

WATER RESOURCES ANALYSIS
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MONTHLY STREAMFLOW IN THE KLICKITAT BASIN

by

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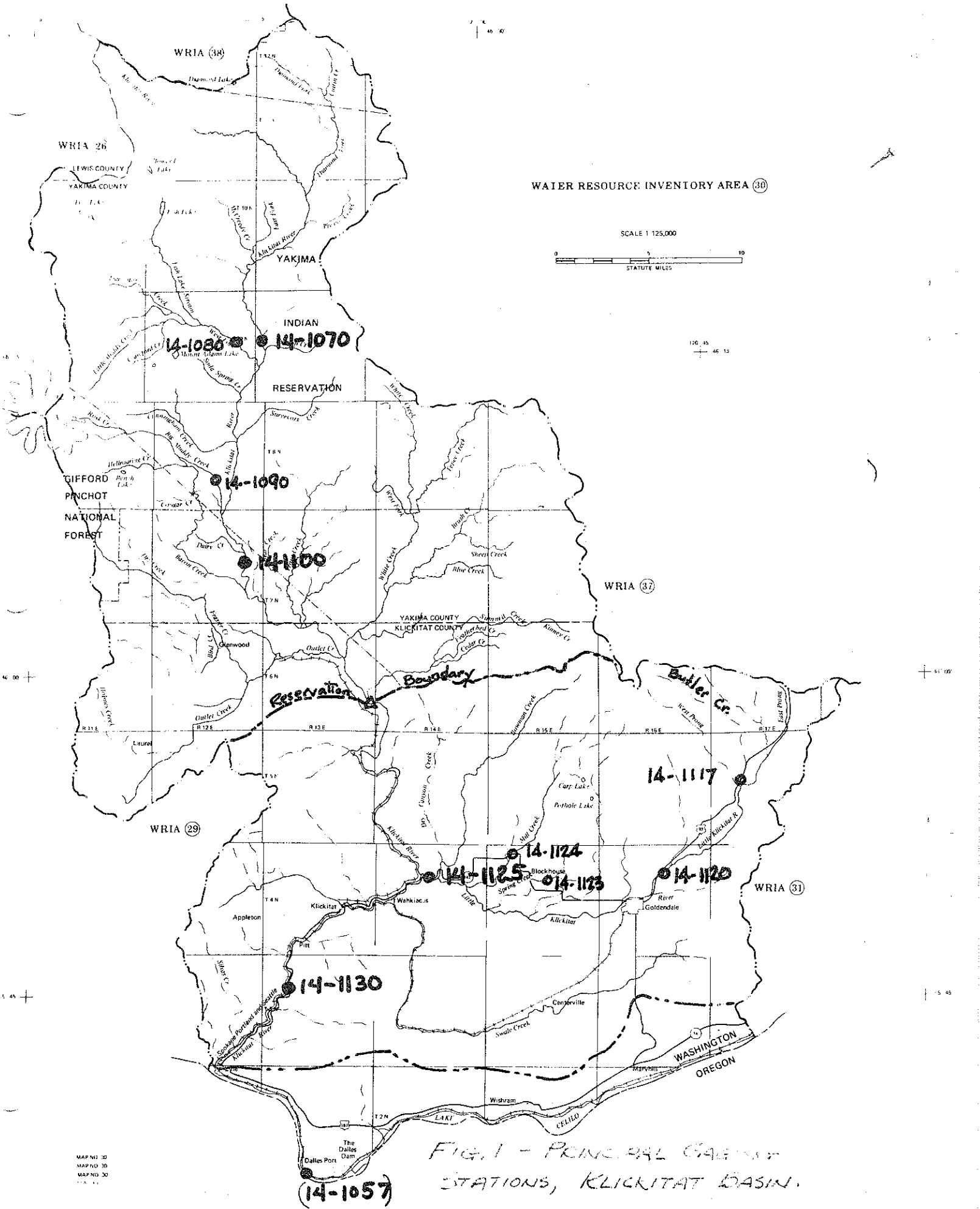
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MONTHLY STREAMFLOW IN THE KLICKITAT BASIN

Average monthly streamflow in the Klickitat Basin is well-defined at ten gaging station sites that are shown on Figure 1. Fragmentary records that were collected at several other stations for less than a year (mostly in 1916) are not considered in this report. Also, no attempt is made here to use miscellaneous low flow measurements for estimating long-term monthly means. Low flows at 12 sites in the upper Klickitat Basin are listed in Table 1, which is taken from a recent USGS open-file report by D. R. Cline.

As defined by Cline, the upper Klickitat River basin is that part of the basin that is within the Yakima Indian Reservation. Since the reservation boundary was extended to below Summit Creek in 1972, the area of the basin within the reservation now includes 749 square miles. This is 55 percent of the total basin area (1,350 square miles). Water resources and water use in the upper basin are described in some detail by Cline, who estimated that the average discharge from the area is 1,200 cfs, or 75 percent of the total basin runoff. Before the reservation was extended in 1972, runoff near the former boundary crossing was measured at the station "near Glenwood" (14-1100) where records from 1909 to 1971 showed an average flow of 841 cfs. Thus, the increase in reservation area resulted in increasing the average annual surface-water supply on the reservation by 359 cfs, or 260,000 acre feet per year.

Monthly streamflow in much of the Klickitat basin is strongly influenced by ground water storage and subsurface flow. This is characteristic of areas



WATER RESOURCE INVENTORY AREA (30)

SCALE 1:125,000



126 45
46 13

FIG. 1 - PRINCIPAL GAGING STATIONS, KLICKITAT BASIN.

MAP NO. 30
MAP NO. 30
MAP NO. 30

(14-1057)

Table 1.--Annual seven-day low flows at selected recurrence intervals at stream sites in upper Klickitat River basin (based on climatic year, April 1-March 31).

Station number or letter in figure 4	Stream name and location	Drainage area (mi ²)	7-day average low flows, in cubic feet per second, for indicated recurrence interval, in years					
			2	5	10	20	50	100
14106500.	Pearl Creek NW $\frac{1}{4}$ sec. 36, T.10 N., R.12 E.	4.31	0.1	0	0	0	0	0
14107000.	Klickitat River above West Fork ^a SW $\frac{1}{4}$ sec.18, T.9 N., R.13 E.	151	86	73	68	64	61	59
14107500.	Swamp Creek NE $\frac{1}{4}$ sec.19, T.9 N., R.13 E.	10.4	4	3.5	3			
14108000.	West Fork Klickitat River ^a SE $\frac{1}{4}$ sec.14, T.9 N., R.12 E.	87.0	185	163	152			
14108500.	Cunningham Creek SE $\frac{1}{4}$ sec.15, T.8 N., R.12 E.	15.4	12	10	9			
14109500.	Cougar Creek ^b NE $\frac{1}{4}$ sec.33, T.8 N., R.12 E.	3.34	.6	.5	.4			
14110000.	Klickitat River near Glenwood ^c SW $\frac{1}{4}$ sec 13, T.7 N., R.12 E.	360	358	314	292	274	256	243
f.	Trout Creek NE $\frac{1}{4}$ sec.5, T.6 N., R.13 E.	34	3.8	3.3	3.0			
k.	Outlet Creek ^d NW $\frac{1}{4}$ sec.14, T.6 N., R.13 E.	130	76	68	63			
14110800.	White Creek SW $\frac{1}{4}$ sec.11, T.6 N., R.13 E.	130	.7	.5	.4			
n.	Klickitat River above Summit Creek SW $\frac{1}{4}$ sec.24, T.6 N., R.13 E.	704	600	530	500			
14111100.	Summit Creek SW $\frac{1}{4}$ sec.24, T.6 N., R.13 E.	44.8	12	10	9			

^aExcludes low flows caused by severe freeze-up at station 14107000 in December 1944 (57 ft³/s) and January-February 1957 (5.6 ft³/s), and at station 14108000 in December 1944 (116 ft³/s).

^bPrior to diversions to Hellroaring Ditch.

^cIncludes the effect in some years of diversions to Hellroaring Ditch from Big Muddy, Hellroaring, Cougar, and Dairy Creeks.

^dMay include some effect of diversions from Big Muddy, Hellroaring, Cougar, Dairy, and Bacon Creeks.

underlain by large deposits of lava, and in such areas no attempt should be made to estimate average monthly streamflows, or low flows, without actual flow measurements. Methods used in other basins, based on assumed average annual precipitation, evapotranspiration, and monthly flow distributions, simply cannot be used in the Klickitat basin. An example of contrasting low flow conditions may be seen in Table 1, where annual seven-day low flows are listed for two streams (Outlet Creek and White Creek) that have the same size drainage area of 130 square miles. At Outlet Creek, in the western basin, the median of the low flows is 76 cfs, whereas at White Creek in the eastern basin it is only 0.7 cfs.

Monthly flows are also strongly influenced by the proximity to Mount Adams, where annual precipitation is much greater than in the rest of the basin, and where seasonal storage is provided by snow and ice. As a result of this influence, monthly or seasonal flow distributions contrast markedly in the western and eastern parts of the basin. Figure 2 illustrates this, as monthly flows of the Little Klickitat are usually greatest in January or February, while those of the main Klickitat River generally peak in May. At the river's mouth near Pitt, monthly flows are a composite of winter rains, spring snowmelt, and year-round contributions from the many springs in the basin. The result is a remarkably steady flow averaging 1,177,000 acre-feet per year.

The effect of water uses in the basin appears to be minor in relation to the total runoff. The principal use is for irrigation of about 7,500 acres, mostly in the vicinity of Glenwood where, in 1974, about 12,000 acre-feet was diverted by Hellroaring Ditch for irrigation of 5,600 acres. This

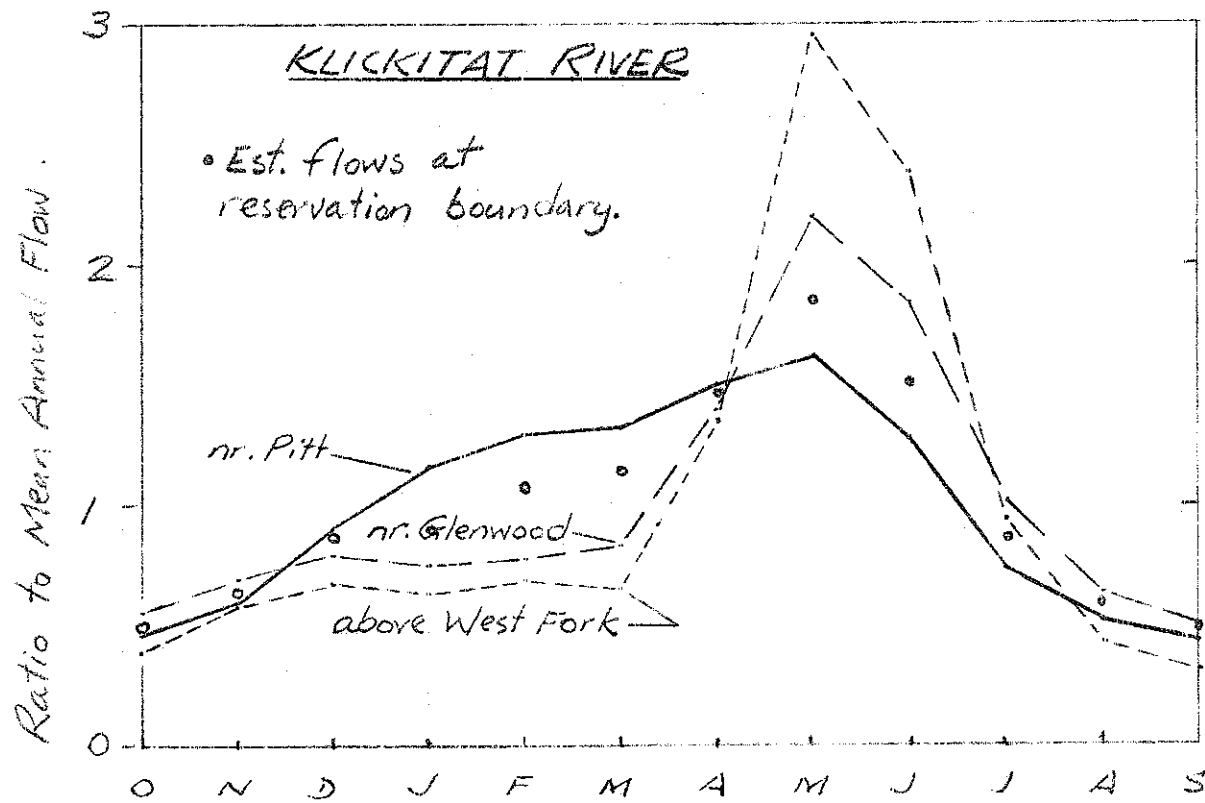
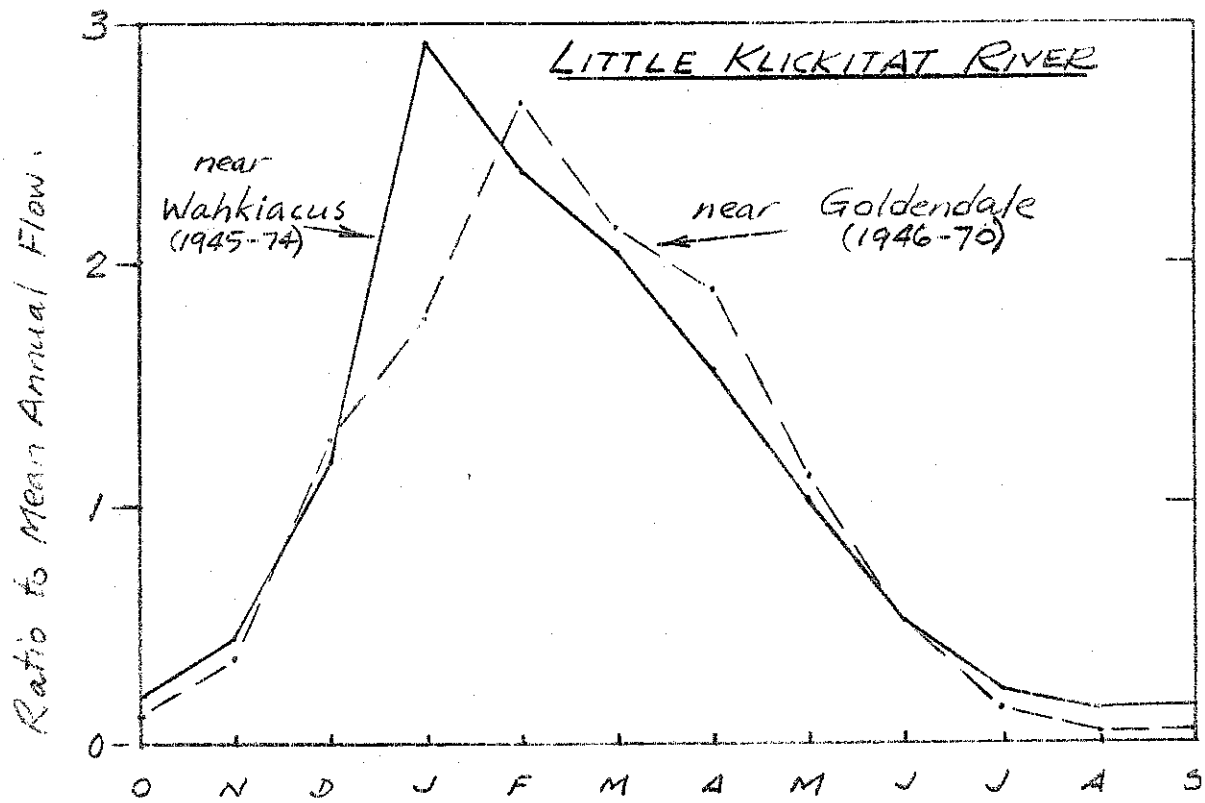


FIG. 2.- MONTHLY FLOW RATIOS,
KLICKITAT AND LITTLE KLICKITAT RIVERS.

diversion affected streamflow records for Big Muddy Creek and, in some years, for the Klickitat River near Glenwood. Except for these two stations, the records listed in Table 2 are essentially of natural streamflow.

In order to make some of the mean monthly flows in Table 1 more representative of longer periods, some estimates were made as indicated by footnotes. For the Klickitat River at the boundary (below Summit Creek), a mean annual discharge of 1,200 cfs was assumed, as estimated by D. R. Cline. The monthly means were then determined by (1) deducting long-term monthly flows of Little Klickitat River from Station 1130, (2) taking 61.5 percent of the remaining inflow below Station 1100, and (3) adding the latter values to the monthly flows at Station 1100. The resulting estimates are shown on Figure 3, along with the mean monthly flows at the three long-term stations on the Klickitat River.

TABLE 2. - MEAN MONTHLY DISCHARGE (CFS) AND RATIO TO MEAN ANNUAL FLOW.

Sta. Name, Dr. Area, Period	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT.	YR.
1070. Klickitat R. ab. W. Fork (151 mi ²) 1944-74.	131 .39	195 .58	227 .68	211 .63	236 .70	223 .66	451 134	988 2.94	801 2.38	312 0.93	143 .43	107 .32	336 (30.2 in.)
1080. West Fk. Klickitat R. (87.0 mi ²) 1944-54. ①	203 .63	238 .74	261 .81	231 .72	265 .83	240 .75	357 1.11	680 2.12	588 1.83	346 1.08	238 .74	200 .62	321 (50.0 in.)
1090. Big Muddy Creek (233 mi ²) 1944-49. ②	68.1 (Summer months affected)	67.2 (Summer months affected)	65.2 (Summer months affected)	59.1 (Summer months affected)	66.4 (Summer months affected)	57.4 (Summer months affected)	84.6 by diversion to Hellcaring ditch.	220	254	130	68.0	49.4	99.2 (57.7 in.)
1100. Klickitat R. nr. Glenwood (360 mi ²) 1909-71.	453 .54	578 .69	661 .79	633 .75	658 .78	694 .83	1178 1.40	1854 2.20	1544 1.84	855 1.02	542 .64	441 .52	841 (31.7 in.)
- Klickitat R. at Res. Bdry. (749 mi ²) Est. ③	627 .52	769 .64	1044 .87	1079 .90	1291 1.08	1369 1.14	1775 1.48	2223 1.85	1816 1.51	1042 .87	711 .59	614 .51	1200 (21.7 in.)
1117. Butler Cr. nr. Golddale (11.6 mi ²) 1964-72. ④	4.0 .18	6.4 .29	17.6 .80	34.7 1.58	44.7 2.03	49.2 2.24	43.0 1.95	37.0 1.68	17.0 .77	6.1 .28	2.6 .12	3.0 .14	22.0 (25.7 in.)
1120. Lit. Klickitat nr. Golddale (83.5 mi ²) 1946-70. ⑤	7.4 .12	23.4 .37	79.5 1.27	111 1.78	167 2.67	134 2.14	119 1.90	692 1.11	32.0 .51	8.6 .14	3.4 .05	3.5 .06	62.5 (10.1 in.)
1123. Spring Cr. nr. Blackhouse (275 mi ²) 1964-68	13.2 (Spring flow, drain. area)	12.8 (Spring flow, drain. area)	15.8 (Spring flow, drain. area)	15.4 (Spring flow, drain. area)	14.0 (Spring flow, drain. area)	13.5 (Spring flow, drain. area)	13.4 (Spring flow, drain. area)	13.0 (Spring flow, drain. area)	13.4 (Spring flow, drain. area)	14.0 (Spring flow, drain. area)	13.6 (Spring flow, drain. area)	13.2 (Spring flow, drain. area)	13.9 (Spring flow, drain. area)
1124. Mill Cr. nr. Blackhouse (26.9 mi ²) 1964-72	4.6 .29	6.4 .41	11.6 .73	21.7 1.37	31.4 1.99	36.2 2.29	31.4 1.99	24.6 1.56	10.7 .68	4.6 .29	3.0 .19	4.2 .27	15.8 (8.0 in.)
1125. Lit. Klickitat nr. Wahkiacus (280 mi ²) 1945-74	38.5 .21	79.4 .44	214 1.18	530 2.93	433 2.39	370 2.04	282 1.56	183 1.01	92.3 .51	39.7 .22	26.8 .15	28.8 .16	181 (8.8 in.)
1130. Klickitat R. nr. Pitt (1297 mi ²) 1928-74	774 .48	967 .60	1498 .92	1889 1.16	2120 1.30	2161 1.33	2431 1.50	2637 1.62	2079 1.28	1199 .74	843 .52	751 .46	1606 (16.8 in.)

①. Includes estimates for Dec. 1948 to Aug. 1953 based on Sta's 1070 & 1100.

②. Dec. 1945 to Sept. 1946 missing.

③. estimates based on Sta's 1100, 1125 & 1130.

④. Includes estimates for Dec 1964 to May 1965, Oct. 1968 to Sept 1972 based on Sta. 1124.

⑤. Includes estimates for Oct. 1951 to Sept 1957 based on Sta. 1125.

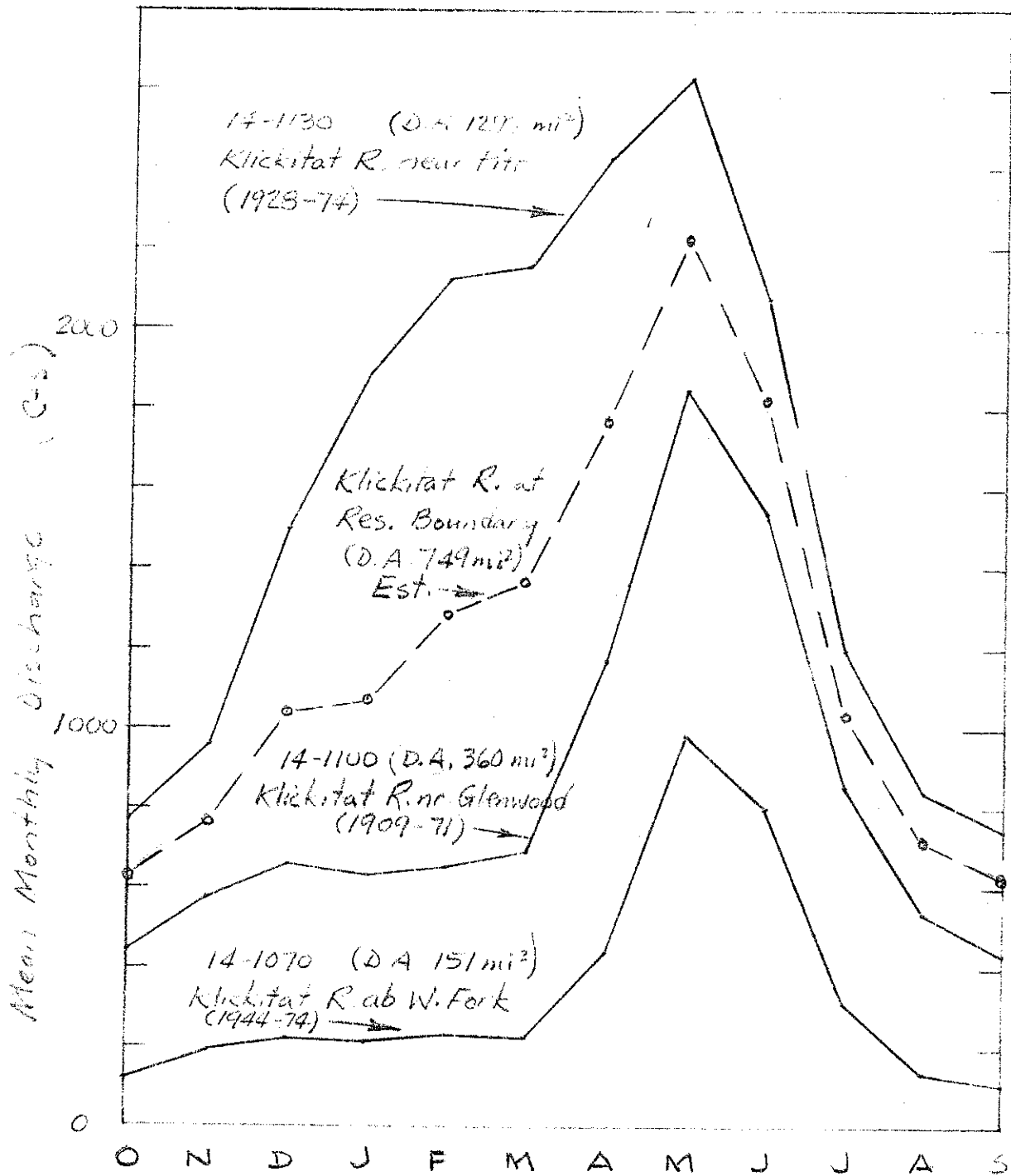


FIG. 3.-- MEAN MONTHLY FLOWS IN CFS
AT 4 SITES ON THE KLICKITAT RIVER.