TABLE 27.7 ERROR LIMITS FOR FLOOD FREQUENCY CURVES

Years of record (n)	Exceedance frequency (%, at 5% level)						
	99.9	99	90	50	10	1	0.1
5	1.22	1.00	0.76	0.95	2.12	3.41	4.41
10	0.94	0.76	0.57	0.58	1.07	1.65	2.11
15	0.80	0.65	0.48	0.46	0.79	1.19	1.52
20	0.71	0.58	0.42	0.39	0.64	0.97	1.23
30	0.60	0.49	0.35	0.31	0.50	0.74	0.93
40	0.53	0.43	0.31	0.27	0.42	0.61	0.77
50	0.49	0.39	0.28	0.24	0.36	0.54	0.67
70	0.42	0.34	0.24	0.20	0.30	0.44	0.55
100	0.37	0.29	0.21	0.17	0.25	0.36	0.45
	0.1	1	10	50	90	99	99.9
	Exceedance frequency (%, at 95% level)						

Note: Tabular values are multiples of the standard deviation of the variate. Five percent error limits are added to the flood value from the fitted curve at the same exceedance frequency and the sum plotted. Ninety-five percent limits are subtracted from the flood value at the same exceedance frequency. Log values are added or subtracted before antilogging and plotting.

to form a reliability band. Table 27.7 shows the factors by which the standard deviations of the variate must be multiplied to mark off a 90 percent reliability band above and below the frequency curve. The 5 percent level, for example, means that only 5 percent of future values should fall higher than the limit, and, similarly, only 5 percent should fall under the 95 percent limit. Nine of ten should fall within the band.

EXAMPLE 27.8

The maximum annual instantaneous flows from the Maury River near Lexington, Virginia, for a 26-year period are listed in Table 27.8.

Plot the log–Pearson III curve of best fit and determine the magnitude of the flood to be equaled or exceeded once in 5, 10, 50, and 100 years. Using Table 27.7, also plot the upper and lower confidence limits.

TABLE 27.8

Water (year)	Discharge (cfs)	Water (year)	Discharge (cfs)	Water (year)	Discharge (cfs)
1926	6,730	1935	13,800	1944	6,680
1927	9,150	1936	40,000	1945	6,540
1928	6,310	1937	10,200	1946	5,560
1929	10,000	1938	13,400	1947	7,700
1930	15,000	1939	8,950	1948	8,630
1931	2,950	1940	11,900	1949	14,500
1932	8,650	1941	5,840	1950	23,700
1933	11,100	1942	20,700	1951	15,100
1934	6,360	1943	12,300		

Solution

1. The statistical calculations are summarized as follows:

	Arithmetic	Log
Mean $\bar{x}$	11,606	4.001
Variance s^2	53.87×10^6	0.0516
Skew coefficient C_s	2.4	0.38

2. After forming an array and computing plotting positions, the data are plotted in Fig. 27.11.
3. Plotting data for log–Pearson III (Table 27.9) are developed from Table B.2. Confidence limits are plotted in Fig. 27.11 using Table 27.7. ■■

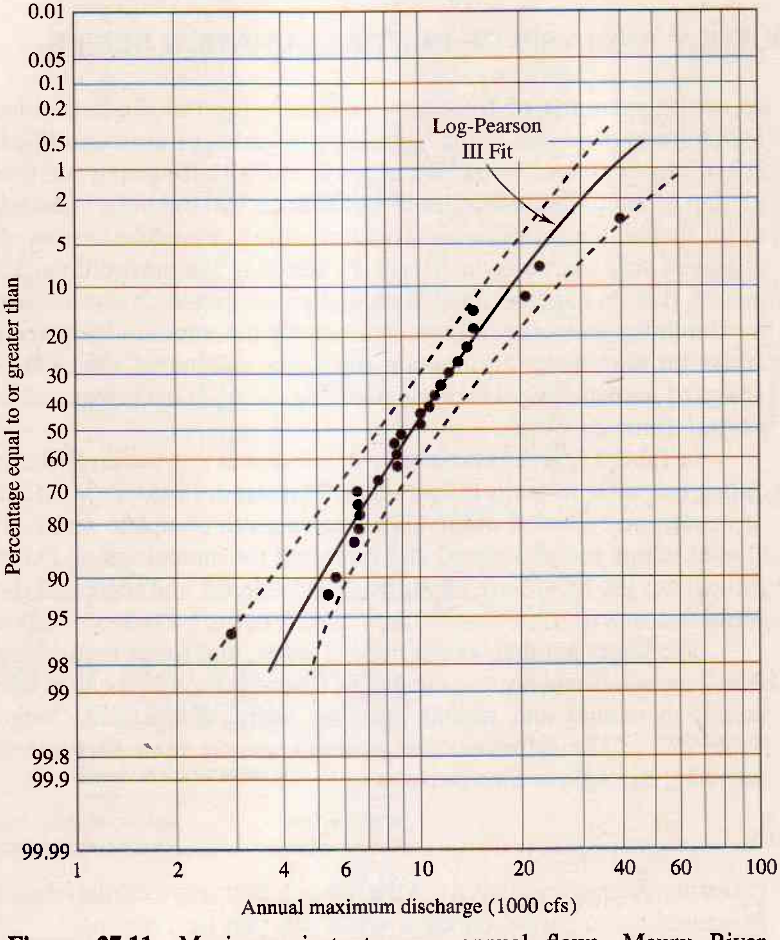

Figure 27.11 Maximum instantaneous annual flows, Maury River, Lexington, Virginia.

TABLE 27.9

Chance (%)	T (yr)	($C_s = 0.38$) K	($\bar{y} = 4.001$) ($s_y = 0.227$) $\bar{y} + Ks_y = \log Q$	Q
99	1.01	−2.044	3.537	3,443
95	1.05	−1.530	3.653	4,498
90	1.11	−1.234	3.721	5,260
80	1.25	−0.855	3.760	5,754
50	2	−0.062	3.987	9,705
20	5	0.818	4.187	15,380
10	10	1.315	4.300	19,950
4	25	1.874	4.426	26,690
2	50	2.251	4.512	32,510
1	100	2.601	4.591	39,030
0.5	200	2.930	4.666	46,360

27.6 FREQUENCY ANALYSIS OF PARTIAL DURATION SERIES

In earlier examples of frequency analysis, only the series of annual maximum or minimum occurrences in the hydrologic record have been described. These extremes constitute an *annual series* that is consistent with frequency analysis and the manipulation of annual probabilities of occurrence. All the observed data—say, all floods or all the daily streamflows—would constitute a *complete series.* Any subset of the complete series is a *partial series.* In selecting the maximum annual events from a record, it often happens that the second greatest event in one year exceeds the annual maximum in some other year. Analysis of the annual series neglects such events. Although they generally contain the same number of events, the extreme values analyzed without regard for the period (i.e., year) of occurrence, is usually termed the *partial duration series.*

In Table 27.10 the maximum rainfall depths that occurred for any 30-min period during excessive rainfalls at Baltimore, Maryland, 1945–1954, are shown in the order of occurrence. The 65 observations represent a complete series. The 11 maximum annual events are underlined and represent the annual series. the greatest 11 events throughout the record are identified by an asterisk and represent the partial duration series.

The larger numbers occur in both series, and hence recurrence intervals for the less-frequent events are the same. The theoretical differences in recurrence intervals based on annual and partial duration series of the same length are shown in Table 27.11. The difference for intervals greater than 10 years is negligible. The following example is illustrative.

EXAMPLE 27.9

Perform a frequency analysis of the 30-min Baltimore rainfall data in Table 27.10 as an annual and a partial duration series and plot the results.

Solution. See Table 27.12. The data are plotted in Fig. 27.12. ■■