WATER RESOURCES ANALYSIS
AND INFORMATION SECTION

Office Report No. 52

A REVIEW OF THE WATER RESOURCES OF THE KLICKITAT BASIN

WRIA 30

by

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(For Use by the Water Resources Management Division)

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Department of Ecology
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INTRODUCTION

The purpose of this report is to present a brief review of the water resources of the Klickitat Basin, with emphasis on water use, irrigated acres, and water rights.

LAND USE

Figure 1 shows the basin and its subdivisions, as determined by the Soil Conservation Service. A good breakdown on land use is given in Table 1. Compiled in 1968, this information is the best available at this time. Recent water right filings indicate a substantial increase in irrigated acreage.

WATER USE

Based on available information, the estimated water use in Klickitat County in 1970 was:

USE	SURFACE WATER (acre-feet per year)	GROUND WATER (acre-feet per year)	TOTAL (acre-feet per year)
Irrigation	58,800	15,300	74,100
Industrial	140	180	320
Municipal	810	1,160	1,970
Domestic	138	276	414
Stock	512	256	768
TOTAL	60,400	17,172	77,572

This information was obtained from an Open-File Report on Municipal, Industrial and Irrigation Water Use in Washington, 1970, published by the U. S. Geological Survey; and from census and agriculture reports on Klickitat County.

Water Rights

The Water Right Information System was edited on a statewide basis during the summer of 1975 and erroneous information was corrected. In addition, a

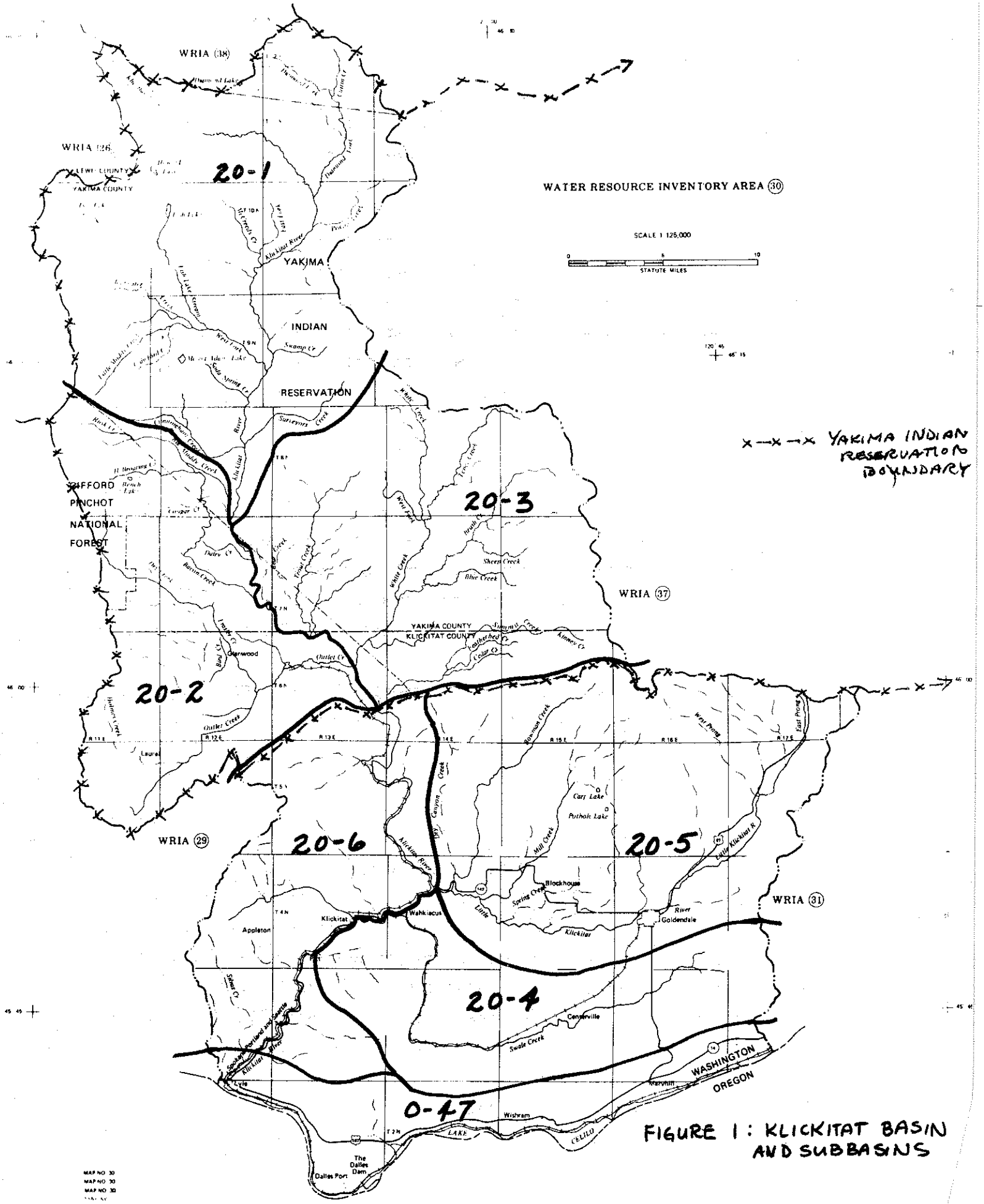


FIGURE 1: KLICKITAT BASIN AND SUBBASINS

TABLE 1: LAND USE AND IRRIGATED ACRES
KLICKITAT BASIN
SCS - 1967
(IN ACRES)

SUBBASIN	MAP NO.	FOREST LAND		CROPLAND	RANGELAND	OTHER	TOTAL	IRRIGATED ACRES			
		GRAZED	NOT GRAZED					SURFACE	GROUND	TOTAL	POTENTIAL
UPPER KLICKITAT RIVER	20-1	126,618	5,000	-0-	63,250	3,675	198,543	-0-	-0-	-0-	-0-
W. CENTRAL KLICKITAT R.	20-2	90,225	6,000	4,000	9,200	8,376	117,801	4,000	-0-	4,000	1,000
E. CENTRAL KLICKITAT R.	20-3	104,046	-0-	60	38,500	960	143,566	60	-0-	60	-0-
SWALE CREEK	20-4	-0-	-0-	35,800	52,140	5,164	93,104	-0-	800	800	2,500
LITTLE KLICKITAT RIVER	20-5	29,840	89,553	43,500	3,000	9,727	175,620	-0-	3,500	3,500	2,000
TWIN BUTTES	20-5-1	-0-	-0-	2,732	1,200	372	4,304	100	400	500	200
LOWER KLICKITAT RIVER	20-6	83,113	-0-	2,000	-0-	21,805	106,918	-0-	-0-	-0-	300
MARYHILL-BINGEN	0-47	2,000	-0-	6,500	65,059	54,058	127,617	2,000	500	2,500	2,000
TOTAL		435,842	100,553	94,592	232,349	104,137	967,473	6,160	5,200	11,360	8,000

continuous program of checking and updating of records is underway. Accurate summaries of recorded water rights are now available, giving instantaneous withdrawals/diversion rates, annual quantities, and irrigated acreage. Table 2 gives a breakdown of water rights by purpose of use within the Klickitat Basin (WRIA 30).

Almost half of the water right claims filed under RCW 90.14 have not been entered into the computer system as yet, and data from those claims is unavailable. It is this writer's opinion that information gathered from water right claim forms is totally worthless for water management purposes, due to the acceptance by this department of erroneous data filed by the claimants. No attempt was made to include any water right claim data in this report.

Irrigated Acres

The largest consumptive use of water in the Klickitat Basin is for irrigation purposes. The number of irrigated acres and potentially irrigable acres is an important factor in determining present and future usage of water. More than half the land in the basin, and a substantial portion of the available surface waters are within, or come from, the Yakima Indian Nation. This also affects potential development in the area. The main sources of data on irrigated acres and water use are broken into two categories, county data and basin data.

County Data

Much of the information is on a county basis. Klickitat County is basically made up of portions of three basins, White Salmon River Basin, Klickitat River Basin, and an area draining into the main stem of the Columbia River. According to the 1969 Census of Agriculture report, 19,363 acres were irrigated in Klickitat County. Of this total, 14,716 acres (76 percent) were in hay-pasture; 4,260 acres (22 percent) were in small grains and other field crops; and 387 acres (2 percent) were in orchards.

The U. S. Geological Survey has estimated 24,500 acres were irrigated in the county in 1970. The Soil Conservation Service estimated 18,120 acres were

TABLE 2: SUMMARY OF WATER RIGHTS, KLICKITAT BASIN, WITH PRIORITY DATES BEFORE JANUARY 1975 (in cfs)

USE	SURFACE	GROUND	TOTAL
Irrigation	250.0	133.4	383.4
Municipal	2.2	9.5	11.7
Domestic	6.0	11.0	17.0
Commercial/Industrial	2.3	9.2	11.5
Fish Propagation	272.0*	0	272.0
Power Generation	17.0	0	17.0
Stock	2.5	7.0	9.5
Others	0.4	3.0	3.4
T O T A L	552.4	173.1	725.5
Irrigated Acres	16,971.7	11,485.5	28,457.2
Total Number of Rights	311	224	535

*Department of Fisheries Surface Water Certificate No. 4802 in the amount of 250 cfs for the operation of five fish ladders included. There is some question as to validity and present usage of this certificate.

irrigated in 1967 and water right summaries indicate 19,966 acres under permit or certificate for the same year.

Basin Data

Many sources give irrigated acres by basin. Among these sources are the Soil Conservation Service, Irrigation Districts, Pacific Northwest River Basins Commission study (C-NP study), and from the Water Right Information System. In 1938, the Washington State Bureau of Statistics and Immigration estimated 6,800 acres of irrigation in the Klickitat Basin with a potential of up to 35,000 acres that could be irrigated.

Table 3 shows some of these sources on a historical basis. Figure 2 is a graph showing the data on a comparative format. Table 1 also shows irrigated acreage by subbasins within the Klickitat Basin.

By comparing the SCS data for 1967 with the Census of Agriculture data for 1970, we come up with a figure of 12,500 acres irrigated in the Klickitat Basin during 1970. This is considered to be the most accurate figure available and will be used in computing irrigation water usage in this report.

Irrigation Water Use

To arrive at an estimation of water use, the Blaney-Criddle method was used to determine evapotranspiration of crops. Table 4 lists the variables used in this analysis. Since rainfall varies substantially between the two major irrigation areas, Glenwood and Goldendale, two different precipitation stations were used in the calculations. The crop requirements (water) for the different crop types is given in Tables 5 and 6.

Table 7 gives the average amount of water used for the major crops in the basin. The monthly amount of water is expressed in feet, and by knowing the amount of irrigated acres in a particular crop, you can compute the amount acre-feet required for that crop.

Table 8 shows the monthly consumptive use, diversions, and return flows in the Klickitat Basin. Table 9 gives a summary of the monthly water balance

TABLE 3 : IRRIGATED ACRES IN KLICKITAT COUNTY

SOURCE	1920	1930	1940	1950	1960	1965	1967	1970	1975
WATER RIGHTS (SURFACE & GROUND)*									
KLICKITAT COUNTY	5878	7610	13,638	14,861	15,966		19,966		41,931
WRIA 30	6565	7809	13,808	15,036	15,798		17,754		28,457
COLUMBIA (LYLE TO CLIFFS)									1,508
LITTLE KLICKITAT BASIN									8,254
CENSUS OF AGRICULTURE	18,978	11,502	13,093	10,306	14,688	15,142		19,363	
U.S. GEOLOGICAL SURVEY						15,970		24,500	
SOIL CONSERVATION SERVICE									
WHITE SALMON BASIN							6,160		
KLICKITAT BASIN							11,360		
COLUMBIA (ROCK CR TO ALDER CR)							600		
KLICKITAT COUNTY							18,120		
IRRIGATION DISTRICTS & COMPANIES									
WHITE SALMON BASIN									378
KLICKITAT BASIN									6,205

*In 1975, irrigated acres by ground water rights constituted 54% of the county total and 40% of the total in WRIA 30.

FIGURE 2: IRRIGATED ACRES, KLICKITAT COUNTY

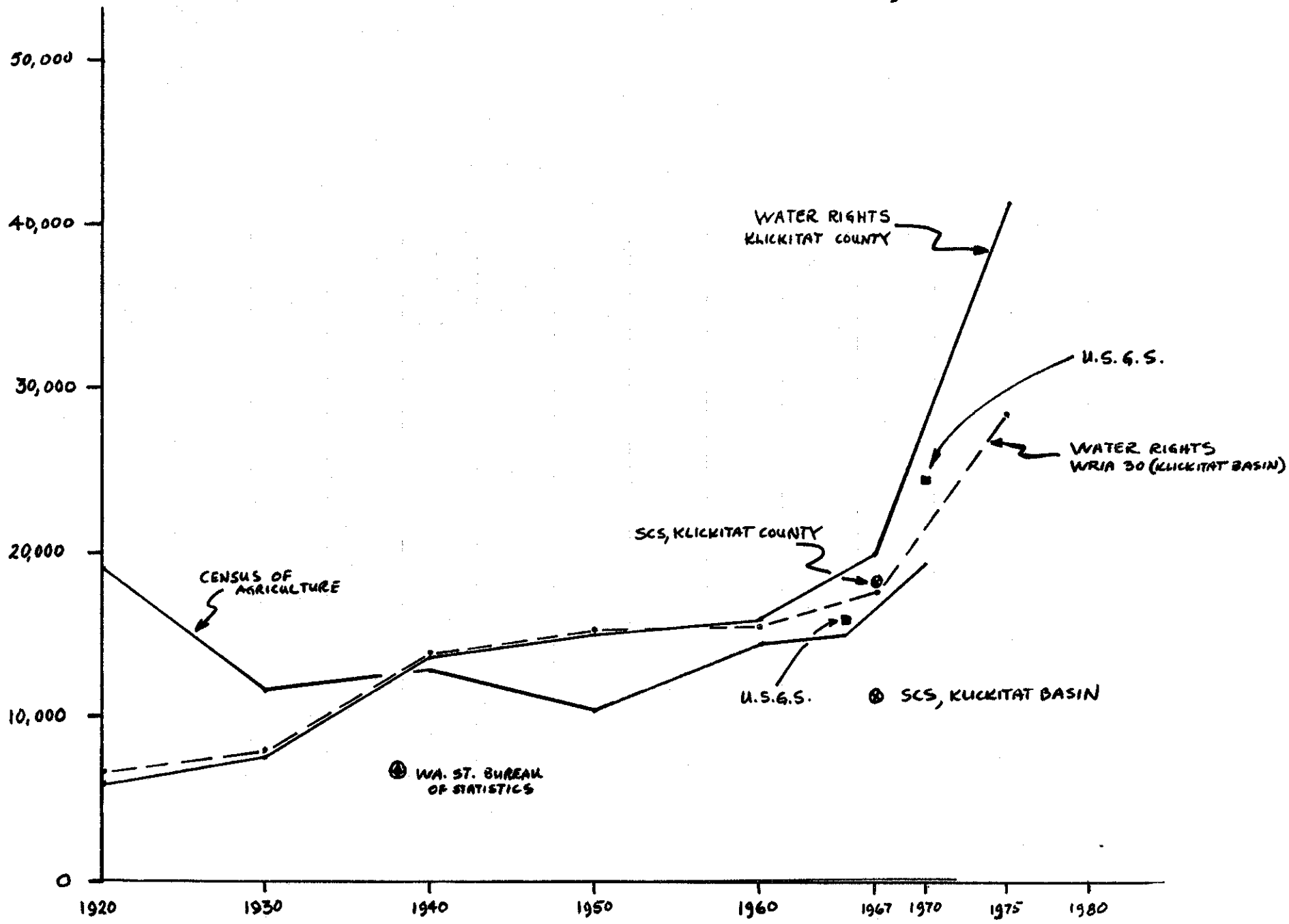


TABLE 4: FACTORS USED IN COMPUTING CROP REQUIREMENTS

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
P (Precipitation, inches)													
Goldendale	2.93	2.03	1.70	0.85	0.79	0.91	0.15	0.21	0.62	1.64	2.53	3.05	17.41
Mt. Adams Ranger Station	8.49	6.05	5.07	2.45	1.67	1.29	0.19	0.42	1.26	4.14	7.25	9.14	47.42
Glenwood*	6.27	4.47	3.74	1.81	1.23	0.94	0.14	0.31	0.93	3.06	5.35	6.75	35.00
T (Temperature)													
Goldendale	29.4	34.6	41.1	48.0	54.7	60.2	66.9	65.1	59.4	49.7	38.5	33.2	48.4
Glenwood**	29.2	34.3	40.8	47.6	54.2	59.7	66.3	64.6	58.9	49.3	38.2	32.9	48.0
p (% Daylight Hours)	6.33	6.50	8.28	9.11	10.38	10.53	10.65	9.79	8.43	7.58	6.37	6.05	
K_t (Climatic Coefficient)	0.30	0.30	0.40	0.51	0.63	0.73	0.84	0.81	0.71	0.55	0.35	0.30	
K_c (Crop Coefficient)													
Pasture-Hay	0.5	0.6	1.0	1.2	1.2	1.0	1.0	1.0	1.1	1.1	0.8	0.6	
Small grains	0	0	0.6	1.0	1.4	1.4	1.3	1.3	1.3	0	0	0	
Orchards (Avg)	0.4	0.5	0.65	0.85	1.25	1.3	1.2	1.2	1.2	0.75	0.55	0.45	

*Calculated from Mt. Adams R.S. records

Blaney-Criddle formula: $ET_p = p(T)(K_t)(K_c)$

**Estimated Temperature using comparative altitudes

TABLE 5: KLICKITAT BASIN CROP REQUIREMENTS
Glenwood Area

FACTOR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
P (Glenwood - inches)	6.27	4.47	3.74	1.81	1.23	0.94	0.14	0.31	0.93	3.06	5.35	6.75	
Pasture - Hay ET_p	0.28	0.40	1.35	2.65	4.25	4.59	5.93	5.12	3.88	2.26	0.68	0.36	
$ET_p - P$	-5.99	-4.07	-2.39	0.84	3.02	3.65	5.79	4.81	2.95	-0.80	-4.67	-6.39	(21.06")[1] (24.31")[2]
% of Irr.				4.0	14.3	17.3	27.5	22.9	14.0				100
Small grains ET_p	0	0	0.81	2.21	4.96	6.42	7.71	6.66	4.58	0	0	0	
$ET_p - P$	-6.27	-4.47	-2.93	0.40	3.73	5.48	7.57	6.35	3.65	-3.06	-5.35	-6.75	(27.18")[1] (28.83")[2]
% of Irr.				1.4	13.7	20.2	27.9	23.4	13.4				100
Orchards ET_p	0.22	0.33	0.88	1.88	4.43	5.97	7.12	6.15	4.23	1.54	0.47	0.27	
$ET_p - P$	-6.05	-4.14	-2.86	0.07	3.20	5.03	6.98	5.84	3.30	-1.52	-4.88	-6.48	(24.42")[1] (25.93")[2]
% of Irr.				0.3	13.1	20.6	28.6	23.9	13.5				100

[1] Summer Irrigation
[2] Winter Recharge

TABLE 6: KLICKITAT BASIN CROP REQUIREMENTS
Goldendale Area

FACTOR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	
P (Goldendale - inches)	2.93	2.03	1.70	0.85	0.79	0.91	0.15	0.21	0.62	1.64	2.53	3.05		
Pasture-Hay ET_p	0.28	0.40	1.36	2.68	4.29	4.63	5.98	5.16	3.91	2.28	0.69	0.36		
$ET_p - P$	-2.65	-1.63	-0.34	1.83	3.50	3.72	5.83	4.95	3.29	0.64	-1.84	-2.69	(23.76")[1]	(9.15")[2]
% of Irr.				7.7	14.7	15.7	24.5	20.8	13.9	2.7			100.	
Small grains ET_p	0	0	0.82	2.23	5.01	6.48	7.78	6.71	4.62	0	0	0		
$ET_p - P$	-2.93	-2.03	-0.88	1.38	4.22	5.57	7.63	6.50	4.00	-1.64	-2.53	-3.05	(29.30")[1]	(13.06"
% of Irr.				4.7	14.4	19.0	26.0	22.2	13.7				100	
Orchards ET_p	0.22	0.34	0.88	1.90	4.47	6.02	7.18	6.19	4.27	1.55	0.47	0.27		
$ET_p - P$	-2.71	-1.69	-0.82	1.05	3.68	5.11	7.03	5.98	3.65	-0.09	-2.06	-2.78	(26.50")[1]	(10.15"
% of Irr.				4.0	13.9	19.3	26.4	22.6	13.8				100	

[1] Summer Irrigation
[2] Winter Recharge

TABLE 7: AVERAGE CROP CONSUMPTION FOR KLICKITAT COUNTY

CROP ET_p	CONSUMPTION* (in feet)											
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
HAY-PASTURE (x 76%)	0	0	0	0	0	0	0.08	0.21	0.23	0.37	0.31	0.20
SMALL GRAINS (x 22%)	0	0	0	0	0	0	0.02	0.07	0.10	0.14	0.18	0.07
ORCHARDS (x 2%)	0	0	0	0	0	0	0.001	0.006	0.008	0.012	0.01	0.006
TOTAL	0	0	0	0	0	0	0.101	0.286	0.338	0.522	0.500	0.276

*Evapotranspiration minus precipitation, when evapotranspiration exceeds precipitation. Otherwise it is zero.

TABLE 8: IRRIGATION USE IN KLICKITAT COUNTY (in feet).

	CONSUMPTIVE USE*	DIVERSION **	RETURN FLOW ***						9-MONTH RETURN FLOW	DIRECT SURFACE RETURN FLOW	TOTAL MONTHLY RETURN VOLUME	ACTUAL CONSUMPTIVE USE ****
Oct.	0	0	.0054	.0169	.0216	.0369	.0413	.0291	0.1512	0	0.1512	-0.1512
Nov.	0	0	.0051	.0157	.0198	.0331	.0355	.0231	0.1323	0	0.1323	-0.1323
Dec.	0	0	.0048	.0147	.0184	.0303	.0318	.0199	0.1199	0	0.1199	-0.1199
Jan.	0	0		.0139	.0173	.0281	.0291	.0178	0.1062	0	0.1062	-0.1062
Feb.	0	0			.0163	.0264	.0270	.0163	0.0860	0	0.0860	-0.0860
Mar.	0	0				.0250	.0254	.0151	0.0655	0	0.0655	-0.0655
Apr.	0.10	0.20	.0219				.0240	.0142	0.0601	0.0250	0.0851	0.1149
May	0.29	0.58	.0104	.0635				.0134	0.0873	0.0725	0.1598	0.4202
Jun.	0.34	0.68	.0083	.0302	.0745				0.1130	0.0850	0.1980	0.4820
Jul.	0.52	1.04	.0071	.0239	.0354	.1139			0.1803	0.1300	0.3103	0.7297
Aug.	0.50	1.00	.0064	.0206	.0281	.0541	.1095		0.2187	0.1250	0.3437	0.6563
Sep.	0.28	0.56	.0058	.0184	.0242	.0429	.0520	.0613	0.2046	0.0700	0.2746	0.2854
TOTAL	2.03	4.06										2.0274

* Consumptive use (ETp-P) is averaged for all crops in the basin; hay-pasture - 76%, small grains - 22%, orchards - 2%.

** Assuming a 50% application efficiency, the diversion is double the consumptive use.

*** The continuous return rate varies with each month and was calculated on a 9-month return period. The formulae used were those proposed by Gene T. Thompsen in Water Research Center Report No. 17C.

**** The actual consumptive use is the diversion minus the total monthly return volume.

TABLE 9: MONTHLY WATER BALANCE FOR IRRIGATED LANDS IN THE KLICKITAT BASIN.

(in acre-feet)

MONTH	DIVERSION	EVAPO-TRANSPIRATION	PRECIPITATION	RETURN FLOW	NET
OCT	0	1829	2448	1890	-1271
NOV	0	552	4104	1654	1898
DEC	0	291	5104	1499	3314
JAN	0	226	4792	1328	3238
FEB	0	324	3385	1075	1986
MAR	0	1278	2833	819	736
APR	2,500	2658	1385	1064	163
MAY	7,250	4616	1052	1998	1688
JUN	8,500	5253	964	2475	1736
JUL	13,000	6638	151	3879	2634
AUG	12,500	5730	271	4296	2745
SEP	7,000	4233	607	3433	-59
TOTAL	50,750	33,628	27,096	25,410	18,808

BASED ON 1970 ESTIMATED IRRIGATED ACREAGE OF 12,500 ACRES, 6,250 ACRES IN GLENWOOD AREA & 6,250 ACRES IN GOLDENDALE AREA.

in the basin. The following formulae were used in tabulating Table 9:

Amount of water into system =
Diversion and Precipitation

Amount of water out of system =
Evapotranspiration and Return Flow Runoff

Amount of water in storage and runoff from precipitation =
Amount of water diverted into system -
amount of return flow out of system

The estimated runoff from the irrigated lands is 18,808 acre-feet per year (18 inches) which is in reasonable agreement with the 14 inches estimated using runoff maps.

Figure 3 shows the major irrigated areas within the Klickitat Basin. Surface water is the major source in the Glenwood area and ground water is the major source in the Goldendale area.

Surface Water Supply

On April 14, 1976, WAC 173-530-910 through 173-530-960, relating to the withdrawal of the waters of the Little Klickitat River Basin from additional appropriations, was adopted by DOE. This withdrawal will be in effect until November 1, 1978 or until a management program has been adopted. The withdrawal came about at the request of the Central Regional Office after the Game Department was unable to substantiate their 1945 request for closure of the waters of the Little Klickitat River and its tributaries.

The following is a list of Game and Fisheries requested closures and/or low flows on the Little Klickitat River system:

Little Klickitat	Closed	11-26-45 and 11-29-45
Mill Creek	Closed	11-26-45 and 4-12-51
Spring Creek	Closed	10-16-50 and 1-5-51
Bowman Creek	Closed	2-13-53 and 4-28-71
East Prong Little Klickitat	Closed	11-10-66 (11-26-45)
Bloodgood Creek	Low Flow (6.0 cfs)	9-29-49 (should be closed--tributary to Little Klickitat)

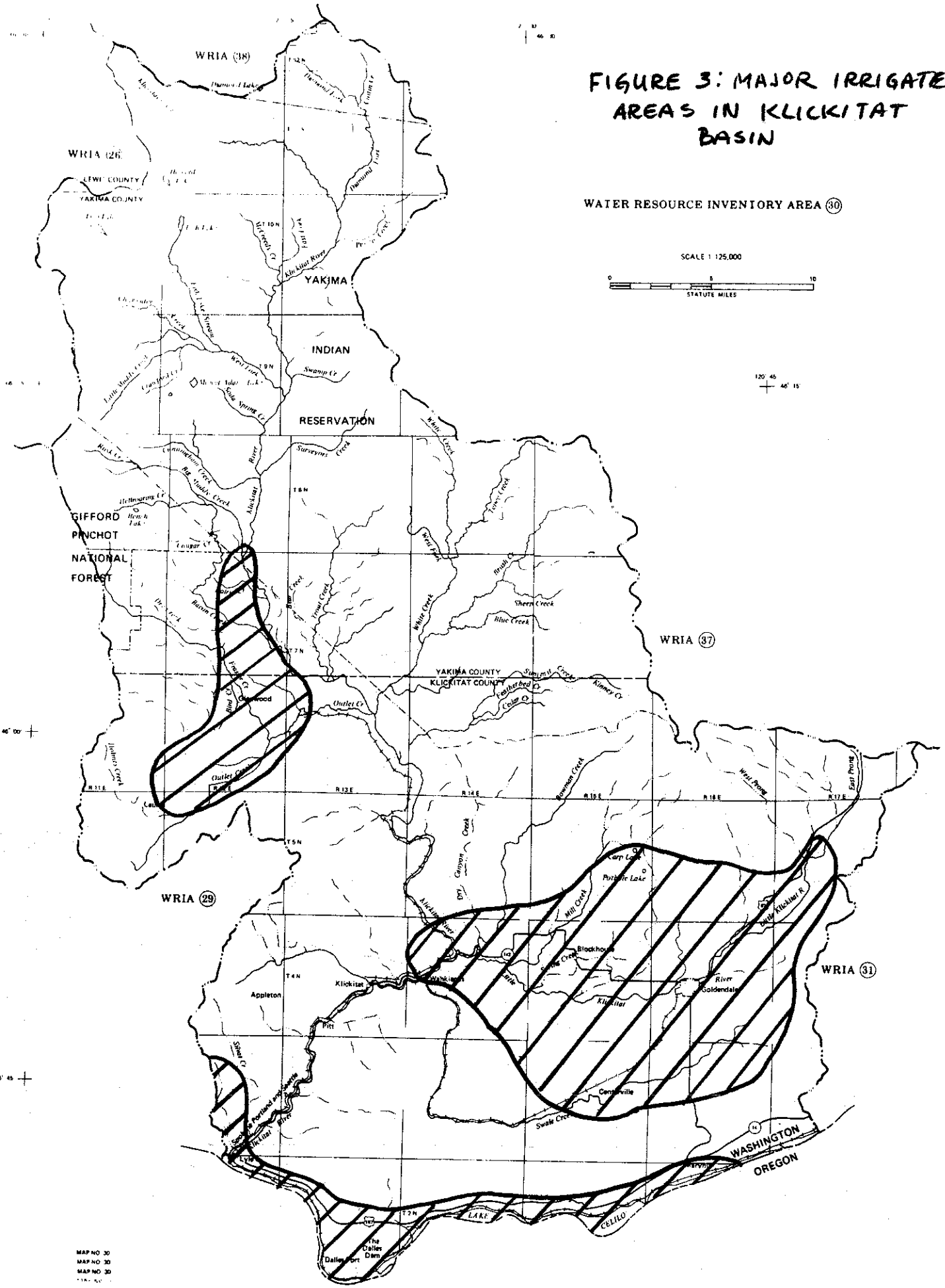


FIGURE 3: MAJOR IRRIGATED AREAS IN KLICKITAT BASIN

Bird Creek, Frazier Creek, Bacon Creek, and Blockhouse Creek have all been adjudicated. Swale Creek, which drains into the Main Klickitat just below the mouth of the Little Klickitat River, also has a Fish and Game low flow in the upper reaches of the stream. The lower stretches of Swale Creek go dry in some years.

Reports indicate very low flows in the Little Klickitat River near Goldendale. Field personnel have reported the river dry at Goldendale, with the only water entering the stream being the effluent from the Goldendale Sewage Treatment Plant. This is evidenced by the recorded flows of the Little Klickitat River (Station 14-1120) near Goldendale. This station is approximately 2 1/2 miles northeast of Goldendale and it is possible that diversions exist between the station and the City of Goldendale. Figure 4 shows the minimum yearly discharges and mean annual discharges at that station. Minimum yearly discharges have consistently been below 1.0 cfs and during 1967, the river dried up completely during portions of three different days in August and September.

Recorded flows of the Little Klickitat River near Wahkiacus (Station 14-1125) show a long term trend towards declining flows. This is evidenced in Figure 5 which shows the actual minimum yearly discharges and the mean annual discharges at Station 14-1125. The trend towards declining flows is better shown when the recorded data is averaged or "filtered." Figure 6 shows the flows at Station 14-1125 when the data has been averaged over three year spans. This is accomplished by adding one-half the flows of the preceding and succeeding years to twice the flow of the year of record, and dividing that total by three.

In the northwestern portion of the basin, surface water provides the largest source of irrigation water. Hell Roaring Irrigation Company diverts approximately 116 cfs through a canal to the Glenwood area. Water is collected from several streams and distributed to irrigate approximately 5,800 acres of land. This area is now totally within the Yakima Indian Nation and the future disposition of water is in question. During the 1974 irrigation season, Hell Roaring Ditch carried approximately 12,000 acre-feet of water.

Since the revision of the Yakima Nation Boundary in 1972, the upper Klickitat River basin is within Indian controlled lands. In a recent open-file report

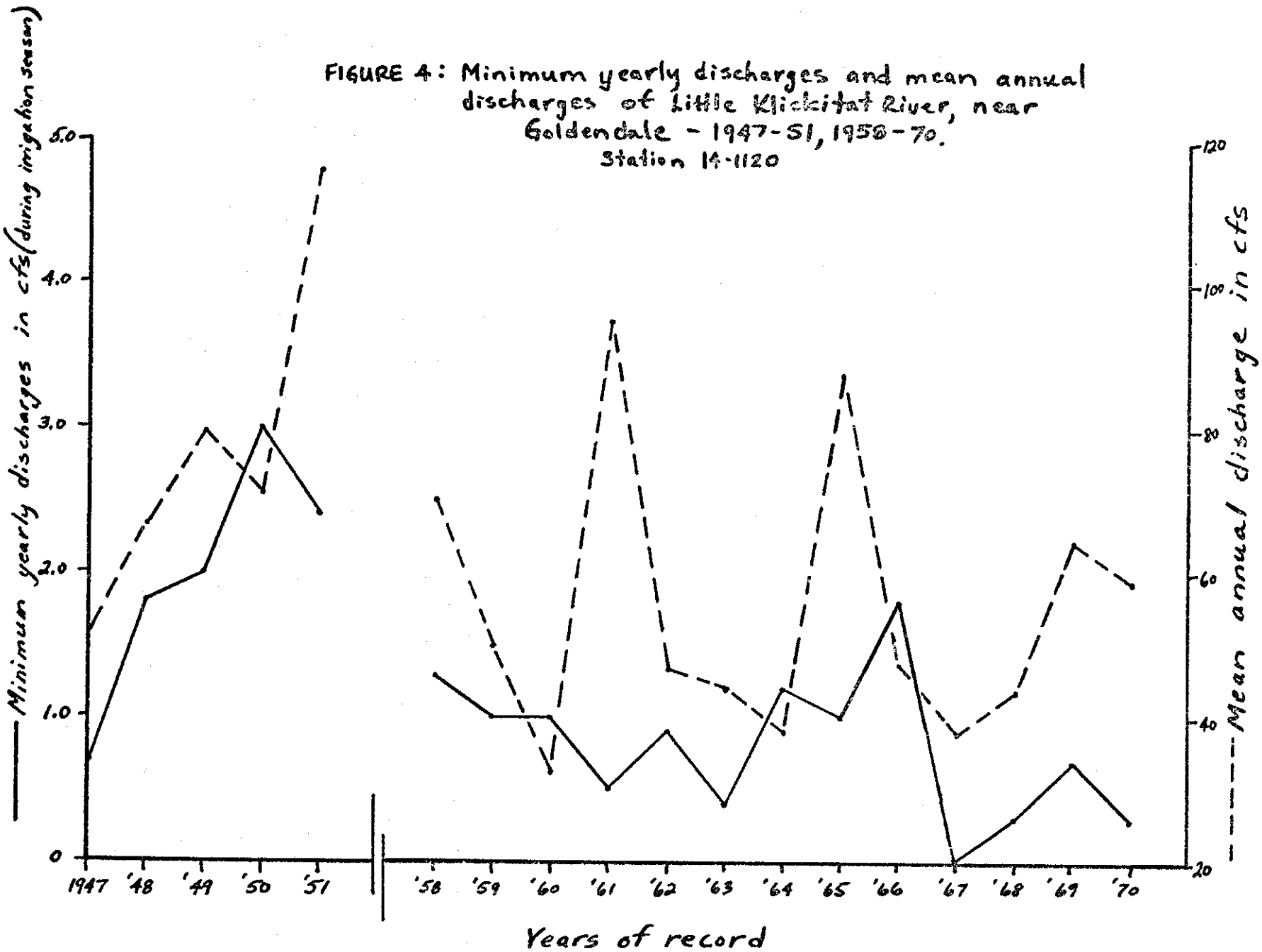


FIGURE 4: Minimum yearly discharges and mean annual discharges of Little Klickitat River, near Goldendale - 1947-51, 1958-70. Station 14-1120

FIGURE 5: Actual minimum yearly discharges and mean annual discharges of Little Klickitat River near Wahkiacus
Station 14-1125

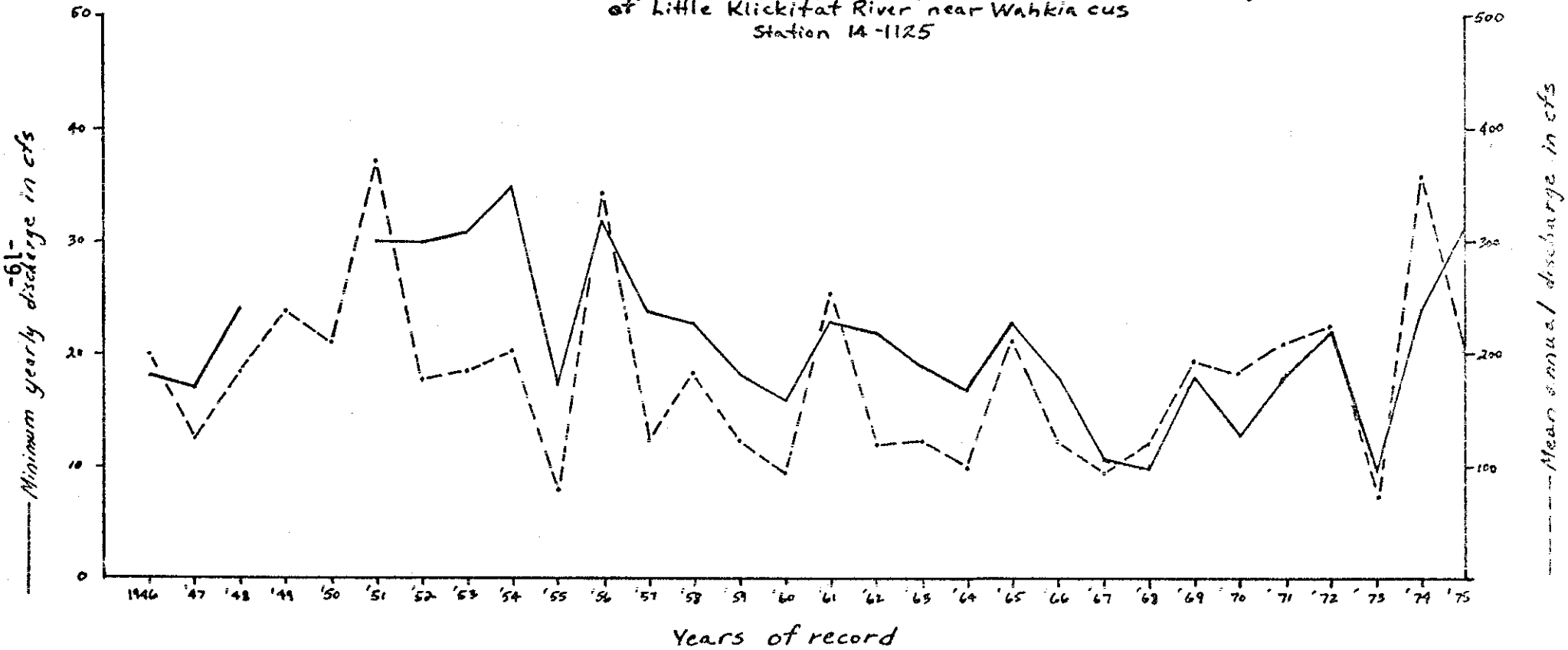
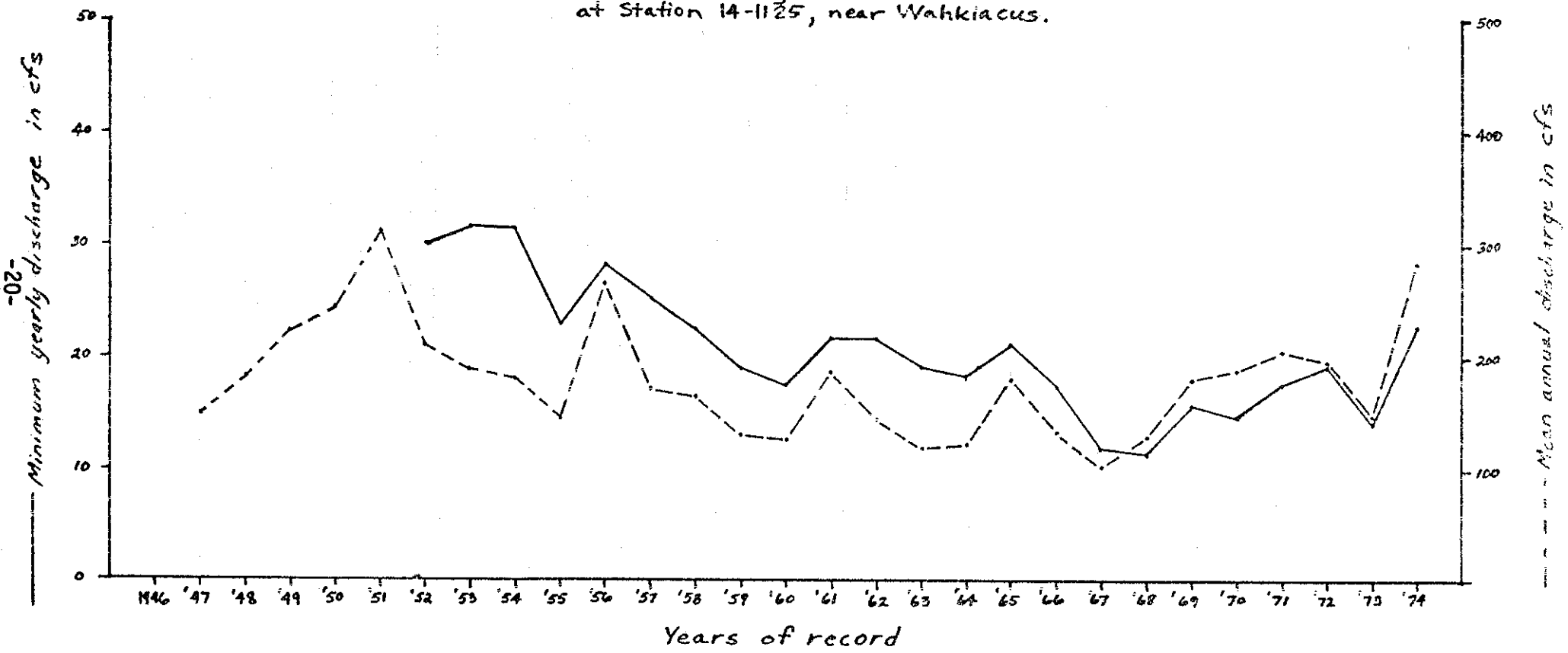


FIGURE 6: Trends toward declining flows in Little Klickitat River at Station 14-1125, near Wahkiacus.



issued by the USGS, D. R. Cline estimated the flow of the Klickitat River leaving the reservation boundary to comprise about 75 percent of the average annual flow, and over 90 percent of the average seven-day low flow of the river at the gage near its mouth. This is an indication that control of future surface water development is in the hands of the Yakima Nation.

The mean monthly discharge for some streams in the basin were determined by frequency analysis. In addition, other flows were calculated, including the one-in-three-year mean monthly discharge, the one-in-two-year mean monthly discharge, and the one-in-ten-year mean monthly discharge. Gaging stations with a period of record of at least five years were selected for analysis. Information on the stations and stream characteristics are listed in Table 10. Figure 7 shows their location.

Tables 11 through 16 give the discharges mentioned above. Table 17 gives the monthly discharges for most of the streams in the basin. The stream segments used are shown in Figure 8.

From the time the State Surface Water Law was enacted in 1917 (RCW 90.03) until 1950, almost 15,000 acres of irrigation were covered by surface water permits or certificates. From 1950 to date, less than 2,000 acres have been added to that total. This is indicative that the best available surface water has been utilized, and further development of surface water is unfeasible, economically unattractive, or is unavailable portions of the time. Recent indications show a dramatic increase in the use of ground water as an irrigation supply, which suggest the surface supply has been fully appropriated in an economic sense.

Figure 9 shows the distribution, geographically, of the existing surface water rights in the Klickitat Basin, as of 1975.

On June 12, 1947, the Departments of Fisheries and Game filed a joint application for the purposes of migratory fish propagation to take place within the channel of the Klickitat River, between its confluence with the Columbia River and the point where the river channel crossed the Yakima-Klickitat County line, a distance of approximately 42 miles.

TABLE 10: BASIN AND STREAMFLOW CHARACTERISTICS - KLICKITAT BASIN.

STATION NAME AND PERIOD OF RECORD	NUMBER	BASIN CHARACTERISTICS					STREAMFLOW CHARACTERISTICS				
		DRAINAGE AREA (sq mi) (A)	% OF AREA LAKES	MEAN BASIN ELEVATION (feet)	ANNUAL PRECIPITATION (P)		MEAN ANNUAL FLOW (cfs)	$\frac{Q}{PxA}$ (%)	20-YEAR 7-DAY MEAN LOW FLOW (cfs)	2-YEAR FLOOD (cfs)	50-YEAR FLOOD (cfs)
					(in/sq mi)	(cfs/sq mi)					
KLICKITAT RIVER above W. FK., near GLENWOOD (1945-1974)	14-1070	151	0.08	4,690	55	4.05	328	53.6	---	1,770	3,790
KLICKITAT RIVER near GLENWOOD (1910-1971)	14-1100	360	0.29	4,520	55	4.05	832	57.1	272	3,040	6,910
LITTLE KLICKITAT near GOLDENDALE (1947-1970)	14-1120	83.5	0.01	3,160	20	1.47	61	49.7	0.7	930	---
LITTLE KLICKITAT near WAHKIACUS (1946-1974)	14-1125	280	0.05	2,600	20	1.47	170	41.3	16	2,930	13,600
KLICKITAT RIVER near PITT (1929-1974)	14-1130	1,297	0.10	3,140	35	2.58	1,577	47.1	508	7,910	30,400

Source: A Proposed Streamflow-Data Program for Washington State - U. S. Geological Survey Open-File Report.

FIGURE 7: LOCATION OF GAGING STATIONS, KLICKITAT BASIN

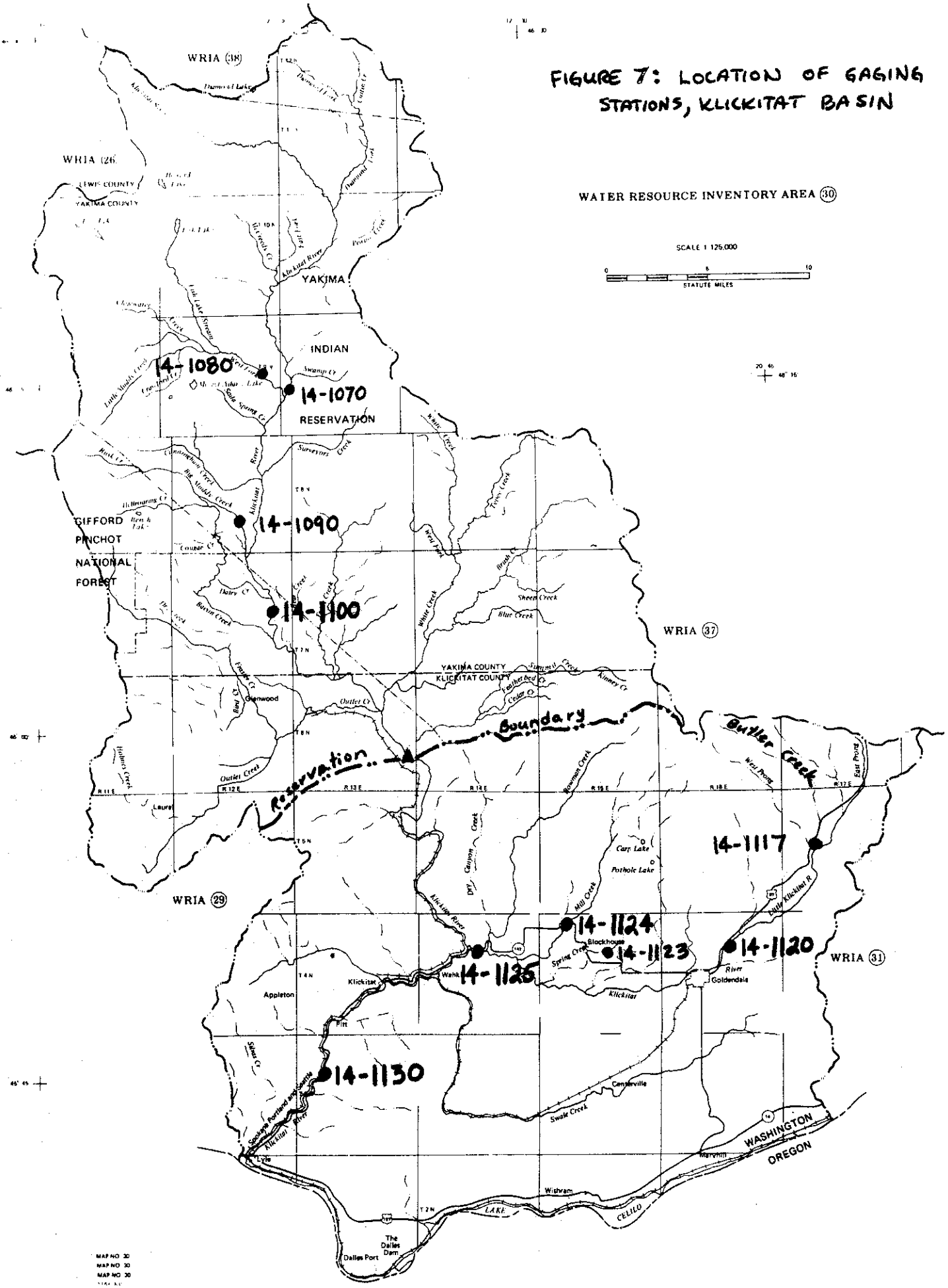


Table 11 FREQUENCY AND WATER USE DATA

FOR KLICKITAT RIVER ABOVE WEST FORK, nr. GLENWOOD U.S.G.S. GAGE 14-1070

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
Mean Discharge	131	195	227	211	236	223	451	988	801	312	143	107
One in Three Year Discharge (Q_3)	143	214	249	231	259	242	498	1082	883	342	156	114
One in Two Year Discharge (Q_2)	123	175	201	194	214	205	422	939	735	285	137	105
One in Ten Year Discharge (Q_{10})	80	96	107	115	121	123	258	614	425	166	94	80
$Q_2 - Q_{10}$	44	79	95	79	93	81	164	325	310	119	43	24
Water Use	—	—	—	—	—	—	—	—	—	—	—	—

Period of Record: 1945-1974. Remarks: MEASURED DATA, LOG-NORMAL DISTRIBUTION

Table 12 FREQUENCY AND WATER USE DATA

FOR KLICKITAT RIVER, nr. GLENWOOD. U.S.G.S. GAGE 14-1100.

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
Mean Discharge	452	578	658	637	656	694	1178	1849	1552	859	544	442
One in Three Year Discharge (Q_3)	488	630	713	693	718	755	1290	2015	1713	937	584	470
One in Two Year Discharge (Q_2)	438	539	597	587	607	652	1122	1772	1435	811	530	435
One in Ten Year Discharge (Q_{10})	319	338	350	359	368	421	742	1209	847	528	397	345
$Q_2 - Q_{10}$	119	201	247	228	239	231	381	564	588	283	133	90
Water Use	—	—	—	—	—	—	—	—	—	—	—	—

Period of Record: 1910-1971. Remarks: MEASURED DATA, LOG-NORMAL DISTRIBUTION

Table 13 FREQUENCY AND WATER USE DATA

FOR LITTLE KLICKITAT, nr. GOLDENDALE U.S.G.S. GAGE 14-1120

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
Mean Discharge	6	23	76	102	171	135	118	66	31	7	3	2
One in Three Year Discharge (Q_3)	7	23	66	110	186	147	132	74	34	8	3	3
One in Two Year Discharge (Q_2)	5	16	40	74	138	114	104	61	27	6	2	2
One in Ten Year Discharge (Q_{10})	3	6	9	22	57	54	50	33	14	3	1	1
$Q_2 - Q_{10}$	2	11	31	51	81	61	54	28	14	3	1	1
Water Use	—	—	—	—	—	—	—	—	—	—	—	—

Period of Record: 1947-1970 Remarks: MEASURED DATA, LOG-NORMAL DISTRIBUTION

Table 14 FREQUENCY AND WATER USE DATA

FOR MILL CREEK, nr. BLOCKHOUSE U.S.G.S. GAGE 14-1124.

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
Mean Discharge	5	7	12	22	31	36	32	25	10	5	3	4
One in Three Year Discharge (Q_3)	5	7	12	25	36	41	36	28	12	5	3	5
One in Two Year Discharge (Q_2)	4	6	10	20	26	32	27	21	9	4	3	4
One in Ten Year Discharge (Q_{10})	3	5	4	9	11	16	13	8	4	2	1	2
$Q_2 - Q_{10}$	2	2	5	10	16	16	15	12	5	2	1	2
Water Use	—	—	—	—	—	—	—	—	—	—	—	—

Period of Record: 1965-1972. Remarks: MEASURED DATA, LOG-NORMAL DISTRIBUTION

Table 15

FREQUENCY AND WATER USE DATA

FOR LITTLE KLICKITAT RIVER, nr. WAHKIACUS U.S.G.S. GAGE 14-1125

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
Mean Discharge	39	81	200	367	439	381	289	187	94	41	27	29
One in Three Year Discharge (Q_3)	42	85	192	374	481	418	323	209	105	45	30	32
One in Two Year Discharge (Q_2)	38	67	133	247	354	318	256	168	86	37	26	28
One in Ten Year Discharge (Q_{10})	28	32	44	72	143	141	128	88	47	21	16	21
$Q_2 - Q_{10}$	10	34	89	175	212	177	128	81	39	16	10	8
Water Use	—	—	—	—	—	—	—	—	—	—	—	—

Period of Record: 1946-1974 Remarks: MEASURED DATA, LOG-NORMAL DISTRIBUTION

Table 16 FREQUENCY AND WATER USE DATA

FOR KLICKITAT RIVER, nr. PITT U.S.G.S. GAGE 14-1130

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
Mean Discharge	774	967	1498	1889	2120	2161	2431	2637	2079	1199	843	751
One in Three Year Discharge (Q_3)	829	1054	1597	2020	2332	2374	2665	2888	2288	1304	899	794
One in Two Year Discharge (Q_2)	758	919	1263	1551	1887	2000	2280	2499	1932	1146	828	742
One in Ten Year Discharge (Q_{10})	581	612	629	706	1003	1199	1433	1624	1166	780	646	605
$Q_2 - Q_{10}$	177	307	635	845	883	800	847	875	766	366	182	137
Water Use	—	—	—	—	—	—	—	—	—	—	—	—

Period of Record: 1929-1974. Remarks: MEASURED DATA, LOG-NORMAL DISTRIBUTION

TABLE 17: MONTHLY DISCHARGE FOR THE KLICKITAT BASIN.

STREAM	STATION No.	DRAINAGE AREA (sq. mi.)	AVERAGE MONTHLY FLOW (in cfs)												MEAN ANNUAL FLOW (cfs)
			OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
KLICKITAT R. ab. W. Fk.	14-1070	151	131	195	227	211	236	223	451	988	801	312	143	107	336
W. Fk. KLICKITAT R.	-1080	87	203	238	261	231	265	240	357	680	588	346	238	200	321
BIG MUDDY CREEK	-1090	23	68	67	65	59	66	57	85	220	254	130	68	49	99
KLICKITAT R. nr. GLENWOOD	-1100	360	452	578	658	637	656	694	1178	1849	1552	859	544	442	842
KLICKITAT R @ RES. BDRY.	—	749	627	769	1044	1079	1291	1369	1775	2223	1816	1042	711	614	1200
BUTLER CR nr. GOLDENDALE	-1117	12	4	6	18	35	45	49	43	37	17	6	3	3	22
LTL. KLICKITAT nr. GOLDENDALE	-1120	84	6	23	76	102	171	135	118	66	31	7	3	2	62
SPRING CR. nr. BLOCKHOUSE	-1123	3	13	13	16	15	14	14	13	13	13	14	14	13	14
MILL CR nr. BLOCKHOUSE	-1124	27	5	7	12	22	31	36	32	25	10	5	3	4	16
LTL. KLICKITAT nr. WAHKIACUS	-1125	280	39	81	200	367	439	381	289	187	94	41	27	29	181
KLICKITAT R. nr. PITT	-1130	1297	774	967	1498	1889	2120	2161	2931	2637	2079	1199	843	751	1606

SOURCE: U.S.G.S DATA & REPORT ON MONTHLY STREAMFLOW IN KLICKITAT BASIN BY DON RICHARDSON.

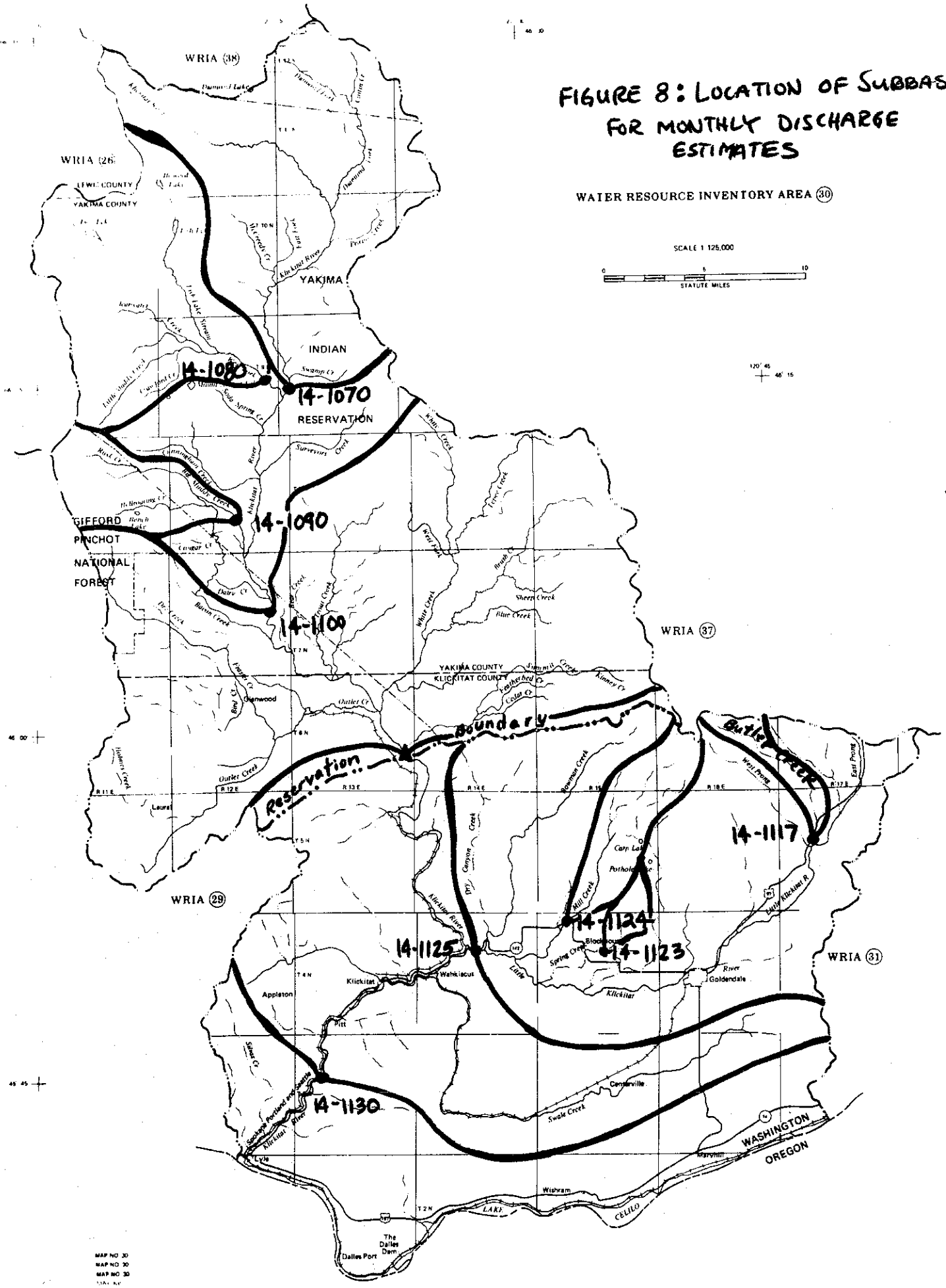


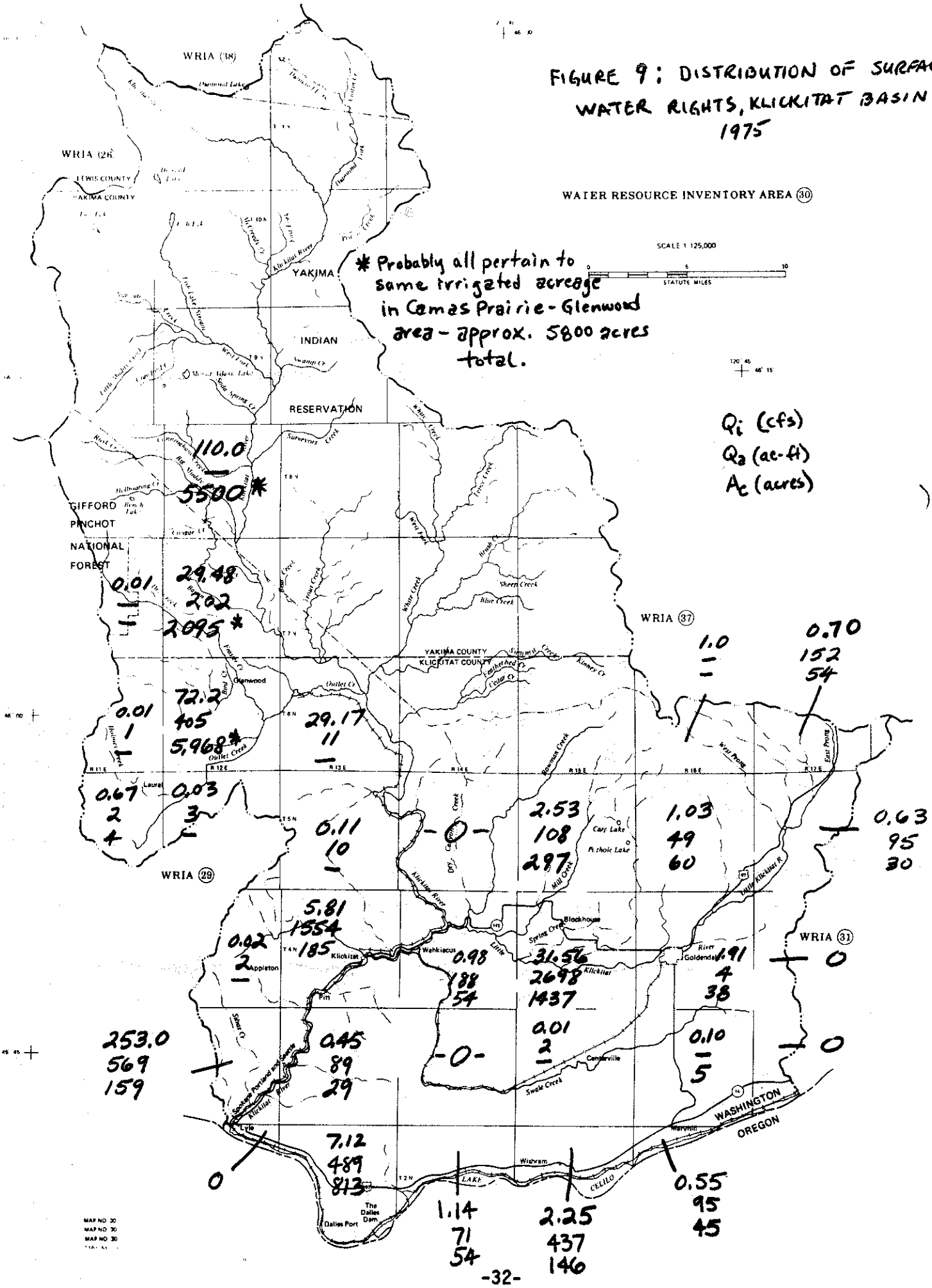
FIGURE 8: LOCATION OF SUBBASINS FOR MONTHLY DISCHARGE ESTIMATES

WATER RESOURCE INVENTORY AREA (30)

SCALE 1:125,000

STATUTE MILES

FIGURE 9: DISTRIBUTION OF SURFACE WATER RIGHTS, KLICKITAT BASIN 1975



Prior to issuance of the permit, it was determined that the actual use would be for the operation of five fish ladders to be located within SE¼ of Sec. 26, T. 3 N., R. 12 E.W.M. The permit issued accordingly. In August, 1952, Certificate No. 4802 was issued for 250 cfs to the Department of Fisheries only. No reason for deleting the Game Department as a co-certificatee was noted.

During the preparation of this report, the writer requested the Department of Fisheries to send a schematic drawing showing the diversions and how the water is used. This drawing is shown in Figure 10. As can be seen, five fish ladders were not constructed as proposed, only two. Fishway No. 1 utilizes 50 cfs, with an additional 100 cfs for "auxillary" water. Fishway No. 2 utilizes 40 cfs, which can be construed as a reuse of a portion of the waters used in No. 1. Also, 100 cfs is utilized for "dual fish passage" in the main channel at the site of Fishway No. 1.

It is the writer's opinion that the certificate was issued erroneously, and should have been issued for 50 cfs only. Further investigation of this water right should take place before the basin management policy is drafted. All water rights issued after the June 1947 priority date are subject to regulation in favor of this certificate.

Table 18 gives the summary of total depletions in the Klickitat Basin. Of the 12,500 acres irrigated in the basin, 8,000 acres are irrigated from surface waters and 4,500 acres from ground waters. A uniform depletion of 12 cfs for ground water was assumed.

TABLE 18: SUMMARY OF TOTAL DEPLETIONS (in cfs).

Month	Ground Water	Surface Water	Total
October	12	-20	- 8
November	12	-18	- 6
December	12	-16	- 4
January	12	-14	- 2
February	12	-12	0
March	12	- 8	4
April	12	15	27
May	12	55	67
June	12	65	77
July	12	95	107
August	12	86	98
September	12	38	50

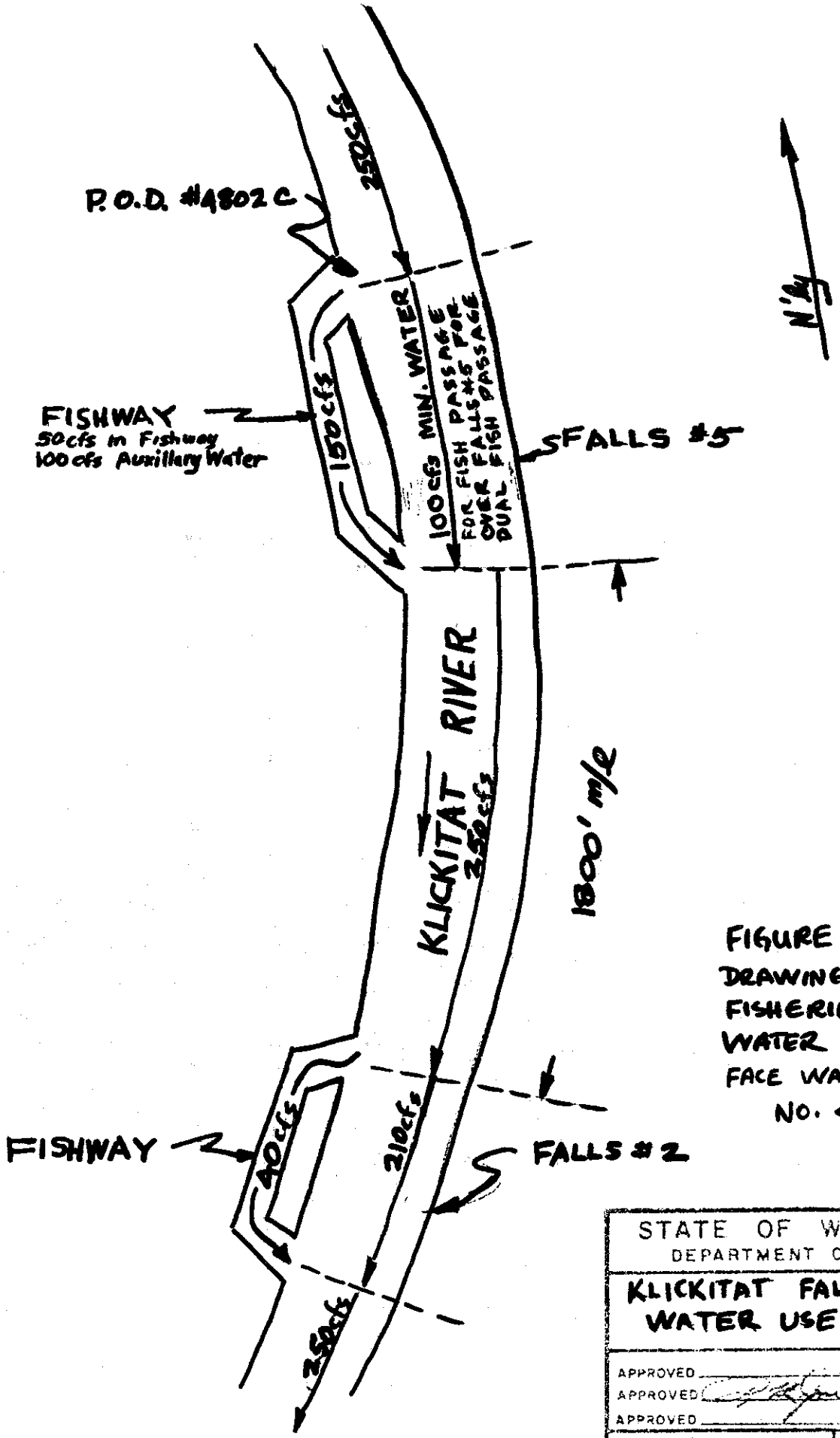


FIGURE 10: SCHEMATIC DRAWING OF DEPT. OF FISHERIES USE OF WATER UNDER SURFACE WATER CERTIFICATE NO. 4802

STATE OF WASHINGTON
DEPARTMENT OF FISHERIES

KLICKITAT FALLS FISHWAYS
WATER USE SCHEMATIC

APPROVED _____ DIRECTO
APPROVED _____ CHF ENG
APPROVED _____ OPERATI

DATE 4-29-76	DRW BY Mauer
SCALE None	DRWG NO

In addition to the depletions for the whole basin, depletions were calculated for the Little Klickitat River subbasin.

Approximately 2,250 acres were irrigated in this subbasin from ground water. Ground water use probably does not deplete stream flow because the withdrawal is from the basalts, which are not connected to the stream system.

The 1967 SCS report indicated no surface water use in the Little Klickitat subbasin, which is probably incorrect. The surface water rights in the area totaled 1,931 acres in 1975. It was substantially the same in 1970 due to the closure of the watershed by Fisheries and Game.

In 1970, Klickitat Basin paper rights were for approximately 22,000 acres; actual usage was approximately 13,000 acres, a ratio of 0.59. Assuming surface water actual usage in the Little Klickitat Basin of (0.59)(1931) = 1,140 acres, the following depletion table was tabulated.

TABLE 19: TOTAL DEPLETIONS - LITTLE KLICKITAT SUBBASIN (in cfs).

Month	Surface Water Depletion	Month	Surface Water Depletion	Month	Surface Water Depletion
Oct	-3	Feb	-2	Jun	9
Nov	-2	Mar	-1	Jul	14
Dec	-2	Apr	+2	Aug	12
Jan	-2	May	8	Sep	5

Tables 20 and 21 show the mean monthly discharges for the Little Klickitat River near Wahkiacus and the Klickitat River near Pitt. These discharges were determined by frequency analysis and have been corrected for depletions.

Ground Water Supply

Few reports on the geology and ground water resources of the Klickitat Basin have been made. The Water Research Center at Pullman is at present conducting a detailed study of Klickitat County, scheduled for completion in early 1977. D. R. Cline in his USGS open-file report on the Upper Klickitat Basin, Yakima Indian Reservation, describes the geohydrologic

Table 20

FREQUENCY AND WATER USE DATA

FOR LTL KLICKITAT RIVER near WANKIACUS. U.S.G.S. GAGE 14-1125.

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
Mean Discharge	36	79	198	365	438	380	291	194	102	53	38	33
One in Three Year Discharge (Q_3)	39	83	190	371	479	417	325	216	113	57	40	36
One in Two Year Discharge (Q_2)	35	65	130	245	352	317	258	177	94	50	37	33
One in Ten Year Discharge (Q_{10})	26	31	43	71	141	140	130	96	55	34	27	25
$Q_2 - Q_{10}$	9	34	88	174	211	177	128	80	39	16	9	8
Water Use	—	—	—	—	—	—	—	—	—	—	—	—

Period of Record: 1946-1974. Remarks: Data corrected for depletions.

Table 21 FREQUENCY AND WATER USE DATA

FOR KLICKITAT RIVER near PITT. U.S.G.S. GAGE 14-1130.

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
Mean Discharge	768	963	1495	1888	2120	2164	2451	2687	2136	1279	916	788
One in Three Year Discharge (Q_3)	823	1049	1593	2018	2332	2377	2686	2940	2350	1388	976	833
One in Two Year Discharge (Q_2)	752	915	1260	1550	1887	2003	2302	2550	1991	1227	900	779
One in Ten Year Discharge (Q_{10})	576	608	626	705	1003	1202	1453	1669	1215	850	709	636
$Q_2 - Q_{10}$	176	306	634	845	883	801	849	881	776	378	191	143
Water Use	—	—	—	—	—	—	—	—	—	—	—	—

Period of Record: 1929-1974. Remarks: Data corrected for depletions.

characteristics of that area. J. E. Luzier of the USGS compiled a Hydrologic Investigations Atlas of the Goldendale area which was published in 1969.

Most ground water use in the upper basin is in the Camas Prairie-Glenwood area. Two major ground water bodies are known, one in the shallow unconsolidated deposits and a deeper one in the underlying basalts. Ground water withdrawal in this area was estimated to be approximately 9 acre-feet in 1974.

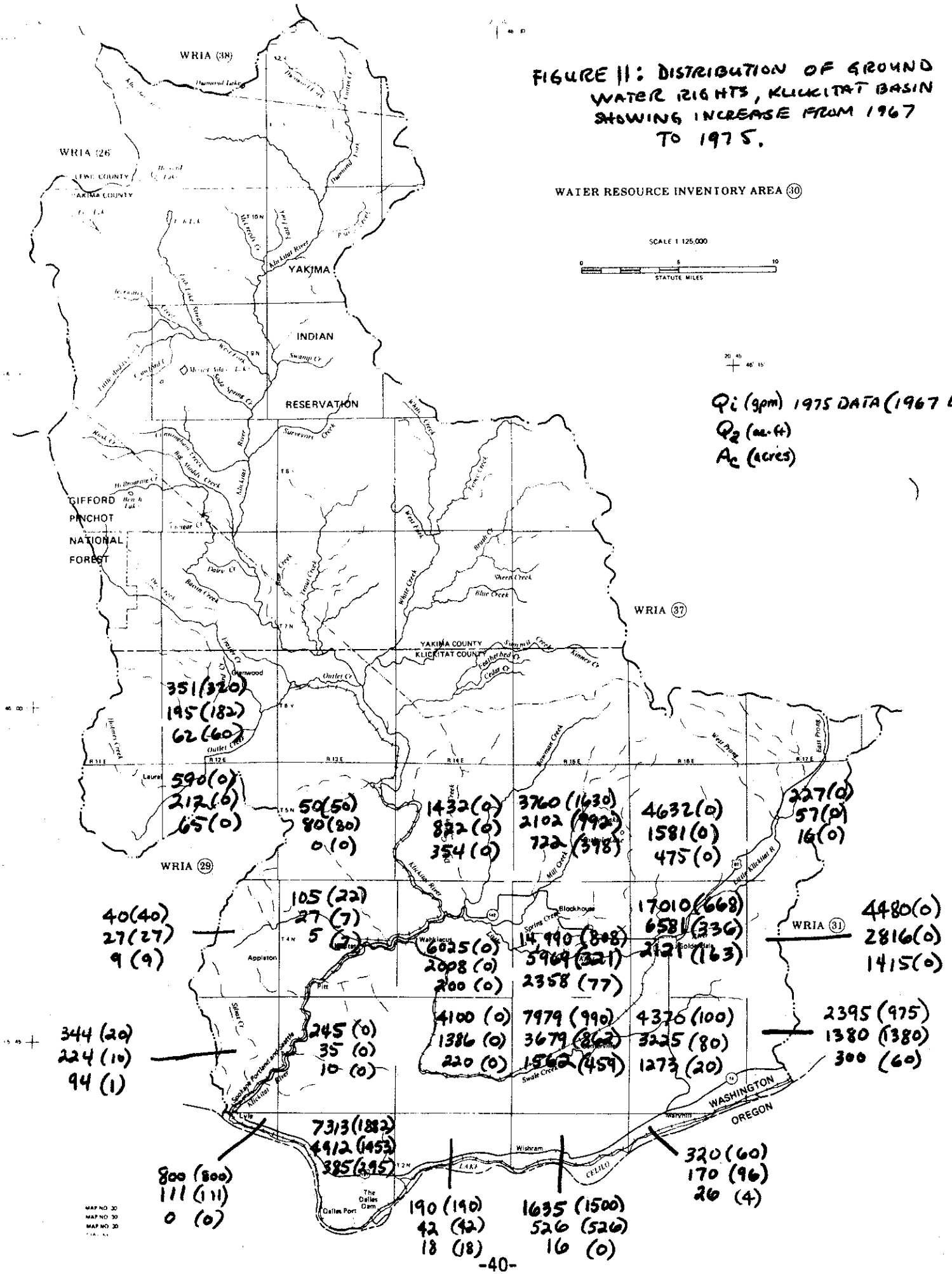
In 1969, Luzier stated that most wells in the Goldendale area were used for domestic and stock use, with a few irrigation wells in use near Centerville and Goldendale. A small number of industrial and irrigation wells were in use along the Columbia River, mainly near Dallesport. Luzier estimated only 3 percent of 120,000 irrigable acres were being irrigated, and the likelihood of increased ground water use was great. The recent increase in the number of ground water permits and certificates in this area has proven his prediction to be true.

Between the years 1967 and 1975, ground water permits and certificates in the Goldendale-Centerville area show an increase in irrigated acres of almost 10,000 acres, to a total of over 11,000 acres. Instantaneous pumping rates in the area have gone from 10,055 gpm (22.4 cfs) in 1967, to 77,912 gpm in 1975, an increase of 675 percent. Further investigation reveals that approximately 47,000 gpm (104.8 cfs) are still in the permit stage, and as such, are probably undeveloped at this time.

Through conversations with department personnel and the Water Research Center, the feeling is, that water for potential development is available and present pumpage is not affecting the water levels significantly. There is a seasonal fluctuation of the levels in the observation wells, but no long-term decline is indicated. If and when the 47,000 gpm under permit are developed, close attention should be paid to the water table; and should problems become apparent, consideration should be given to establishing a ground water subarea. There have been localized cases of interference between wells.

Figure 11 shows the geographical distribution of the ground water rights in the Klickitat Basin. This shows the rights as of January 1, 1967 (in parenthesis) and the rights as of January 1, 1975. It is apparent from this map that the increase in ground water rights is concentrated in the Goldendale-Centerville area.

FIGURE 11: DISTRIBUTION OF GROUND WATER RIGHTS, KLICKITAT BASIN SHOWING INCREASE FROM 1967 TO 1975.



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