER, Z=ZERO OR MISSING, X=COMPUTED CURVE

--ZWRITE: /TEST NO. 1/FISHKILL CREEK/FREQ-FLOW/MAX EVENTS/1945-68/USGS ANNUAL PEAKS/

--ZWRITE: /TEST NO. 1/FISHKILL CREEK/FREQ-FLOW/MAX ANALYTICAL/1945-68/USGS ANNUAL PEAKS/

```
+++++++++++++++++++++++++
+ END OF RUN            +
+ NORMAL STOP IN FFA    +
+++++++++++++++++++++++++
```



DSPLAY plot of final frequency curve (see Appendix C).

2.2 Test No. 2 - Adjusting for High Outliers

The input data for Test 2 are the same as that for Example 2 in Appendix 12 of the WRC Guidelines. Test 2 illustrates the application to data with a high outlier. Note that preliminary results are output to enable comparison of the systematic data results with the results adjusted for a high outlier.

COMMAND LINE

FFA I=TEST2.DAT O=TEST2.OUT DSS=FFA

INPUT

```
TT TEST NO. 2 FLOOD FLOW FREQUENCY ANALYSIS PROGRAM
TT WRC APPENDIX 12, EXAMPLE 2 - ADJUSTING FOR A HIGH OUTLIER
TT FLOYD RIVER AT JAMES, IA
ID 06-6005  FLOYD RIVER AT JAMES, IOWA          DA=882 SQ MI              1935-73
GS  6005            -0.3
SI  1892            70000
ZW /TEST NO. 2/FLOYD RIVER/FREQ-FLOW//1935-73/ANNUAL PEAKS/
QR  600506281935    1460
QR  600503101936    4050
QR  600505271937    3570
QR  600509151938    2060
QR  600503121939    1300
QR  600506051940    1390
QR  600503111941    1720
QR  600506041942    6280
QR  600506171943    1360
QR  600505131944    7440
QR  600503121945    5320
QR  600503011946    1400
QR  600506251947    3240
QR  600503171948    2710
QR  600503051949    4520
QR  600506191950    4840
QR  600503281951    8320
QR  600503311952   13900
QR  600506081953   71500
QR  600506221954    6250
QR  600507101955    2260
QR  600507131956     318
QR  600507051957    1330
QR  600506311958     970
QR  600506011959    1920
QR  600503291960   15100
QR  600503021961    2870
QR  600503291962   20600
QR  600506021963    3810
QR  600509091964     726
QR  600504021965    7500
QR  600502101966    7170
QR  600506191967    2000
QR  600507211968     829
QR  600504051969   17300
QR  600503041970    4740
QR  6005      1971   13400
QR  6005      1972    2940
QR  6005      1973    5660
ED
```

```
*************************************      **************************************
*              FFA                  *      *                                    *
*     FLOOD FREQUENCY ANALYSIS      *      *   U.S. ARMY CORPS OF ENGINEERS     *
*     PROGRAM DATE:  FEB 1982       *      * THE HYDROLOGIC ENGINEERING CENTER  *
*     VERSION DATE: 10 JAN 1992     *      *         609 SECOND STREET          *
*     RUN  DATE   AND   TIME:       *      *      DAVIS, CALIFORNIA 95616       *
*        10 JAN 92    10:45:42      *      *         (916) 756-1104             *
*                                   *      *                                    *
*************************************      **************************************



 INPUT FILE NAME: TEST2.DAT
OUTPUT FILE NAME: TEST2.OUT
   DSS FILE NAME: FFA



   -----DSS---ZOPEN:  Existing File Opened,  File: FFA.DSS
                      Unit:  71;  DSS Version: 6-FN

**TITLE RECORD(S)**
TT   TEST NO. 2 FLOOD FLOW FREQUENCY ANALYSIS PROGRAM
TT   WRC APPENDIX 12, EXAMPLE 2 - ADJUSTING FOR A HIGH OUTLIER
TT   FLOYD RIVER AT JAMES, IA

**STATION IDENTIFICATION**
ID   06-6005  FLOYD RIVER AT JAMES, IOWA          DA=882 SQ MI             1935-73

**GENERALIZED SKEW**
     ISTN   GGMSE    SKEW
GS   6005    .000    -.30

**SPECIAL STATION INFORMATION**
    IYRA     IYRL   HITHRS   LOTHRS    LOGT     NDEC     NSIG
SI  1892        0   70000.       0.       0        0        0

**DSS WRITE PATHNAME**
ZW   /TEST NO. 2/FLOYD RIVER/FREQ-FLOW//1935-73/ANNUAL PEAKS/

**SYSTEMATIC EVENTS**
     39 EVENTS TO BE ANALYZED

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

PRELIMINARY RESULTS

-PLOTTING POSITIONS- 06-6005 FLOYD RIVER AT JAMES, IOWA

EVENTS ANALYZED				ORDERED EVENTS			
			FLOW		WATER	FLOW	WEIBULL
MON	DAY	YEAR	CFS	RANK	YEAR	CFS	PLOT POS
6	28	1935	1460.	1	1953	71500.	2.50
3	10	1936	4050.	2	1962	20600.	5.00
5	27	1937	3570.	3	1969	17300.	7.50
9	15	1938	2060.	4	1960	15100.	10.00
3	12	1939	1300.	5	1952	13900.	12.50
6	5	1940	1390.	6	1971	13400.	15.00
3	11	1941	1720.	7	1951	8320.	17.50
6	4	1942	6280.	8	1965	7500.	20.00
6	17	1943	1360.	9	1944	7440.	22.50
5	13	1944	7440.	10	1966	7170.	25.00
3	12	1945	5320.	11	1942	6280.	27.50
3	1	1946	1400.	12	1954	6250.	30.00
6	25	1947	3240.	13	1973	5660.	32.50
3	17	1948	2710.	14	1945	5320.	35.00
3	5	1949	4520.	15	1950	4840.	37.50
6	19	1950	4840.	16	1970	4740.	40.00
3	28	1951	8320.	17	1949	4520.	42.50
3	31	1952	13900.	18	1936	4050.	45.00
6	8	1953	71500.	19	1963	3810.	47.50
6	22	1954	6250.	20	1937	3570.	50.00
7	10	1955	2260.	21	1947	3240.	52.50
7	13	1956	318.	22	1972	2940.	55.00
7	5	1957	1330.	23	1961	2870.	57.50
6	31	1958	970.	24	1948	2710.	60.00
6	1	1959	1920.	25	1955	2260.	62.50
3	29	1960	15100.	26	1938	2060.	65.00
3	2	1961	2870.	27	1967	2000.	67.50
3	29	1962	20600.	28	1959	1920.	70.00
6	2	1963	3810.	29	1941	1720.	72.50
9	9	1964	726.	30	1935	1460.	75.00
4	2	1965	7500.	31	1946	1400.	77.50
2	10	1966	7170.	32	1940	1390.	80.00
6	19	1967	2000.	33	1943	1360.	82.50
7	21	1968	829.	34	1957	1330.	85.00
4	5	1969	17300.	35	1939	1300.	87.50
3	4	1970	4740.	36	1958	970.	90.00
0	0	1971	13400.	37	1968	829.	92.50
0	0	1972	2940.	38	1964	726.	95.00
0	0	1973	5660.	39	1956	318.	97.50

-SKEW WEIGHTING -

BASED ON 39 EVENTS, MEAN-SQUARE ERROR OF STATION SKEW = .158
DEFAULT OR INPUT MEAN-SQUARE ERROR OF GENERALIZED SKEW = .302

PRELIMINARY RESULTS

-FREQUENCY CURVE- 06-6005 FLOYD RIVER AT JAMES, IOWA

COMPUTED CURVE FLOW IN CFS	EXPECTED PROBABILITY FLOW IN CFS	PERCENT CHANCE EXCEEDANCE	CONFIDENCE LIMITS .05 FLOW IN CFS	CONFIDENCE LIMITS .95 FLOW IN CFS
88700.	116000.	.2	199000.	50100.
62300.	76000.	.5	130000.	37000.
46700.	54500.	1.0	91500.	28800.
34100.	38300.	2.0	62800.	21900.
21500.	23000.	5.0	36000.	14600.
14300.	14900.	10.0	22300.	10100.
8780.	8980.	20.0	12700.	6490.
3530.	3530.	50.0	4700.	2650.
1450.	1420.	80.0	1970.	1000.
924.	888.	90.0	1300.	595.
639.	600.	95.0	933.	385.
323.	284.	99.0	514.	170.

SYSTEMATIC STATISTICS

LOG TRANSFORM: FLOW, CFS		NUMBER OF EVENTS	
MEAN	3.5553	HISTORIC EVENTS	0
STANDARD DEV	.4642	HIGH OUTLIERS	0
COMPUTED SKEW	.3566	LOW OUTLIERS	0
REGIONAL SKEW	-.3000	ZERO OR MISSING	0
ADOPTED SKEW	.1000	SYSTEMATIC EVENTS	39

FINAL RESULTS

-PLOTTING POSITIONS- 06-6005 FLOYD RIVER AT JAMES, IOWA

EVENTS ANALYZED				ORDERED EVENTS			
			FLOW		WATER	FLOW	WEIBULL
MON	DAY	YEAR	CFS	RANK	YEAR	CFS	PLOT POS
6	28	1935	1460.	1	1953	71500.	1.20
3	10	1936	4050.	2	1962	20600.	3.09
5	27	1937	3570.	3	1969	17300.	5.66
9	15	1938	2060.	4	1960	15100.	8.23
3	12	1939	1300.	5	1952	13900.	10.80
6	5	1940	1390.	6	1971	13400.	13.36
3	11	1941	1720.	7	1951	8320.	15.93
6	4	1942	6280.	8	1965	7500.	18.50
6	17	1943	1360.	9	1944	7440.	21.07
5	13	1944	7440.	10	1966	7170.	23.64
3	12	1945	5320.	11	1942	6280.	26.20
3	1	1946	1400.	12	1954	6250.	28.77
6	25	1947	3240.	13	1973	5660.	31.34
3	17	1948	2710.	14	1945	5320.	33.91
3	5	1949	4520.	15	1950	4840.	36.48
6	19	1950	4840.	16	1970	4740.	39.05
3	28	1951	8320.	17	1949	4520.	41.61
3	31	1952	13900.	18	1936	4050.	44.18
6	8	1953	71500.	19	1963	3810.	46.75
6	22	1954	6250.	20	1937	3570.	49.32
7	10	1955	2260.	21	1947	3240.	51.89
7	13	1956	318.	22	1972	2940.	54.45
7	5	1957	1330.	23	1961	2870.	57.02
6	31	1958	970.	24	1948	2710.	59.59
6	1	1959	1920.	25	1955	2260.	62.16
3	29	1960	15100.	26	1938	2060.	64.73
3	2	1961	2870.	27	1967	2000.	67.30
3	29	1962	20600.	28	1959	1920.	69.86
6	2	1963	3810.	29	1941	1720.	72.43
9	9	1964	726.	30	1935	1460.	75.00
4	2	1965	7500.	31	1946	1400.	77.57
2	10	1966	7170.	32	1940	1390.	80.14
6	19	1967	2000.	33	1943	1360.	82.70
7	21	1968	829.	34	1957	1330.	85.27
4	5	1969	17300.	35	1939	1300.	87.84
3	4	1970	4740.	36	1958	970.	90.41
0	0	1971	13400.	37	1968	829.	92.98
0	0	1972	2940.	38	1964	726.	95.55
0	0	1973	5660.	39	1956	318.	98.11

NOTE- PLOTTING POSITIONS BASED ON-HISTORIC PERIOD (H) = 82
NUMBER OF HISTORIC EVENTS PLUS HIGH OUTLIERS(Z) = 1
WEIGHING FACTOR FOR SYSTEMATIC EVENTS (W) = 2.1316

-OUTLIER TESTS -

LOW OUTLIER TEST

BASED ON 39 EVENTS, 10 PERCENT OUTLIER TEST VALUE K(N) = 2.671

0 LOW OUTLIER(S) IDENTIFIED BELOW TEST VALUE OF 206.8

HIGH OUTLIER TEST

BASED ON 39 EVENTS, 10 PERCENT OUTLIER TEST VALUE K(N) = 2.671

1 HIGH OUTLIER(S) IDENTIFIED ABOVE TEST VALUE OF 62395.
OR INPUT BASE OF 70000.

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

STATISTICS AND FREQUENCY CURVE ADJUSTED FOR 1 HIGH OUTLIER(S)
AND 0 HISTORIC EVENT(S)

-SKEW WEIGHING -

BASED ON 82 EVENTS, MEAN-SQUARE ERROR OF STATION SKEW = .073
DEFAULT OR INPUT MEAN-SQUARE ERROR OF GENERALIZED SKEW = .302

FINAL RESULTS

-FREQUENCY CURVE- 06-6005 FLOYD RIVER AT JAMES, IOWA

COMPUTED CURVE FLOW IN CFS	EXPECTED PROBABILITY FLOW IN CFS	PERCENT CHANCE EXCEEDANCE	CONFIDENCE LIMITS .05 FLOW IN CFS	CONFIDENCE LIMITS .95 FLOW IN CFS
70900.	91000.	.2	152000.	41300.
50800.	61300.	.5	101000.	31000.
38700.	44700.	1.0	73000.	24500.
28800.	32100.	2.0	51200.	19000.
18600.	19900.	5.0	30300.	12900.
12700.	13200.	10.0	19300.	9170.
8010.	8180.	20.0	11300.	6020.
3390.	3390.	50.0	4440.	2590.
1470.	1440.	80.0	1960.	1040.
958.	923.	90.0	1320.	632.
676.	637.	95.0	967.	419.
356.	315.	99.0	551.	195.

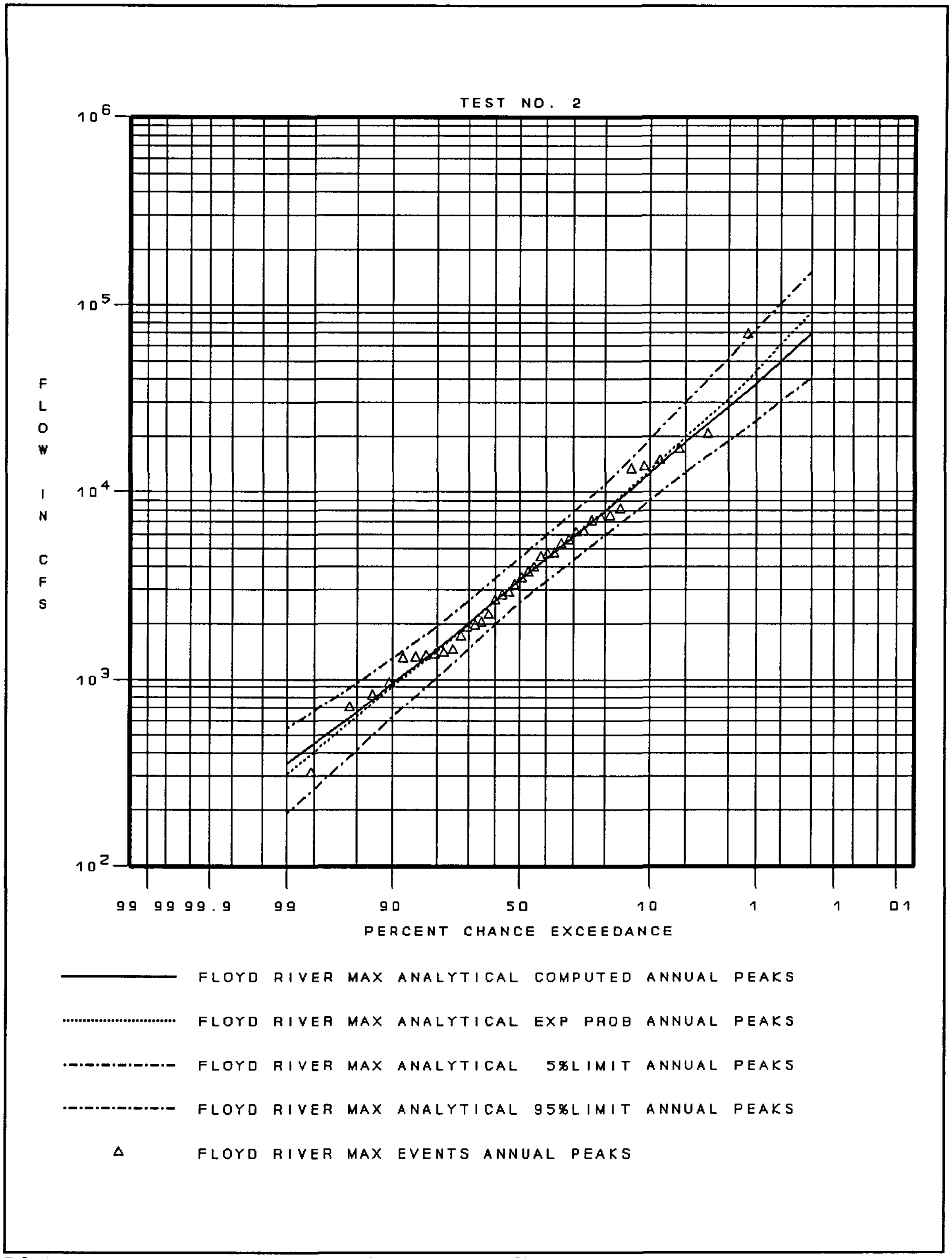
ADJUSTED STATISTICS

LOG TRANSFORM: FLOW, CFS		NUMBER OF EVENTS	
MEAN	3.5374	HISTORIC EVENTS	0
STANDARD DEV	.4377	HIGH OUTLIERS	1
COMPUTED SKEW	.1654	LOW OUTLIERS	0
REGIONAL SKEW	-.3000	ZERO OR MISSING	0
ADOPTED SKEW	.1000	SYSTEMATIC EVENTS	39
		HISTORIC PERIOD	82

```
--ZWRITE: /TEST NO. 2/FLOYD RIVER/FREQ-FLOW/MAX EVENTS/1935-73/ANNUAL PEAKS/


--ZWRITE: /TEST NO. 2/FLOYD RIVER/FREQ-FLOW/MAX ANALYTICAL/1935-73/ANNUAL PEAKS/


++++++++++++++++++++++++
+ END OF RUN           +
+ NORMAL STOP IN FFA   +
++++++++++++++++++++++++
```



DSPLAY plot of final frequency curve (see Appendix C).

2.3 Test No. 3 - Testing and Adjusting for a Low Outlier

The input data for Test 3 are the same as that for Example 3 in Appendix 12 of the WRC Guidelines. Test 3 illustrates the application to data with a low outlier. Note that the program outputs the test value in the input flow units and automatically screens for low outliers. If low outliers are found, the program outputs the preliminary results to allow comparison with the final results.

COMMAND LINE

FFA I=TEST3.DAT O=TEST3.OUT DSS=FFA

INPUT

```
TT TEST NO. 3 FLOOD FLOW FREQUENCY ANALYSIS PROGRAM
TT WRC APPENDIX 12, EXAMPLE 3 - TESTING AND ADJUSTING FOR A LOW OUTLIER
TT BACK CREEK NEAR JONES SPRINGS, WV
ID 01-6140 BACK CR  NEAR JONES SPRINGS, WEST VA    DA=243 SQ MI     1929-31,39-73
GS016140            0.5
ZW /TEST NO. 3/BACK CREEK/FREQ-FLOW//1929-73/ANNUAL PEAKS/
QR  614004171929    8750
QR  614010231929   15500
QR  614005081931    4060
QR  614002041939    6300
QR  614004201940    3130
QR  614004061941    4160
QR  614005221942    6700
QR  614010151942   22400
QR  614003241944    3880
QR  614009181945    8050
QR  614006031946    4020
QR  614003151947    1600
QR  614004141948    4460
QR  614012311948    4230
QR  614002021950    3010
QR  614012051950    9150
QR  614004281952    5100
QR  614011221952    9820
QR  614003021954    6200
QR  614008191955   10700
QR  614003151956    3880
QR  614002101957    3420
QR  614003271958    3240
QR  614006031959    6800
QR  614005091960    3740
QR  614002191961    4700
QR  614003221962    4380
QR  614003201963    5190
QR  614001101964    3960
QR  614003061965    5600
QR  6140        1966    4670
QR  6140        1967    7080
QR  6140        1968    4640
QR  6140        1969     536
QR  6140        1970    6680
QR  6140        1971    8360
QR  6140        1972   18700
QR  6140        1973    5210
ED
```

```
*************************************         *************************************
*             FFA                   *         *                                   *
*    FLOOD FREQUENCY ANALYSIS       *         *   U.S. ARMY CORPS OF ENGINEERS    *
*    PROGRAM DATE:  FEB 1982        *         * THE HYDROLOGIC ENGINEERING CENTER *
*    VERSION DATE: 10 JAN 1992      *         *        609 SECOND STREET          *
*    RUN  DATE   AND   TIME:        *         *      DAVIS, CALIFORNIA 95616      *
*       10 JAN 92    10:45:47       *         *          (916) 756-1104           *
*                                   *         *                                   *
*************************************         *************************************


 INPUT FILE NAME: TEST3.DAT
OUTPUT FILE NAME: TEST3.OUT
   DSS FILE NAME: FFA


   -----DSS---ZOPEN:  Existing File Opened,  File: FFA.DSS
                      Unit:  71;  DSS Version: 6-FN

**TITLE RECORD(S)**
TT   TEST NO. 3 FLOOD FLOW FREQUENCY ANALYSIS PROGRAM
TT   WRC APPENDIX 12, EXAMPLE 3 - TESTING AND ADJUSTING FOR A LOW OUTLIER
TT   BACK CREEK NEAR JONES SPRINGS, WV

**STATION IDENTIFICATION**
ID   01-6140 BACK CR  NEAR JONES SPRINGS, WEST VA    DA=243 SQ MI    1929-31,39-73

**GENERALIZED SKEW**
     ISTN   GGMSE    SKEW
GS 016140    .000     .50

**DSS WRITE PATHNAME**
ZW   /TEST NO. 3/BACK CREEK/FREQ-FLOW//1929-73/ANNUAL PEAKS/

**SYSTEMATIC EVENTS**
     38 EVENTS TO BE ANALYZED

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


----------------------PRELIMINARY RESULTS ----------------------

-SKEW WEIGHING -
----------------------------------------------------------------
BASED ON  38 EVENTS, MEAN-SQUARE ERROR OF STATION SKEW =   .197
DEFAULT OR INPUT MEAN-SQUARE ERROR OF GENERALIZED SKEW =   .302
----------------------------------------------------------------
```

PRELIMINARY RESULTS

-FREQUENCY CURVE- 01-6140 BACK CR NEAR JONES SPRINGS, WEST VA

COMPUTED CURVE FLOW IN CFS	EXPECTED PROBABILITY FLOW IN CFS	PERCENT CHANCE EXCEEDANCE	CONFIDENCE LIMITS .05 FLOW IN CFS	CONFIDENCE LIMITS .95 FLOW IN CFS
28900.	32600.	.2	45200.	21100.
24600.	27000.	.5	37200.	18400.
21500.	23200.	1.0	31600.	16300.
18500.	19600.	2.0	26300.	14300.
14700.	15200.	5.0	20000.	11700.
11900.	12200.	10.0	15500.	9650.
9130.	9240.	20.0	11500.	7580.
5390.	5390.	50.0	6430.	4520.
3080.	3040.	80.0	3710.	2460.
2280.	2210.	90.0	2810.	1730.
1760.	1680.	95.0	2230.	1280.
1070.	964.	99.0	1440.	700.

SYSTEMATIC STATISTICS

LOG TRANSFORM: FLOW, CFS		NUMBER OF EVENTS	
MEAN	3.7220	HISTORIC EVENTS	0
STANDARD DEV	.2804	HIGH OUTLIERS	0
COMPUTED SKEW	-.7311	LOW OUTLIERS	0
REGIONAL SKEW	.5000	ZERO OR MISSING	0
ADOPTED SKEW	-.2000	SYSTEMATIC EVENTS	38

FINAL RESULTS

-PLOTTING POSITIONS- 01-6140 BACK CR NEAR JONES SPRINGS, WEST VA

EVENTS ANALYZED				ORDERED EVENTS			
			FLOW		WATER	FLOW	WEIBULL
MON	DAY	YEAR	CFS	RANK	YEAR	CFS	PLOT POS
4	17	1929	8750.	1	1943	22400.	2.56
10	23	1929	15500.	2	1972	18700.	5.13
5	8	1931	4060.	3	1930	15500.	7.69
2	4	1939	6300.	4	1955	10700.	10.26
4	20	1940	3130.	5	1953	9820.	12.82
4	6	1941	4160.	6	1951	9150.	15.38
5	22	1942	6700.	7	1929	8750.	17.95
10	15	1942	22400.	8	1971	8360.	20.51
3	24	1944	3880.	9	1945	8050.	23.08
9	18	1945	8050.	10	1967	7080.	25.64
6	3	1946	4020.	11	1959	6800.	28.21
3	15	1947	1600.	12	1942	6700.	30.77
4	14	1948	4460.	13	1970	6680.	33.33
12	31	1948	4230.	14	1939	6300.	35.90
2	2	1950	3010.	15	1954	6200.	38.46
12	5	1950	9150.	16	1965	5600.	41.03
4	28	1952	5100.	17	1973	5210.	43.59
11	22	1952	9820.	18	1963	5190.	46.15
3	2	1954	6200.	19	1952	5100.	48.72
8	19	1955	10700.	20	1961	4700.	51.28
3	15	1956	3880.	21	1966	4670.	53.85
2	10	1957	3420.	22	1968	4640.	56.41
3	27	1958	3240.	23	1948	4460.	58.97
6	3	1959	6800.	24	1962	4380.	61.54
5	9	1960	3740.	25	1949	4230.	64.10
2	19	1961	4700.	26	1941	4160.	66.67
3	22	1962	4380.	27	1931	4060.	69.23
3	20	1963	5190.	28	1946	4020.	71.79
1	10	1964	3960.	29	1964	3960.	74.36
3	6	1965	5600.	30	1956	3880.	76.92
0	0	1966	4670.	31	1944	3880.	79.49
0	0	1967	7080.	32	1960	3740.	82.05
0	0	1968	4640.	33	1957	3420.	84.62
0	0	1969	536.	34	1958	3240.	87.18
0	0	1970	6680.	35	1940	3130.	89.74
0	0	1971	8360.	36	1950	3010.	92.31
0	0	1972	18700.	37	1947	1600.	94.87
0	0	1973	5210.	38	1969	536.	97.44

-OUTLIER TESTS -

LOW OUTLIER TEST

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

1 LOW OUTLIER(S) IDENTIFIED BELOW TEST VALUE OF 945.8

STATISTICS AND FREQUENCY CURVE ADJUSTED FOR 1 LOW OUTLIER(S)

HIGH OUTLIER TEST

BASED ON 37 EVENTS, 10 PERCENT OUTLIER TEST VALUE K(N) = 2.650

0 HIGH OUTLIER(S) IDENTIFIED ABOVE TEST VALUE OF 22760.

-SKEW WEIGHING -

BASED ON 38 EVENTS, MEAN-SQUARE ERROR OF STATION SKEW = .186
DEFAULT OR INPUT MEAN-SQUARE ERROR OF GENERALIZED SKEW = .302

FINAL RESULTS

-FREQUENCY CURVE- 01-6140 BACK CR NEAR JONES SPRINGS, WEST VA

COMPUTED CURVE FLOW IN CFS	EXPECTED PROBABILITY FLOW IN CFS	PERCENT CHANCE EXCEEDANCE	CONFIDENCE LIMITS .05 FLOW IN CFS	CONFIDENCE LIMITS .95 FLOW IN CFS
37700.	46200.	.2	61000.	27000.
29300.	33900.	.5	44800.	21700.
23900.	26700.	1.0	35000.	18300.
19400.	21000.	2.0	27100.	15200.
14400.	15000.	5.0	18900.	11700.
11200.	11500.	10.0	14100.	9390.
8440.	8550.	20.0	10100.	7250.
5230.	5230.	50.0	6030.	4510.
3490.	3460.	80.0	4070.	2890.
2910.	2860.	90.0	3440.	2340.
2530.	2480.	95.0	3040.	1990.
2020.	1940.	99.0	2490.	1520.

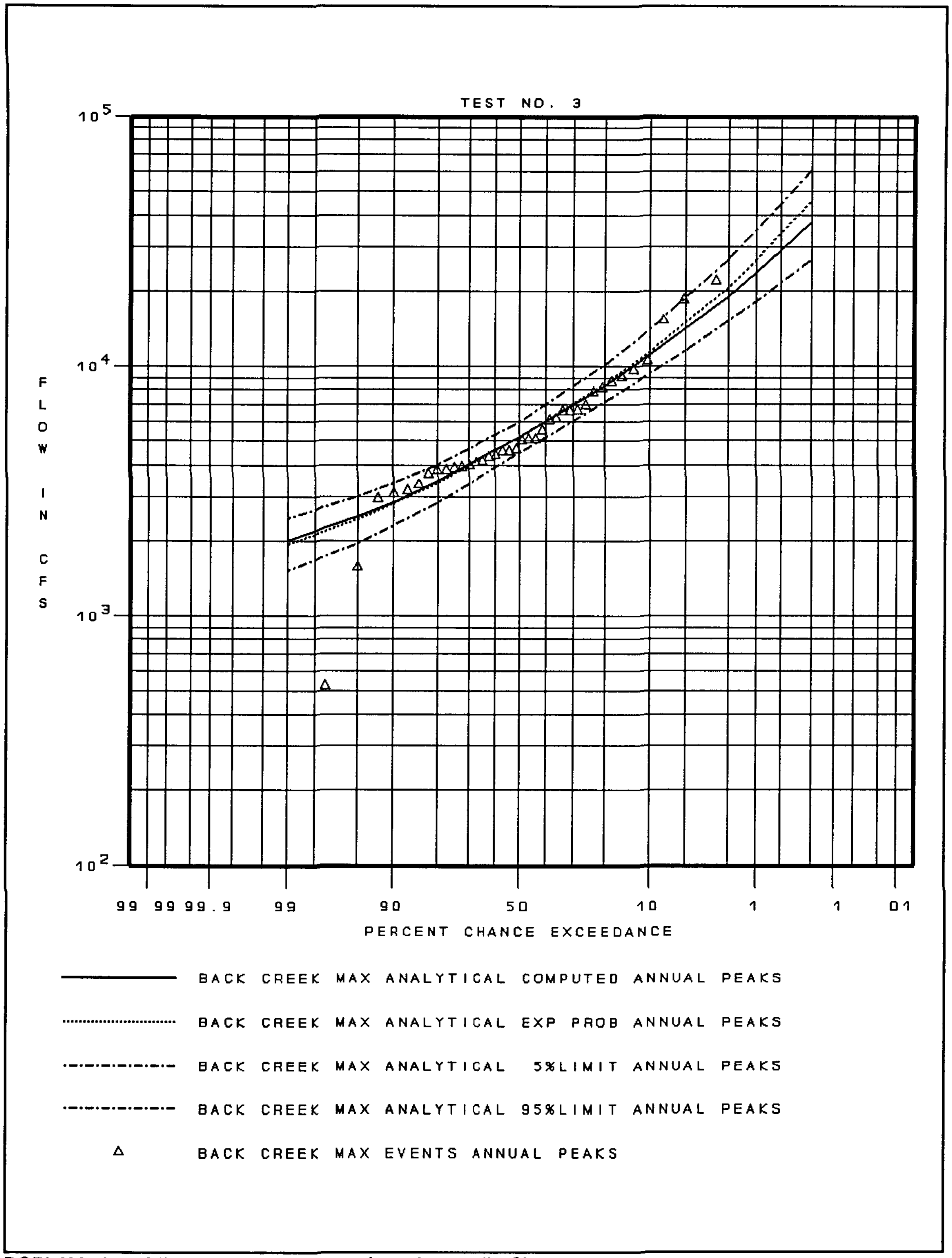
SYNTHETIC STATISTICS

LOG TRANSFORM: FLOW, CFS		NUMBER OF EVENTS	
MEAN	3.7413	HISTORIC EVENTS	0
STANDARD DEV	.2315	HIGH OUTLIERS	0
COMPUTED SKEW	.6238	LOW OUTLIERS	1
REGIONAL SKEW	.5000	ZERO OR MISSING	0
ADOPTED SKEW	.6000	SYSTEMATIC EVENTS	38

--ZWRITE: /TEST NO. 3/BACK CREEK/FREQ-FLOW/MAX EVENTS/1929-73/ANNUAL PEAKS/

--ZWRITE: /TEST NO. 3/BACK CREEK/FREQ-FLOW/MAX ANALYTICAL/1929-73/ANNUAL PEAKS/

```
+++++++++++++++++++++++++
+ END OF RUN            +
+ NORMAL STOP IN FFA    +
+++++++++++++++++++++++++
```



DSPLAY plot of final frequency curve (see Appendix C).

2.4 Test No. 4 - Zero-Flood Years

The input data for Test 4 are the same as that for Example 4 in Appendix 12 of the WRC Guidelines. Test 4 illustrates the application to data that includes several zero-flood events.

COMMAND LINE

FFA I=TEST4.DAT O=TEST4.OUT P=Y DSS=FFA

INPUT

```
TT TEST NO. 4 FLOOD FLOW FREQUENCY ANALYSIS PROGRAM
TT WRC APPENDIX 12, EXAMPLE 4 - ZERO FLOOD YEARS
TT ORESTIMBA CREEK NEAR NEWMAN, CA
ID 11-2745  ORESTIMBA CREEK NEAR NEWMAN, CA     DA=134 SQ MI              1932-73
GS112745          -0.3
ZW /TEST NO. 4/ORESTIMBA CREEK/FREQ-FLOW//1932-73/ANNUAL PEAKS/
QR  274502081932   4260
QR  274501291933    345
QR  274501011934    516
QR  274504081935   1320
QR  274502131936   1200
QR  274502131937   2180
QR  274502111938   3230
QR  274503091939    115
QR  274502271940   3440
QR  274504041941   3070
QR  274501241942   1880
QR  274501211943   6450
QR  274502291944   1290
QR  274502021945   5970
QR  274512251945    782
QR  2745      1947      0
QR  2745      1948      0
QR  274503121949    335
QR  274502051950    175
QR  274512031950   2920
QR  274501121952   3660
QR  274512071952    147
QR  2745      1954      0
QR  274501191955     16
QR  274512231955   5620
QR  274502241957   1440
QR  274504021958  10200
QR  274502161959   5380
QR  274502101960    448
QR  2745      1961      0
QR  274502151962   1740
QR  274502011963   8300
QR  274501221964    156
QR  2745      1966    560
QR  274512301965    128
QR  274501241967   4200
QR  2745      1968      0
QR  274501251969   5080
QR  274503011970   1010
QR  274512211970    584
QR  2745      1972      0
QR  274502111973   1510
ED
```

```
**************************************     **************************************
*              FFA                   *     *                                    *
*     FLOOD FREQUENCY ANALYSIS       *     *  U.S. ARMY CORPS OF ENGINEERS      *
*     PROGRAM DATE:  FEB 1982        *     * THE HYDROLOGIC ENGINEERING CENTER  *
*     VERSION DATE: 10 JAN 1992      *     *         609 SECOND STREET          *
*     RUN  DATE   AND   TIME:        *     *       DAVIS, CALIFORNIA 95616      *
*        10 JAN 92    10:45:51       *     *          (916) 756-1104            *
*                                    *     *                                    *
**************************************     **************************************



 INPUT FILE NAME: TEST4.DAT
OUTPUT FILE NAME: TEST4.OUT
   DSS FILE NAME: FFA


   -----DSS---ZOPEN:  Existing File Opened,  File: FFA.DSS
                      Unit:  71;  DSS Version: 6-FN

**TITLE RECORD(S)**
TT   TEST NO. 4 FLOOD FLOW FREQUENCY ANALYSIS PROGRAM
TT   WRC APPENDIX 12, EXAMPLE 4 - ZERO FLOOD YEARS
TT   ORESTIMBA CREEK NEAR NEWMAN, CA

**STATION IDENTIFICATION**
ID   11-2745  ORESTIMBA CREEK NEAR NEWMAN, CA     DA=134 SQ MI            1932-73

**GENERALIZED SKEW**
     ISTN   GGMSE    SKEW
GS 112745    .000    -.30

**DSS WRITE PATHNAME**
ZW   /TEST NO. 4/ORESTIMBA CREEK/FREQ-FLOW//1932-73/ANNUAL PEAKS/

**SYSTEMATIC EVENTS**
     42 EVENTS TO BE ANALYZED

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


----------------------PRELIMINARY RESULTS ----------------------


NOTE - ADOPTED SKEW EQUALS COMPUTED SKEW AND PRELIMINARY
       FREQUENCY STATISTICS ARE FOR THE CONDITIONAL
       FREQUENCY CURVE BECAUSE OF ZERO OR MISSING EVENTS.
```

PRELIMINARY RESULTS

-FREQUENCY CURVE- 11-2745 ORESTIMBA CREEK NEAR NEWMAN, CA

COMPUTED CURVE FLOW IN CFS	EXPECTED PROBABILITY FLOW IN CFS	PERCENT CHANCE EXCEEDANCE	CONFIDENCE LIMITS .05 FLOW IN CFS	CONFIDENCE LIMITS .95 FLOW IN CFS
20400.	22700.	.2	46600.	11200.
17400.	19200.	.5	38600.	9770.
15100.	16400.	1.0	32400.	8590.
12600.	13500.	2.0	26100.	7330.
9220.	9750.	5.0	18000.	5560.
6690.	6950.	10.0	12300.	4160.
4260.	4360.	20.0	7320.	2750.
1470.	1470.	50.0	2250.	977.
379.	363.	80.0	583.	225.
165.	151.	90.0	272.	85.
78.	67.	95.0	139.	35.
16.	11.	99.0	35.	5.

CONDITIONAL STATISTICS

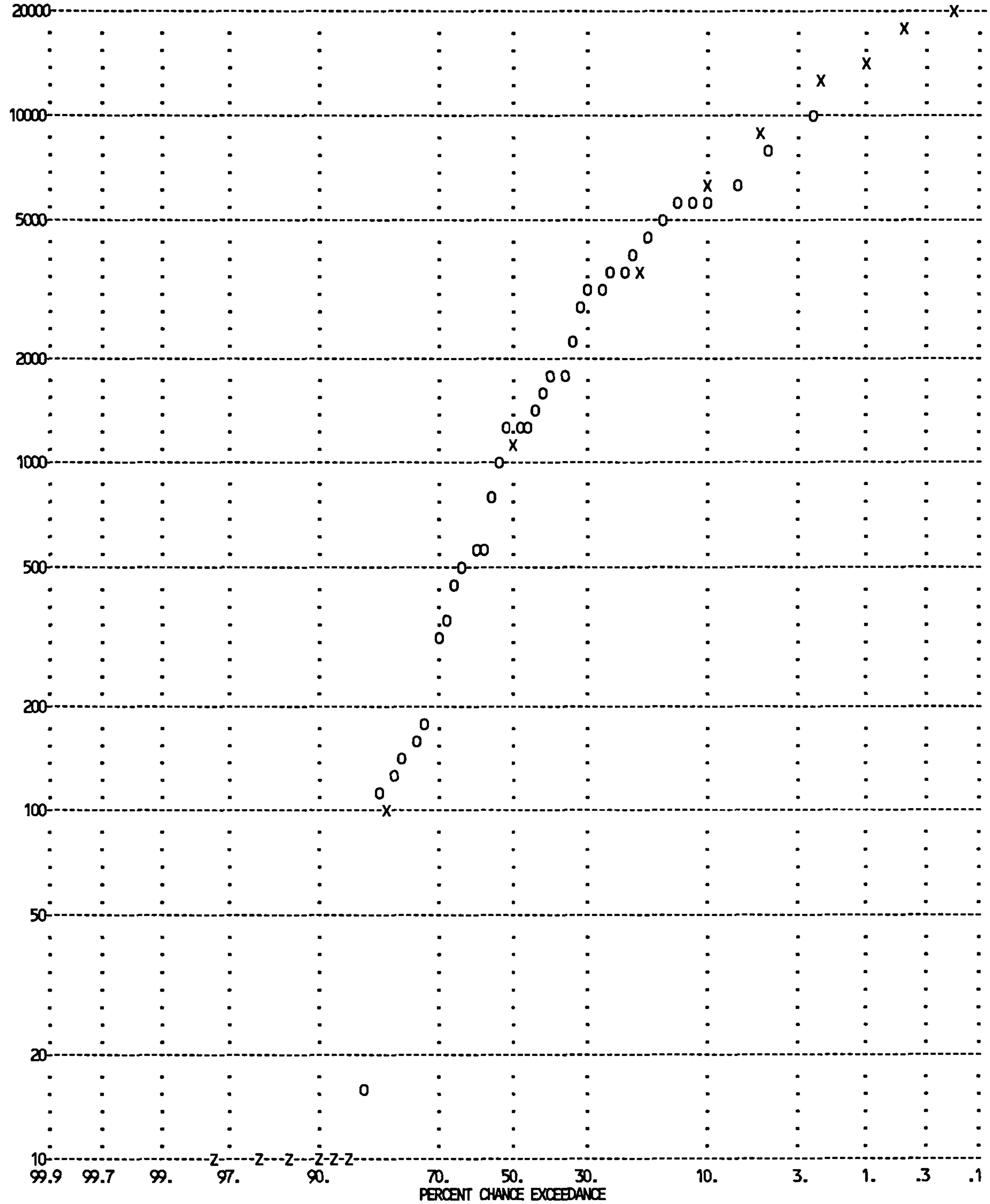
LOG TRANSFORM: FLOW, CFS		NUMBER OF EVENTS	
MEAN	3.0786	HISTORIC EVENTS	0
STANDARD DEV	.6443	HIGH OUTLIERS	0
COMPUTED SKEW	-.8360	LOW OUTLIERS	0
REGIONAL SKEW	-.3000	ZERO OR MISSING	6
ADOPTED SKEW	-.8360	SYSTEMATIC EVENTS	42

CONDITIONAL PROBABILITY ADJUSTED ORDINATES

-FREQUENCY CURVE- 11-2745 ORESTIMBA CREEK NEAR NEWMAN, CA

COMPUTED CURVE FLOW IN CFS	EXPECTED PROBABILITY FLOW IN CFS	PERCENT CHANCE EXCEEDANCE	CONFIDENCE LIMITS .05 FLOW IN CFS	CONFIDENCE LIMITS .95 FLOW IN CFS
19869.	-1.	.2	-1.	-1.
16898.	-1.	.5	-1.	-1.
14498.	-1.	1.0	-1.	-1.
12025.	-1.	2.0	-1.	-1.
8624.	-1.	5.0	-1.	-1.
6101.	-1.	10.0	-1.	-1.
3735.	-1.	20.0	-1.	-1.
1077.	-1.	50.0	-1.	-1.
104.	-1.	80.0	-1.	-1.
0.	-1.	90.0	-1.	-1.
0.	-1.	95.0	-1.	-1.
0.	-1.	99.0	-1.	-1.

PRELIMINARY RESULTS
-FREQUENCY PLOT - 11-2745 ORESTIMBA CREEK NEAR NEWMAN, CA DA=134 SQ MI 1932-73
BASED ON COMPUTED VALUES - FLOW IN CFS



LEGEND - O=OBSERVED VALUE, H=HIGH OUTLIER OR HISTORIC VALUE, L=LOW OUTLIER, Z=ZERO OR MISSING, X=COMPUTED CURVE

FINAL RESULTS

-PLOTTING POSITIONS- 11-2745 ORESTIMBA CREEK NEAR NEWMAN, CA

EVENTS ANALYZED				ORDERED EVENTS			
			FLOW		WATER	FLOW	WEIBULL
MON	DAY	YEAR	CFS	RANK	YEAR	CFS	PLOT POS
2	8	1932	4260.	1	1958	10200.	2.33
1	29	1933	345.	2	1963	8300.	4.65
1	1	1934	516.	3	1943	6450.	6.98
4	8	1935	1320.	4	1945	5970.	9.30
2	13	1936	1200.	5	1956	5620.	11.63
2	13	1937	2180.	6	1959	5380.	13.95
2	11	1938	3230.	7	1969	5080.	16.28
3	9	1939	115.	8	1932	4260.	18.60
2	27	1940	3440.	9	1967	4200.	20.93
4	4	1941	3070.	10	1952	3660.	23.26
1	24	1942	1880.	11	1940	3440.	25.58
1	21	1943	6450.	12	1938	3230.	27.91
2	29	1944	1290.	13	1941	3070.	30.23
2	2	1945	5970.	14	1951	2920.	32.56
12	25	1945	782.	15	1937	2180.	34.88
0	0	1947	0.	16	1942	1880.	37.21
0	0	1948	0.	17	1962	1740.	39.53
3	12	1949	335.	18	1973	1510.	41.86
2	5	1950	175.	19	1957	1440.	44.19
12	3	1950	2920.	20	1935	1320.	46.51
1	12	1952	3660.	21	1944	1290.	48.84
12	7	1952	147.	22	1936	1200.	51.16
0	0	1954	0.	23	1970	1010.	53.49
1	19	1955	16.	24	1946	782.	55.81
12	23	1955	5620.	25	1971	584.	58.14
2	24	1957	1440.	26	1966	560.	60.47
4	2	1958	10200.	27	1934	516.	62.79
2	16	1959	5380.	28	1960	448.	65.12
2	10	1960	448.	29	1933	345.	67.44
0	0	1961	0.	30	1949	335.	69.77
2	15	1962	1740.	31	1950	175.	72.09
2	1	1963	8300.	32	1964	156.	74.42
1	22	1964	156.	33	1953	147.	76.74
0	0	1966	560.	34	1966	128.	79.07
12	30	1965	128.	35	1939	115.	81.40
1	24	1967	4200.	36	1955	16.	83.72
0	0	1968	0.	37	1968	0.	86.05
1	25	1969	5080.	38	1948	0.	88.37
3	1	1970	1010.	39	1954	0.	90.70
12	21	1970	584.	40	1947	0.	93.02
0	0	1972	0.	41	1972	0.	95.35
2	11	1973	1510.	42	1961	0.	97.67

-OUTLIER TESTS -

LOW OUTLIER TEST

BASED ON 36 EVENTS, 10 PERCENT OUTLIER TEST VALUE K(N) = 2.639

1 LOW OUTLIER(S) IDENTIFIED BELOW TEST VALUE OF 23.9
BASED ON THE STATISTICS AFTER 6 ZERO OR MISSING EVENTS DELETED

STATISTICS AND FREQUENCY CURVE ADJUSTED FOR 1 LOW OUTLIER(S)
AND/OR 6 ZERO OR MISSING EVENT(S)

HIGH OUTLIER TEST

BASED ON 35 EVENTS, 10 PERCENT OUTLIER TEST VALUE K(N) = 2.628

0 HIGH OUTLIER(S) IDENTIFIED ABOVE TEST VALUE OF 41786.

-SKEW WEIGHING -

BASED ON 42 EVENTS, MEAN-SQUARE ERROR OF STATION SKEW = .167
DEFAULT OR INPUT MEAN-SQUARE ERROR OF GENERALIZED SKEW = .302

FINAL RESULTS

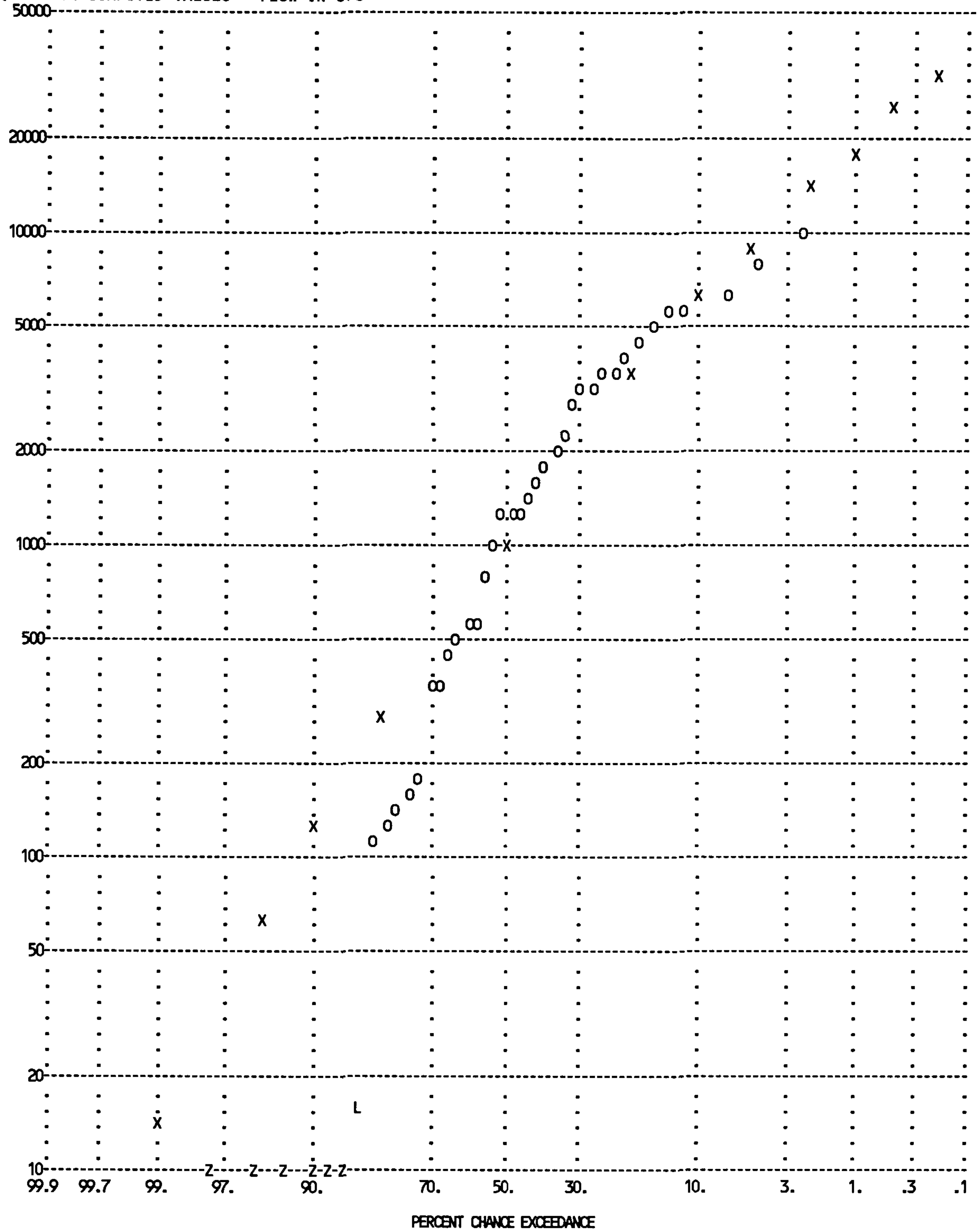
-FREQUENCY CURVE- 11-2745 ORESTIMBA CREEK NEAR NEWMAN, CA

COMPUTED CURVE FLOW IN CFS	EXPECTED PROBABILITY FLOW IN CFS	PERCENT CHANCE EXCEEDANCE	CONFIDENCE LIMITS .05 FLOW IN CFS	CONFIDENCE LIMITS .95 FLOW IN CFS
31000.	36900.	.2	75500.	16200.
23700.	27200.	.5	54800.	12800.
18700.	21000.	1.0	41300.	10400.
14200.	15600.	2.0	29900.	8160.
9160.	9770.	5.0	17800.	5520.
6000.	6260.	10.0	10900.	3770.
3450.	3540.	20.0	5770.	2260.
1050.	1050.	50.0	1570.	708.
266.	258.	80.0	405.	161.
121.	113.	90.0	195.	65.
60.	54.	95.0	105.	29.
15.	11.	99.0	31.	5.

SYNTHETIC STATISTICS

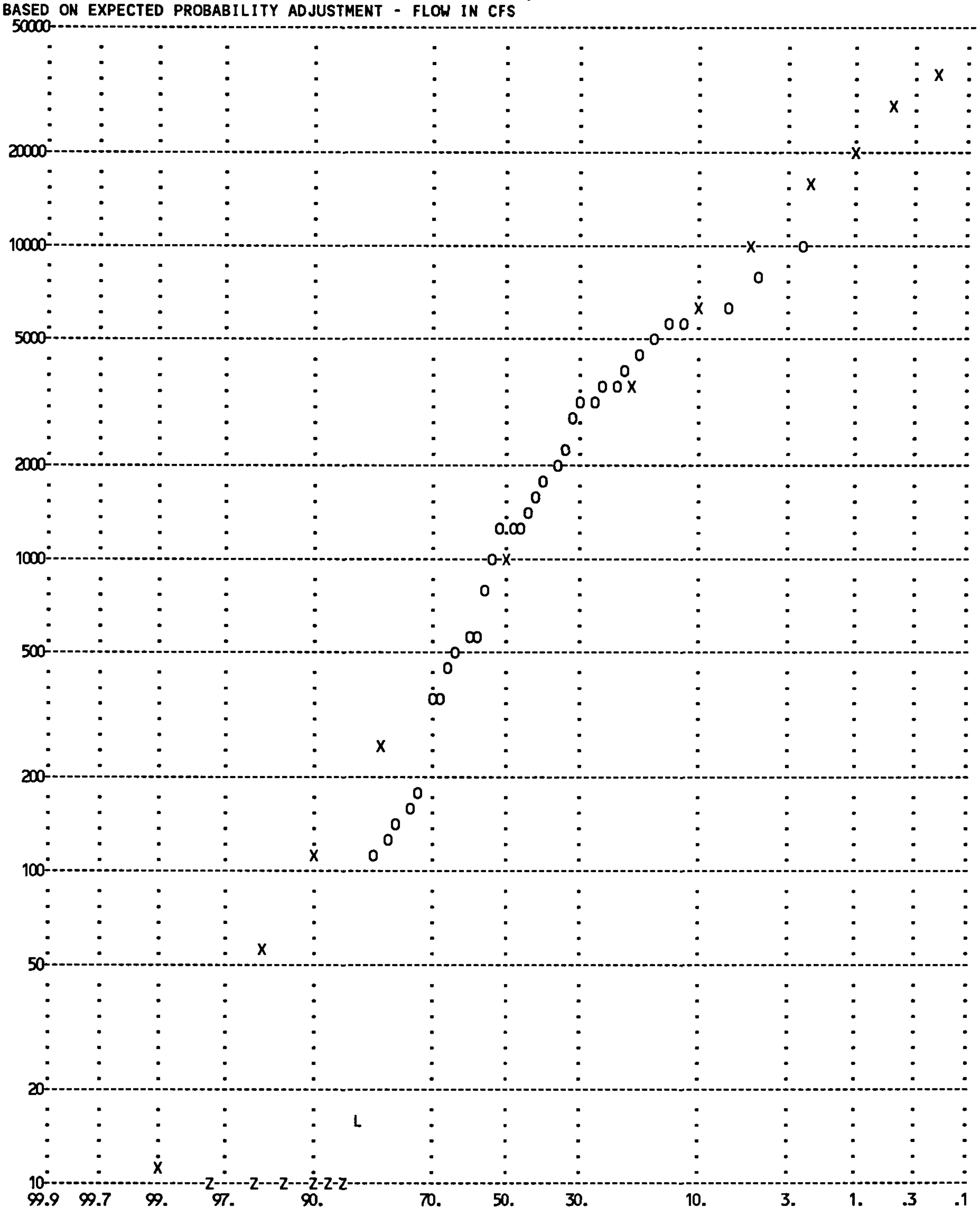
LOG TRANSFORM: FLOW, CFS		NUMBER OF EVENTS	
MEAN	2.9657	HISTORIC EVENTS	0
STANDARD DEV	.6682	HIGH OUTLIERS	0
COMPUTED SKEW	-.5682	LOW OUTLIERS	1
REGIONAL SKEW	-.3000	ZERO OR MISSING	6
ADOPTED SKEW	-.5000	SYSTEMATIC EVENTS	42

FINAL RESULTS
-FREQUENCY PLOT - 11-2745 ORESTIMBA CREEK NEAR NEWMAN, CA DA=134 SQ MI 1932-73
BASED ON COMPUTED VALUES - FLOW IN CFS



LEGEND - O=OBSERVED VALUE, H=HIGH OUTLIER OR HISTORIC VALUE, L=LOW OUTLIER, Z=ZERO OR MISSING, X=COMPUTED CURVE

FINAL RESULTS
-FREQUENCY PLOT - 11-2745 ORESTIMBA CREEK NEAR NEWMAN, CA DA=134 SQ MI 1932-73
BASED ON EXPECTED PROBABILITY ADJUSTMENT - FLOW IN CFS

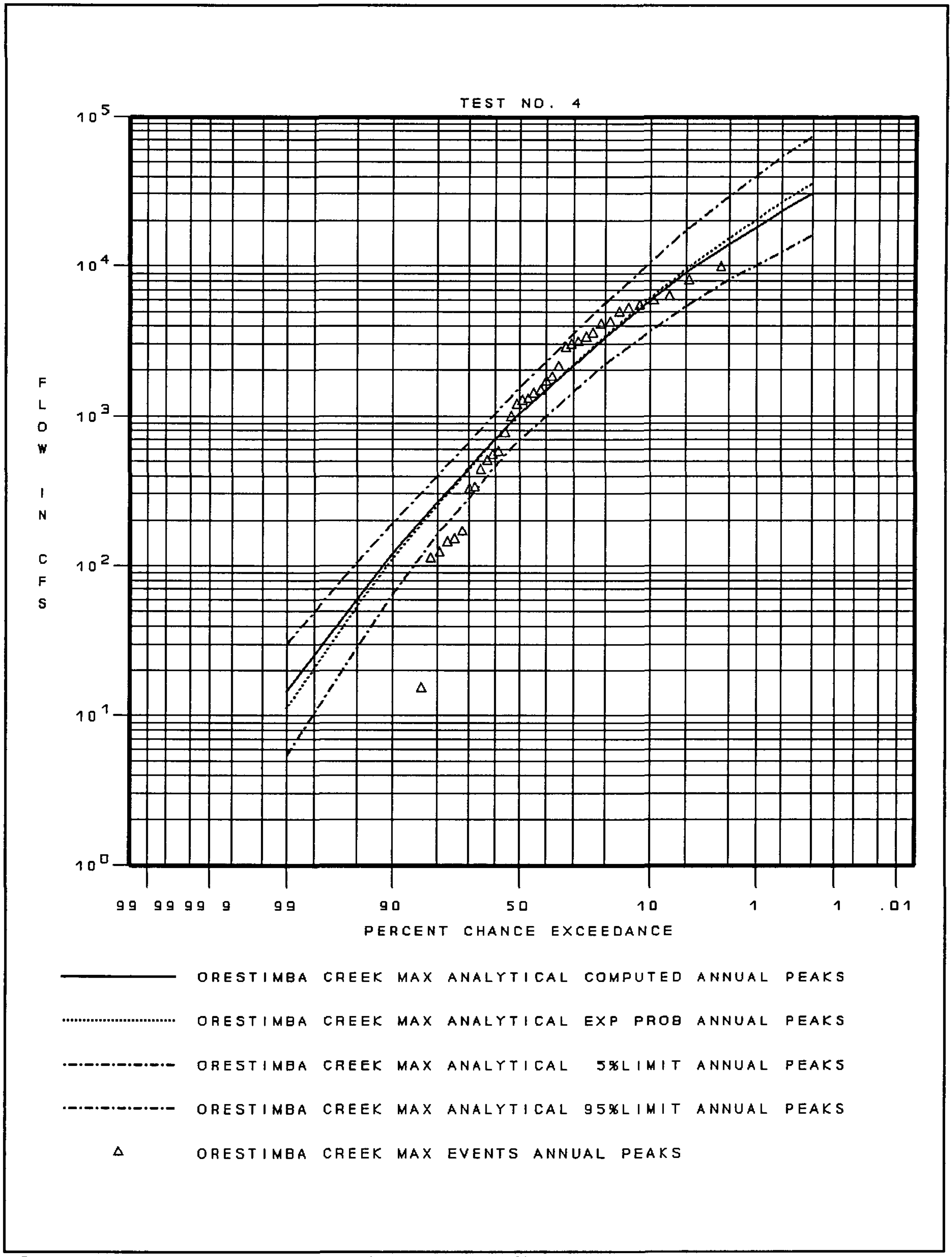


LEGEND - O=OBSERVED VALUE, H=HIGH OUTLIER OR HISTORIC VALUE, L=LOW OUTLIER, Z=ZERO OR MISSING, X=COMPUTED CURVE

```
--ZWRITE: /TEST NO. 4/ORESTIMBA CREEK/FREQ-FLOW/MAX EVENTS/1932-73/ANNUAL PEAKS/


--ZWRITE: /TEST NO. 4/ORESTIMBA CREEK/FREQ-FLOW/MAX ANALYTICAL/1932-73/ANNUAL PEAKS/


+++++++++++++++++++++++++
+ END OF RUN            +
+ NORMAL STOP IN FFA    +
+++++++++++++++++++++++++
```



DSPLAY plot of final frequency curve (see Appendix C).

2.5 Test No. 5 - Use of IPROUT, CLIMIT, and BASEPK

This test illustrates the use of three variables which modify the standard mode of computation and output. On the J1 record, the value for IPROUT is 33 which is the sum of 1 (to suppress the printout of the input data for preliminary results) and 32 (to suppress the printout of the input data for expected probability adjustment). The variable CLIMIT on the J2 record sets the confidence limit probability. In this case, .01 specifies the .01 and .99 confidence limit curves. This data set includes two very low values and the second lowest value just missed being classified as a low outlier. As both of these values were below 2,000 cfs, this amount was input for the variable BASEPK and the program identified any values below 2,000 cfs as low outliers.

COMMAND LINE

FFA I=TEST5.DAT O=TEST5.OUT P=Y DSS=FFA

INPUT

```
TT TEST NO. 5 FLOOD FLOW FREQUENCY ANALYSIS PROGRAM
TT EXAMPLE USE OF PRINTOUT SUPPRESSION (IPROUT), OTHER CONFIDENCE LIMITS
TT (CLIMIT), AND A BASE PEAK DISCHARGE (BASEPK)
J1                 33
J2                .01
ID  05-5925  KASKASKIA RIVER AT VANDALIA,ILL    DA=1980 SQ MI           1908-70
GS  5925          -.4
SI                         2000
ZW /TEST NO. 5/KASKASKIA RIVER/FREQ-FLOW//1908-70/USGS ANNUAL PEAKS/
QR  592505061908    7870
QR  592504141909    7670
QR  592503011910    7020
QR  592505011911    5670
QR  592510041911   13000
QR  592507211915   15800
QR  592501311916   14400
QR  592506051917   16800
QR  592505111918    8880
QR  592503191919   11000
QR  592505191920   12600
QR  592504181922   18800
QR  592503171923   14300
QR  592512151923   10500
QR  592503161925    9980
QR  592509171926    8460
QR  592503201927   20000
QR  592512011927   12200
QR  592505141929   12200
QR  592501141930   11500
QR  592509181931    1270
QR  592501241932    5550
QR  592505151933   17500
QR  592508191934    4250
QR  592505161935   11200
QR  592503261936    7290
QR  592501151937   14900
QR  592503311938   40700
QR  592503141939   16000
QR  592505031940    6760
QR  592506121941    4560
```

Test no. 5 INPUT (continued)

```
QR 592507121942   13600
QR 592505181943   52200
QR 592504241944   31000
QR 592506101945   21500
QR 592505041946   13000
QR 592506101947   12300
QR 592503281948   19000
QR 592502161949   25000
QR 592501041950   51300
QR 592506291951   31000
QR 592504151952   10500
QR 592503051953    5680
QR 592504191954     505
QR 592504251955    5000
QR 592502271956    7840
QR 592506291957   62700
QR 592508041958   12400
QR 592502121959   17200
QR 592506301960   11800
QR 592504101961   34400
QR 592503251962   17100
QR 592505221963    9000
QR 592505041964    8500
QR 592505041965    5350
QR 592505191966   11900
QR 592512101966   27000
QR 592512231967   20800
QR 592501311969   20700
QR 592506161970   30000
ED
```

```
************************************     **************************************
*          FFA                     *     *                                    *
*   FLOOD FREQUENCY ANALYSIS       *     *   U.S. ARMY CORPS OF ENGINEERS     *
*   PROGRAM DATE:  FEB 1982        *     * THE HYDROLOGIC ENGINEERING CENTER  *
*   VERSION DATE:  BETA 2/91       *     *         609 SECOND STREET          *
*   RUN  DATE   AND   TIME:        *     *      DAVIS, CALIFORNIA 95616       *
*      07 FEB 91    10:45:59       *     *          (916) 756-1104            *
*                                  *     *                                    *
************************************     **************************************


 INPUT FILE NAME: TEST5.DAT
OUTPUT FILE NAME: TEST5.OUT
   DSS FILE NAME: FFA



   -----DSS---ZOPEN:  Existing File Opened,  File: FFA.DSS
                      Unit:  71;  DSS Version: 6-FN

**TITLE RECORD(S)**
TT   TEST NO. 5 FLOOD FLOW FREQUENCY ANALYSIS PROGRAM
TT   EXAMPLE USE OF PRINTOUT SUPPRESSION (IPROUT), OTHER CONFIDENCE LIMITS
TT   (CLIMIT), AND A BASE PEAK DISCHARGE (BASEPK)

**JOB RECORD(S)**
     IPPC   ISKFX  IPROUT    IFMT    IWYR   IUNIT   ISMRY   IPNCH    IREG
J1     0       0     33        0       0       0       0       0       0

        A       B  CLIMIT    NDSSCV   IEXT
J2   .00     .00     .01          0      0

**STATION IDENTIFICATION**
ID    05-5925  KASKASKIA RIVER AT VANDALIA,ILL    DA=1980 SQ MI            1908-70

**GENERALIZED SKEW**
     ISTN   GGMSE    SKEW
GS   5925    .000    -.40

**SPECIAL STATION INFORMATION**
    IYRA    IYRL   HITHRS   LOTHRS    LOGT    NDEC    NSIG
SI     0       0       0.    2000.       0       0       0

**DSS WRITE PATHNAME**
ZW   /TEST NO. 5/KASKASKIA RIVER/FREQ-FLOW//1908-70/USGS ANNUAL PEAKS/

**SYSTEMATIC EVENTS**
     60 EVENTS TO BE ANALYZED

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



----------------------PRELIMINARY RESULTS ----------------------


-SKEW WEIGHING -
----------------------------------------------------------------
BASED ON  60 EVENTS, MEAN-SQUARE ERROR OF STATION SKEW =   .199
DEFAULT OR INPUT MEAN-SQUARE ERROR OF GENERALIZED SKEW =   .302
----------------------------------------------------------------
```

PRELIMINARY RESULTS

-FREQUENCY CURVE- 05-5925 KASKASKIA RIVER AT VANDALIA,ILL

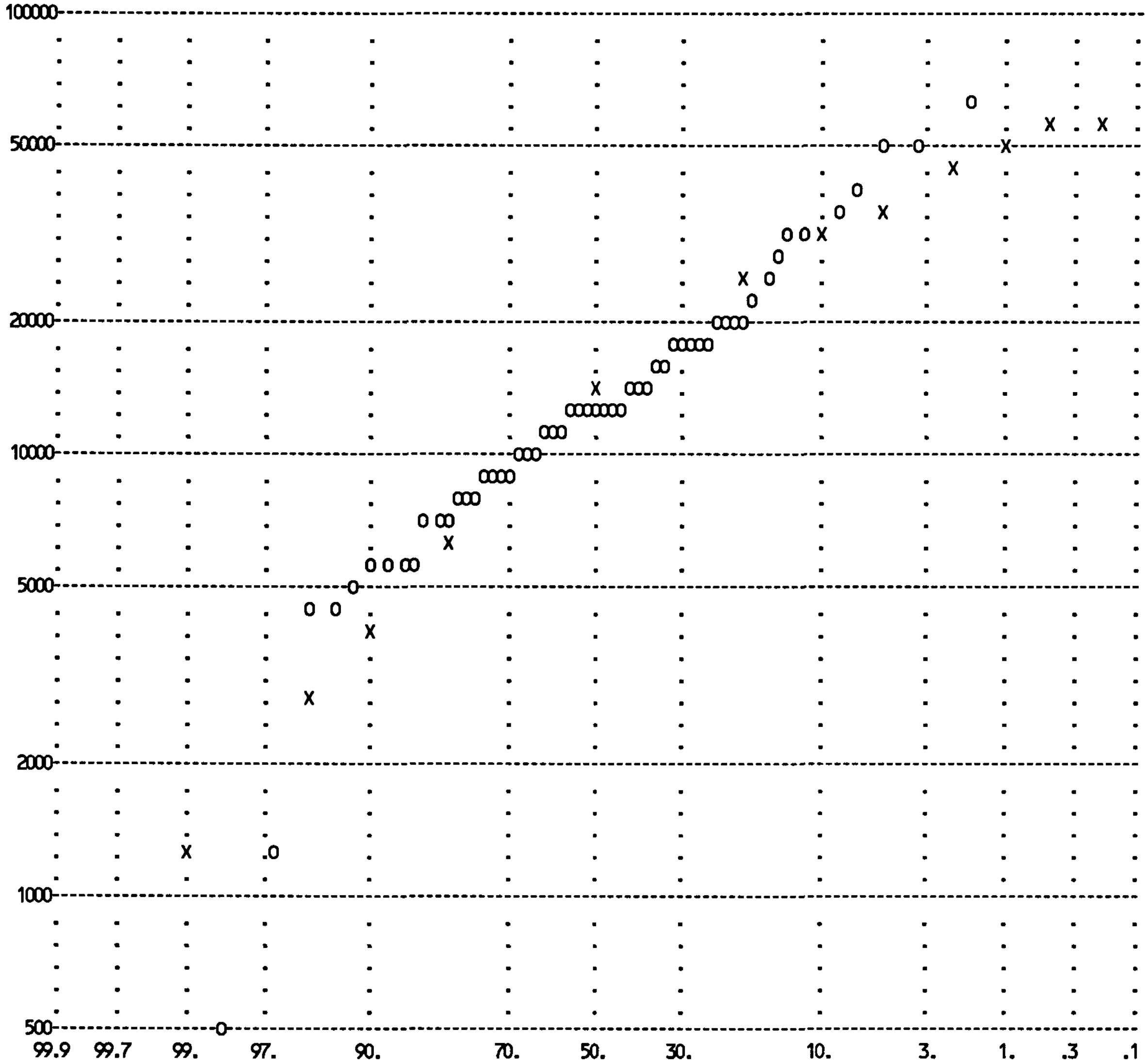
COMPUTED CURVE FLOW IN CFS	EXPECTED PROBABILITY FLOW IN CFS	PERCENT CHANCE EXCEEDANCE	CONFIDENCE LIMITS .01 FLOW IN CFS	CONFIDENCE LIMITS .99 FLOW IN CFS
58300.	60600.	.2	96600.	40900.
53300.	55100.	.5	86500.	37900.
49100.	50500.	1.0	78100.	35200.
44300.	45400.	2.0	69000.	32200.
37200.	37900.	5.0	55800.	27600.
31100.	31500.	10.0	45000.	23600.
24300.	24500.	20.0	33600.	18800.
13600.	13600.	50.0	17500.	10700.
6530.	6450.	80.0	8420.	4770.
4180.	4060.	90.0	5600.	2810.
2790.	2660.	95.0	3930.	1720.
1200.	1070.	99.0	1910.	603.

SYSTEMATIC STATISTICS

LOG TRANSFORM: FLOW, CFS		NUMBER OF EVENTS	
MEAN	4.0869	HISTORIC EVENTS	0
STANDARD DEV	.3486	HIGH OUTLIERS	0
COMPUTED SKEW	-1.0942	LOW OUTLIERS	0
REGIONAL SKEW	-.4000	ZERO OR MISSING	0
ADOPTED SKEW	-.8000	SYSTEMATIC EVENTS	60

PRELIMINARY RESULTS

-FREQUENCY PLOT - 05-5925 KASKASKIA RIVER AT VANDALIA,ILL DA=1980 SQ MI 1908-70
BASED ON COMPUTED VALUES - FLOW IN CFS



PERCENT CHANCE EXCEEDANCE

LEGEND - O=OBSERVED VALUE, H=HIGH OUTLIER OR HISTORIC VALUE, L=LOW OUTLIER, Z=ZERO OR MISSING, X=COMPUTED CURVE

FINAL RESULTS

-PLOTTING POSITIONS- 05-5925 KASKASKIA RIVER AT VANDALIA,ILL

EVENTS ANALYZED				ORDERED EVENTS			
			FLOW		WATER	FLOW	WEIBULL
MON	DAY	YEAR	CFS	RANK	YEAR	CFS	PLOT POS
5	6	1908	7870.	1	1957	62700.	1.64
4	14	1909	7670.	2	1943	52200.	3.28
3	1	1910	7020.	3	1950	51300.	4.92
5	1	1911	5670.	4	1938	40700.	6.56
10	4	1911	13000.	5	1961	34400.	8.20
7	21	1915	15800.	6	1944	31000.	9.84
1	31	1916	14400.	7	1951	31000.	11.48
6	5	1917	16800.	8	1970	30000.	13.11
5	11	1918	8880.	9	1967	27000.	14.75
3	19	1919	11000.	10	1949	25000.	16.39
5	19	1920	12600.	11	1945	21500.	18.03
4	18	1922	18800.	12	1968	20800.	19.67
3	17	1923	14300.	13	1969	20700.	21.31
12	15	1923	10500.	14	1927	20000.	22.95
3	16	1925	9980.	15	1948	19000.	24.59
9	17	1926	8460.	16	1922	18800.	26.23
3	20	1927	20000.	17	1933	17500.	27.87
12	1	1927	12200.	18	1959	17200.	29.51
5	14	1929	12200.	19	1962	17100.	31.15
1	14	1930	11500.	20	1917	16800.	32.79
9	18	1931	1270.	21	1939	16000.	34.43
1	24	1932	5550.	22	1915	15800.	36.07
5	15	1933	17500.	23	1937	14900.	37.70
8	19	1934	4250.	24	1916	14400.	39.34
5	16	1935	11200.	25	1923	14300.	40.98
3	26	1936	7290.	26	1942	13600.	42.62
1	15	1937	14900.	27	1946	13000.	44.26
3	31	1938	40700.	28	1912	13000.	45.90
3	14	1939	16000.	29	1920	12600.	47.54
5	3	1940	6760.	30	1958	12400.	49.18
6	12	1941	4560.	31	1947	12300.	50.82
7	12	1942	13600.	32	1928	12200.	52.46
5	18	1943	52200.	33	1929	12200.	54.10
4	24	1944	31000.	34	1966	11900.	55.74
6	10	1945	21500.	35	1960	11800.	57.38
5	4	1946	13000.	36	1930	11500.	59.02
6	10	1947	12300.	37	1935	11200.	60.66
3	28	1948	19000.	38	1919	11000.	62.30
2	16	1949	25000.	39	1952	10500.	63.93
1	4	1950	51300.	40	1924	10500.	65.57
6	29	1951	31000.	41	1925	9980.	67.21
4	15	1952	10500.	42	1963	9000.	68.85
3	5	1953	5680.	43	1918	8880.	70.49
4	19	1954	505.	44	1964	8500.	72.13
4	25	1955	5000.	45	1926	8460.	73.77
2	27	1956	7840.	46	1908	7870.	75.41
6	29	1957	62700.	47	1956	7840.	77.05
8	4	1958	12400.	48	1909	7670.	78.69
2	12	1959	17200.	49	1936	7290.	80.33
6	30	1960	11800.	50	1910	7020.	81.97
4	10	1961	34400.	51	1940	6760.	83.61
3	25	1962	17100.	52	1953	5680.	85.25
5	22	1963	9000.	53	1911	5670.	86.89
5	4	1964	8500.	54	1932	5550.	88.52
5	4	1965	5350.	55	1965	5350.	90.16
5	19	1966	11900.	56	1955	5000.	91.80
12	10	1966	27000.	57	1941	4560.	93.44
12	23	1967	20800.	58	1934	4250.	95.08
1	31	1969	20700.	59	1931	1270.	96.72
6	16	1970	30000.	60	1954	505.	98.36

-OUTLIER TESTS -

LOW OUTLIER TEST

BASED ON 60 EVENTS, 10 PERCENT OUTLIER TEST VALUE K(N) = 2.837

COMPUTED LOW OUTLIER TEST VALUE 1253.2
2 LOW OUTLIER(S) IDENTIFIED BELOW INPUT BASE OF 2000.0

STATISTICS AND FREQUENCY CURVE ADJUSTED FOR 2 LOW OUTLIER(S)

HIGH OUTLIER TEST

BASED ON 58 EVENTS, 10 PERCENT OUTLIER TEST VALUE K(N) = 2.824

0 HIGH OUTLIER(S) IDENTIFIED ABOVE TEST VALUE OF 78238.

-SKEW WEIGHING -

BASED ON 60 EVENTS, MEAN-SQUARE ERROR OF STATION SKEW = .113
DEFAULT OR INPUT MEAN-SQUARE ERROR OF GENERALIZED SKEW = .302

FINAL RESULTS

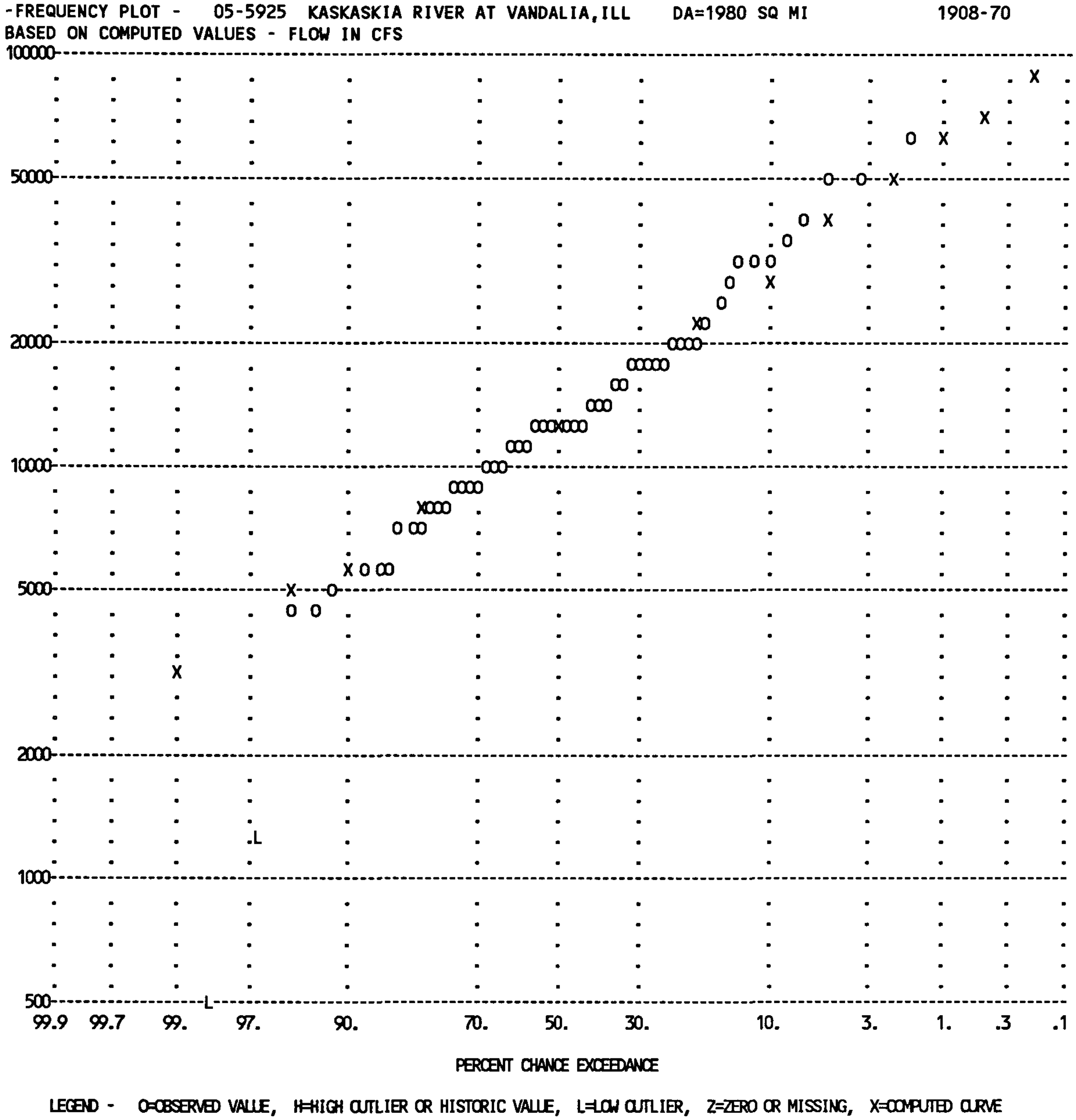
-FREQUENCY CURVE- 05-5925 KASKASKIA RIVER AT VANDALIA,ILL

COMPUTED CURVE FLOW IN CFS	EXPECTED PROBABILITY FLOW IN CFS	PERCENT CHANCE EXCEEDANCE	CONFIDENCE LIMITS .01 FLOW IN CFS	CONFIDENCE LIMITS .99 FLOW IN CFS
93600.	104000.	.2	167000.	63500.
74600.	80900.	.5	126000.	52500.
62100.	66100.	1.0	99900.	44900.
51000.	53400.	2.0	78200.	37900.
38200.	39300.	5.0	54700.	29500.
29700.	30200.	10.0	40400.	23600.
22100.	22300.	20.0	28400.	18000.
12800.	12800.	50.0	15500.	10500.
7650.	7590.	80.0	9360.	5930.
5910.	5830.	90.0	7410.	4370.
4810.	4700.	95.0	6170.	3410.
3310.	3160.	99.0	4460.	2150.

SYNTHETIC STATISTICS

LOG TRANSFORM: FLOW, CFS		NUMBER OF EVENTS	
MEAN	4.1163	HISTORIC EVENTS	0
STANDARD DEV	.2738	HIGH OUTLIERS	0
COMPUTED SKEW	.3993	LOW OUTLIERS	2
REGIONAL SKEW	-.4000	ZERO OR MISSING	0
ADOPTED SKEW	.2000	SYSTEMATIC EVENTS	60

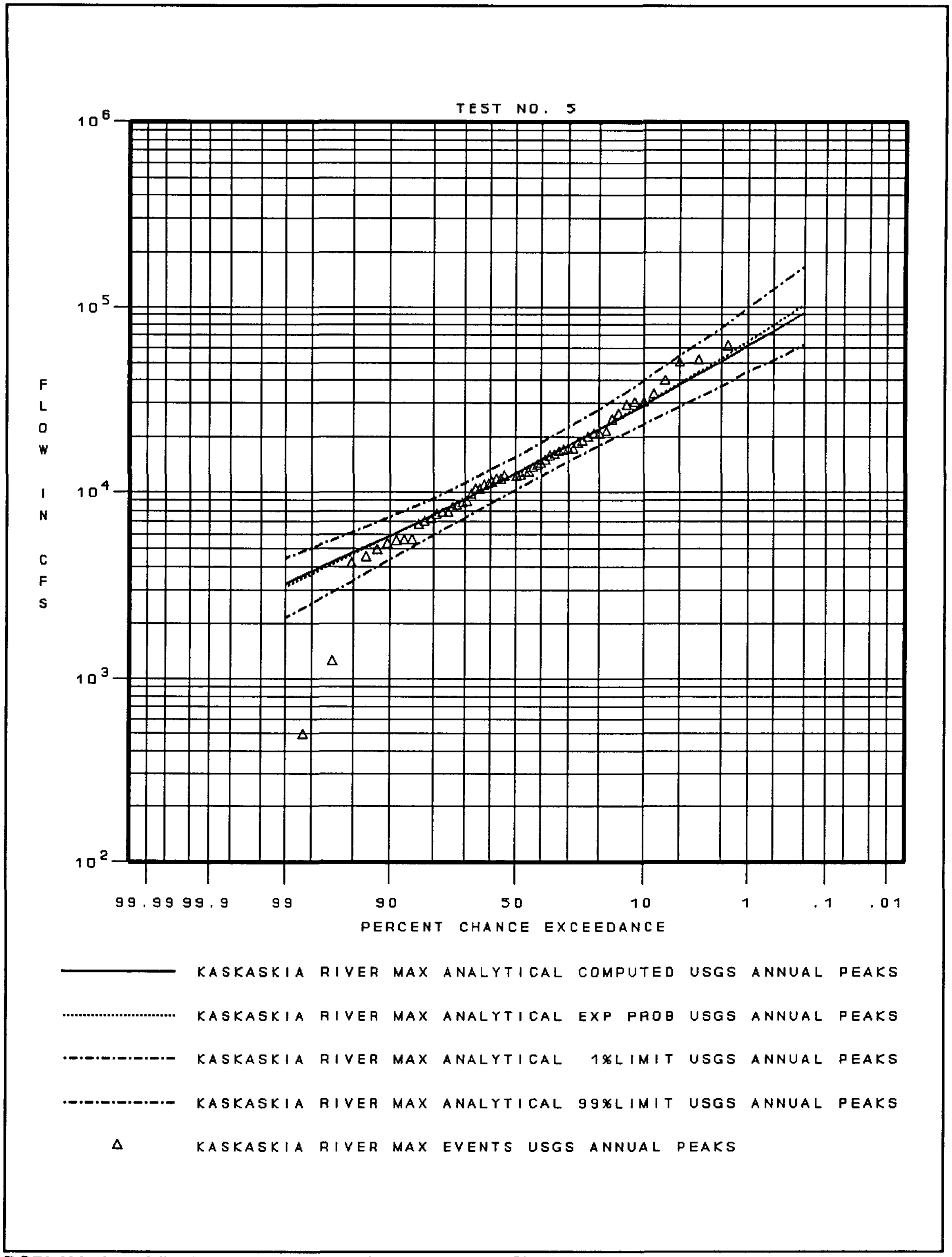
FINAL RESULTS



--ZWRITE: /TEST NO. 5/KASKASKIA RIVER/FREQ-FLOW/MAX EVENTS/1908-70/USGS ANNUAL PEAKS/

--ZWRITE: /TEST NO. 5/KASKASKIA RIVER/FREQ-FLOW/MAX ANALYTICAL/1908-70/USGS ANNUAL PEAKS/

```
+++++++++++++++++++++++++
+ END OF RUN            +
+ NORMAL STOP IN FFA    +
+++++++++++++++++++++++++
```



DSPLAY plot of final frequency curve (see Appendix C).

2.6 Test No. 6 - Use of IPPC, IFMT, QR Records and IYRL

This test illustrates the use of variables which modify the standard mode of operation and provide for the incorporation of historic flood peaks. On the J1 record, the value of IPPC is 2 to compute the median plotting positions rather than the Weibull. The IPROUT value of 21 is the sum of 1 (to suppress input data listing for preliminary results), 4 (to suppress the plot of preliminary results), and 16 (to suppress the plot based on the computed values, i.e., without the expected probability adjustment, from the final results). IFMT is 2 as the input data are prepared in the format of four 8-column fields for day, month, year-end flow. HP records were used in this test to demonstrate the laser jet plot, see plot following the output data.

A historic flood peak of 15,000 cfs which occurred in 1843 is input on the QH record. This value is the highest known value up to the present time, even though the systematic record stopped in 1955. Therefore, the year 1974 is input for IYRL on the SI record.

COMMAND LINE

FFA I=TEST6.DAT O=TEST6.OUT

INPUT

```
TT TEST NO. 6 FLOOD FLOW FREQUENCY ANALYSIS PROGRAM
TT EXAMPLE USE OF MEDIAN PLOT POSITIONS(IPPC),WRC FORMAT(IFMT), HISTORIC
TT DATA(QR CARD), AND PERIOD OF KNOWLEDGE BEYOND LAST YEAR OF DATA(IYRL)
J1     2               21      2
ID 01-4765 RIDLEY CREEK AT MOYLAN, PA           DA=31.9 SQ MI           1932-55
GS  4765               .4
SI         1974
HP PLOT6.PCL                                            31.9 SQ MI
HP TEST NO. 6
HP Ridley  Creek
HP Ridley Creek at Moylan.PA
QH      5       8    1843   15000
       28       3    1932     891
       23       8    1933    2680
        5       3    1934    1080
        9       7    1935    3000
        3       1    1936    1590
       22       2    1937     770
       23       7    1938    3320
        3       2    1939     978
       15       3    1940    1770
        7       2    1941     746
       13       8    1942    1000
       30      12    1942     980
        6       1    1944     865
       18       9    1945    1040
       26      12    1945    1000
       22       5    1947     483
        5       5    1948     740
       30      12    1948    1040
        3       8    1950    1590
       25      11    1950    5720
       11       3    1952    1490
       22      11    1952     918
       14      12    1953     670
       18       8    1955    4390
ED
```

```
*************************************     **************************************
*             FFA                   *     *                                    *
*     FLOOD FREQUENCY ANALYSIS      *     *   U.S. ARMY CORPS OF ENGINEERS     *
*     PROGRAM DATE:  FEB 1982       *     * THE HYDROLOGIC ENGINEERING CENTER  *
*     VERSION DATE: 10 JAN 1992     *     *          609 SECOND STREET         *
*     RUN  DATE   AND   TIME:       *     *      DAVIS, CALIFORNIA 95616       *
*        10 JAN 91    12:11:39      *     *          (916) 756-1104            *
*                                   *     *                                    *
*************************************     **************************************


 INPUT FILE NAME: TEST6.DAT
OUTPUT FILE NAME: TEST6.OUT


**TITLE RECORD(S)**
TT    TEST NO. 6 FLOOD FLOW FREQUENCY ANALYSIS PROGRAM
TT    EXAMPLE USE OF MEDIAN PLOT POSITIONS(IPPC),WRC FORMAT(IFMT), HISTORIC
TT    DATA(QR CARD), AND PERIOD OF KNOWLEDGE BEYOND LAST YEAR OF DATA(IYRL)

**JOB RECORD(S)**
     IPPC   ISKFX  IPROUT    IFMT    IWYR   IUNIT   ISMRY   IPNCH    IREG
J1     2       0     21        2       0       0       0       0       0

**STATION IDENTIFICATION**
ID   01-4765 RIDLEY CREEK AT MOYLAN, PA          DA=31.9 SQ MI          1932-55

**GENERALIZED SKEW**
     ISTN   GGMSE    SKEW
GS   4765    .000     .40

**SPECIAL STATION INFORMATION**
    IYRA    IYRL  HITHRS  LOTHRS    LOGT    NDEC    NSIG
SI     0    1974      0.      0.       0       0       0

**HP PLOT **
     HP PLOT FILE                   IHPCV  KLIMIT    IPER    BAREA
HP PLOT6.PCL                            0       0       0 31.9 SQ MI
HP TEST NO. 6
HP Ridley  Creek
HP Ridley Creek at Moylan.PA

**HISTORIC EVENTS**
QH   5   8  1843    15000.

**SYSTEMATIC EVENTS**
     24 EVENTS TO BE ANALYZED

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


----------------------PRELIMINARY RESULTS ---------------------


-SKEW WEIGHTING -
----------------------------------------------------------------
BASED ON  24 EVENTS, MEAN-SQUARE ERROR OF STATION SKEW =    .315
DEFAULT OR INPUT MEAN-SQUARE ERROR OF GENERALIZED SKEW =    .302
----------------------------------------------------------------
```

PRELIMINARY RESULTS

-FREQUENCY CURVE- 01-4765 RIDLEY CREEK AT MOYLAN, PA

COMPUTED CURVE FLOW IN CFS	EXPECTED PROBABILITY FLOW IN CFS	PERCENT CHANCE EXCEEDANCE	CONFIDENCE LIMITS .05 FLOW IN CFS	CONFIDENCE LIMITS .95 FLOW IN CFS
13600.	21000.	.2	30000.	8280.
9890.	13400.	.5	19800.	6360.
7680.	9640.	1.0	14300.	5170.
5910.	6950.	2.0	10200.	4150.
4080.	4470.	5.0	6320.	3030.
3000.	3170.	10.0	4300.	2320.
2130.	2190.	20.0	2830.	1710.
1200.	1200.	50.0	1490.	962.
754.	742.	80.0	944.	562.
613.	597.	90.0	783.	438.
527.	506.	95.0	685.	363.
414.	387.	99.0	556.	267.

SYSTEMATIC STATISTICS

LOG TRANSFORM: FLOW, CFS		NUMBER OF EVENTS	
MEAN	3.1120	HISTORIC EVENTS	0
STANDARD DEV	.2740	HIGH OUTLIERS	0
COMPUTED SKEW	.9416	LOW OUTLIERS	0
REGIONAL SKEW	.4000	ZERO OR MISSING	0
ADOPTED SKEW	.7000	SYSTEMATIC EVENTS	24

FINAL RESULTS

-PLOTTING POSITIONS- 01-4765 RIDLEY CREEK AT MOYLAN, PA

EVENTS ANALYZED MON	DAY	YEAR	FLOW CFS	ORDERED EVENTS RANK	WATER YEAR	FLOW CFS	MEDIAN PLOT POS
8	5	1843	15000.	1	1843	15000.	.53
3	28	1932	891.	2	1951	5720.	2.97
8	23	1933	2680.	3	1955	4390.	7.09
3	5	1934	1080.	4	1938	3320.	11.21
7	9	1935	3000.	5	1935	3000.	15.34
1	3	1936	1590.	6	1933	2680.	19.46
2	22	1937	770.	7	1940	1770.	23.58
7	23	1938	3320.	8	1936	1590.	27.70
2	3	1939	978.	9	1950	1590.	31.83
3	15	1940	1770.	10	1952	1490.	35.95
2	7	1941	746.	11	1934	1080.	40.07
8	13	1942	1000.	12	1949	1040.	44.19
12	30	1942	980.	13	1945	1040.	48.32
1	6	1944	865.	14	1946	1000.	52.44
9	18	1945	1040.	15	1942	1000.	56.56
12	26	1945	1000.	16	1943	980.	60.68
5	22	1947	483.	17	1939	978.	64.81
5	5	1948	740.	18	1953	918.	68.93
12	30	1948	1040.	19	1932	891.	73.05
8	3	1950	1590.	20	1944	865.	77.17
11	25	1950	5720.	21	1937	770.	81.30
3	11	1952	1490.	22	1941	746.	85.42
11	22	1952	918.	23	1948	740.	89.54
12	14	1953	670.	24	1954	670.	93.67
8	18	1955	4390.	25	1947	483.	97.79

NOTE- PLOTTING POSITIONS BASED ON-HISTORIC PERIOD (H) = 132
NUMBER OF HISTORIC EVENTS PLUS HIGH OUTLIERS(Z) = 1
WEIGHTING FACTOR FOR SYSTEMATIC EVENTS (W) = 5.4583

-OUTLIER TESTS -

HIGH OUTLIER TEST

BASED ON 24 EVENTS, 10 PERCENT OUTLIER TEST VALUE K(N) = 2.467

0 HIGH OUTLIER(S) IDENTIFIED ABOVE TEST VALUE OF 6136.

STATISTICS AND FREQUENCY CURVE ADJUSTED FOR 0 HIGH OUTLIER(S)
AND 1 HISTORIC EVENT(S)

LOW OUTLIER TEST

BASED ON 132 EVENTS, 10 PERCENT OUTLIER TEST VALUE K(N) = 3.109

0 LOW OUTLIER(S) IDENTIFIED BELOW TEST VALUE OF 172.9

-SKEW WEIGHTING -

BASED ON 132 EVENTS, MEAN-SQUARE ERROR OF STATION SKEW = .116
DEFAULT OR INPUT MEAN-SQUARE ERROR OF GENERALIZED SKEW = .302

FINAL RESULTS
-FREQUENCY CURVE- 01-4765 RIDLEY CREEK AT MOYLAN, PA

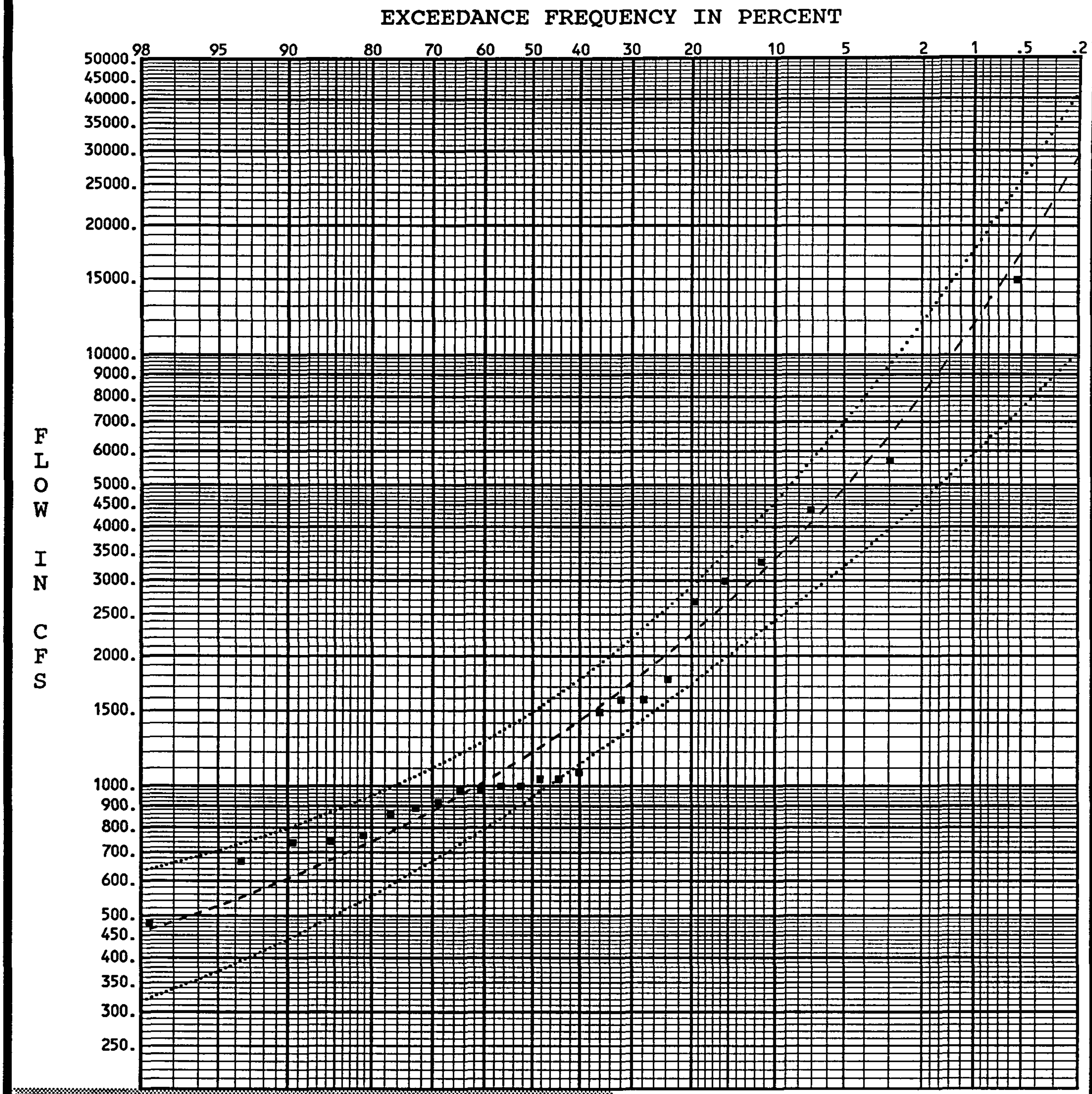
COMPUTED CURVE FLOW IN CFS	EXPECTED PROBABILITY FLOW IN CFS	PERCENT CHANCE EXCEEDANCE	CONFIDENCE LIMITS .05 FLOW IN CFS	CONFIDENCE LIMITS .95 FLOW IN CFS
17600.	29300.	.2	42000.	10200.
12200.	17400.	.5	25900.	7550.
9100.	11800.	1.0	17700.	5950.
6740.	8110.	2.0	12000.	4630.
4440.	4920.	5.0	7050.	3260.
3160.	3360.	10.0	4600.	2430.
2180.	2240.	20.0	2920.	1730.
1200.	1200.	50.0	1490.	948.
754.	744.	80.0	953.	557.
623.	608.	90.0	800.	442.
545.	526.	95.0	710.	374.
446.	423.	99.0	597.	291.

ADJUSTED STATISTICS

LOG TRANSFORM: FLOW, CFS		NUMBER OF EVENTS	
MEAN	3.1200	HISTORIC EVENTS	1
STANDARD DEV	.2838	HIGH OUTLIERS	0
COMPUTED SKEW	1.0783	LOW OUTLIERS	0
REGIONAL SKEW	.4000	ZERO OR MISSING	0
ADOPTED SKEW	.9000	SYSTEMATIC EVENTS	24
		HISTORIC PERIOD	132

HP PLOT WRITTEN TO THE FILE: PLOT6.PCL

```
+++++++++++++++++++++++++
+ END OF RUN            +
+ NORMAL STOP IN FFA    +
+++++++++++++++++++++++++
```



- - -Flow Frequency (with Exp. Prob.)

■ Median Plotting Positions

········5% and 95% Confidence Limits

FREQUENCY STATISTICS

LOG TRANSFORM OF FLOW, CFS		NUMBER OF EVENTS	
MEAN	3.1200	HISTORIC EVENTS	1
STANDARD DEV	.2838	HIGH OUTLIERS	0
SKEW	1.0783	LOW OUTLIERS	0
REGIONAL SKEW	.4000	ZERO OR MISSING	0
ADOPTED SKEW	.9000	SYSTEMATIC EVENTS	24
		HISTORIC PERIOD(1843-1974)	132

TEST NO. 6
Ridley Creek
Ridley Creek at Moylan.PA
BASIN AREA = 31.9 SQ MI
WATER YEARS IN RECORD
1843,1932-1955

HP Plot of final frequency curve (see HP record in Appendix B).

APPENDIX A

USING HEC-FFA

A.1 Introduction

FFA may be executed through the standard "command line" format or through a MENU shell. If the MENU is used, on-line help is available through the COED editor, similar to several other HEC programs.

A.2 Using the Command Line

As with many computer programs, the command line may be used to specify the required files for execution. To run FFA, the input and output files must be specified. A sample execution line is:

FFA I=IN.DAT O=OUT.OUT

This will execute FFA with an input file called IN.DAT and an output file called OUT.OUT. If omitted, the user would be prompted to input the desired file names. Other files that can be specified on the command line are the DSS files and a station statistics file (see SS record). For example:

FFA I=IN.DAT O=OUT.OUT DSS=file SS=file P=Y

If printer plots are desired, then the command line must contain,

PLOT=YES (or abbreviated to P=Y).

Specifying this on the command line is necessary to obtain printer plots, but the output suppression on the J1 record overrides this option.

For a quick reference of the command line input specification parameters, at the prompt type:

FFA ? [enter]

The information in Table A-1 will be displayed on the screen.

Table A-1
Command Line Input Specification Parameter

FFA : 10 JAN 19 VERSION

UNIT	KEYWORD	*ABREV	**MAX	DEFAULT
5	INPUT	I	30	CON
6	OUTPUT	O	30	CON
NOP	PLOT	P	1	NO
NOP	SSRECORD	S	30	SSRECORD
8	TAPE8	T	30	SCRATCH.002
9	TAPE9	TAPE9	30	SCRATCH.031
NOP	DSSFILE	D	30	

* ABREV - SHORTEST ABBREVIATION ALLOWED FOR KEYWORD
** MAX - MAXIMUM # OF CHARACTERS FOR FILENAME (OR STRING)
Stop - Program terminated.

A.3 Using the FFA MENU

FFAMENU is a menu program that assists in transfers between files, editing an input file, executing a program, and viewing the results. To use the FFA menu, simply type FFAMENU at the DOS prompt and select an operation, such as select files, edit file, ... etc. FFAMENU will make batch files to run FFA for the user. From the FFAMENU "Run" (program execution) line, you can toggle between the following programs: FFA, FGRAPH, DSPLAY, and DSSUTL. COED, see next paragraph, is executed form the FFAMENU "create/edit input file" line. FFA and FGRAPH are provided in the HEC FFA package; DSPLAY and DSSUTL must be obtained separately from your vendor.

A.4 On-line Help

FFA has an on-line help file for the HEC editor COED. This allows the user to see information about the records and variables being input. Because the help file works in conjuction with the COED editor, COED must be the editor used for creating data files. If COED is not used, the input data section of this manual provides the same information.

IF the FFAMENU program is not used to execute COED, add "/HP:FFA" to execution line. An example of executing COED with the help file for Test #1 would be:

COED TEST1.DAT /HP:FFA

If the FFA MENU program is used to operate FFA, the help file will automatically be loaded when the COED editor is called.

APPENDIX B

INPUT DESCRIPTION

Flood Frequency Analysis

This exhibit contains a detailed description of each variable on each input record. Many of the records shown can be omitted if certain options are not required. The Summary of Input Records at the end of this exhibit shows the sequential arrangement of records and the location of variables on the records.

The location of variables for each input record is shown by field number. The records are normally divided into ten fields of eight columns each except field 1. Variables occurring in field 1 may only occupy record columns 3-8 because record columns 1 and 2 are reserved for the required identification characters. The different values a variable may assume and the conditions for each are described for each variable. Some variables are used simply to indicate whether or not a program option is to be used. The values for these variables are integer values and must be right justified (entered on the far right side of the field) without any decimal points. Other variables are assigned numbers which express the variable's magnitude. For these, either a "+" or a "-" sign where the value may also be negative, is shown in the description under "value" and the numerical value of the variable is entered as input. Where the variable value is to be zero, the variable may be left blank, since a blank field is read as zero and any number without a sign is considered positive. Unless noted otherwise, variable names beginning with the letters I, J, K, L, M or N represent integer variables and decimal point must not appear in the field. All others are floating point variables and may either have a decimal point or be right justified. The location of variables on records is sometimes referred to by an abbreviated designation, for example, J1.4 means the fourth field of the J1 record.

Those records that are flagged with an asterisk are required records and must be supplied for every job. Several jobs may be processed at the same time by inserting each job sequentially in the file.

I. TITLE RECORDS

TT Record - Title Information

Field	Variable	Value	Description
1-10	--	Alpha	Alphanumeric information to identify the job. As many TT records may be supplied as necessary to input the desired descriptive information.

II. JOB RECORDS

J1 Record - First Job Record

Job record which specifies program options. If omitted, default values in parentheses will be assigned. When this record is provided, the specified input options will be maintained for all succeeding stations until another J1 record is encountered.

Field	Variable	Value	Description
1	IPPC (1)	+	Plotting positions in the program are computed by the general formula (m-A)/(N+1-A-B) where: m = order number; N = number of years; A,B = constants. *The standard constants may be specified below.* If other constants are desired, they may be specified on the J2 record.
		0 or 1	Weibull plotting positions will be used for output and plotting (A and B equal 0.0).
		2	Median plotting positions will be used for output and plotting (A and B equal 0.3).
		3	Hazen plotting positions will be used for output and plotting (A and B equal 0.5).
		4	Plotting positions constants (A and B) will be read in on J2 record.

J1 Record - First Job Record (continued)

Field	Variable	Value	Description
2	ISKFX	0 or 1	Adopted skew coefficient will be the weighted value computed in accordance with the WRC Guidelines and rounded to the nearest tenth.
		2	Adopted skew coefficient will be the weighted value computed as above, except it is not rounded.
		3	Adopted skew coefficient will be set equal to the input regional map skew coefficient which is read in on the GS record, i.e., no weighing with the station skew coefficient.
3	IPROUT (0)	+	The sum of the following output codes which suppress selected portions of the normal output. For example, a value of 63 would suppress all output except the printout of the frequency curve ordinates and statistics of the final results.
		0	No output suppressed.
		1	Suppress the printout of input data, arrayed data, and plotting positions of the preliminary results.
		2	Suppress the printout of the frequency curve ordinates and corresponding statistics of the preliminary results.
		4	Suppress the plot of the preliminary results.
		8	Suppress the printout of input data, arrayed data, and plotting positions of the final results.
		16	Suppress the plot based on computed flows from the final results.
		32	Suppress the plot based on the expected probability adjustment of the flows from the final results.
		64	Suppress the printout of the frequency curve ordinates and corresponding statistics of the final results. A value of 127 for IPROUT will suppress all station output except for the summary of results.

J1 Record - First Job Record (continued)

Field	Variable	Value	Description
4	IFMT	0 or 1	Flow data is in the format specified for QH or QR records.
		2	Data is in the format of four 8-column fields for day, month, year and flow (note order of day and month).
		3	Format of data is specified by FT record for month, day, year and flow (note order of day and month).
		4	Format of data is specified by FT record for day, month, year and flow (note order of day and month).
5	IWYR	0	Annual series data selected from the standard water year (October-September), IWYR will be set to 10.
		+	The order number of the first month in the water year, e.g., 1 for calendar year beginning in January, etc.
6	IUNIT	0 or 1	Label for plot will be "CUBIC FEET PER SECOND."
		2	Label for plot will be "CUBIC METERS PER SECOND."
		3	Label for plot will be input on FU record.
7	ISMRY	0	No summary will be printed.
		1	A summary of the final results will be printed for all of the stations in the run.
		2	A summary of the preliminary results will be printed.
		3	A summary of both the preliminary and the final results will be printed.

J1 Record - First Job Record (continued)

Field	Variable	Value	Description
8	IPNCH	0	No statistics written to special file.
		1	Station statistics will be written for final results.
		2	Station statistics will be written for the preliminary results.
		3	Station statistics will be written for the preliminary and final results.

Statistics will be output in the format as shown below:

Item	Record Columns
SS - Record identification	1- 2
DURN - type of analysis	3- 8
USGS part number	9-10
Station identification number	11-16
Number of events in systematic record	17-20
Historic period	21-24
Station mean	25-32
Station standard deviation	33-40
Station computed skew coefficient	41-48
Station regional skew coefficient	49-56
Station adopted skew coefficient	57-64
Number of historic events	65-68
Number of high outliers	69-72
Number of low outliers	73-76
Number of zero or missing flows	77-80

Field	Variable	Value	Description
9	IREG		This field is only needed when the input flow data is in WATSTORE format. Otherwise the field should be left blank.
		0	Delete all events with a <u>known</u> or <u>unknown</u> effect of regulation or diversion. All flow records with a "1", "2", "5", or "6 in column 33 are deleted.
		2	Include all flow data, regardless of the code in column 33 of the flow record.

J2 Record - Second Job Record

Job record which specifies nonstandard plotting position constants and criteria for confidence limits.

Field	Variable	Value	Description
1	A	+	Plotting position constants A and B. Default values are those specified by IPPC (J1.1). IPPC must equal 4 to activate these input constants.
2	B	+	
3	CLIMIT (0.05)	+	Confidence limit probability for either side. Default value of zero computes the .05 and the complimentary .95 confidence limits. The approximating equations become less accurate for small sample sizes as smaller values are specified, e.g., the .01 limit values are less accurate than .05 limit values for 10 years of data.
4	NDSSCV	0	If a DSS write is used (see ZW record) then NDSSCV specifies the frequency curves that are written to the DSS file. If NDSSCV is not specified FFA will default to writing four curves to the DSS file: the computed, the expected probability and the upper and lower confidence curves.
		1	Computed curve only.
		2	Expected Probability curve only.
5	IEXT	0	Extended character set indicator. The default for output text is to use the extended character set. (i.e. lines around the tables in printout rather than asterisks)
		1	If a printer without extended character set capability is used, then set IEXT to 1. Program will print only conventional text in output file.

FR Record - Frequency Ordinates Record

The FR record is used to specify nonstandard frequency ordinates. When specified, the number of decimal places printed in frequency curve table increases from one to two.

Field	Variable	Value	Description
1	NFRQ	+	NFRQ is the number of frequency ordinates that will be specified (up to 25). If more than nine ordinates are to be input, then more FR records must be used, but NFRQ is only specified on the first FR record.
2-10	FREQ(1...NFRQ)	+	Frequency ordinates, in percent. These must be input in ascending order. The ordinates 1., 10. and 50. percent must be included in this record. This is for the conditional probability adjustment. Note, for second FR record, ordinates are specified on fields 1-10.

FT Record - Flow Format

Provide this record if IFMT (J1.4) is 3 or 4.

Field	Variable	Value	Description
1- 10	IFRMT	Alpha	Format of data on records. If IFMT is 3, the format specification must have fields for data in the following order: month, day, year, and flow, "(8X, 212, I4, F8.0)" is the standard program format. The parentheses must be included in the format specification. If IFMT is 4, the format specification must have fields for data in the following order: day month, year, and flow, e.g., "(3I8, F8.0)" is the format of input data for the program in the WRC Guidelines. The parentheses must be included in the format specification.

FU Record - Variable Name and Units Labels (optional record)

(Can be provided anytime.)

Field	Variable	Value	Description
0	ICD	FU	Record identifier.
1	VNAME (FLOW)	Char	Variable name label, i.e., FLOW, ELEV, etc. Limited to 6 characters in columns 3 through 8 and is used in various table headings. Only the first four characters will be used in the DSS write. The default is 'FLOW'.
2	VUNIT (CFS)	Char	Units label, i.e., CFS, FEET, etc. May be 8 characters in length. The label also is used in table headings and the DSS write. The default is 'CFS '.

III. STATION DATA RECORDS

ID Record - Station Identification and Information

Field	Variable	Value	Description
1-10	ISTA	Alpha	Alphanumeric information such as station number, location, drainage area, period of record, etc. Although columns 2-8 may be used for station identification, only columns 3 through 48 are printed as a heading for each table. If this record is not provided, the brief station identification on the GS record (GS.1) will be used. if a GS record is not provided, the array is filled with blanks

GS Record - Generalized skew

This record is used to specify the generalized (regional map) skew coefficient which will be weighted with the station skew coefficient in accordance with the Bulletin 17B Guidelines. If this record is not provided, the computed station skew coefficient, founded to the nearest tenth if ISKFX(J1.2) is equal to 0 or 1, will be used in computing the frequency curve. If the GS record is included in the input file, but all fields are left blank, FFA will proceed with the analysis with a generalized skew of 0 with a mean square error of 0.302 (the default value).

Field	Variable	Value	Description
1	ISTN	Alpha	Brief alphanumeric identification of station, e.g., could be USGS station number, to assist in identifying record. If a ID record is not provided, the information in this field will be used to label the output.
2	GGMSE	+	Mean squared error (MSE) of the generalized skew if Plate I, Bulletin 17b is not used. If left blank, a value of 0.302 will be used to correspond with Plate I.
3	SKEW	+	Regional (Generalized) skew coefficient.

SI Record - Special Station Information

This record is used to input a historic period other than that represented by the flow data records, to specify the number of high outliers in the systematic record, and to input a base peak discharge.

Field	Variable	Value	Description
1	IYRA	+	The earliest year for defining a period during which the largest recorded events (see NOUTL, SI.3) or historic events (see QH records) are known to be a maximum. If left blank, IYRA will be the first year found on either QH or QR records.
2	IYRL	+	The last year of the period for which the historic information applies. if left blank, IYRL will be the last year found on either QH or QR records.
3	HITHRS	+	Magnitude of high outlier flood peak. All flood peaks <u>in the systematic record</u> (QR records) greater than or equal to HITHRS, are treated as high outliers in the historic period IYRA to IYRL.
		0	If historic data is provided and HITHRS is not specified, it will default to the lowest historic peak.
4	LOTHRS	+	Magnitude of low threshold flood peak. Any recorded event less than or equal to LOTHRS will be treated as a low outlier.
		0	The program automatically applies the WRC procedures to identify and adjust for low outliers (default).
5	LOGT (1)		Logarithmic transformation indicator for frequency analysis.
		-1	No transformation.
		0,1	Log (base 10) transformation, default.
6	NDEC (0)	+	Number of decimal places to print in tables of plotting positions and frequency curve ordinates; 0, 1, 2, or 3 allowed.
7	NSIG (3)		Number of significant figures in output of computed frequency curve ordinates.
		-1	No rounding will be done.
		0	Round to 3 significant figures, default.
		+	Round values to NSIG significant figures.

SS Record - Station Statistics

With this record, FFA can be used to calculate log Pearson type III frequencies given; mean, standard deviation, and skew of the logarithm of the flows. The output tabulated frequency curve is in the same format as would normally be produced for systematic data.

This record can be input manually using the nonstandard fields listed below or can generated by FFA on a previous run. FFA will generate this record and write it to a file specified on the execution line (see IPNCH variable, field 8 on the J1 record). Common fields are not used for the station statistics because it contains 14 pieces of information. The columns numbers for the variables are listed rather than field numbers.

To calculate the frequency curve the only variables required are the mean, standard deviation and the adopted skew. The mean and standard deviation must be input, but FFA will calculate the adopted skew if the computed skew, the generalized skew and the number of years of record are input.

	Columns	Variable	Value	Description
	3-8	DURN	Alpha	Type of analysis. If left blank DURN will default to 'PEAK' analysis.
	9-11	IPART	Alpha	USGS part number.
	11-16	ISTN	Alpha	Station identification number.
	17-20	NSYS	+	Number of events in systematic record.
	21-24	NYR	+	Historic period.
	25-32	XM	+	Station mean.
	33-40	S	+	Station standard deviation.
*	41-48	G	+	Station computed skew coefficient.
*	49-56	SKEW	+	Station regional map skew coefficient.
*	57-64	AG	+	Station adopted skew coefficient.
	65-68	NHIS	+	Number of historic events.
	69-72	NOUTL	+	Number of high outliers.
	73-76	NLOW	+	Number of low outliers.
	77-80	NZMSG	+	Number of zero or missing flows.

* The value of AG will only be used for the adopted skew if the values for G and SKEW are left blank. Otherwise, the adopted skew will be computed by weighing G and SKEW via their mean square error (MSE). The MSE for G is determined based on the maximum value of NSYS and NYR, and for SKEW via the value specified on the GS record (default equals 0.302).

ZW Record - DSS Write Pathname (optional record)

This record specifies the pathname in which to write the plotting position information and frequency curve ordinates. A ZW record must be provided for each data set for which frequency relations are to be written to a DSS file.

Field	Variable	Value	Description
0	ICD	ZW	Record identifier.
1-10	CPATH	Char	Character pathname to be assigned to curves written to a DSS file. Either pathname parts A, B, C, E, and F if the first ZW record, or just the parts that are being changed may appear in columns 3-80. The parts must be separated by a space or comma. Each pathname part may not exceed 32 characters.

An example ZW record with a full pathname is:

ZW /TEST NO 1/FISHKILL CREEK/FREQ-FLOW//1945-68/USGS ANNUAL PEAKS/

The same example with pathname parts is:

ZW A=TEST NO 1 B=FISHKILL CREEK C=FREQ-FLOW E=1945-68 F=USGS ANNUAL PEAKS

The usual conventions for DSS pathnames are:

A = Project or Basin name.

B = Stream, gage or location name.

C = Curve parameters. This part contains the two parameter names for the data. Example valid *parameters are* FREQ-FLOW, FREQ-ELEV, FREQ-STAGE, FREQ-STORAGE, and FREQ-PRECIP. The FREQ part of the label is used by DSPLAY to set the probability scale; therefore, should not be changed.

D = Further identifies the curves. This part cannot be specified by the user and is assigned by the program, depending on the output as follows: a) For plotting positions and input events, 'MAX EVENTS'; or b) For computed frequency curve ordinates, 'MAX ANALYTICAL'. There are four curves contained within this pathname. They have the labels 'COMPUTED' for the computed ordinates, 'EXP PROB' for the expected probability ordinates, and two curves with 'x% LIMIT' for the upper and lower confidence limit curves.

E = Usually used as a time descriptor for data. This part is not required.

F = Unique user defined descriptor to identify the source of the data, the conditions, etc; i.e., USGS, WATSTORE, RESERVOIR INFLOW, NATURAL, etc.

An example of a paired data pathname written to HEC-DSS when a ZW record is specified is:

/TEST NO. 1/FISHKILL CREEK/FREQ-FLOW/MAX EVENTS/1945-68/USGS ANNUAL PEAKS/

HP

HP Records - Write Hewlet Packard Laser Jet Printer File

The HP record specifies the file name and title information necessary for FFA to produce a frequency plot. The file FFA produces contains the Hewlet Packard(HP) printer control characters necessary to produce the frequency plot. This file can then be sent to the printer for the plot. The codes in the file are in the Hewlet Packard Laser Jet II format, but most laser printers are HP compatible thus, plot files produced with this function can be printed on most laser printers.

Up to ten HP records can be input. The first HP record is used to enter the plot file name, the control variables and the basin area; the remaining HP records are used to enter the other title information that appears on the frequency plot.

The HP plot has a title area with room for 10 rows of information. The basin area input on the first HP record takes one of the rows and the period of record determined from the data set reserves an additional 3 rows. This leaves 6 title-information rows to be specified by the user. The default for FFA is to determine the period of record from the data set, though this option can be overridden with the variable IPER (HP.7) which would leave 9 rows for title information available for the user.

The basin area is specified in a different location than other information in an attempt to force the user to include the basin area on the plot; however, the basin area requirement can be overridden.

See example of HP record on TEST NO. 6 in Section 2 of this manual.

FIRST HP RECORD

Field	Variable	Value	Description
0	ICD	HP	Record Identifier.
1-4	HPFILE	alpha	Enter the file path(if desired) and the file name for the HP plot file. For example: PLOT6.PCL
5	IHPCV	0,1	IHPCV specifies the frequency curves to be written to HPFILE. IF IHPCV equals 0 or 1, the expected probability curve will be written to HPFILE.
		2	Computed curve will be written to HPFILE.
		3	Both the expected and computed curves will be written to HPFILE.
		4	No frequency curves will be written to HPFILE (only the plotting positions will be on plot).
6	KLIMIT	0	KLIMIT specifies wether of not the confidence limits will be written to HPFILE. If not specified, KLIMIT will default to 0 and write the confidence limits.
		1	The confidence limits will not be written to HPFILE.
7	IPER	0	FFA will automatically determine the period of record in water years and write on the title area of plot. (HP records 7-9 *cannot be specified.)*
		1	The period of record will not be calculated (HP records 7-9 can be specified for additional title information).
8-9	BAREA	alpha	Enter the phrase that describes the basin area for the frequency curve. For Example: 31 SQ MI. The string entered in BAREA is appended to the phrase: "BASIN AREA = ", and printed in the title area of the HP plot. If BAREA variable is blank the plot will be suppressed.
		N	If the area is unavailable, enter "N" in this field to override the basin area requirement.

SUBSEQUENT HP RECORDS

The second through seventh (or ninth) HP records are used to input title information. The area for title information in the plot has space for 10 lines, which are each 30 characters long. The basin area input from the first HP record is appended to the rows of title information. IF IPER is zero (default) the period of record will be determined from the data set and appended to the last rows in the title area. The block of titles will automatically be centered vertically and each individual title will be centered horizontally. See test no. 6 in section 2. All titles after 6 (or 9 if IPER =1) are not used.

HP record NO.	Variable	Field(Columns)	Value	Comments
2-7(9)	TITLE(N)	1-4 (3-32)	Alpha	Title information.

See the HP plot example for sample input and output (Section 2.6).

Commands to Print the HP Plot File on a Laser Printer

The file produced by FFA contains the printer control codes necessary to produce the plot. This information needs to be sent to the printer. In DOS this can be done with either the **PRINT** or the **COPY** commands. For example, if you produced the HP plot file **PLOT6.PCL**, type:

PRINT PLOT6.PCL

(If the computer responds with the prompt [prn], just press enter.)

Another option is to copy the file to the printer. The same example above using the copy command is:

COPY PLOT6.PCL LPT1

LPT1 used in this example is the path to the printer. This can vary with different computer systems, but usually LPT1 is the name for the printer.

QH Record - Historic Flood Peak

This record is used to input historic flood peaks that are to be weighted with the systematic record (QR records). Care must be exercised in selecting historic peaks as those peaks in the systematic record that the smallest historic peak will be treated as high outliers. Any peaks in the systematic record that are larger than the smallest input historic peak are automatically weighted along with the historic peaks. A nonstandard format and order of month and day may be used, see IFMT (J1.4).

Field	Variable	Value	Description
1	ISTN	Alpha	Brief alphanumeric identification of station e.g., could be USGS station number, to assist in identifying data.
2	IMO,IDAY,IYR	+	The month, number (columns 9 and 10), the day (columns 11 and 12) and the year (columns 13-16) of the flood flow peak. The month and/or day may be left blank. The year must be the calendar year of the event if the month is indicated; otherwise, the year must be the water year. (J1.5 for establishing water year.)
3	QH	+	Historic annual flood peak. The program is dimensioned for up to 50 historic peaks.

*QR Record - Systematic (Recorded) Flood Peak

This record is used to input recorded flood peaks. A period of years may be absent (broken record). The QR is not required in the first two columns. Two blanks or a G blank (Regional Frequency Computation program flow record) is treated as a QR record. A nonstandard format and order of month and day may be used, see IFMT (J1.4). Records after the QR records will not be used in FFA analysis.

Field	Variable	Value	Description
1	ISTN	Alpha	Brief alphanumeric identification of station, e.g., could be USGS station number, to assist in identifying data.
2	IM,IDY,IY	+	The month number (columns 9 and 10), the day (columns 11 and 12) and the year (columns 13-16) of the flood flow peak. The month and/or day may be left blank. The year must be the calendar year of the event if the month is indicated; otherwise, the year must be the water year. (See J1.5 for establishing water year.).
3	Q	+	Recorded annual flood peak. If flow was too low to record, enter -1, and the data will be analyzed by the incomplete record procedure. The number of QH records plus QR records is dimensioned for up to 130 values.

* Required record

CD Record - Read Data From Hydrodata By Earth-Info (CD ROM) Data File

This record provides a link between the program FFA and the data retrieval system by HYDRODATA, where the information is stored on compact disk. The CD record replaces the QR records in FFA input file, by specifying a file name containing the peak flows in the format produced by the Hydrodata software when "Tabular" format is specified (See Appendix D).

Refer to Appendix D for an example of CD record.

Field	Variable	Value	Description
0	ICD	CD	Record identifier.
1-10	CDFILE	alpha	Enter the file path (if necessary) and the file name of data file retrieved from Hydrodata. Note the data must be in tabular format for FFA to read it.

ED Record - End of Data Record

The program reads flow data until it encounters a record that does not have a "20", "21", "QR", "G", and a blank, or has two blanks in the first two columns, or has a completely blank record or an ED in the first two columns. When any of these conditions occur, a new station is assumed unless there is no more data (end of file) in which case normal termination occurs.

SUMMARY OF INPUT RECORDS

Flood Frequency Analysis

I. Title Information:

TT Job Title Information (as many as needed)

II. Job Specification:

J1	**IPPC**	**ISKFX**	**IPROUT**	**IFMT**	**IWYR**	**IUNIT**	**ISMRY**	**IPNCH**	**IREG**
J2	**A**	**B**	**CLIMIT**	**NDSSCV**	**IEXT**				
FR	**NFRQ**	**FREQ(1)**	**FREQ(2)**	**FREQ(3)**	**...etc.**				

FT Nonstandard format for flood pead data

FU VNAME VUNIT

III. Station Data Cards

ID Station Identification

GS	**ISTN**	**GGMSE**	**SKEW**				
SI	**IYRA**	**IYRL**	**HITHRS**	**LOTHRS**	**LOGT**	**NDEC**	**NSIG**

SS See SS record for details of column specifications

ZW DSS pathname

HP	**HPFILE**	**IHPCV**	**KLIMIT**	**IPER**	**BAREA**

QH	**ISTN**	**DATE**	**QH**
QR*	**ISTN**	**DATE**	**Q**

CD CDFILE

ED*

* Required Records

APPENDIX C

FFA - USAGE WITH DSS AND DSPLAY

Other than the printer plots produced by FFA, graphical plots can be generated by the use of the DSPLAY program (Ref. HEC-DSS User's Manual April 1990 version). DSPLAY is a graphics package that allows the user to plot data contained in a DSS file. During execution of the FFA program, the computed frequency curve, the expected probability curve, and the confidence limits are written to a DSS file (see ZW record in Appendix B and J2 record NDSSCV variable). Through the use of the DSPLAY program, the plots shown at the end of each of the six test examples can be generated. The following commands were used.

Command	Description
CA.NA	Develop a new catalog of all the data stored in the DSS file and display it in an abbreviated format on the screen.
FR OFF	Turns frame around graph off (the frames around graphical plots in section 2 were generated by the word processor used to publish this manual).
DA OFF	The default for the Date (DA) command is to print the date above the plot. This command turns that off.
AX LIN,LOG	Sets the Y-axis to logarithm scale. The X-axis defaults to the probability scale because of frequency analysis.
DG BOX=THICK	Sets the main box around the plot to double thick.
GR ON,ON	Turns the major and minor grids on.
DL CU=1 STY=0 WI=1 SY=0 **DL CU=2 STY=1 WI=1 SY=0** **DL CU=3 STY=2 WI=1 SY=0** **DL CU=4 STY=2 WI=1 SY=0** **DL CU=5 STY=-1 SY=3 SI=.6**	These commands set the individual line styles for the frequency curves (curves 1-4), and the symbol type and size for the plotting positions (curve 5). See HEC-DSS User's Manual for more details.
PL 1,2	Plot on the screen (default device) the data referenced by pathnames 1 and 2 in the DSS file catalog listing.

Command	Description
DEV META	Change plotting device option to a meta file, a graphical format file. This is only one option for the output, to get a hardcopy of a plot directly , the printer might be selected as the output device. For this case the command would be DEV PRINTER. METAFILES were used in test examples so that the plots could be integrated into this manual.
PL	Send the previously defined option (PL 1 and 2) to the printer.
DEV SCREEN	Reset the current plotting device to the screen.
FIN	Finish the DSPLAY session and return to DOS or MENU.

Using these commands in DSPLAY, produces a file called **METAFILE.DAT**. A commercial word processor can then import these plots into documents. The METAFILE is a **C**omputer **G**raphics **M**etafile format (CGM) and is compatible with most word processors.

APPENDIX D

FFA - USAGE WITH HYDRODATA

FFA can read indirectly from the HYDRODATA CD ROM package with the CD record. To use this capability, a data file must be retrieved in tabular format and the name of this file input in the CD record. Below are a list of commands to retrieve in the tabular format. The actual file produced is shown in table D-1. Sample HYDRODATA input and output files using the retrieved CD file are shown in table D-2.

Additional flows can be added to the analysis with QR records, but the CD record must precede them in the input file.

Commands required to retrieve a data set from the HYDRODATA information system.

Execute the HPEAK.EXE program (PV for 1991 version).

Select State (HPEAK and PV are menu driven).

Select the desired station by marking: position the cursor on the station and pressing the F5 key. (F4 unmarks station.) The marked station will be in bold text.

Press ESC key to get into menu, cursor to EXPORT and press ENTER.

Select FILE and enter the desired file name.
(In the following example, the file was named DRY_BEAV.ASC, the ASC extension is not required but was used as reminder that file is in ASCII format.)

Select FILE, then cursor to FORMAT and select the TABULAR or ASCII format.

Select GO from menu, and press ENTER.

The above actions creates a file called DRY_BEAV.ASC (for this example). This file should reside in your FFA directory.

TABLE D-1

File Retrieved from the CD ROM With HYDRODATA

Station	DRY BEAVER CREEK NEAR RIMROCK, ARIZ.			Id	09505350
State	AZ	Drainage Area	142.0	Hydrolog Unit	15060202
County	025	Contribute Area	0.0	Years	1961-1988
Latitude	34:43:43	Gage Datum	3694.38	Continuous	Yes /No
Longitude	111:46:30	Base Flow	600.0	Ann/Part Cnt	28 /112

Year	Date	Discharge	Dcode	Stage	Scode	High	AltStage	AltDate	Acode	#Par
1961	07/14/61	1610.0	0	5.400	0					2
1962	02/12/62	2510.0	0	6.860	0					1
1963	08/17/63	3260.0	0	7.880	0					1
1964	03/30/64	1160.0	0	5.050	0					1
1965	01/06/65	7970.0	0	9.070	0					8
1966	11/23/65	9670.0	0	9.690	0					4
1967	12/07/66	9460.0	0	9.620	0					0
1968	02/11/68	652.0	0	4.320	0					0
1969	01/25/69	10600.0	0	9.980	0					3
1970	09/05/70	26600.0	0	14.350	0					1
1971	09/01/71	537.0	0	4.240	0					0
1972	12/26/71	2740.0	0	6.190	0					2
1973	12/28/72	6160.0	0	8.220	0					8
1974	04/03/74	253.0	0	3.680	0					0
1975	04/14/75	1220.0	0	5.080	0					1
1976	02/09/76	7020.0	0	8.640	0					2
1977	04/07/77	304.0	0	3.820	0					0
1978	03/01/78	8410.0	0	9.250	0					7
1979	12/18/78	24200.0	0	12.200	0					8
1980	02/14/80	18600.0	0	12.530	0					10
1981	08/11/81	1250.0	0	5.100	0					1
1982	03/12/82	7790.0	0	8.810	0					5
1983	11/30/82	8190.0	0	8.990	0					9
1984	12/04/83	5780.0	0	7.950	0					2
1985	12/27/84	4250.0	0	7.130	0					3
1986	11/30/85	4340.0	0	7.190	0					3
1987	03/09/87	1160.0	0	4.980	0					3
1988	04/25/88	2650.0	0	6.270	0					2

TABLE D-2

FFA Example Using the CD Record

Input File

```
TT EXAMPLE OF DATA INPUT FROM HYDRODATA - CD ROM
GS                  -.1
CD DRY_BEAV.ASC
ED
```

Output File

```
 *************************************     **************************************
 *             FFA                   *     *                                    *
 *     FLOOD FREQUENCY ANALYSIS      *     *   U.S. ARMY CORPS OF ENGINEERS     *
 *     PROGRAM DATE:  FEB 1982       *     * THE HYDROLOGIC ENGINEERING CENTER  *
 *     VERSION DATE: BETA   2/91     *     *         609 SECOND STREET          *
 *     RUN  DATE   AND   TIME:       *     *      DAVIS, CALIFORNIA 95616       *
 *        11 JUN 91    15:33:48      *     *          (916) 756-1104            *
 *                                   *     *                                    *
 *************************************     **************************************



  INPUT FILE NAME: DRY_BEAV.DAT
 OUTPUT FILE NAME: DRY_BEAV.OUT



 **TITLE RECORD(S)**
 TT   EXAMPLE OF DATA INPUT FROM HYDRODATA - CD ROM

 **GENERALIZED SKEW**
      ISTN   GGMSE    SKEW
 GS           .000    -.10

 **CD FILE DATA**
 CD DRY_BEAV.ASC

   Station     DRY BEAVER CREEK NEAR RIMROCK, ARIZ.                    Id     09505350

   State       AZ               Drainage Area         142.0       Hydrolog Unit 15060202

   County      025              Contribute Area         0.0       Years         1961-1988

   Latitude     34:43:43        Gage Datum          3694.38       Continuous    Yes /No

   Longitude   111:46:30        Base Flow             600.0       Ann/Part  Cnt 28  /112

 **SYSTEMATIC EVENTS**
      28 EVENTS TO BE ANALYZED

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

FINAL RESULTS

-PLOTTING POSITIONS- DRY BEAVER CREEK NEAR RIMROCK, ARIZ.

EVENTS ANALYZED				ORDERED EVENTS			
			FLOW		WATER	FLOW	WEIBULL
MON	DAY	YEAR	CFS	RANK	YEAR	CFS	PLOT POS
7	14	1961	1610.	1	1970	26600.	3.45
2	12	1962	2510.	2	1979	24200.	6.90
8	17	1963	3260.	3	1980	18600.	10.34
3	30	1964	1160.	4	1969	10600.	13.79
1	6	1965	7970.	5	1966	9670.	17.24
11	23	1965	9670.	6	1967	9460.	20.69
12	7	1966	9460.	7	1978	8410.	24.14
2	11	1968	652.	8	1983	8190.	27.59
1	25	1969	10600.	9	1965	7970.	31.03
9	5	1970	26600.	10	1982	7790.	34.48
9	1	1971	537.	11	1976	7020.	37.93
12	26	1971	2740.	12	1973	6160.	41.38
12	28	1972	6160.	13	1984	5780.	44.83
4	3	1974	253.	14	1986	4340.	48.28
4	14	1975	1220.	15	1985	4250.	51.72
2	9	1976	7020.	16	1963	3260.	55.17
4	7	1977	304.	17	1972	2740.	58.62
3	1	1978	8410.	18	1988	2650.	62.07
12	18	1978	24200.	19	1962	2510.	65.52
2	14	1980	18600.	20	1961	1610.	68.97
8	11	1981	1250.	21	1981	1250.	72.41
3	12	1982	7790.	22	1975	1220.	75.86
11	30	1982	8190.	23	1987	1160.	79.31
12	4	1983	5780.	24	1964	1160.	82.76
12	27	1984	4250.	25	1968	652.	86.21
11	30	1985	4340.	26	1971	537.	89.66
3	9	1987	1160.	27	1977	304.	93.10
4	25	1988	2650.	28	1974	253.	96.55

-OUTLIER TESTS -

LOW OUTLIER TEST

BASED ON 28 EVENTS, 10 PERCENT OUTLIER TEST VALUE K(N) = 2.534

0 LOW OUTLIER(S) IDENTIFIED BELOW TEST VALUE OF 143.8

HIGH OUTLIER TEST

BASED ON 28 EVENTS, 10 PERCENT OUTLIER TEST VALUE K(N) = 2.534

0 HIGH OUTLIER(S) IDENTIFIED ABOVE TEST VALUE OF 83095.

-SKEW WEIGHTING -

BASED ON 28 EVENTS, MEAN-SQUARE ERROR OF STATION SKEW = .216
DEFAULT OR INPUT MEAN-SQUARE ERROR OF GENERALIZED SKEW = .302

FINAL RESULTS

-FREQUENCY CURVE- DRY BEAVER CREEK NEAR RIMROCK, ARIZ.

COMPUTED CURVE FLOW IN CFS	EXPECTED PROBABILITY FLOW IN CFS	PERCENT CHANCE EXCEEDANCE	CONFIDENCE LIMITS .05 FLOW IN CFS	CONFIDENCE LIMITS .95 FLOW IN CFS
81400.	109000.	.2	224000.	41300.
61500.	77100.	.5	157000.	32600.
48400.	58100.	1.0	117000.	26600.
37000.	42600.	2.0	83400.	21100.
24300.	26700.	5.0	49600.	14700.
16500.	17500.	10.0	30800.	10400.
10100.	10400.	20.0	17100.	6650.
3680.	3680.	50.0	5510.	2470.
1230.	1180.	80.0	1860.	729.
669.	617.	90.0	1070.	351.
397.	348.	95.0	677.	185.
142.	105.	99.0	281.	51.

SYSTEMATIC STATISTICS

LOG TRANSFORM: FLOW, CFS		NUMBER OF EVENTS	
MEAN	3.5387	HISTORIC EVENTS	0
STANDARD DEV	.5450	HIGH OUTLIERS	0
COMPUTED SKEW	-.4304	LOW OUTLIERS	0
REGIONAL SKEW	-.1000	ZERO OR MISSING	0
ADOPTED SKEW	-.3000	SYSTEMATIC EVENTS	28

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+++++++++++++++++++++++++
+ END OF RUN            +
+ NORMAL STOP IN FFA    +
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