STATION EVALUATION
FORREST KERR CREEK ABOVE 460 M CONTOUR

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Vancouver, B.C.

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Kerr Creek above 460 M contour.

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ABSTRACT

The streamflow data collected at this station has been analyzed in this report. Rating curves, both high and low, have been inspected for appropriate extensions. The high and mean flow characteristics have been compared to those of neighbouring streams and methods of computation have been noted. The effect of various physical conditions on the development of data have been related to the quality of the records.

Over one half of the streamflow record has been estimated which includes the ice period (47%) and periods during open water (6%) where stage record was not obtained. Only one peak flow record is suspect. Peak discharges in this basin have two distinct causes: snowmelt and rainstorms.

The minimum and mean flow record will not be improved until a stable control is found or the frequency of measurements is increased.

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1. INTRODUCTION

Streamflow records are among the most valuable of all hydrologic factors used in basin planning. The flow of streams is a sensitive indicator of climatic variations as runoff is the residual precipitation after the requirements for evapotranspiration have been satisified.

Streamflow records to be used in any analysis involving the record as a whole should be checked for quality.

The primary purpose of station evaluation, therefore, is to assess the quality of data being collected at hydrometric stations. This report was undertaken to provide this quality assessment of the streamflow data assembled for this station.

1.1 Purpose of Station

The station was established on June 16, 1972 in conjunction with More Creek station, for hydroelectric power studies at the request of G.E. Crippen and Associates acting for B.C. Hydro.

1.2 Basin Description

Forrest Kerr Creek rises in the Boundary Range of the Coast Mountains between the Iskut and Stikine Rivers. It is a tributary to the Iskut River as shown on location map in Figure 1.

The gauging station is located 21 kilometres (km) above the mouth or its confluence with the Iskut River. A stream profile is shown in Figure 2 which indicates it is a short stream with a steep gradient. An area-elevation curve is shown in Figure 3. The basin at the stream gauging station drains an area of 311 square kilometres (km^2). The drainage area at this location comprises mostly glaciers. Drainage area boundaries are difficult to define in this type of terrain. A map of Forrest Kerr Creek basin is shown on Figure 4.

Climate

The climate of the basin is dominated by continental influences. The mean temperatures for the five winter months are below freezing. The winter continental Arctic air masses move down from the North producing extremely low temperatures as shown for Telegraph Creek in Figure 5. In the spring and summer these cold air masses are pushed back and the climate warms up reaching temperatures in the mid-thirties. As a contrast the relatively even climate regime is shown in Figure 6 for Stewart. Precipitation is generally relatively light in the valley bottoms as shown by the histogram of Figure 7. The basin is located in the lee slopes of the Coast Mountains which accounts for the lower precipitation. Precipitation is considerably heavier in the mountains as evidenced by the large glaciers and ice fields.

Pacific storms sometimes find their way through the mountains to produce the October floods. The valleys of the Nass, Bell-Irving, and Unuk Rivers to the south provide access for these storms.

1.3 Station Description

This station was established June 16, 1972 with a cableway, servo-manometer and A-71 recorder. The river channel at the gauge is shown in Figures 8-10.

Highwater measurements are made from the cableway. Selected cross sections under the cableway are shown in Figure 11 which indicates that the stream bed is very unstable and subject to scouring during high flow. Low water measurements are made by wading a short distance above or below the gauge. A sample cross section is shown in Figure 12. This section is also subject to scouring during high flow. A new orifice was installed in May of 1982.

Flow Computations

Discharges are computed from gauge heights obtained from an automatic recorder chart. The open water rating curves are developed each year from an average of five measurements. Flowrates under ice have been estimated from an average of two measurements per season, air temperatures and hydrographing with other streams.

2. QUALITY OF DATA

2.1 Derivation of Maximum Flows

Inspection of past rating curves indicates that the control is unstable at the lower gauge heights as is shown in Figure 13, where selected discharges are plotted against the stage for the period each rating curve has been used. A scatter of points shows at low stage on the logarithmic plot of stage versus discharge shown in Figure 14 and a composite rating curve is shown in Figure 15. This logarithmic plot also indicates that there is a change in control from section to channel in the range of stage from 0.9 to 1.2 metres (m). This change in control has not been recognized or accounted for in the various rating curves. The rating curves, however, have been kept constant at the top end.

The highest discharge measurement taken during the operation of this station was obtained on August 10, 1977 and July 24, 1979 with a flow of 136 cubic metres per second (m^3/s). The maximum recorded gauge height of 2.603 m occurred on September 8, 1981. The discharge at this gauge height was 262 m^3/s estimated by extending the rating curve above a measured discharge of 136 m^3/s. The highest measured flow and estimated peaks are shown for each year in Figure 16.

The computer extension of rating curve #5 and the composite curve of all measurements are to the right of curve #5. These curves would give higher flows ranging from 11% to 18% as shown in Table 1.

Figure 17 shows the relationship of the extended rating curve #5, Computer extension of curve #5 and the extended composite curve.

The flood of September 8, 1981 changed the stage-discharge relationship over the low and medium stage range as illustrated in Figures 11 and 14.

Double-Mass Curve Analysis

The streamflow records are free of any influence of storage or diversion. Changes in basin runoff characteristics because of logging, forest fires or mining are not considered. Assuming that a constant ratio of cumulative annual peak runoff exists between a given station and a group of stations, each record was tested for homogeneity by a double-mass curve analysis. The runoff characteristics for the area were established by using five gauging stations with fourteen years of concurrent record from 1972 to 1985. These stations are listed in Table 2 and the location is shown in Figure 18.

The cumulative annual maximum discharge per square kilometre of drainage area for the Forrest Kerr Creek was plotted against the cumulative average annual maximum discharge per square kilometre of drainage area for all five stations. The results are shown in Figure 19. Forrest Kerr Creek has changes in slope which test statistically significant at the 5% level on the basis of a variance ratio test (F-test). This indicates that this basin is not homogeneous with the other basins in the area in its flood-producing characteristics.

The relationship of the published maximum instantaneous discharge to published annual maximum daily discharge is shown in Figure 20 and the average ratio of the two is 1:1.4. There is no discernible difference in the ratio between snowmelt and rainstorm events.

Table 2 lists the hydrometric and meteorologic stations in the area which were used in the study. The bar chart in Figure 21 shows the length of record for these hydrometric stations.

Assessment of the Quality of Maximum Flow Data

The top end of the rating curves have not been adequately defined. Peak flows have not been extreme, except in one case where the estimated flow is nearly double the highest measured discharge used to define the rating curve.

The uncertainty function program was used to calculate the accuracy of the stage-discharge relationship. The parameters used in the study are the number and accuracy of measurements and the accuracy of the stage-discharge relationship during the open water period. The standard error for the discharge measurements is set at 5% to account for any unusual measuring conditions. No loss of record was considered in the study. The standard error is shown in Table 3 and Figure 22 corresponding to the number of measurements required to obtain that standard error. The standard error represents the maximum error in the instantaneous discharge two thirds of the time.

The number of open water discharge measurements used in the analysis over the fourteen year period was 68, which averages to 5 per season. The standard error as shown in Table 3 for 5 measurements is approximately 8%. The latter period of the record for the gauging station, Tulameen River near Princeton (08NL024), (1974-1984), which was considered good record, had a standard error of approximately 14% for the same number of measurements. To obtain the same standard error as Tulameen River data, a minimum of 2 well planned measurements would be required each year during the open water period.

2.2 Derivation of Minimum Flows

Minimum flows occur from late winter to early spring. All of the annual minimum flows have been obtained when the stream is under ice cover. On the average, flow at this stream is either under ice or affected by ice 47% of the time each year. See Table 4. Records for the period affected by ice are estimated by the use of two measurements, comparing hydrographs with other stations and temperatures recorded at Bob Quinn Lake. A more reliable means of estimating flow under ice is by the use of recession analysis or by use of a model. The ice measurements would need to be timed better in order to make maximum use of the above methods.

The lowest discharge measurement to date was made March 19, 1974 for a flow of 0.566 m^3/s. The minimum flow on record is 0.549 m^3/s estimated for the period of March 7, 1974.

Assessment of the Quality of Minimum Flows

The section control is subject to some shifting as indicated in Figure 13. (A large shift occurred in the low to medium stage range during the high flow of 1981.) Shifts in control are adjusted from measurement to measurement but when there are long periods between measurements, adjustments are not always reliable. There have been seven rating curves developed for twelve years of record, which means an average of a shift every two years.

A shifting control does not always mean poor record. It is a matter of how well the measurement program is planned. The standard error as shown by the uncertainty function program is a means to assess the quality of data as shown in Table 3. The ice period record is at best an educated guess guided by two measurements, temperature and hydrographs from neighbouring stations. The ice period each year averages 5.6 months as shown in Table 4. The ice period together with the missing data make up 56% of the record produced from this station. This is shown graphically in Figure 23.

2.3 Derivation of Average Flow

The mean annual discharge for the period of record is 26.9 m^3/s for thirteen years of record. Shifting of the control is not expected to have a significant effect on the average flow.

Record estimation has amounted to 9% of the total record produced. For example in the calendar year of 1975, which is the worst year, 194 days of open water record were estimated and 171 days of discharges affected by ice cover. Lost records are due to equipment malfunction and sediment build-up over the orifice which appeared to be a continuous problem. Some stage record was discarded because of large flushing corrections.

The volume of runoff for the four months (June to September) is approximately 84% of the annual runoff. Figure 24 shows the mean annual and mean monthly runoff for this station. Volume of runoff during the ice period averages approximately 4% of the annual runoff.

Double-Mass Curve Analysis

Under the assumption that a constant ratio of cumulative annual runoff (mm) exists between a given station and a group of stations, each record was tested for homogeneity by a double-mass curve analysis. The runoff characteristics for the area were established by using the five gauging stations listed in Table 2, which have thirteen years of concurrent record from 1973 to 1985. The cumulative mean annual runoff for Forrest Kerr Creek in millimetres was plotted against the cumulative average annual runoff for all five stations. The results are shown in Figure 25. Forrest Kerr Creek has changes in slope which test statistically significant at the 5% level on the basis of a variance ratio test (F-test). This indicates that the basin is not homogeneous with the other basins in the area in its annual runoff characteristic.

Assessment of the Quality of Average Flow

The quality of the mean annual discharge would not be adversely affected by the shifting control at the lower and medium stages but may be affected by silting of the orifice if the proper adjustments are not made. Some records have been rated very poor because silting of the orifice.

2.4 Summary

The reliability of the stage-discharge relationship for the lower stages is fair. The control shifts are caused either by high water or ice. The top ends of the rating curves, although held fairly constant, have not been adequately defined by measurements, although only one high flow would be questioned because of this. There has been a problem with sediment build up over the orifice which has resulted in some large and long flushing corrections. This record has been rated as poor.

Low flow data will not be improved until a more stable control is found, although some improvement will be obtained by use of a model for estimating flowrates under ice.

2.5 Recommendations

The station has a fairly stable control but requires some improvement to solve the silting problems. The number of required visits to this station to obtain good data is low but would have to be increased because of silting and redefinition of the rating curve after any significant high flow.

The high end of the rating curve should be better defined as soon as the opportunity presents itself.

Recession curve analysis and the application of a flow model for ice-covered streams should be initiated as soon as possible in order to improve the estimation of flowrates during the ice periods. A measurement program should be initiated to obtain a measurement soon after freeze-up to aid in the use of the above methods of analysis.

Care should be taken in using data from this station in correlation or regression studies for regional equations as some streamflow characteristics are not homgeneous with the region.

3. STATISTICS OF DATA

3.1 Statistical Structure of Selected Streamflow Characteristics

The following streamflow characteristics are considered: mean annual, mean monthly, 1, 7 and 14 day lows, maximum daily mean and maximum instantaneous discharges.

Population Statistics

The best estimates of population are given by:

Mean	$\bar{x} = (1/N)\ \Sigma x$
Standard Deviation	$\bar{s} = \{[1/(N-1)]\ \Sigma\ (x-\bar{x})2\}^{1/2}$
Skew Coefficient	$g = \{N^2/[(N-1)(N-2)]\}\ (m_3/s^{-3})$
Coefficient of Kurtosis	$\bar{g}_2 = \{[N^2(N+1)]/[(N-1)(N-2)(N-3)]\}(m_4/\bar{s}^4)$

The third and fourth central moments are defined by:

$$m_3 = (1/N)\ \Sigma\ (x-\bar{x})^3$$

$$m_4 = (1/N)\ \Sigma\ (x-\bar{x})^4$$

The values are listed in Table 5.

3.2 Non-Parametric Statistical Tests

The streamflow characteristics of 1, and 7 day lows, and the maximum daily mean and maximum instantaneous discharges have been tested by non-parametric tests for independence, stationarity, homogeneity and general randomness. The data and test results are listed in Tables 6 to 15. A trend has been identified in the low flow data for the period 1973 to 1985. This is illustrated in Figure 26. The trend may be due to: sampling procedures, a short period of record, or a climatic warming trend.

The data has also been indicated as lacking in homogeneity based on a time span of 1973/78 and 1979/85. This means that the two samples appear to be from different populations. The reasons for the non-homogeneity could be the same as those listed above.

3.3 Flood Frequency Distribution

Annual peak discharges from this basin are caused by two types of runoff: snowmelt, and rainstorms or rain on snow. Although this distribution of peaks did not show up as significant on the homogeneity test it is obvious from an examination of hydrographs.

Floods from snowmelt generally occur from June to August and those occurring from rainstorms from September through October. The type of flood was determined from an examination of mean daily discharge hydrographs. It was assumed that a fairly steady rise and recession would indicate snowmelt runoff, and that a sharp rise and fall would indicate runoff from rainstorms. In those years where a significant rainstorm flood does not occur a flow value is accepted, after the flow recession is well below the mean annual discharge, where there is a rapid increase in runoff. These arrays are listed in Tables 16 and 17.

One Event Annual Series

The magnitude and frequency of peak discharges are shown in table form for the annual maximum daily and annual maximum instantaneous discharges. The period of record used is from 1973 to 1985. The flood frequency estimates are given for four distributions: Generalized Extreme Value, Three Parameter Lognormal, Log Pearson Type III, and Wakeby. The Weibull distribution is used only if the untransformed data has a high negative skew. The distributions are fitted to the data and are shown in Figures 27 to 30. The discharge data, sample statistics and flood frequency regime data are listed in Tables 18 to 23 for the maximum daily discharge. The same distributions fitted to the maximum instantaneous dicharge are shown in Figures 31 to 34. The discharge data, sample statistics and flood frequency regime data are listed in Tables 24 to 27.

One high outlier was detected in the maximum daily discharge data but no historic information is available on which to extend the time span.

Two Event Annual Series

The four distributions were fitted to both the snowmelt and rainfall events and are shown in Figures 35 to 42. The sample statistics and flood frequency regime data are listed in Tables 28 to 35.

The frequency curve for the two event analysis is obtained by combining the frequencies of the events. The resulting curve is shown in Figure 43. The difference in the two analyses can be observed in the slope of the frequency curves.

Figure 44 shows the monthly maximum discharge for the period 1972 to 1985.

3.4 Low Flow Frequency Distribution

Low flow frequency curves show the magnitude and frequency of low flows for various periods of consecutive days. The periods selected are the 1, 7 and 14 days. The climatic year was used for each period which begins May 1 and ends April 30. The Gumbel III probability distribution has been fitted to the data and is shown in Figures 45 to 47. Tables 36 to 41 list the low flow data, sample statistics and frequency regime data. For comparison purposes Figure 48 shows the family of low flow frequency curves for the periods of 1, 7 and 14 consecutive days.

The monthly minimum discharges for the period 1974 to 1974 are shown in Figure 49.

3.5 Hydrographs

The time distribution of runoff is influenced by climatic factors, and by the topographic and geologic features of the basin; thus the final hydrograph is affected by all three factors. Climatic factors predominate in producing the rising limit, while the recession limb is largely independent of storm characteristics producing the runoff. The maximum, minimum, and mean discharge hydrographs and the standard deviations are illustrated in Figure 50 for this basin. The daily discharge hydrograph for 1985 is shown in Figure 51 for Forrest Kerr Creek, More Creek and Iskut River for comparison purposes.

3.6 Base-Flow Index

Geologic conditions are generally considered to have a major influence on low flow yields. To isolate the geologic effect on low flows a value called the base-flow index statistic is computed. It is defined as the ratio of the runoff under the base-flow separation line to the total runoff for the same period. Differences in this value can be attributed to differences in basin hydrogeology with very little influence from climate. The index indicates the amount of storage available in the basin as groundwater. The average value of the index for this basin was calculated to be 0.718. The yearly values are listed in Table 42.

3.7 Flow Duration Curves

The duration curve is used to determine water supply potential for run of river hydro projects, and municipal and domestic water supplies. The amount of flow available for any selected percent of time can be obtained from the curve. The chronological sequence of events is completely masked in a duration curve which greatly restricts its use. Figure 52 shows the flow duration curve for daily mean flows from 1973 to 1985.

3.8 Basin Physiographic Parameters

Basins have been defined on the Universal Transverse Mercator projection maps of the National Topographic System. These maps, at a scale of 1:50,000, have a rectangular system of grid lines spaced at one kilometre. The computation of basin parameters is based on a unit of four of these squares, making a grid system of two km by two km squares. The parameters extracted are: the elevation at the centre of the two km by two km square, area of lakes and swamps, stream length and the number of contour lines crossing either the horizontal or vertical line passing through the centre of the two km by two km square. The average values of basin parameters are computed from the sum of the two km by two km squares within the basin boundary.

Basin Area:

Summation of one km by one km squares included in the basin multiplied by four which is the area of each two km by two km square in km^2.

Average Basin Elevation:

Arithmetic mean of the elevation in metres of all squares. The elevation of each two km by two km square is measured at its geometric centre.

Percentage of Lakes and Swamps:

Summation of the area of lakes and swamps of each square divided by the area of the basin and multiplied by 100%.

Stream Density:

Summation of the stream lengths of each square divided by the basin area.

Average Basin Slope:

Proportional to the summation of all the contour lines crossing either the horizontal or the vertical line passing through the centre of each square.

The values are listed in Table 43.

4. CONCLUSIONS

4.1 Quality of Data

The quality of the data from this station is considered to be only fair because of some shifting in the control and not enough visits to reduce the influence of the silting orifice. However, the data is considered to be within accuracy limits for statistical analysis.

Peak and annual discharge characteristics should not be used in regional studies as the basin is not homogeneous with others in the region for these characteristics.

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TABLES 1 - 43

TABLE 1

COMPARISON OF ESTIMATED PEAK FLOW FROM EXTENDED RATING CURVES

DATE	STAGE IN METRES	EXTENDED RATING CURVE #5 (m^3/s)	COMPUTER EXTENSION OF CURVE #5 (m^3/s)	COMPOSITE CURVE ALL DATA (m^3/s)
Sept 8/81	2.603	262	291	308

TABLE 2

SELECTED HYDROMETRIC AND METEOROLOGIC STATIONS
USED IN STUDY

Hydrometric Stations

STATION NUMBER	STATION NAME	DRAINAGE AREA (Km^2)
08DC006	Bear River above Bitter Creek	350
08DD001	Unuk River near Stewart	1480
08CG004	Iskut River above Snippaker Creek	7230
08CG001	Iskut River below Johnson River	9350
08CG005	More Creek near the Mouth	844
08CG006	Forrest Kerr Creek above 460 M Contour	311

Meteorologic Stations

STATION NUMBER	STATION NAME
1200ROJ	Bob Quinn Lake
1204215	Kinaskan Lake
1208202	Todagin Ranch
1208041	Telegraph Creek
1067742	Stewart A

TABLE 3

UNCERTAINTY FUNCTION STUDY

RELATION OF STANDARD ERROR OF DATA TO NUMBER OF MEASUREMENTS

1973 TO 1983

NUMBER OF MEASUREMENTS	STANDARD ERROR IN PERCENT 1972 to 1985
0	15.89
1	13.49
2	11.38
3	9.88
4	8.82
5	8.01
6	7.40
7	6.89
8	6.47
9	6.14
10	5.86
15	4.83
20	4.24
25	3.83
30	3.53
35	3.29

STATISTICS

One Day Autocorrelation	0.98146
Variance of Process	0.00470
Mean of Residuals	-0.01215
Measurement Variance	0.000471
Variance of Residuals	0.00684
Sample Size	68

TABLE 4

PORTION OF DATA ESTIMATED EACH YEAR

Calendar Year	Ice Periods Estimated Record (months)	Open Water Periods Actual Record (months)	Open Water Periods Estimated Record (months)
1972	1	3.5	2
1973	6	6	0
1974	5	5	2
1975	5.5	6.5	0
1976	5	6	1
1977	4.75	7.25	0
1978	5.5	6.5	0
1979	6	4.5	1.5
1980	6	6	0
1981	5.5	4	2.5
1982	5.75	6.25	0
1983	6	6	0
1984	6.25	5.75	0
1985	6	5	1

TABLE 5

STATISTICS FOR SELECTED STREAMFLOW CHARACTERISTICS
FOR PERIOD 1972 to 1985

Streamflow Characteristics	Mean	SD	CV	CS	CK	Percent of Annual Runoff
Mean Monthly						
Jan	1.4145	0.4693	33.18	1.876	8.251	0.44
Feb	1.1088	0.2796	25.21	0.7183	4.023	0.34
Mar	0.8602	0.1908	22.18	0.7188	4.217	0.27
Apr	2.1216	1.116	52.60	0.2090	2.713	0.65
May	12.9692	3.887	29.97	0.5102	3.355	4.00
Jun	47.3769	13.70	28.91	0.3839	2.653	14.6
Jul	88.5071	23.16	26.17	0.1661	3.433	27.3
Aug	88.2846	18.30	20.73	-0.4663	6.192	27.2
Sept	47.5429	17.46	36.73	0.3944	3.349	14.7
Oct	25.4914	16.63	65.25	0.6334	2.729	7.86
Nov	6.2079	3.647	58.76	0.9683	3.445	1.91
Dec	2.0464	0.7112	34.75	1.208	4.887	0.63
Mean Annual	27.0177	5.428	20.09	-0.1222	3.728	
Low Flow						
1 Day	0.7610	0.1559	20.48	0.4291	2.795	
7 Day	0.7694	0.1559	20.26	0.3995	2.662	
14 Day	0.7868	0.1584	20.13	0.2746	2.537	
High Flow						
Maximum Daily	157.2857	35.64	22.66	1.294	7.521	
Instantaneous	174.5714	34.74	19.90	0.8117	6.240	
Snowmelt (Max.D)	149.3571	29.96	20.06	0.8387	5.170	
Rainfall (Max.D)	85.5571	65.73	76.83	0.8116	3.634	

Table 6 Minimum Daily Discharge

WSC STATION NAME=FORREST KERR CREEK ABOVE 460 m CONTOUR

YEAR	MON	FLOW
1973	4	0.5950
1974	3	0.5490
1975	4	0.6170
1976	3	0.6430
1977	3	0.8210
1978	3	0.6770
1979	3	0.9200
1980	3	0.7700
1981	3	0.8910
1982	4	0.6700
1983	3	1.0200
1984	1	0.9950
1985	3	0.7250

Table 7 Non-parametric Statistical Tests - Minimum Daily Flow

```
--- SPEARMAN TEST FOR INDEPENDENCE ---

08CG006              FORREST KERR CREEK ABOVE 460 m CONTOUR
MINIMUM DAILY DISCHARGE            1973 TO 1985  DRAINAGE AREA =  311.0000


SPEARMAN RANK ORDER SERIAL CORRELATION COEFF = 0.325    D.F.= 10
               CORRESPONDS TO STUDENTS T = 1.087
            CRITICAL T VALUE AT 5% LEVEL = 1.812     NOT SIGNIFICANT
              -     -    -    -  1%   -  = 2.764     NOT SIGNIFICANT
```

Interpretation: The null hypothesis is that the correlation is zero.

At the 5% level of significance, the correlation is not significantly different from zero. That is, the data do not display significant serial dependence.

```
--- SPEARMAN TEST FOR TREND ---

08CG006              FORREST KERR CREEK ABOVE 460 m CONTOUR
MINIMUM DAILY DISCHARGE            1973 TO 1985  DRAINAGE AREA =  311.0000


SPEARMAN RANK ORDER CORRELATION COEFF =-0.725    D.F.= 11
         CORRESPONDS TO STUDENTS T =-3.494
      CRITICAL T VALUE AT 5% LEVEL =-2.201          SIGNIFICANT
        -     -    -    -  1%   -  =-3.106          SIGNIFICANT
```

Interpretation: The null hypothesis is that the serial(lag-one) correlation is zero.

At the 1% level of significance, the correlation is significantly different from zero. That is the data displ highly significant trend.

```
--- RUN TEST FOR GENERAL RANDOMNESS ---

08CG006              FORREST KERR CREEK ABOVE 460 m CONTOUR
MINIMUM DAILY DISCHARGE            1973 TO 1985  DRAINAGE AREA =  311.0000


THE NUMBER OF RUNS ABOVE AND BELOW THE MEDIAN(RUNAB) =  6
         THE NUMBER OF RUNS ABOVE THE MEDIAN(N1) =  6
         THE NUMBER OF RUNS BELOW THE MEDIAN(N2) =  6

(NOTE: Z IS THE STANDARD NORMAL VARIATE.)
```

For this test, Z = 0.000

Critical Z value at the 5% level = 1.960 NOT SIGNIFICANT

Interpretation: The null hypothesis is that the data are random.

At the 5% level of significance, the null hypothesis cannot be rejected. That is, the sample is significantly random.

```
--- MANN-WHITNEY SPLIT SAMPLE TEST FOR HOMOGENEITY ---

08CG006              FORREST KERR CREEK ABOVE 460 m CONTOUR
MINIMUM DAILY DISCHARGE    1973 TO 1985   DRAINAGE AREA=  311.0000

SPLIT BY TIME SPAN, SUBSAMPLE 1 SAMPLE SIZE=  6
                    SUBSAMPLE 2 SAMPLE SIZE=  7

MANN-WHITNEY U = 4.0    P= 0.007        SIGNIFICANT (AT 1%)
```

Interpretation: The null hypothesis is that there is no location difference between the two samples.

At the 1% level of significance, the hypothesis of no location difference between the samples is rejected.

Table 8 7 Day Low Flow

WSC STATION NO.=08CG006
WSC STATION NAME=FORREST KERR CREEK ABOVE 460 m CONTOUR

YEAR	MON	FLOW
1973	4	0.5960
1974	3	0.5600
1975	4	0.6330
1976	3	0.6480
1977	3	0.8450
1978	3	0.6880
1979	3	0.9290
1980	3	0.7700
1981	3	0.9190
1982	4	0.6770
1983	3	1.0200
1984	1	0.9970
1985	3	0.7280

Table 9 Non-parametric Statistical Tests - 7 Day Low Flow

--- SPEARMAN TEST FOR INDEPENDENCE ---

```
08CG006           FORREST KERR CREEK ABOVE 460 m CONTOUR
7 DAY LOW FLOW                        1973 TO 1985  DRAINAGE AREA =  311.0000


SPEARMAN RANK ORDER SERIAL CORRELATION COEFF = 0.325   D.F.= 10
                     CORRESPONDS TO STUDENTS T = 1.087
                  CRITICAL T VALUE AT 5% LEVEL = 1.812    NOT SIGNIFICANT
                      -    -    -    -  1%   -  = 2.764    NOT SIGNIFICANT
```

Interpretation: The null hypothesis is that the correlation is zero.

At the 5% level of significance, the correlation is not significantly different from zero. That is, the data do not display significant serial dependence.

--- SPEARMAN TEST FOR TREND ---

```
08CG006           FORREST KERR CREEK ABOVE 460 m CONTOUR
7 DAY LOW FLOW                        1973 TO 1985  DRAINAGE AREA =  311.0000


SPEARMAN RANK ORDER CORRELATION COEFF =-0.725   D.F.= 11
             CORRESPONDS TO STUDENTS T =-3.494
          CRITICAL T VALUE AT 5% LEVEL =-2.201          SIGNIFICANT
              -    -    -    -  1%   -  =-3.106          SIGNIFICANT
```

Interpretation: The null hypothesis is that the serial(lag-one) correlation is zero.

At the 1% level of significance, the correlation is significantly different from zero. That is the data displ highly significant trend.

--- RUN TEST FOR GENERAL RANDOMNESS ---

```
08CG006           FORREST KERR CREEK ABOVE 460 m CONTOUR
 7 DAY LOW FLOW                        1973 TO 1985  DRAINAGE AREA =  311.0000


THE NUMBER OF RUNS ABOVE AND BELOW THE MEDIAN(RUNAB) =  6
        THE NUMBER OF RUNS ABOVE THE MEDIAN(N1) =  6
        THE NUMBER OF RUNS BELOW THE MEDIAN(N2) =  6
```

(NOTE: Z IS THE STANDARD NORMAL VARIATE.)

For this test, Z = 0.000

Critical Z value at the 5% level = 1.960 . NOT SIGNIFICANT

Interpretation: The null hypothesis is that the data are random.

At the 5% level of significance, the null hypothesis cannot be rejected. That is, the sample is significantly random.

--- MANN-WHITNEY SPLIT SAMPLE TEST FOR HOMOGENEITY ---

```
08CG006           FORREST KERR CREEK ABOVE 460 m CONTOUR
7 DAY LOW FLOW                  1973 TO 1985   DRAINAGE AREA=  311.0000

SPLIT BY TIME SPAN, SUBSAMPLE 1 SAMPLE SIZE=  6
                    SUBSAMPLE 2 SAMPLE SIZE=  7

MANN-WHITNEY U = 4.0    P= 0.007        SIGNIFICANT (AT 1%)
```

Interpretation: The null hypothesis is that there is no location difference between the two samples.

At the 1% level of significance, the hypothesis of no location difference between the samples is rejected.

Table 10 14 Day Low Flow

WSC STATION NO.=08CG006
WSC STATION NAME=FORREST KERR CREEK ABOVE 460 m CONTOUR

YEAR	MON	FLOW
1973	4	0.5990
1974	3	0.5660
1975	3	0.6640
1976	3	0.6540
1977	3	0.8540
1978	3	0.7030
1979	3	0.9470
1980	3	0.7720
1981	3	0.9640
1982	3	0.6850
1983	3	1.0300
1984	1	1.0000
1985	3	0.7880

Table 11 Non-parametric Statistical Tests - 14 Day Low Flow

```
         --- SPEARMAN TEST FOR INDEPENDENCE ---

08CG006            FORREST KERR CREEK ABOVE 460 m CONTOUR
14 Day Low Flow                      1973 TO 1985  DRAINAGE AREA =  311.0000

SPEARMAN RANK ORDER SERIAL CORRELATION COEFF = 0.252    D.F.= 10
                  CORRESPONDS TO STUDENTS T = 0.823
               CRITICAL T VALUE AT 5% LEVEL = 1.812      NOT SIGNIFICANT
                   -    -    -    -  1%    -   = 2.764      NOT SIGNIFICANT
```

Interpretation: The null hypothesis is that the correlation is zero.

At the 5% level of significance, the correlation is not significantly different from zero. That is, the data do not display significant serial dependence.

```
         --- SPEARMAN TEST FOR TREND ---

08CG006            FORREST KERR CREEK ABOVE 460 m CONTOUR
14 Day Low Flow                      1973 TO 1985  DRAINAGE AREA =  311.0000

SPEARMAN RANK ORDER CORRELATION COEFF =-0.758   D.F.= 11
           CORRESPONDS TO STUDENTS T =-3.857
        CRITICAL T VALUE AT 5% LEVEL =-2.201         SIGNIFICANT
            -    -    -    -  1%    -   =-3.106         SIGNIFICANT
```

Interpretation: The null hypothesis is that the serial(lag-one) correlation is zero.

At the 1% level of significance, the correlation is significantly different from zero. That is the data displ highly significant trend.

```
         --- RUN TEST FOR GENERAL RANDOMNESS ---

08CG006            FORREST KERR CREEK ABOVE 460 m CONTOUR
14 Day Low Flow                      1973 TO 1985  DRAINAGE AREA =  311.0000

THE NUMBER OF RUNS ABOVE AND BELOW THE MEDIAN(RUNAB) =  6
             THE NUMBER OF RUNS ABOVE THE MEDIAN(N1) =  6
             THE NUMBER OF RUNS BELOW THE MEDIAN(N2) =  6
```

(NOTE: Z IS THE STANDARD NORMAL VARIATE.)

For this test, Z = 0.000

Critical Z value at the 5% level = 1.960   NOT SIGNIFICANT

Interpretation: The null hypothesis is that the data are random.

At the 5% level of significance, the null hypothesis cannot be rejected. That is, the sample is significantly random.

```
      --- MANN-WHITNEY SPLIT SAMPLE TEST FOR HOMOGENEITY ---

08CG006            FORREST KERR CREEK ABOVE 460 m CONTOUR
14 Day Low Flow                 1973 TO 1985   DRAINAGE AREA=  311.0000

SPLIT BY TIME SPAN, SUBSAMPLE 1 SAMPLE SIZE=  6
                    SUBSAMPLE 2 SAMPLE SIZE=  7

MANN-WHITNEY U = 4.0    P= 0.007        SIGNIFICANT (AT 1%)
```

Interpretation: The null hypothesis is that there is no location difference between the two samples.

At the 1% level of significance, the hypothesis of no location difference between the samples is rejected.

Table 12 Maximum Instantaneous Discharge

WSC STATION NO.=08CG106
WSC STATION NAME=FORREST KERR CREEK ABOVE 460 m CONTOUR

SEQ.NO.	YEAR	MON	FLOW
1	1972	10	180.000
2	1973	8	139.000
3	1974	10	180.000
4	1975	7	165.000
5	1976	8	182.000
6	1977	8	193.000
7	1978	10	190.000
8	1979	10	184.000
9	1980	10	171.000
10	1981	9	262.000
11	1982	7	196.000
12	1983	9	145.000
13	1984	8	116.000
14	1985	8	141.000

Table 13 Non-parametric Statistical Tests - Maximum Instantaneous Discharge

```
--- SPEARMAN TEST FOR INDEPENDENCE ---

08CGI06            FORREST KERR CREEK ABOVE 460 m CONTOUR
ANNUAL MAXIMUM DAILY FLOW SERIES  1972 TO 1985  DRAINAGE AREA =  311.0000


SPEARMAN RANK ORDER SERIAL CORRELATION COEFF = 0.261    D.F.= 11
                   CORRESPONDS TO STUDENTS T = 0.895
                CRITICAL T VALUE AT 5% LEVEL = 1.796     NOT SIGNIFICANT
                   -   -   -   -  1%   -     = 2.718     NOT SIGNIFICANT
```

Interpretation: The null hypothesis is that the correlation is zero.

At the 5% level of significance, the correlation is not significantly different from zero. That is, the data do not display significant serial dependence.

```
--- SPEARMAN TEST FOR TREND ---

08CGI06            FORREST KERR CREEK ABOVE 460 m CONTOUR
ANNUAL MAXIMUM DAILY FLOW SERIES  1972 TO 1985  DRAINAGE AREA =  311.0000


SPEARMAN RANK ORDER CORRELATION COEFF = 0.086   D.F.= 12
            CORRESPONDS TO STUDENTS T = 0.298
         CRITICAL T VALUE AT 5% LEVEL = 2.179    NOT SIGNIFICANT
            -   -   -   -  1%   -     = 3.055    NOT SIGNIFICANT
```

Interpretation: The null hypothesis is that the serial(lag-one) correlation is zero.

At the 5% level of significance, the correlation is not significantly different from zero. That is, the data do not display significant trend.

```
--- RUN TEST FOR GENERAL RANDOMNESS ---

08CGI06            FORREST KERR CREEK ABOVE 460 m CONTOUR
ANNUAL MAXIMUM DAILY FLOW SERIES  1972 TO 1985  DRAINAGE AREA =  311.0000

THE NUMBER OF RUNS ABOVE AND BELOW THE MEDIAN(RUNAB) =  5
     THE NUMBER OF OBSERVATIONS ABOVE THE MEDIAN(N1) =  6
     THE NUMBER OF OBSERVATIONS BELOW THE MEDIAN(N2) =  6
Range at 5% level of significance:  4. to 10.    NOT SIGNIFICANT
```

Interpretation: The null hypothesis is that the data are random.

At the 5% level of significance, the null hypothesis cannot be rejected. That is, the sample is significantly random.

```
--- MANN-WHITNEY SPLIT SAMPLE TEST FOR HOMOGENEITY ---

08CGI06            FORREST KERR CREEK ABOVE 460 m CONTOUR
ANNUAL MAXIMUM FLOW SERIES  1972 TO 1985   DRAINAGE AREA=  311.0000

SPLIT BY TIME SPAN, SUBSAMPLE 1 SAMPLE SIZE=  5
                    SUBSAMPLE 2 SAMPLE SIZE=  9

                                MANN-WHITNEY U =  20.0
     CRITICAL U VALUE AT 5% SIGNIFICANT LEVEL =   9.0    NOT SIGNIFICANT
       -    -    -    -  1%      -         -  =   5.0    NOT SIGNIFICANT
```

Interpretation: The null hypothesis is that there is no location difference between the two samples.

At the 5% level of significance, there is no significant location difference between the two samples. That is, they appear to be from the same population.

Table 14 Maximum Daily Discharge

WSC STATION NO.=08CG006
WSC STATION NAME=FORREST KERR CREEK ABOVE 460 m CONTOUR

SEQ.NO.	YEAR	MON	FLOW
1	1972	7	161.000
2	1973	8	113.000
3	1974	10	164.000
4	1975	7	151.000
5	1976	8	168.000
6	1977	8	171.000
7	1978	8	151.000
8	1979	10	175.000
9	1980	8	163.000
10	1981	9	254.000
11	1982	7	169.000
12	1983	9	129.000
13	1984	8	108.000
14	1985	8	125.000

Table 15 Non-parametric Statistical Tests - Maximum Daily Discharge

--- SPEARMAN TEST FOR INDEPENDENCE ---

08CG006 FORREST KERR CREEK ABOVE 460 m CONTOUR
MAXIMUM DAILY DISCHARGE 1972 TO 1985 DRAINAGE AREA = 311.0000

SPEARMAN RANK ORDER SERIAL CORRELATION COEFF = 0.061 D.F.= 11
CORRESPONDS TO STUDENTS T = 0.201
CRITICAL T VALUE AT 5% LEVEL = 1.796 NOT SIGNIFICANT
- - - - 1% - = 2.718 NOT SIGNIFICANT

Interpretation: The null hypothesis is that the correlation is zero.

At the 5% level of significance, the correlation is not significantly different from zero. That is, the data do not display significant serial dependence.

--- SPEARMAN TEST FOR TREND ---

08CG006 FORREST KERR CREEK ABOVE 460 m CONTOUR
MAXIMUM DAILY DISCHARGE 1972 TO 1985 DRAINAGE AREA = 311.0000

SPEARMAN RANK ORDER CORRELATION COEFF = 0.119 D.F.= 12
CORRESPONDS TO STUDENTS T = 0.415
CRITICAL T VALUE AT 5% LEVEL = 2.179 NOT SIGNIFICANT
- - - - 1% - = 3.055 NOT SIGNIFICANT

Interpretation: The null hypothesis is that the serial(lag-one) correlation is zero.

At the 5% level of significance, the correlation is not significantly different from zero. That is, the data do not display significant trend.

--- RUN TEST FOR GENERAL RANDOMNESS ---

08CG006 FORREST KERR CREEK ABOVE 460 m CONTOUR
MAXIMUM DAILY DISCHARGE 1972 TO 1985 DRAINAGE AREA = 311.0000

THE NUMBER OF RUNS ABOVE AND BELOW THE MEDIAN(RUNAB) = 7
THE NUMBER OF OBSERVATIONS ABOVE THE MEDIAN(N1) = 7
THE NUMBER OF OBSERVATIONS BELOW THE MEDIAN(N2) = 7
Range at 5% level of significance: 4. to 12. NOT SIGNIFICANT

Interpretation: The null hypothesis is that the data are random.

At the 5% level of significance, the null hypothesis cannot be rejected. That is, the sample is significantly random.

--- MANN-WHITNEY SPLIT SAMPLE TEST FOR HOMOGENEITY ---

08CG006 FORREST KERR CREEK ABOVE 460 m CONTOUR
MAXIMUM DAILY DISCHARGE 1972 TO 1985 DRAINAGE AREA= 311.0000

SPLIT BY TIME SPAN, SUBSAMPLE 1 SAMPLE SIZE= 5
SUBSAMPLE 2 SAMPLE SIZE= 9

MANN-WHITNEY U = 18.0
CRITICAL U VALUE AT 5% SIGNIFICANT LEVEL = 9.0 NOT SIGNIFICANT
- - - - 1% - - = 5.0 NOT SIGNIFICANT

Interpretation: The null hypothesis is that there is no location difference between the two samples.

At the 5% level of significance, there is no significant location difference between the two samples. That is, they appear to be from the same population.

Table 16 Maximum Daily Discharge - Snowmelt

WSC STATION NO=SNOWCG6
WSC STATION NAME=FORREST KERR CREEK ABOVE 460 M CONTOUR, SNOW

MONTH	YEAR	DATA	ORDERED	RANK	PROB.	RET. PERIOD
(1)	(2)	(3) (CMS)	(4) (CMS)	(5)	(6) (%)	(7) (YEARS)
7	1972	161.000	222.000	1	3.95	25.333
8	1973	113.000	171.000	2	10.53	9.500
9	1974	124.000	169.000	3	17.11	5.846
7	1975	151.000	168.000	4	23.68	4.222
8	1976	168.000	163.000	5	30.26	3.304
8	1977	171.000	161.000	6	36.84	2.714
8	1978	151.000	151.000	7	43.42	2.303
7	1979	136.000	151.000	8	50.00	2.000
8	1980	163.000	136.000	9	56.58	1.767
7	1981	222.000	134.000	10	63.16	1.583
7	1982	169.000	129.000	11	69.74	1.434
9	1983	129.000	125.000	12	76.32	1.310
8	1984	108.000	124.000	13	82.89	1.206
8	1985	125.000	113.000	14	89.47	1.118
8	1986	134.000	108.000	15	96.05	1.041

Table 17 Maximum Daily Discharge - Rainstorm

WSC STATION NO=RAINCG6
WSC STATION NAME=FORREST KERR CK ABOVE 460 M CONTOUR

MONTH (1)	YEAR (2)	DATA (3) (CMS)	ORDERED (4) (CMS)	RANK (5)	PROB. (6) (%)	RET. PERIOD (7) (YEARS)
10	1972	129.700	254.000	1	3.95	25.333
9	1973	60.600	175.000	2	10.53	9.500
10	1974	164.000	164.000	3	17.11	5.846
9	1975	30.000	149.000	4	23.68	4.222
11	1976	55.800	148.000	5	30.26	3.304
10	1977	32.300	144.000	6	36.84	2.714
10	1978	148.000	129.700	7	43.42	2.303
10	1979	175.000	75.300	8	50.00	2.000
10	1980	149.000	60.600	9	56.58	1.767
9	1981	254.000	60.200	10	63.16	1.583
10	1982	75.300	55.800	11	69.74	1.434
9	1983	50.400	50.400	12	76.32	1.310
10	1984	29.700	32.300	13	82.89	1.206
9	1985	60.200	30.000	14	89.47	1.118
10	1986	144.000	29.700	15	96.05	1.041

Table 18 Flood Frequency - Maximum Daily Discharge

WSC STATION NO=08CG006
WSC STATION NAME=FORREST KERR CREEK ABOVE 460 m CONTOUR

MONTH (1)	YEAR (2)	DATA (3) (CMS)	ORDERED (4) (CMS)	RANK (5)	PROB. (6) (%)	RET. PERIOD (7) (YEARS)
7	1972	161.000	254.000*	1	4.23	23.667
8	1973	113.000	175.000	2	11.27	8.875
10	1974	164.000	171.000	3	18.31	5.462
7	1975	151.000	169.000	4	25.35	3.944
8	1976	168.000	168.000	5	32.39	3.087
8	1977	171.000	164.000	6	39.44	2.536
8	1978	151.000	163.000	7	46.48	2.152
10	1979	175.000	161.000	8	53.52	1.868
8	1980	163.000	151.000	9	60.56	1.651
9	1981	254.000	151.000	10	67.61	1.479
7	1982	169.000	129.000	11	74.65	1.340
9	1983	129.000	125.000	12	81.69	1.224
8	1984	108.000	113.000	13	88.73	1.127
8	1985	125.000	108.000	14	95.77	1.044

Table 19 Sample Statistics and Frequency Regime Data for Generalized Extreme Value Distribution

FREQUENCY ANALYSIS - GENERALIZED EXTREME VALUE DISTRIBUTION
08CG006 FORREST KERR CREEK ABOVE 460 m CONTOUR

SAMPLE STATISTICS

	MEAN	S.D.	C.V.	C.S.	C.K.
X SERIES	157.286	35.638	0.227	1.294	7.521
LN X SERIES	5.036	0.215	0.043	0.390	5.237

X(MIN)= 108.000
X(MAX)= 254.000
LOWER OUTLIER LIMIT OF X= 95.647

TOTAL SAMPLE SIZE= 14
NO. OF LOW OUTLIERS= 0
NO. OF ZERO FLOWS= 0

SOLUTION OBTAINED VIA MAXIMUM LIKELIHOOD

DISTRIBUTION IS UPPER BOUNDED AT (U+A/K)= 0.1168E+04
GEV PARAMETERS: U= 142.23 A= 27.570 K= 0.027

FLOOD FREQUENCY REGIME

RETURN PERIOD	EXCEEDANCE PROBABILITY	FLOOD
1.003	0.997	92.50
1.050	0.952	111.00
1.250	0.800	129.00
2.000	0.500	152.00
5.000	0.200	183.00
10.000	0.100	202.00
20.000	0.050	221.00
50.000	0.020	244.00
100.000	0.010	262.00
200.000	0.005	278.00
500.000	0.002	300.00

Table 20 Sample Statistics and Frequency Regime Data for Three Parameter Lognormal Distribution

FREQUENCY ANALYSIS - THREE-PARAMETER LOGNORMAL DISTRIBUTION
08CG006 FORREST KERR CREEK ABOVE 460 m CONTOUR

SAMPLE STATISTICS

	MEAN	S.D.	C.V.	C.S.	C.K.
X SERIES	157.286	35.638	0.227	1.294	7.521
LN X SERIES	5.036	0.215	0.043	0.390	5.237
LN(X-A) SERIES	4.606	0.328	0.071	0.000	4.640

X(MIN)= 108.000
X(MAX)= 254.000
LOWER OUTLIER LIMIT OF X= 95.647

TOTAL SAMPLE SIZE= 14
NO. OF LOW OUTLIERS= 0
NO. OF ZERO FLOWS= 0

SOLUTION OBTAINED VIA MAXIMUM LIKELIHOOD

3LN PARAMETERS: A= 52.114 M= 4.606 S= 0.328

FLOOD FREQUENCY REGIME

RETURN PERIOD	EXCEEDANCE PROBABILITY	FLOOD
1.003	0.997	92.70
1.050	0.952	110.00
1.250	0.800	128.00
2.000	0.500	152.00
5.000	0.200	184.00
10.000	0.100	204.00
20.000	0.050	224.00
50.000	0.020	248.00
100.000	0.010	267.00
200.000	0.005	285.00
500.000	0.002	309.00

Table 21 Sample Statistics and Frequency Regime Data for Log Pearson Type III Distribution

FREQUENCY ANALYSIS - LOG PEARSON TYPE III DISTRIBUTION
08CG006 FORREST KERR CREEK ABOVE 460 m CONTOUR

SAMPLE STATISTICS

	MEAN	S.D.	C.V.	C.S.	C.K.
X SERIES	157.286	35.638	0.227	1.294	7.521
LN X SERIES	5.036	0.215	0.043	0.390	5.237

X(MIN)= 108.000
X(MAX)= 254.000
LOWER OUTLIER LIMIT OF X= 95.647

TOTAL SAMPLE SIZE= 14
NO. OF LOW OUTLIERS= 0
NO. OF ZERO FLOWS= 0

SOLUTION OBTAINED VIA MAXIMUM LIKELIHOOD

LP3 PARAMETERS: A= 0.3232E-01 B= 41.03 LOG(M)= 3.710
M = 40.85

FLOOD FREQUENCY REGIME

RETURN PERIOD	EXCEEDANCE PROBABILITY	FLOOD
1.003	0.997	93.40
1.050	0.952	111.00
1.250	0.800	129.00
2.000	0.500	152.00
5.000	0.200	182.00
10.000	0.100	202.00
20.000	0.050	220.00
50.000	0.020	244.00
100.000	0.010	261.00
200.000	0.005	279.00
500.000	0.002	302.00

Table 22 Sample Statistics and Frequency Regime Data for Wakeby Distribution

FREQUENCY ANALYSIS - WAKEBY DISTRIBUTION
08CG006 FORREST KERR CREEK ABOVE 460 m CONTOUR

SAMPLE STATISTICS

	MEAN	S.D.	C.V.	C.S.	C.K.
X SERIES	157.286	35.638	0.227	1.294	7.521
LN X SERIES	5.036	0.215	0.043	0.390	5.237

X(MIN)= 108.000
X(MAX)= 254.000
LOWER OUTLIER LIMIT OF X= 95.647

TOTAL SAMPLE SIZE= 14
NO. OF LOW OUTLIERS= 0
NO. OF ZERO FLOWS= 0

THE FOLLOWING WAKEBY PARAMETERS WERE OBTAINED BY ASSUMING M TO BE NON-ZERO. THE ITERATION ALGORITHM WAS NOT REQUIRED.

M= 71.166 A= 81.756 B= 5.51 C= 14.978 D= 0.530

FLOOD FREQUENCY REGIME

RETURN PERIOD	EXCEEDANCE PROBABILITY	FLOOD
1.003	0.997	72.50
1.050	0.952	90.80
1.250	0.800	131.00
2.000	0.500	158.00
5.000	0.200	173.00
10.000	0.100	189.00
20.000	0.050	211.00
50.000	0.020	257.00
100.000	0.010	310.00
200.000	0.005	387.00
500.000	0.002	542.00

Table 23 Flood Frequency - Maximum Instantaneous Discharge

WSC STATION NO=08CG106
WSC STATION NAME=FORREST KERR CREEK ABOVE 460 m CONTOUR

MONTH (1)	YEAR (2)	DATA (3) (CMS)	ORDERED (4) (CMS)	RANK (5)	PROB. (6) (%)	RET. PERIOD (7) (YEARS)
10	1972	180.000	262.000	1	4.23	23.667
8	1973	139.000	196.000	2	11.27	8.875
10	1974	180.000	193.000	3	18.31	5.462
7	1975	165.000	190.000	4	25.35	3.944
8	1976	182.000	184.000	5	32.39	3.087
8	1977	193.000	182.000	6	39.44	2.536
10	1978	190.000	180.000	7	46.48	2.152
10	1979	184.000	180.000	8	53.52	1.868
10	1980	171.000	171.000	9	60.56	1.651
9	1981	262.000	165.000	10	67.61	1.479
7	1982	196.000	145.000	11	74.65	1.340
9	1983	145.000	141.000	12	81.69	1.224
8	1984	116.000	139.000	13	88.73	1.127
8	1985	141.000	116.000	14	95.77	1.044

Table 24 Sample Statistics and Frequency Regime Data for Generalized Extreme Value Distribution

FREQUENCY ANALYSIS - GENERALIZED EXTREME VALUE DISTRIBUTION
08CG106 FORREST KERR CREEK ABOVE 460 m CONTOUR

SAMPLE STATISTICS

	MEAN	S.D.	C.V.	C.S.	C.K.
X SERIES	174.571	34.736	0.199	0.812	6.240
LN X SERIES	5.144	0.196	0.038	0.010	5.004

X(MIN)= 116.000
X(MAX)= 262.000
LOWER OUTLIER LIMIT OF X= 111.120

TOTAL SAMPLE SIZE= 14
NO. OF LOW OUTLIERS= 0
NO. OF ZERO FLOWS= 0

SOLUTION OBTAINED VIA MAXIMUM LIKELIHOOD

DISTRIBUTION IS UPPER BOUNDED AT (U+A/K)= 0.4172E+03
GEV PARAMETERS: U= 160.68 A= 29.840 K= 0.116

FLOOD FREQUENCY REGIME

RETURN PERIOD	EXCEEDANCE PROBABILITY	FLOOD
1.003	0.997	102.00
1.050	0.952	125.00
1.250	0.800	146.00
2.000	0.500	171.00
5.000	0.200	202.00
10.000	0.100	220.00
20.000	0.050	236.00
50.000	0.020	254.00
100.000	0.010	267.00
200.000	0.005	279.00
500.000	0.002	293.00

Table 25 Sample Statistics and Frequency Regime Data for Three Parameter Lognormal Distribution

FREQUENCY ANALYSIS - THREE-PARAMETER LOGNORMAL DISTRIBUTION
08CG106 FORREST KERR CREEK ABOVE 460 m CONTOUR

SAMPLE STATISTICS

	MEAN	S.D.	C.V.	C.S.	C.K.
X SERIES	174.571	34.736	0.199	0.812	6.240
LN X SERIES	5.144	0.196	0.038	0.010	5.004
LN(X-A) SERIES	5.163	0.193	0.037	0.023	5.013

X(MIN)= 116.000
X(MAX)= 262.000
LOWER OUTLIER LIMIT OF X= 111.120

TOTAL SAMPLE SIZE= 14
NO. OF LOW OUTLIERS= 0
NO. OF ZERO FLOWS= 0

SOLUTION OBTAINED VIA MAXIMUM LIKELIHOOD

3LN PARAMETERS: A= -3.100 M= 5.163 S= 0.193

FLOOD FREQUENCY REGIME

RETURN PERIOD	EXCEEDANCE PROBABILITY	FLOOD
1.003	0.997	99.70
1.050	0.952	124.00
1.250	0.800	145.00
2.000	0.500	172.00
5.000	0.200	202.00
10.000	0.100	220.00
20.000	0.050	237.00
50.000	0.020	256.00
100.000	0.010	270.00
200.000	0.005	284.00
500.000	0.002	301.00

Table 26 Sample Statistics and Frequency Regime Data for Log Pearson Type III Distribution

FREQUENCY ANALYSIS - LOG PEARSON TYPE III DISTRIBUTION
08CG106 FORREST KERR CREEK ABOVE 460 m CONTOUR

SAMPLE STATISTICS

	MEAN	S.D.	C.V.	C.S.	C.K.
X SERIES	174.571	34.736	0.199	0.812	6.240
LN X SERIES	5.144	0.196	0.038	0.010	5.004

X(MIN)= 116.000
X(MAX)= 262.000
LOWER OUTLIER LIMIT OF X= 111.120

TOTAL SAMPLE SIZE= 14
NO. OF LOW OUTLIERS= 0
NO. OF ZERO FLOWS= 0

SOLUTION OBTAINED VIA MOMENTS

LP3 PARAMETERS: A= 0.9923E-03 B= 0.3906E+05 LOG(M)= -33.62
M = 0.2512E-14

FLOOD FREQUENCY REGIME

RETURN PERIOD	EXCEEDANCE PROBABILITY	FLOOD
1.003	0.997	100.00
1.050	0.952	124.00
1.250	0.800	145.00
2.000	0.500	171.00
5.000	0.200	202.00
10.000	0.100	221.00
20.000	0.050	237.00
50.000	0.020	257.00
100.000	0.010	271.00
200.000	0.005	285.00
500.000	0.002	302.00

Table 27 Sample Statistics and Frequency Regime Data for Wakeby Distribution

FREQUENCY ANALYSIS - WAKEBY DISTRIBUTION
08CG106 FORREST KERR CREEK ABOVE 460 m CONTOUR

SAMPLE STATISTICS

	MEAN	S.D.	C.V.	C.S.	C.K.
X SERIES	174.571	34.736	0.199	0.812	6.240
LN X SERIES	5.144	0.196	0.038	0.010	5.004

X(MIN)= 116.000
X(MAX)= 262.000
LOWER OUTLIER LIMIT OF X= 111.120

TOTAL SAMPLE SIZE= 14
NO. OF LOW OUTLIERS= 0
NO. OF ZERO FLOWS= 0

THE FOLLOWING WAKEBY PARAMETERS WERE OBTAINED BY ASSUMING M TO BE NON-ZERO. THE ITERATION ALGORITHM WAS NOT REQUIRED.

M= 76.214 A= 90.626 B= 6.80 C= 25.970 D= 0.427

FLOOD FREQUENCY REGIME

RETURN PERIOD	EXCEEDANCE PROBABILITY	FLOOD
1.003	0.997	78.10
1.050	0.952	102.00
1.250	0.800	150.00
2.000	0.500	175.00
5.000	0.200	192.00
10.000	0.100	210.00
20.000	0.050	234.00
50.000	0.020	279.00
100.000	0.010	326.00
200.000	0.005	390.00
500.000	0.002	510.00

Table 28 Sample Statistics and Frequency Regime Data for Generalized Extreme Value Distribution - Snowmelt

FREQUENCY ANALYSIS - GENERALIZED EXTREME VALUE DISTRIBUTION
SNOW FORREST KERR CREEK ABOVE 460 M CONTOUR

SAMPLE STATISTICS

	MEAN	S.D.	C.V.	C.S.	C.K.
X SERIES	148.333	29.139	0.196	0.947	5.361
LN X SERIES	4.982	0.189	0.038	0.394	4.028

X(MIN)= 108.000
X(MAX)= 222.000
LOWER OUTLIER LIMIT OF X= 95.362

TOTAL SAMPLE SIZE= 15
NO. OF LOW OUTLIERS= 0
NO. OF ZERO FLOWS= 0

SOLUTION OBTAINED VIA MAXIMUM LIKELIHOOD

DISTRIBUTION IS UPPER BOUNDED AT (U+A/K)= 0.2037E+04
GEV PARAMETERS: U= 135.52 A= 22.528 K= 0.012

FLOOD FREQUENCY REGIME

RETURN PERIOD	EXCEEDANCE PROBABILITY	FLOOD
1.003	0.997	95.50
1.050	0.952	110.00
1.250	0.800	125.00
2.000	0.500	144.00
5.000	0.200	169.00
10.000	0.100	186.00
20.000	0.050	201.00
50.000	0.020	221.00
100.000	0.010	236.00
200.000	0.005	251.00
500.000	0.002	270.00

Table 29 Sample Statistics and Frequency Regime Data for Three Parameter Lognormal Distribution - Snowmelt

FREQUENCY ANALYSIS - THREE-PARAMETER LOGNORMAL DISTRIBUTION
SNOW FORREST KERR CREEK ABOVE 460 M CONTOUR

SAMPLE STATISTICS

	MEAN	S.D.	C.V.	C.S.	C.K.
X SERIES	148.333	29.139	0.196	0.947	5.361
LN X SERIES	4.982	0.189	0.038	0.394	4.028
LN(X-A) SERIES	4.248	0.387	0.091	-0.082	3.565

X(MIN)= 108.000
X(MAX)= 222.000
LOWER OUTLIER LIMIT OF X= 95.362

TOTAL SAMPLE SIZE= 15
NO. OF LOW OUTLIERS= 0
NO. OF ZERO FLOWS= 0

SOLUTION OBTAINED VIA MAXIMUM LIKELIHOOD

3LN PARAMETERS: A= 73.341 M= 4.248 S= 0.387

FLOOD FREQUENCY REGIME

RETURN PERIOD	EXCEEDANCE PROBABILITY	FLOOD
1.003	0.997	97.50
1.050	0.952	110.00
1.250	0.800	124.00
2.000	0.500	143.00
5.000	0.200	170.00
10.000	0.100	188.00
20.000	0.050	206.00
50.000	0.020	228.00
100.000	0.010	246.00
200.000	0.005	263.00
500.000	0.002	287.00

Table 30 Sample Statistics and Frequency Regime Data for Log Pearson Type III Distribution - Snowmelt

FREQUENCY ANALYSIS - LOG PEARSON TYPE III DISTRIBUTION
SNOW FORREST KERR CREEK ABOVE 460 M CONTOUR

SAMPLE STATISTICS

	MEAN	S.D.	C.V.	C.S.	C.K.
X SERIES	148.333	29.139	0.196	0.947	5.361
LN X SERIES	4.982	0.189	0.038	0.394	4.028

X(MIN)= 108.000
X(MAX)= 222.000
LOWER OUTLIER LIMIT OF X= 95.362

TOTAL SAMPLE SIZE= 15
NO. OF LOW OUTLIERS= 0
NO. OF ZERO FLOWS= 0

SOLUTION OBTAINED VIA MAXIMUM LIKELIHOOD

LP3 PARAMETERS: A= 0.5478E-01 B= 11.43 LOG(M)= 4.357
M = 77.98

FLOOD FREQUENCY REGIME

RETURN PERIOD	EXCEEDANCE PROBABILITY	FLOOD
1.003	0.997	98.40
1.050	0.952	111.00
1.250	0.800	124.00
2.000	0.500	143.00
5.000	0.200	169.00
10.000	0.100	186.00
20.000	0.050	203.00
50.000	0.020	226.00
100.000	0.010	243.00
200.000	0.005	260.00
500.000	0.002	285.00

Table 31 Sample Statistics and Frequency Regime Data for Wakeby Distribution - Snowmelt

FREQUENCY ANALYSIS - WAKEBY DISTRIBUTION
SNOW FORREST KERR CREEK ABOVE 460 M CONTOUR

SAMPLE STATISTICS

	MEAN	S.D.	C.V.	C.S.	C.K.
X SERIES	148.333	29.139	0.196	0.947	5.361
LN X SERIES	4.982	0.189	0.038	0.394	4.028

X(MIN)= 108.000
X(MAX)= 222.000
LOWER OUTLIER LIMIT OF X= 95.362

TOTAL SAMPLE SIZE= 15
NO. OF LOW OUTLIERS= 0
NO. OF ZERO FLOWS= 0

THE FOLLOWING WAKEBY PARAMETERS WERE OBTAINED BY ASSUMING M TO BE NON-ZERO. THE ITERATION ALGORITHM WAS NOT REQUIRED.

M= 78.456 A= 52.131 B= 7.11 C= 121.083 D= 0.166

FLOOD FREQUENCY REGIME

RETURN PERIOD	EXCEEDANCE PROBABILITY	FLOOD
1.003	0.997	79.60
1.050	0.952	94.70
1.250	0.800	124.00
2.000	0.500	145.00
5.000	0.200	168.00
10.000	0.100	187.00
20.000	0.050	209.00
50.000	0.020	242.00
100.000	0.010	270.00
200.000	0.005	302.00
500.000	0.002	350.00

Table 32 Sample Statistics and Frequency Regime Data for Generalized Extreme Value Distribution - Rainfall

FREQUENCY ANALYSIS - GENERALIZED EXTREME VALUE DISTRIBUTION
RAIN FORREST KERR CREEK ABOVE 460 M CONTOUR

SAMPLE STATISTICS

	MEAN	S.D.	C.V.	C.S.	C.K.
X SERIES	103.867	67.253	0.647	0.702	3.574
LN X SERIES	4.425	0.710	0.160	-0.133	2.405

X(MIN)= 29.700
X(MAX)= 254.000
LOWER OUTLIER LIMIT OF X= 16.959

TOTAL SAMPLE SIZE= 15
NO. OF LOW OUTLIERS= 0
NO. OF ZERO FLOWS= 0

SOLUTION OBTAINED VIA MOMENTS

DISTRIBUTION IS UPPER BOUNDED AT (U+A/K)= 0.7544E+03
GEV PARAMETERS: U= 74.98 A= 57.891 K= 0.085

FLOOD FREQUENCY REGIME

RETURN PERIOD	EXCEEDANCE PROBABILITY	FLOOD
1.003	0.997	-
1.050	0.952	7.37
1.250	0.800	46.90
2.000	0.500	95.90
5.000	0.200	156.00
10.000	0.100	194.00
20.000	0.050	227.00
50.000	0.020	267.00
100.000	0.010	295.00
200.000	0.005	322.00
500.000	0.002	354.00

Table 33 Sample Statistics and Frequency Regime Data for Three Parameter Lognormal Distribution - Rainfall

FREQUENCY ANALYSIS - THREE-PARAMETER LOGNORMAL DISTRIBUTION
RAIN FORREST KERR CREEK ABOVE 460 M CONTOUR

SAMPLE STATISTICS

	MEAN	S.D.	C.V.	C.S.	C.K.
X SERIES	103.867	67.253	0.647	0.702	3.574
LN X SERIES	4.425	0.710	0.160	-0.133	2.405
LN(X-A) SERIES	3.942	1.131	0.287	-0.571	2.867

X(MIN)= 29.700
X(MAX)= 254.000
LOWER OUTLIER LIMIT OF X= 16.959

TOTAL SAMPLE SIZE= 15
NO. OF LOW OUTLIERS= 0
NO. OF ZERO FLOWS= 0

SOLUTION OBTAINED VIA MAXIMUM LIKELIHOOD

3LN PARAMETERS: A= 22.116 M= 3.942 S= 1.131

FLOOD FREQUENCY REGIME

RETURN PERIOD	EXCEEDANCE PROBABILITY	FLOOD
1.003	0.997	24.40
1.050	0.952	29.90
1.250	0.800	42.00
2.000	0.500	73.60
5.000	0.200	156.00
10.000	0.100	242.00
20.000	0.050	353.00
50.000	0.020	548.00
100.000	0.010	738.00
200.000	0.005	971.00
500.000	0.002	1360.00

Table 34 Sample Statistics and Frequency Regime Data for Log Pearson Type III Distribution - Rainfall

FREQUENCY ANALYSIS - LOG PEARSON TYPE III DISTRIBUTION
RAIN FORREST KERR CREEK ABOVE 460 M CONTOUR

SAMPLE STATISTICS

	MEAN	S.D.	C.V.	C.S.	C.K.
X SERIES	103.867	67.253	0.647	0.702	3.574
LN X SERIES	4.425	0.710	0.160	-0.133	2.405

X(MIN)= 29.700
X(MAX)= 254.000
LOWER OUTLIER LIMIT OF X= 16.959

TOTAL SAMPLE SIZE= 15
NO. OF LOW OUTLIERS= 0
NO. OF ZERO FLOWS= 0

SOLUTION OBTAINED VIA MAXIMUM LIKELIHOOD

DISTRIBUTION IS UPPER BOUNDED AT M= 419.1
LP3 PARAMETERS: A=-0.3263 B= 4.945 LOG(M)= 6.038
M = 419.1

FLOOD FREQUENCY REGIME

RETURN PERIOD	EXCEEDANCE PROBABILITY	FLOOD
1.003	0.997	5.52
1.050	0.952	21.20
1.250	0.800	47.90
2.000	0.500	92.90
5.000	0.200	155.00
10.000	0.100	192.00
20.000	0.050	223.00
50.000	0.020	258.00
100.000	0.010	281.00
200.000	0.005	300.00
500.000	0.002	322.00

Table 35 Sample Statistics and Frequency Regime Data for Wakeby Distribution - Rainfall

FREQUENCY ANALYSIS - WAKEBY DISTRIBUTION
RAIN FORREST KERR CREEK ABOVE 460 M CONTOUR

SAMPLE STATISTICS

	MEAN	S.D.	C.V.	C.S.	C.K.
X SERIES	103.867	67.253	0.647	0.702	3.574
LN X SERIES	4.425	0.710	0.160	-0.133	2.405

X(MIN)= 29.700
X(MAX)= 254.000
LOWER OUTLIER LIMIT OF X= 16.959

TOTAL SAMPLE SIZE= 15
NO. OF LOW OUTLIERS= 0
NO. OF ZERO FLOWS= 0

THE FOLLOWING WAKEBY PARAMETERS WERE OBTAINED VIA ITERATION FOR PARAMETER B, ASSUMING M TO BE NON-ZERO.

M= 20.999 A= -9.191 B= 10.24 C= -332.783 D=-0.378
DISTRIBUTION IS UPPER BOUNDED AT E= 0.3446E+03

FLOOD FREQUENCY REGIME

RETURN PERIOD	EXCEEDANCE PROBABILITY	FLOOD
1.003	0.997	21.10
1.050	0.952	23.50
1.250	0.800	39.60
2.000	0.500	88.50
5.000	0.200	163.00
10.000	0.100	205.00
20.000	0.050	237.00
50.000	0.020	269.00
100.000	0.010	286.00
200.000	0.005	300.00
500.000	0.002	313.00

Table 36 Low Flow Frequency - Minimum Daily Discharge

08CG006 FORREST KERR CREEK ABOVE 460 m CONTOUR
1 DAY LOW FLOW MEAN DISCH. IN PERIOD DEC 1 TO MAY 31

STARTING MONTH	YEAR	1 DAY MEAN FLOW	ASCENDING ORDER	RANK	CUMULAT. PROBABIL. (%)	RETURN PERIOD (YEARS)
4	1973	0.5950	0.5490	1	4.55	22.00
3	1974	0.5490	0.5950	2	12.12	8.25
4	1975	0.6170	0.6170	3	19.70	5.08
3	1976	0.6430	0.6430	4	27.27	3.67
3	1977	0.8210	0.6700	5	34.85	2.87
3	1978	0.6770	0.6770	6	42.42	2.36
3	1979	0.9200	0.7250	7	50.00	2.00
3	1980	0.7700	0.7700	8	57.58	1.74
3	1981	0.8910	0.8210	9	65.15	1.53
4	1982	0.6700	0.8910	10	72.73	1.37
3	1983	1.0200	0.9200	11	80.30	1.25
1	1984	0.9950	0.9950	12	87.88	1.14
3	1985	0.7250	1.0200	13	95.45	1.05

Table 37 Sample Statistics and Frequency Regime Data for Gumbel III Distribution

```
08CG006   FORREST KERR CREEK ABOVE 460 m CONTOUR
        1 DAY LOW FLOW MEAN DISCH. IN PERIOD DEC  1 TO MAY 31
MEAN=   0.76  S.D.=   0.1559  SKEW=   0.4291  C.V.=   0.2048
   GUMBEL III DISTRIBUTION   -   PARAMETERS BY MAXIMUM LIKELIHOOD
   N= 13      XMIN=    0.549      A=  1.42342     E=   0.5370  U=  0.7822
```

RETURN PERIOD (YRS)	DROUGHT ESTIMATE
1.005	1.329
1.010	1.255
1.110	0.9787
1.250	0.8795
2.000	0.7265
5.000	0.6224
10.000	0.5874
20.000	0.5674
50.000	0.5528
100.000	0.5467
200.000	0.5429
500.000	0.5401

Table 38 Low Flow Frequency - 7 Day Minimum Discharge

STARTING MONTH	YEAR	7 DAY MEAN FLOW	ASCENDING ORDER	RANK	CUMULAT. PROBABIL. (%)	RETURN PERIOD (YEARS)
4	1973	0.5960	0.5600	1	4.55	22.00
3	1974	0.5600	0.5960	2	12.12	8.25
4	1975	0.6330	0.6330	3	19.70	5.08
3	1976	0.6480	0.6480	4	27.27	3.67
3	1977	0.8450	0.6770	5	34.85	2.87
3	1978	0.6880	0.6880	6	42.42	2.36
3	1979	0.9290	0.7280	7	50.00	2.00
3	1980	0.7700	0.7700	8	57.58	1.74
3	1981	0.9190	0.8450	9	65.15	1.53
4	1982	0.6770	0.9190	10	72.73	1.37
3	1983	1.0200	0.9290	11	80.30	1.25
1	1984	0.9970	0.9970	12	87.88	1.14
3	1985	0.7280	1.0200	13	95.45	1.05

Table 39 Sample Statistics and Frequency Regime Data for Gumbel III Distribution

08CG006 FORREST KERR CREEK ABOVE 460 m CONTOUR
7 DAY LOW FLOW MEAN DISCH. IN PERIOD DEC 1 TO MAY 31
MEAN= 0.77 S.D.= 0.1561 SKEW= 0.3815 C.V.= 0.2027
GUMBEL III DISTRIBUTION - PARAMETERS BY MAXIMUM LIKELIHOOD
N= 13 XMIN= 0.560 A= 1.36829 E= 0.5500 U= 0.7891

RETURN PERIOD (YRS)	DROUGHT ESTIMATE
1.005	1.359
1.010	1.281
1.110	0.9911
1.250	0.8885
2.000	0.7329
5.000	0.6299
10.000	0.5961
20.000	0.5772
50.000	0.5638
100.000	0.5583
200.000	0.5549
500.000	0.5525

Table 40 Low Flow Frequency - 14 Day Minimum Discharge

08CG006 FORREST KERR CREEK ABOVE 460 m CONTOUR
14 DAY LOW FLOW MEAN DISCH. IN PERIOD DEC 1 TO MAY 31

STARTING MONTH	YEAR	14 DAY MEAN FLOW	ASCENDING ORDER	RANK	CUMULAT. PROBABIL. (%)	RETURN PERIOD (YEARS)
4	1973	0.5990	0.5660	1	4.55	22.00
3	1974	0.5660	0.5990	2	12.12	8.25
3	1975	0.6640	0.6540	3	19.70	5.08
3	1976	0.6540	0.6640	4	27.27	3.67
3	1977	0.8540	0.6850	5	34.85	2.87
3	1978	0.7030	0.7030	6	42.42	2.36
3	1979	0.9470	0.7720	7	50.00	2.00
3	1980	0.7720	0.7880	8	57.58	1.74
3	1981	0.9640	0.8540	9	65.15	1.53
3	1982	0.6850	0.9470	10	72.73	1.37
3	1983	1.0300	0.9640	11	80.30	1.25
1	1984	1.0000	1.0000	12	87.88	1.14
3	1985	0.7880	1.0300	13	95.45	1.05

Table 41 Sample Statistics and Frequency Regime Data for Gumbel III Distribution

08CG006 FORREST KERR CREEK ABOVE 460 m CONTOUR
14 DAY LOW FLOW MEAN DISCH. IN PERIOD DEC 1 TO MAY 31
MEAN= 0.79 S.D.= 0.1583 SKEW= 0.2731 C.V.= 0.2012
GUMBEL III DISTRIBUTION - PARAMETERS BY MAXIMUM LIKELIHOOD
N= 13 XMIN= 0.566 A= 1.49139 E= 0.5497 U= 0.8106

RETURN PERIOD (YRS)	DROUGHT ESTIMATE
1.005	1.348
1.010	1.277
1.110	1.007
1.250	0.9087
2.000	0.7537
5.000	0.6451
10.000	0.6074
20.000	0.5853
50.000	0.5687
100.000	0.5616
200.000	0.5571
500.000	0.5537

TABLE 42

BASE-FLOW INDEX

YEAR OF RECORD	BASE-FLOW INDEX
1973	0.736
1974	0.730
1975	0.776
1976	0.514
1977	0.591
1978	0.737
1980	0.766
1981	0.624
1982	0.735
1983	0.782
1984	0.849
1985	0.778

MEAN = 0.718

SD = 0.094

CV = 0.131

TABLE 43

PHYSIOGRAPHIC PARAMETERS

Station Name	Basin Area (km^2)	Average Elevation (m)	% of Lakes	Stream Density (km/km^2)	Average Slope (m/km)	Main Channel Length (km)	Main Channel Slope (m/km)
Forrest Kerr Cr. ab. 460m Contour	311	4386	0.3183	0.2352	1408	32.3	55.8
More Creek near the Mouth	888	4369	0.5394	0.5466	1954	33.6	14.0

FIGURES 1 - 52

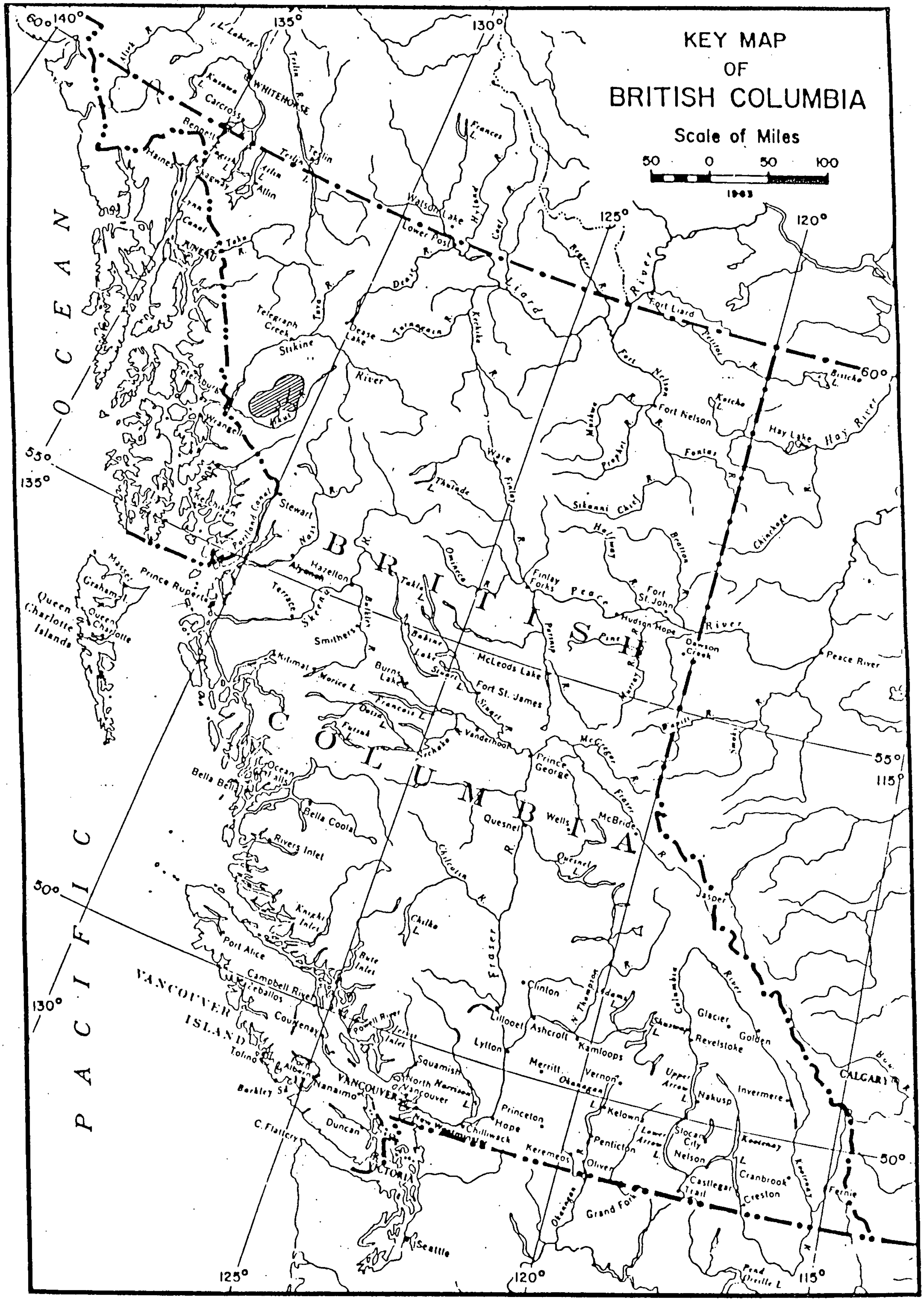


Figure 1 Key Map of British Columbia Showing Location of Forrest Kerr Creek and More Creek Basins

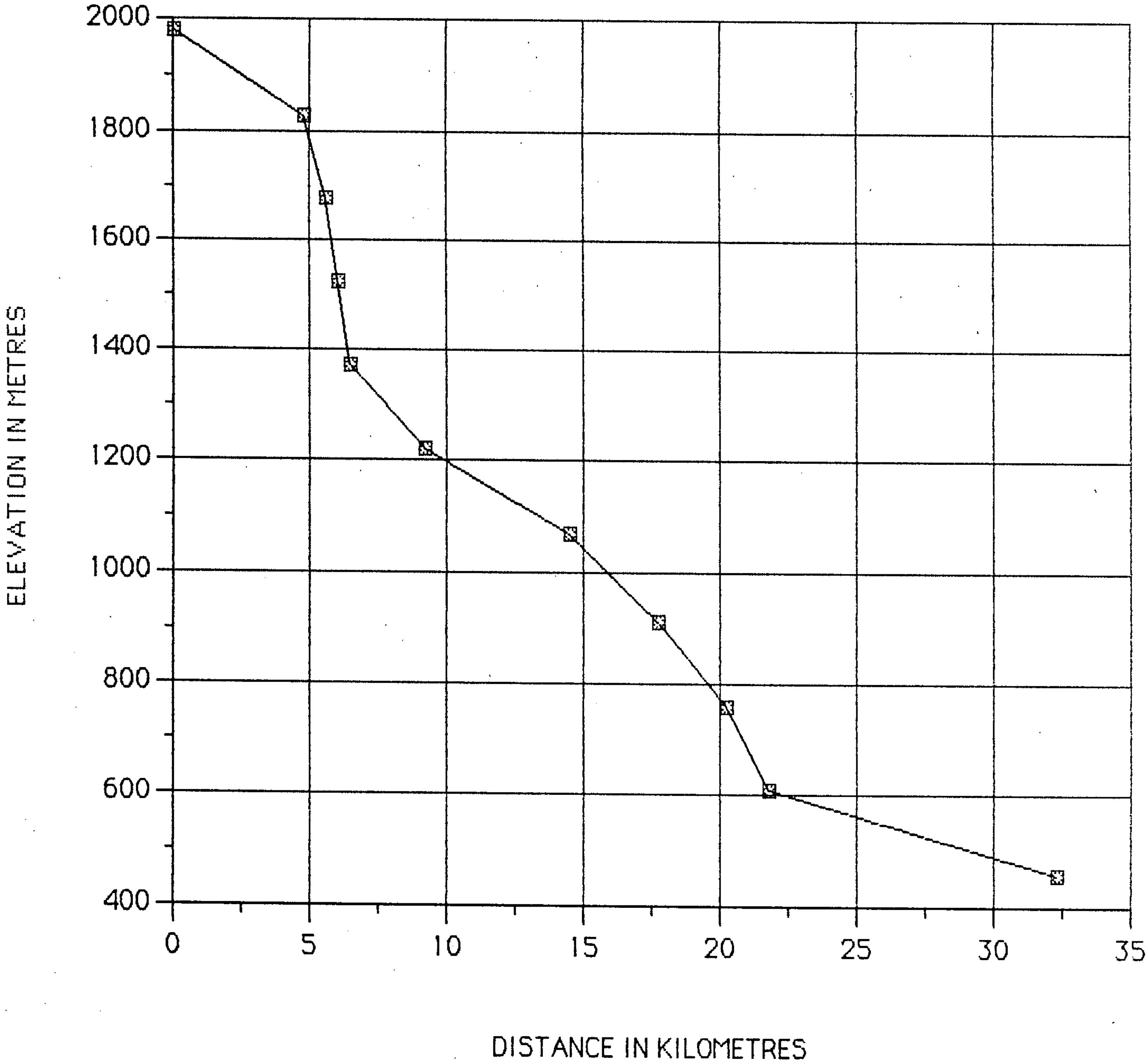


Figure 2 Profile of Forrest Kerr Creek

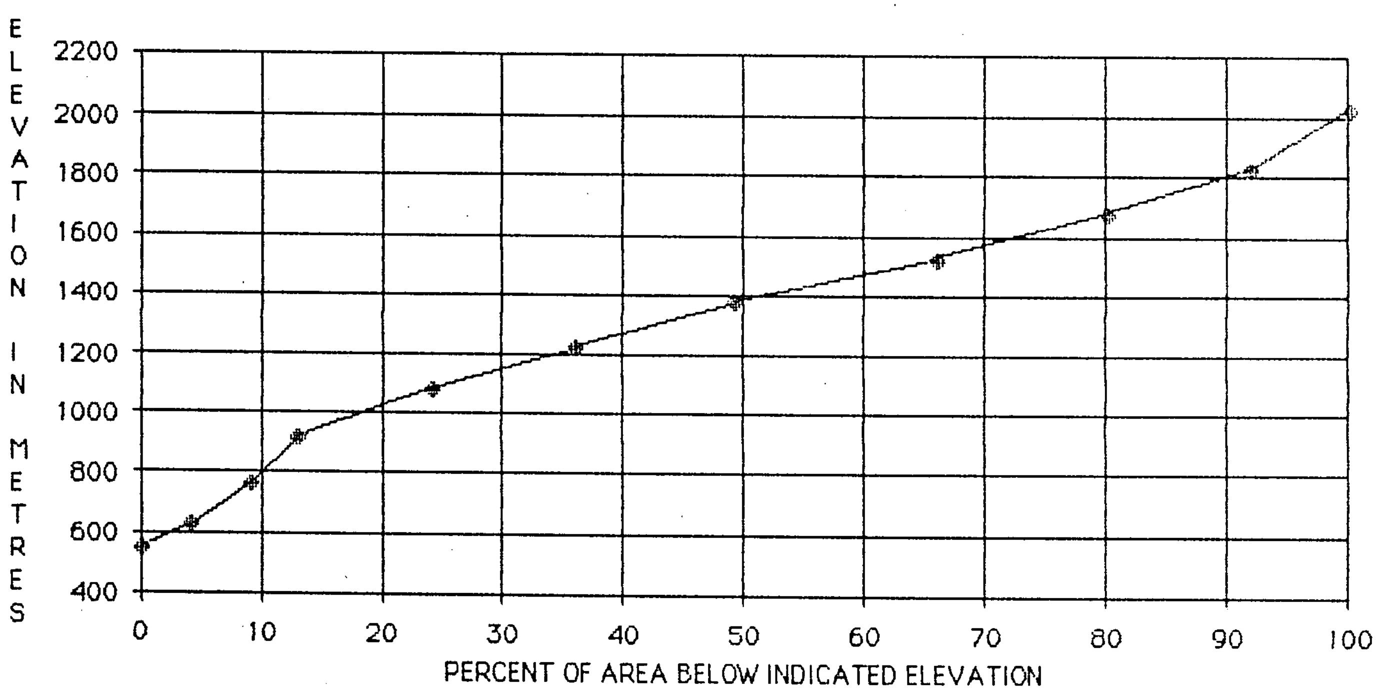


Figure 3 Hypsometric Graph of Basin

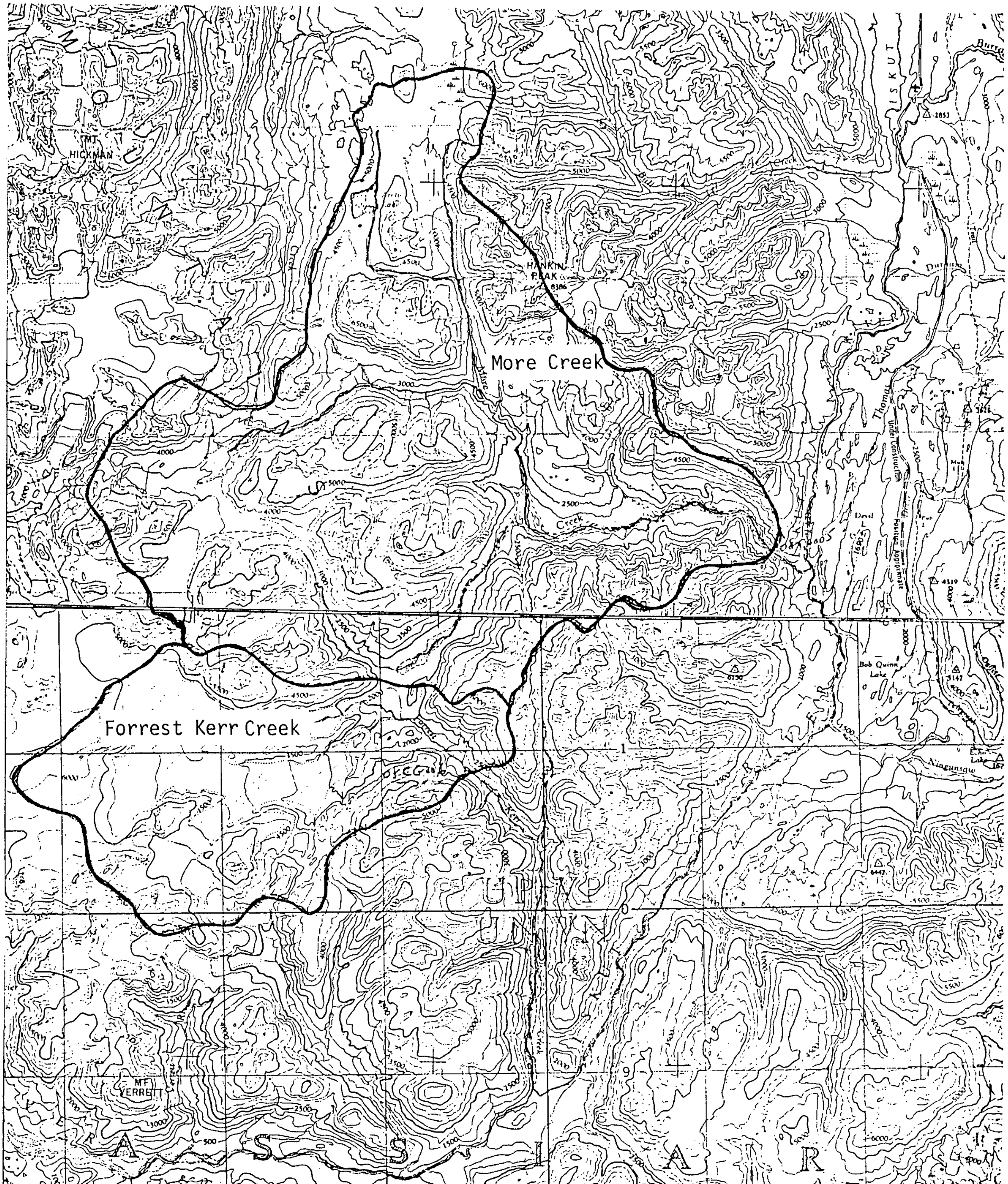


Figure 4 Map of Forrest Kerr Creek Basin

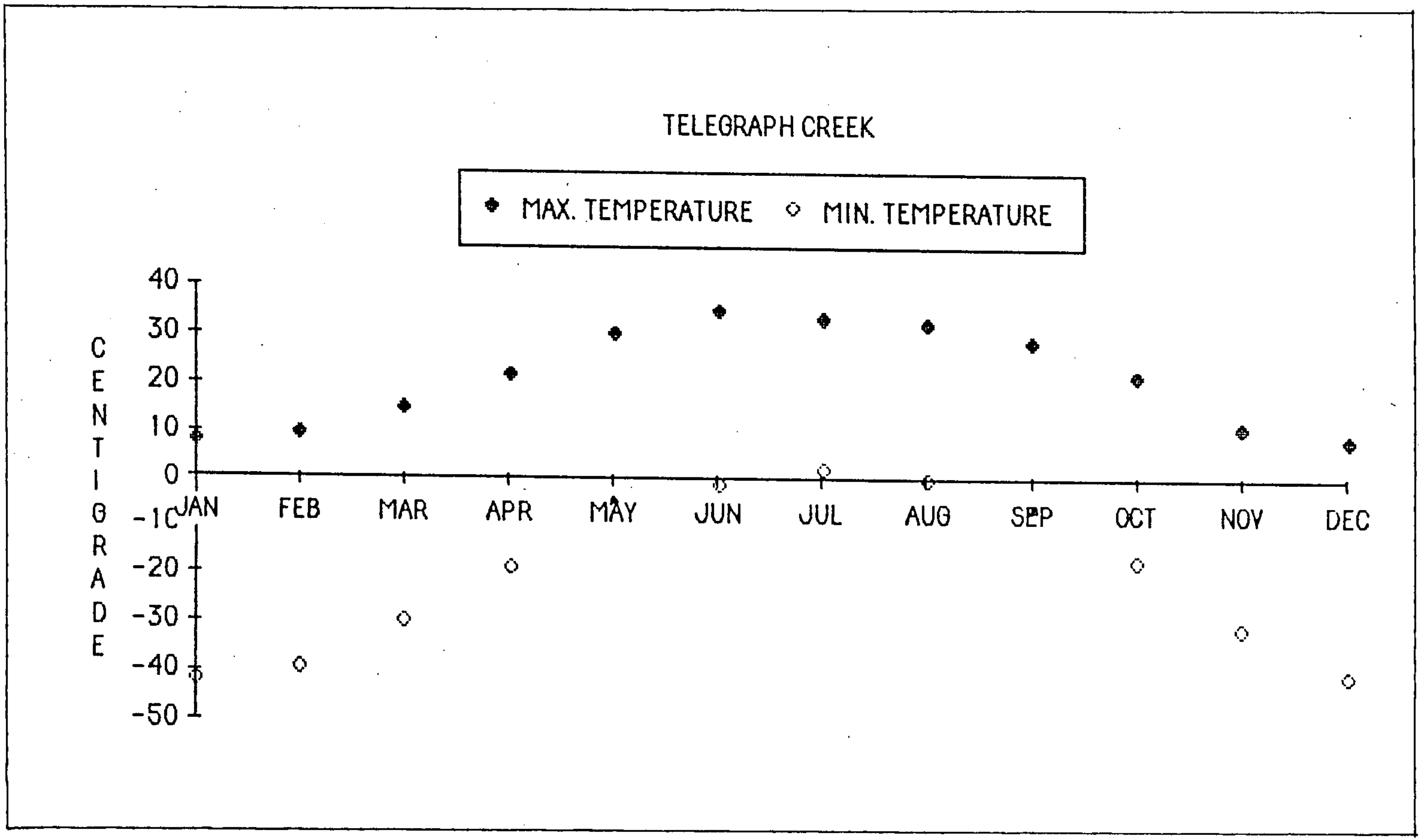


Figure 5 Maximum and Minimum Temperature Extremes at Telegraph Creek

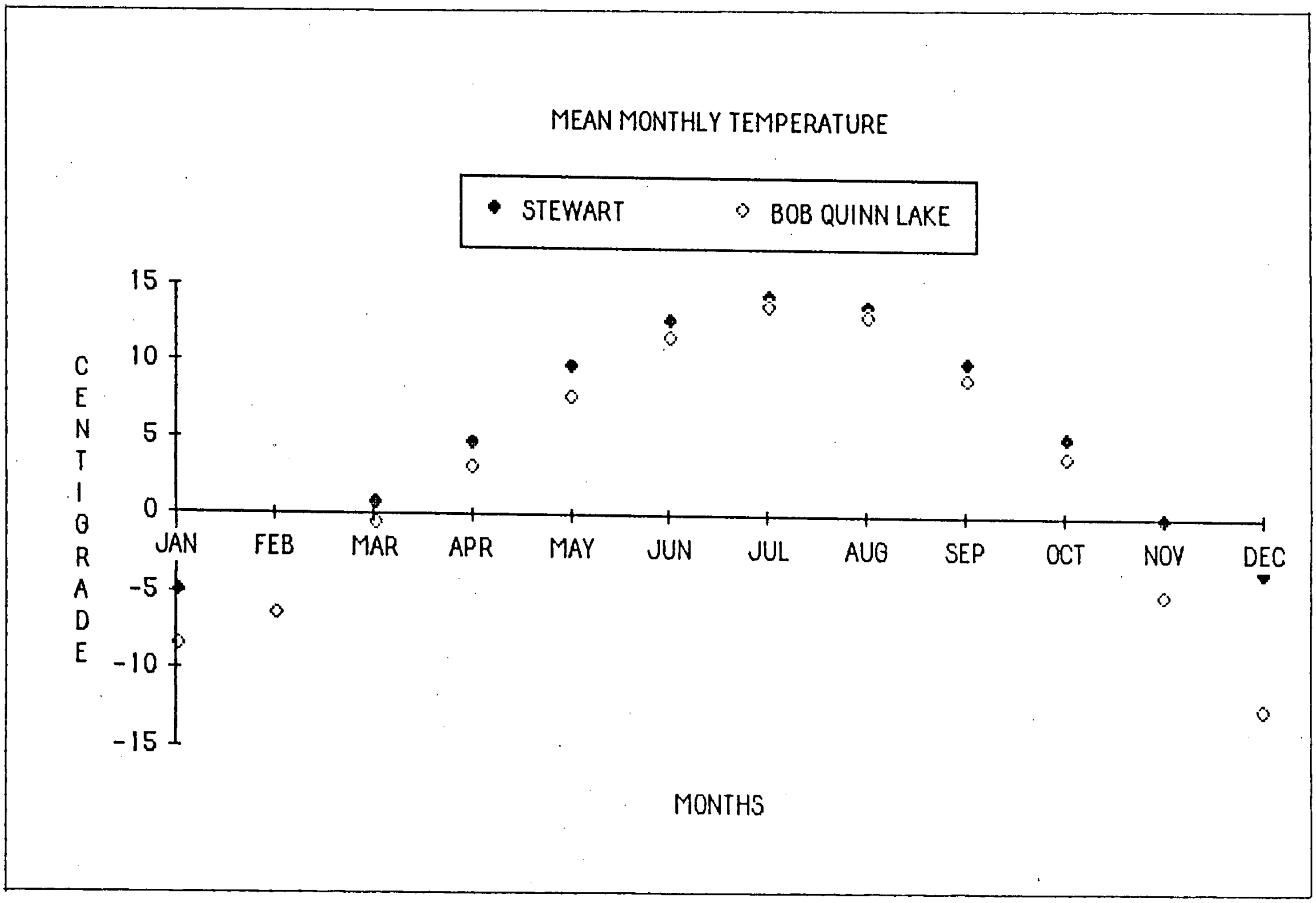


Figure 6 Monthly Mean Temperature - Stewart and Bob Quinn Lake

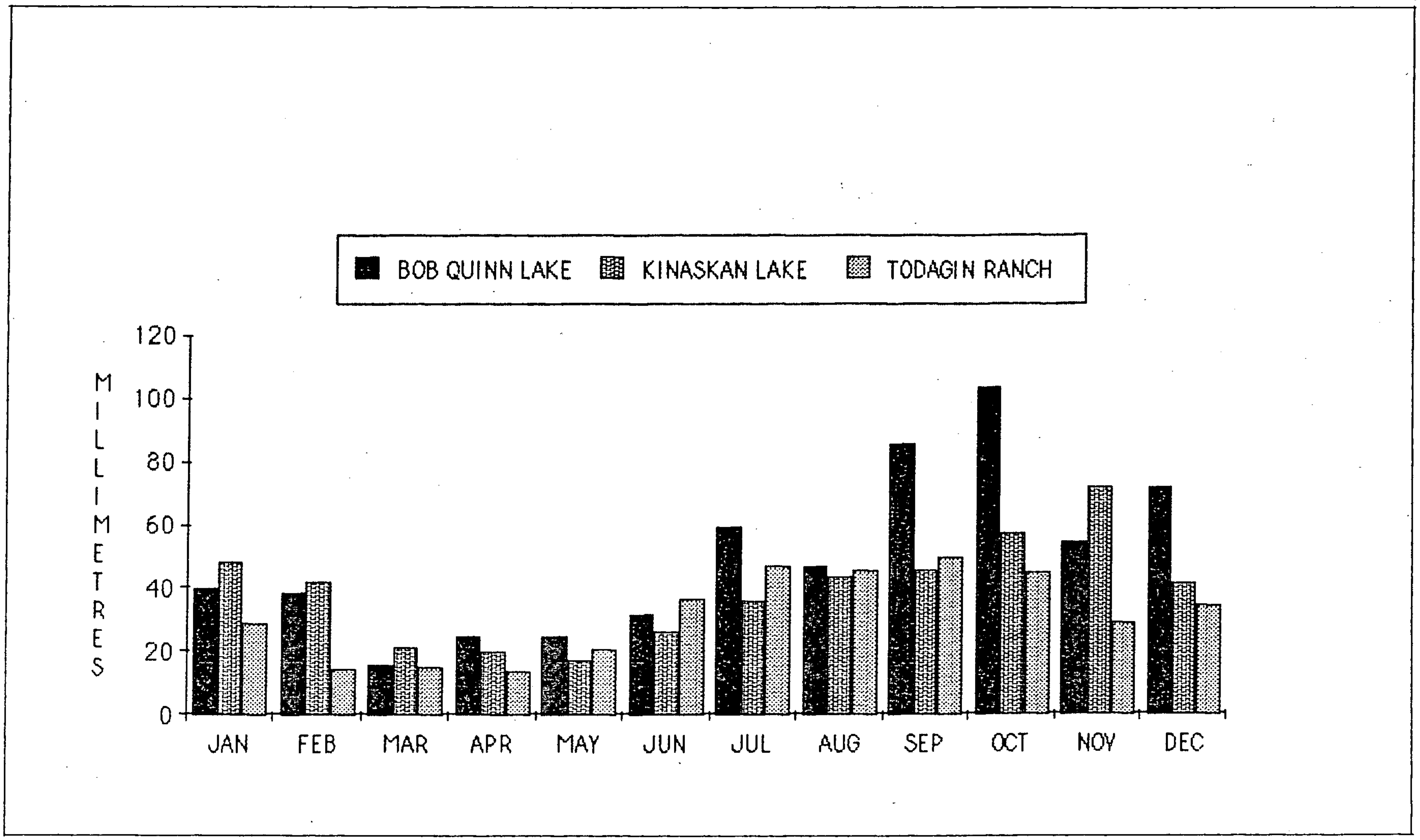


Figure 7 Long Term Mean Monthly Precipitation for Bob Quinn Lake, Kinaskan Lake and Todagin Ranch

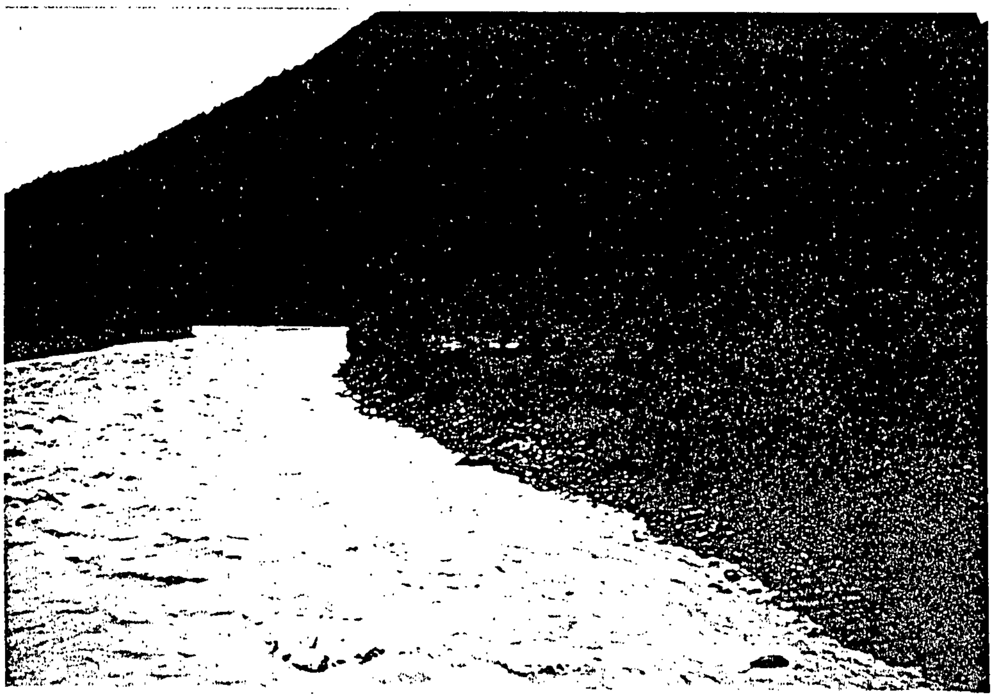


Figure 8 Photographs of Stream Channel - Downstream from Cableway -
July 8, 1986 - Right Bank (top)
Left Bank (bottom)

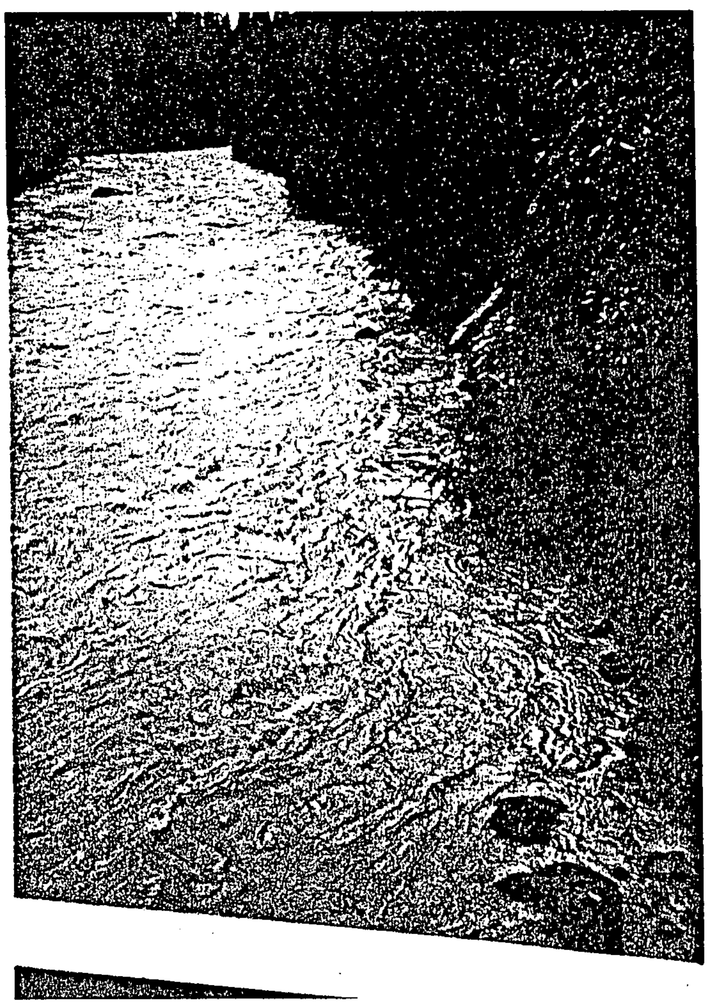


Figure 9 Photographs of Stream Channel - Upstream from Cableway
July 8, 1986 - Right Bank (top)
Left Bank (bottom)

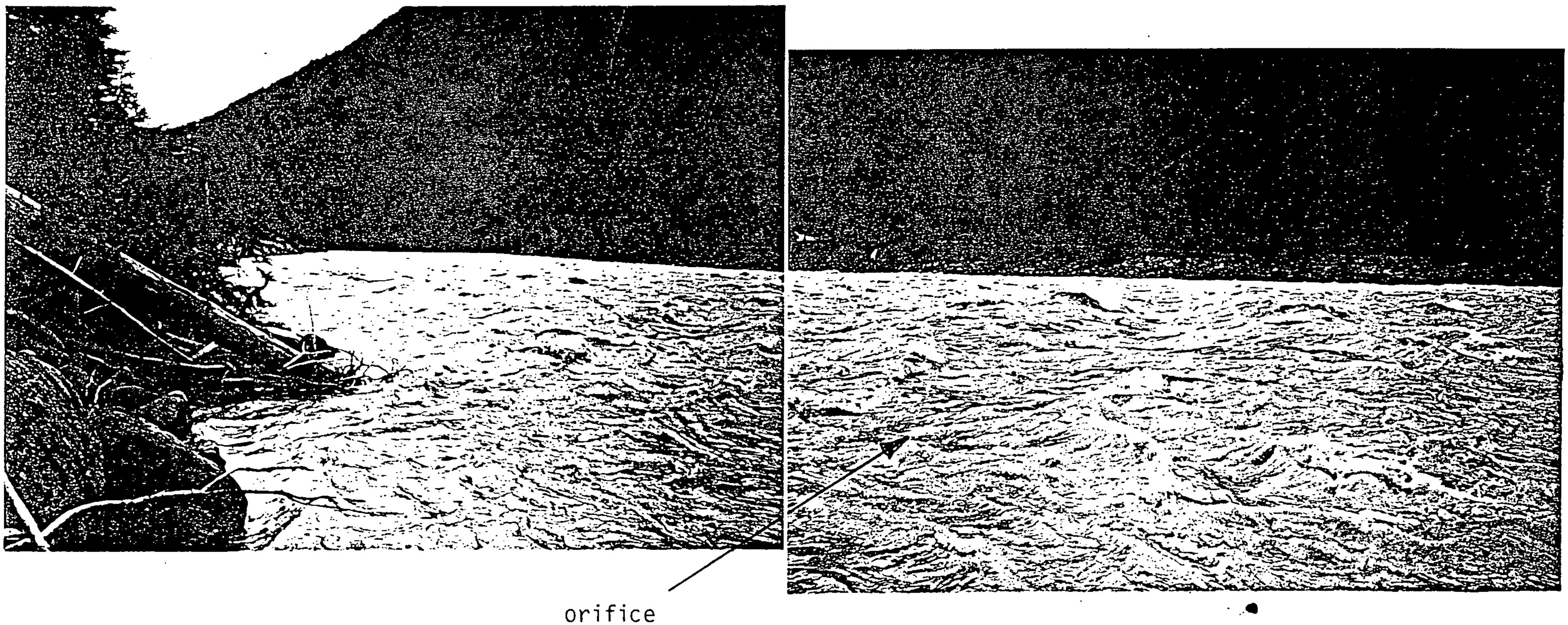


Figure 10 Photograph of Stream Channel at Recorder Looking Downstream July 8, 1986

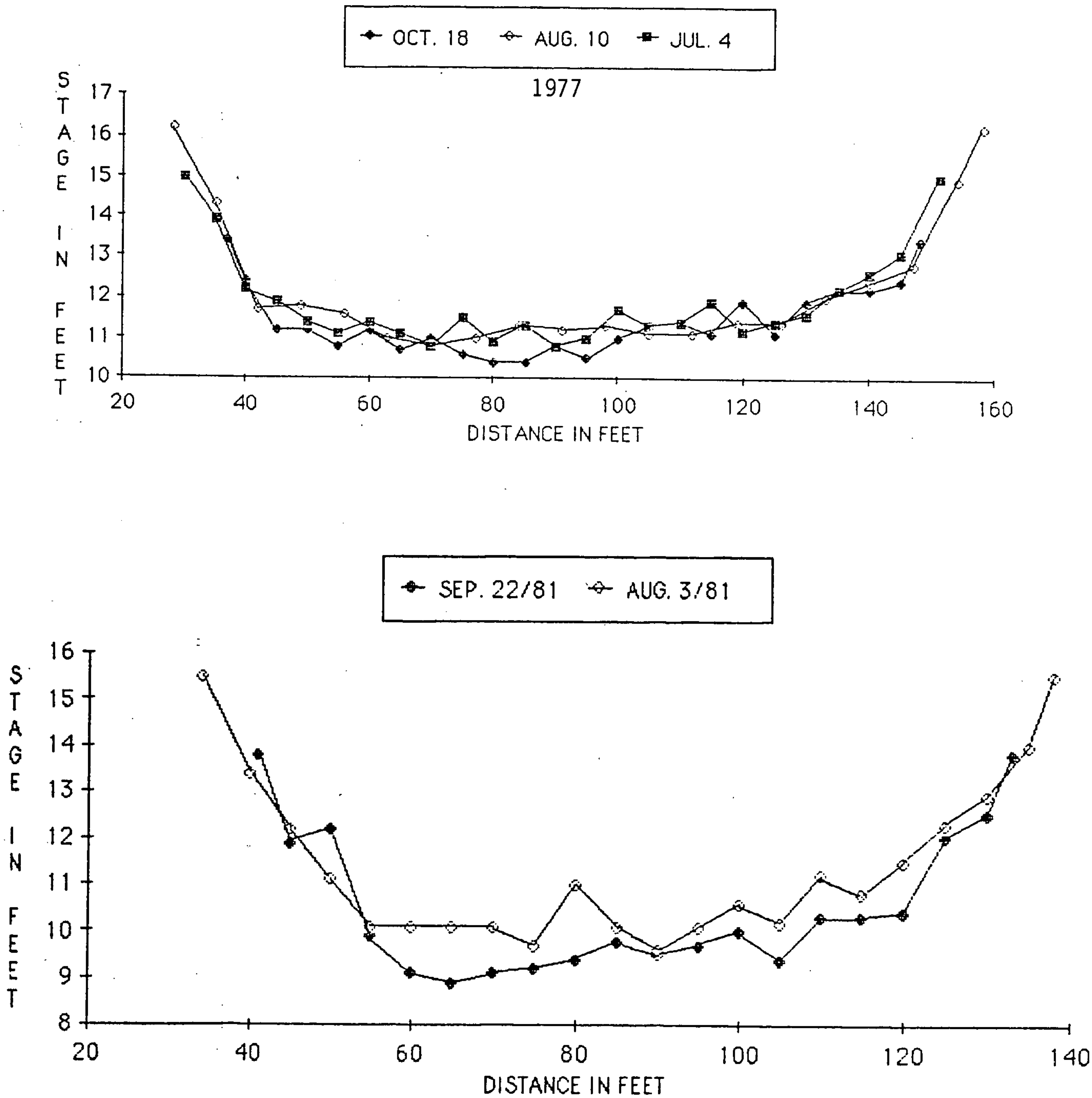


Figure 11 Cross Sections at Cableway Before and After the Flood of September 8, 1981

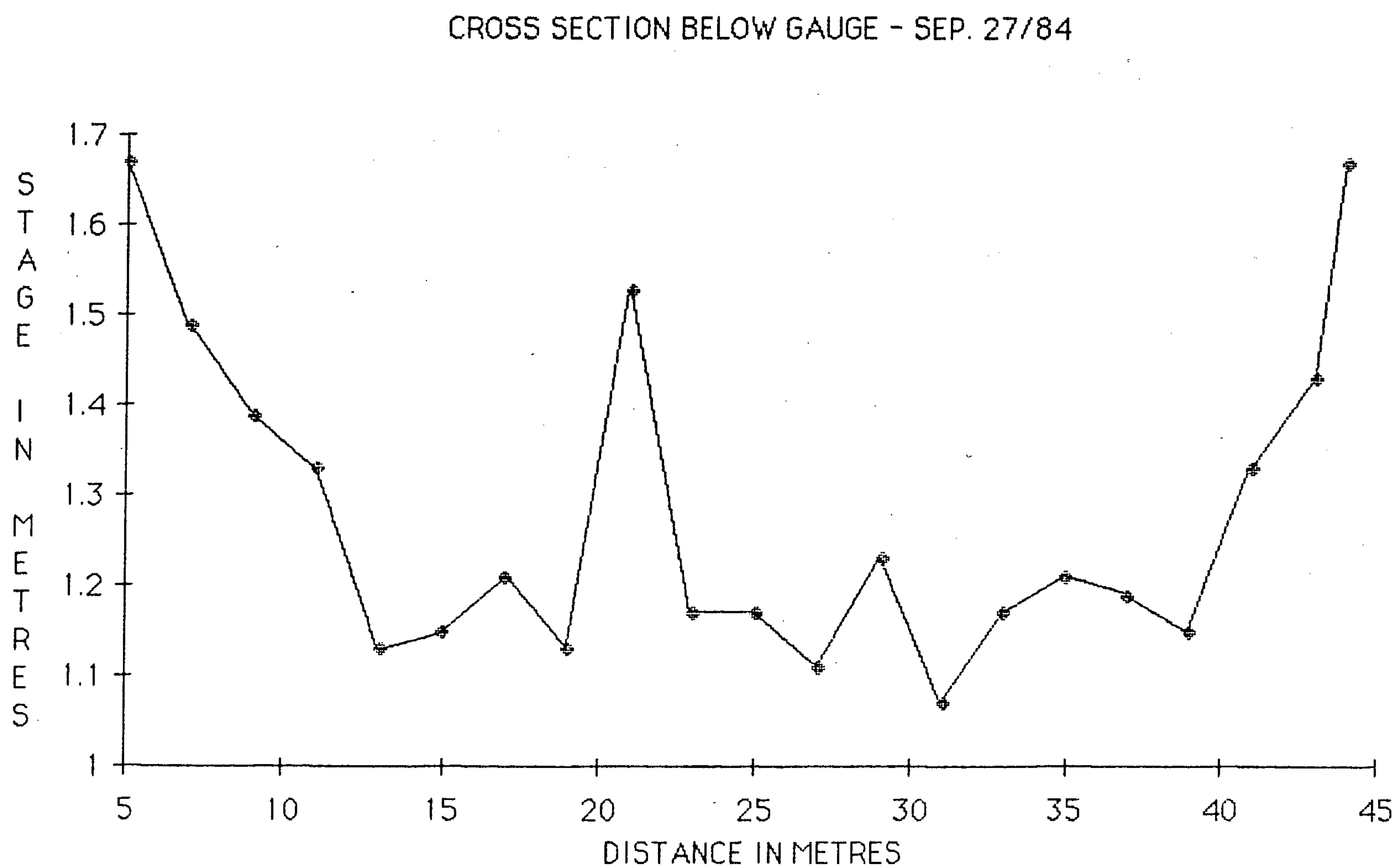


Figure 12 Sample Cross Section at Wading Sections

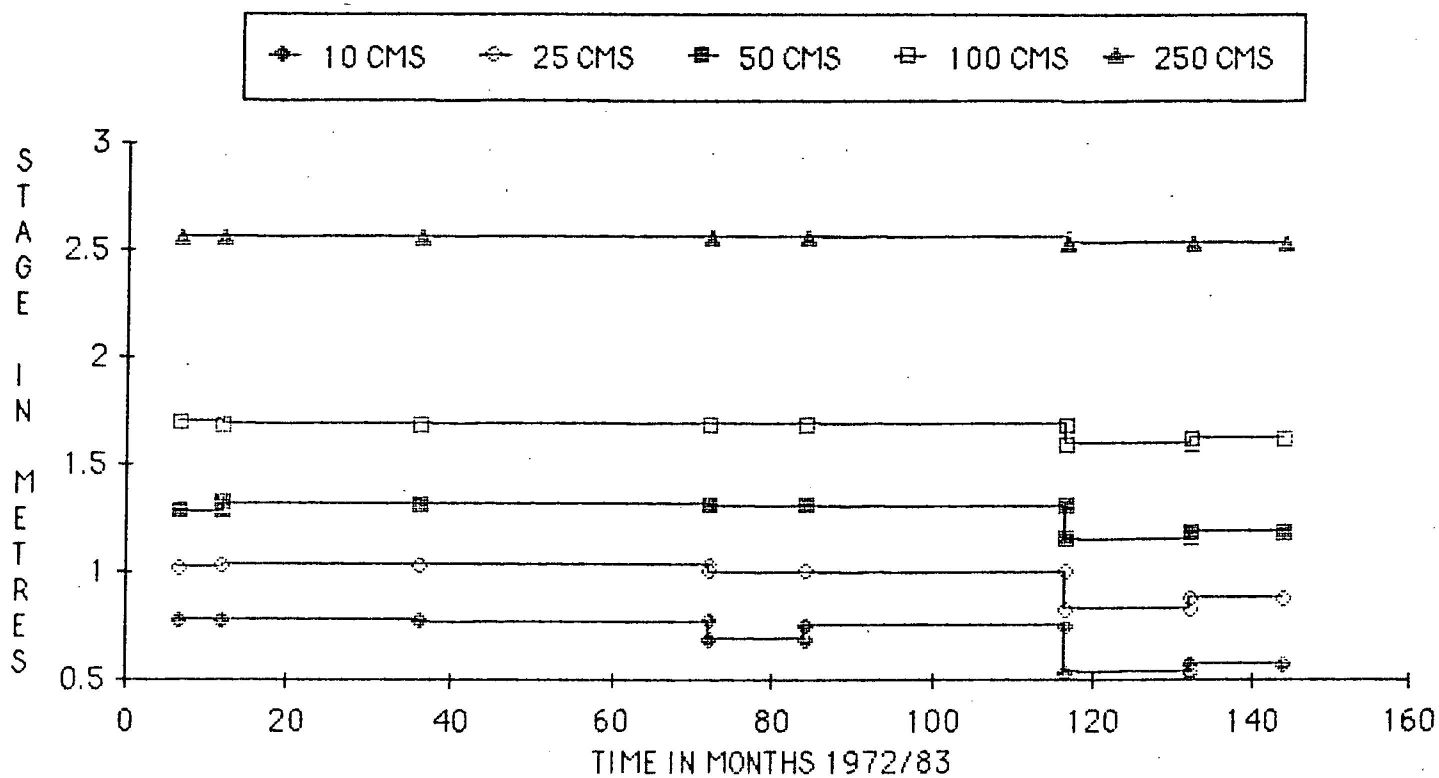


Figure 13 Stage Relationship with Selected Discharges

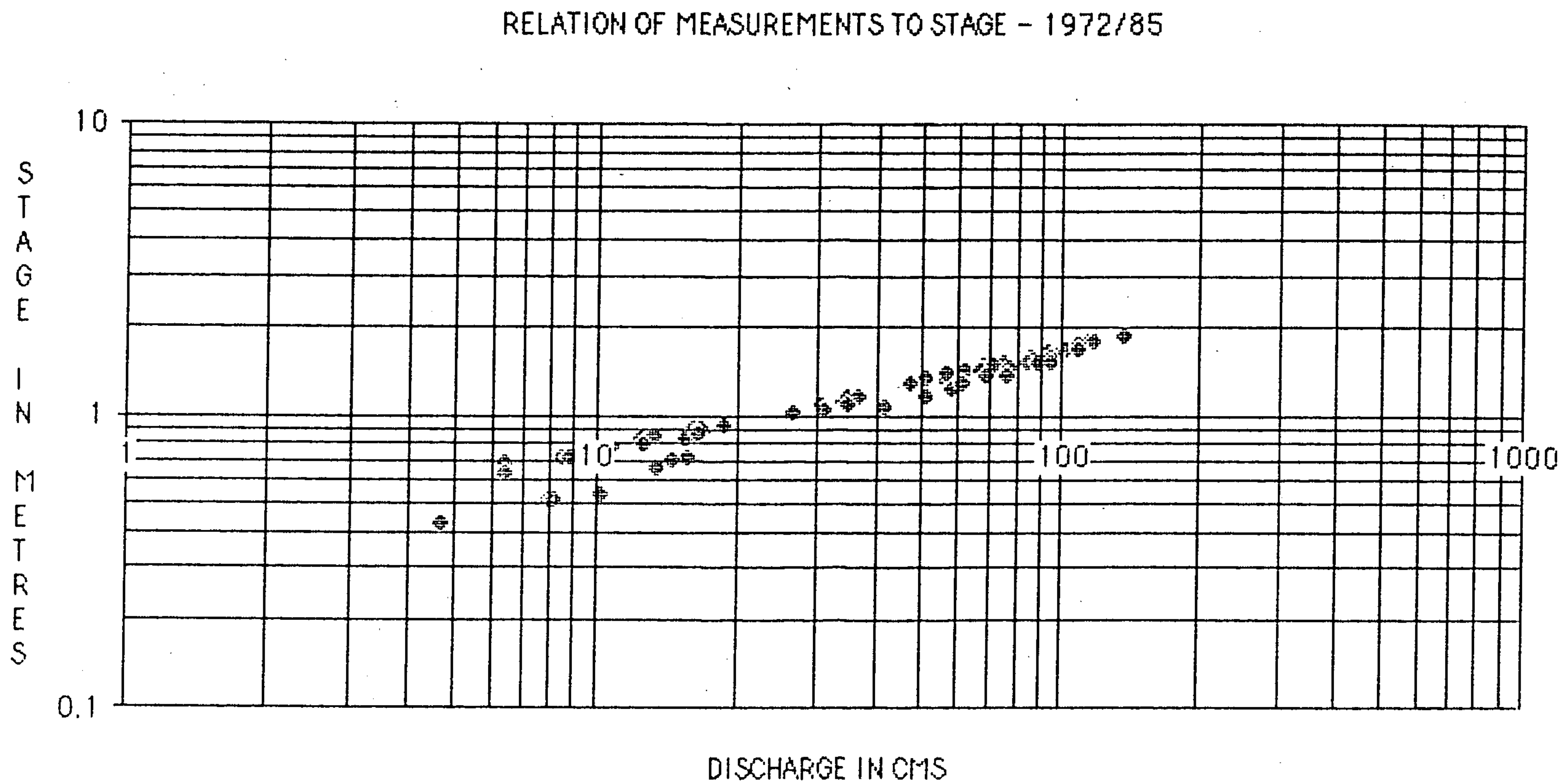


Figure 14 Composite Curve of all Open Water Measurements

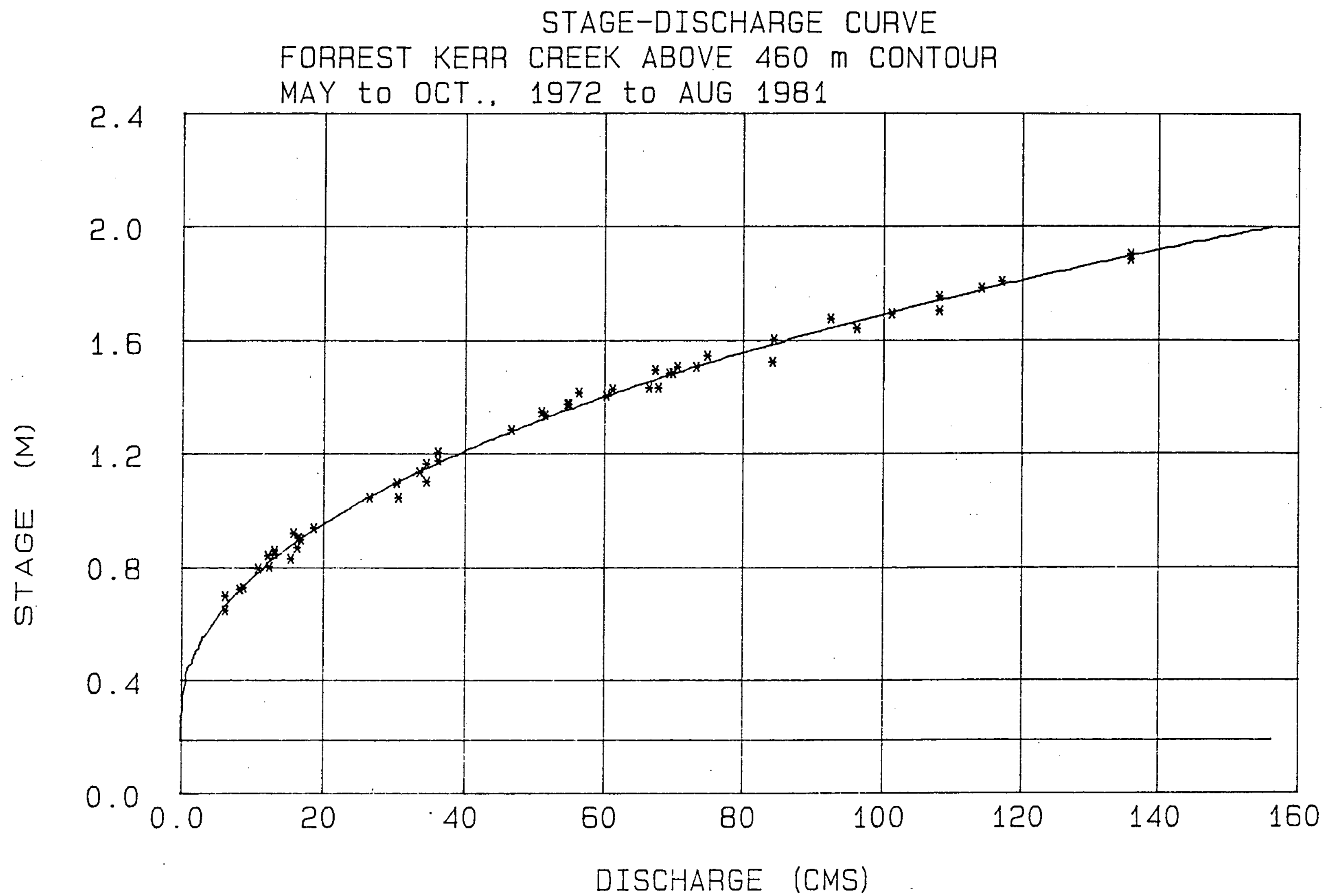


Figure 15 Composite Rating Curve of all Open Water Measurements

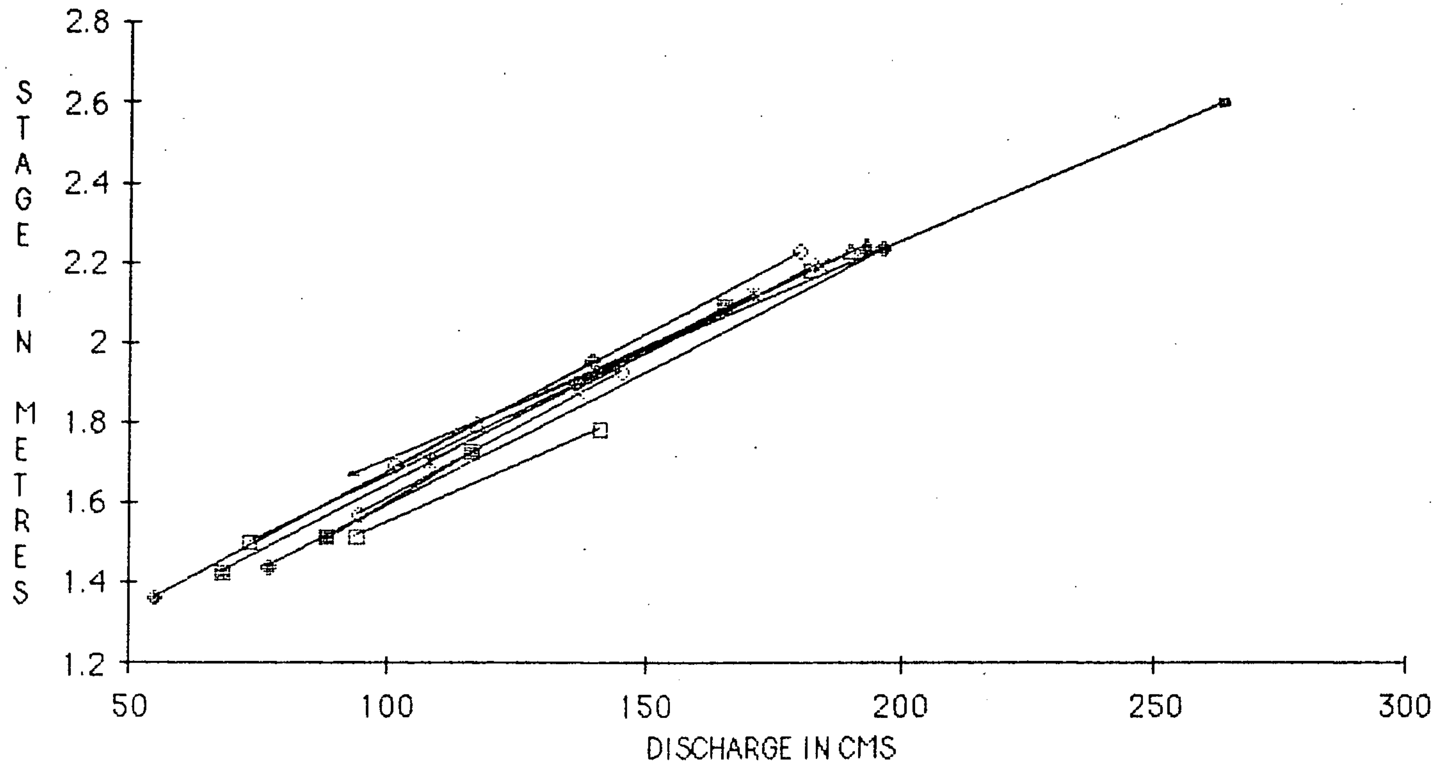


Figure 16 Measured vs. Estimated Discharges for Period of Record

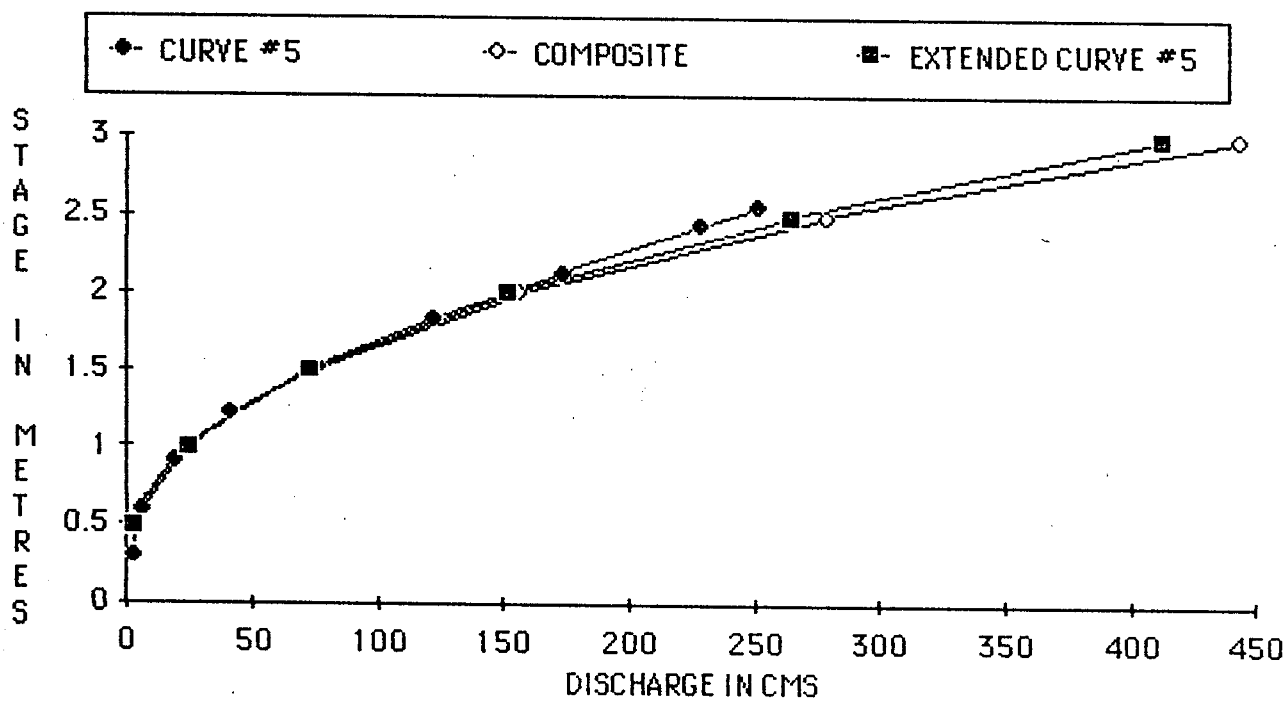


Figure 17 Relationship of Extended Rating Curve #5, Computer Extension of #5 and Composite Curve

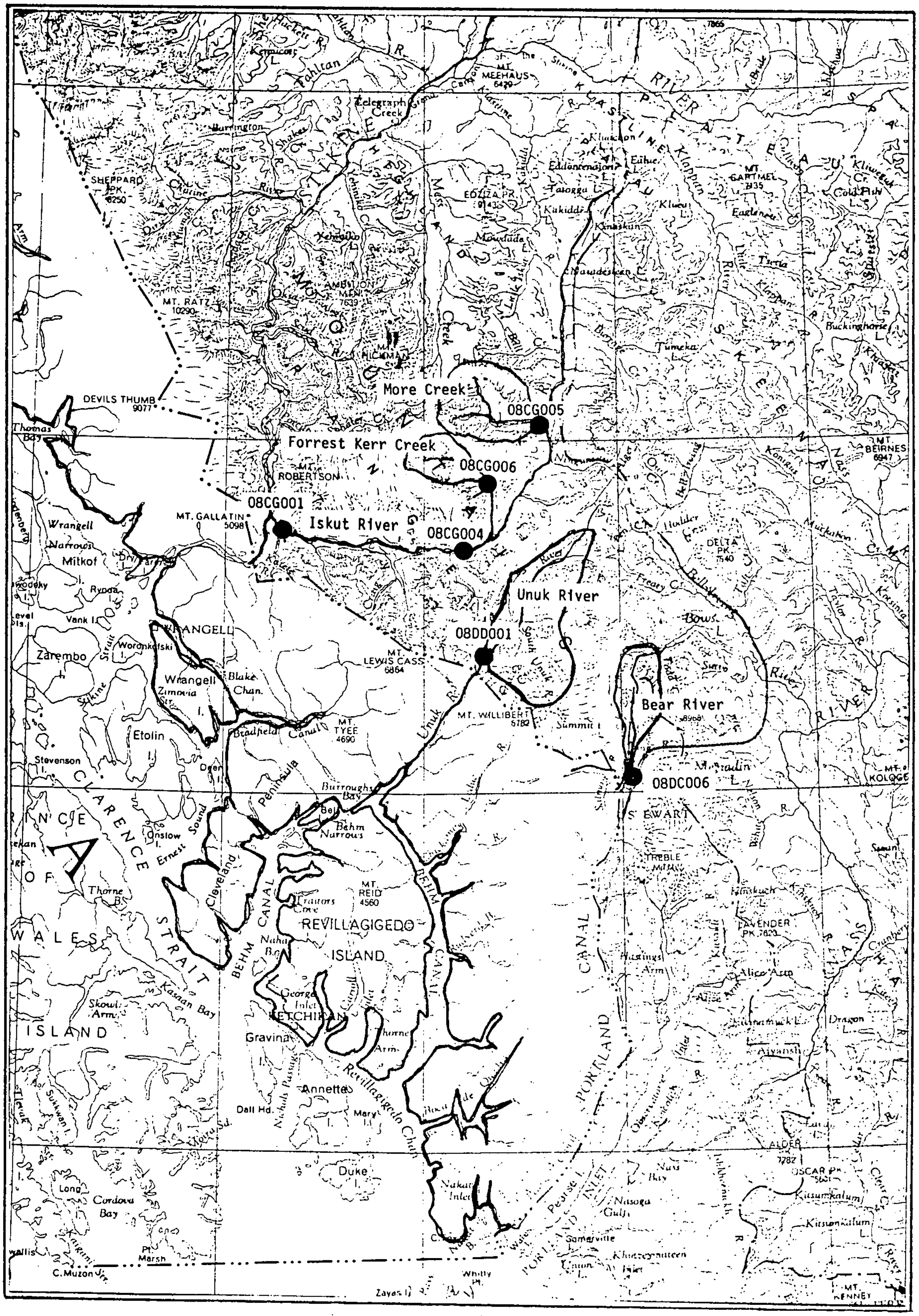


Figure 18 Map of Surrounding Basins

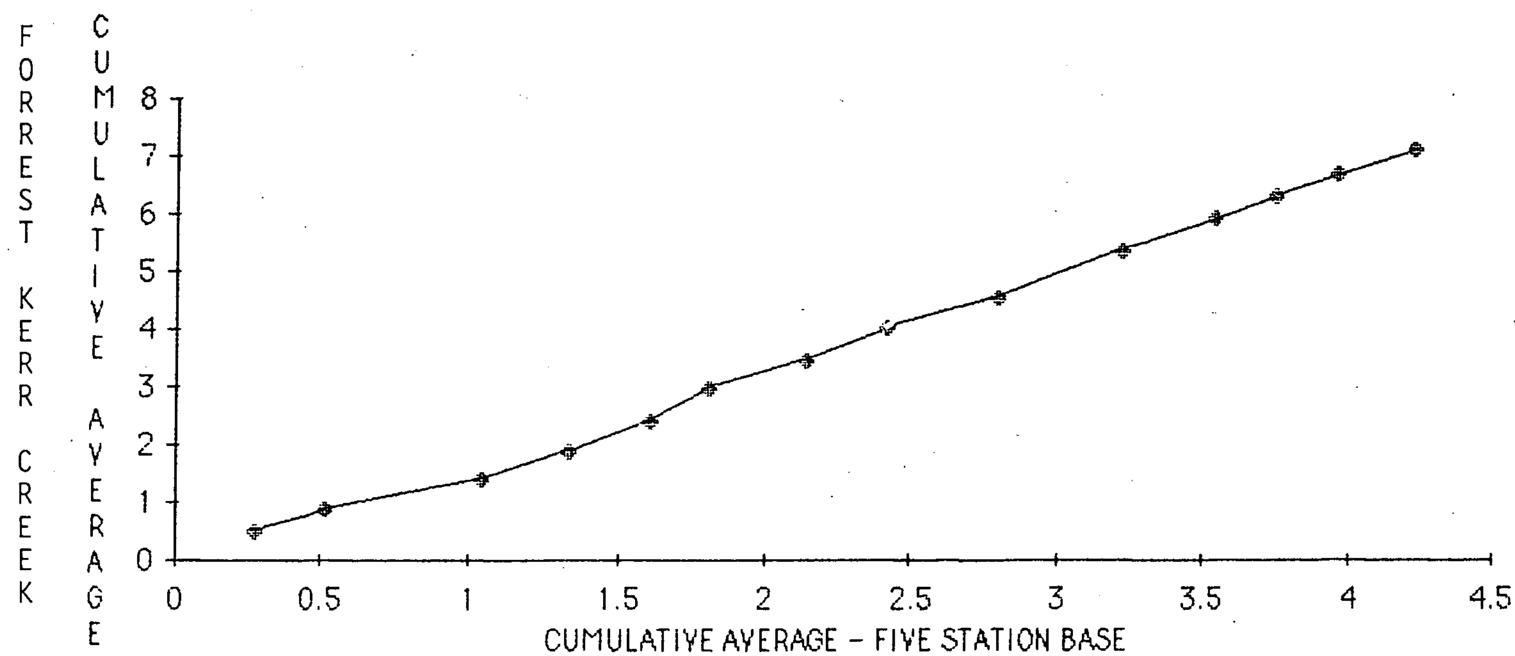


Figure 19 Double-Mass Curve Analysis - Maximum Daily Discharge

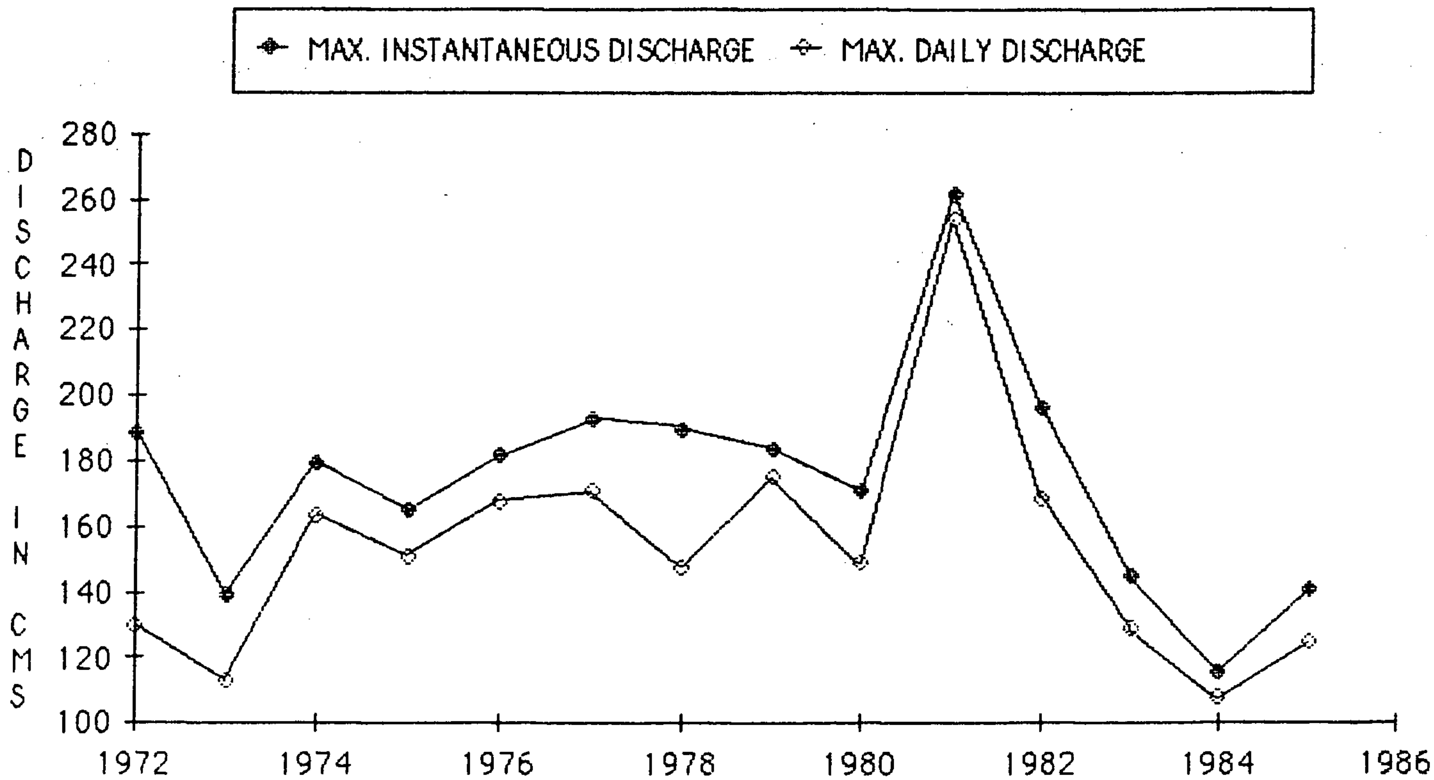


Figure 20 Relationship of Maximum Daily Discharge to Maximum Instantaneous Discharge

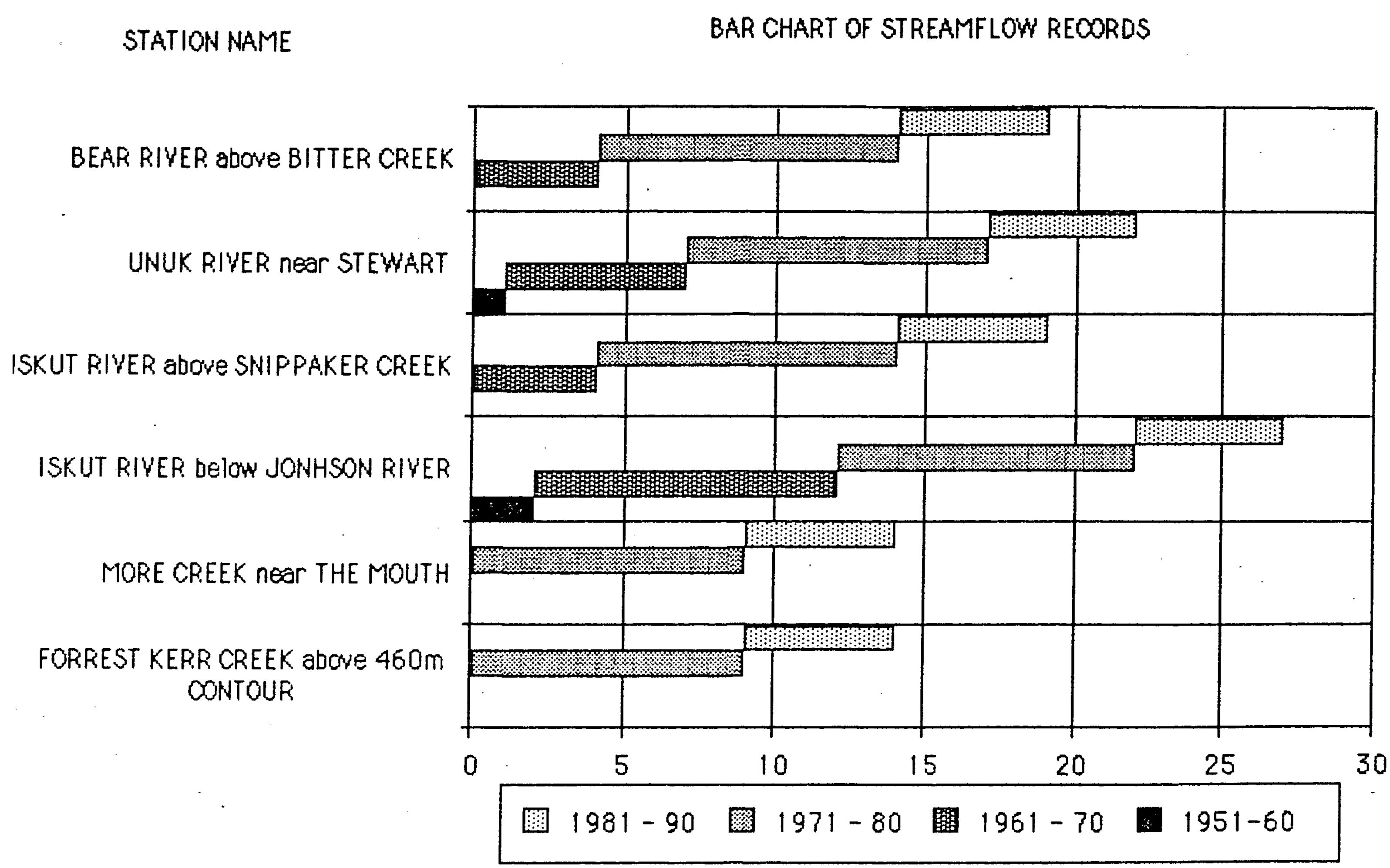


Figure 21 Bar Chart of Streamflow Records

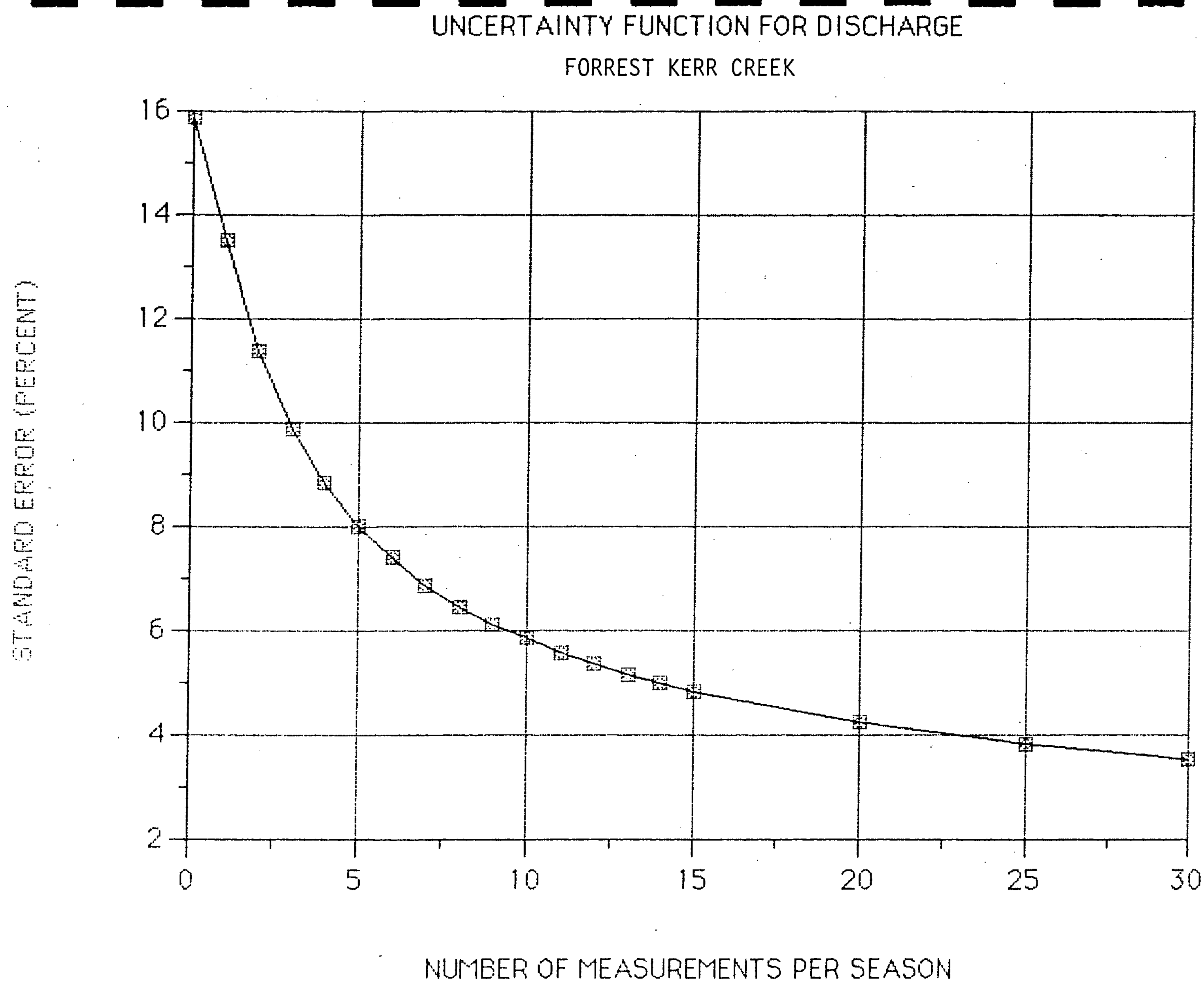


Figure 22 Relation of Standard Error of Data to Number of Measurements per Season

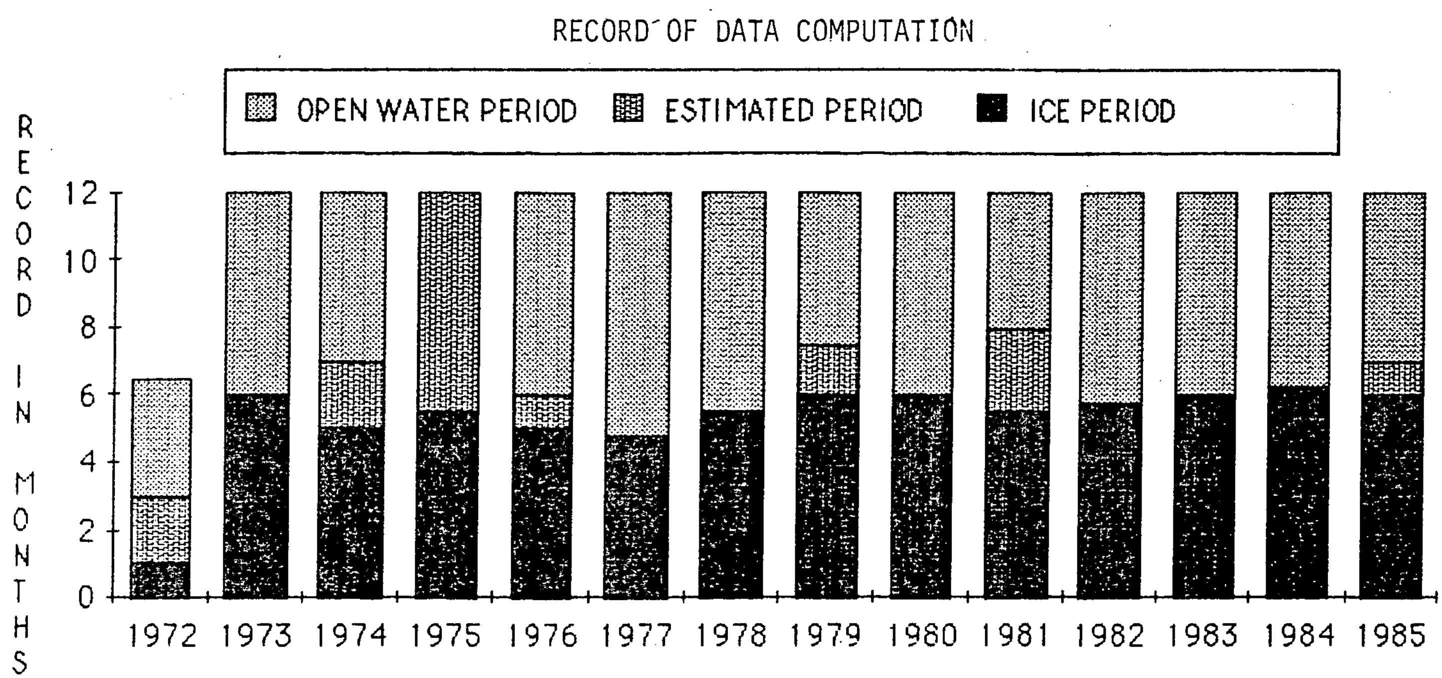
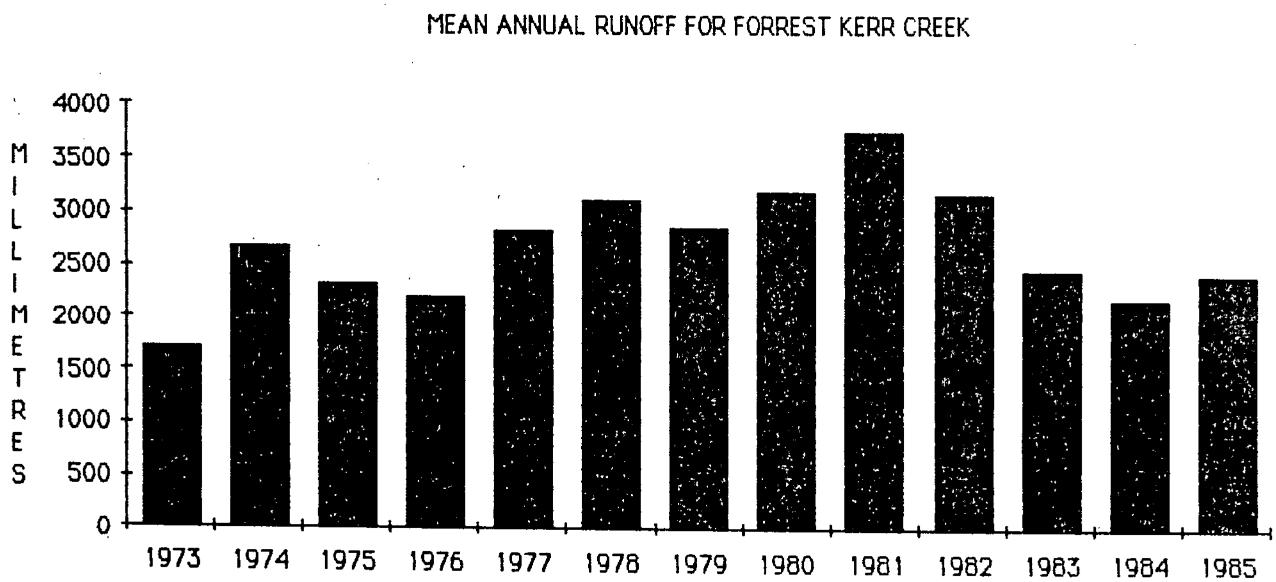


Figure 23 Methods of Data Computation



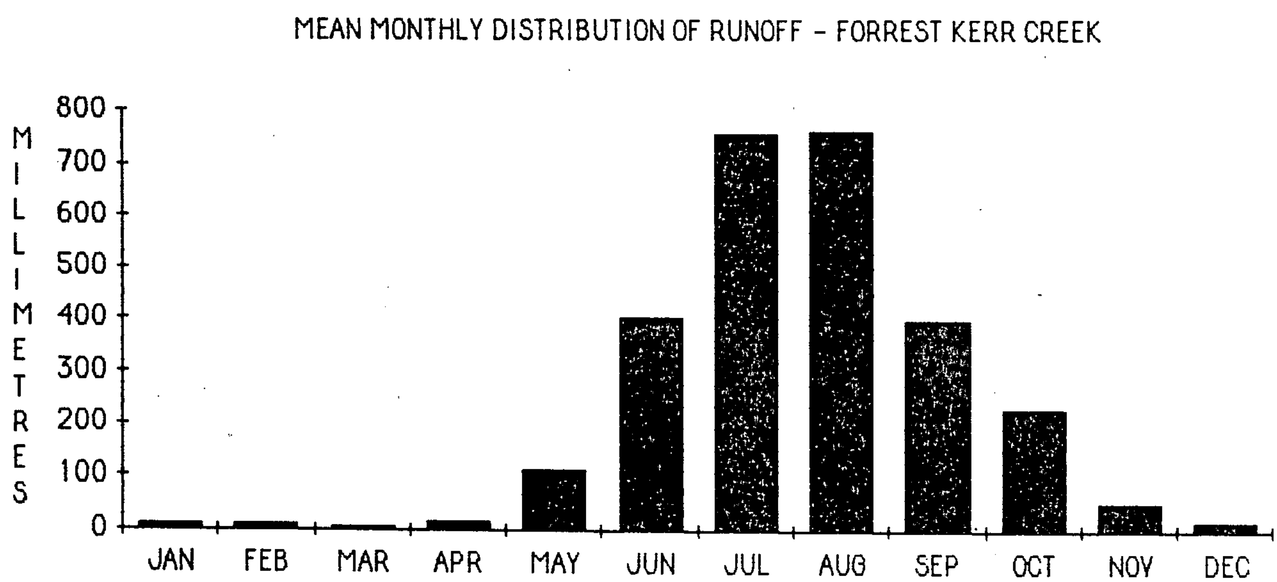


Figure 24 Mean Annual Runoff and Mean Monthly Runoff

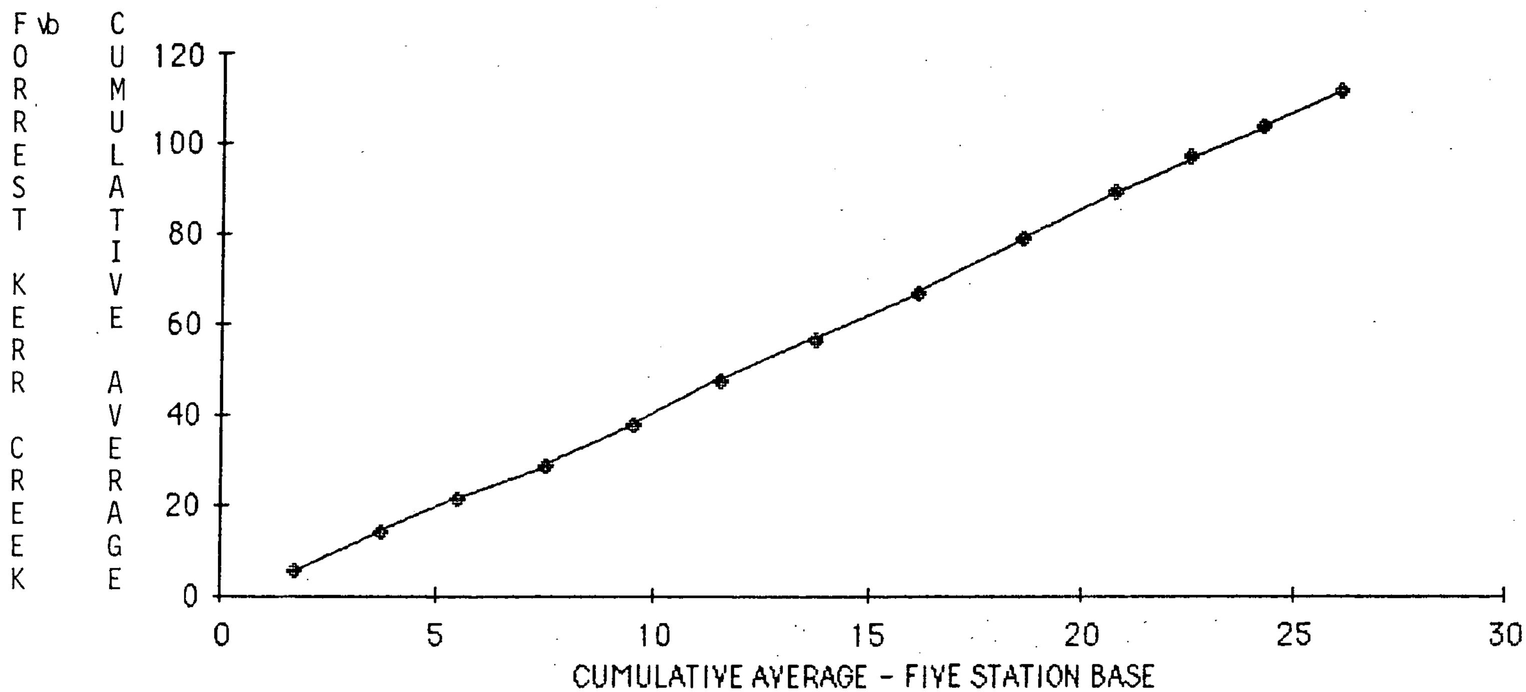


Figure 25 Double-Mass Curve Analysis - Mean Annual Discharge

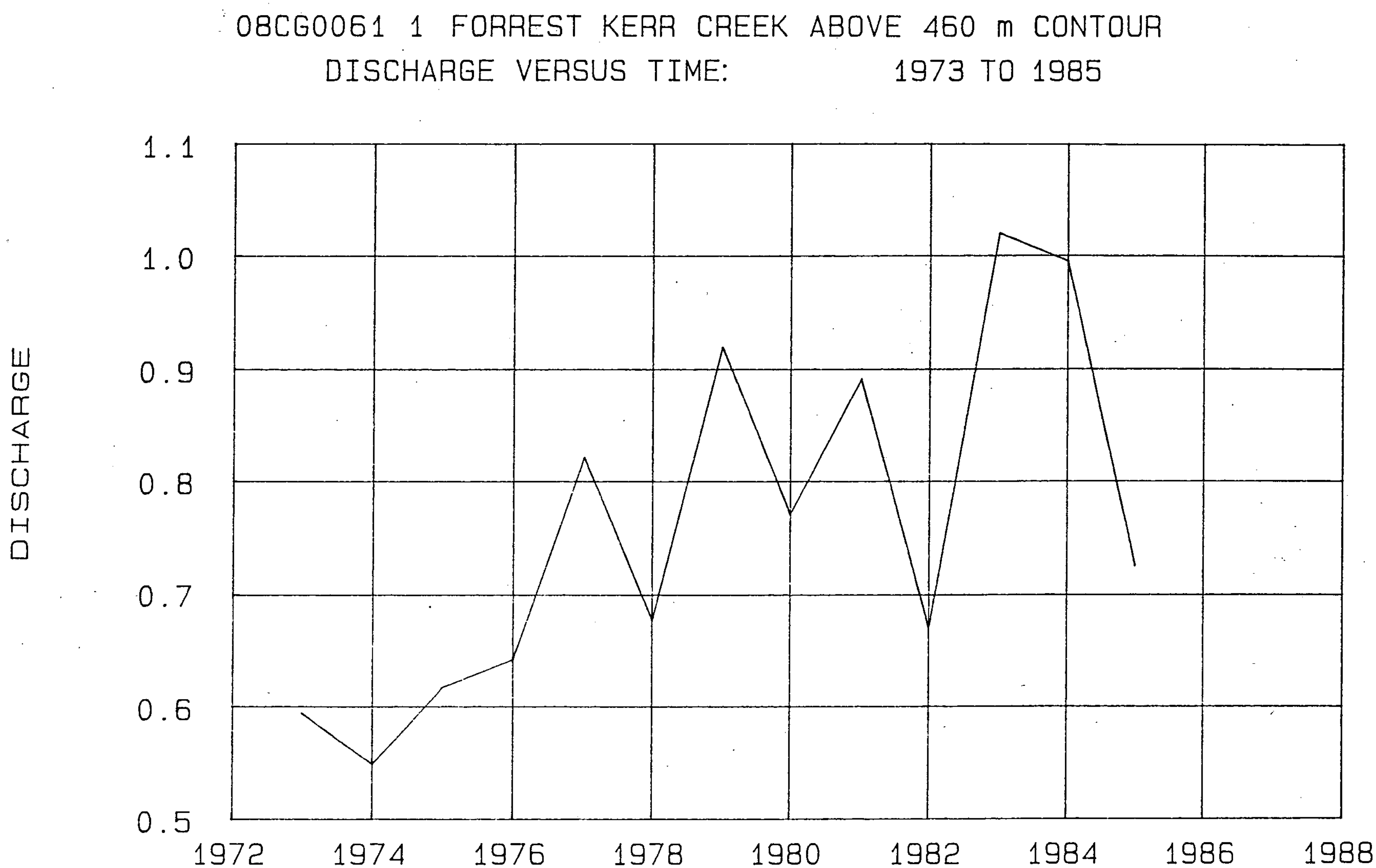


Figure 26 Relation of Low Flow to Time

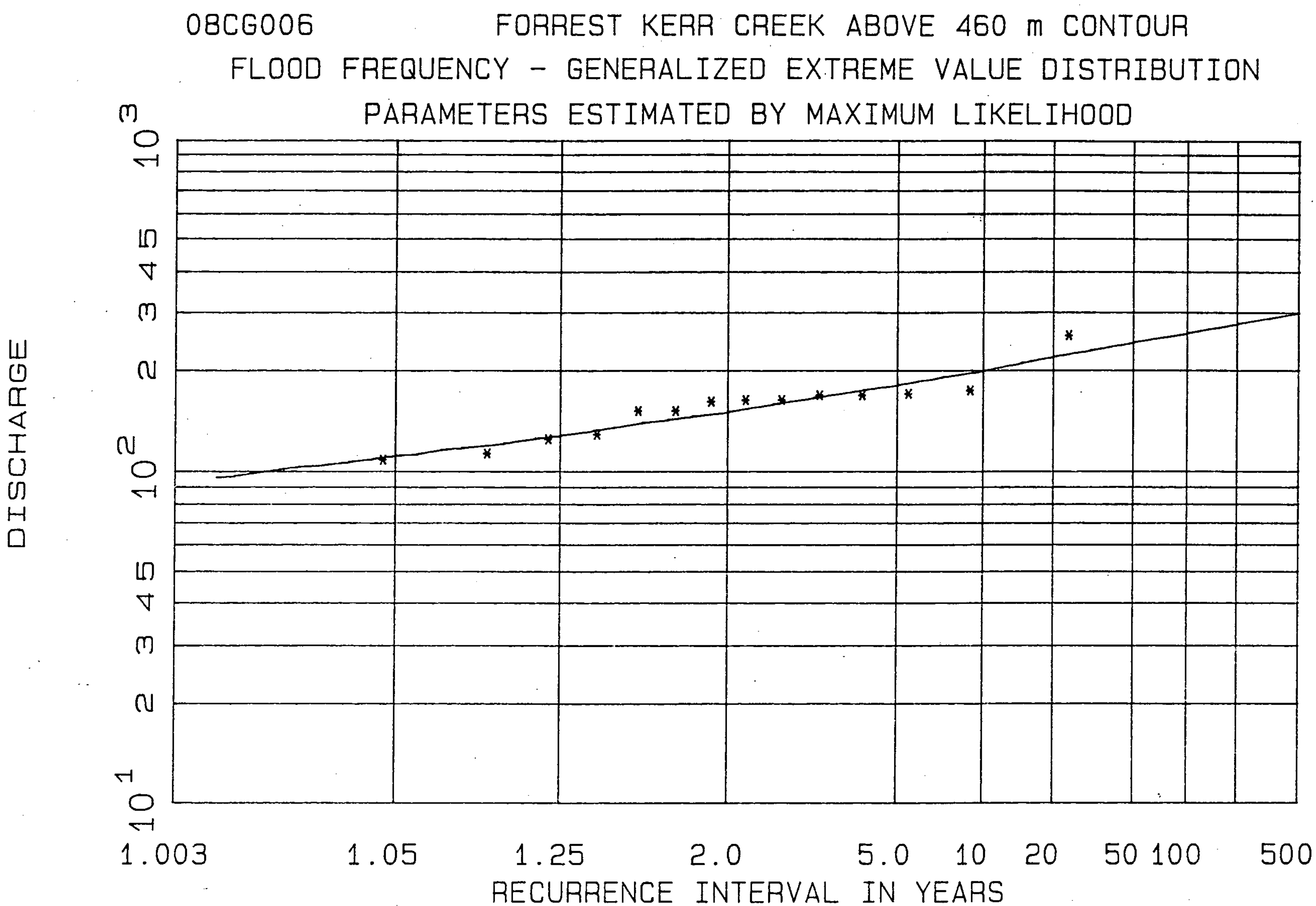


Figure 27 Flood Frequency Curve for Generalized Extreme Value - Maximum Daily Discharge

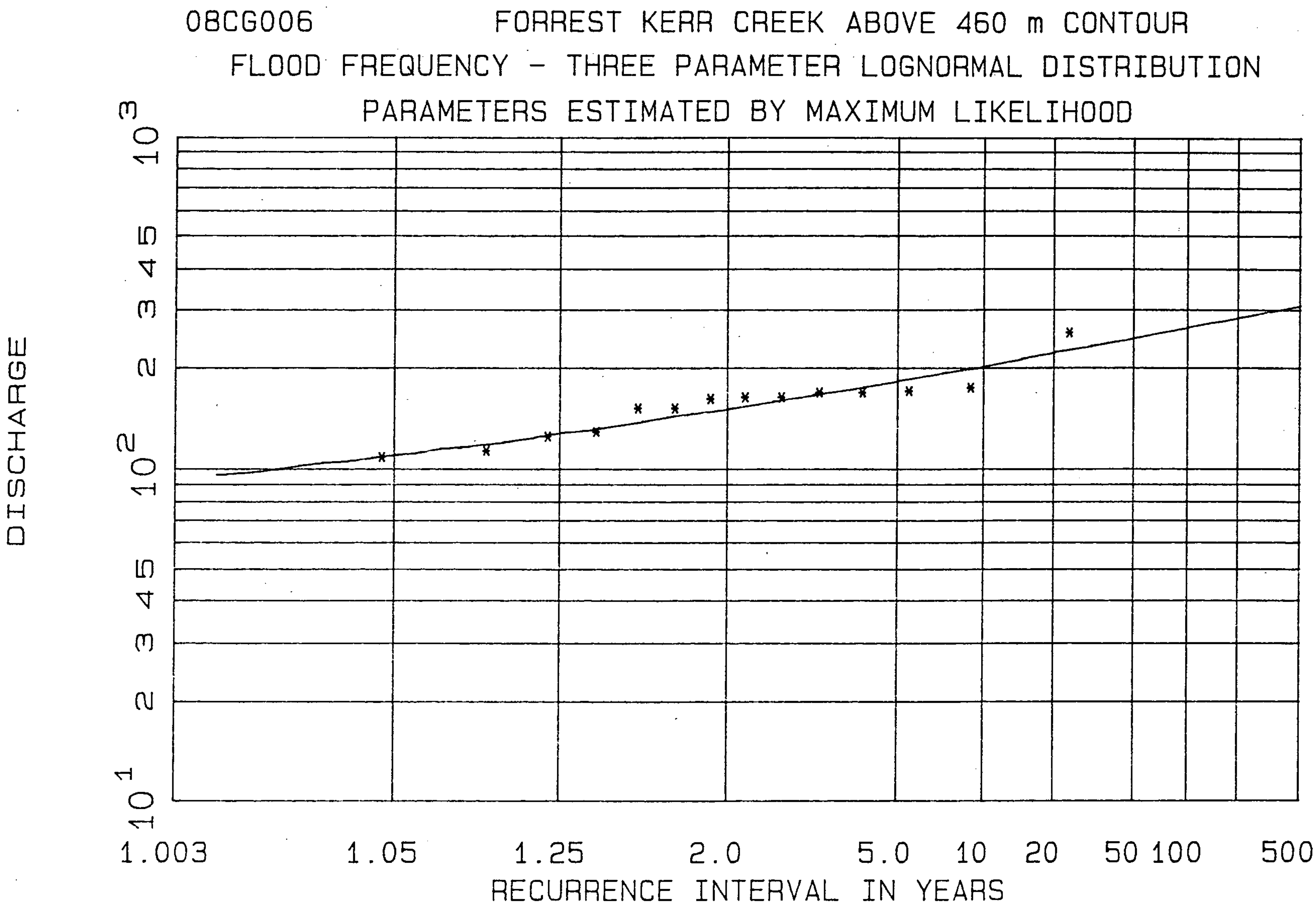


Figure 28 Flood Frequency Curve for Three Parameter Log Normal Distribution - Maximum Daily Discharge

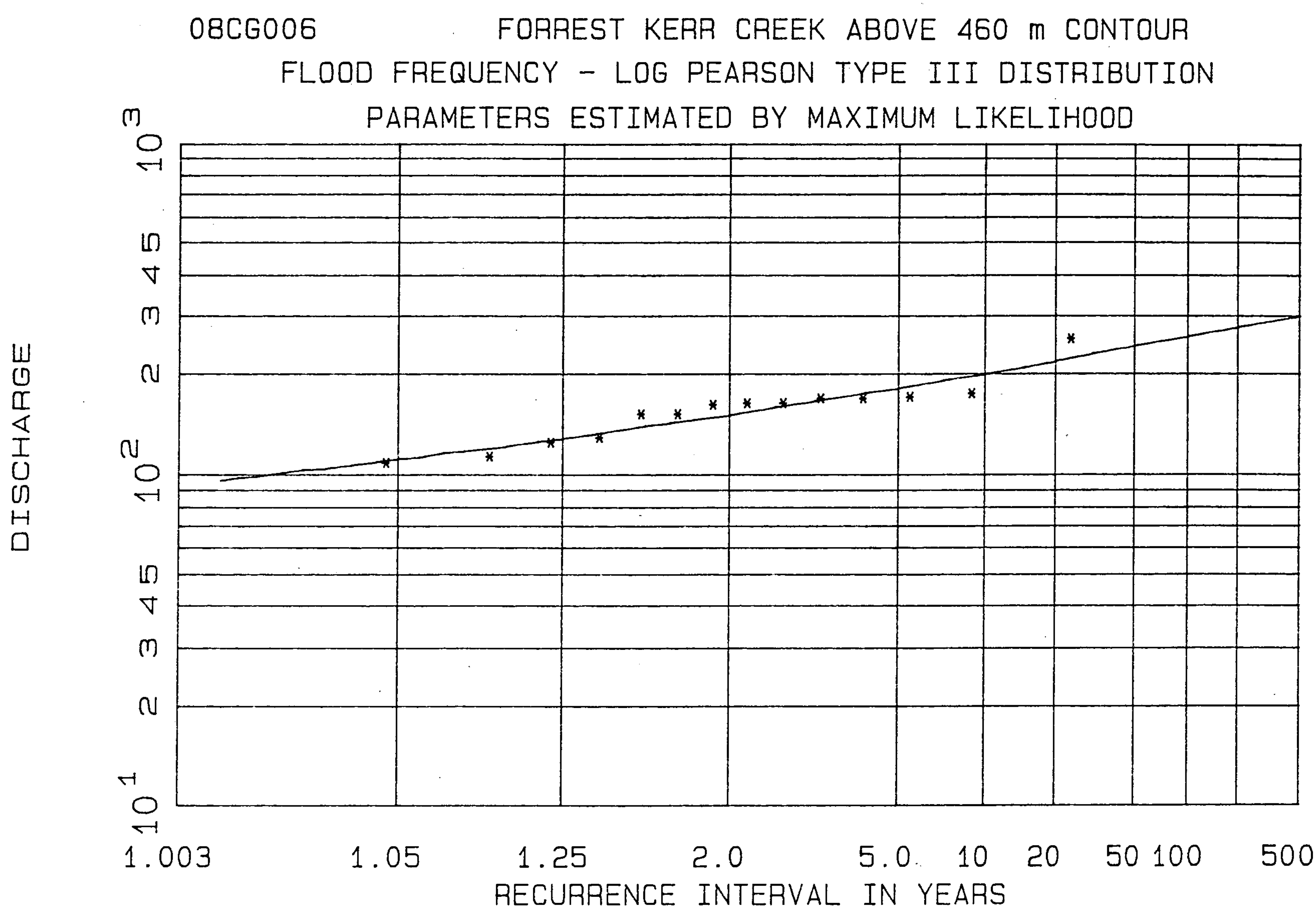


Figure 29 Flood Frequency Curve for Log Pearson III - Maximum Daily Discharge

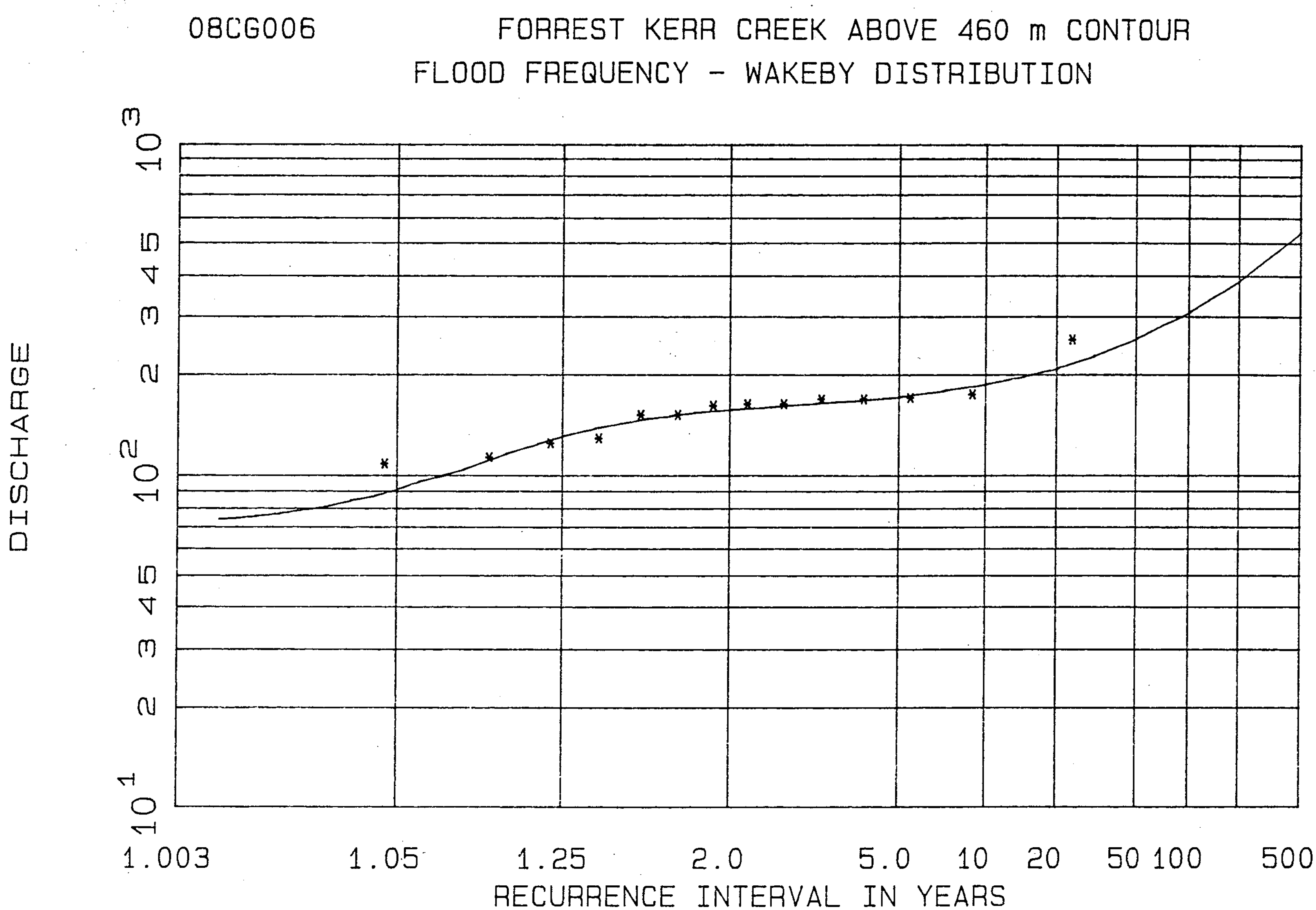


Figure 30 Flood Frequency Curve for Wakeby Distribution - Maximum Daily Discharge

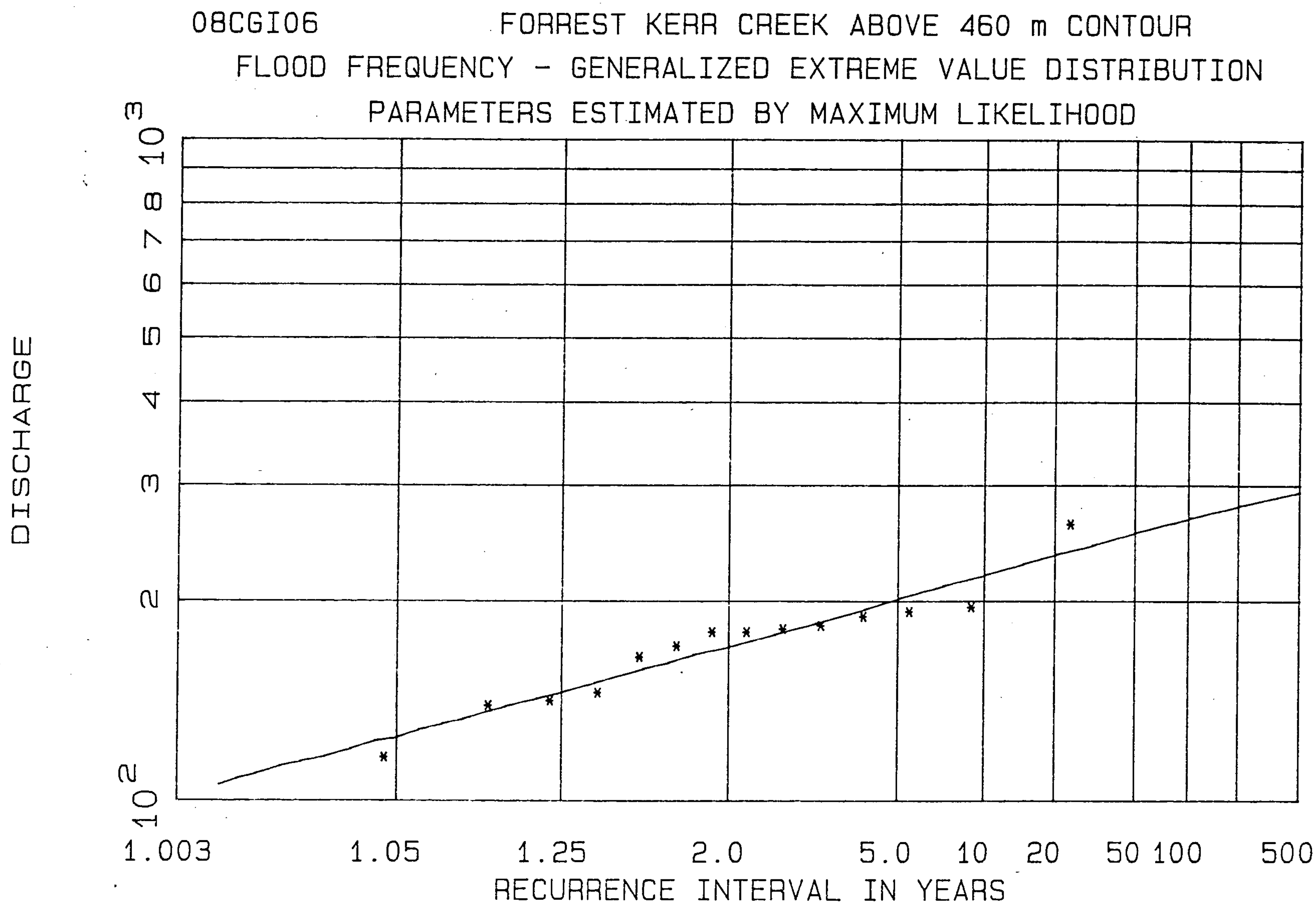


Figure 31 Flood Frequency Curve for Generalized Extreme Value Distribution - Maximum Instantaneous Discharge

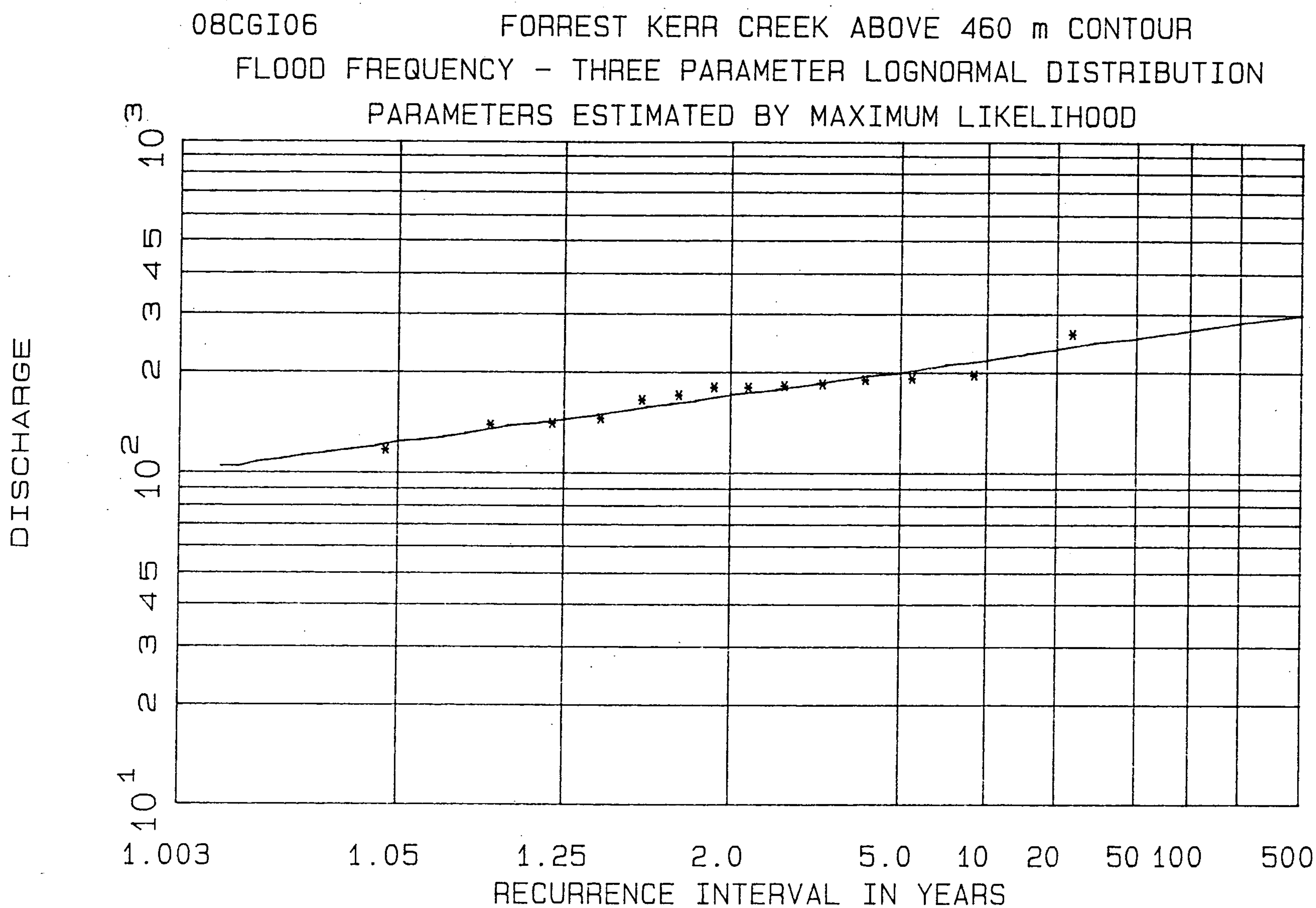


Figure 32 Flood Frequency Curve for Three Parameter Log Normal Distribution - Maximum Instantaneous Discharge

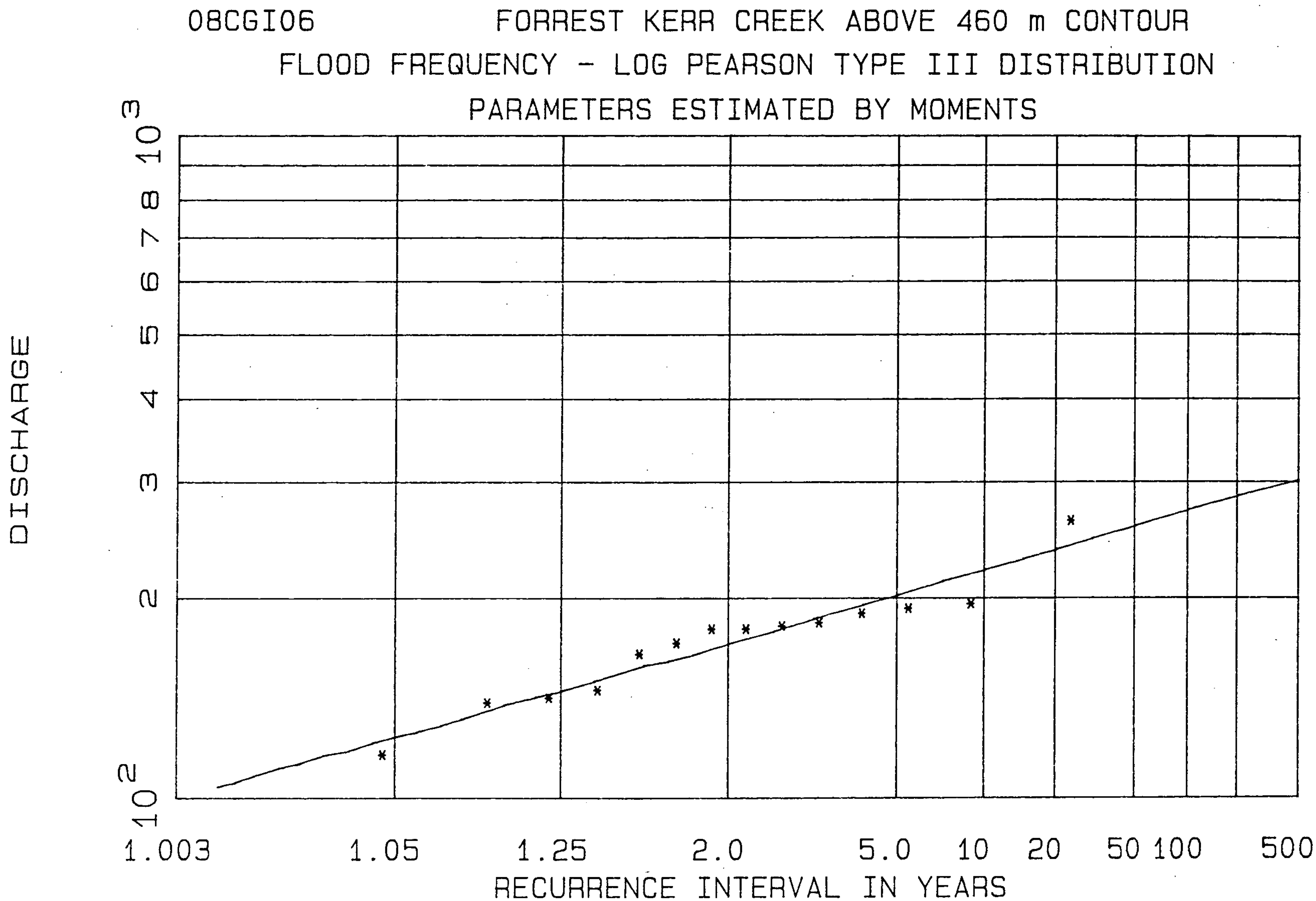


Figure 33 Flood Frequency Curve for Log Pearson III Distribution - Maximum Instantaneous Discharge

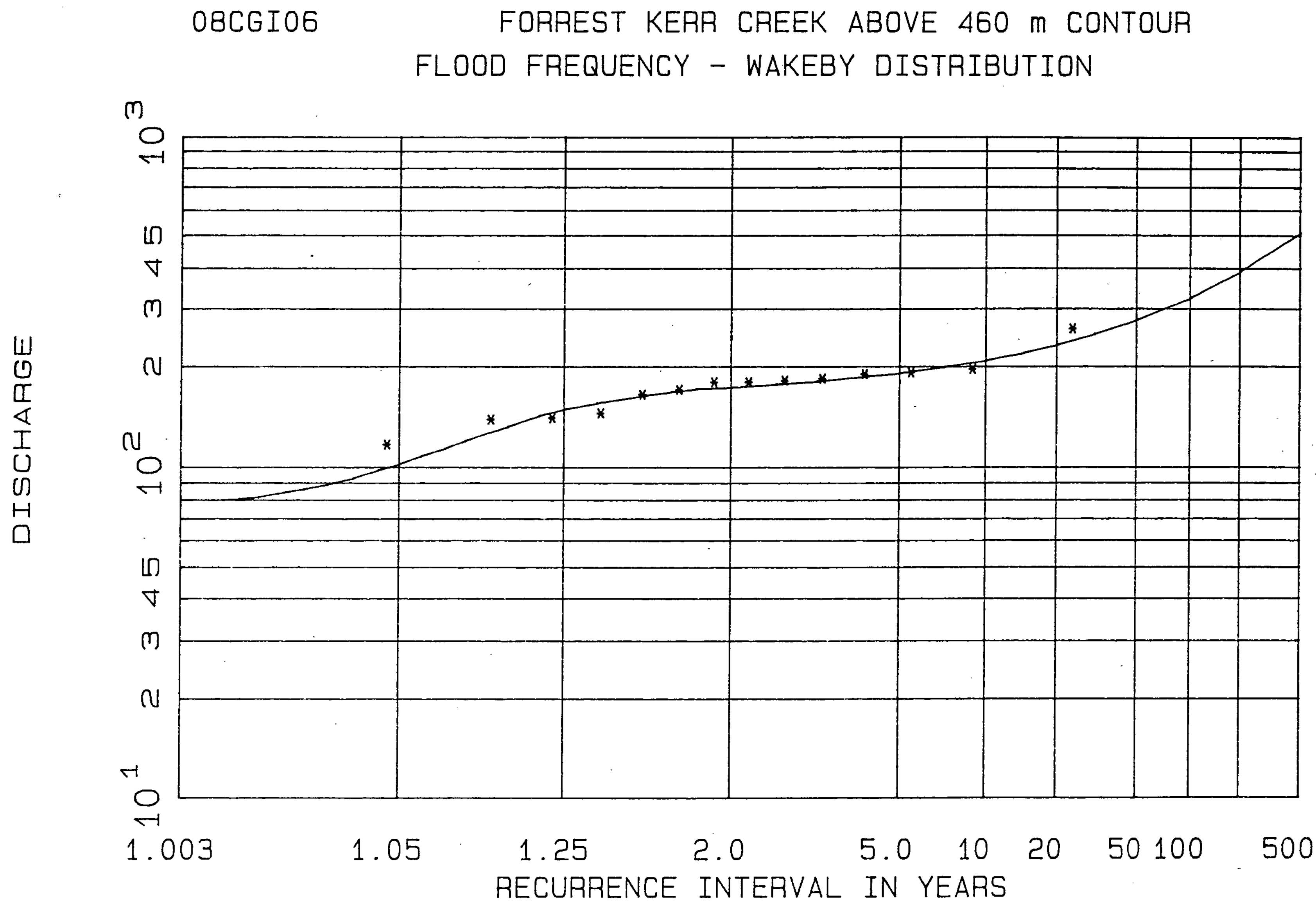


Figure 34 Flood Frequency Curve for Wakeby Distribution - Maximum Instantaneous Discharge

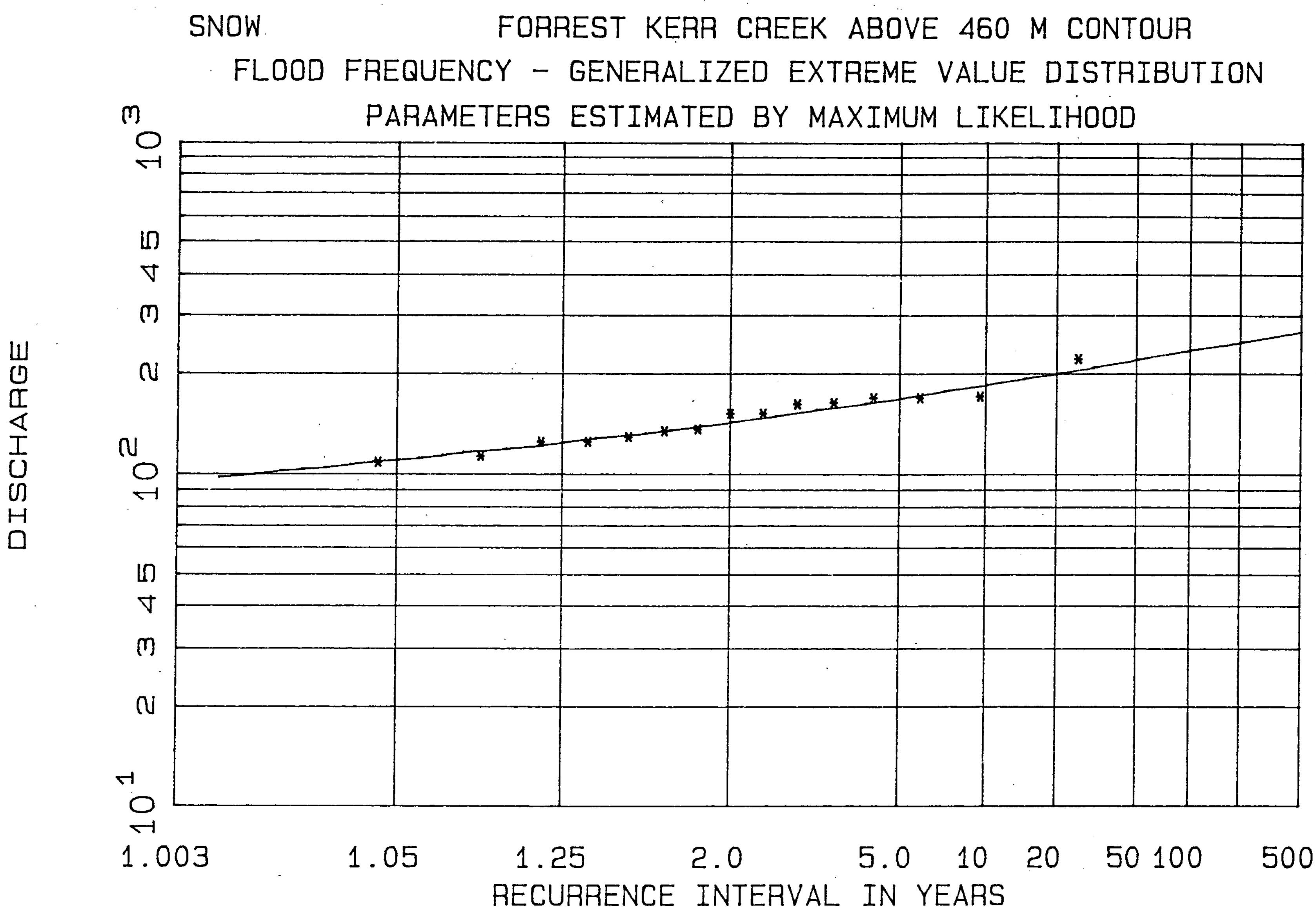


Figure 35 Flood Frequency Curve for Generalized Extreme Value - Snowmelt

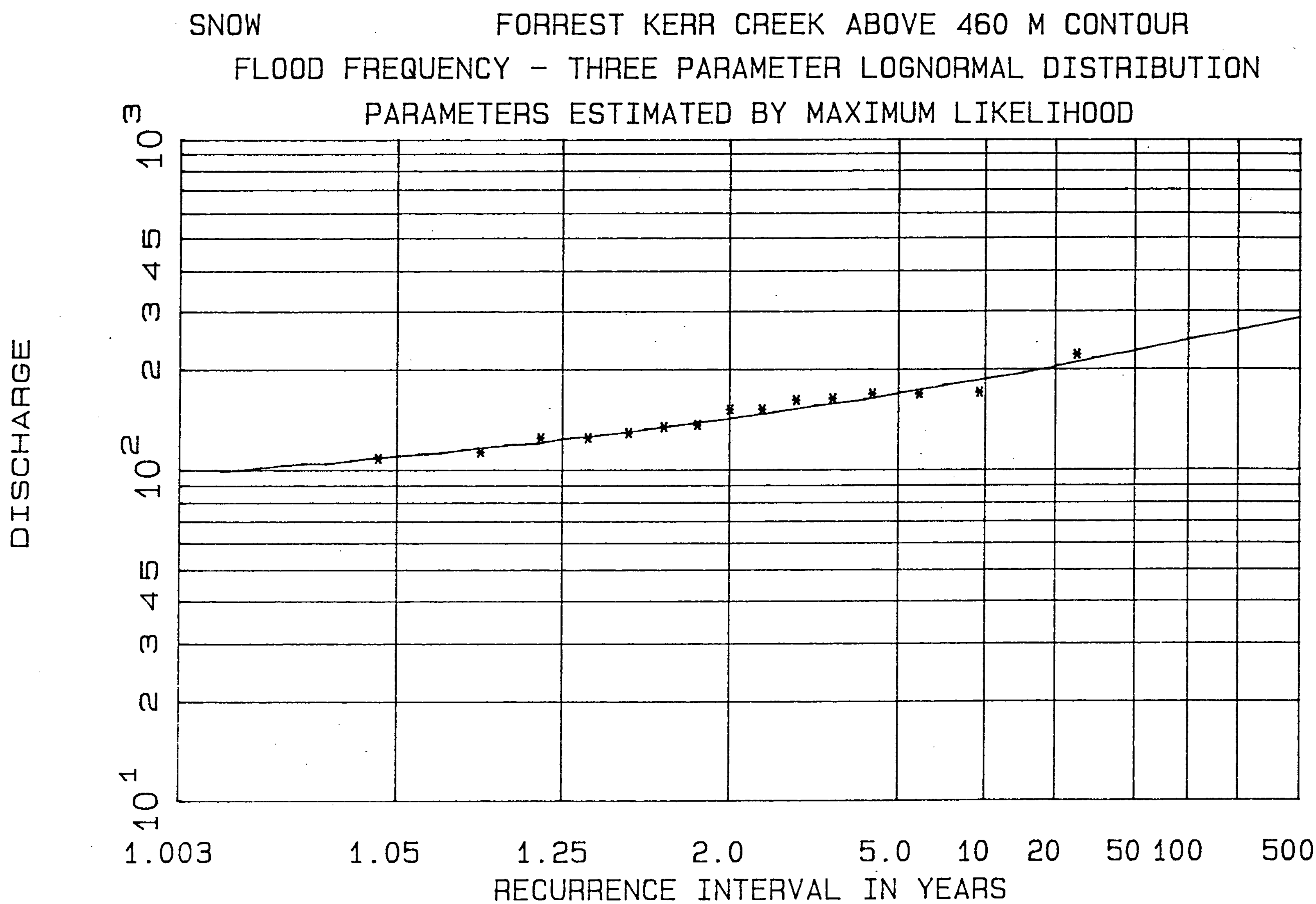


Figure 36 Flood Frequency Curve for Three Parameter Log Normal Distribution - Snowmelt

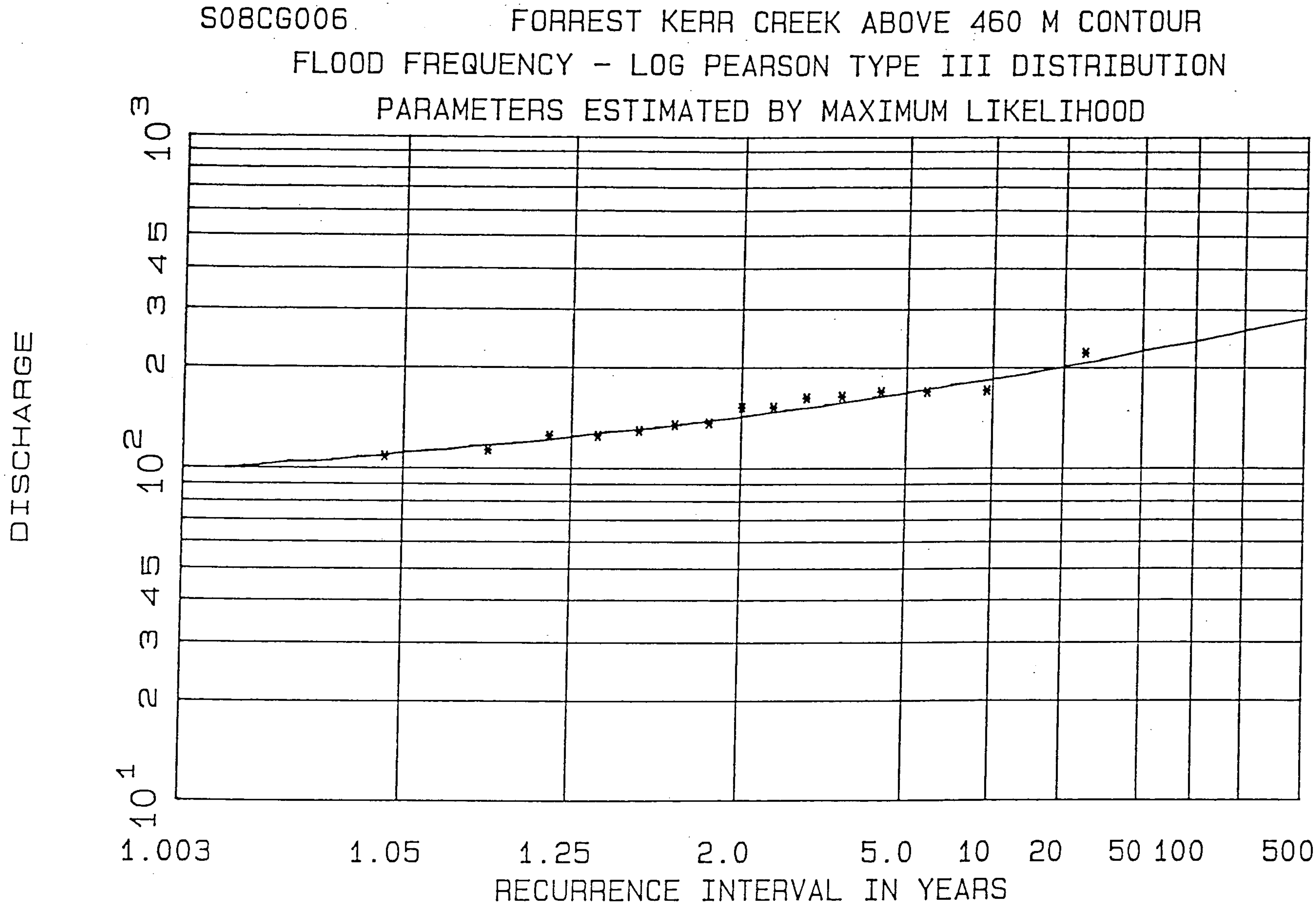


Figure 37 Flood Frequency Curve for Log Pearson III - Snowmelt

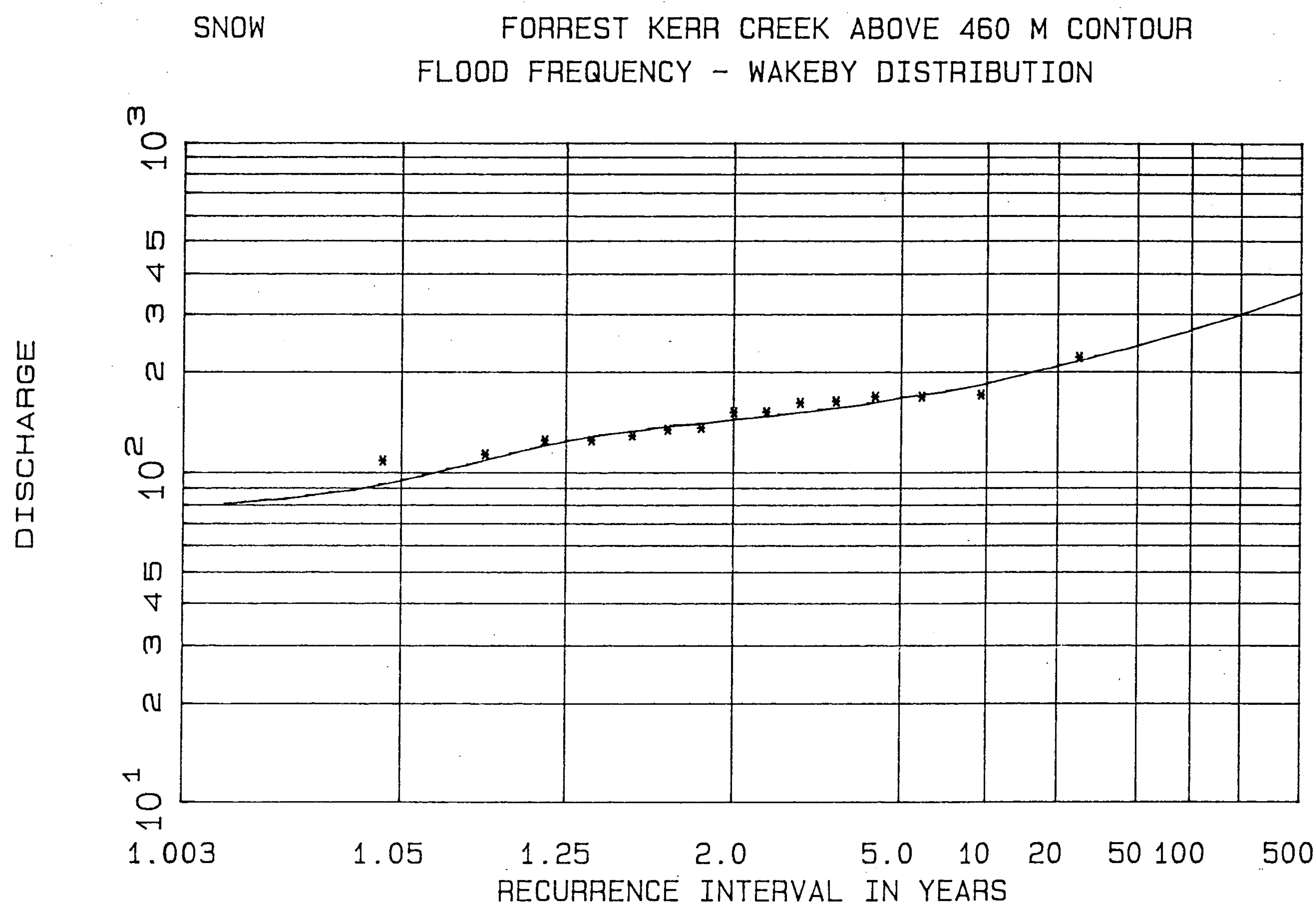


Figure 38 Flood Frequency Curve for Wakeby Distributions - Snowmelt

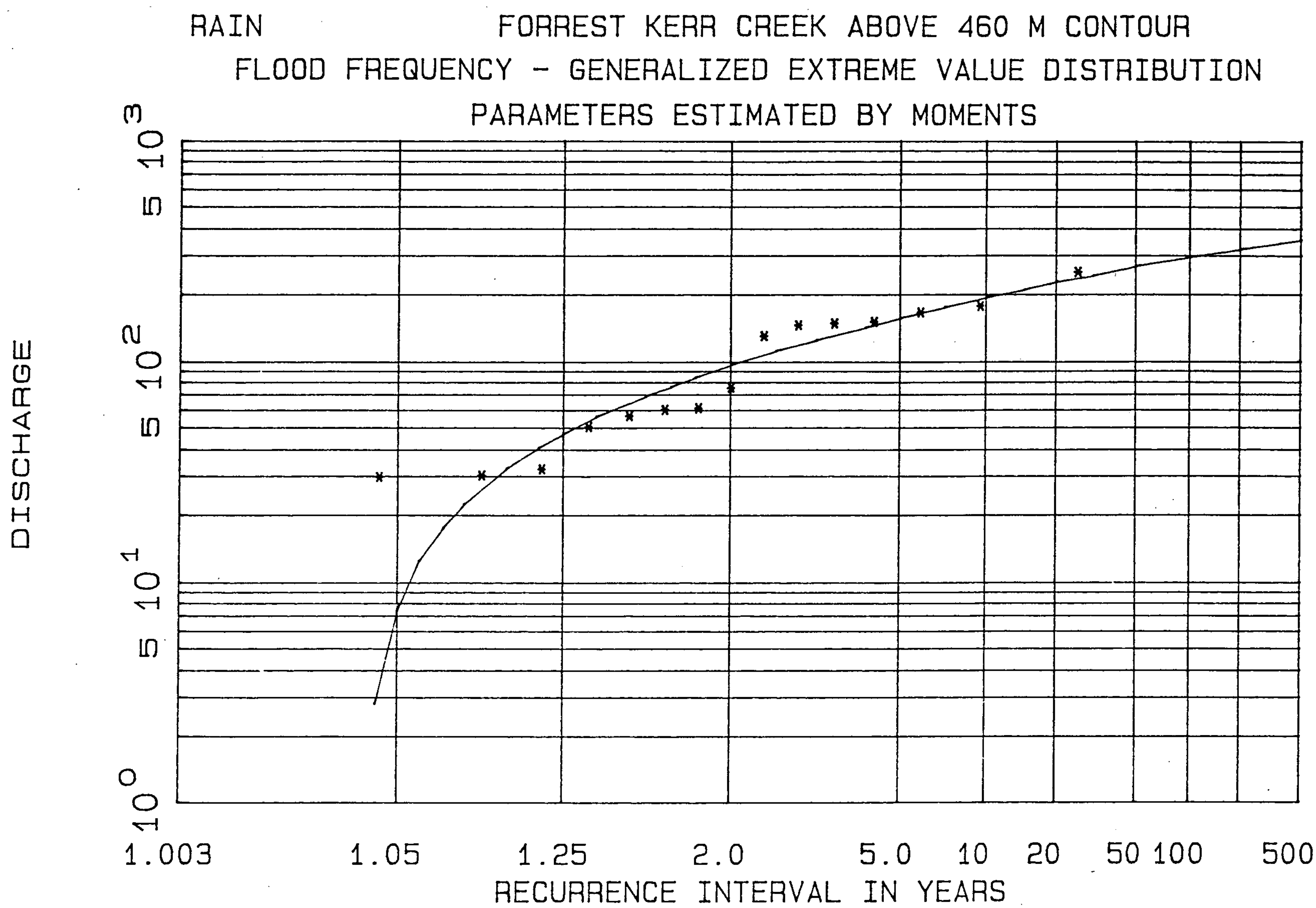


Figure 39 Flood Frequency Curve for Generalized Extreme Value Distribution - Rainfall

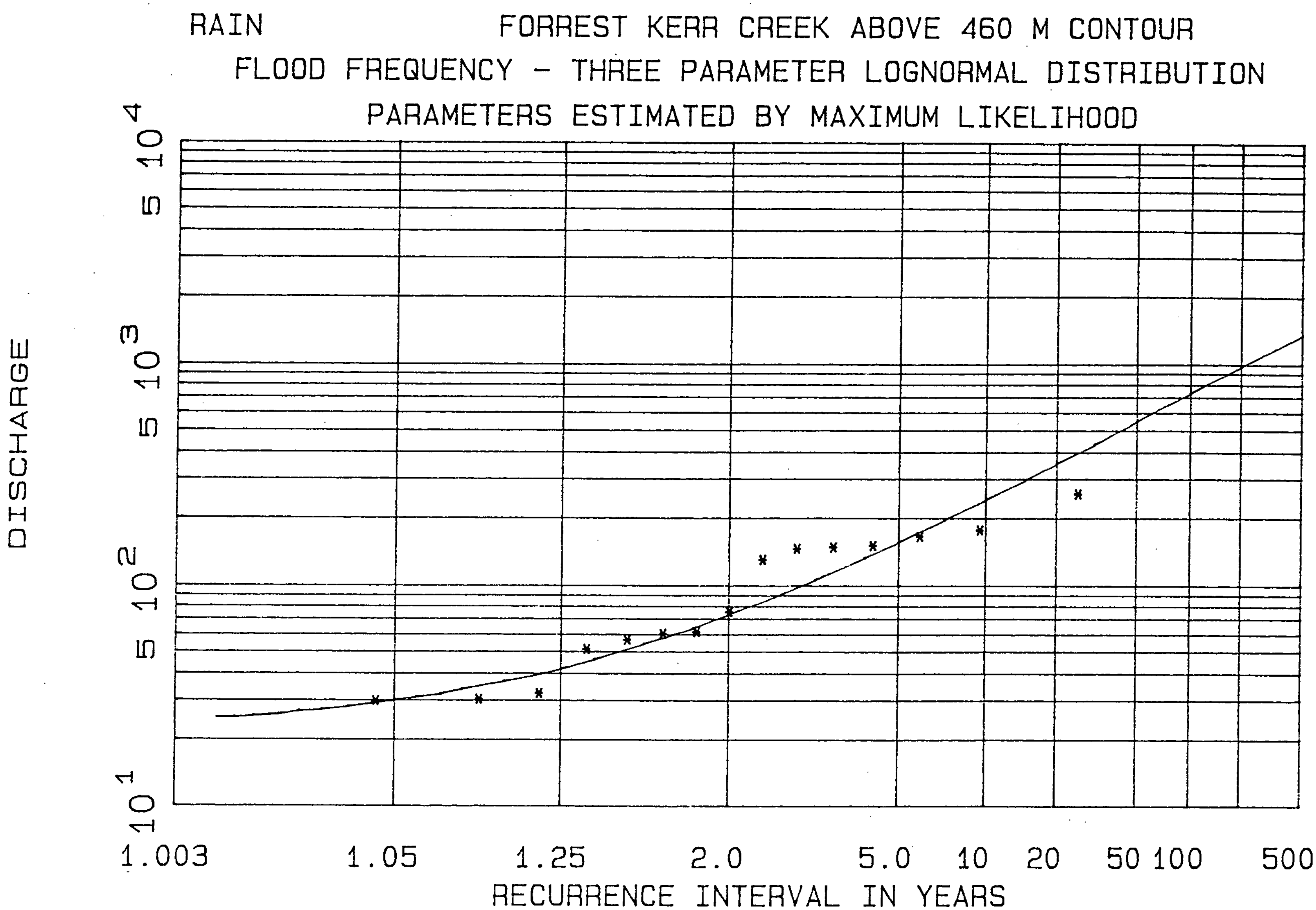


Figure 40 Flood Frequency Curve for Three Parameter Log Normal Distribution - Rainfall

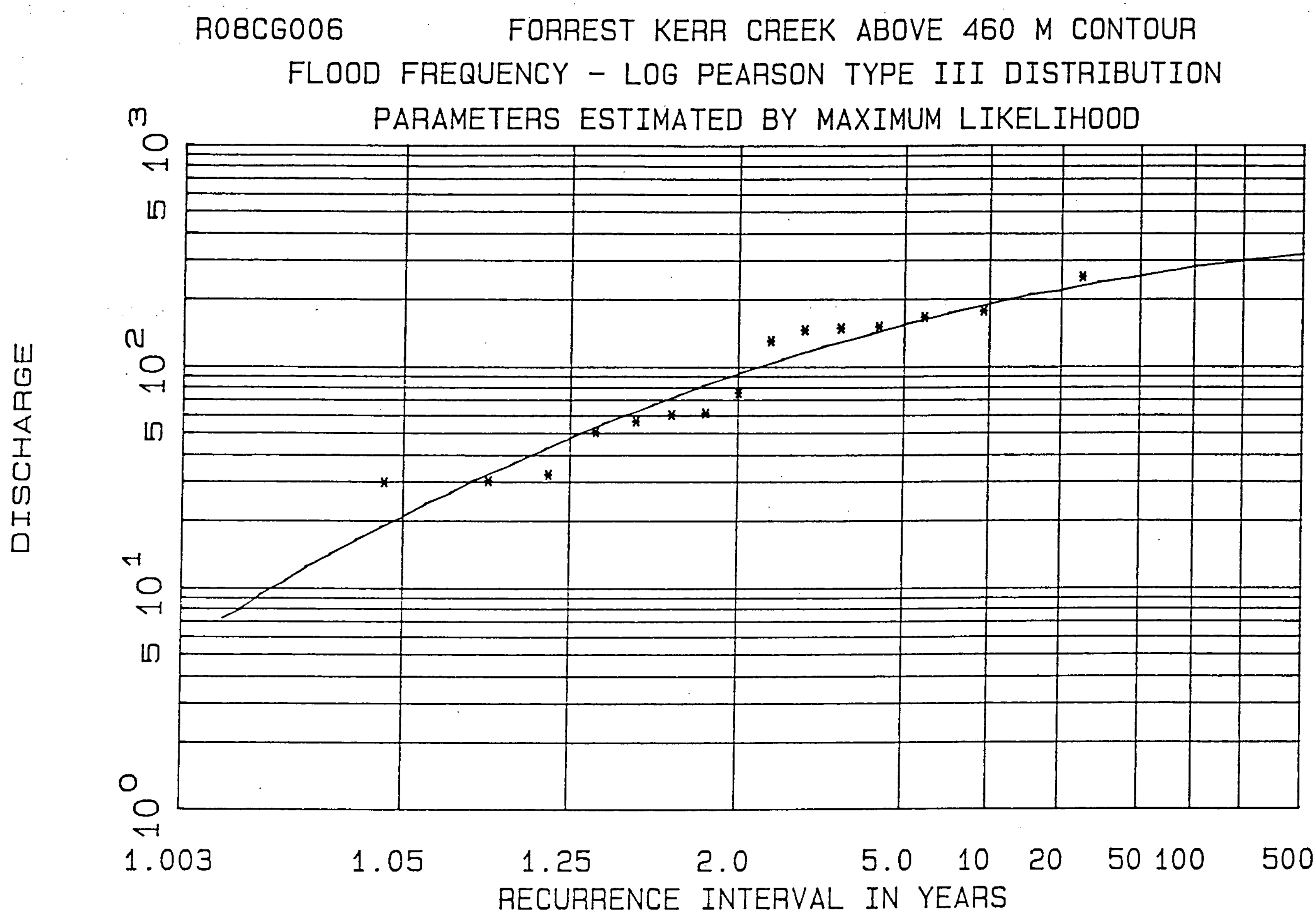


Figure 41 Flood Frequency Curve for Log Pearson III Distribution - Rainfall

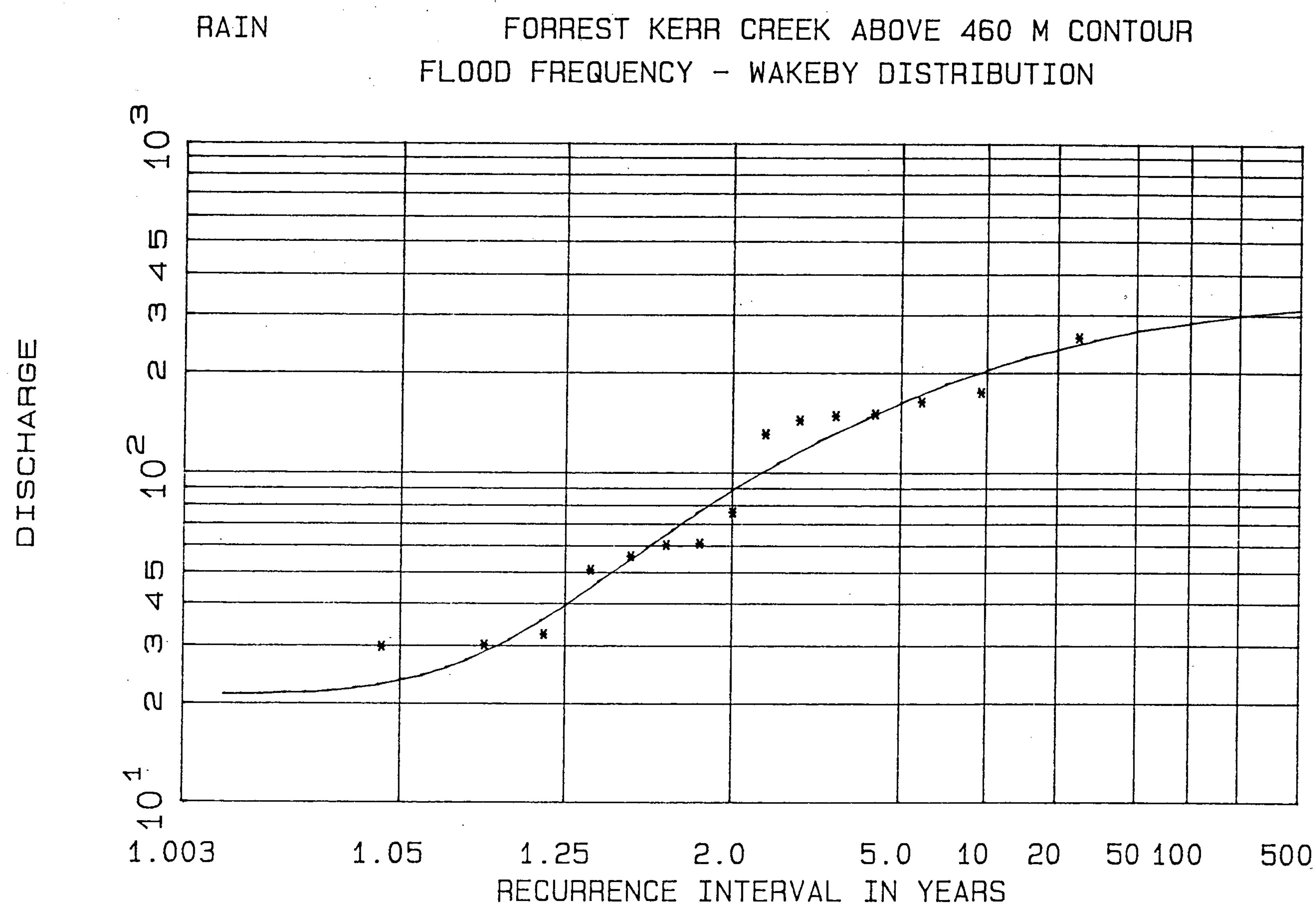
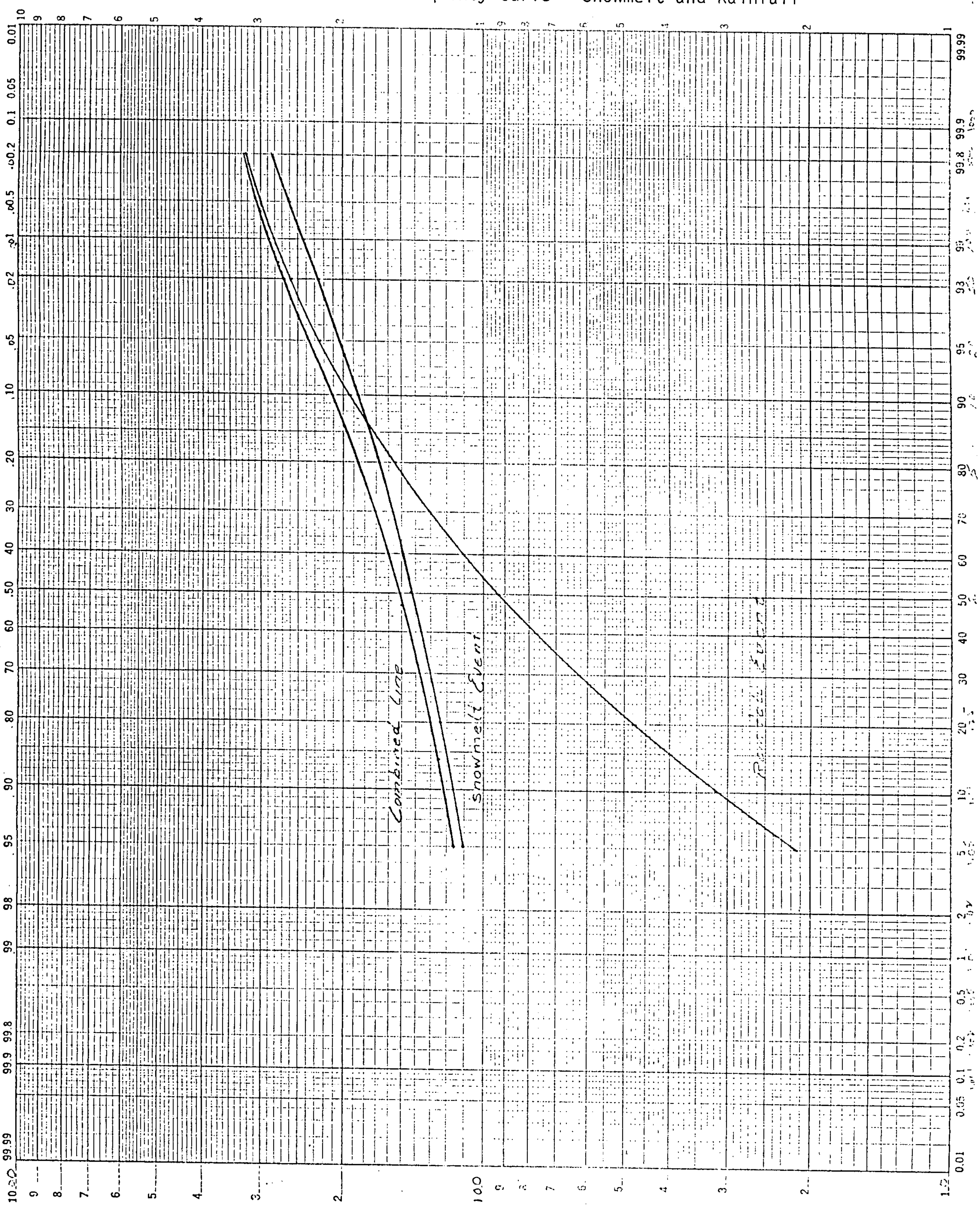


Figure 42 Flood Frequency Curve for Wakeby Distribution - Rainfall

Figure 43 Combined Frequency Curve - Snowmelt and Rainfall



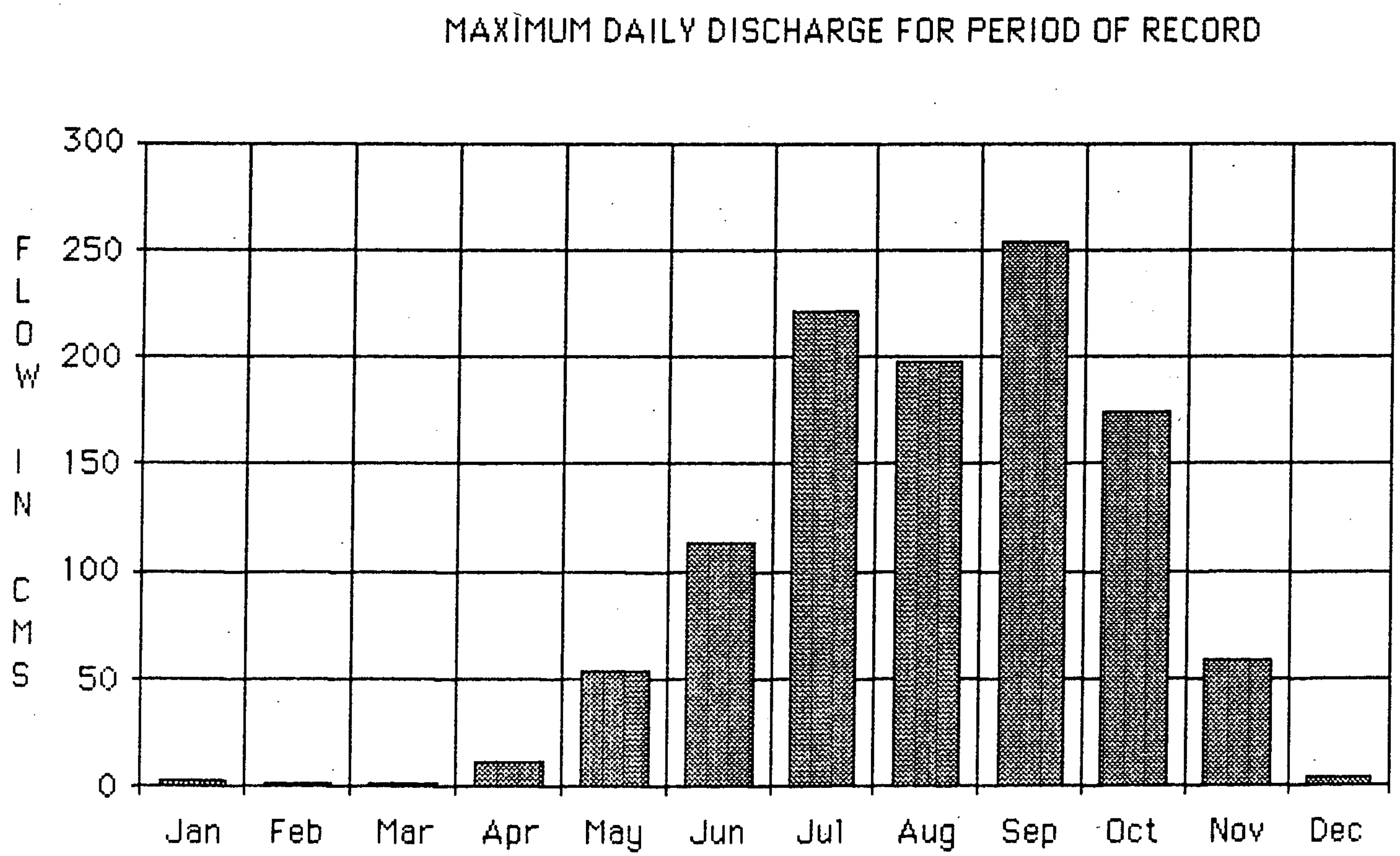


Figure 44 Distribution of Maximum Daily Discharge for Period of Record

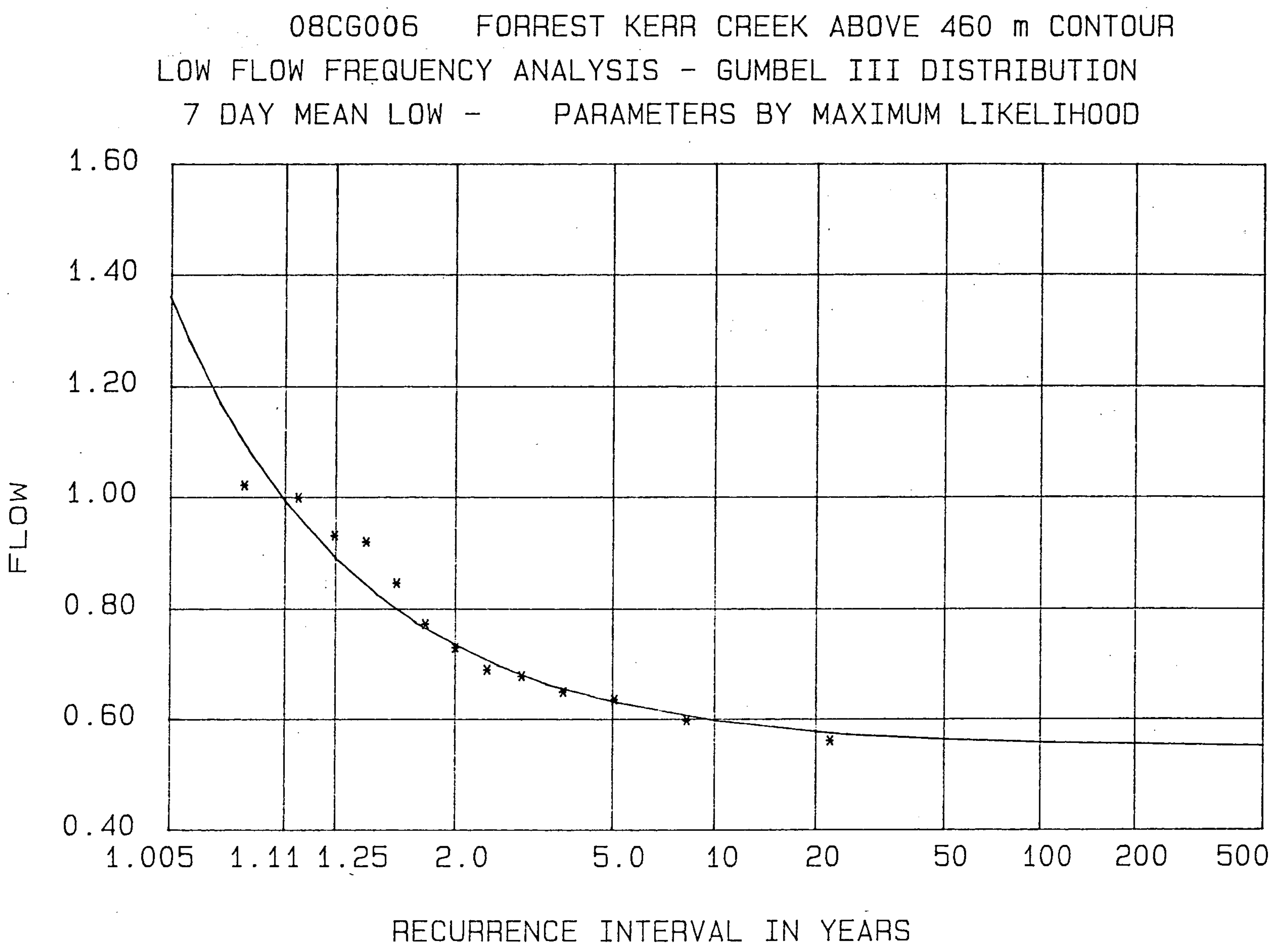


Figure 46 Seven Day Low Flow Frequency Curve for Gumbel III

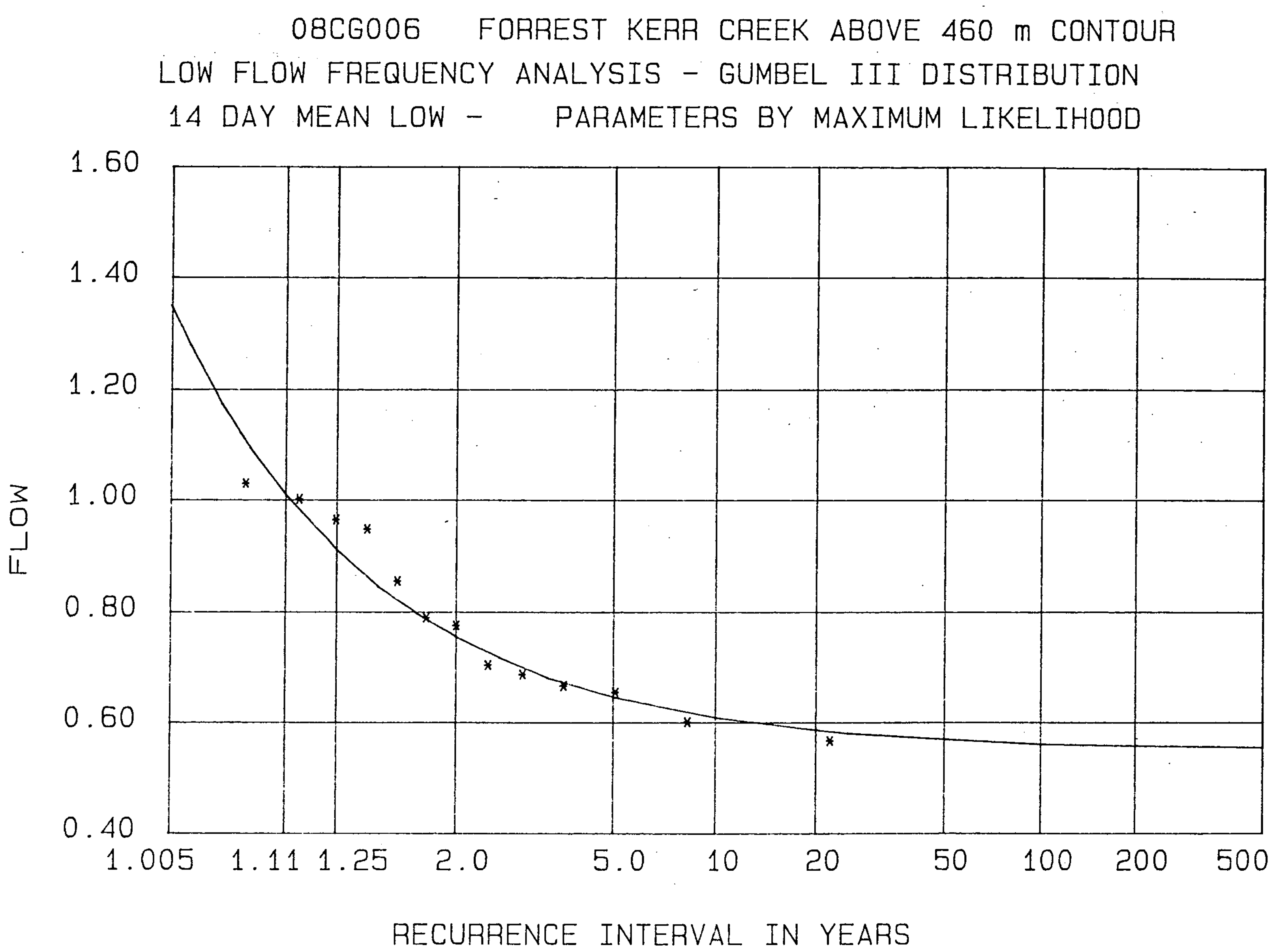


Figure 47 Fourteen Day Low Flow Frequency Curve for Gumbel III

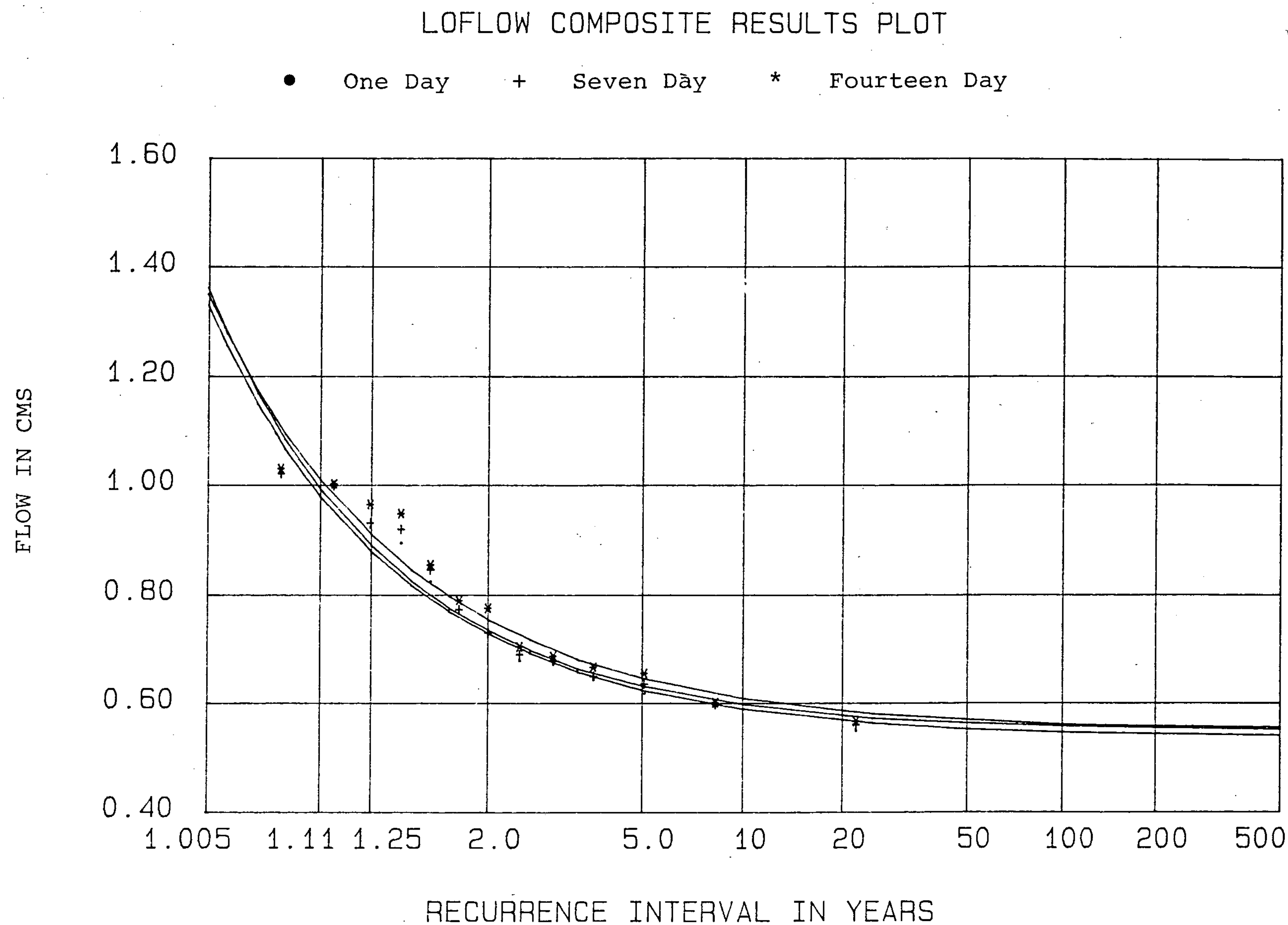


Figure 48 One, Seven, and Fourteen Day Low Flow Frequency Curves for Gumbel III

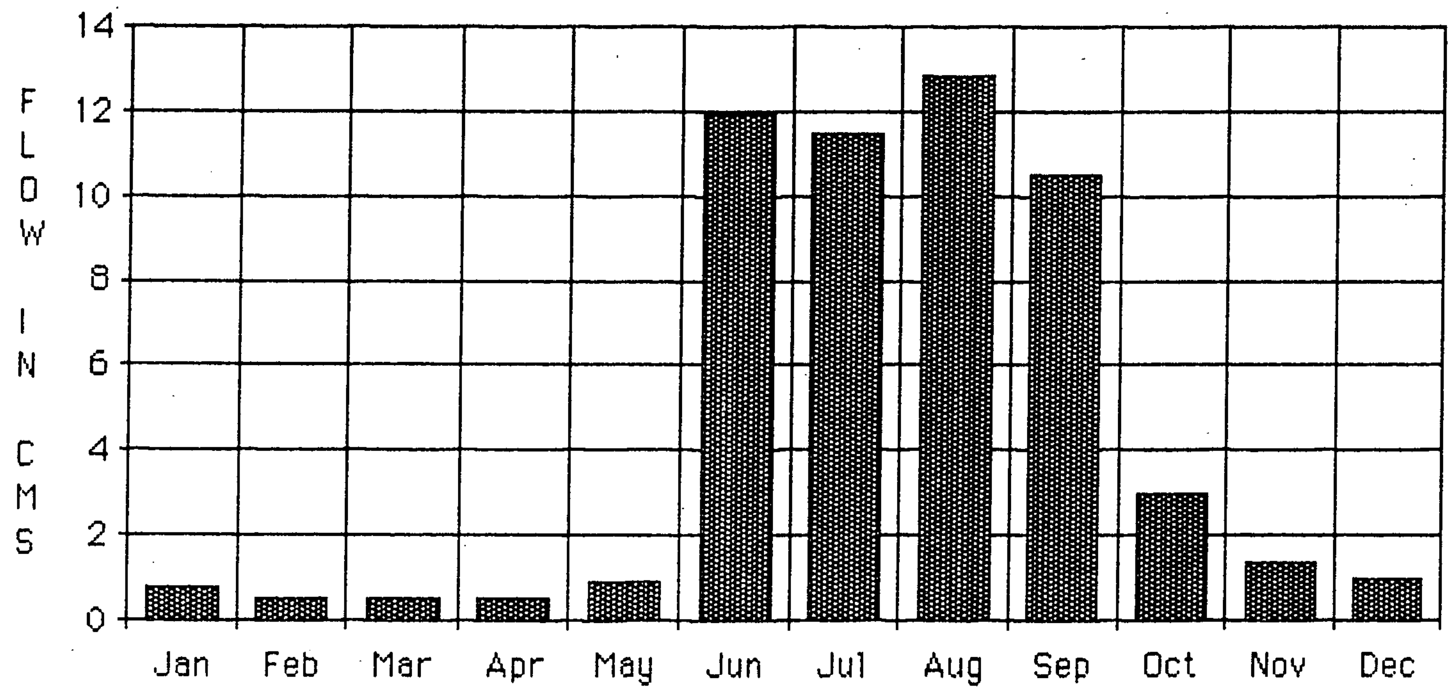


Figure 49 Distribution of Minimum Daily Discharge for Period of Record

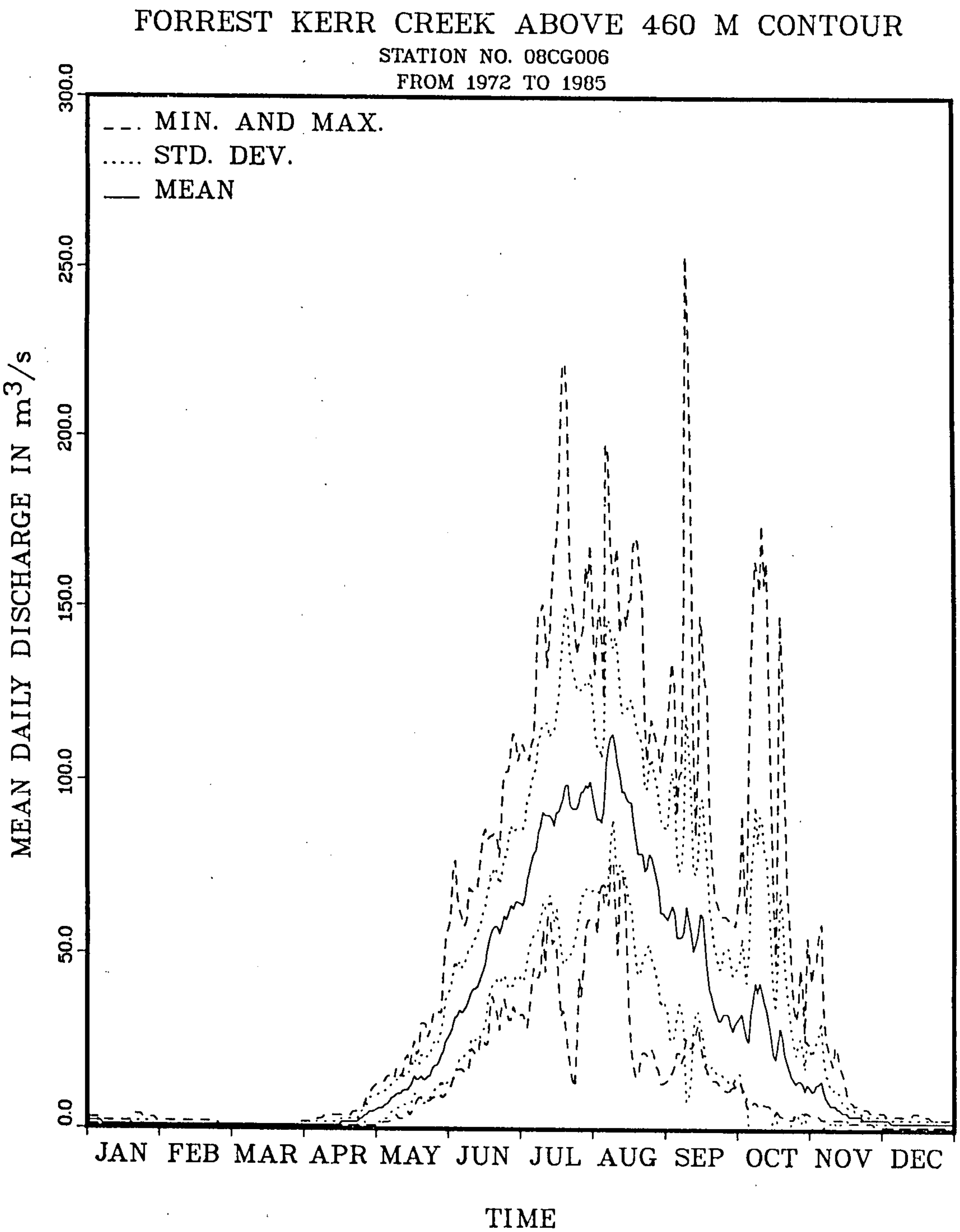


Figure 50 Hydrograph of the Maximum, Minimum, Mean and Standard Deviation of Daily Discharge

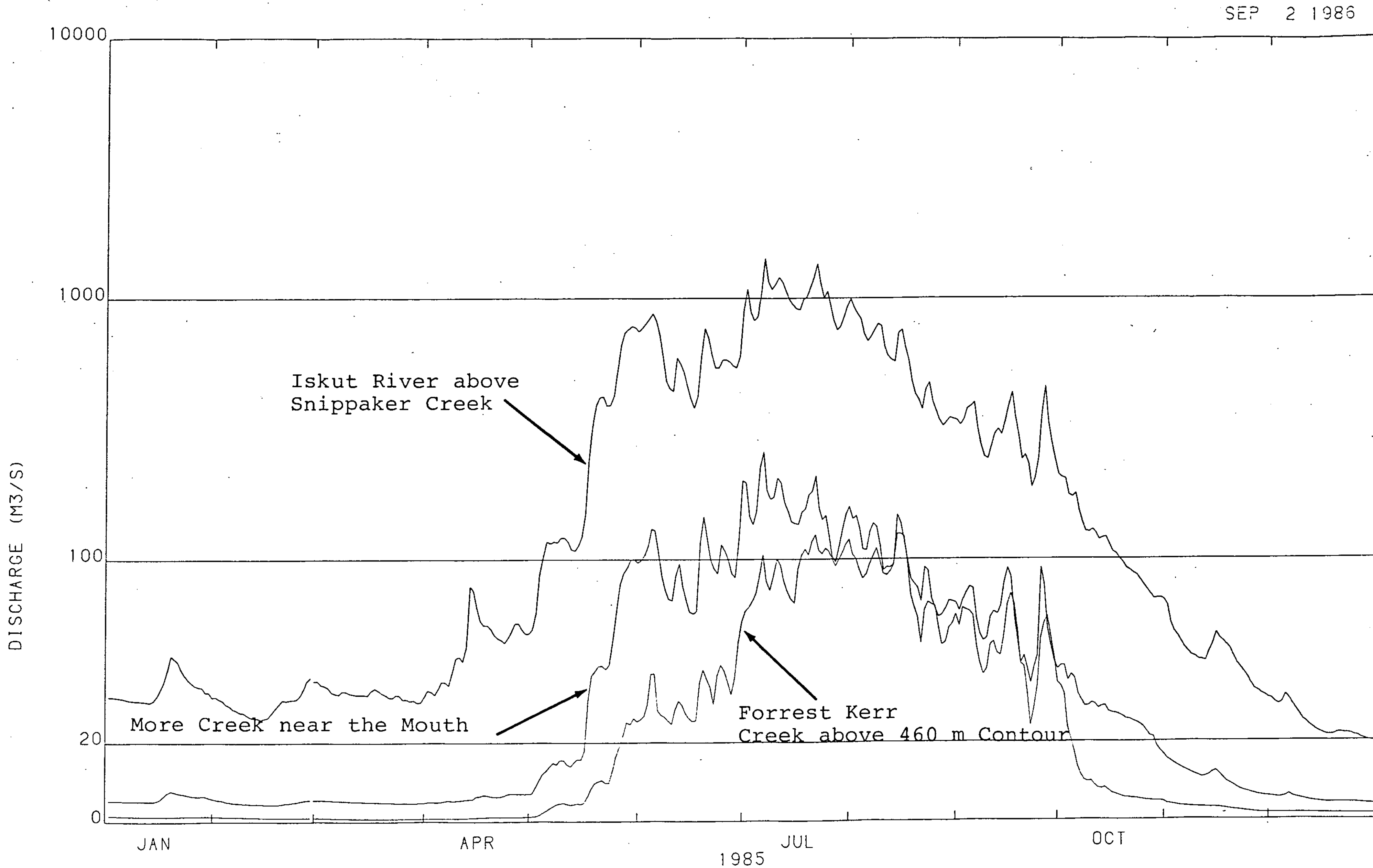


Figure 51 Hydrograph of 1985 for Forrest Kerr Creek, More Creek and Iskut River

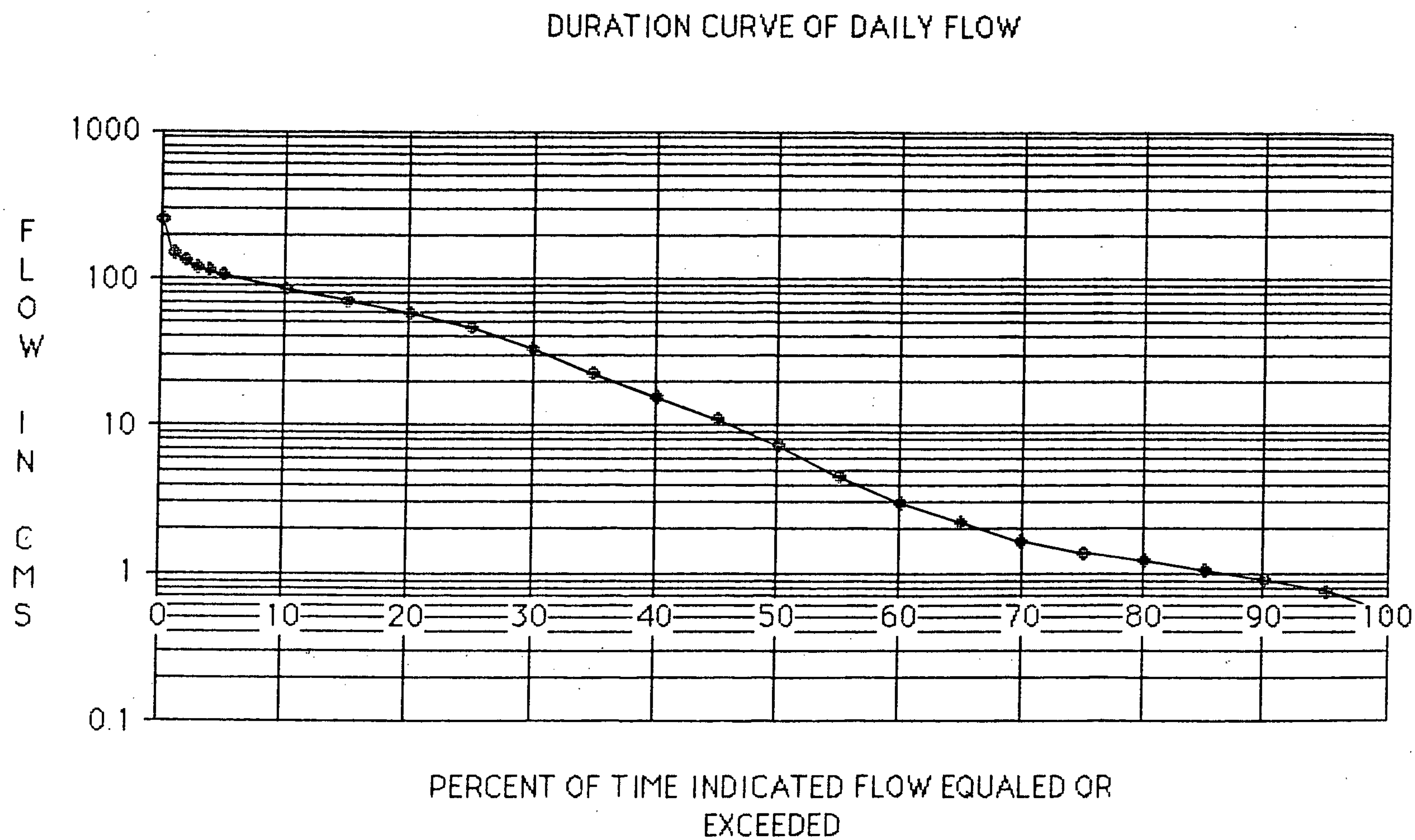


Figure 52 Duration Curve of Daily Flow