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INITIAL WATERSHED ASSESSMENT
WATER RESOURCES INVENTORY AREA 45
WENATCHEE RIVER WATERSHED

Open file Report 95-12

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Introduction

This report is the product of a recent initiative by the Department of Ecology (Ecology) to assess the availability of ground and surface water for each watershed within Washington State. This initiative is part of a larger overall effort to make the water rights decision making process more efficient. The watershed assessment process will not only reduce the time needed to make decisions, but also will allow Ecology to make better informed decisions based on a more comprehensive understanding of each watershed. Ecology also believes these reports will be useful to local governments for planning purposes.

The scope of this report was limited to a review of existing information. No new field work or data collection efforts were conducted. The information reviewed includes hydrologic data, water rights data, water quality data, and fisheries data. A bibliography of reports and information review is contained at the end of this report.

Watershed Description

Area Description

The Wenatchee River drains a portion of the east slopes of the Cascade Mountains in north central Washington within Chelan County. The river flows generally in a southeasterly direction, emptying into the Columbia River at the City of Wenatchee. The Wenatchee River Watershed (WRIA 45) encompasses approximately 1,371 square miles, with 230 miles of major streams and rivers. The watershed originates in high mountainous regions of the Cascade Mountains, with numerous tributaries draining subalpine regions within the Alpine Lakes and Glacier Peak wilderness areas. The Little Wenatchee and White Rivers flow into Lake Wenatchee, the source of the Wenatchee River. From the lake outlet at River Mile (RM) 54.2 the river descends rapidly through Tumwater Canyon, dropping into a lower gradient section in the region of Leavenworth, where Icicle Creek joins the mainstem (RM 25.6). Other major tributaries include Mission, Peshastin, Chumstick and Chiwaukum Creeks, Chiwawa River and Nason Creek. The Wenatchee River Watershed also includes areas on the west side of the Columbia River from the south part of the City of Wenatchee northward to Rocky Reach Dam. Map 1 illustrates the boundaries and major features of the watershed.

Watershed Subbasins

The Wenatchee River Watershed was divided into 18 subbasins. The subbasins are shown in Map 1. Table 1 lists the subbasins, their area and which stream they are a tributary to. The subbasins represent the division of management by Ecology of water resources in the watershed.

Table 1
Wenatchee River Watershed Subbasins

	Name	Area (square nines)	Area (acres)	Tributary to:
1	White River	155.8	99,712	Lake Wenatchee
2	Little Wenatchee River	103	65,920	Lake Wenatchee
3	Lake Wenatchee	20.2	12,928	Upper Wenatchee River
4	Chiwawa River	199.2	127,488	Upper Wenatchee River
5	Nason Creek	105.9	67,776	Upper Wenatchee River
6	Chiwaulkum Creek	50.1	32,064	Upper Wenatchee River
7	Cabin Creek	40.3	25,792	Upper Wenatchee River
8	Chum stick Creek	79.6	50,944	Upper Wenatchee River
9	Icicle Creek	212.7	136,128	Upper Wenatchee River
10	Peshastin Creek	135.3	86,592	Lower Wenatchee River
11	Derby Canon	24.8	15,872	Lower Wenatchee River
12	Ollala Canon	9.8	6,272	Lower Wenatchee River
13	Mission Creek	93.3	59,712	Lower Wenatchee River
14	Nahahum Canon	21.3	13,632	Lower Wenatchee River
15	Warm Springs Canon	27.6	17,664	Lower Wenatchee River
16	No. 1 & 2 Canons	39.5	25,280	Lower Wenatchee River,
17	Upper Wenatchee River	31.1	19,904	Lower Wenatchee River
18	Lower Wenatchee River	21.4	17,536	Columbia River
	Totals	**1370.9**	**877 76**	

Land Use

The primary land uses within the Wenatchee River Watershed are forestry, wilderness, agriculture, range, residential and recreation. An estimate of land ownership in the watershed is contained in Table 2. An estimate of area in different land uses is contained in Table 3. Table 3 also presents a breakdown of land uses by subbasin. The subbasin definitions used in Table 3 were obtained from a separate study and differ from those described in this study. The area totals in both Table 2 and 3 do not correspond to the area listed in Table 1. The reason is the data in Tables 2 and 3 are only for area tributary to the Wenatchee River. Our study area also includes the west side of the Columbia River from the City of Wenatchee to Rocky Reach Dam. The largest landowner is the U.S. Forest Service with approximately 395,000 acres of forest land or 45 percent of the total

watershed area. The acreage of irrigated farmland in the watershed tributary to the lower Wenatchee River was estimated to be 12,479 acres.

The population of the study area is divided between cities and towns (approximately 56 percent) and unincorporated areas of Chelan County (approximately 44 percent). Table 4 lists 1993 estimates of populations of cities and towns within the study area.

Table 2
Land Ownership in the Wenatchee River Watershed

Ownership	Approximate Area (acres)	Percent of Total
State		
Common School, Indemnity, Escheat	9,000	1.1
Dept. of Wildlife	2,000	0.3
Federal		
National Forest	395,000	49.4
Wilderness	219,000	27.4
BLM	1,000	0.1
Private Ownership	174,000	21.7
Totals	**800,000**	**100**

Source: WDOF, 1990

Table 3
Areas of Different Land Use by Subbasin

Land Use	Area in Acres									
	Peshastin	**Icicle**	**Nason**	**Lake Wenatchee**	**White**	**Chiwawa**	**Chumstick**	**Mission**	**Main Stem**	**Total**
Urban & Built up	0	66	0	0	0	25	4	772	2,076	2,943
Agricultural Land	259	725	0	0	0	296	701	2,011	8,487	12,479
Rangeland	1,844	9,383	1,491	2,333	8,913	1,937	531	1,405	25,895	53,732
Forest Land	82,102	119,532	66,068	60,494	71,757	110,107	48,679	55,408	122,529	736,676
Water	32	1,303	159	197	322	90	0	0	2,868	4,971
Wetland	0	0	82	1,704	3,698	770	0	0	490	6,744
Barren Land	0	0	16	52	0	10	0	7	85	170
Tundra	11962	5,990	507	0	6,664	2,978	0	0	1,360	19,461
Perennial Snow &	239	198	0	0	8,658	3,647	0	0	0	12,742
Totals	**86,438**	**137,197**	**68,323**	**64,780**	**100,012**	**119,860**	**49,915**	**59,603**	**163,790**	**849,918**

Source: Chelan County Conservation District, 1994

Table 4
Current Population Estimates

Area	1990 Population	1993 Population
Wenatchee, City of	21,839	23,000
Wenatchee rural area	5,634	n/a
Cashmere, City of	2,544	2,585
Cashmere rural area	6,348	n/a
Leavenworth, City of	1,692	1,825
Lake Wenatchee-Plain	1,251	n/a
Leavenworth rural area	1,445	n/a
Wenatchee River Watershed Total	**40,753**	**n/a**
Chelan Coun Total	**52,250**	**56,000**

Source: Chelan County Conservation District, 1994.

A graph showing the trend in population growth in Chelan County is shown in Figure 1. Population projections through the year 2010 are also shown. Population projections for census -division areas within the Wenatchee River Watershed are tabulated in Table 5. The rate of population growth of the entire State of Washington is included on Figure 1 for comparison. The population growth in the county was below the state average until the 1970's, when growth accelerated. The population growth in the period of 1990-1993 was 7.2 percent (1994 Washington State Almanac).

Table 5
Population Growth in Wenatchee River Watershed

Area	Population				
	1970	1980	1990	2000[a]	20102
Wenatchee division	23,490	24,058	27,473	32,401	36,816
Cashmere division	6,848	7,885	8,892	10,165	11,300
Leavenworth/Lk. Wen. division	2,622	3,591	4,388	4,519	5,023
Wenatchee River Watershed	**32,960**	**35,534**	**40,753**	**47,085**	**53,139**
Chelan Coun Total	**41 103**	**45 061**	**52 250**	**59 591**	**66 246**

[a]Projection by Office of Finance and Management
Source: Chelan County Conservation District, 1994

Climate and Precipitation

The Cascade Mountains and the prevailing westerly winds are the dominant climatic factors influencing the watershed. Moist air from the Pacific Ocean uplifts and cools as it moves east over the mountains. Most precipitation occurs in late fall and winter. The Cascade Mountain area is characterized by heavy precipitation, with nearly 150 inches annually and snow accumulations of 25 feet or more at the crest. Winter daily temperatures average 25° F to 40° F (Fahrenheit), with summer temperatures averaging 60° F to 80° F. As air masses move east toward the Columbia Basin, moisture progressively decreases, resulting in arid conditions within the lowermost region of the watershed. In contrast to the mountainous areas, the City of Wenatchee receives 8.5 inches or less of precipitation annually with maximum summer temperatures averaging 95° F to 100° F. Violent summer thunderstorms occur periodically, and can result in flash flood conditions on local watersheds.

Records from three climatological stations (Lake Wenatchee, Plain and Wenatchee) in the watershed show no increasing or decreasing trend in precipitation. Figure 2 illustrates the trends in precipitation over the last 40 to 80 years for the three stations. An analysis of state-wide precipitation trends was performed by Ecology (Barker, 1995). The conclusions from that report was that precipitation in eastern Washington was generally above the average since the 1940's. However, the mid 1970's and late 1980's were both below average. An extended period of below average precipitation also occurred in the 1920's through about 1940.

Water Usage In The Wenatchee River Watershed

Irrigation Water Use

A precise estimate of the area of agricultural land within the Wenatchee River Watershed was not available. However, an estimate of 12,479 acres for most of the watershed was listed in Table 3. This estimate does not include irrigated areas in the City of Wenatchee and areas along the Columbia River within WRIA 45. A review of irrigation district records indicate that approximately 21,500 acres receive water diverted from the Wenatchee River. The additional irrigated area is located on the east side of the Columbia River (East Wenatchee) within Wenatchee Reclamation District boundaries. A listing of irrigation districts located within the Wenatchee River Watershed is contained in Table 6. Table 6 also contains information on their irrigated acreage and approximate water use. The numbers were obtained from Water Conservation Plans for the Icicle and Peshastin Irrigation Districts (Klohn Leonoff, 1992), through a telephone survey and other miscellaneous sources. Data on water use by other private irrigation or ditch companies could not be found.

Table 6

Irrigation Water Use in Wenatchee River Watershed

Name	Irrigated acres	Water Source		Estimated Water Use	
		Name	Subbasin	Peak (cfs)	Annual (ac-ft)
Icicle Irrigation District	4,331	Icicle Creek & tributaries	Icicle	84	24,700
Peshastin Irrigation District	3,305 [a)]	Icicle Creek & tributaries Peshastin Creek	Icicle Peshastin	22 40	7,400 12,500
Wenatchee Reclamation District	12,500 [b)]	Wenatchee River	Wenatchee	200	64,740
Wenatchee-Chiwawa Irrigation District	1,300 [b)]	Chiwawa River	Chiwawa	25	4,725

cfs = cubic feet per second
ac-ft = acre-feet
[a] Includes 1,182 acres in lands served by Gibbs and Tandy Companies canals.
[b] Total acres in district, irrigated acres not available.

Municipal Water Use

The primary municipal water users in the Wenatchee River Watershed are listed in Table 7. This table summarizes the population served (both current and about 20 years in the future), current

and future water use, and current permitted water rights. The Wenatchee urban area, which accounts for approximately 50 percent of the Wenatchee River Watershed population, is served by the City of Wenatchee and Chelan County PUD No. 1 using water from a groundwater source near Rocky Reach Dam on the Columbia River. This water source is located on the east side of the Columbia River in WRIA 44. Water rights for this source, the permit for which is held by the city, currently greatly exceed current and projected future demand. Water supply lines from this source may in the future extend up the Highway 2 corridor to serve communities such as Monitor and Cashmere.

Table 7
Municipal Water Use in Wenatchee River Watershed

Name	Population Served		Water Source		Current Water Use		Future Water Use		Current Water Right	
	Current	Future	Name or Type	Subbasin	Peak (cfs)	Annual (ac-ft)	Peak (cfs)	Annual (ac-ft)	Peak (cfs)	Annual (ac-ft)
City of Wenatchee	n/a	n/a	Rocky Reach wellfield	WRIA 44	n/a	n/a	n/a	n/a	66.8[a]	13,277[a]
Chelan County PUD - Wenatchee urban area	8,603	12,029	Rocky Reach welifield	WRIA 44	4.9	1,840	6.9	2,575	66.88[a]	13,277[a]
Chelan County PUD - Dryden	152	203	Well	Lower Wenatchee	0.25	16	0.29	21	0.33	74
Chelan County PUD - Lake Wenatchee area	950	1,565	Well and Lake	Lake Wenatchee	0.78	208	1.2	342	-- [b]	-- [b]
City of Cashmere	2,660	3,296	Wenatchee River	Lower Wenatchee	n/a	649	n/a	1,797	n/a	n/a
City of Leavenworth	2,4184	3,823	Icicle Creek Groundwater	Icicle Creek Icicle Creek	5.4[d]	1,166[d]	9.1	1,463	5.2[d]	n/a

[a]Shared water supply source in Douglas County (WRIA 44). Water right is held by City of Wenatchee.
[b]Water rights are currently held by many. PUD is exploring options on how to consolidate or seek new rights.
[c]Future is year 2010 to 2012 timeframe.
[d]1991 estimate - from Water System Plan.

Table 8 summarizes, by subbasin, the total system capacity for all public water systems located in the Wenatchee River Watershed. These data were obtained from the Washington State Department of Health database of system facility data for Group A and B systems. Municipal water use data contained in Table 7 is included in Table 8 totals, except for the City of Wenatchee source, which is located outside the Wenatchee River Watershed.

A listing of the individual water systems within each Wenatchee River Watershed subbasin is included in Appendix A. Table A-1 in Appendix A identifies the system location, name, water source, class, and total capacity. Group A water systems serve 15 or more connections or 25 or more people per day for 60 or more days per year. Group B water systems serve fewer connections than Group A systems.

Table 8

Capacity of Public Water Systems

Subbasin		Total Capacity	
		gpm	**cfs**
1	White River	80	0.18
2	Little Wenatchee River	0	0.00
3	Lake Wenatchee	1;060	2.36
4	Chiwawa River	163	0.36
5	Nason Creek	582	1.30
6	Chiwaulkum Creek	60	0.13
7	Cabin Creek	0	0.00
8	Chumstick Creek	158	0.35
9	Icicle Creek	2,800	6.25
10	Peshastin Creek	505	1.13
11	Derb Canon	10	0.02
12	Ollala Canon	478	1.07
13	Mission Creek	115	0.26
14	Nahahum Canon	0	0.00
15	Warm Springs Canon	29,930	66.82
16	No. 1 & 2 Canons	102	0.23
17	Upper Wenatchee River	5,795	13.34
18	Lower Wenatchee River	6,015	13.43
	Total	**47,853**	**107.20**

gpm - gallons per minute
Source: Washington State Health Department database for Class A and B systems.

Surface Water

Watershed Hydrology

Hydrology is the study of the occurrence, circulation, distribution and properties of the earth's waters and their reaction to the environment. Water occurs in the form of rain and snow and then circulates as groundwater and surface water. In the Wenatchee River Watershed, precipitation mostly falls as snow and accumulates to create the winter snowpack. The warmer temperatures and rain of spring and early summer melt the snowpack, generating water to supply streamflow. A portion of the melt water, as well as some of the rain water, also infiltrates down through the soil to become groundwater. Later on, this same groundwater discharges to the river and tributaries, and supplies much of the streamflow from late summer through winter. The continual movement of precipitation, surface water runoff, infiltration, surface and subsurface storage, groundwater discharge, and evapotranspiration between the earth and atmosphere is referred to as the hydrologic cycle. An illustration of the hydrologic cycle is shown in Figure 3.

The main surface water feature of the Wenatchee River Watershed is the Wenatchee River, which has its source at Lake Wenatchee. Four large tributaries join together at or near Lake Wenatchee to form the Wenatchee River: the Chiwawa River, White River, Little Wenatchee River, and Nason Creek. The river then flows southeasterly though the Wenatchee Valley and discharges to the Columbia River at Wenatchee. The drainage area of the Wenatchee River is 1,328 square miles. The Wenatchee River Watershed is confined by the Entiat mountains to the northeast, the crest of the Cascade range to the northwest, and the Wenatchee mountains to the southwest. The Wenatchee River Watershed also includes areas along the west side of the Columbia River from Rocky Reach Dam downstream to the south end of the City of Wenatchee. The total watershed area is 1,371 square miles.

Most of the streamflow in the Wenatchee River Watershed originates from several large tributaries in the upper portion of the watershed. Five tributaries - the Chiwawa River; White River, Little Wenatchee River, Nason Creek and Icicle Creek - are the source of over 94 percent of the surface water within the watershed (based on 1992-1993 measurements), whereas their drainage area represents only 58 percent of the total watershed area. Figure 4 shows the relative amount-of streamflow that each tributary contributes to the Wenatchee River.

Available Data

Streamflow in the Wenatchee River Watershed has been measured and recorded at many gauging stations located on the Wenatchee River and associated tributaries. In general, measured streamflows from stream gauges in the upper watershed (above Leavenworth) have not been greatly affected by consumptive water usage because the streams drain mostly undeveloped mountainous areas. Water supply for small domestic systems and a single irrigation diversion near Plain are the only uses. Stream gauges that are located near the lower ends of stream basins, particularly on the Wenatchee River and in tributaries below Leavenworth, have measured streamflow that has been affected by water usage for irrigation, water supply, and other activities. This has resulted in reduced streamflow rates and/or modified seasonal runoff patterns. An analysis to determine what the natural streamflow characteristics would be in the absence of human activities has not been conducted on streams in the Wenatchee River Watershed and was beyond the scope of this assessment report. Therefore, the analysis of streamflows is based on data that reflects and incorporates changes caused by historical water usage.

Streamflow gauging stations with continuous historical flow records are summarized in Table 9. The period of record for stations on principal tributaries and for the main stem of the Wenatchee River is fairly good, with continuous records dating as far back as 1929. However, only four gauges are currently operating: three on the Wenatchee River and one on the Chiwawa River. Several stations that were discontinued in the 1970's and/or 1980's have been recently reactivated.

Data on the remaining perennial streams in the lower portions of the Wenatchee River Watershed are very limited. Continuous records on these streams are generally very short and date from many years ago. For example, the only continuous streamflow data available for Peshastin Creek are for the period of 1911-1912. Gauging stations with short and dated records are not listed in Table 9. Recently, many streams were measured on a semi-monthly basis between October 1992 and September 1993 for the Wenatchee River Watershed Ranking Project (Chelan County Conservation District, 1994). That study provides the only available streamflow data on several small tributaries. However, since these data cover only one year in a drought period, when streamflows in the Wenatchee River were only 67 percent of normal, they may not be representative of long-term conditions. It would be difficult to assess the status of current streamflows in these streams using that data. The location of USGS streamflow gauging stations are shown on Map 1.

Reservoirs in the Wenatchee River Watershed that are used for storage of water for irrigation and water supply are listed in Table 10. Reservoir storage in the Icicle Creek subbasin is used to augment irrigation water used by the Icicle and Peshastin Irrigation Districts. Water is released from these reservoirs and diverted into the irrigation canal at Icicle Creek when there is not sufficient streamflow in Icicle Creek and/or Peshastin Creek to meet the Irrigation District's diversion requirements. Water from these reservoirs is also used to supplement the water for the City of Leavenworth and the U.S. Fish and Wildlife Service hatchery located at Leavenworth.

Table 9
Available Recorded Streamflow Data in Wenatchee River Watershed

Name and Location	USGS Gauge	Drainage Area (sq mi)	River Mile (mi)	Period of Record	Upstream Irrigation or Diversions (acres)
Chiwawa River near Plain	12456500*	170	6.2	1936-1949 1954-1957 1991-1995	None
White River near Plain	12454000	150	6.4	1954-1983	None
Wenatchee River below Wenatchee Lake	12455000	273	---	1932-1958	None
Wenatchee River at Plain	12457000*	591	46.2	1910-1979 1989-1995	1,400 acres supplied by lower Chiwawa River
Icicle Creek above Snow Creek	12458000	193	5.8	1936-1971	Regulation by upstream reservoirs for diversion below gauge
Wenatchee River at Peshastin	12459000*	1,000	21.5	1929-1995	6,900 acres of irrigation
Mission Creek above Sand Creek near Cashmere	12461400	39.8	7.0	1958-1971	None
Wenatchee River at Monitor	12462600*	1,301	7.0	1962-1995	200 cfs to Highline Canal plus an additional 9,000 acres of irrigation upstream

* Indicates currently active stream gauge

Table 10
Storage Reservoirs in Wenatchee River Watershed

Name	Location	Subbasin	Primary Purpose	Normal Active Storage (acre-feet)
Colechuck Lake	Colechuck Creek	Icicle	Irrigation	1,240
Eightmile Lake	Eightmile Creek	Icicle	Irrigation	1,610
Klonoqua Lake	French Creek	Icicle	Irrigation	1,920
Square Lake	Prospect Creek	Icicle	Irrigation	500
Snow Lake	Snow Creek	Icicle	Irrigation	n/a
H&H Reservoir #3	E. Fork Mission Creek	.Mission	Irrigation Water Supply	27

Source: Ecology (1994)

Average Annual Flows

A summary of historical average annual flows at various locations within the Wenatchee River Watershed is presented in Table 11. This table includes averages of streamflows that were measured over many years at USGS gauging stations, and also streamflows that were measured during October 1992 to September 1993 for the Wenatchee River Watershed Ranking Project. Streamflows were only 67 percent of average in 1992-1993, probably caused by an extended period of below average precipitation that began in the mid 1980's. However, the percentage of streamflow that each tributary contributed to the Wenatchee River during 1992-1993 is very similar to that indicated by the long-term USGS streamflow measurements.

Based on the 1992-1993 streamflow measurements, the five principal tributaries in the upper watershed - the Chiwawa River, White River, Little Wenatchee River, Nason Creek and Icicle Creek - are the source of over 94 percent of the surface water that is discharged from the Wenatchee River. These five tributaries are all located above Leavenworth and represent only 58 percent of the total Wenatchee River drainage area. The White River is the largest in terms of total flow and also has the highest amount of runoff per square mile. The remaining 42 percent of the drainage area, located below Leavenworth, contributed less than 6 percent of the streamflow to the Wenatchee River. Since these estimates are based on streamflows that were measured during an abnormally dry year, they may not be representative of normal or wet years. Relative streamflow contribution from smaller tributaries would probably be somewhat greater during wetter periods because the smaller streams in the lower watershed would be more affected by drought conditions.

Historical annual streamflows for selected stations with long-term records (greater than about 30 years) are shown in Figures 5-8. Data for these stations are tabulated in Appendix B. The graphs depict the long term trend of annual runoff at various locations on these rivers. Trends in annual

runoff are depicted by a straight line calculated using a linear regression analysis. Also shown on these graphs are total annual precipitation at Lake Wenatchee. Comparison of runoff to precipitation can indicate whether streamflow trends are related to climatic trends.

Based on data trends shown in these graphs, the average annual flows on the Wenatchee River at Plain (Figure 8) have increased by about 200 cfs over the past 80 years, and have shown a smaller increase over the past 60 years at the stream gauge located at Peshastin (Figure 5). Although total flow volume fluctuated widely from year to year, extended periods of higher or lower than normal streamflows occurred at several different times during the last 80 years. For example, the mid1930's to mid-1940's were particularly dry, followed by a wet period that lasted to about 1960. The early 1970's were a wet period, followed by a dry period in the 1980's. These patterns are also illustrated by the annual precipitation graphs plotted above the streamflow graphs. The average annual flow in Icicle Creek (Figure 6) showed an increasing trend for it's period of record (19361971). That period coincides with a cycle from a dry period to a wet period. The average annual flow in the White River (Figure 7) showed a decreasing trend for it's period of record (1954-1983). That period coincides with a cycle from a wet period to a dry period.

The trends indicated by the regression analyses are strongly influenced by the period analyzed. Because of that, it is concluded that there has not been a trend of increasing or decreasing flows in the Wenatchee River Watershed.

Table 11
Average Annual Flows in the Wenatchee River Watershed

Location	Drainage Area		Period of Record Streamflows[b]		1993 Streamflows[c]		
	Square Miles	Percent[a]	Average Annual Volume (acre-feet)	Average Flow WS)	Annual Volume (acre-feet)	Average Flow (cfs)	Percent of Outflow[d]
TRIBUTARY INFLOWS							
- White River	150	11.5%	589,000	814	434,000	600	27.6%
- Chiwawa River	187	14.4%	353,000	488	236,000	326	15.0%
- Little Wenatchee River	100	7.7%	---	---	242,000	335	15.4%
- Icicle Creek	211	16.2%	451,000	624	340,000	471	21.7%
- Nason Creek	108	8.3%	---	---	197,000	273	12.5%
- Peshastin Creek	133	10.2%	---	---	74,000	103	4.7%
- Mission Creek	82	6.3%	9,800	13.5	7,200	9.9	0.5%
- Chumstick Creek	78	6.0%	---	---	2,900	4.0	0.2%
- Tributary total	1,049	80.6%	---	---	1,533,000	2,122	97.6%a
MAINSTEM FLOWS							
- Wenatchee River at Lk. Wenatchee	273	21.0%	950,000	1,314	819,000	1,133	52.2%
- Wenatchee River at Plain	591	45.4%	1,636,000	2,262	1,093,000	1,513	69.6%
- Wenatchee River at Peshastin	1,000	76.9%	2,214,000	3,062	1,474,000	2,040	93.9%
- Wenatchee River at Monitor	1,301	100.0%	2,337,000	3,231	1,570,000	2,173	100.0%

a Compared to drainage area of Wenatchee River measured at Monitor.
b From USGS for varying periods of record.
c Based on 20 flow measurements between October 1992-September 1993 (Chelan County Conservation District, 1994). Flows for Chiwawa River and Wenatchee River at Plain, Peshastin and Monitor from daily USGS streamflow records for water year 1993.
d Compared to average flow rate of Wenatchee River measured at Monitor.

Monthly Flow Exceedences

To determine how streamflows have varied historically throughout the year, a statistical analysis using recorded daily streamflows was performed. The analysis produces low, median and high flow exceedence probability estimates for incremental dates during the year. Low flow is defined as the 90 percent exceedence probability, and is equal to the flow rate that occurred 9 years out of 10 for a particular period of time. Median flow is defined as the 50 percent exceedence probability; and is equal to the flow rate that occurred five years out of ten. High flow is defined as the 10 percent exceedence probability, and is equal to the flow rate that occurred one year out of ten.

Figures 9-16 present the results of the monthly flow exceedence analysis. The analysis was conducted on four Wenatchee River stream gauges and four tributary stream gauges. The data are also tabulated in Appendix B. The WAC instream flows are also shown on the figures where applicable. WAC instream flows are discussed in the Water Demand section.

The flow exceedence curves show the peak annual flows occurring in late May and early June, at the peak of the spring snowpack melt. The lowest annual flows occur in late September and early October prior to the start of the fall rains. Flow rates increase moderately during the mid winter in response to runoff from winter storms and then fall to another low flow period (but not as low as in the fall) in early spring. Flow rates decrease by ten- to twelvefold on average between the times of peak runoff and low flows on the Wenatchee River and most tributaries. Mission Creek experiences an even larger drop (fifteen fold) in flow rate between the spring peak and fall low flow. The volume of runoff on the Wenatchee River for the months of May through July averages 57 percent of the total annual runoff volume.

Streamflow records show that during mid-September, when the lowest flows of the season occur, flow rates in the Wenatchee River remain constant from about Leavenworth to the mouth. Gauging records from Peshastin and Monitor indicate that the flow rate in this reach drops to an annual low of approximately 730 cfs during average flow years and 430 cfs during dry years (50 percent and 90 percent exceedence flows, respectively).

Low Flows

Trends in late summer and fall streamflows do not always correspond to trends in annual flows because the majority of runoff volume occurs during the period of spring runoff. Trends in low flows are best evaluated by examining the historical trend in annual 7-day flows. The 7-day low flow is defined as the average of the seven lowest consecutive flow days in each year.

Historical 7-day low flows with their trends for streamflow stations in the Wenatchee River Watershed are shown in Figures 17-24. Annual average flows are also shown on these graphs to enable comparison of annual average and annual low flow trends. In general, the trend over about the last 80 years at all locations where streamflow records are available is a slight increase in annual 7-day low flows. However, short-term cycles are present within this 80-year period, resulting in periods when streamflows appear to be decreasing. For example, when streamflow records for the period since about 1960 are examined, a slight decreasing trend in 7-day low flows is apparent. This recent trend was caused by relatively high low flows in the 1960's, and

very low flows in the late 1970's and late 1980's. When the entire 80-year streamflow record is examined, it could be seen that these recent low flows were very similar in magnitude to low flows that occurred during the late 1930's and early 1940's. As a result, the 1930-1960 period shows an increasing trend in annual 7day low flows.

In general, the trend in annual 7-day low flows closely match the trend inn average annual flows. Therefore, it does not appear that summer streamflows are changing over time any differently than average annual flows. This indicates that the apparent trend in summer low flows could be caused by overall climatic trends, which affects streamflows year-round, rather than by activities such as irrigation withdrawal that consume water only .during the summer.

In conclusion, the trend in annual 7-day low flows appears to be largely determined by long-term climatic cycles, with the, 1930's and 1980's both representing low points in the cycle. This pattern in streamflows makes it appear that annual 7-day low flows have been decreasing in magnitude over the last 30 years. However, without further analysis of streamflow and water use data, this trend cannot be attributed to anything but the long-term climatic cycle.

Excursions of WAC Instream Flows

Figures 9 - 13 compare instream flows established in Chapter 173-545 WAC to the monthly flow exceedence curves. (WAC instream flows for the Wenatchee River Watershed are discussed in the **Water Demand** section). In general, the instream flow standard lies at about the 50 percent. (median) flow exceedence line during late summer and early fall, and. below the 90 percent (low) flow exceedence line during the period of spring runoff and extending to about the beginning of August. During August and early September the instream flow standard lies between the 50 percent and 90 percent exceedence line. The Mission Creek plot (Figure 11) shows the WAC instream flows for Mission Creek near Cashmere, whereas the flow data are from a gauge located further upstream. Due to the large difference in drainage area between the two gauges (81.2 square miles and 39.8 square miles, respectively), a conclusion could not be reached by a comparison of instream flows to flow exceedence statistics.

A summary of average monthly and annual WAC instream flow excursions is contained in Table 12. This summary represents a comparison of the WAC instream flows to the total record of available streamflow data. The number of excursions varies considerably from year to year depending on the natural variability of streamflow. Average excursion data for Mission Creek is not shown in Table 12 for the reasons described in the previous paragraph.

Table 12
Summary of Excursions of WAC Instream Flows

Month	Percent of Time Instream Flow Not Met			
	Wenatchee River at Plain	**Icicle Creek near Leavenworth**	**Wenatchee River at Peshastin**	**Wenatchee River at Monitor**
January	19	12	18	21
February	16	12	13	10
March	17	19	10	4
April	7	6	6	3
May	1	2	1	1
June	3	3	1	1
July	12	12	11	8
August	27	33	30	20
September	52	40	57	43
October	41	37	45	37
November	16	23.	17	10
December	15	17	18	12
Annual	**19**	**18**	**19**	**14**

The number of excursions from WAC instream flows during the historical streamflow records are shown as a function of time in Figures 25 - 28. The total number of instream flow excursions are shown as both annual and June through September totals. Historical trends calculated using a linear regression equation are also shown. In general, a decreasing trend of instream flow excursions is evident over the last 80 years on the Wenatchee River at Plain and Peshastin, but an increasing trend is apparent over the last 30 years at Monitor. The trends in total annual excursions are decreasing faster than the June-September excursions, indicating that excursions during the winter are becoming less frequent than excursions during the summer.

The difference in the trend of instream flow excursions over the last 80 years versus the last 30 years was also observed in the graphs of trends in annual 7-day low flows. Again, the linear regression trends appear to be influenced by the low flow periods in the 1930's and 1980's. The slope of the trend line, whether increasing or decreasing, depends on whether those historical low flow periods are present in the streamflow record being examined. Although the graph of instream flow excursions on the Wenatchee River at Monitor (Figure 25) shows a two to

three-fold increase in excursions over the last 30 years, this can be attributed to the relatively high streamflow conditions of the 1960's and the relatively low streamflow conditions in the 1980's. The apparent trend would be quite different if a longer streamflow record were available at Monitor. In fact, the late 1930's and early 1940's were considerably worse in terms of instream flow excursions than the mid to late 1980's.

Hydrogeology

Geology

Much of the Wenatchee River Watershed falls within a geologic province known as the Chiwaukum graben, an erosional lowland developed on downdropped sandstone and shale. Areas outside of the Chiwaukum graben generally have bedrock consisting of granitic and metamorphic rocks. These rocks form a complex arrangement of geologic terrains, that are, in places, fractured, folded and faulted.

During the last large scale glaciation, more than 10,000 years ago, the Wenatchee River Watershed was filled with a large valley glacier that extended from the Cascade Crest. The glaciers, and associated features, deposited several different geological units, including:

lacustrine deposits - silts and clay deposited as lake bottom sediments behind glacial ice or moraine dams.
outwash deposits - advancing and retreating glaciers deposit primarily sand and gravel sediments in front of the glacier from glacial meltwater.
till - a very dense, poorly sorted mixture of clay, silt, sand and gravel, deposited directly beneath glacial ice.

These sequences of unconsolidated materials are generally present as valley fill and along valley walls as terraces.

More recently modern rivers have scoured the bedrock and glacial deposits and redeposited them as sand and gravel terraces and plains. A review of well logs, and previous reports indicates that the valley fill and terrace deposits may be more than 150 feet thick in areas.

Aquifer Characteristics

Groundwater in the Wenatchee River Watershed is present in two major flow systems; a bedrock flow system and a surficial flow system present in sediments overlying bedrock.

While many domestic wells within the watershed do penetrate bedrock, yields are generally low, less than one gpm. Some bedrock wells reportedly have yields up to 15 gpm. The bedrock wells are not considered viable sources for significant groundwater development. Many of the domestic wells penetrating bedrock have found reliable sources of water contained in the sandstone. Often a thin zone of relatively high permeability weathered bedrock may be present, that also contains enough water for domestic development. Recharge to bedrock aquifers is derived from direct precipitation on bedrock outcrops, and from overlying glacial deposits.

The alluvial and glaciofluvial outwash sediments, that fill river valleys and depressions in the bedrock, are a source for much of the domestic and public water supply. The nature and extent of these fill materials is highly variable, with reported areas of confined aquifer conditions due to overlying lacustrine silts and clays. Well yields in the fill materials reportedly range from less

than 5 gpm to over 100 gpm. Recharge to the aquifers is primarily in the form of precipitation infiltration, surface water infiltration, and recharge from deeper bedrock aquifers. Groundwater flow is likely in a down valley direction. Some localized aquifers, such as those found in smaller drainages above the Wenatchee River Valley, will likely be more affected by increased groundwater usage than the larger aquifers located in the Wenatchee River Valley. This is because recharge is limited by the small basin size and low amounts of precipitation occurring in those drainages.

Several well tests have been performed in the Wenatchee River Watershed, with estimates of transmissivity for bedrock aquifers of about 25 ft2/day and about 1720 ftz/day for the sand and gravel fill materials (Golder Associates, 1995).

Groundwater Surface Water Interaction

Reports indicate that groundwater and surface water interact throughout the watershed, depending on the subarea's morphology. Many of the smaller drainages have aquifers in valley fill that are in direct connection with surface water and the water levels generally respond together. In all cases, interaction between surface water and groundwater within the watershed is largely dependent on the highly variable geologic conditions. Generally, increased withdrawal from groundwater will result in a decrease in recharge to surface water at some point. Ultimately, most all groundwater within the watershed eventually flows to surface water or another aquifer.

Water Demand

Water Rights Permits and Certificates

Since the adoption of the state surface and groundwater codes, the only means of acquiring a Water Right within the state is by filing for, and receiving, a Permit and/or subsequent Certificate from Ecology or one of its predecessors. One exception is allowed under the domestic exemption to the groundwater code (RCW 90.44). For this portion of the report only Permits and Certificates were used.

When a water user or future water user (applicant) expects to use any amount of surface water for any purpose, or in the case of groundwater (well) use more than 5,000 gallons per day for domestic or industrial purposes and/or irrigate more than 1/2 acre;, the applicant must file a Water Right . Application with Ecology. If Ecology determines that water is available for a beneficial use, that the use will not impair other rights and is not detrimental to public interest, it issues a Water Right Permit, which allows the applicant to proceed with the project. Upon project completion Ecology issues a Certificate documenting the actual perfected, authorized water use.

A summary of Surface Water and Groundwater Rights, Permits and Certificates issued in the Wenatchee River Watershed is contained in Table 13 and are divided by subbasin in Tables 14 and 15. The data. in Tables 13 - 15 represent "paper" rights for active Permits and Certificates. Paper rights generally do not give a good indication of actual consumptive use for several reasons including: many permits do not use their full allocation, irrigation usage varies seasonally and yearly depending on weather, domestic usage by individuals is not represented (i.e., exempt groundwater wells) and there may be illegal usage of water.

The historical growth of Water Rights Appropriations in the Wenatchee River Watershed is shown in Figures 29 and 30. The graphs show that appropriations for both surface and groundwater increased steadily during the last several decades, but has leveled out since the early 1980's.

The purpose of use of Water Rights Permits is also summarized in Table 13 and shown graphically in Figures 31 and 32. In terms of annual quantity, about 67 percent of issued surface water rights is for irrigation use, 16 percent is for municipal water supply, and 14 percent is for commercial and industrial use. Groundwater rights issued for irrigation use represents 17 percent of the total groundwater rights, with domestic and municipal water supply, commercial and industrial, and fish propagation all making up the remainder as major groundwater users. Water rights issued for irrigation usage comprise 55 percent of the total quantity of surface and groundwater rights issued in the Wenatchee River.

Maps 2 and 3 illustrate the distribution of Water Rights Permits and Certificates within the Wenatchee River Watershed.

A total of 420 cfs and 81,012 acre-feet in Water Rights Permit and Certificates have been issued in WRIA 45. Of that total, 357 cfs and 61,857 acre-feet are Surface Water Rights and Certificates, and 63 cfs (28,300 gpm), and 19,155 acre-feet are Groundwater Rights and Certificates.

Table 13
Summary of Water Rights Permits and Certificates

Type and Purpose of Use	Qi Instantaneous Rate		Qa Annual Quantity		Permit Holders		Irrigated acres
	cfs	Percent of Total	ac-ft/yr	Percent of Total	Number	Percent of Total	
Surface Water Permits and Certificates							
Comm/Indust.	35	10%	8,561	14%	9	2%	0
Domestic	19	5%	702	1%	302	62%	0
Irrigation	271	76%	41,508	67%	137	28%	32,054
Municipal	26	7%	10,145	16%	9	2%	0
Other	6	2%	941	2%	34	7%	12
Subtotal	**357**	**100%**	**61,857**	**100%**	**491**	**100%**	**32,066**
Groundwater Permits and Certificates							
Comm/Indust.	6.8	11%	1,981	10%	10	3%	0
Domestic	23.3	37%	4,499	23%	244	69%	0
Irrigation	16.3	26%	3,285	17%	81	23%	1,139
Municipal	5.3	8%	2,327	12%	5	1%	0
Other	0.1	0%	686	4%	12	3%	0
Fish Propagation	11.3	18%	6,377	33%	2	1%	0
Subtotal	**63.1**	**100%**	**19,155**	**100%**	**354**	**100%**	**1,139**
Total	**420.1**	---	**81,012**	---	845	---	**33,205**

Table 14
Surface Water Rights, Claims and Applications in Wenatchee River Watershed Subbasins

Subbasin		Permits and Certificates			Claims			Applications		
		Qi (cfs)	Qa (ac-ft/yr)	Number	Qi (cfs)	Qa (ac-ft/yr)	Number	Qi (cfs)	Qa (ac-ft/yr)	Number
1	White River	0.9	14	9	3.4	682	5	0.1	n/a	1
2	Little Wenatchee River	1.0	4	3	0.0	0	0	0.0	n/a	0
3	Lake Wenatchee	3.8	239	134	2.0	236	84	0.6	n/a	21
4	Chiwawa River	35.6	4,786	7	32.1	6,408	6	0.7	n/a	1
5	Nason Creek	3.5	693	27	6.8	1,314	35	0.9	n/a	3
6	Chiwaulkum Creek	0.5	0	3	0.4	74	3	0.0	n/a	0
7	Cabin Creek	1.0	0	3	0.0	0	0	0.0	n/a	0
8	Chumstick Creek	8.2	1,148	54	36.4	7,226	99	0.0	n/a	1
9	Icicle Creek	205.4	29,631	23	9.5	1,890	13	8.8	n/a	5
10	Peshastin Creek	1.2	141	16	84.2	16,796	36	0.7	n/a	1
11	Derby Canyon	0.4	81	8	1.1	216	6	0.0	n/a	1
12	Ollala Canyon	7.2	258	21	2.6	472	42	0.1	n/a	1
13	Mission Creek	1.6	49	5	8.5	1,684	24	1.0	n/a	1
14	Nahahum Canyon	1.5	267	26	3.7	686	28	0.7	n/a	3
15	Warm Springs Canyon	14.8	5,724	4	1.8	348	14	0.0	n/a	0
16	No. 1 & 2 Canyons	40.5	9,814	23	6.9	1,330	46	1.7	n/a	5
17	Upper Wenatchee River	9.6	1,333	65	4.8	832	85	0.8	n/a	4
18	Lower Wenatchee River	20.3	5,646	54	403.5	80,598	120	4.3	= n/a	7
	Total	**357.0**	**59,828**	**485**	**607.7**	**120,792**	**646**	**20.4**	**n/a**	**55**

Note: Small differences in values between this table and Table 13 are due to incomplete information on section-township-range data in the WRIS database.

n/a = not available - quantities not specified in Applications.

Table 15
Groundwater Rights, Claims and Applications in Wenatchee River Watershed Subbasins

	Subbasin	Permits and Certificates			Claims			Applications		
		Qi (gpm)	Qa (ac.ft/yr)	Number	Ql (gpm)	Qa (ac-ft/yr)	Number	. Qi (gpm)	Qa (ac-ft/yr)	Number
1	White River	350	22	1	18	4	2	661	n/a	1
2	Little Wenatchee River	0	0	0	0	0	0	0	n/a	0
3	Lake Wenatchee	151	117	4	342	76	38	386	n/a	7
4	Chiwawa River	78	44	2	27	6	3	514	n/a	2
5	Nason Creek	770	159	11	270	82	22	2,555	n/a	6
6	Chiwaulkum Creek	50	1	1	18	6	2	0	n/a	0
7	Cabin Creek	0	0	0	9	2	1	0	n/a	0
8	Chumstick Creek	2,194	523	103	1,215	446	61	250	n/a	7
9	Icicle Creek	5,178	6,381	5	369	136	16	135	n/a	4
10	Peshastin Creek	315	229	3	558	156	50	26	n/a	1
11	Derby Canyon	190	20	3	171	62	9	20	n/a	1
12	Ollala Canyon	445	135	7	720	180	75	99	n/a	1
13	Mission Creek	1,302	639	16	2,556	1,102	42	250	n/a	2
14	Nahahum Canyon	774	345	25	423	166	13	21	n/a	2
15	Warm Springs Canyon	377	152	6	117	32	12	30	n/a	1
16	No. 1& 2 Canyons	4,645	2,510	10	4,410	1,910	34	181	n/a	2
17	Upper Wenatchee River	3,446	3,054	47	2,232	644	188	3,886	n/a	18
18	Lower Wenatchee River	8,924	4,778	107	13,860	5,096	671	294	n/a	9
	Total	**29,188**	**19,106**	**351**	**27,315**	**10,106**	**1,239**	**9,308**	**n/a**	**64**

Note: Small differences in values between this table and Table 13 are due to incomplete information on section-township-range data in the WRIS database.

n/a= not available - quantities not specified in Applications.

Water Rights Claims

The Claims Registration Act, Chapter 90.14 RCW, sought to document existing surface water and groundwater uses prior to adoption of the State Surface Water Code, Chapter 90.03 RCW, and the State Groundwater Code, chapter 90.44 RCW. These laws were adopted in 1917 and 1945 respectively. During the Claims Registration period, water users completed a long form to claim detailed uses for domestic and irrigation needs, and completed a short form for a single domestic use with up to 1/2 acre for non-commercial lawn and garden.

While the accuracy of the data on some Claims is questionable, the final determination of the validity and extent associated with a Claim registered in accordance with RCW 90.14 ultimately lies with the Superior Court through the general adjudication process provided for by RCW 90.03.110 through 90.03.240. Therefore, for the purpose of this report, the quantities shown on the Claims documents were used. If a Claim did not specify a water quantity, Ecology used the estimates contained in Table 16 below.

Table 16
Estimates Used for Claims Not Specifying a Water Quantity

Use	Groundwater	Surface Water
Single Domestic Use (up to 1/2 acre)	9 gallons per minute (gpm) instantaneous use and two acre-feet annual use	0.02 cubic feet per second (cfs) instantaneous use and two acre-feet annual use
Irrigation (per acre)	9 gpm instantaneous use and four acre-feet annual use	0.02 cfs instantaneous use and four acre-feet annual use

Water Rights Claims received by Ecology for the Wenatchee River Watershed are summarized in Table 17 and are also detailed by subbasin in Tables 14 and 15. Surface Water Claim volumes are much greater than Surface Water Permits volumes. Quantities of Groundwater Claims are less than those for Groundwater Permits in most subbasins, but are still significant.

The distribution of Water Rights Claims in the Wenatchee River Watershed is illustrated in Maps 4 and 5.

Table 17
Summary of Water Rights Claims

Type	Qi Instantaneous Rate Ws)	Oa Annual Quantity (ac-ft/yr)	Number of Claims
Surface water	608	120,792	646
Groundwater	61	10,106	1,239
Total	**669**	**130,898**	**1,885**

Water Rights Applications

Pending Groundwater and Surface Water Applications are summarized by subbasin in Tables 14 and 15. Fifty-five applications for Surface Water Permits are pending requesting a total of 20.4 cfs (annual quantities are generally not listed in the applications). Most of the Surface Water Applications are located in the Lake Wenatchee subbasins, the Icicle Creek subbasin, and the Upper and Lower Wenatchee River subbasins below Leavenworth. The total quantity of Surface Water Applications is approximately 2 percent of existing permits, certificates and claims.

Applications for Groundwater Permits total 64 for 9,308 gpm (20.8 cfs). Nearly 75 percent of the water requested in the Groundwater Applications is located in the Nason Creek and Upper Wenatchee River subbasins, and is likely associated with domestic water systems. The total quantity of Groundwater Applications is equal to 16 percent of existing permits, certificates and claims.

The distribution of Water Rights Applications in the Wenatchee River Watershed is illustrated in Maps 6 and 7.

Instream Flows

Instream flows were established by rule in 1983 for three reaches on the Wenatchee River, one reach on Icicle Creek and one reach on Mission Creek. The instream flows are set in Chapter 173-545 WAC (included in Appendix C). Future consumptive Water Rights for diversion of surface water from the main stem of the Wenatchee River and perennial tributaries are subject to these instream flows as measured at the appropriate stream gauge, preferably the nearest one downstream. Chapter 173 - 545 WAC also stipulates that Peshastin Creek is subject to a June 15 to October 15 closure for protection of instream values. With few exceptions, these instream flows do not affect water rights that were in existence prior to 1983, single domestic and stockwater use, and nonconsumptive uses that are compatible with the purposes of the instream flows.

Table 18 lists the five stream reaches (called stream management units) affected by the instream flow criteria set in Chapter 173-545 WAC. Control stations are USGS streamflow gauging stations. Instream flow rates for each reach are tabulated in Table 19.

Table 18
WAC Stream Management Units in Wenatchee River Watershed

Control Station	Stream Gage	River Mile	Stream Management Reach
Wenatchee River at Plain	12-457000	46.2	From Plain Road Bridge RM 46.2, to headwaters
Icicle Creek near Leavenworth	12-458500	1.5	From headwaters of Icicle Creek to its mouth
Wenatchee River at Peshastin	12-459000	21.5	From confluence of Derby Creek to Plain Road Bridge, RM 46.2 excluding Derby Creek and Icicle Creek
Wenatchee River at Monitor	12-462500	7.0	From mouth to confluence of Derby Creek, including Derby Creek and excluding Mission Creek
Mission Creek near Cashmere	12-462000	1.5	From Mission Creek headwaters to its mouth

Table 19
WAC Instream Flow Requirements in Wenatchee River Watershed

		Instream Flow from WAC (cfs)				
Month	**Day**	**12-457000 Wenatchee River at Plain**	**12-458000 Icicle Creek near Leavenworth**	**12-459000 Wenatchee** River at **Peshastin**	**12-462000 Mission Creek near Cashmere**	**12-462500 Wenatchee River at Monitor**
Jan	1	550	120	700	6	820
	15	550	120	00	6	820
Feb	1	550	120	700	6	820
	15	550	120	700	6	800
Mar	1	550	150	750	6	800
	15	700	170	940	11	1040
Apr	1	910	200	1300	22	1350
	15	1150	300	1750	40	750
May	1	1500	450	2200	40	2200
	15	2000	660	2800	40	2800
Jun	1	2500	1000	3500	28	3500
	15	2000	660	2600	20	2400
Jul	l	1500	450	1900	14	1700
	15	1200	300	1400	10	1200
Aug	1	880	200	1000	7	800
	15	700	170	840	5	700
Sep	1	660	130	820	4	700
	15	620	130	780	4	700
Oct	1	580	130	750	4	700
	15	520	130	700	5	700
Nov	1	550	150	750	6	800
	15	550	150	750	6	800
Dec	1	550	150	750	6	800
	15	550	150	750	6	800

Environmental Assessment

Water Quality

The Wenatchee River is designated Class AA (excellent) status by the State of Washington (Standards for Surface Waters, Chapter 173-201A-130 WAC, 1992) from its headwaters to the Wenatchee National Forest boundary near Leavenworth. The remainder of the river, to its confluence with the Columbia River, is designated *Class A* status. This classification requires the Wenatchee to meet or exceed the standards for all designated beneficial uses, including: water supply, stock watering, fish and shellfish, wildlife habitat, and commerce and navigation. Water quality standards have been developed to maintain these beneficial uses. Notably, dissolved oxygen shall exceed 8.0 mg/L; temperature shall not exceed 18.0 degrees Celsius; pH shall be within the range of 6.5 to 8.5; and toxic concentrations shall be below levels which adversely affect water uses, public health, or aquatic biota. (as per WAC 173-201A-040 and WAC 173-201A-050). The Wenatchee River Watershed was the subject of the 1994 *Wenatchee River Watershed Ranking Project* by the Chelan County Conservation District. For that study, water quality samples were collected from twenty sites in the watershed from October 1992 to September 1993.

The 303(d) report (Butkus, S., 1994) is a list submitted by the Department of Ecology to the U.S. Environmental Protection Agency (EPA) as required by Section 303(d) of the Clean Water Act. The list contains all those surface water body segments that fail to meet state water quality standards. The Wenatchee River was included on the list because of failures to meet water quality standards including temperature, dissolved oxygen, and pH. Table 20 lists the locations of monitoring stations on the Wenatchee River that experienced non-compliance with state water quality standards.

In addition to the above violations, water quality data, collected in 1992 and 1993 for the Wenatchee River Watershed Ranking Project indicate several instances of non-compliance with water quality standards. Dissolved oxygen concentrations dropped below state water quality standards for a Class A river in August/September of both years at one or more sampling locations. Monitored pH levels dropped below the state recommended minimum throughout the sampling period, mainly from December through March. Fecal coliform levels in several tributaries to the Wenatchee (Mission and Chumstick Creeks) greatly exceeded standards. One sample site (Brender Creek) had all samples above the standard of 100 colonies/100 mL, with a maximum sample concentration of 19,900 colonies/100 mL. Samples from several stations exceeded temperature standards in August. The smaller tributaries which have experienced high fecal coliform levels and high temperatures have more intensive land use and are areas of increasing population.

Table 20
Exceedences from Water Quality Standards

Monitoring Station Location	Monitoring Station	Parameters Exceeding Standards	Description of Parameter Exceedence
Wenatchee River at Wenatchee, 1.1 miles from mouth of Wenatchee River.	Ecology ambient monitoring station 45A070	Temperature	3 excursions beyond criteria between 1/1/90 and 1/1/92
Wenatchee River at Wenatchee, 1.1 miles from mouth of Wenatchee River.	Ecology ambient monitoring station 45A070	pH	3 excursions beyond criteria between 1/1/90 and 1/1/92
Wenatchee River near Leavenworth, US Highway 2 bridge.	Ecology ambient monitoring station 45A110	Temperature	3 excursions beyond criteria between 1/1/90 and 1/1/92
Wenatchee River near Leavenworth, US Highway2 bridge.	Ecology ambient monitoring station 45A110	Dissolved oxygen	3 excursions beyond criteria between 1/1/90 and 1/1/92

Fisheries

Several sources of information were reviewed to identify key fish populations of management concern in the Wenatchee River Watershed. These sources included: 1) the Washington Department of Fisheries' "Washington State Salmon and Steelhead Stock Inventory" (SASSI) database (WDF 1992); 2) the Washington Department of Wildlife's (WDW) "Washington River Inventory System" (WARIS) GIS database; 3) the WDF's "Salmon and Steelhead Production Plan for the Wenatchee River Subbasin" (WDW 1990); and 4) the American Fisheries Society's Pacific salmon "Stocks at Risk" report (Nehlsen et al. 1991). The latter document was prepared as part of the Columbia Basin System Planning program, and was co-authored by the Confederated Tribes and Bands of the Yakima Indian Nation, the Confederated Tribes of the Colville Indian Reservation, and finally the Washington Department of Wildlife. In addition, state instream flow specialists with the Washington Department of Fish and Wildlife were contacted to identify flow-related fisheries issues in the Wenatchee River Watershed.

Species present in the Wenatchee River Watershed are summarized in Table 21. Habitat conditions are also summarized in this table. Based upon the above-named sources, three anadromous fish populations are managed in the Wenatchee River Watershed. These fish populations are:

- Chinook Salmon *(Oncorhynchus tshawytscha),* spring and summer race;
- Sockeye Salmon *(Oncorhynchus nerka);* and
- Steelhead Trout *(Oncorhynchus mykiss),* summer race.

Table 21
Summary of Species Present and Habitat Conditions within the Wenatchee River Watershed

Location	Important Habitat for Species Present	Low Flow	Water Quality	Migration Barriers
White River	Chinook (spring), Sockeye, Bull Trout, Steelhead (summer)	No	Good	impassable falls, high flows
Chiwawa River	Chinook (spring), Steelhead (summer), Bull Trout	No	Good	high gradient, high flows
Nason Creek	Chinook (spring & summer), Steelhead (summer)	Yes .	Good	high gradient, high flows
Little Wenatchee River	Chinook (spring), Sockeye, Bull Trout, Steelhead (summer)	Yes	Good	high gradient
Wenatchee River (mainstem)	Chinook (spring, summer & fall), Bull Trout, Sockeye, Steelhead (summer)	Yes	Fair	irrigation diversions, water supply
Wenatchee River (other tributaries to lower mainstem)	Chinook (spring, summer & fall), Steelhead (summer)	Yes	Fair to Poor	irrigation diversions, water supply, impassable falls

A life history bar chart showing the timing of entry, spawning, emergence, rearing and outmigration of the anadromous fish populations in the Wenatchee River Watershed is shown in Table 22.

In addition to those species managed in the watershed, the Wenatchee River contains populations of westslope cutthroat, rainbow trout, mountain whitefish as well as introduced species such as brook trout and golden trout. Tributaries to the Wenatchee are also used by Bull trout *(Salvelinus con, fluentus),* a candidate species for the Federal Threatened and Endangered Species List (Hindes, 1994). In Lake Wenatchee, there are five species of salmonids including; sockeye or kokanee, chinook, mountain whitefish, cutthroat trout, and rainbow trout (there are also lake trout in a few other mountain lakes). The WDF has determined that the Wenatchee River Watershed is one of the best salmon producing systems in eastern Washington offering fair to excellent habitat for spawning and rearing (WDF 1990).

Natural barriers such as high gradient tributaries exist within the Wenatchee River Watershed that prevent upstream passage of anadromous fish. For example upstream passage in precluded on the Little Wenatchee River above approximately river mile 7.0 (WDF 1990).

In addition to natural barriers, anadromous fish in the watershed encounter *flow* patterns typical of the Cascade mountain's eastern slope climates. Streamflows are high during spring and early summer months followed by very low flows during the late summer and early fall, limiting juvenile salmonid and steelhead habitat during both flow stages. During freshet conditions, low

velocity refuge from high flows for juvenile anadromous fish has been replaced by agricultural areas, highways, and other developments that include shoreline armoring and fill in the lower mainstem from Leavenworth to the mouth of the Wenatchee River. In addition to high flow impacts, low flow conditions have been documented by the WDF as a probable major factor limiting juvenile summer chinook and steelhead production in the Wenatchee River during the summer and early fall (WDF 1990).

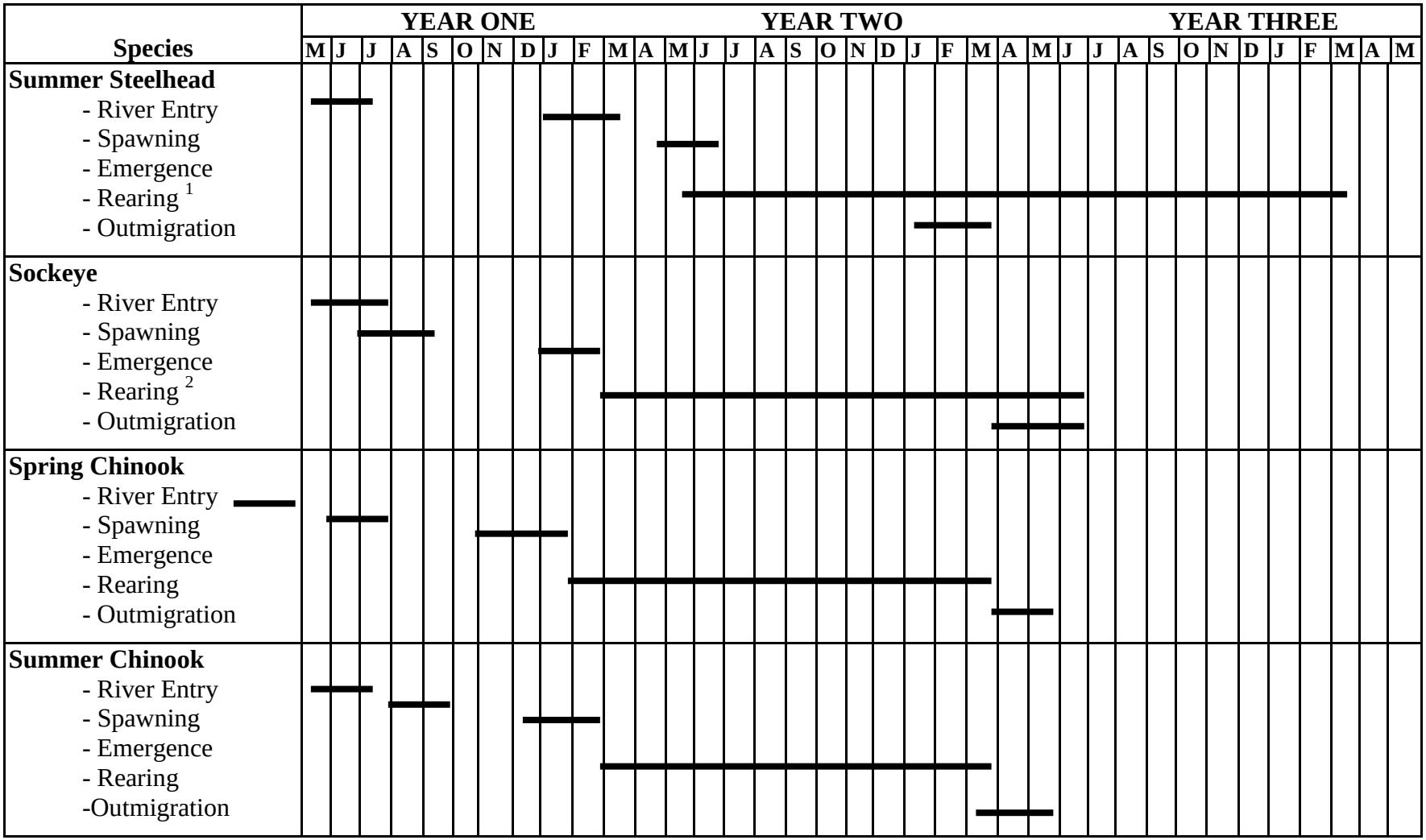
The Washington Department of Ecology has set instream flow standards for the Wenatchee River. The standards were set through a negotiation, process involving Ecology and water user groups. No Instream Flow Incremental Methodology (1FIM) study was conducted to determine optimal flows. The standards set for the Wenatchee River are only applicable to water rights issued after the instream flow standards were established. Therefore, water rights issued before the standards were set are not required to adhere to the Ecology instream flow standards which can result in flows below the established minimum during drought years (WDF, 1990).

It has been determined by the WDF that the dominant factor impacting anadromous fish stocks in the Wenatchee River Watershed is the presence of seven Columbia River Dams downstream of the watershed. These dams limit anadromous fish access to spawning areas and result in stress and physical injury related mortality each year.

Spring Chinook Salmon

The Wenatchee River is one of the few remaining systems above the confluence of the Snake River that supports runs of wild spring chinook. Spring chinook enter the watershed in May and June and migrate upstream to spawn in the mainstem and lower reaches of the Wenatchee River and its upper tributaries, the White, Little Wenatchee, Chiwawa Rivers and Nason Creek. Fish arrive at spawning areas at different times depending on flow conditions in the lower mainstem with arrival time being earlier in low flow years and later during high flow years. The fish spawn in mid-August through early September. Average run size determined during counts conducted in 1991 and 1992 estimated about 4,000 fish (a four year average from 1991 - 1994 was approximately 2,000 fish). Juveniles emerge in spring and rear for about one year before migrating the following spring as four inch smolts.

Table 22
Life history of fish populations in the Wenatchee River Watershed.



[1] Steelhead juveniles typically rear for 2 to 3 years before outmigration in the spring.
[2] Sockeye juveniles rear for 1 + years after migration from spawning streams into Lake Wenatchee.

The Leavenworth National Fish Hatchery supports fish in the Wenatchee River and tributaries in the lower mainstem. The hatchery releases as many as 1.8 million smolts into the Icicle River every year and the juveniles arrive at the mouth of the Columbia River in early May. The average run size for the hatchery is about 4,377 fish. During the late summer and early fall, water quantity and quality problems such as low flows and high temperatures have been reported at the hatchery.

Summer Chinook Salmon

Summer Chinook populations were historically abundant in the mainstem and tributaries of the middle and upper Columbia River drainage, and are still considered healthy in the Wenatchee River Watershed (SASSI, 1992). The majority of the population inhabits the area of mainstem Wenatchee River below Lake Wenatchee. In July, Summer Chinook migrate upstream into the middle and upper Wenatchee River. Fish spawn in the mainstem from late-September through late . October. Juveniles emerge from mid-February until about mid-April and remain in the mainstem Wenatchee River for approximately one year before out-migration to the ocean via the Columbia River in April through June. The Summer Chinook return estimate to the Wenatchee River between 1967 - 1987 averaged 12,000 fish; the 1992 estimate was about 6,700 fish for that year (McDonald, 1994).

The major factors which impact summer chinook populations within the, Wenatchee River Watershed are barriers to upstream passage, flow conditions, and lack of adequate screening on diversion and intake structures. Summer chinook encounter naturally high gradient tributaries in the Wenatchee River Watershed which prevents upstream passage on the Little Wenatchee River and Icicle Creek above their lower reaches. Reduction in habitat quantity and quality for juvenile and adult fish during both high flow spring conditions and low flow summer and early fall conditions results in annual losses of summer chinook within the Wenatchee River and its tributaries. Additional impacts to the summer chinook population due to inadequate screening facilities on irrigation diversions and intake structures was also reported. However the screens at the diversion of most concern, the Dryden Dam diversion, have been recently upgraded. The performance of the new screens are currently being evaluated by the Bonneville Power Administration, who funded the project. A report will be issued in the near future to address any upgrades that may be needed to optimize the facility.

Steelhead Trout

The Wenatchee River and its tributaries have historically supported productive steelhead trout populations. Although the cause for the reduction of steelhead within the watershed has not been specifically determined, major dams on the Columbia River, commercial fishing pressures, and diversions are likely associated with their decline.

Wenatchee River steelhead were mixed with other upper Columbia River stocks during the Grand Coulee Fish Maintenance Project. During this project, fish from several upper Columbia River watersheds were trapped and released into adjacent watersheds. Population counts of steelhead were historically collected at the Rock Island Dam and included stocks from the Okanogan, the upper Columbia, and 3 other tributaries to the upper Columbia River. The counts conducted in the 1950s averaged 3,722 fish (WDW 1990).

Summer steelhead enter the Wenatchee River Watershed in mid-July and peak in from mid-September through October. Summer steelhead spawn in March through May throughout the Wenatchee River Watershed. Fry emerge during the summer of the same year and rear for one complete year before out-migration to the ocean in the spring.

Steelhead within the Wenatchee River Watershed are a mixed stock. The Wells Salmon and Steelhead Hatchery has planted smolts in the watershed since 1983. Due to the relatively limited number of natural fish identified in the watershed it is believed that hatchery fish have exerted genetic influence on the wild population (WDW 1990).

Sockeye Salmon

Historically, sockeye salmon inhabited several of the lake systems within the mid and upper Columbia River and its tributaries. The development of the mainstem Columbia River hydroelectric projects, and construction of impassable diversions within these watersheds has significantly reduced fish access to spawning areas. Today, Lake Wenatchee and Osoyoos Lake are the only two lakes inhabited by sockeye within this region (WDW 1990).

Sockeye salmon inhabit and spawn in Lake Wenatchee but spawn primarily in the White and Little Wenatchee Rivers located above the lake. Migration up the Wenatchee River begins in late July through early August and continues until fish reach the lake in late August to early September, with spawning beginning in early September and peaking in late September. Average inter-dam run size counts for the ten year period between 1977 - 1986 is about 31, 000 fish. Eggs hatch in the winter or early-spring. Fry emerge in May through June and generally move from the spawning stream into the lake where they rear for one year before out migration (some juveniles remain for up' to two additional years) (WDW 1990).

Habitat quality within the Little Wenatchee and White Rivers is considered fair, however, low water temperatures and limited productivity are considered population constraints (WDF, 1990). Similarly, Lake Wenatchee is oligotrophic providing limited primary production within the watershed. Sockeye must compete with the other anadromous species inhabiting the lake, with kokanee proving to be the greatest competitor for food. In addition, bull trout and cutthroat trout as well as other fish species within the lake prey on out-migrating sockeye. Fry emerging from lacustrine redds axe particularly susceptible to predation by a number of species. Despite these genetic, environmental, and harvest impacts, the sockeye runs within the Wenatchee River Watershed have maintained genetic viability.

Sockeye were reared at the Leavenworth Fish Hatchery until the facility abandoned propagation in the mid-1960's. Currently, the Chelan County PUD is operating a supplemental program for sockeye. The program rears juvenile fish in net pens within Lake Wenatchee. In addition, the National Marine Fisheries Service (NMFS) has a sockeye program on Lake Wenatchee to determine the feasibility of reintroducing the species to Lake Cle Elum.

Sockeye within Lake Wenatchee support a viable recreational fishery, however, the fishery is closed during years when not enough fish reach the lake. Commercial harvests of Wenatchee sockeye occur primarily in the lower Columbia River. In addition, some ceremonial and subsistence harvests occur within the watershed.

Status of Fish Stocks

Fish population and stock data from the American Fisheries Society (AFS) Threatened and Endangered Fishery Stock Report (Nehlsen et al. 1991) and the Washington State Salmon and Steelhead Inventory (SASSI) were reviewed. The status of stocks in the Wenatchee River Watershed as given in the AFS and SASSI reports is presented in Table 23.

Table 23
Comparison of American Fisheries Society List and Salmon and Steelhead Stock Inventory

Water Body	Stock	AFS Status	AFS Factors	SASSI Status	SASSI Origin	SASSI Type
White River	Chinook Salmon Spring race	*Moderate Risk*	1	Depressed	Native	Wild
Chiwawa River	Chinook Salmon Spring race	No Listing	No Listing	Depressed	Native	Wild
Nason Creek	Chinook Salmon Spring race	No Listing	. No Listing	Depressed	Native	Wild
Little Wenatchee River	Chinook Salmon Spring race	No Listing	No Listing	Depressed	Native	Wild
Wenatchee River	Chinook Salmon Summer race	*Special Concern*	1	Healthy	Native	Wild
Wenatchee River	Sockeye Salmon .	*Special Concern*	*1*	Healthy	Native	Wild
Wenatchee River	Steelhead Trout Summer race	*High Risk*	1, 4	Depressed	Mixed	Wild

A description of the headings contained in Table 23 follows.

Water Body

The water body is the river, creek, lake (etc.) that is named in the respective reports as being the place of origin for the identified stock (i.e., where the stock returns to spawn).

Stock

The term stock defines the population of fish that spawn in a particular season and do not breed with other fish that spawn in a different watershed during a different season. These populations contain specific genetic differences that have adapted to the specific characteristics of the water body and season in which they spawn.

AFS Status

The American Fisheries Society has established a list of at high risk (A), at moderate risk (B), or of special concern (C) salmon, steelhead, and sea-run cutthroat trout stocks.

AFS Factors

The American Fisheries Society developed a list of factors that are currently most threatening to the stocks identified in the AFS Status list. The two factors presented in Table 23 are:

1. . The present or threatened destruction; modification, or curtailment of stocks habitat or range, as well as mainstem passage and flow problems, and predation during reservoir passage or residence.

4. Other natural or human-created factors affecting the stocks continued existence, such as hybridization, introduction of exotic or translocated species, predation not primarily associated with mainstem passage and flow problems, and competition. This category includes poor ocean survival conditions, as well as, negative interactions with hatchery fish, such as hybridization, competition and disease.

SASSI Status

The WDF Salmon and Steelhead Stock Inventory has established a set of status ratings ranging from Healthy to Extinct. The rating "depressed" presented in Table 23, defines a stock of fish whose production is below levels that are based on available habitat and natural variation in survival rates, but above a level that is likely to result in permanent damage to the stock.

SASSI Origin

Fish Stock origin definitions were developed to attempt to categorize the genetic history of stocks. The assessments of stock origin presented in Table 23 should be considered primary until additional information confirms or refutes the current designations. The definitions of the designations presented in Table 23 are:

1. Native - a stock that has become established outside of its original range.

2. Mixed - a stock that has undergone significant genetic change, hybridization, and/or originated from commingling native and non-native parents.

SASSI Type

This classifications refers to the type of spawning and rearing activity that produced the fish. The definition of the Type presented in Table 23 is:

1. Wild - a stock that is sustained by natural spawning and rearing in the natural habitat, regardless of rearing parentage (includes native).

Water Quality Impacts

Water quality factors which can potentially limit the fish populations in the Wenatchee River Watershed include high summer temperatures, arsenic, and zinc, as well as concentrations of such organo-pollutants as dichlorodiphenyltrichloroethane (DDT) in fish tissues. These problems have been mainly observed in more populated areas of the lower watershed. Besides these factors, water quality can be regarded as good to excellent in the Wenatchee River Watershed. Water quality values in the Wenatchee River Watershed fall within normal ranges for Cascade Range streams. The only water quality problem of concern to salmonid fish in the watershed is warm water temperatures which sometimes exceeds 21 ° C from July to September during periods of low flow in the lower reaches of the Wenatchee River. In addition, low water temperatures in the winter may also limit salmonid production in the watershed by reducing egg and alevin survival, as well as juvenile survival. The oligotrophic (low nutrient and primary production) nature of water in the Wenatchee River Watershed may also limit salmonid fish production, especially in the more upstream tributaries to river.

Conclusions

The following conclusions can be drawn from the information contained in this report:

- The Wenatchee River Watershed (WRIA 45) encompasses about 1371 square miles. The watershed originates in the Cascade Mountains and extends to the Columbia River. Principal land uses in the Wenatchee River Watershed are forestry, wilderness, agriculture, rangeland, residential development and recreation. Precipitation within the watershed varies from nearly 150 inches per year in the Cascade Mountains to 8.5 inches per year at the City of Wenatchee. Most precipitation occurs in late fall and winter.

- Total annual streamflow in the Wenatchee River averages about 2.3 million acre-feet (measured at the USGS gauging station located at Monitor). A majority of that flow occurs in the spring arid early summer from snowmelt runoff.

- There is an estimated 12,479 acres of irrigated area within the portion of WRIA 45 that is tributary to the Wenatchee River. An estimated 21,500 acres of irrigated area is served by water diverted from the Wenatchee River. The additional acreage served is located within the City of Wenatchee and on the east side of the Columbia River in the East Wenatchee area. The volume of water diverted for the 21,500 irrigated acres was estimated to be in the range of 114,000 acre-feet per year. Other land uses such as municipal use much less water than irrigation.

- A total of 420 cfs and 81,012 acre-feet in Water Rights Permits and Certificates have been issued in WRIA 45. Of that total, 357 cfs and 61,857 acre-feet are Surface Water Rights and Certificates, and 63 cfs (28,300 gpm) and 19,155 acre-feet are Groundwater Rights and Certificates. Irrigation is the largest type of water user, with about 67 percent of the volume of the Surface Water Permits and Certificates, but only 17 percent of the volume of Groundwater Permits and Certificates. An additional 1,885 surface water and ground water claims have been registered for a total of 668 cfs and 130,898 acre-feet. There are currently 119 Water Rights Permit Applications on file at Ecology, requesting a total of 41.2 cfs. Most of the Surface Water Applications are located in the Lake Wenatchee, Icicle, Upper and Lower Wenatchee River subbasins. Groundwater Applications are located mostly in the Nason Creek and Upper Wenatchee River subbasins.

- Groundwater resources are present primarily within the sand and gravel valley fill material of the Wenatchee River valley. Aquifers present within the watershed are generally considered to be in hydraulic connection with the surface water bodies, i.e. streams, lakes and rivers. However, insufficient data exists to fully characterize the relationship between surface and ground water within the watershed. Due to the limited nature of surficial aquifers located in smaller drainages above the Wenatchee River Valley, further groundwater development may effect existing wells. Many domestic wells are present in the fractured, weathered, or porous bedrock, but yields are generally too low for large scale development.

- The Washington Department of Ecology has set instream flow standards for the Wenatchee River. The standards were set through a negotiation process involving Ecology and water user groups. No Instream Flow Incremental Methodology (IFIM) study was conducted to determine optimal flows. The standards set for the Wenatchee River are also only applicable to water rights issued after the instream flow standards were established.

- Anadromous fish populations in the Wenatchee River Watershed are both abundant and diverse. This watershed possesses some of the most important anadromous fish resources in eastern Washington.

- Seven Columbia River dams and associated smolt and adult mortality impacts are the dominant factors limiting the production of anadromous fish in the Wenatchee River Watershed from historic levels.

- Rearing habitat for juvenile salmon and steelhead trout may be an important factor limiting production of these fish in the lower Wenatchee River. Rearing habitat for these fish has been reduced due to channelization and bank armoring, which has eliminated much of the shoreline habitat during high flow periods. The shoreline areas serve as important refuge habitat to fish including chinook salmon fry.

- Anadromous fish habitat is limited by extremes in high and low flows which occur throughout the year. Low flows during the late summer and fall may be an important limiting factor to yearling chinook salmon and steelhead trout. The Wenatchee River channel at low flow provides relatively poor cover habitat to rearing anadromous fish.

- Inadequate screening of irrigation diversions may be responsible for some mortality to salmon and steelhead fry in the watershed, however screening problems at the major Wenatchee River diversion at Dryden Dam were recently fixed.

- There is only one small hydroelectric project in the Wenatchee River Watershed. Consequently, impacts to anadromous fish populations by hydroelectric projects located in the watershed are minimal. Future developments of hydroelectric projects and resulting diversions of water in the watershed are not likely because of the important anadromous fish populations present.

- The Wenatchee River Watershed meets Washington State Water Quality Standards in most of the watershed. Water quality problems are evident in smaller drainages such as the Mission and Chumstick drainages. Those drainages also have increasing populations. The Wenatchee River on occasion does not meet water quality criteria for temperature, dissolved oxygen and pH.

Recommendations

The following recommendations for further action are made based on the information contained in this report:

- Prepare detailed water budgets for subbasins or reaches of the Wenatchee River for which Water Rights Permit applications are outstanding and for which water availability issues cannot be resolved with this report. The water budgets should review surface and ground water hydrology, existing uses and instream flows to determine the availability of water.

- Prepare a more in-depth analysis of the available groundwater resources including:

  - A field verification survey of existing wells and approximate groundwater consumption along the Wenatchee River corridor.

  - Develop a network of wells to be used for regular water level measurements to
  - establish long term trends in groundwater availability.

  - Perform aquifer testing to further define aquifer parameters and relationships with
  - surface water and existing users.

- Present instream flow standards for the Wenatchee River were developed through negotiations with state agencies and water users, which were based upon flow frequency records. As a result, relationships between flow and fish habitat are not well quantified in the Wenatchee River drainage. A habitat based method for evaluating flows (e.g., instream flow incremental method) would improve the understanding between present and future flow regimes in the Wenatchee River and habitat quantity and quality.

- Further improvements or replacements of diversion screens and fish bypass systems should be examined as a way a reducing anadromous fish mortality related to water use.

- Reactivate the Mission Creek near Cashmere stream gauge to provide additional data and a means to manage the Mission Creek stream management unit.

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Figures

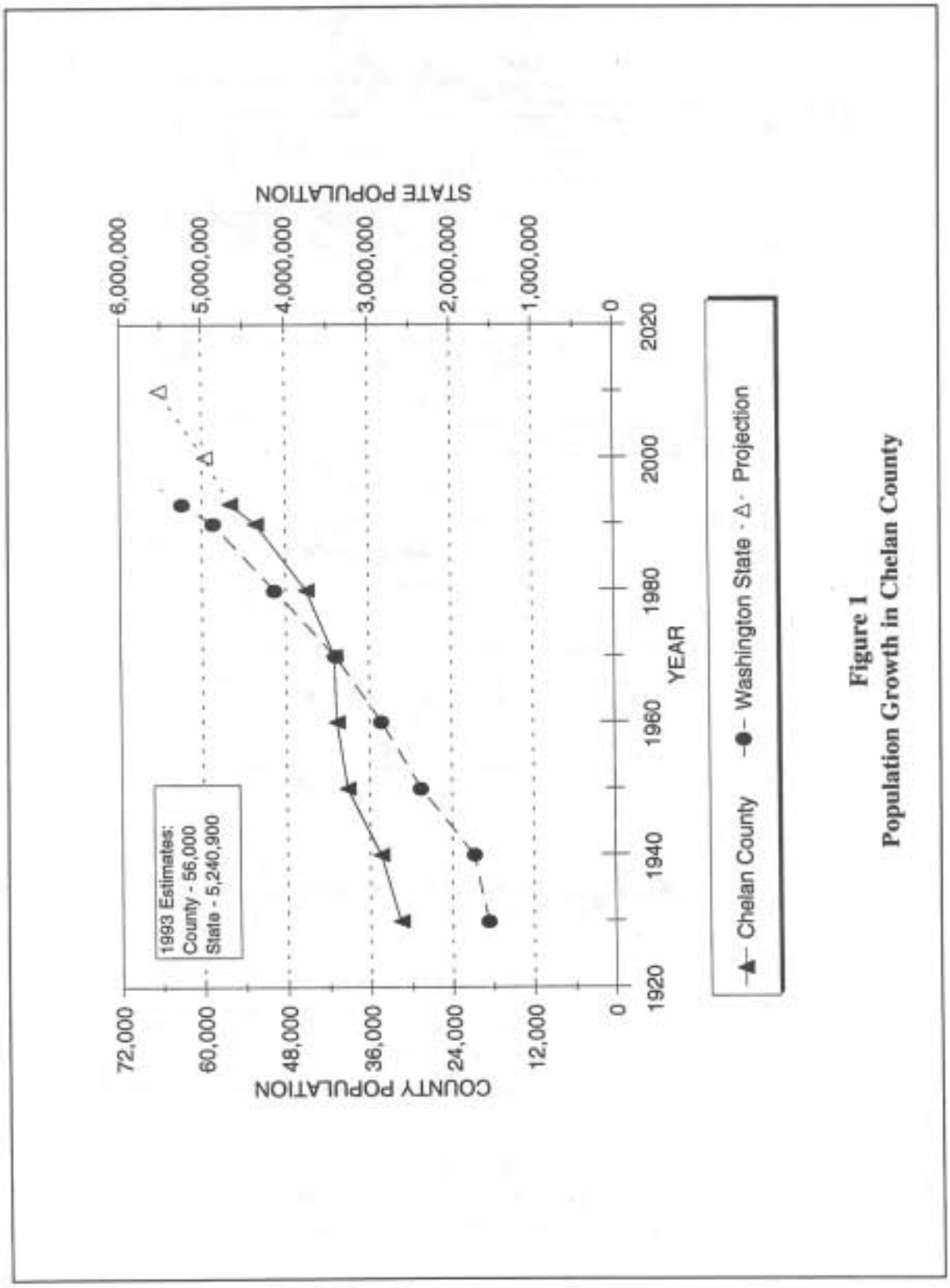


Figure 1
Population Growth in Chelan County

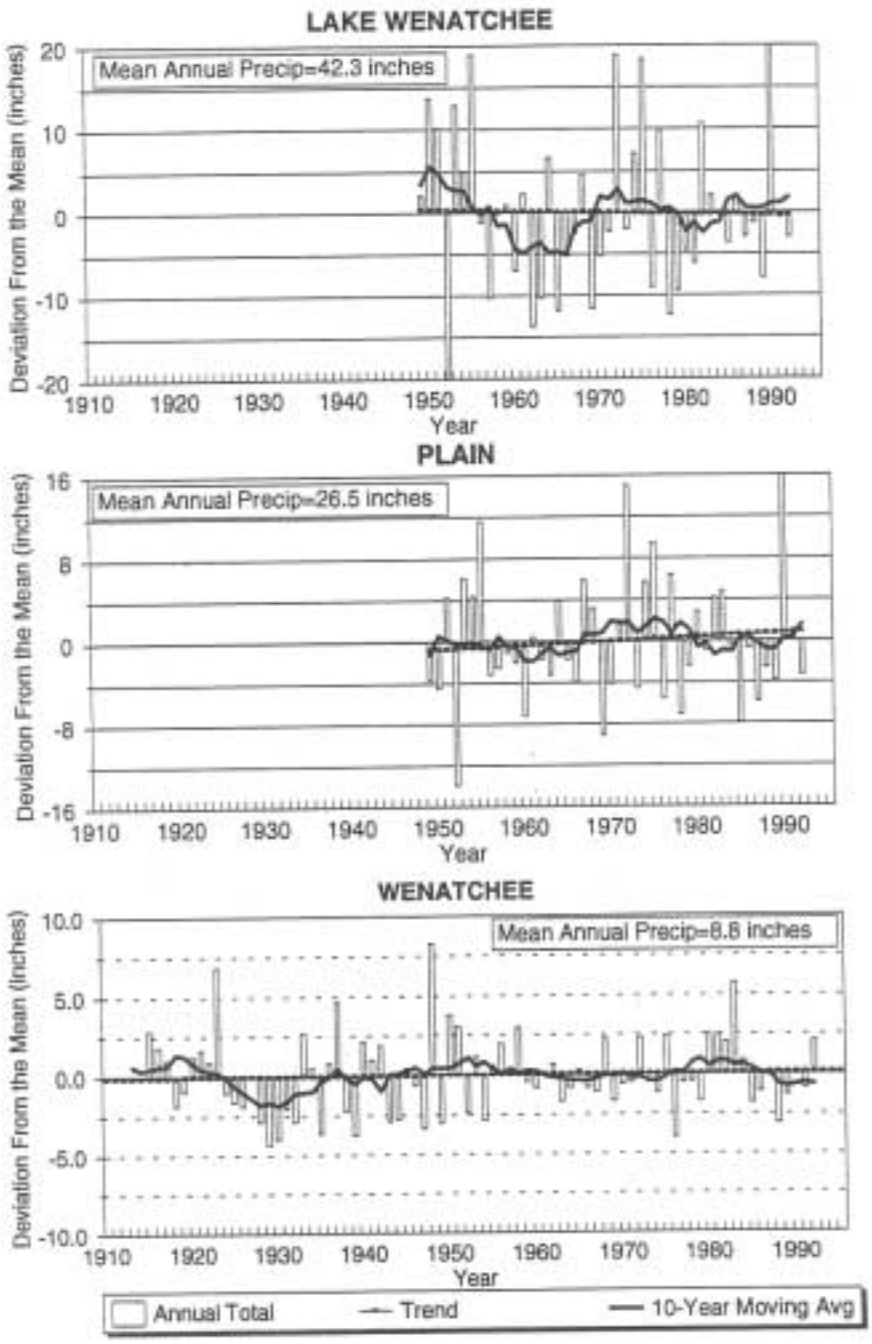


Figure 2
Historical Precipitation Trends
Lake Wenatchee, Plain and Wenatchee

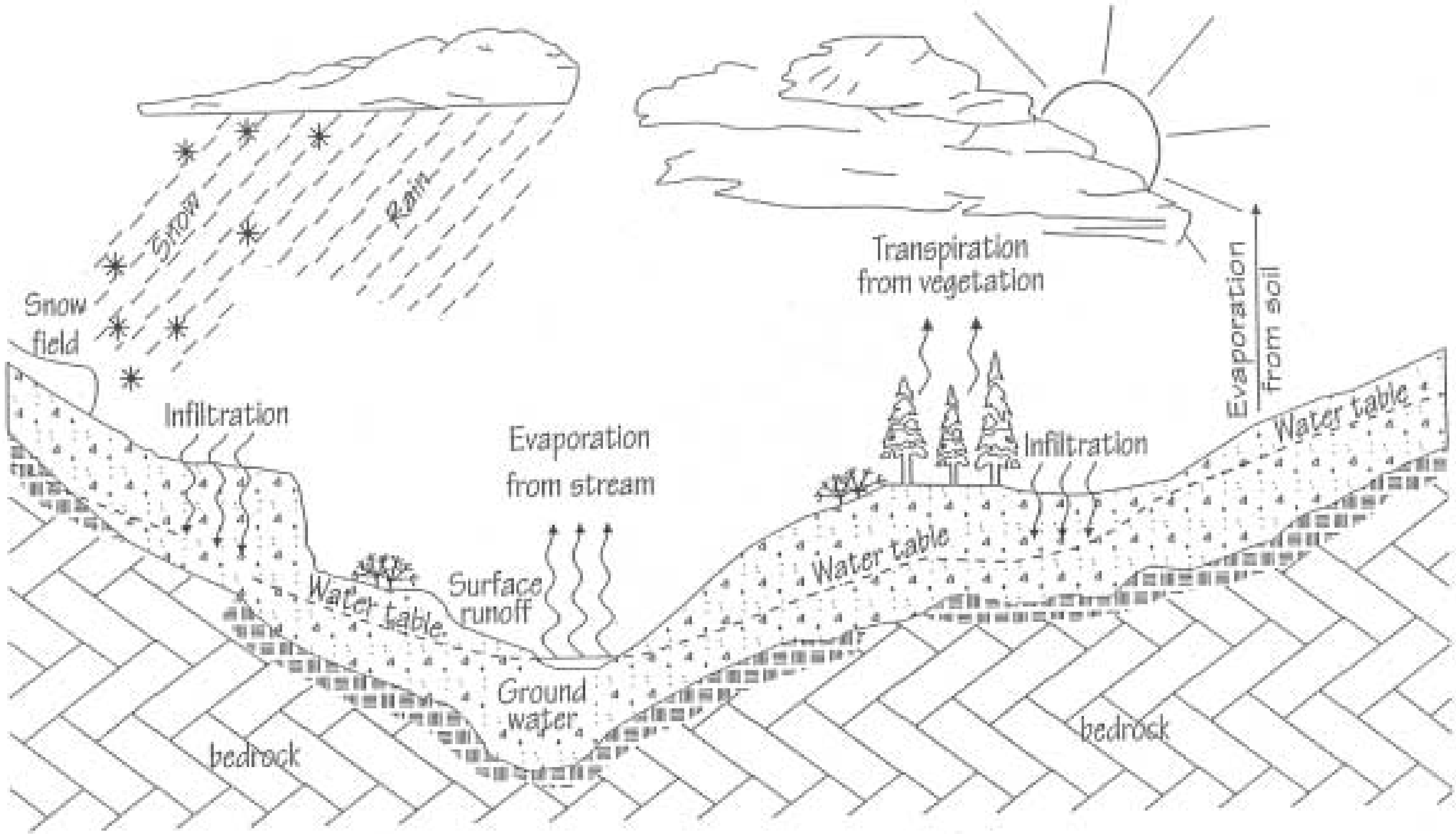


Figure 3
The Hydrologic Cycle
Wenatchee River Watershed

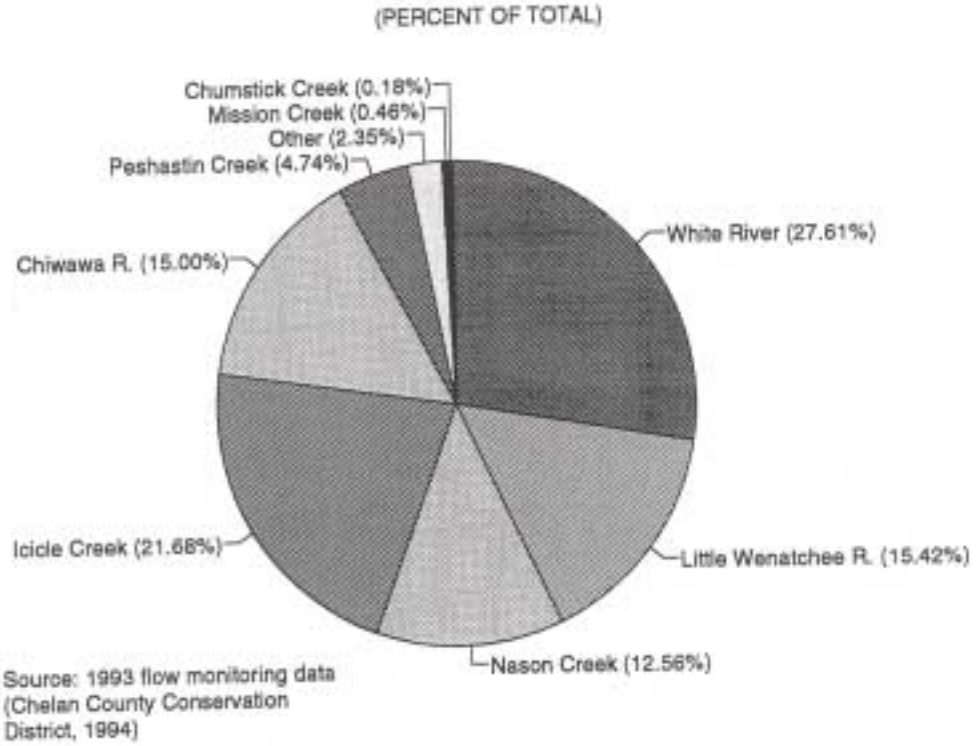


Figure 4
Streamflow Sources in Wenatchee Watershed

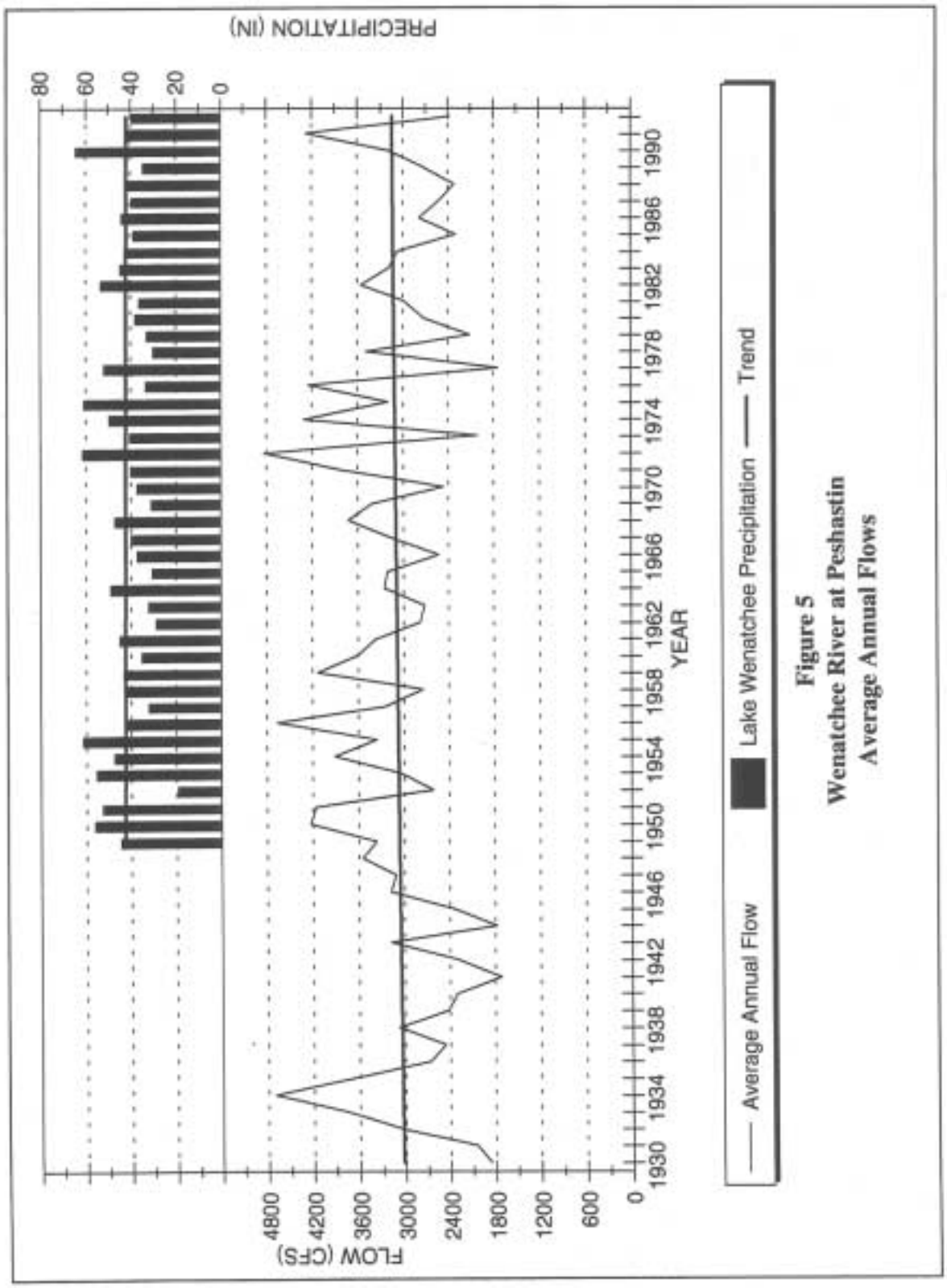


Figure 5
Wenatchee River at Peshastin
Average Annual Flows

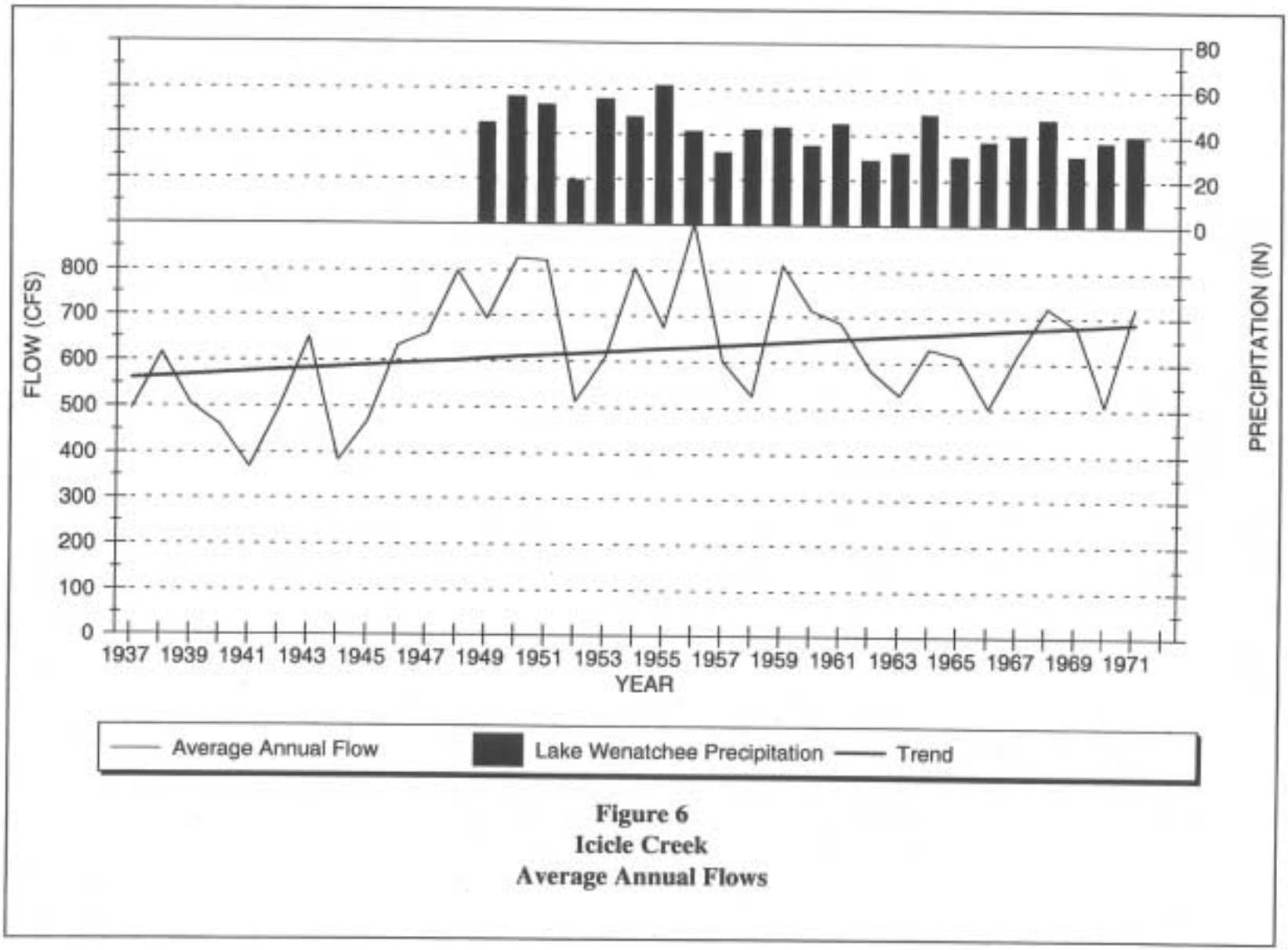


Figure 6
Icicle Creek
Average Annual Flows

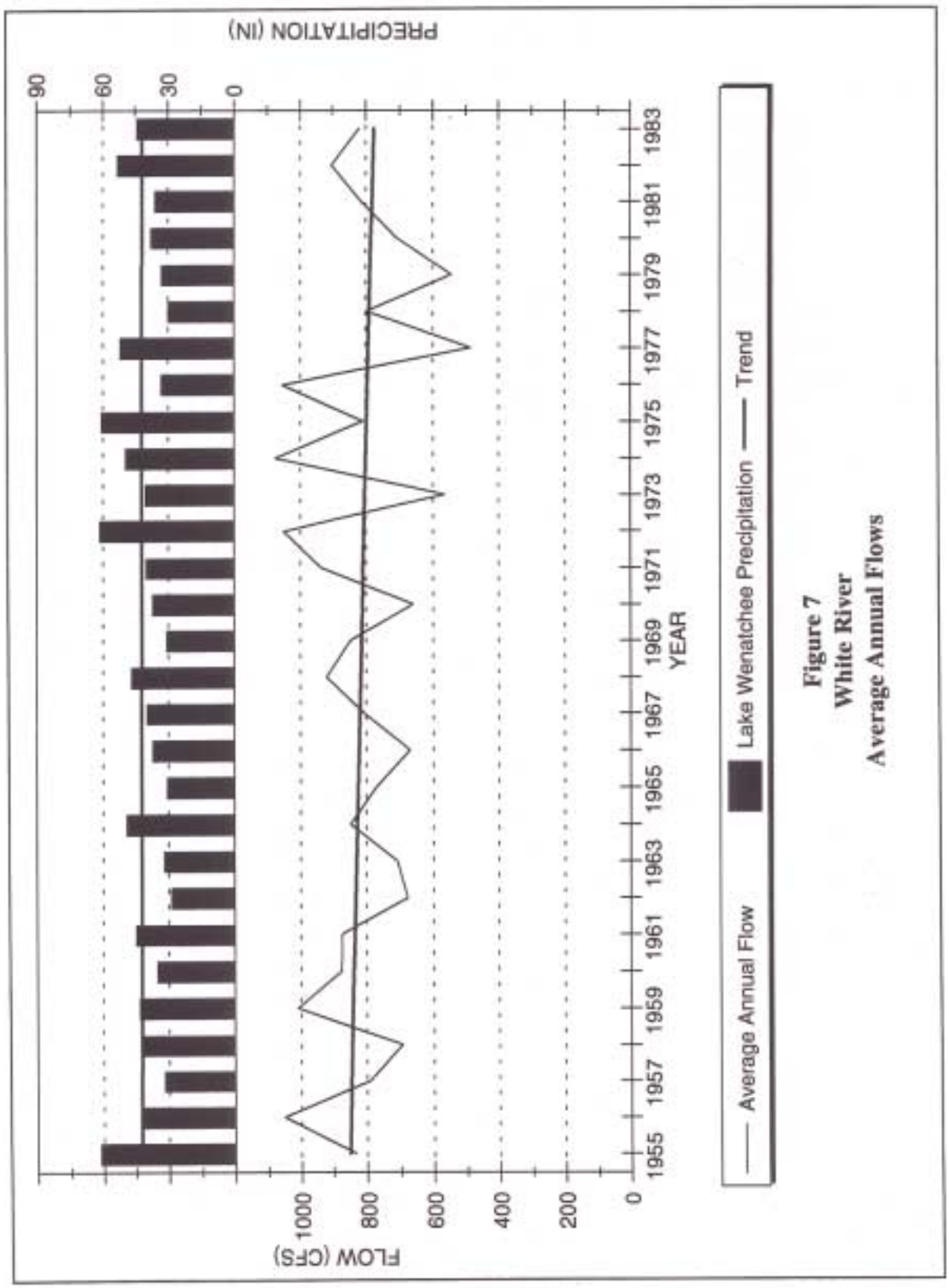


Figure 7
White River
Average Annual Flows

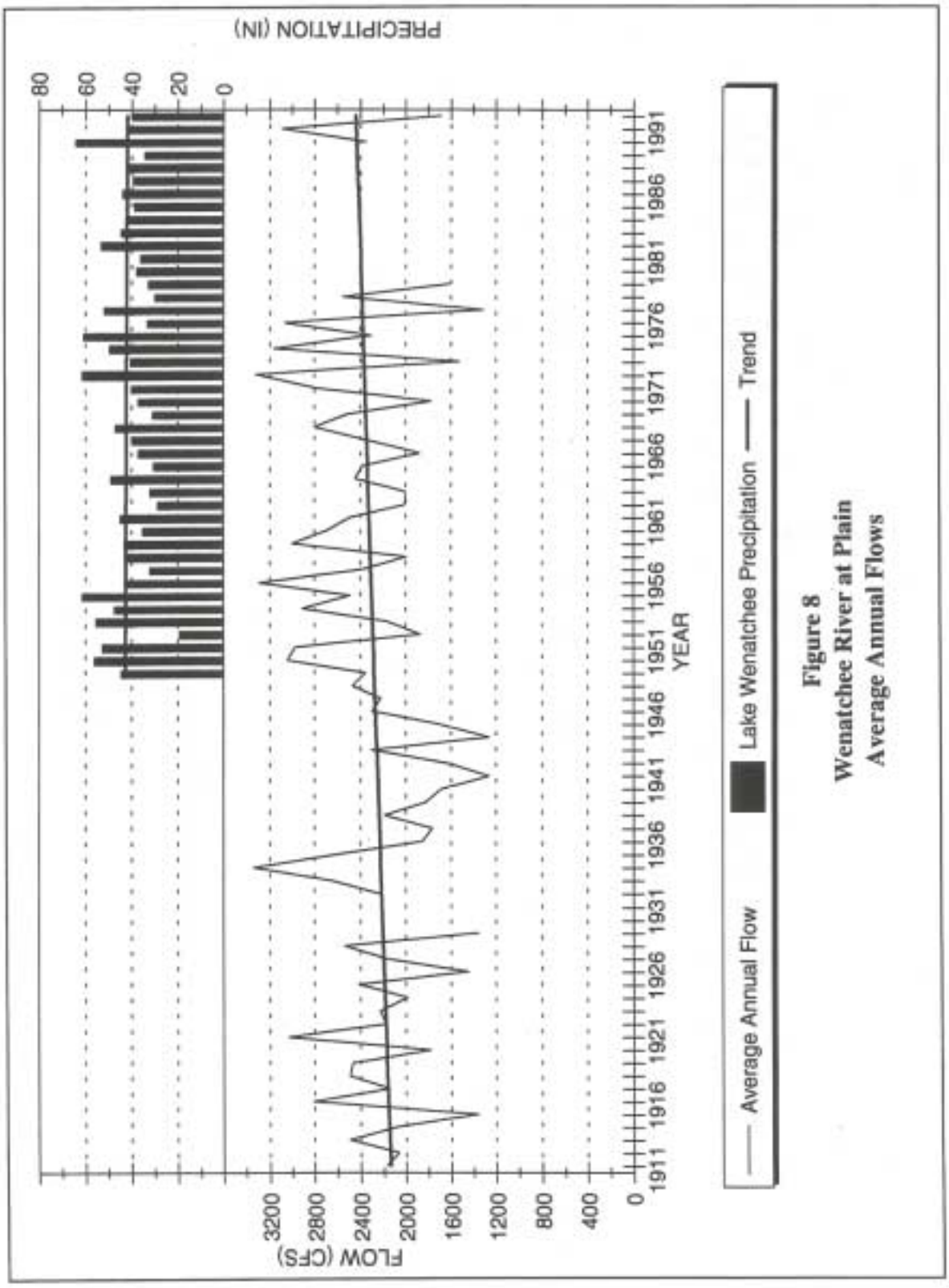


Figure 8
Wenatchee River at Plain
Average Annual Flows

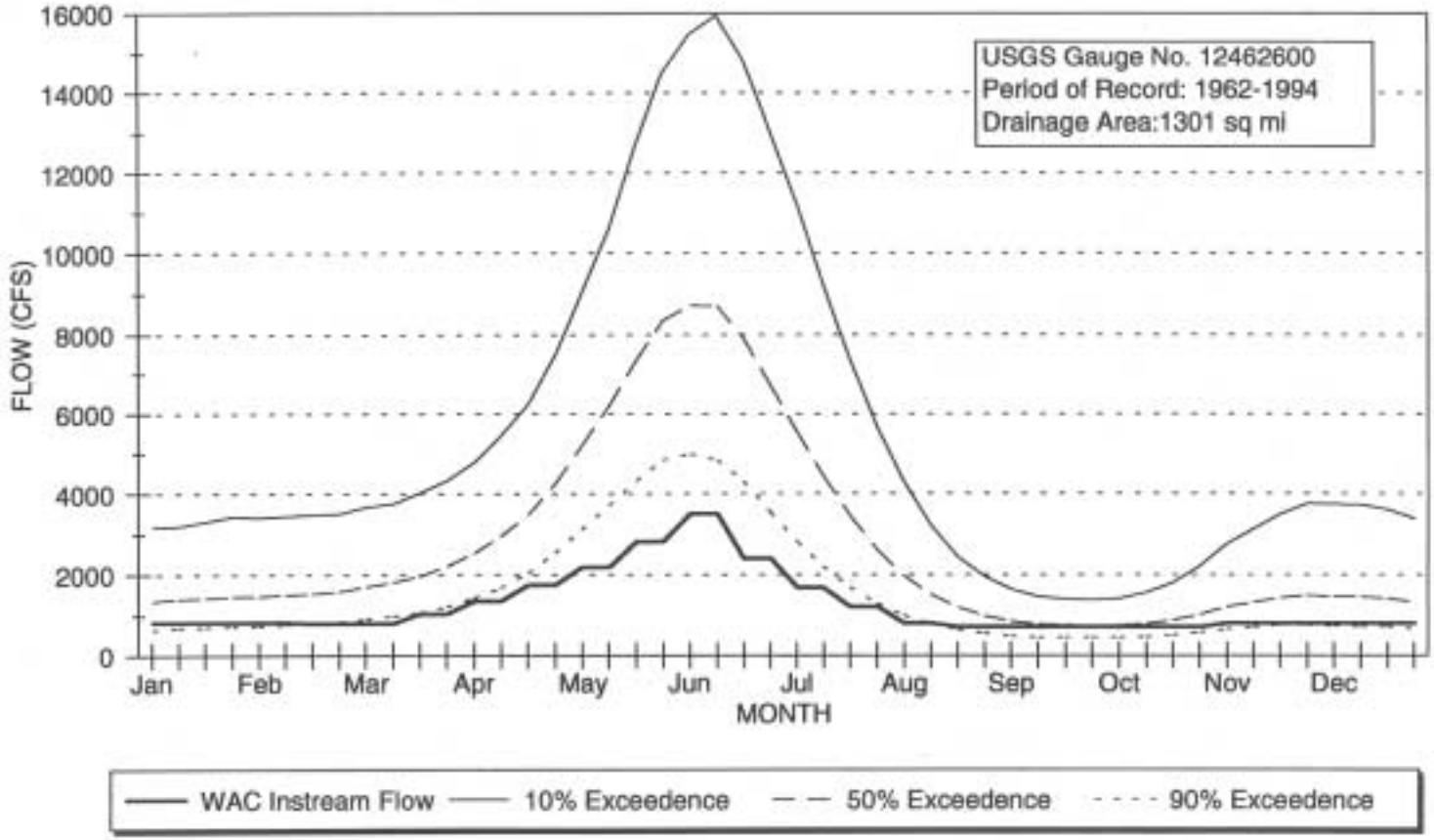


Figure 9
Wenatchee River at Monitor
Monthly Flow Exceedence

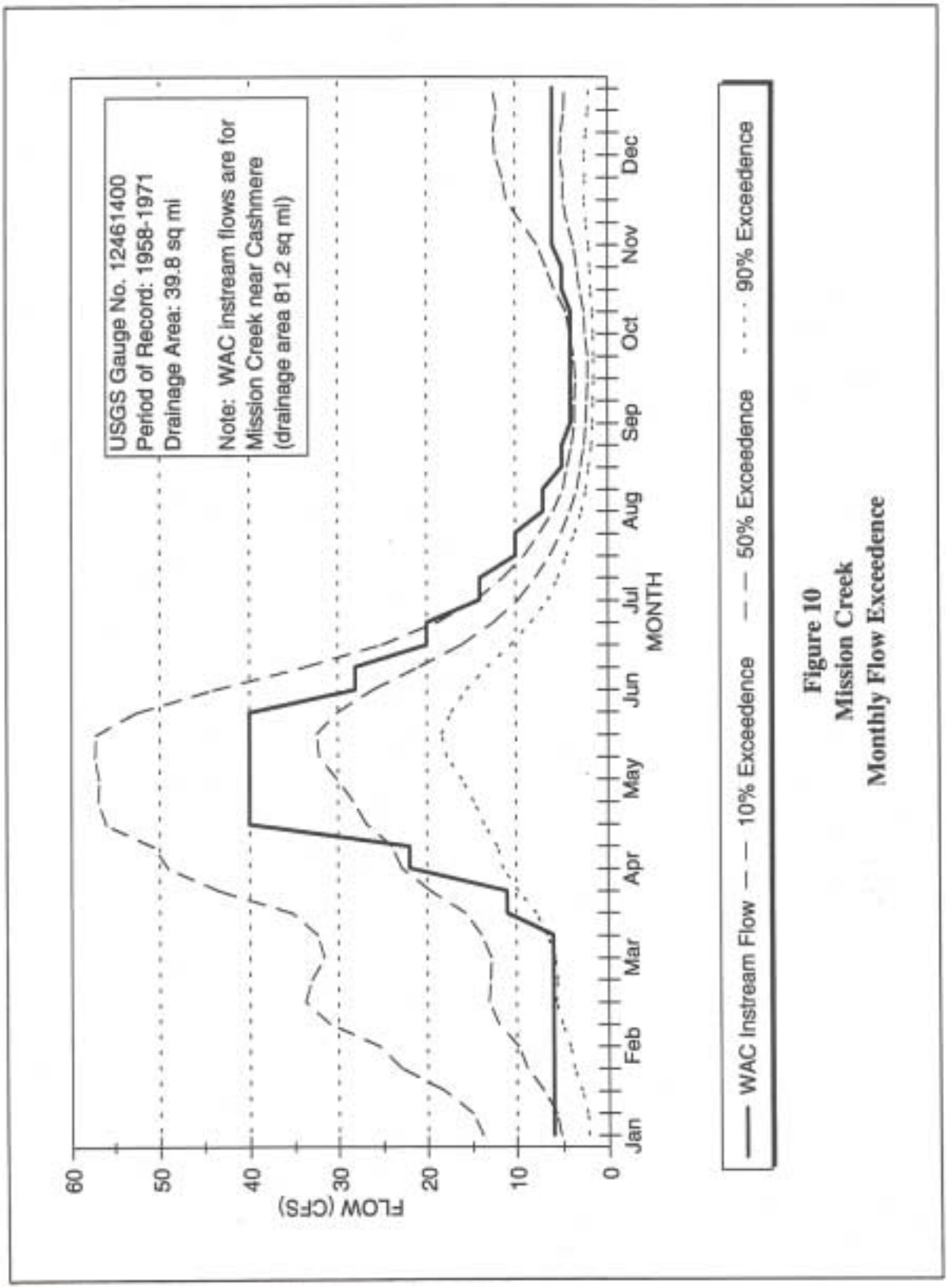


Figure 10
Mission Creek
Monthly Flow Exceedence

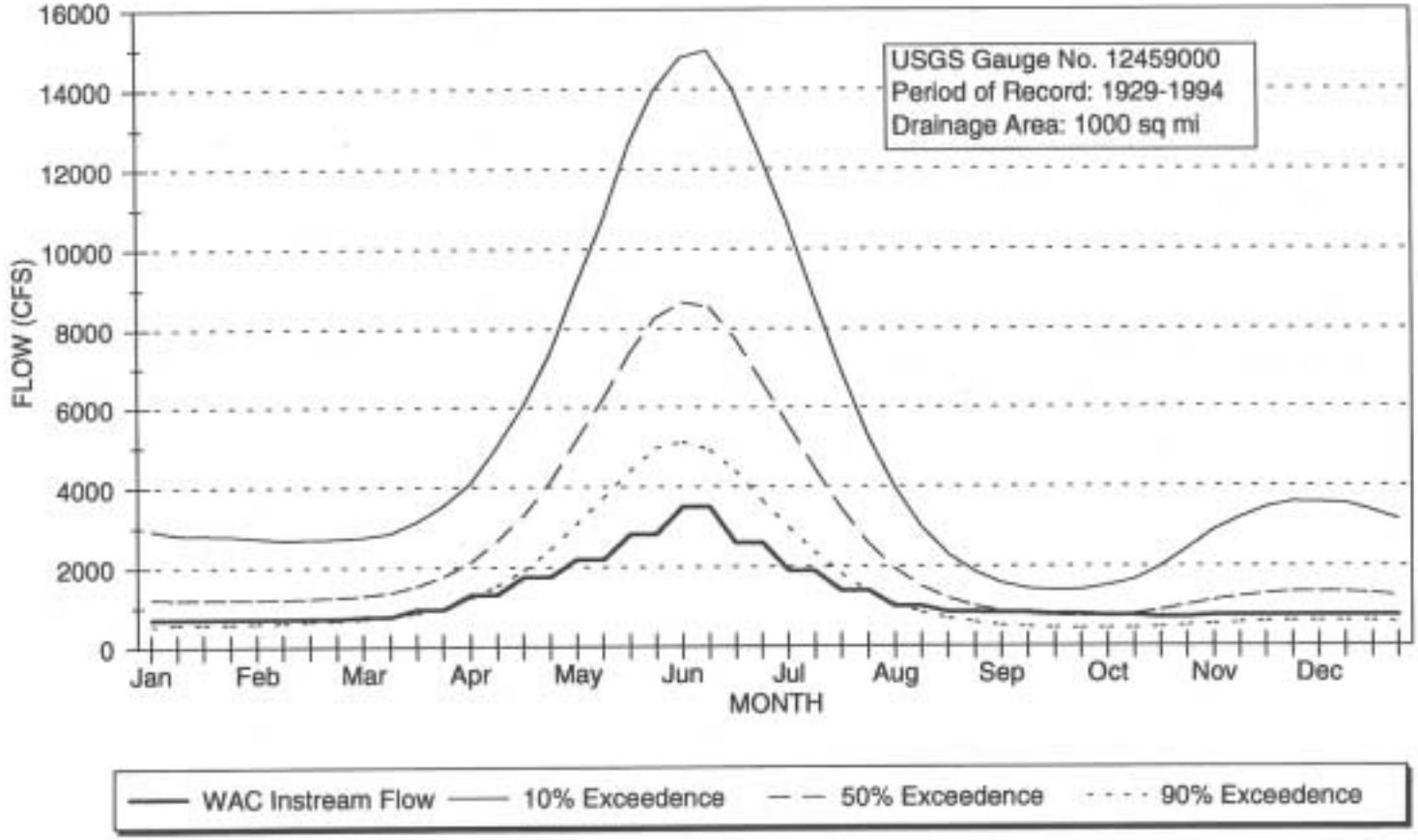


Figure 11
Wenatchee River at Peshastin
Monthly Flow Exceedence

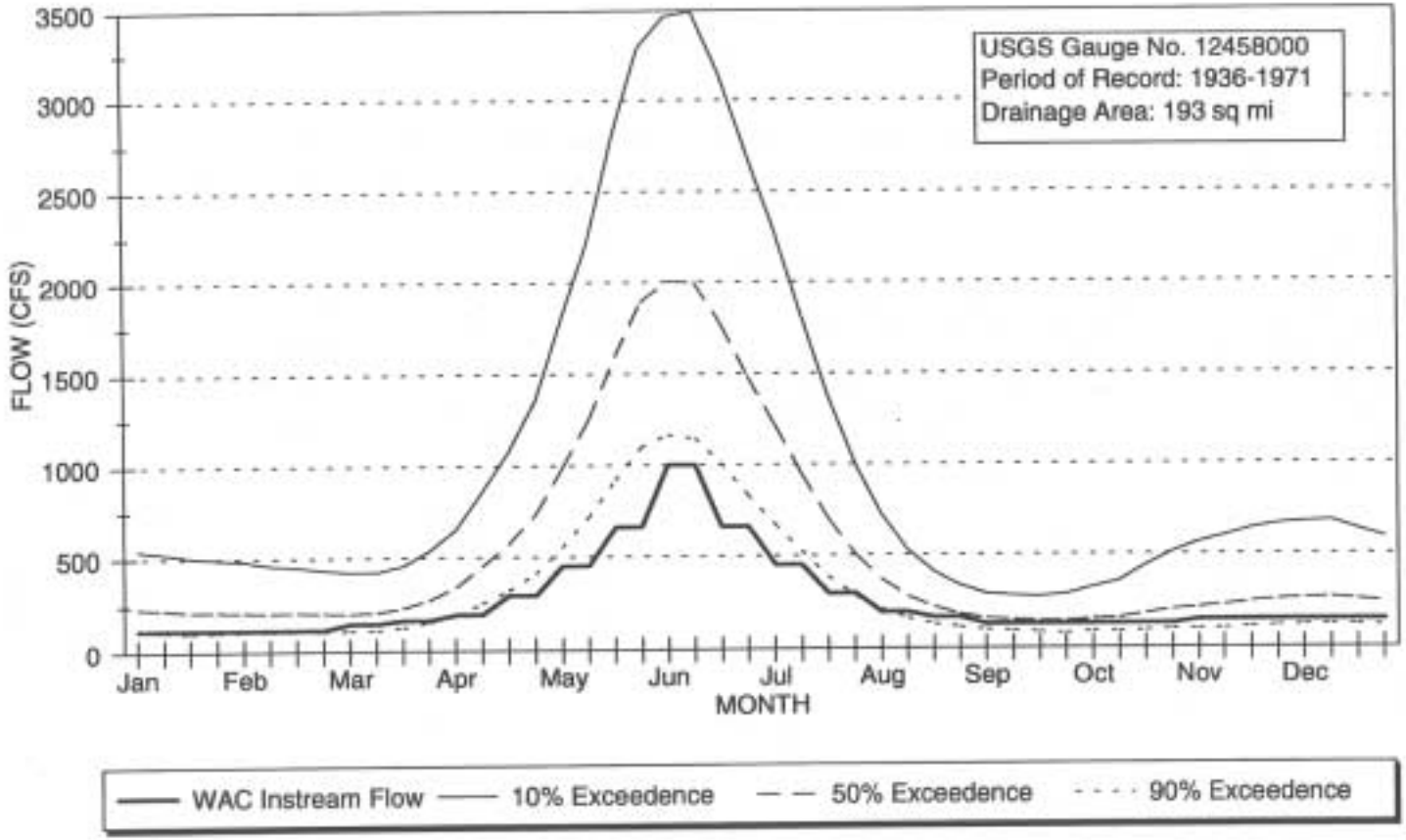


Figure 12
Icicle Creek
Monthly Flow Exceedence

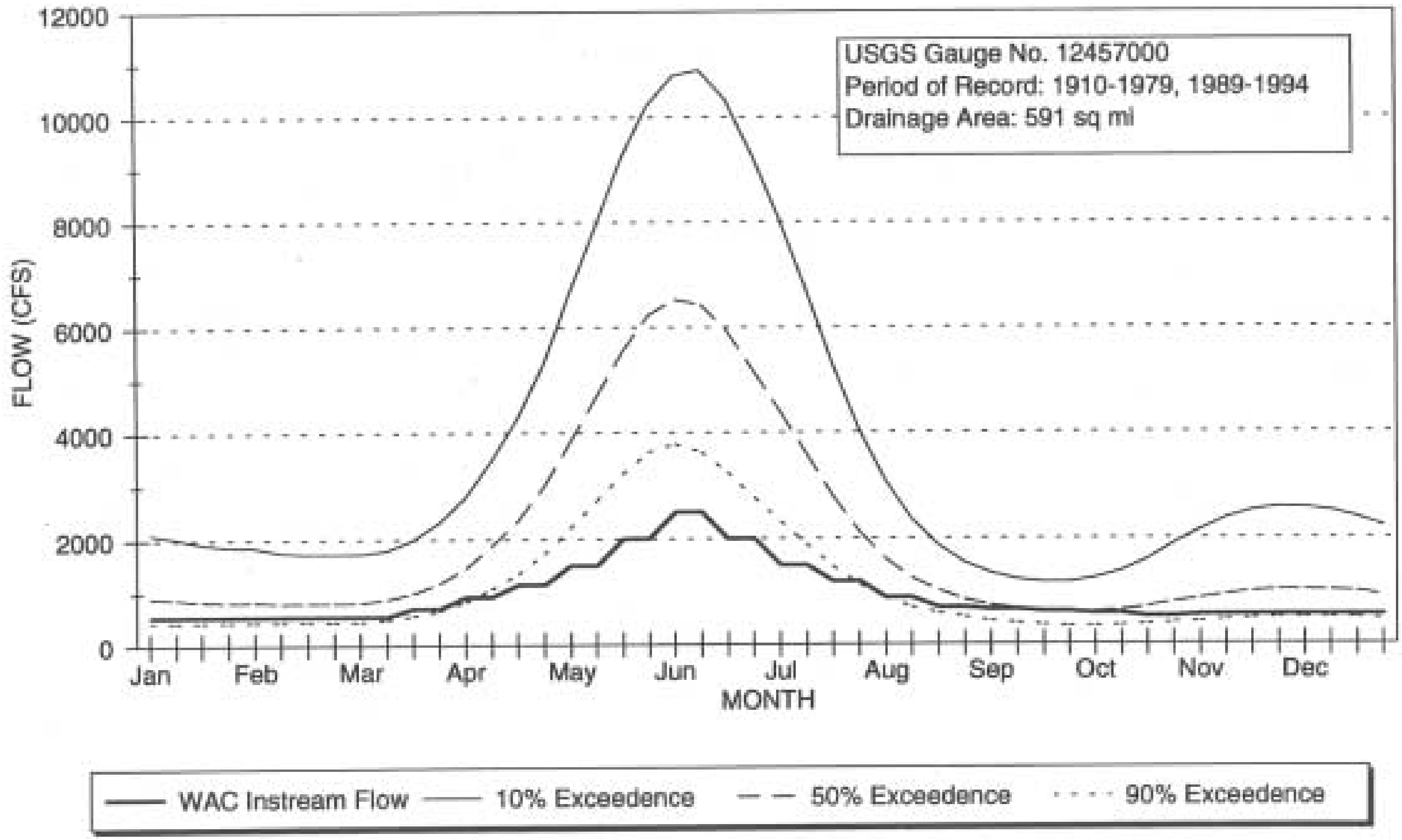


Figure 13
Wenatchee River at Plain
Monthly Flow Exceedence

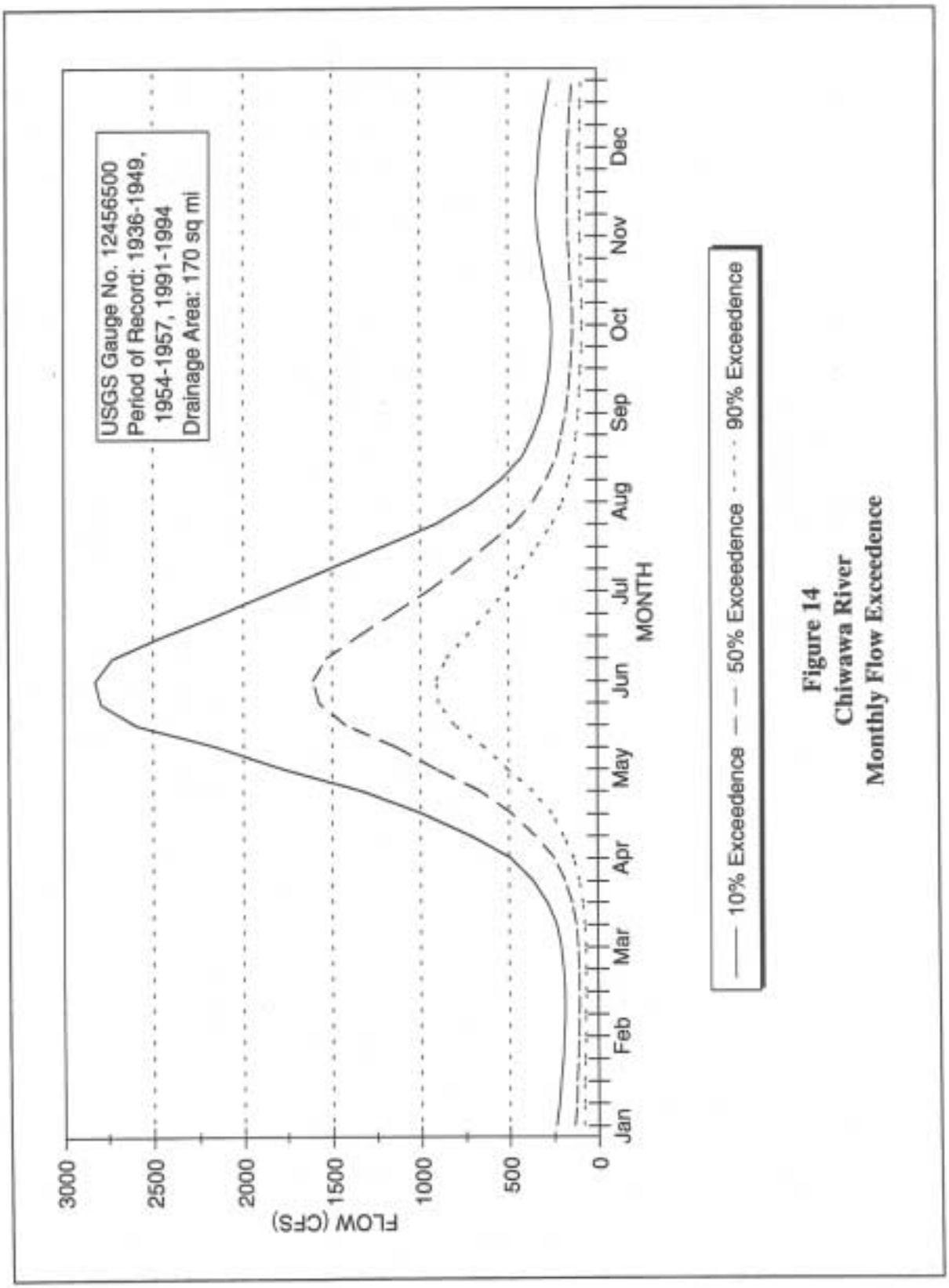


Figure 14
Chiwawa River
Monthly Flow Exceedence

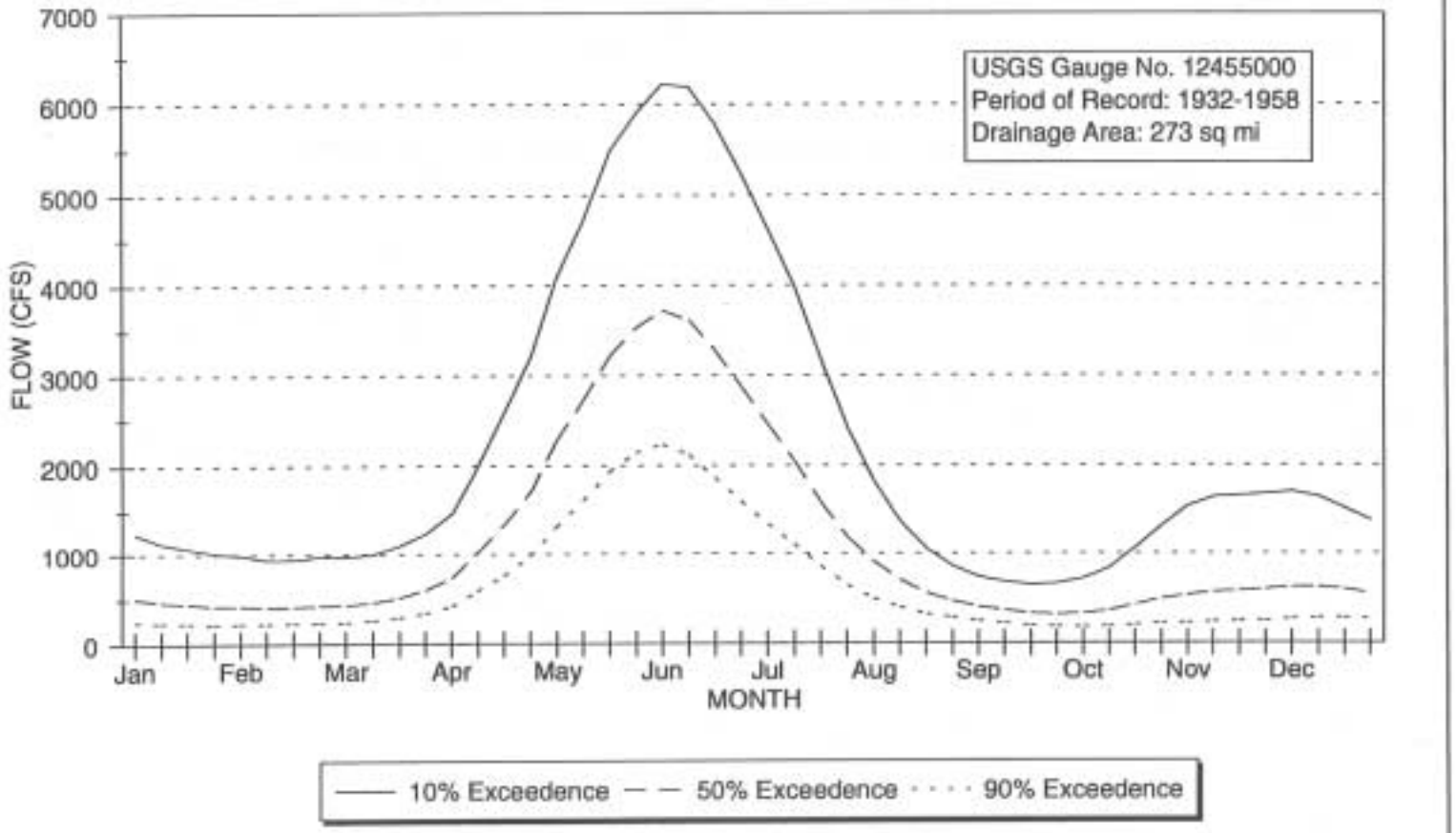


Figure 15
Wenatchee River Below Lake Wenatchee
Monthly Flow Exceedence

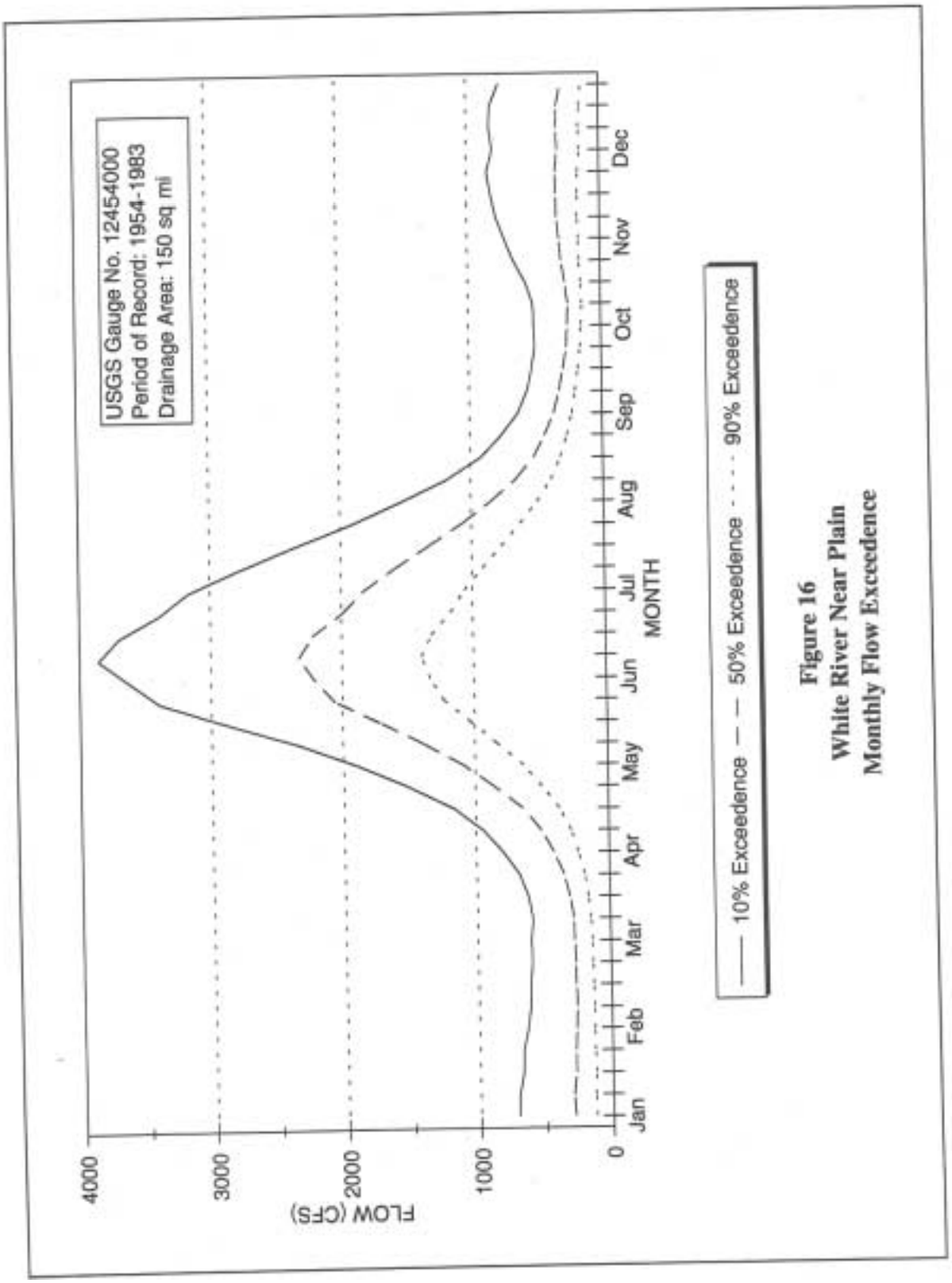


Figure 16
White River Near Plain
Monthly Flow Exceedence

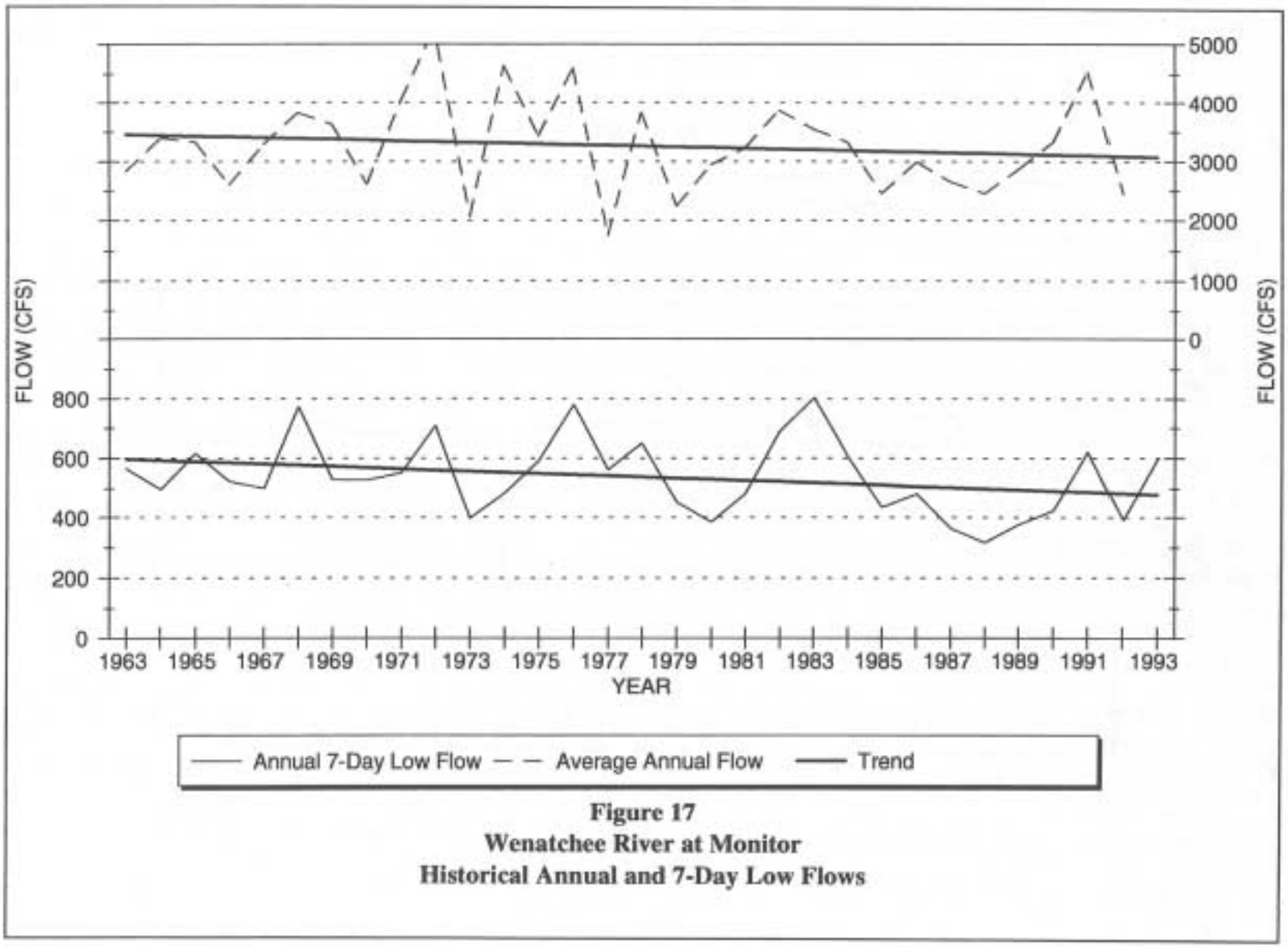


Figure 17
Wenatchee River at Monitor
Historical Annual and 7-Day Low Flows

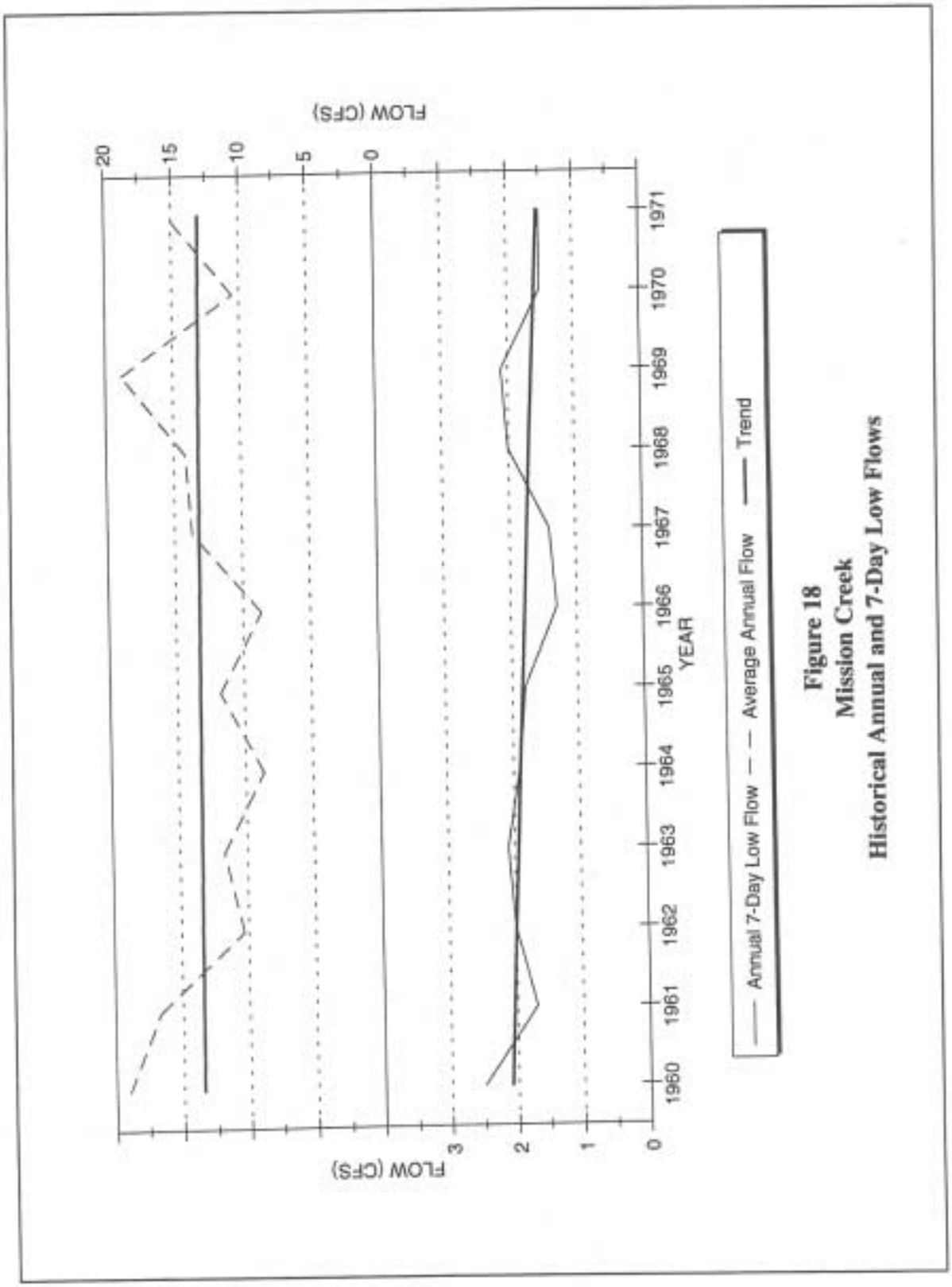


Figure 18
Mission Creek
Historical Annual and 7-Day Low Flows

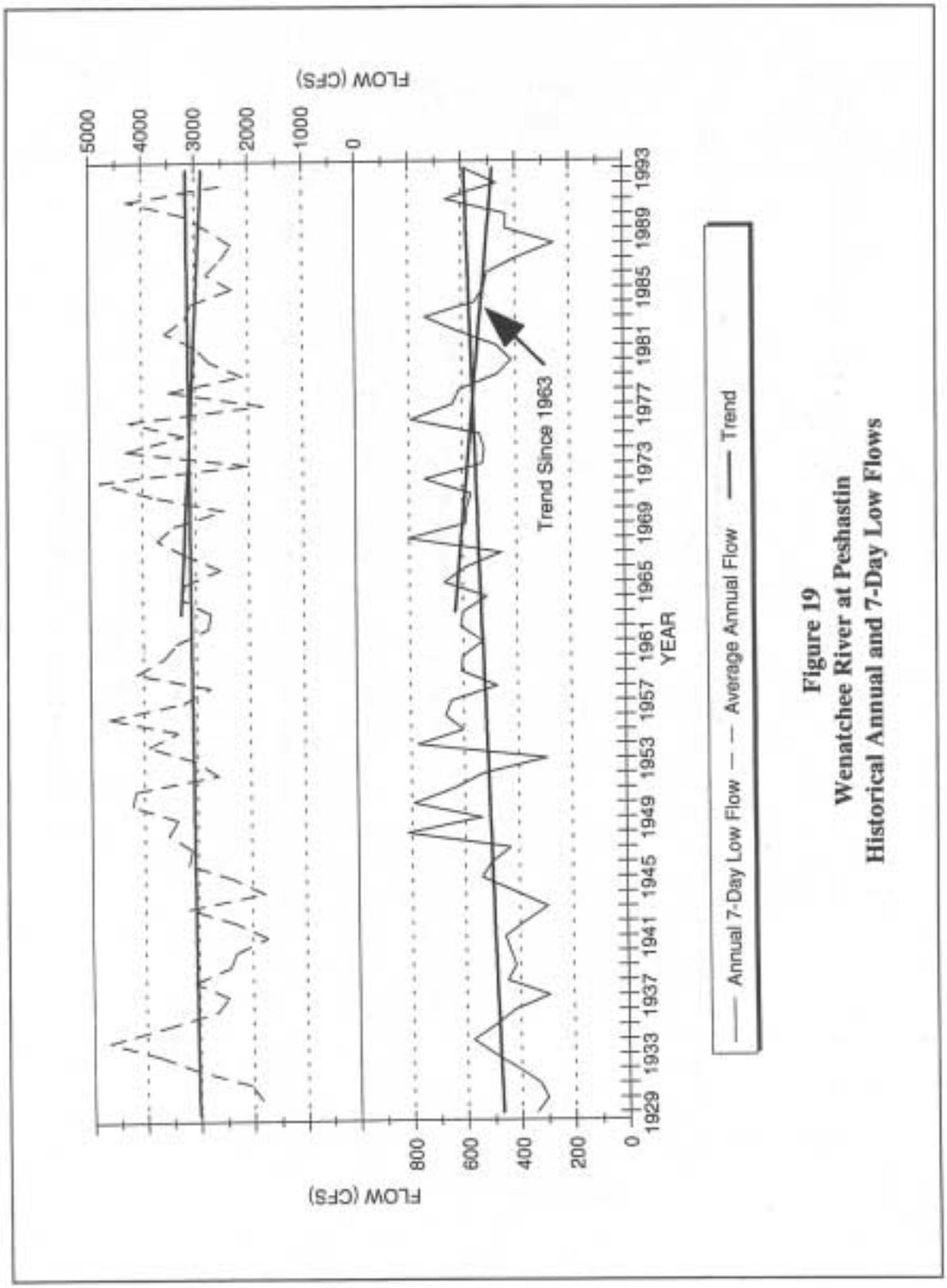


Figure 19
Wenatchee River at Peshastin
Historical Annual and 7-Day Low Flows

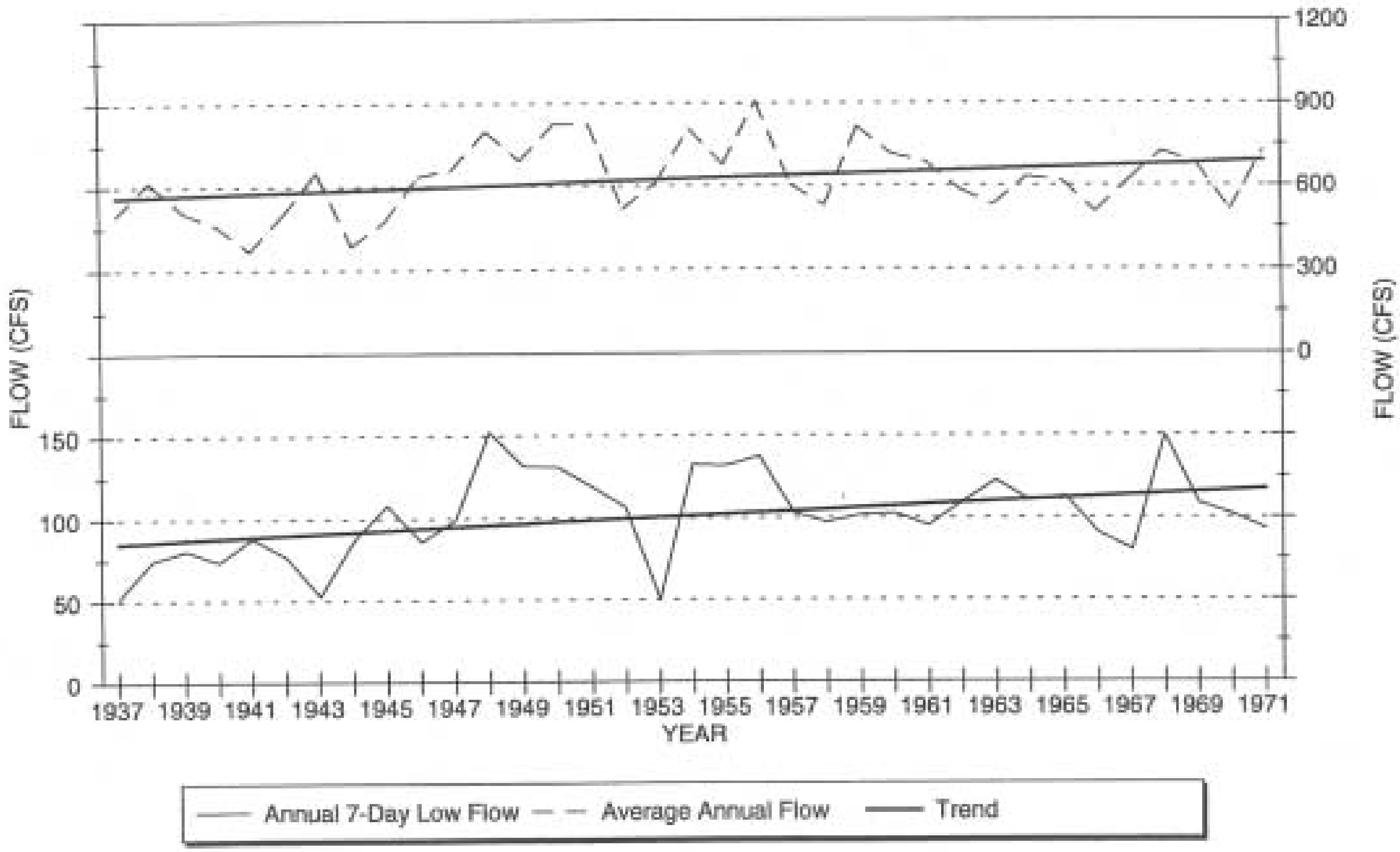


Figure 20
Icicle Creek
Historical Annual and 7-Day Low Flows

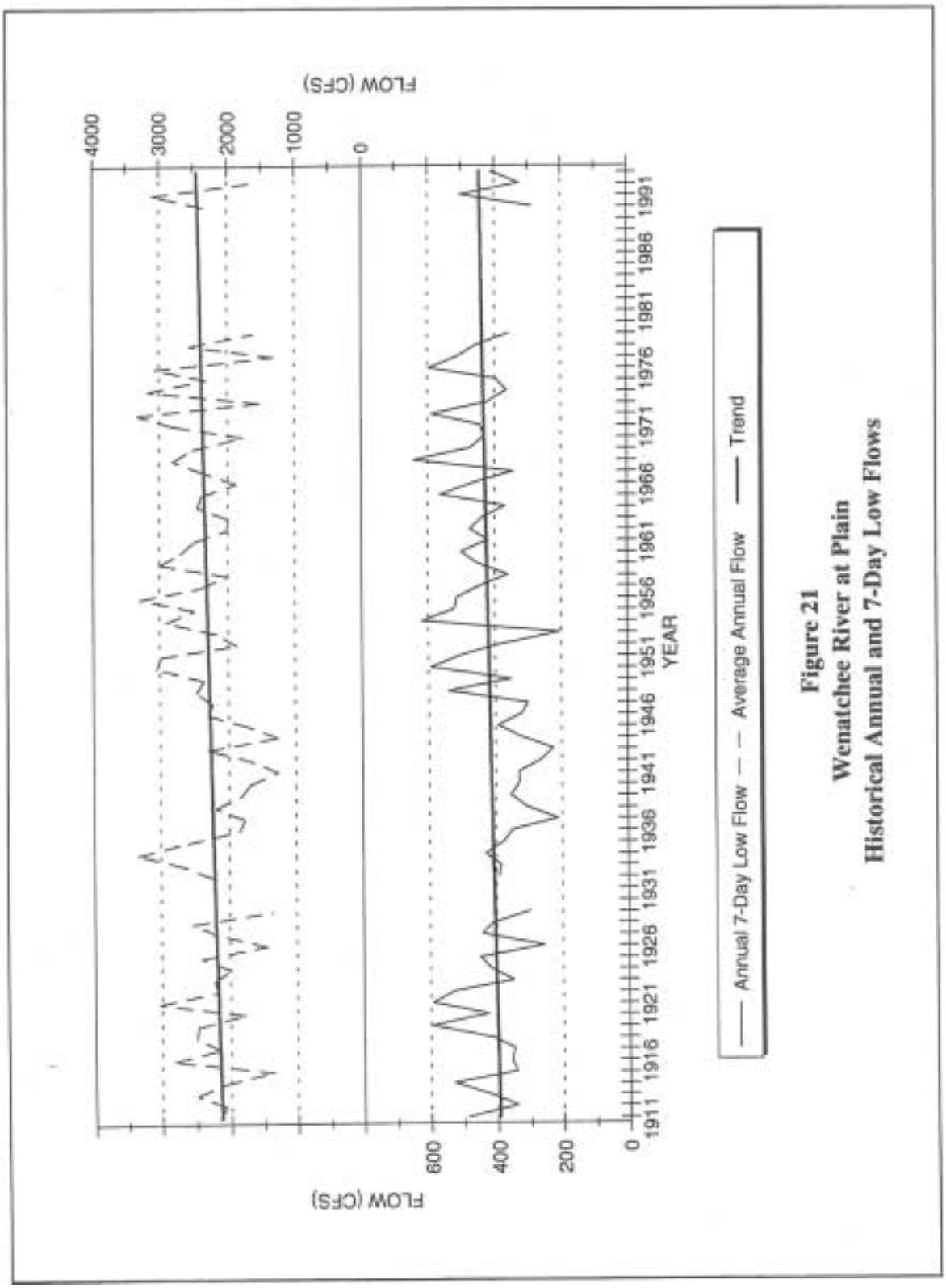


Figure 21
Wenatchee River at Plain
Historical Annual and 7-Day Low Flows

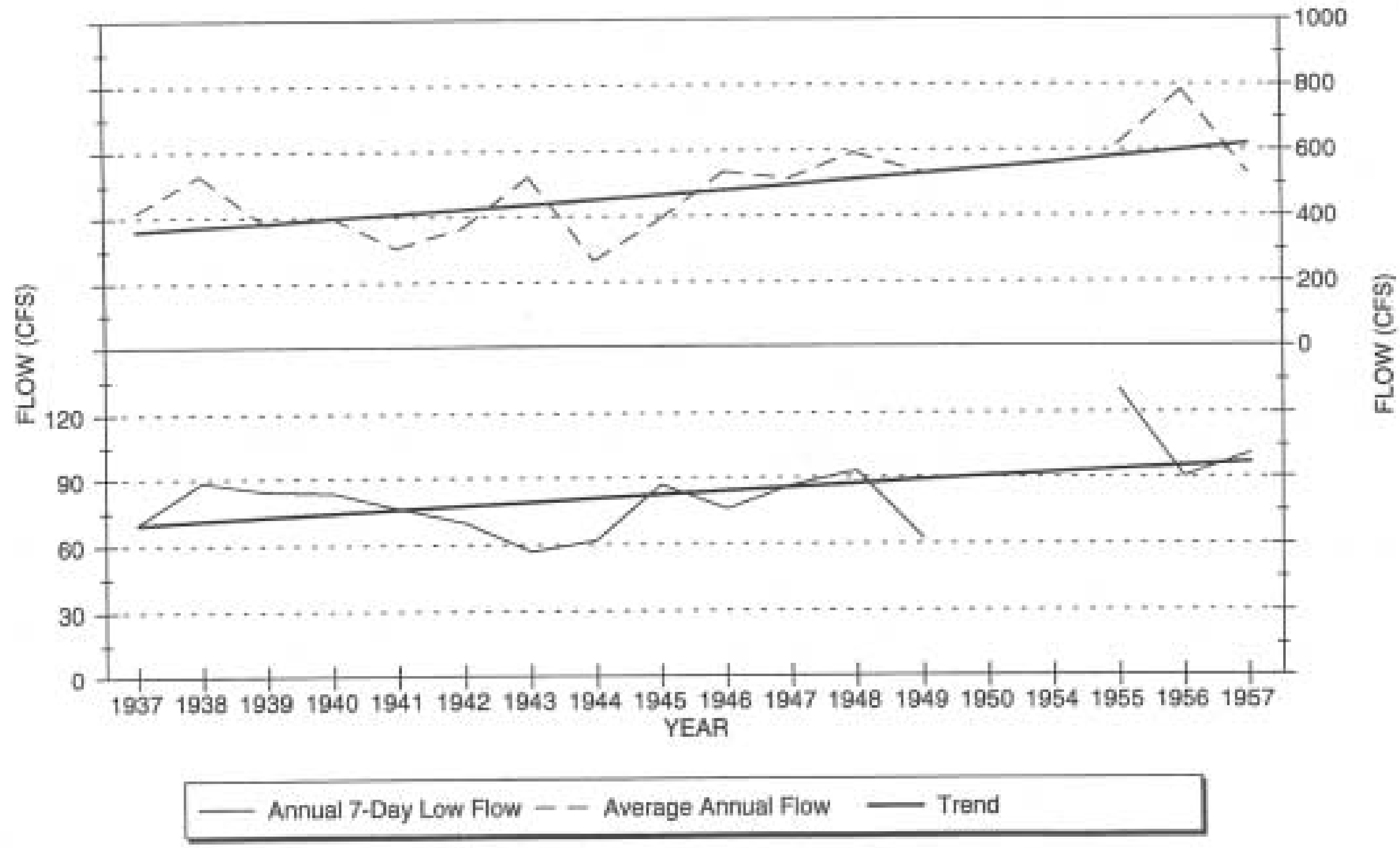


Figure 22
Chiwawa River
Historical Annual and 7-Day Low Flows

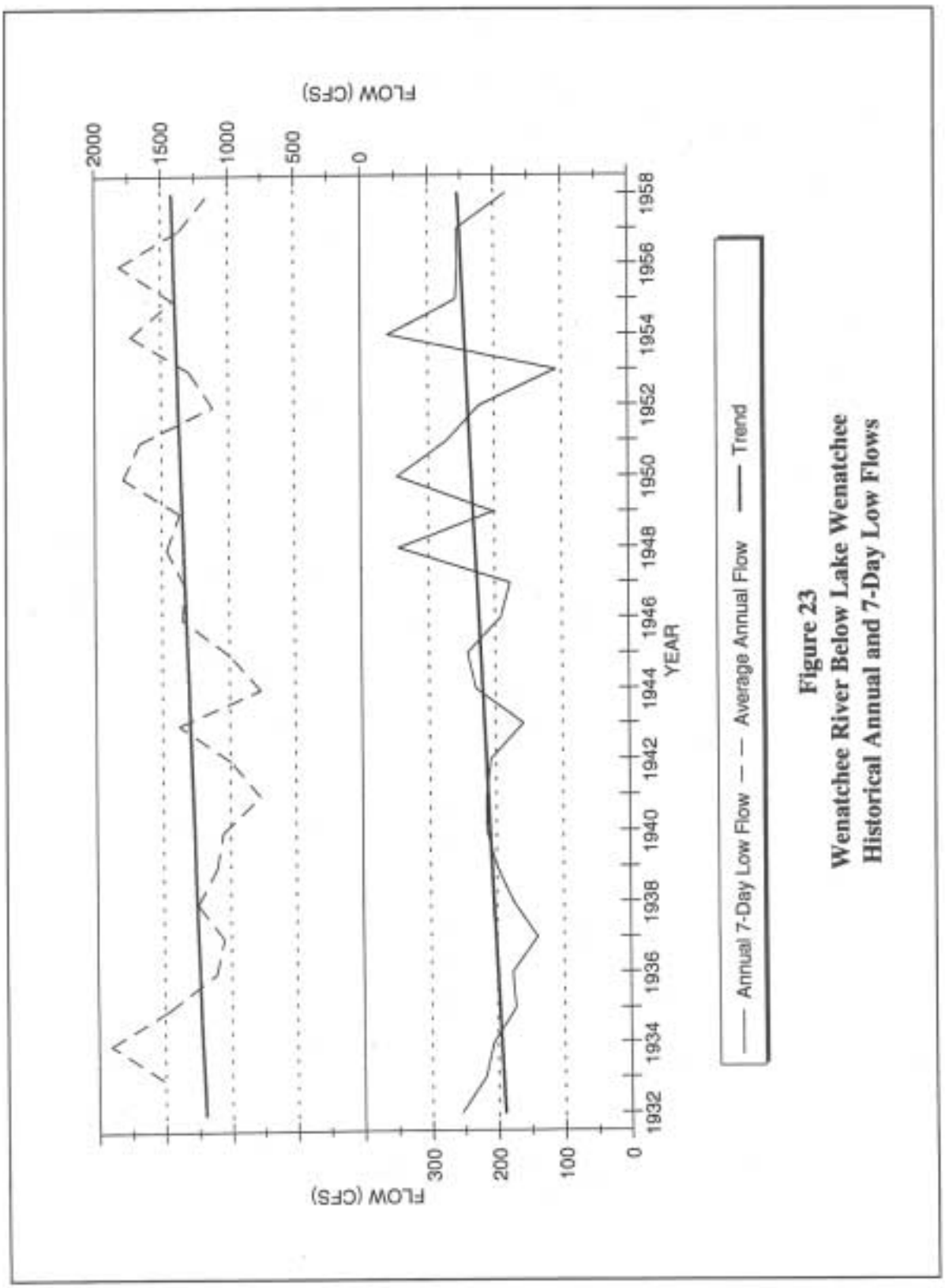


Figure 23
Wenatchee River Below Lake Wenatchee
Historical Annual and 7-Day Low Flows

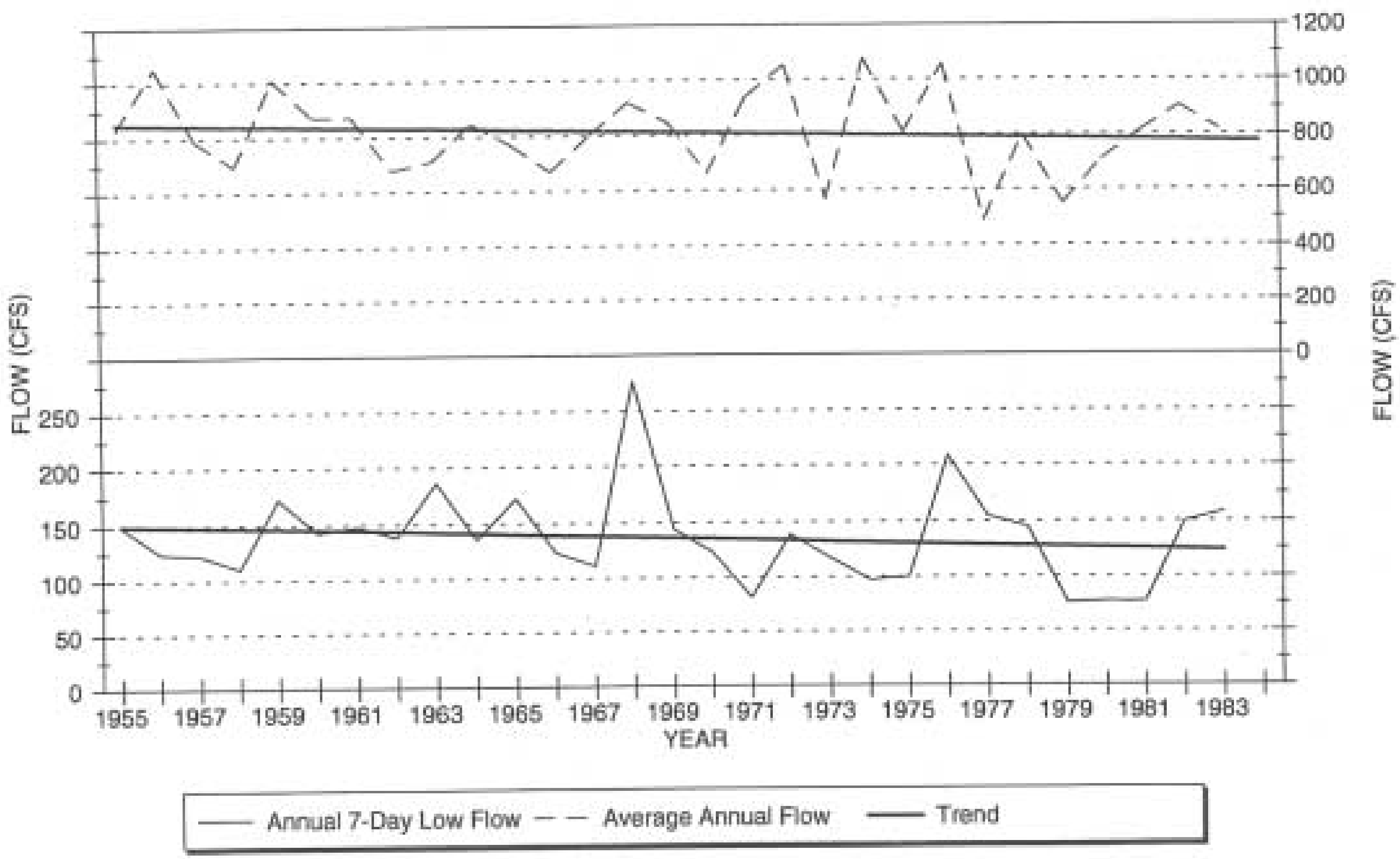


Figure 24
White River
Historical Annual and 7-Day Low Flows

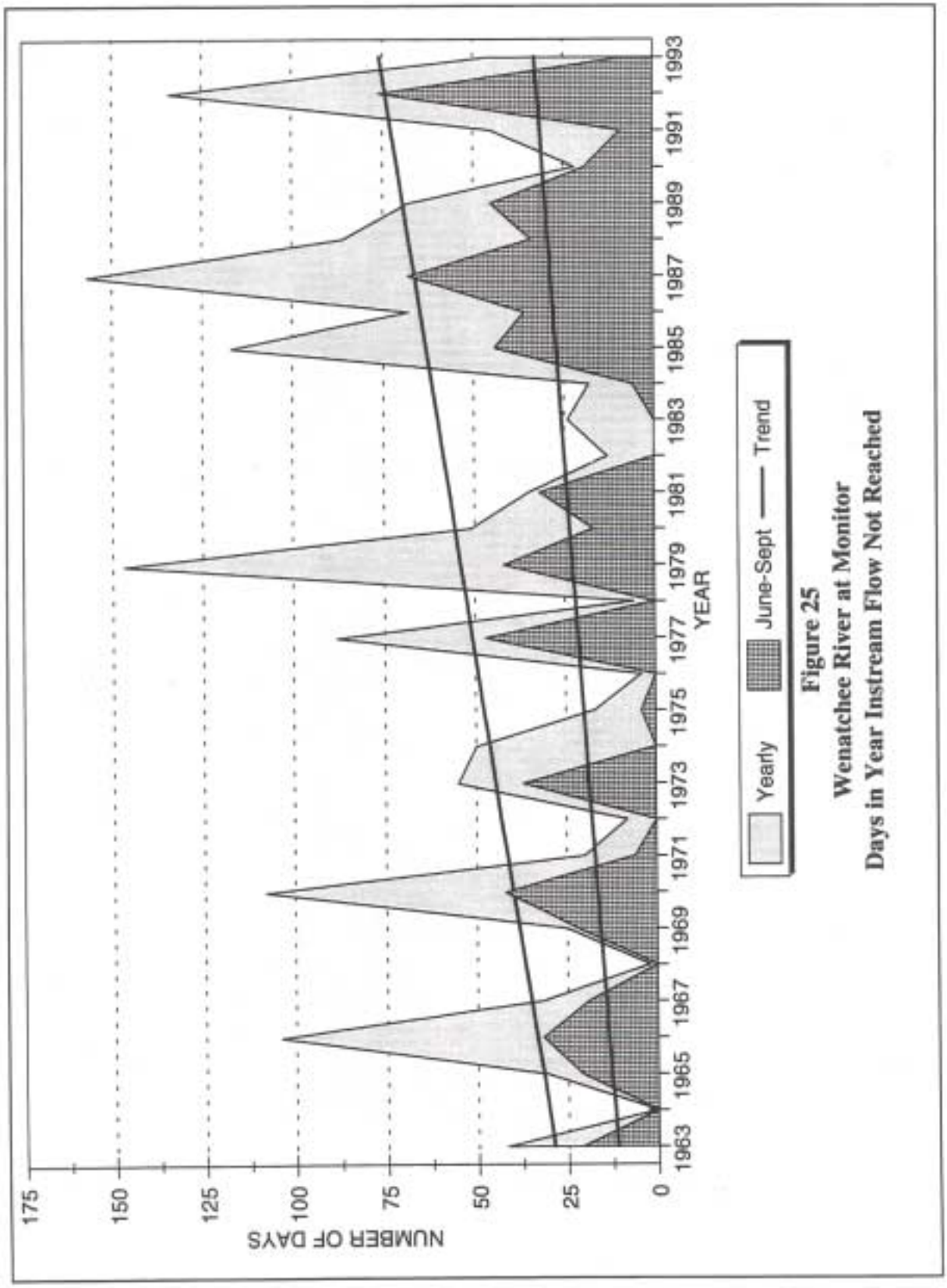


Figure 25
Wenatchee River at Monitor
Days in Year Instream Flow Not Reached

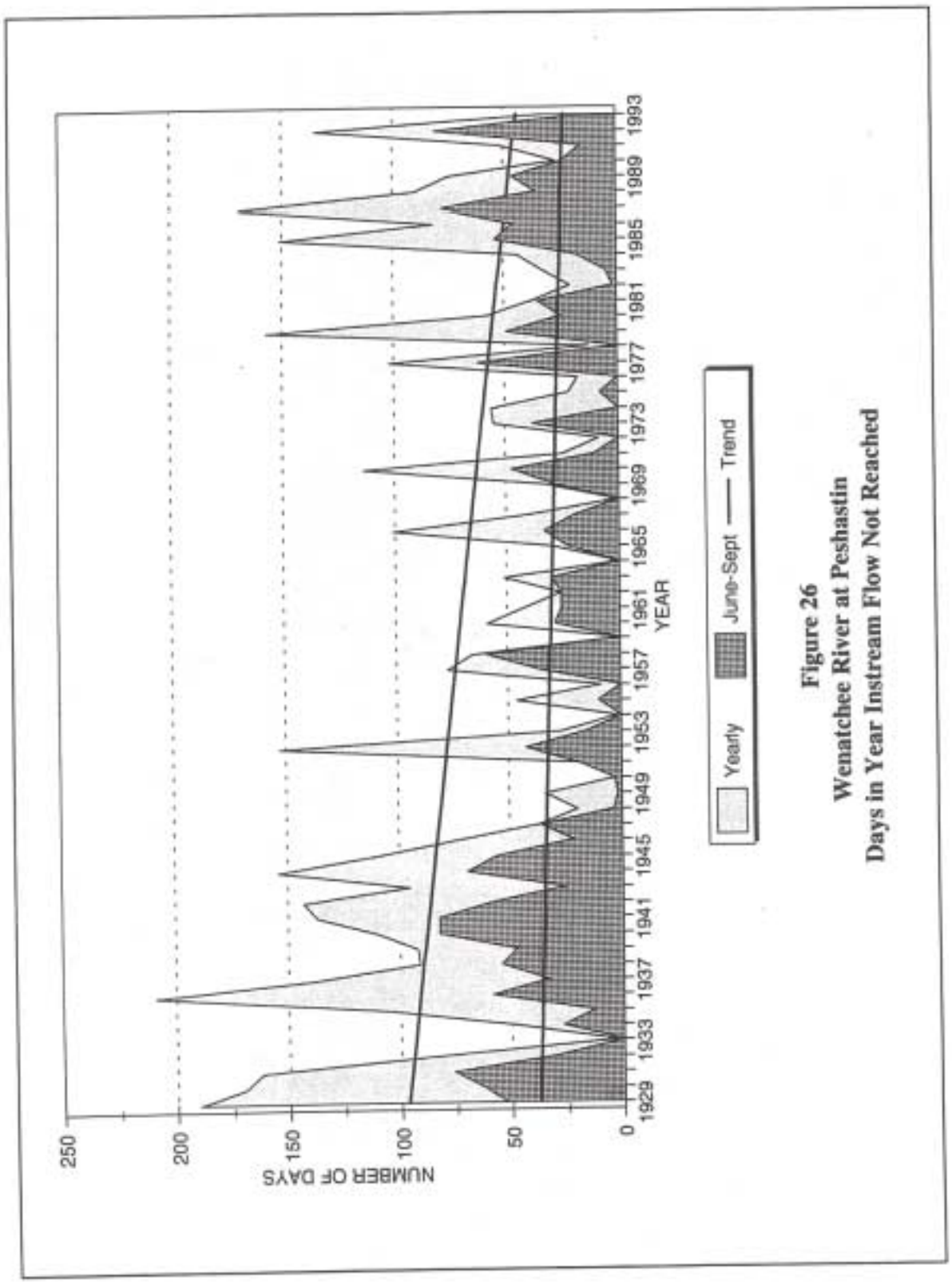


Figure 26
Wenatchee River at Peshastin
Days in Year Instream Flow Not Reached

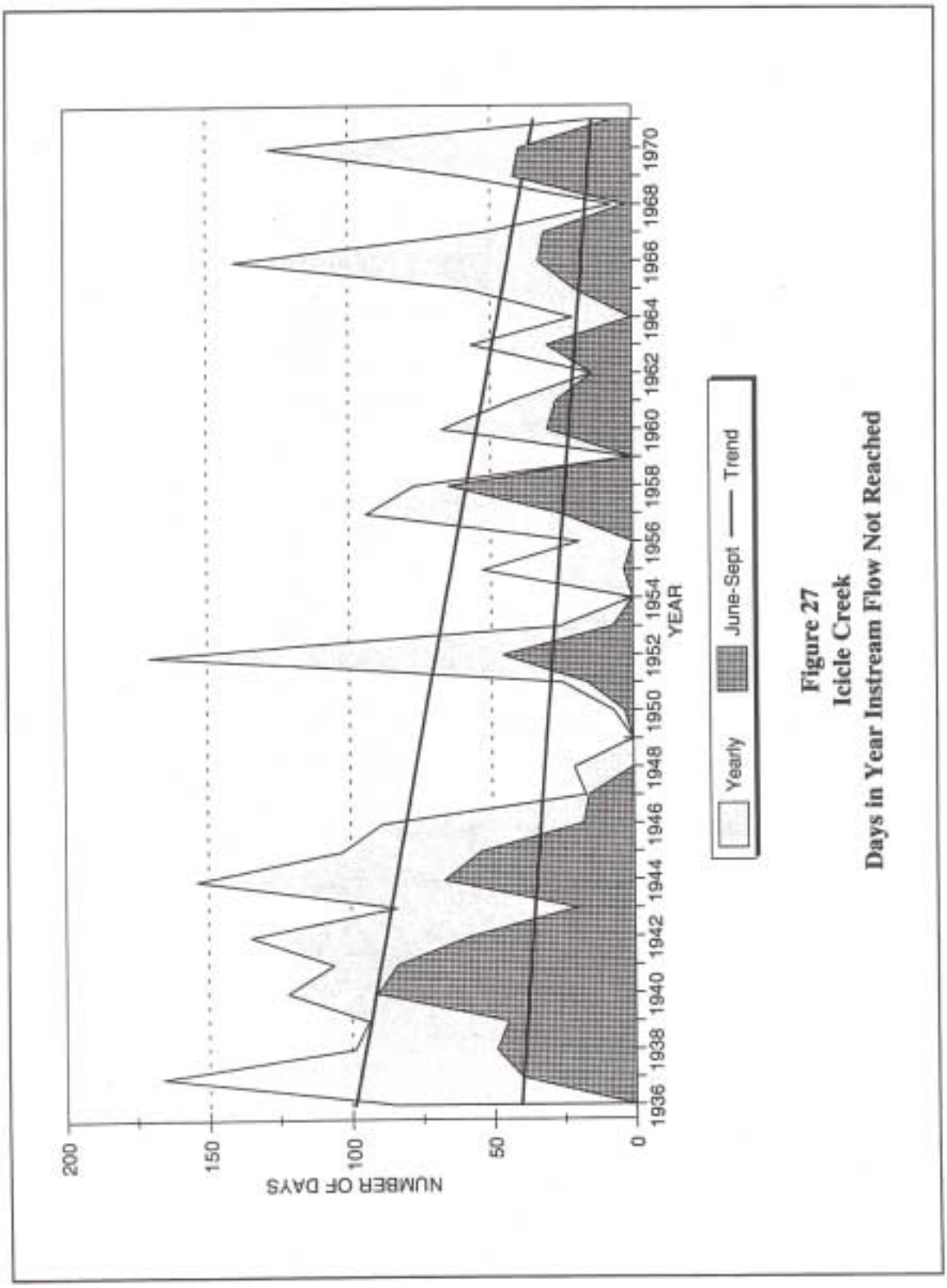


Figure 27
Icicle Creek
Days in Year Instream Flow Not Reached

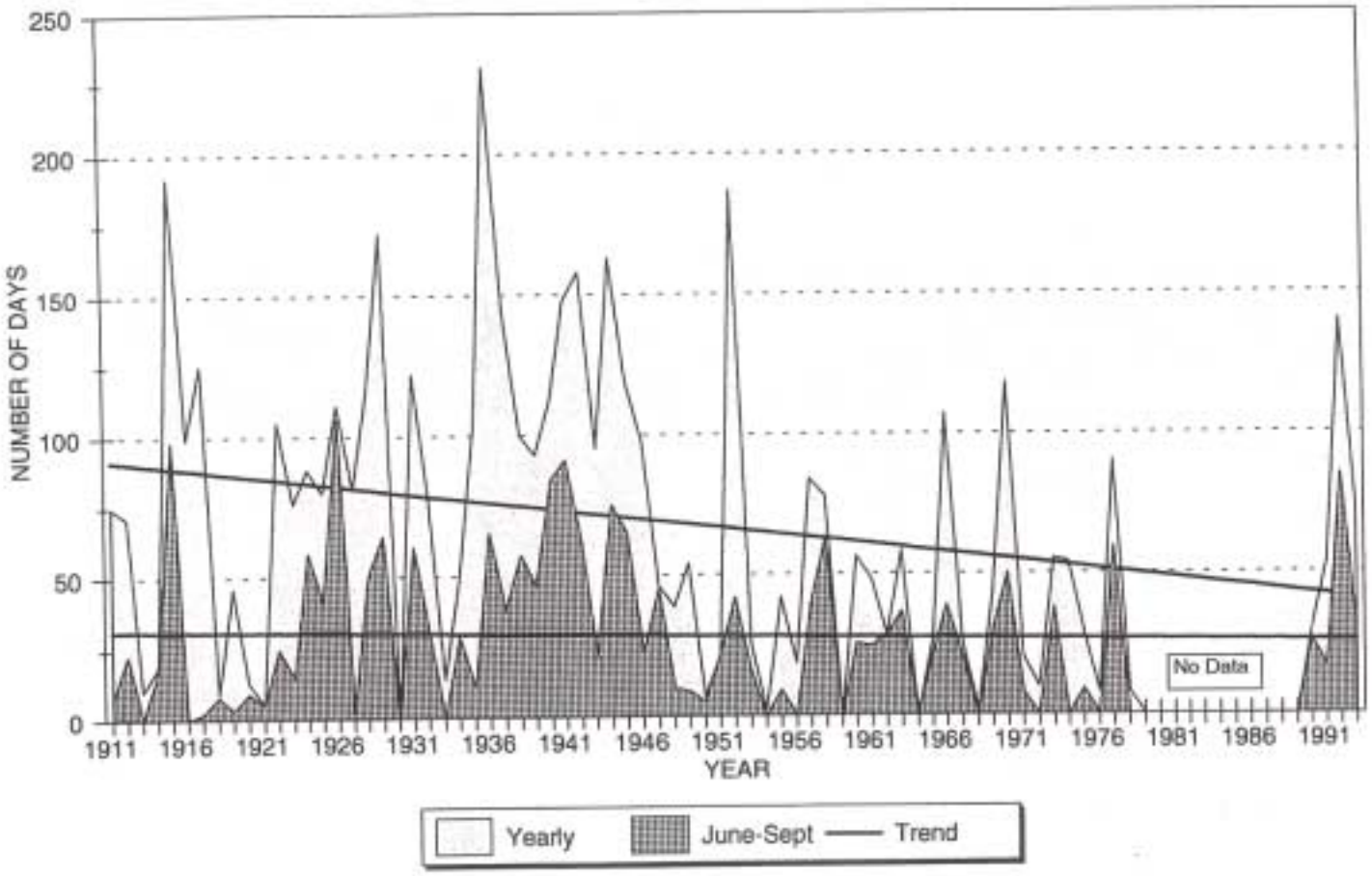


Figure 28
Wenatchee River at Plain
Days in Year Instream Flow Not Reached

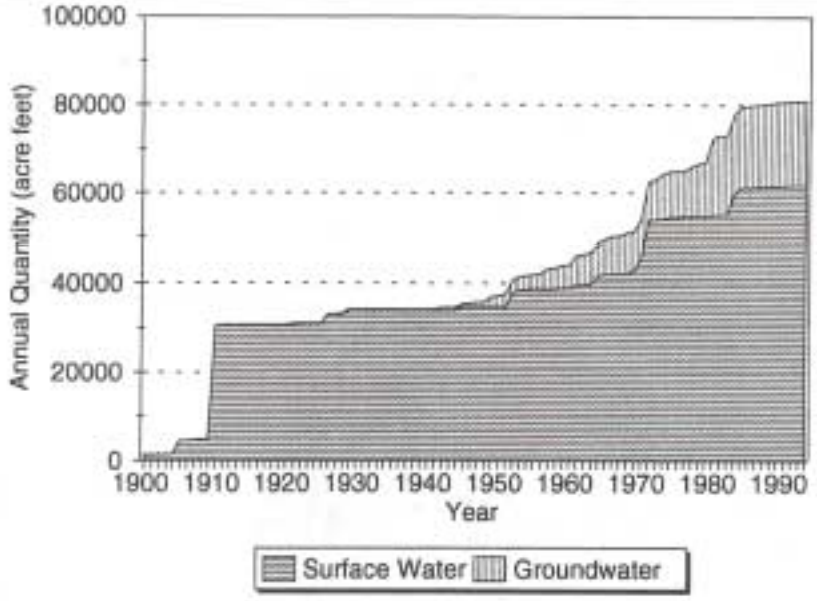


Figure 29
Historical Growth of Water Rights Appropriations in Wenatchee River Watershed
Total Annual Quantity

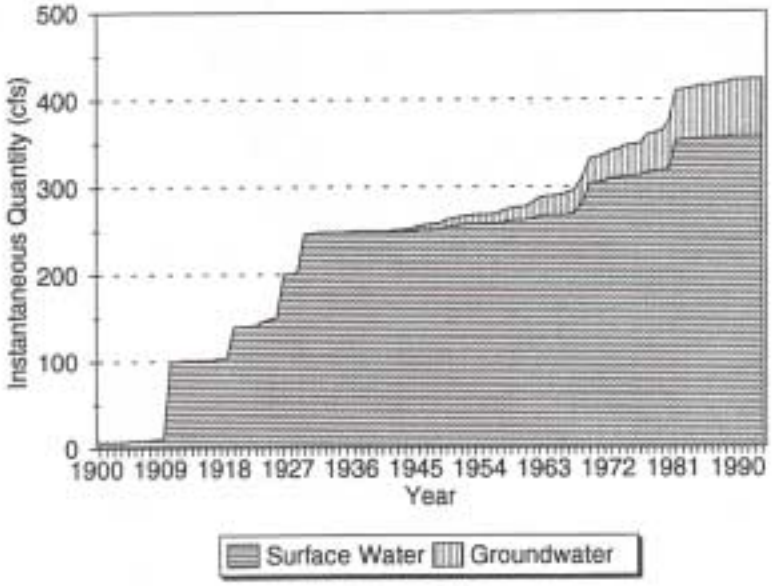


Figure 30
Historical Growth of Water Rights Appropriations in Wenatchee River Watershed
Total Instantaneous Rate

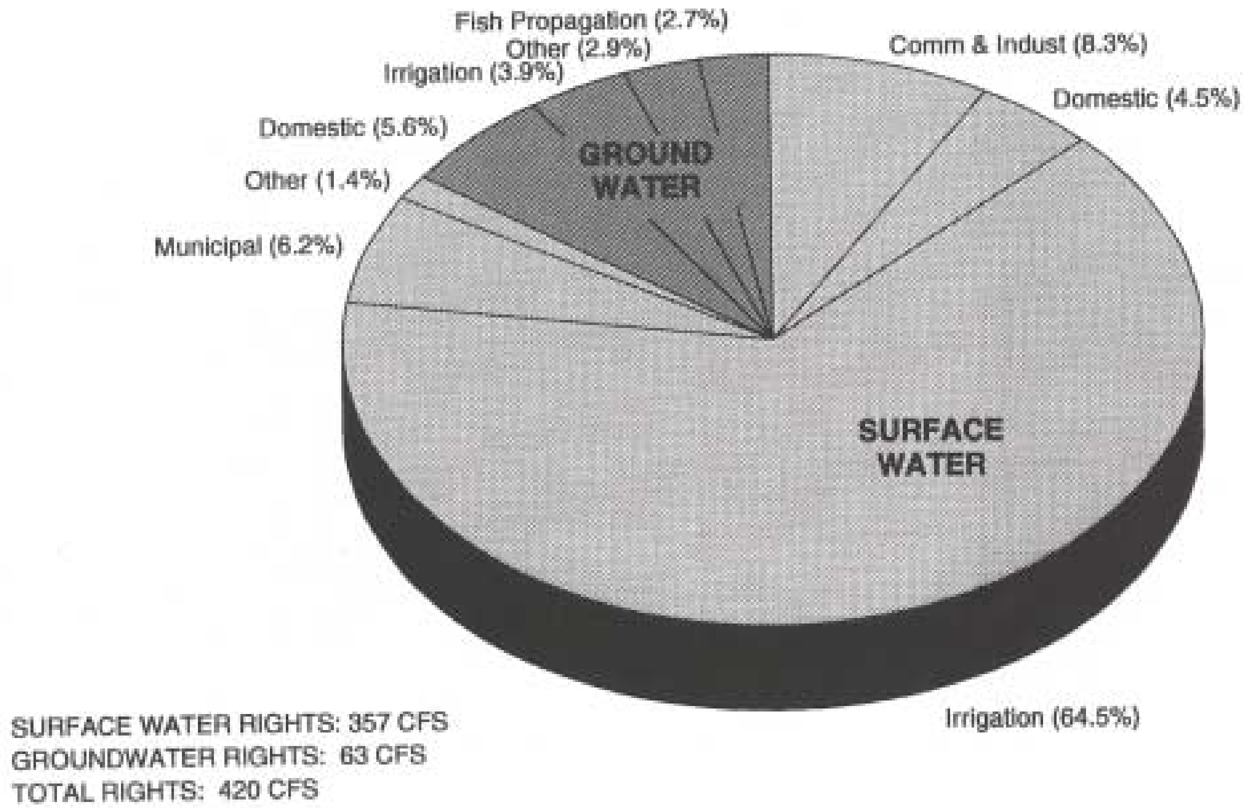


Figure 31
Water Rights in Wenatchee River Watershed
Total Instantaneous Rate

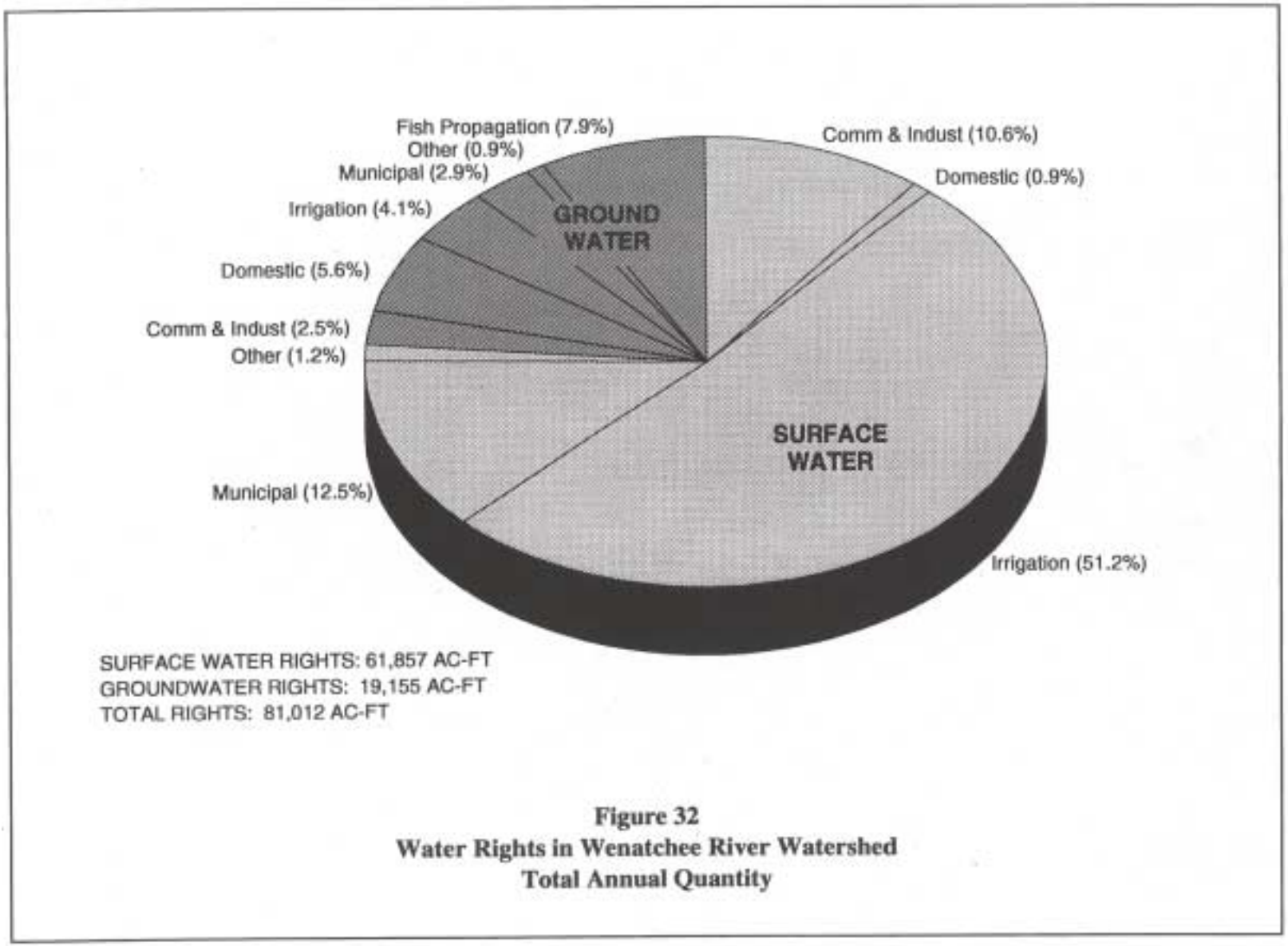
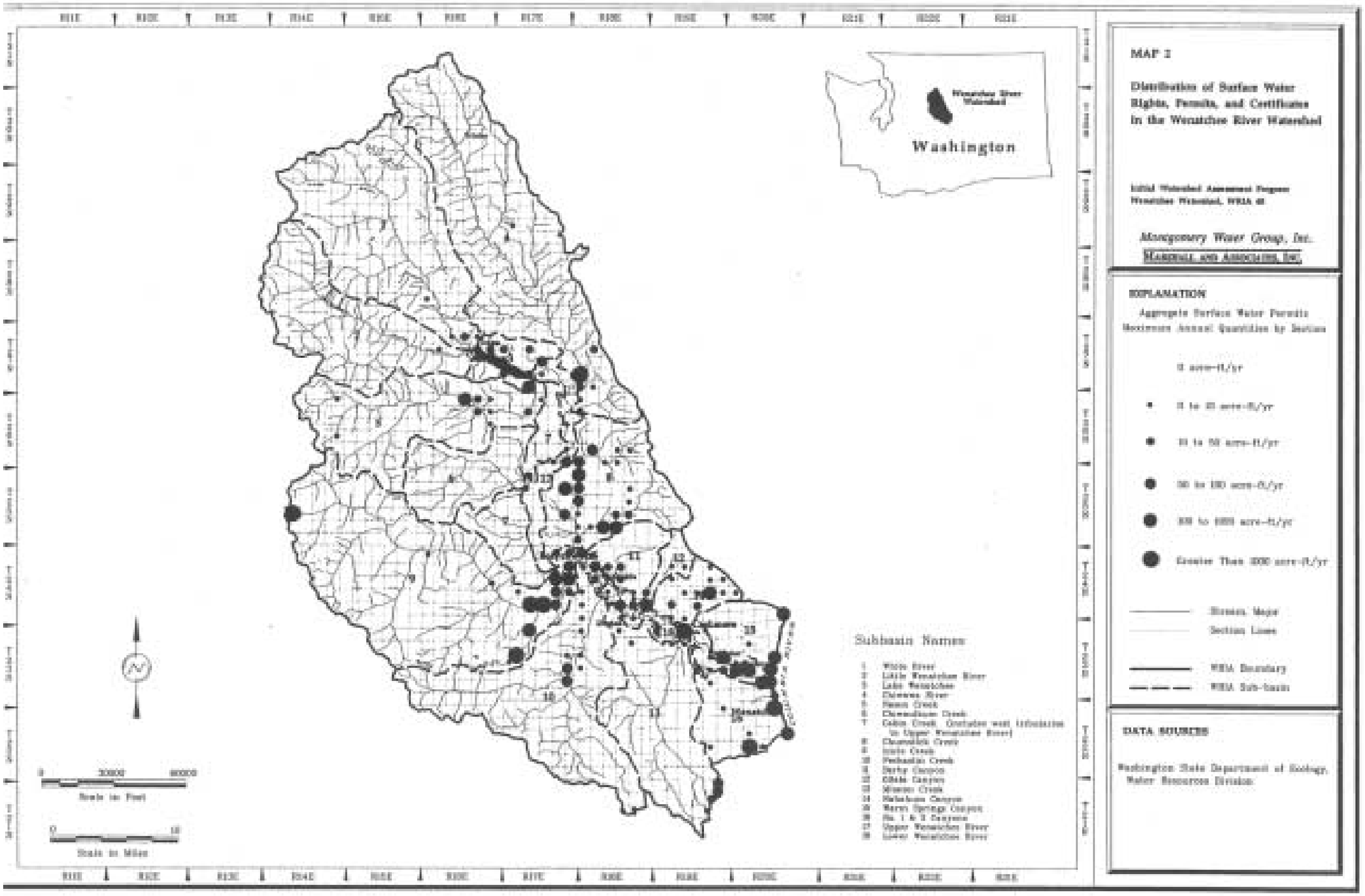
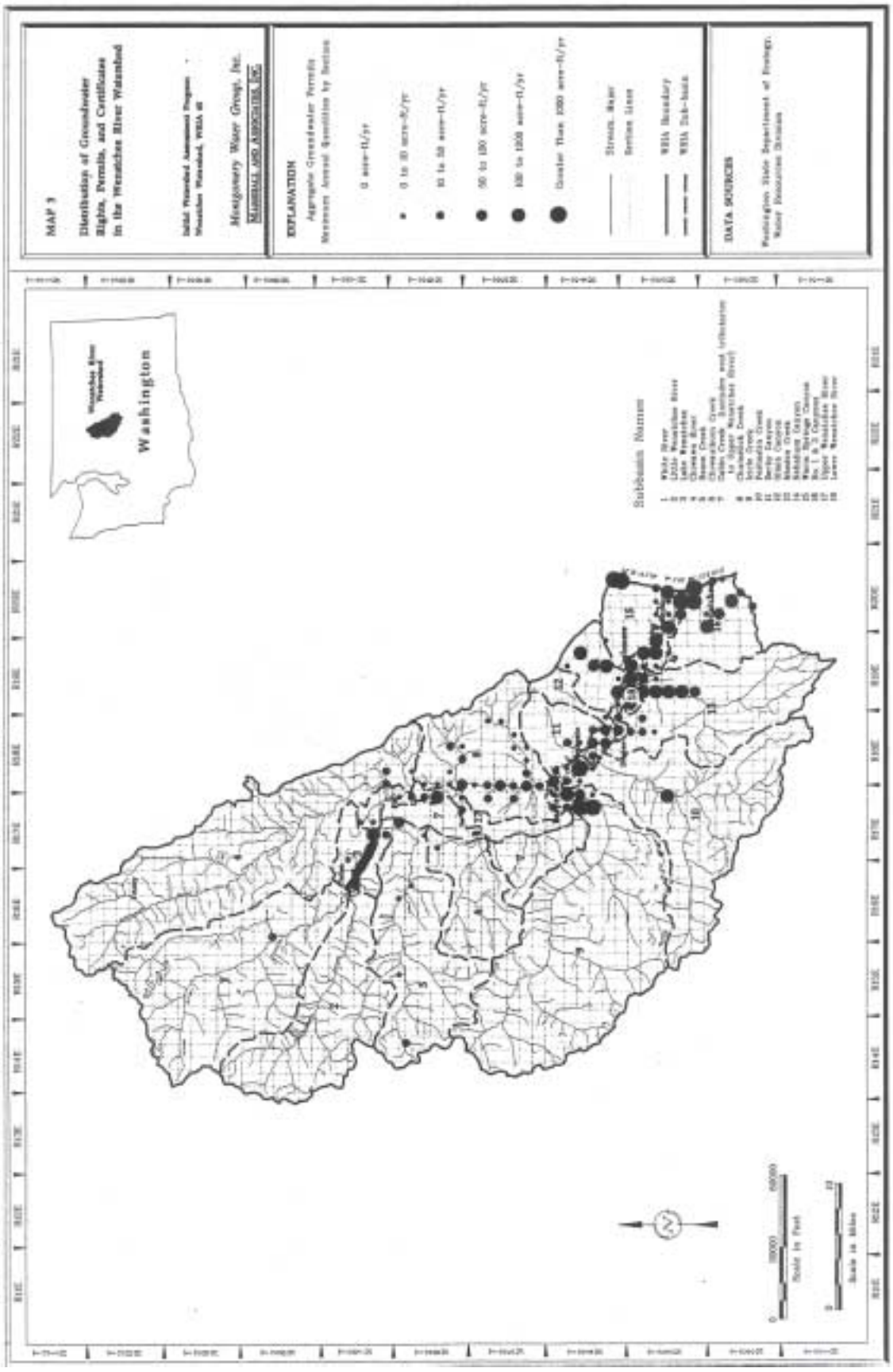


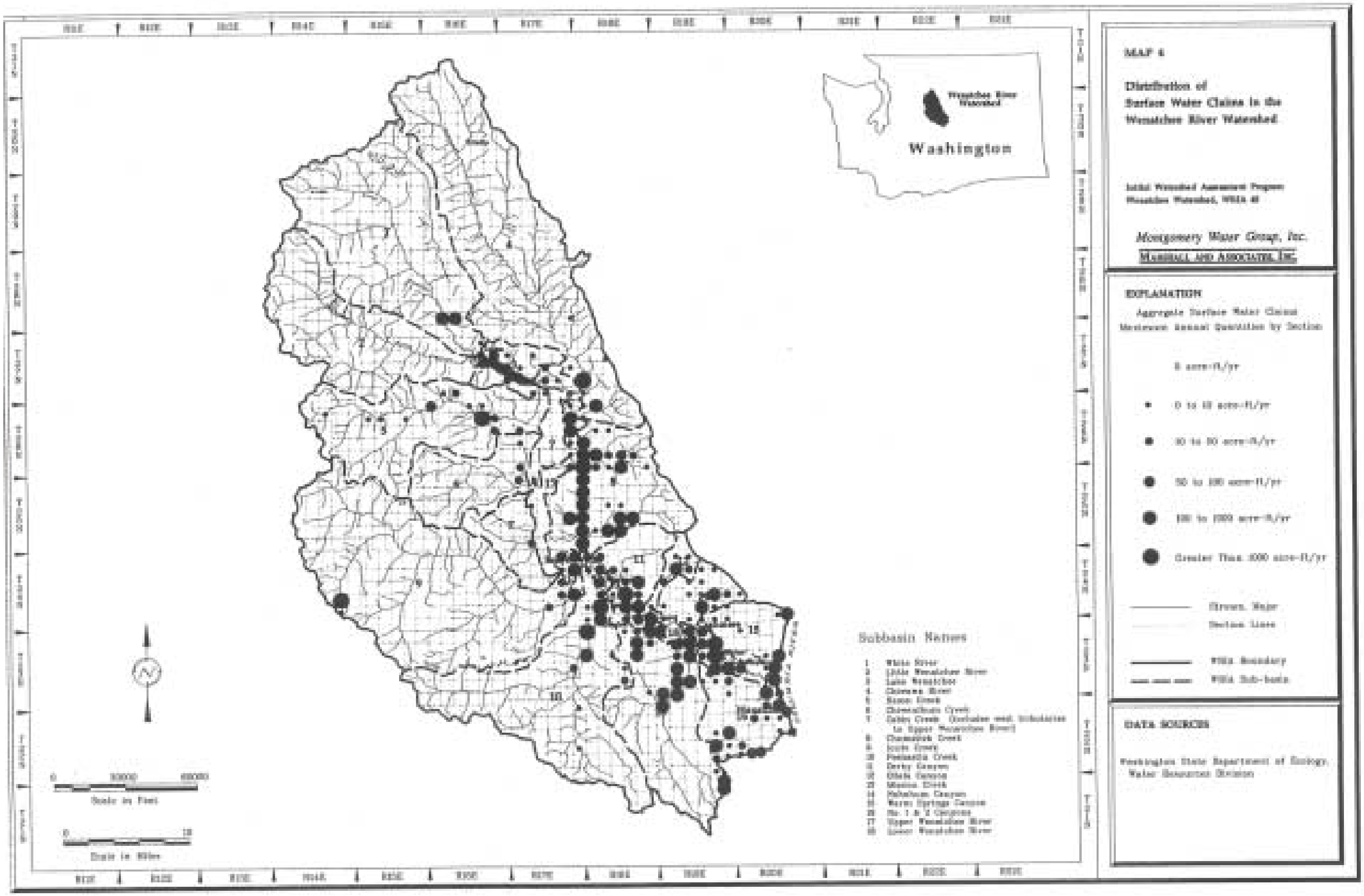
Figure 32
Water Rights in Wenatchee River Watershed
Total Annual Quantity

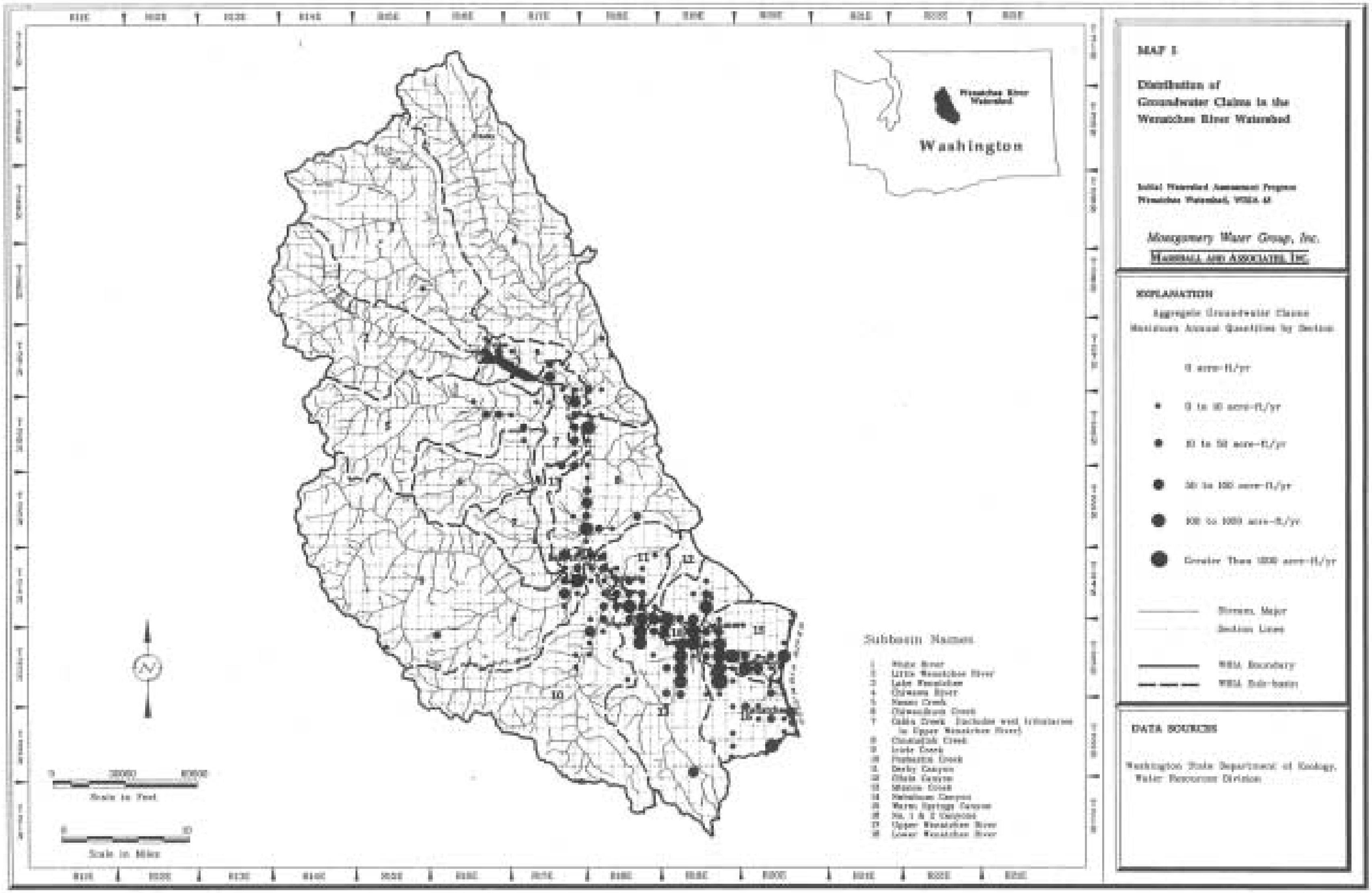
Maps

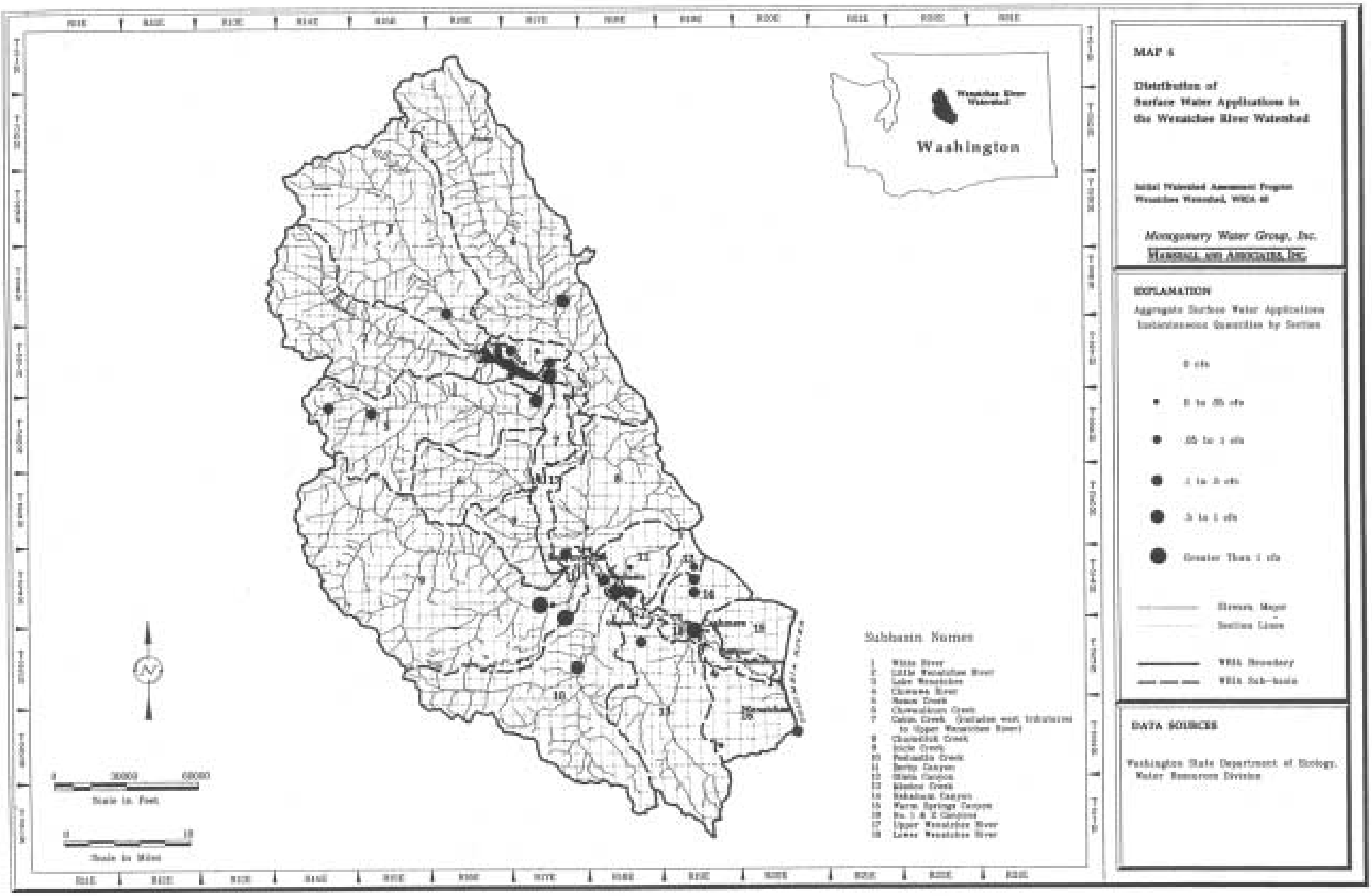

Washington
Subbasin Names
MAP 1
Wenatchee River Watershed
WRIA Boundary and Subbasins
Initial Watershed Assessment Program
Montgomery Water Group, Inc.
EXPLANATION
Stream Gauge
Weather Station
Section Lines
WRIA Boundary
DATA SOURCES
Washington State Department of Ecology,
Water Resources Division

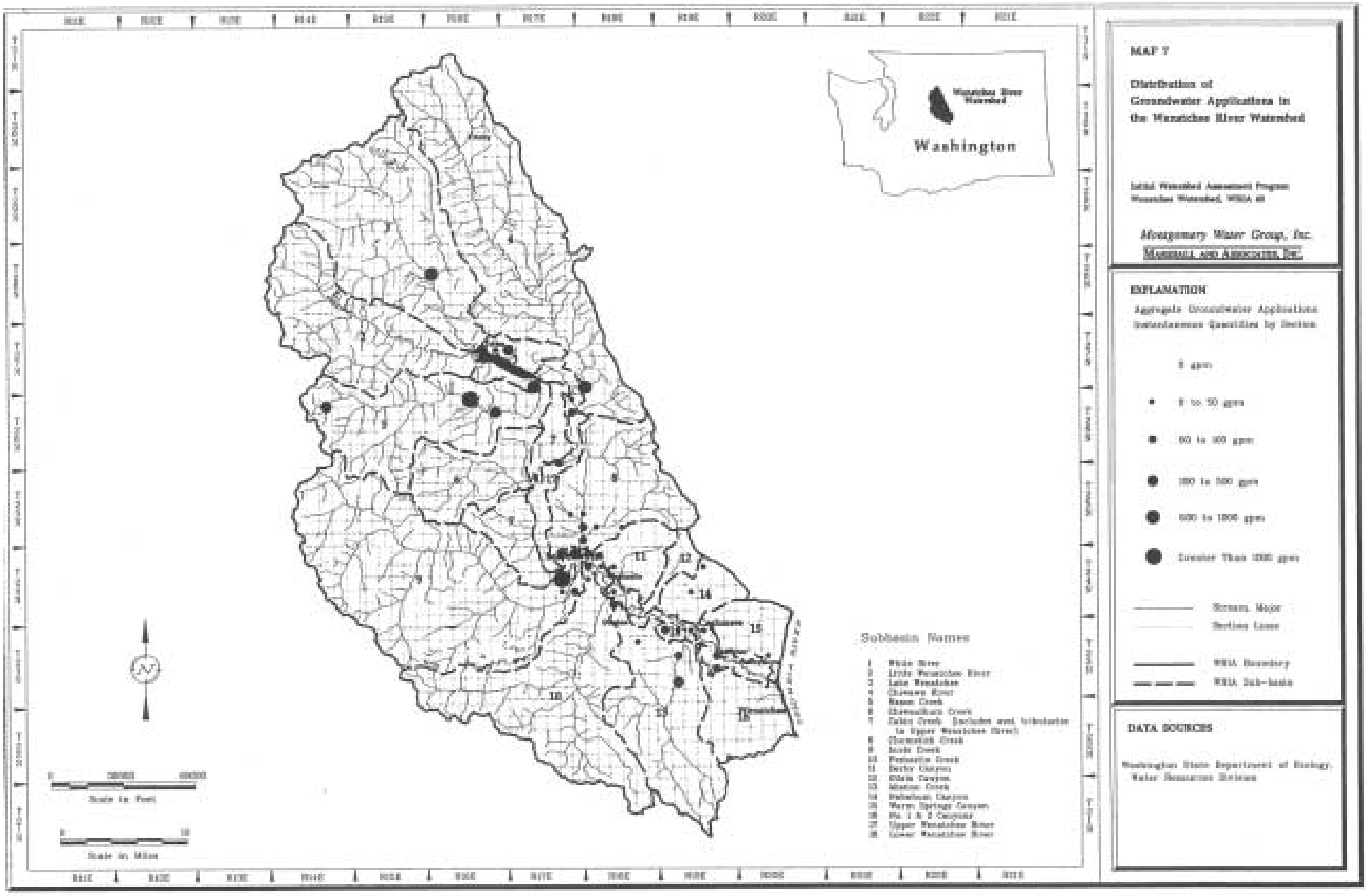

MAP 2
Distribution of Surface Water Rights, Permits, and Certificates in the Wenatchee River Watershed
Initial Watershed Assessment Program Wenatchee Watershed, WRIA 45
Montgomery Water Group, Inc.
Marshall and Associates, Inc.
EXPLANATION
Aggregate Surface Water Permits Maximum Annual Quantities by Section
0 acre-ft/yr
Stream, Major
Section Lines
WRIA Boundary
WRIA Sub-basin
DATA SOURCES
Washington State Department of Ecology, Water Resources Division
Wenatchee River Watershed
Washington
Subbasin Names
Scale in Feet
Scale in Miles


MAP 1
Distribution of Groundwater Rights, Permits, and Certificates in the Wenatchee River Watershed
Montgomery Water Group, Inc.
EXPLANATION
Aggregate Groundwater Permit Maximum Annual Quantities by Section
0 acre-ft/yr
0 to 10 acre-ft/yr
10 to 50 acre-ft/yr
50 to 100 acre-ft/yr
100 to 1000 acre-ft/yr
Greater Than 1000 acre-ft/yr
Streams, Major
Section Lines
WRIA Boundary
WRIA Sub-basin
DATA SOURCES
Washington State Department of Ecology, Water Resources Division
Washington
Wenatchee River Watershed
Subbasin Names
White River
Little Wenatchee River
Icicle Creek
Chiwawa River
Nason Creek
Chumstick Creek
Entiat River
Mission Creek
Peshastin Creek
Ingalls Creek
Derby Canyon
Wilson Canyon
Stemilt Creek
Squilchuck Creek
Mainstem Wenatchee River
Upper Wenatchee River
Lower Wenatchee River
Scale in Feet
Scale in Miles


Washington
MAP 6
Distribution of
Surface Water Claims in the
Wenatchee River Watershed
Montgomery Water Group, Inc.
Marshall and Associates, Inc.
EXPLANATION
DATA SOURCES
Subbasin Names


Washington
MAP 1
Distribution of Groundwater Claims in the Wenatchee River Watershed
Montgomery Water Group, Inc.
EXPLANATION
DATA SOURCES
Washington State Department of Ecology, Water Resources Division
Subbasin Names
Scale in Feet
Scale in Miles


Washington
MAP 6
Distribution of Surface Water Applications in the Wenatchee River Watershed
Montgomery Water Group, Inc.
EXPLANATION
Subbasin Names
DATA SOURCES


MAP 7
Distribution of Groundwater Applications in the Wenatchee River Watershed
Initial Watershed Assessment Program
Wenatchee Watershed, WRIA 45
Montgomery Water Group, Inc.
Marshall and Associates, Inc.
EXPLANATION
Aggregate Groundwater Applications
Instantaneous Quantities by Section
0 gpm
0 to 50 gpm
50 to 100 gpm
100 to 500 gpm
500 to 1000 gpm
Greater Than 1000 gpm
Stream, Major
Section Lines
WRIA Boundary
WRIA Sub-basin
DATA SOURCES
Washington State Department of Ecology,
Water Resources Division
Washington
Subbasin Names
Scale in Feet
Scale in Miles

APPENDIX A

LIST OF PUBLIC WATER SYSTEMS

Table A-1
Public Water Systems in Wenatchee Watershed

Location			Name	Water Source	Group	Capacity (gpm)
Twn	Rng	Sec				
Subbasin 1- White River						
28	16	18	Tall Timber Water System	well # 1	A	80
					Total	80
Subbasin 2 - Little Wenatchee River						
			(none)		Total	0
Subbasin 3 - Lake Wenatchee						
27	16	13	Lake Wenatchee Ranger Station	Lake Wenat R.S Well	A	30
27	16	13	Lake Wenatchee Wtr. Users	Creek	A	100
27	16	14	Cougar Inn	Lake Wenatchee	A	10
27	16	14	Mellon Well	Mellon Well	B	25
27	16	14	Zufall	Zufall Well	B	60
27	16	23 '	Glacier View CgdLake Wen. RD.	Glacier View Spring	A	65
27	16	25	Camp Zanika Lache	Ichabod Creek	A	50
27	17	16	Porter's Hideaway Resort	Spring	B	5
27	17	16	Porter's Hideaway Resort	Well	B	5
27	17	18	Brown Road Water Users Assn.	Barnard Creek Spring	B	50
27	17	18	Whispering Pines Water Association	Spring	A	50
27	17	19	Griffiths, Darel	Lake Wenatchee	B	25
27	17	19	Mcleod Water System	well #1	B	20
27	17	28	Lake Wenatchee State Park North S	Well #1	A	500
27	17	28	Lake Wenatchee State Park South S	Well #1	A	10
27	17	29	Bruya Water System	Lake Wenatchee	B	35
27	17	29	Olason, Harold	Spring	B	5
27	17	29	Ymca Camp	Lake Wenatchee	A	15
					Total	1,060
Subbasin 4 - Chiwawa River '						
26	18	7	Alpine Boys Ranch	Original Well	B	20
26	18	7	Alpine Boys Ranch	Spring	B	20
27	17	13	Goose Creek Cg #2 - Lake Wen. RD	Well #1	B	10
27	18	18	Goose Creek Cg #1- Lake Wen. RD	Goose Creek Cg-Well	B	20
27	18	32	Forest Glen Water System	Well #1	B	55
28	17	3'6	Rock Creek G.S./Finner Creek C.G.	Rock Cr Gs/Finner Cr	B	10
29	16	36	Chiwawa Horse Camp	Well #1	A	28

Location			Name	Water Source	Group	Capacity (gpm)
Twn	Rng	Sec				
					Total	163
Subbasin 5 - Nason Creek						
26	13	1	Yodelin Water System	Spring #1	B	27
26	14	1	Lichtenfeld Lodge	Blitzen Wasser Creek	B	20
26	15	3	Stevens Pass Maintenance Site	Well #1	B	70
26	16	2	Chandlier Inn	Well	B	n/a
26	16	6	Cascade Meadows	Well #1	A	100
26	16	11	Sloth Creek		B	0
26	16	11	Suniand Sites	Well #1	A	96
26	16	12	Nason Creek Rest Area	Well #1	A	50
26	16	12	Nason Gardens Community Water Rd	Well #1	B	25
26	17	3	Pine River Ranch #2	Well #1	B	60
26	17	3	Pine River Ranch Bed & Breakfast	Well #1	B	20
26	17	3	Pine River Water Users Assoc.	Well # 1	B	30
26	17	8	Oxbow Cafe	Well #1	A	5
26	17	8	Squirrel Tree, The		A	n/a
26	17	16	Sunny Sites Addition #1	Well #1	B .	40
26	17	17	Bear's Lair Restaurant	Well #1	A	10
27	16	32	Rayrock Springs	Spring	B	n/a
27	17	33	Nason Creek_Cg./Lake Wen R.D.	Nason Creek Well	A	30
					Total	583
Subbasin 6 - Chiwaukum Creek						
26	17	20	Longview Fibre Company	Well #1	A	50
26	17	20	Winton School	Winton School Well	B	10
					Total	60
Subbasin 7 - Cabin Creek						
			(none)		Total	0
Subbasin 8 - Chumstick Creek						
25	17	12	Circle S Recovery Ranch	Lodge Well #1	A	3
25	17	12	Circle S Recovery Ranch	Well #3	A	22
25	17	36	Leavenworth Ski Hill/L'worth RD.	Well'#1	A	20
25	18	19	Tremmel, Floyd	Well	B	n/a
25	18	31	Cascade Mountain Bible Church	Well #1	A	70
26	18	31	Camp Camrec	Well #1	A	17
26	18	31	Raggio Water System	Well #1	B	26
					Total	158
Subbasin 9 - Icicle Creek						

Location			Name	Water Source	Group	Capacity WgPm)
Twn	Rng	Sec				
Subbasin 9 - Icicle Creek						
24	15	1	Rock Island C.G. Upper/L'worth Rd	Rock Island Cg Well	B	15
24	15	1	Rock Island Campground (Main)	Rock Island Cg Well	B	n/a
24	15	1	Rock Island Campground (South)	Rock Island Cg Well	B	2
24	15	2	Blackpine Cr. Horse Camp/l''worth	Blackpine Cr. Horse	B	20
24	16	2	Johnny Cr. Cg #0 - Longworth R.D.	Johnny Creek Well	B	9
24	16	2	Johnny Cr. Cg #1- Longworth R.D.	Johnny Cr Campground	B	20
24	16	2	Johnny Cr. Cg #2 - Longworth R.D:	Johnny Cr Campground	B	20
24	16	2	Johnny Cr. Cg #3 - Longworth R.D.	Johnny Cr Campground	B	20
24	16	4	Ida Creek Cg./L'worth RD.	Ida Creek Cg Well	A	20
24	16	6	Chatter Cr. Cg./L'worth R.D.	Chatter Cr. Well	A	2
24	16	6	Chatter Creek Station/Campground	Chatter Spring	B	10
24	16	24	Bridge Cr. Campground	Bridge Cr C.G. Well	B	4
24	17	19	Hesler Water System	Well	B	n/a
24	17	23	Foster Water System	Well #1	B	25
24	17	23	Hutchens, Gary R.	Well	B	20
24	17	23	Norman, Liv Water System	Norman Well #1	B	27
24	17	23	Schmidt Well	Schmidt Well	B	23
24	17	23	Wicks, Gordon	Well	B	n/a
24	17	24	Dempsey Larry Water System	Unnamed Spring	B	n/a
24	17	26	Leavenworth National Fish Hatcher	Icicle River	B	40
24	17	27	Kincaid, Schmidt & Ulery Wtr. Sys	Well #1	B	30
24	17	28	Leavenworth, City Of	Icicle Crk Wtp	A	2,440
24	17	30	8 Mile Cg East/L'worth Rd.	East Well	A	9
24	17	30	8-Mile Cg. West/L'worth RD.	West Well	A	8
24	17	30	Eight Mile Cg.-#2/L'worth R.D.	Eight Mile Cg-Well 2	A	20
24	17	30	Eightmile Cg.-#1/L'worth RD.	Well #1	A	20
					Total	2,804
Subbasin 10 - Peshastin Creek						
22	18	20	Bonanza Campground	Bonanza C.G. Well	B	8
23	17	24	Blewett Pass Main Site	Well #1	B	10
23	17	24	Blu-Shastin Trailer Park	Well # 1	B	20
23	17	24	Geiger Trading Post	Well #1	A	15
23	17	24	Ingalls Creek Lodge	Well # 1	A	70
23	17	24	Old Blewett Bed And Breakfast	Well	B	n/a
23	17	24	Valley Hi Community Club	Well #2	A	185
23	17	24	Valley Hi Community Club	Well #1	A	75
23	17	25	Crystal Waters Water System	Well #1	B	24

Location			Name	, Water Source	Group	Capacity (gpm)
Twn	Rng	Sec				
23	18	6	Smith; John B	Well #1	B	n/a
23	18	18	Marci's Catering	wen #1	B	10
23	18	18	Noyes, Stephen Sp #2265	Well (Noyes)	B	8
23	18	27	Camas Meadows Bible Camp	Spring #1	A	5
23	18	27	Camas Meadows Bible Camp	Well # 1	A	5
24	18	19	Mt. Home Lodge	Mt Home Lodge	B	28
24	18	29	Buckboard Cafe	Well #1	A	10
24	18	29	Crm Orchards Inc	Well	B	19
24	18	29	Stewart Ranch	Well	B	14
					Total	506
Subbasin 11-				Derby Canyon		
24	18	15	Al Stemm		B	10
					Total	10
Subbasin 12 - Ollala Canyon						
24	18	25	Olalla Canyon Domestic Water Assn	Spring	A	35
24	18	27	B.J.'S Food And Fuel #2	Well	A	10
24	18	27	Dryden Complex	Well # 1	A	32
24	18	27	Dryden Water System	Well #1	A	100
24	18	27	Ramiriz Water System	Well #1	B	30
24	18	27	Roach Short Plat	Well #1	B	36
24	18	27	Smitty's World Famous Fruit Stand		B	5
24	18	27	Valley Cottage Motel	Well #1	B	231
					Total	479
Subbasin 13 - Mission Creek						
23	19	16	Yakson Canyon Water System	Well #1	B	15
23	19	16	Yaxon Hills	Well	B	20
23	19	17	Dolman Plat	Dolman Plat	B	70
					Total	105
Subbasin 14 - Nababum Canyon						
			(none)	Total		0
Subbasin 15 - Warm Springs Canyon						
24	20	35	Chelan County Pud #1	Wenatchee Reg 943507	A	n/a
					Total	0
Subbasin 16 - No. l & 2 Canyons						
22	19	13	Duncan Well	Well	B	15
22	19	13	Duncan, Keith D.	Well A	B	22
22	20	22	Hughes/Main Water System	Well	B	11
22	20	24	Welton, George	Well #1	B	37

Location			Name	Water Source	Group	Capacity (gpm)
Twn	Rug.	Sec				
22	20	35	Grubb & Grubb	Spring	B	10
22	20	36	Mc Greger & Auger		B	7
					Total	102
Subbasin 17 - Upper Wenatchee River						
24	17	1	Kimmerly Short Plat	Well #1	B	23
24	17	1	Morgan Short Plat #2214	Well (Morgan)	B	40
24	17	1	Phippin Bed .& Breakfast	Well #1	B	20
24	17	2	Allen/Rubin Water System	Well #1	B	35
24	17	2	Rohrbach, Haus	Rohrbach Spring	B	25
24	17	2	Rohrbach, Haus	Well #1	B	60
24	17	2	Ski Hill Tract Well	Well	B	36
24	17	2	Ski Hill Tracts Community Well	Well # 1	B	25
24	17	2	Upper Ski Hill Water Association	Spring # 1	A	10
24	17	2	Upper Ski Hill Water Association	Spring # 2	A	40
24	17	12	Duncan Water System	Well #1	B	31
24	17	12	Irwin Two Rivers Water Assn	Well #1	B	20
24	17	14	Leavenworth, City Of	Infiltration Well	A	1,000
24	17	14	Leavenworth, City Of	Well #1 & #2	A	2,100
24	17	14	Norco Water System	Well #1	B	28
24	17	14	Ritz Water System	well #1	B	24
24	17	14	Sparks, Jones & Price Wtr. Sys.	Well # 1	B	25
24	18	5	Parsons Pflugrath Et Al	Well # 1	B	23
24	18	6	Pine Village Koa	Well	A	n/a
24	18	6	River Bend Park Water System	Well # 1	A	40
24	18	6	Wedeberg #2	Well #1	B	5
24	18	7	Chalet Park		B	30
24	18	7 `	Miller-Prey Water System	Well #1	B	30
24	18	16	Community Water Association, Inc.	Well # 2	A	450
24	18	17	Community Water Association, Inc.	Well # 1	A	450
24	18	17	Rivers Edge Lodge	Spring # 1	A	10
24	18	20	Springdale Orchards Domestic Wate	R	B	n/a
25	17	9	Tumwater Cg./L'worth R.D.	Tumwater Well	A	20
26	17	1	Fritz Water System	Well #1	B	15
26	17	12	Alpine Acres Community Assoc.	Wellfield # 1 + 2	A	190
26	17	12	Grunewald Guild Chalet	Well #1	B	10
26	17	13	Beaver Hill Cafe	Well #1	A	15
26	17	13	Chalet Acres #1 Coom Water Rd Cor	Well # 1	B	40

Location			Name	Water Source	Group	Capacity (gpm)
Twn	Rug	Sec				
26	17	13	Chalet .Acres #2 Comet Water Corp	Well A	B	n/a
26	17	13	D & D Plain Grocery	Well #1	B	22
26	17	13	Plain Flats Water System	Well	B	80
26	17	24	Ponderosa Community Club Inc.	Wellfield 1, 3, 4	A	470
26	17	24	Ponderosa Community Club Inc.	Well #6 Morgan St	A	240
26	17	25	Featherwinds Bed & Breakfast	Well #1	B	25
26	18	6	Corning Water System #2	Well #1	B	25
26	18	6	Rosebrook Water System	wen #1	B	30
27	17 .	22	Cove Resort	Fish Lake	B	80
27	17	22	Fish Lake Comet Club-	Fish Lake	A	100
27	17	22	Idlewild		B	16
27	17	22	Midway Village & Grocery	Well # 2	A	10
27	17	22	Midway Village & Grocery	Well # 1	A	10
27	17	27	Headwaters Inn	Well #2	B	10
27	17	27	Lk Wenatchee Village	Well #1	A	n/a
					Total	5,988
Subbasin 18 - Lower Wenatchee River						
23	18	1	Brender Canyon Water Works	Spring	A	n/a
23	18	1	Knox Neighborhood Water System	Well #1	B	50
23	19	3	Bob's Apple Barrel	Well #1	A	40
23	19	3	Lippert, Larry #1 Water System	Well #1'	B	30
23	19	3	Lippert, Larry #2 Water System	Well #1	B	35
23	19	4	Cashmere Water Department	Water Treatment Plant	A	2,400
23	19	4	Cashmere Water Department	Well # 4	A	246
23	19	4	Cox Water System	Well	B	28
23	19	5	Bagwell Water Supply	Well #1	B	27
23	19	5	Candle Water System		B	37
23	19	5	Cashmere Water Department	Well # 10	A	350
23	19	5	Colin Short Plat	Well #1	B	24
23	19	5	Cope Water System	Well #1	B	12
23	19	5	Fleeting Subdivision	Fleeting Well	B	30
23	19	5	Kimber Road Properties	Well #1	B	60
23	19	5	Miller-Lopeman Wtr System	Well #1	B	29
23	19	5	Sites Short Plat Community Well	Well	B	30
23	19	5	Smith, Charles		B	18
23	19	5	Spears Water System	Well #1	B	10
23	19	5	Todd Water System	well #1	B	30
23	19	5	Town, Monte	Well #1	B	n/a

Location			Name	Water Source	Group	Capacity (gpm)
Twn	Rug	Sec,				
23	19	5	Towns Mobile Home Park	Well # 1	A	30
23	19	6	Chelan County Fairground	Well # 1	A	50
23	19	6	Dawn Lee Courts	Well #1	A	35
23	19	6	Flagel Water System	Well #1	B	30
23	19	6	Paton #2 Wtr. Sys.	Paton #2	B	36
23	19	6	Paton Water System	Well #1	B	10
23	19	6	Wolfe Addition Water Users	Well	B	n/a
23	19	10	Bardin Farms Home Ranch	Yonkin	A	10
23	19	10	Bardin Farms Home Ranch	Home Place	A	10
23	19	10	Dale Kelly	Spring	B	9
23	19	11	Heins, Larry Water System	Well	B	27
23	19	11	Selfs Trailer Court	Well #1	A	n/a
23	19	13	East Monitor Water Assoc	Well # 1	A	20
23	19	13	Pace, Tom Water System	Well #1	B	3
23	19	13	Rust, Agnes		B	25
23	19	13	Wenatchee River County Park	Well #2	A	150
23	19	13	Wenatchee River County Park	Well #1	A	300
23	19	14	Boswell & Sons	Well A	B	50
23	19	14	Corky's	Well	A	60
23	19	14	Monitor Inn	Well #1	A	9
23	19	23	Bardin Farms Home Ranch	Fairview	A	15
23	20	17	Grand View Acres	Well #1	B	8
23	20	19	Hilscher, Pat	Well	B	12
23	20	19	Sleepy Hollow	Well	B	4
23	20	28	Chelan County Pud #1	North Bank Wells 1&2	A	550
23	20	28	Confluence State Park	#12284j-Chelan Co. P.Ub	A	500
24	18	21	Big Y Cafe	wen #1	A	30
24	18	21	Peshastin Domestic Water Assn.	Well #1	A	100
24	18	21	Y-Easy Mart	Well #1	A	20
24	18	22	Dodrill Water System	Well #1	B	n/a
24	18	23	Smith Orchard	Well	B	11
24	18	35	Carlson, Ivan Water System	Well #1	B	28
24	18	35	Davis, John E.	Well #1	B	30
24	18	35	Dryden Orchard	Well # 1	B	20
24	18	35	Riverbend Park Mobil Court	Well #2	A	50
24	18	35	Riverbend Park Mobil Court	Well #1	A	50
24	19	31	Kyner Short Plat	Well	B	15
24	19	31	Pacific Nw Commodities	Well #1	B	25

Location			Name	Water Source	Group	Capacity (gpm)
Twn	Rng	Sec				
24	19	31	Smith/Dronen Water System	Well # 1	B	27
24	19	32	Apple Inn Cafe	Well # 1	A	10
24	19	32	Baker/Boyce Water System	Well #1	B	23
24	19	32	Bergren Short Plat #1769	Well #1	B	40
24	19	32	Holladay/Bates Water System	Well #1	B	30
24	19	32	West Cashmere Water System	Well #2 .	A	30
24	19	32	West Cashmere Water System	New Well	A	SO
					Total	6,028

n/a - not listed in WDOH database

APPENDIX B

TABULATED STREAMFLOW RECORDS AND STATISTICS

WENATCHEE WRIA
STREAMFLOW EXCEEDENCES

Period	White River near Plain			Chiwawa River near Plain			Wenatchee River below Lk.We		
	90% cfs	50% cfs	10% cfs	90% cfs	50% cfs	10% cfs	90% cfs	50% cfs	10% cfs
1 Jan	128	287	708	82	134	238	251	510	1,240
2	135	293	706	78	125	222	236	468	1,126
3	129	277	674	78	121	212	231	448	11069
4	132	279	671	75	114	198	221	422	1,012
5 Feb	133	272	635	72	110	192	226	421	992
6	133	265	609	70	107	186	226	409	939
7	136	268	607	68	105	186	230	414	945
8	139	269	591	68	107	194	235	425	973
9 Mar	143	274	595	69	112	207	242	433	970
10	151	279	583	73	121	231	261	463	1,005
11	164	302	614	84	144	281	294	518	1,095
12	190	346	681	103	183	365	342	600	1,245
13 Apr	236	421	800	134	243	490	424	737	1,476
14	287	507	944	191	351	716	589	1,023	1,989
15	' 373	646	1,166	260	485	993	761	1,338	2,576
16	502	856	1,504	365	667	1,328	982	1,718	3,213
17 May	640	1,086	1,875	508	912	1,760	1,322	2,269	4,088
18	838	1,394	2,332	646	1,143	2,141	1,619	2,720	4,713
19	1;028	1,722	2,882	811	1,422	2,588	1,936	3,227	5,496
20	1,230	2,058	3,400	898	1,572	2,792	2,140	3,534	5,892
21 Jun	1,333	2,212	3,636	911	1,605	2,825	2,228	3,722	6,210
22	1,394	2,328	3,857	854	1,533	2,729	2,110	3,617	6,185
23	1,319	2,221	3,706	741	1,351	2,451	1,864	3,285	5,798
24	1,169	1,992	3,397	623	1,150	2,127	1,601	2,880	5,255
25 Jul	1,059	1,828	3,177	516	956	1,814	1,338	2,448	4,620
26	922	1,598	2,794	421	786	1,519	1,110	2,047	4,003
27	775	1,339	2,375	334	624	1,208	851	1,587	3,187
28	628	1,073	1,921	251	468	910	640	1,184	2,404
29 Aug	500	854	1,549	194.	362	703	499	904	1,824
30	394	659	1,188	154	282	539	400	700	1,373
31	318	520	921	125	224	419	327	555	1,054
32	271	436	766	114	198	358	285	468	855
33 Sep	229	365	636	102	172	306	247	401	735
34	203	320	564	96	158	280	220	362	676
35	181	291	528	89	147	264	196	333	648
36	159	264	501	83	137	253	184	323	659
37 Oct	153	258	509	81	134	251	180	332	718
38	146	252	510	82	138	261	181	358	828
39	153	269	566	87	148	288	201	426	1,067
40	163	295	656	88	152	307	218	490	1,321
41 Nov	163	310	717	92	160	329	225	536	1,540
42	168	325	782	92	162	337	234	567	1,646
43	166	328	822	93	164	340	240	581	1,661
44	162	331	846	95	162	327	249	592	1,684
45 Dec	153	315	807	97	161	320	267	614	1,705
46	156	323	829	93	154	306	277	614	1,646
47	151	317	824	90	146	284	280	595	1,521
48	137	289	754	86	139	264	. 264	548	1,380

WENATCHEE WRIA
STREAMFLOW EXCEEDENCES

Period	Wenatchee River at Plain			Icicle Creek above Snow Creek			Wenatchee River at Peshastin		
	90% cfs	50% cfs	10% cfs	90% cfs	50% cfs	10% cfs	90% cfs	50% cfs	10% cfs
1 Jan	447	904	2,099	113	237	546	559	1,217	2,945
2	449	886	2,036	109	227	528	568	1,193	2,822
3	444	852	1,933	105	217	506	577	1,188	2,805
4	445	838	1,873	107	215	496	585	1,187	2,794
5 Feb	451	839	1,855	108	214	487	597	1,189	2,751
6	445	813	1,756	109	210	462	609	1,190	2,694
7	446	809	1,730	111	210	450	632	1,218	2,713
8	451	813	1,723	111	208	439	657	1,246	2,722
9 Mar	458	823	1,728	111	206	427	693	1,292	2,757
10	**488**	**874**	1,799	117	211	426	752	1,374	2,845
11	554	990	1,996	131	233	457	840	1,530	3,125
12	664	1,179	2,325	157	276	536	991	1,776	3,535
13 Apr	833	1,464	2,800	196	343	652	1,214	2,127	4,086
14	1,071	1,871	3,472	256	450	853	1,535	2,655	4,990
15	1,349	2,360	4,290	322	570	1,071	1,930	3,294	6,038
16	1;728	3,005	5,327	414	733	1,357	2,439	4,117	7,355
17 May	2,204	3,824	6,636	554	980	1,795	3,062	5,151	9,047
18	2,735	4,699	7,916	713	1,244	2,226	3,735	6,223	10,675
19	3,229	5,541	9,202	919	1,595	2,818	4,408	7,374	12,581
20	3,639	6,223	10,199	1,097	1,,890	3,291	4,952	8,270	13,944
21 Jun	3,776	6,528	10,777	1,162	2,005	3,468	5,121	8,668	14,776
22	3,629	6,426	10,890	1,144	1,997	3;495	4,933	8,549	14,967
23	3,252	5,913	10,349	1,006	1,769	3,151	4,384	7,753	13,972
24	2,775	5,154	9,279	829	1,482	2,717	3,639	6,607	12,345
25 Jul	2,316	4,377	8,068	670	1,214	2,301	2,967	5,515	10,645
26	1,893	3,596	6,733	523	947	1,828	2,371	4,453	8,812
27	1,469	2,794	5,292	387	700	1,377	1,811	3,435	6,949.
28	1,129	2,112	4,024	284	505	998	1,369	2,572	5,242
29 Aug	885	1,616	3,080	214	373	724	1,061	1,955	3,970
30	709	1,258	2,361	166	281	528	840	1,504	2,986
31	590	1,012	1,859	134	222	410	684	1,186	2,284
32	515	858	1,548	116	188	337	593	999	1,867
33 Sep.	450	740	1,341	102	163	294	521	862	1,590
34	403	667	1,225	95	155	286	475	782	1,442
35	369	620	1,175	87	145	280	444	739	1,390
36	348	599	1,176	84	145	291	428	726	1,413
37 Oct	349	616	1,263	88	157	327	427	746	1,511
38	351	643	1,378	87	163	$60	427	781	1,670
39	378	715	1,609	96	187	442	466	885	1,990
40	410	802	1,897	100	205	514	506	1,011	2,439
41 Nov	431	864	2,143	102	217	563	541	1,134	2,890
42	461	937	2,374	105	228	598	570	1,223	3,201
43	479	984	2,512	112	245	641	594	1,302	3,460
44	496	1,013	2,569	118	258	663	606	1,343	3,595
45 Dec	498	1,017	2,561	122	267	676	604	1,342	3,571
46	500	1,010	2,498	125	270	678	612	1,347	3,544
47	492	981	2,388	123	259	633	605	1,307	3,362
48	466	. 916	2 214	118	244	590	573	1 227	3140

WENATCHEE WRIA
STREAMFLOW EXCEEDENCES

Period	Mission Creek above Sand Cr.			Wenatchee River at Monitor		
	90% cfs	50% cfs	10% cfs	90% cfs	50% ofs	10% cfs
1 Jan	2.3	5.3	13.8	631	1,352	3,170
2	2.4	5.7	15.0	687	1,411	3,193
3	3.0	7.1	18.2	706	1,442	3,314
4	3.8	8.9	23.0	721	1,473	3,423
5 Feb	4.2	9.8	25.4	736	1,483	3,407
6	5.1	12.0	31.0	766	1,518	3,437
7	5.7	13.1	33.8	795	1,548	3,464
8	5.6	12.9	33.0	836	1,599	3,502
9 Mar	5.8	12.8	31.6	909	1,712	3,675
10	6.7	13.9	32.3	991	1,821	3,750
11	7.8	15.7	35.2	1,066	1,970	4,004
12	9.8	19.7	43.2	1,221	2,216	4,337
13 Apr	11.5	22.9	49.0	1,440	2,537	4,783
14	12.1	24.0	50.6	1,695	2,939	5,448
15	13.6	26.8	56.0	2,052	3,467	6,238
16	14.8	28.3	56.9	2,553	4,259	7,473
17 May	16.1	30.1	56.8	3,115	5,200	9,020
18	17.8	32.1	57:3	3,712	6,187	10,594
19	18.4	32.4	57.2	4,323	7,343	12,734
20	17.3	30.0	52.6	4,849	8,340	14,502
21 Jun	15.6	26.0	44.0	4,981	8,727	15,489
22	13.2	20.9	33.7	4,843	8,706	15,952
23	10.5	16.1	25.1	4,302	7,893	14,831
24	8.4	12.5	18.9	3,517	6,687	13,032
25 Jul	6.5	9.7	14.4	2,810	5,532	11,225
26	5.5	7.9	11.5	2,207	4,426	9,234
27	4.5	6.3	9.1	1,699	3,446	7,357
28	3.6	5.1	7.4	1,289	2,600	5,631
29 Aug	2.9	4.1	5.9	997	1,973	4,293
30	2.4	3.4	4.9	784	1,515	3,215
31	2.1	3.0	4.4	637	1,187	2,431
32	1.8	2.6	3.9	550	991	1,961
33 Sep	1.7	2.4	3.6	486	853	1,652
34	1.6	2.3	3.6	453	772	1,463
35	1.5	2.2	3.5	449	751	1,408
36	1.5	2.2	3.7	442	733	1,388
37 Oct	1.6	2.5	4.1	445	739	1,426
38	1.7	2.6	4.5	464	787	1,571
39	1.9	3.1	5.8	51.1	881	1,800
40	2.0	3.4	6.7	578	1,029	2,232
41 Nov	2.1	3.7	7.6	651	1,205	2,769
42	2.4	4.4	9.4	707	1,325	3,124
43	2.6	4.9	11.0	753	1,439	3,490
44	2.5	4.9	11.5	764	1,503	3,756
45 Dec	2.6	5.2	12.3	729	1,469	3,746
46	2.4	5.1	12.5	723	1,464	3,727
47	2.2	4.8	12.1	716	1,427	3,599
48	2.1	4.7	12.6	665	1 330	3 369

WHITE RIVER NEAR PLAIN, WASH.
USGS STATION: 12454000

FLOW (CFS)

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	AVG
1954	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	600.9	.0
1955	335.8	821.4	387.9	219.2	205.0	161.8	305.6	1190.9	3005.3	2217.4	830.6	332.5	834.5
1956	612.2	1072.2	35.4	196.5	140.1	140.7	962.7	2846.1	2825.7	2427.3	701.3	354.1	1051.2
1957	466.8	458.0	792.1	234.3	171.3	248.1	743.5	2811.9	2052.7	880.4	385.3	249.9	791:2
1958	210.0	211.7	196.8	157.3	247.6	305.9	645.6	2987.1	2147.5	680.7	320.5	220.5	694.3
1959	399.6	549.4	867.4	441.3	262.4	300.0	1141.8	1762.9	2815.7	2234.2	679.0	656.7	1009.2
1960	995.2	920.8	815:7	252.9	177.9	327.7	931.0	1453.2	2278.0	1625.0	478.9	239.4	874.6
1961	230.3	304.0	181.5	360.8	509.0	478.2	989.5	2077.0	3273.0	1341.1	493.7	242.6	873.4
1962	315.5	229.0	177.8	599.4	504.0	224.0	985.2	1171.2	1905.7	1268.6	504.5	247.7	677.7
1963	362.6	653.3	541.7	415.1	710.5	466.7	509.4	1508.7	1722.1	887.9	464.8	265.3	709.0
1964	265.3	335.2	337.8	350.3	208.2	222.8	505.6	1388.4	3035.0	2350.0	818.2	336.0	846.1
1965	422.8	230.5	322.1	233.0	403.9	412.9	943.9	1702.7	2370.0	1431.0	565.8	205.4	770.3
1966	283.0	'362.2	234.1	197.5	135.6	226.6	931.5	1847.8	1810.7	1302.3	482.8	240.7	671.2
1967	253.5	228.7	485.8	352.7	333.8	251.6	337.6	1572.5	3364.3	1698.1	522.3	246.8	804.0
1968	668.1	648.3	607.7	764.9	706.3	772.6	512.0	1552.7	2286.3	1587.0	530.9	394.6	919.3
1969	330.7	409.8	306.8	351.6	186.0	233.9	822.6	2661.0	3207_7	956.6	351.4	335:9	846.2
1970	377.3	308.1	186.5	159:0	178.9	234.5	437.2	1727.6	2789.7	1008.1	299.9	228.7	661.3
1971	166.1	187.7	124.4	354.5	861.0	282.0	455.3	2474.2	2426.7	2575.2	1040.9	294.1	936.8
1972	197.0	316.2	183.1	168.7	308.6	1003.9	733.7	2422.0	3156.7	2448.1	1218.3	465.8	1051.8
1973	309.7	194.4	336.3	333.1	177.8	219.9	589.4	1470.6	1521.1	954.1	426.0	243.6	564.7
1974	274.9	302.8	234.5	750.0	314.0	304.4	761.4	1589.7	3625.0	2833.2	1425.7	491.3	1075.6
1975	165.8	172.5	227.5	324.2	218.2	226.8	423.1	1794.3	2788.3	2334.6	705.7	336.8	809.8
1976	398.2	818.5.	1284.4	574.8	468.0	256.5	566.8	2040.6	2006.7	2347.1	1320.5	588.0	1055.8
1977	234.5	264.1	228.4	389.3	317.0	246.1	717.1	826.8	1330.2	515.9	486.3	299.0	487.9
1978	189.2	574.0	844.6	241.2	175.0	441.9	864.4	1423.5	2351.0	1476.1	525.9	479.6	798.9
1979	230.4	452.5	157.0	82.5	90.1	401.0	571.4	1760.6	1417.2	758.3	360.9	265.8	545.6
1980	192.3	128.0	850.6	271.5	260.0	376.5	1123.3	1938.7	1603.7	1083.5	410.1	263.7	708.5
1981	134.2	611.2	1698.2	727.9	549.8	499.8	662.4	1462.8	.1417.7	1225.4	524.0	251.1	813.7
1982	386.2	420.4	264.0	275.5	668.4	422.1	540.8	1815.8	3341.7	1747.1	639.0	312.9	902.8
1983	293.5	219.0	325.5	508.4	290.3	621.9	878.5	2239.4	2109.0	1381.6	665.3	310.0	820.2
1984	140.6	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
AVG	328.0	427.7	466.7	354.7	337.2	355.6	710.1	1845.6	2413.2	1571.6	626.8	333.3	814.2

CHIWAWA RIVER NEAR PLAIN, WASH.
USGS STATION: 12456500

FLOW (CFS)

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	AVG
1911	.0	.0	.0	.0	.0	.0	.0	1326.7	1538.9	830.1	320.7	230.9	.0
1912	139.2	204.7	158.9	148.0	151.0	147.0	621.8	.0	.0	.0	.0	.0	.0
1913	.0	.0	.0	.0	.0	.0	.0	:0	.0	1243.3	486.7	351.1	.0
1914	295.1	307.7	222.0	257.4	164.4	364.5	1266.0	1671.6	1355.9	817.8	293.1	216.2	602.6
1915	242.2	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1936	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	175.0	115.0	.0
1937	90.5	77.8	96.5	78.4	76.3	93.7	214.3	1053.2	2041.3	836.6	208.0	127.7	416.2
1938	133.5	196.5	176.5	174.1	101.5	129.8	642.8	1890.3	1965.7	665:7	169.3	118.2	530.3
1939	114.2	123.8	133.1	151.8	98.6	148.5	603.0	1271.6	965.9	616.6	206.8	109.0	378.6
1940	106.5	126.4	210.0	111.1	94.0	207.8	704.7	1493.8	1109.4	389.0	145.3	98.7	399.7
1941	179.3	125.3	112.9	90.6	84.0	239.7	790.8	873.1	659.5	256.1	106.3	145.7	305.3
1942	237.5	216.8	283.2	101.2	100.7	113.2	560.3	1035.6	973.3	540.1	160.5	80.5	366.9
1943	63.5	85.8	95.6	78.9	68.6	100.5	621.2	1267.1	1941.3	1382.0	387.5	158.2	520.
1944	114.6	105.7	153.8	107.1	75.9	116.7	324.7	826.4	803.3	287.9	128.5	123.5	264.0
1945	110.4	124.3	144.7	263.4	174.6	116.9	251.9	1228.3	1325.8	607.0	175.7	122.2	387.1
1946	148.4	172.1	133.5	101.1	80.4	105.1	397.9	2202.1	1723.3	923.4	30045	145.3	536.1
1947	142.5	121.6	148.5	211.7	169.3	306.5	885.6	1971.6	1243.8	593.4	232.5	132.6	513.3
1948	282.1	255.6	184.8	129.0	113.3	112.4	343:5	1756.0	2679.0	761.6	317.1	179.3	592.8
1949	203.2	149.6	122.3	80.5	94.4	104.9	564.5	2327.4	1593.5	726.7	269.0	169.0	533.7
1950	150.5	381.5	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1954	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	359.4	.0
1955	238.8	420.0	281.7	175.7	162.8	148.2	232.6	941.6	2636.7	1458.7	481.2	198.0	614.7
1956	346.6	571.2	197.1	141.9	96.0	107.1	763.0	2682.9	2397.7	1438.9	418.9	218.5	781.6
1957	228.6	205.5	327.9	152.6	130.9	173.1	550.1	2277.4	1445.7	512.4	219.0	141.0	530.4
1991	.0	.0	.0	.0	.0	.0	.0	1990.0	1793.3	1472.9	516.1	192.7	.0
1992	114.5	178.0	142.2	143.4	204.0	488.3	885.9	1356.7	969.5	317.1	138.9	107.9	420.5
1993	102.2	122.0	82.5	87.6	88.3	107.2	314.1	1578.1	926.8	340.3	.0	.0	.0
AVG	172.0	203.4	170.4	139.3	116.4	171.5	576.9	1572.5	1528.1	773.5	266.2	167.0	488.1

WENATCHEE.RIVER BELOW WENATCHEE LAKE, WASH.
USGS STATION: 12455000

FLOW (CFS)

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	AVG
1932	.0	.0	.0	415.4	906.4	1160.7	1647.3	3079.7	3382.0	1652.6	608.8	289.6	.0
1933	401.6	2128.2	1149.4	619.7	461.3	529.0	1054.3	1872.6	4508.3	3659.4	1254.8	571.9	1517.5
1934	1564.8	1821.1	2237.3	1549.0	1184.6	2112.9 4	714.7	3311.9	2444.0	1117.1	505.5	286.8	1904.2
1935	474.7	1657.1	717.1	1527.8	1209.0	740.5	924.7	3060.6	3983.3	2181.0	655.1	427.5	1463.2
1936	240.5	197.9	196.5	221.9	186.0	368.7	1986.1	4467.4	3783.3	1013.5	397.9	289.4	1112.4
1937	203.7	147.0	316.5	221.6	199.6	303.3	765.7	2803.2	4901.3	2057.5	439.5	288.6	1054.0
1938	318.0	812.2	736.6	604.6	331.4	423.7	1844.0	3802.9	3908.3	1499.7	366.9	259.8	1242.3
1939	259.8	354.7	587.6	887.0	366.7	536.5	1812.7	3381.3	2544.7	1731.6	496.3	251.1	1100.8
1940	342.8	710.6	970.1	384.2	415.2	818.5	1947.7	3385.2	2356.3	758.5	334.7	265.4	1057.4
1941	515.6	400.0	532.1	297.7	262.3	804.1	1907.0	1839.7	1337.6	588.5	322.5	456.6	772.0
1942	1086.5	759.4	1036.1	358.1	300.4	363.5	1536.1	2290.6	2273.7	1291.2	432.3	229.7	996.5
1943	171.1	320.8	463.5	466.4	364.4	460.8	2355.0	2919.0	4208.0	3501.9	932.5	356.4	1376.6
1944	256.1	288.1	694.7	274.4	272.5	481.9	1095.0	2331.9	2128.0	702.4	293.1	354.5	764.4
1945	336.7	392.3	612.7	925.9	775.8	453.2	689.5	3077.4	2812.7	1240.7	390.6	312.2	1001.6
1946	514.8	565.7	347.5	359.7	295.3	417.5	1349.3	4934.8	3995.0	2343.9	684.4	309.3	1343.1
1947	408.4	359.0	875.2	657.2	844.1	1193.8	2173.3	4102.3	2971.3	1540.7	549.5	312.3	1332.3
1948	1044.7	946.7	634.2	458.5	419.1	395.2	1038.8	3833.5	5773.3	1807.4	747.3	442.4	1461.8
1949	665.4	487.0	479.9	264.7	336.0	540.5	1709.3	4806.8	3811.0	2081.6	730.7	467.7.	1365.0
1950	606.1	1935.5	1383.0	651.0	438.2	812.1	970.6	2913.2	5806.0	4171.3	1302.7	464.2	1787.8
1951	1124.2	1350.0	1608.5	902.1	1598.3	599.2	1926.4	4161.9	3733.3	2003.9	597.0	346.1	1662.6
1952	837.1	784.4	399.5	273.6	309.2	334.2	1631.3	3378.4	2924.3	1673.5	556.8	259.1	1113.5
1953	184.1	153.3	168.1	1076.8	1376.4	613.8	1219.7	3191.3	3225.3	2975.8	943.7	385.3	1292.8
1954	506.4	890.5	1056.5	696.8	503.6	533.0	1108.2	3827.4	4218.3	4556.5	1971.0	886.6	1729.6
1955	618.2	1457.2	779.2	424.6	493.9	324.4	646.6	2042.8	5137.0	3338.1	1217.9	469.7	1412.5
1956	965.5	2019.9	724.5	434.8	298.3	318.0	1848.4	5126.1	5066.3	3583.5	910.7	495.4	1816.0
1957	924.0	876.0	1717.3	507.3	389.9	564.2	1319.1	4787.7	3211.0	1184.7	499.9	312.0	1357.8
1958	253.3	383.9	438.6	357.0	515.0	628.0	1236.9	5017.1	3236.3	955.3	424.4	341.8	1149.0
AVG	570.2	853.8	802.4	585.8	557.5	623.4	1572.5	3472.1	3617.8	2044.9	687.7	375.2	1313.6

WENATCHEE RIVER AT PLAIN, WASH.
USGS STATION: 12457000

FLOW CCFS)

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	AVG
1911	2000.0	3000.0	1243.2	876.1	591.4	950.1	2543.0	4211.9	6215.0	2716.8	950.9	755.9	2171.2
1912	400.4	1308.0	890.2	731.6	785.1	662.4	2326.0	6761.6	6694.3	2601.3	1066.1	602.5	2069.1
1913	483.1	732.8	697.6	620.8	809.1	815.4	2137.6	5985.2	9565.7	5256.8	1700.0	1131.7	2494.6
1914	1242.9	1287.9	830.3	1155.7	665.8	1508.9	3411.0	5923.5	4560.7	2762.3	980.7	709.5	2086.6
1915	949.5	2234.0	893.0	491.0	430.5	1027.7	3629.3	2612.9	1861.3	1055.3	764.0	401.6	1362.5
1916	618.0	939.6	588.6	548.4	737.5	1657.7	3090.3	6156.8	9365.7	6435.5	2588.7	981.3	2809.0
1917	485.1	557.4	408.5	429.0	604.4	487.2	912.7	5211.0	8025.7	6152.3	1740.3	753.5	2147.2
1918	516.7	678.4	3635.6	3937.7	1248.2	975.6	2879.0	4807.1	6724.7	2769.7	1072.6	647.3	2491.1
1919	936.8	997.8	1970.8	1136.8	867.5	792.1	3002.7	6008.7	6470.7	4989.4	1700.6	758.8	2469.4
1920	456.4	1395.6	1055.2	1499.5	1197.6	1019.4	1264.0	3476.8	4178.7.	3281.0	1011.0	1542.2	1781.4
1921	2468:7	1252.8	931.6	1391.9	2180.4	2099.0	2845.0	7231.6	9149.7	4330.6	1572.6	917.3	3030.9
1922	1330.3	1590.7	3771.9	914.8	723.1	642.7	1668.8	5138.1	6904.0	2012.3	850.2	621.0	2180.7
1923	533.4	579.0	651.1	1264.7	592.1	698.7	4079.0	6381.0	6047.7	3720.3	15%.8	625.0	2230.7
1924	476.9	646.7	907.3	688.9	3010.3	1934.2	1927.7	7134.2	3947.0	1925.5	756.1	506.7	1988.5
1925	677.4	880.0	2057.4	1281.9	1286.8	1303.2	3809.0	7817.1	5601.0	2772.6	930.3	523.3	2411.7
1926	420.1	548.8	1312.9	748.4	925.0	1988.7	37%.7	3500.0	2222.0	975.8	530.3	408.3	1448.1
1927	1363.5	864.3	1167.9	601.4	492.4	523.3	1766.5	4921.3	8771.3	3553.5	1133.2	985.5	2178.7
1928	1738.1	2394.0	2101.6	2196.3	955.9	1560.8	2334.7	8354.2	5116.7	2472.9	757.9	467.4	2537.5
1929	915.0	508.7	410.1	334.7	305.9	561.4	1005.5	4546.8	4677.3	1919.1	683.0	406.3	1356.2
1931	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	559.5	490.0	.0
1932	445.6	958.2	483.2	707.3	1496.1	2473.5	3228.3	5964.5	6462.7	3022.3	1203.5	504.4	2245.8
1933	651.2	3156.1	1962.1	1233.4	679.5	655.9	2043.3	4319.4	8038.3	6085.8	2123.2	987.6	2661.3
1934	2526.6	3066.0	3720.0	2537.4	1993.9	3719.0	8161.7	6515.8	4433.7	1953.2	918.1	538.0	3340.3
1935	785.0.	2715.7	1269.4	2399.4	2161.8	1432.9	1920.0	5941.3.	7007.0	3749.0	1167.7	715.9	2605.4
1936	469.7	400.8	392.0	425.6	386.6	688.4	3278.9	7480.0	5985.7	1625.0	651.2	470.5	1854.5
1937	344.2	235.8	570.7	352.4	331.9	594.5	1394.5	4627.7	8075.3	3314.5	818.5	521.1	1765.1
1938	543.5	1340.0	1240.3	1059.4	629.6	837.6	.3272.0	6839.4	6899.3	2493.9	692.4	451.5	2191.6
1939	462.4	635.1	1011.1	1421.3	659.5	946.1	3054.7	5632.3	4129.3	2670.6	827.3	424.1	1822.8
1940	465.0	856.5	1445.7	642.9	675.9	1327.8	3260.3	5521.0	3846.7	1258.1	522.7	400.1	1685.2
1941	807.3	616.7	827.7	499.3	444.3	1313.5	3240.3	3174.2	2235.7	885.7	456.1	671.2	1264.3
1942	1528.1	1243.0	1653.9	630.8	518.5	634.8	2614.4	3971.6	3818.0	2028.7	643.6	312.5	1633.2
1943	250.6	525.6	765.4	804.6	635.0	799.9	3858.3	5064.2	7276.3	5627.1	1435.3	582.0	2302.0
1944	458.3	501.8	1093.5	476.0	490.5	826.4	1823.3	3876.5	3460.7	1154.2	467.8	557.4	1265.5
1945	561.7	636.2	904.7	1625.1	1291.9	766.3	1230.6	5343.5	4956.3	2060.1	642.7	506.3	1710.5
1946	785.8	1080.2	610.6	618.7	485.8	746.1	2309.5	8639.7	6893.0	3759.4	1120.3	541.9	2299.2
1947	663.4	598.9	1348.4	1009.8	1272.4	1944.8	3834.7	7266.5	5033.0	2389.0	878.4	503.9	2228.6
1948	1600.4	1528.5	1063.5	715.0	667.5	643.4	1744.2	6614.5	10085.0	3000.0	1234.8	712.4	2467.4
1949	1072.2	832.1	797.8	468.5	575.2	869.1	3154.3	8736.1	6570.3	3307.1	1173.9	756.1	2359.4
1950	966.3	2869.1	2149.4	1089.7	760.3.	1324.8	1779.0	5412.6	10330.3	6%7.7	2070.6	797.9	3043.1
1951	1678.3	2113.3	2543.5	1530.6	2805.0	1191.9	3719.3	8119.4	6942.7	3425.8	1035.7	626.6	2977.7
1952	1295.9	1222.7	713.0	525.1	572.9	656.4	2780.7	5956.1	4906.0	2535.2	870.2	427.4	1871.8
1953	299.6	271.1	295.7	1532.0	2063.6	1071.5	2057.0	5656.5	5798.3	4891.0	1472.3	644.5	2171.1
1954	809.9	1301.1	1593.9	1054.1	816.7	901.3	1995.3	6868.4	7548.7	7540.0	3044.5	1382.5	2904.7
1955	1026.4	2231.6	1309.2	768.5	852.0	627.8	1195.7	3945.5	9442.3	5732.9	1973.5	790.8	2491.3
1956	1593.6	3316.0	1378.7	799.9	583.9	635.7	3653.7	9771.3	9198.3	6093.9	1617.7	824.6	3288.9
1957	1462.0	1424.2	2800.7	888.4	686.8	.997.6	2566.3	8855.5	5769.0	2006.1	850.8	526.8	2402.9
1958	479.7	688.8	750.0	636.0	888.9	1088.8	2213.7	8843.2	5621.3	1535.8	687.1	532.8	1997.2
1959	1088.6	2028.3	2686.8	1688.7	1040.5	1190.0	3571.7	6028.7	8227.3	5371.6	1499.0	1573.3	2999.5
1960	2722.3	3193.3	3055.8	1068.3	801.1	1132.5	3371.0	4901.0	6707.0	3679.7	1047.0	598.4	2689.8

1961	.589.8	1051.8	630.5	1194.4	1700.4	1636.8	3050.7	6579.4	9045.7	2908.7	934.3	596.2	2493.2
1962	873.0	755.2	657.6	1926.5	1603.3	827.3	3282.5	3781.3	5694.7	3005.2	1117.9	567.3	2007.6
1963	904.1	2054.0	1755.5	1472.6	2103.9	1549.4	1711.7	4451.3	4662.3	1903.2	918.0	559.2	2003.8
1964	613.8	950.7	940.0	1093.7	676.1	794.8	1753.3	4308.1	9328.0	6028.7	1997.4	857.0	2445.1
1965	1228.7	777.9	1195.7	861.2	1510.0	1425.5	3321.0	5901.0	6969.3	3477.7	1325.9	624.3	2384.9
1966	722.4	1097.1	780.0	699.1	499.8	718.4	2977.7	5566.8	4977.3	2981.6	1004.5	501.5	1877.2
1967	650.5	687.0	1481.0	1289.7	1247.0	927.7	1202.9	4949.7	9739.0	4192.6	1215.4	612.2	2349.5
1968	1754.0	2273.0	2119.1	2702.3	2603.1	2911.6	1914.0	5060.6	6497.3	3511.3	1210.2	1032.2	2799.1
1969	968.8	1418.0	1146.3	1220.3	688.5	831.7	2913.3	8509.7	8746.3	2153.5	824.9	715.7	2511.4
1970	1093.5	843.1	596.5	537.2	600.1	797.5	1497.3	4640.0.	7226.3	2228.7	705.5	575.4	1778.4
1971	497.2	655.6	570.3	1055.4	2648.9	1008.3	1567.0	7946.1	7787.0	6552.6	2301.6	802.3	2782.7
1972	643.5	1076.1	729.5	726.1	1231.6	3627.7	2732.7	7735.2	10649.3	6730.0	2759.4	1190.0	3319.3
1973	866.1	705.1	1123.9	1100.6	653.5	795.7	1699.5	4178.4	3884.0	1947.7	811.9	523.2	1524.1
1974	675.6	892.2	813.4	.1791.3	1162.1	1084.5	2691.3	5345.5	11755.0	7538.4	3154.2	1076.1	3165.0
1975	476.5	573.9	885.3	1146.1	776.8	770.3	1346.0	5454.2	8546.3	5497.7	1451.3	747.5	2306.0
1976	915.0	2201.0	4394.8	1864.2	1591.0	985.7	1936.8	6712.9	6096.0	6059.4	2865.8	1176.6	3066.6
1977	608.4	789.9	813.5	1182.7	1028.6	853.5	2138.7	2659.4	3967.7	1016.2	813.6	693.6	1313.8
1978	557.9	1826.2	3187.1	878.6	745.3	1725.7	3290.0	5175.8	7243.7	3676.5	1161.1	1150.0	2551.5
1979	692.7	1215.4	608.8	410.5	488.0	1313.0	1812.3	5733.5	4099.7	1744.2	746.2	593.6	1621.5
1980	364.4	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1990	405.8	1938.4	2242.7	1138.7	1088.3	1333.5	5032.0	4348.4	5871.7	3263.2	1048.5	539.5	2354.2
1991	1322.8	6702.0	2122.9	1432.9	2747.5	1668.4	2934.3	5317.7	5698.7	4838.7	1677.5	664.1	3094.0
1992	404.4	923.1	1083.4	934.4	1465.5	2310.0	3252.7	4681.0	3134.3	1098.4	562.9	432.3	1690.2
1993	448.4	702.3	481.6	574.0	616.4	926.1	1809.0	6427.1	3423.7	1225.5	.0	.0	.0
AVG	890.7	1353.4	1356.6	1088.6	1058.5	1184.1	2628.5	5796.2	6423.1	3457.0	1221.1	695.0	2262.7

ICICLE CREEK ABV SNOW CR NR LEAVENWORTH, WASH.
USGS STATION: 12458000

FLOW (CFS)

YEAR	OCT	NOV	DEC	JAN	FES	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	AVG
1937	84.0	67.3	121.4	72.4	72.5	112.1	293.2	1392.3	2571.0	838.7	183.6	121.1	494.1
1938	122.2	344.4	342.2	276.7	153.4	190.7	852.3	2039.8	2149.7	632.8	165.7	117.4	615.6
1939	110.5	146.6	220.6	289.4	142.9	290.5	919.2	1711.0	1241.5	699.5	180.1	105.7	504.8
1940	120.7	223.9	422.8	152.2	173.0	340.1	820.9	1713.5	1041.2	280.9	123.5	98.8	459.3
1941	177.4	137.7	193.5	123.2	119.0	384.7	886.7	983.7	779.4	268.9	121.3	237:6	367.8
1942	442.9	386.9	507.3	170.6	130.6	153.8	778.8	1294.2	1252.0	598.4	156.6	92.8	497.1
1943	74.7	192.2	252.8	285.9	203.9	247.4	1098.8	1336.0	2157.0	1495.5	326.6	125.0	649.6
1944	111.6	112.6	264.0	120.7	97.8	189.8	510.7	1342.1	1190.0	344.6	132.1	193.8	384.2
1945	156.5	151.7	237.8	415.3	397.3	209.2	330.4	1610.5	1352.7	482.5	149.5	155.7	470.8
1946	176.3	251.5	160.5	157.8	114.7	174.1	688.4	2563.9	1996.3	940.4	245.3	133.5	633.6
1947	223.6	190.5	388.8	284.7	347.3	534.3	1017.7	2311.3	1549.7	690.8	229.4	148.0	659.7
1948	566.5	555.2	366.1	220.5	189.0	175.9	424.9	2214.1	3429.0	924.0	333.1	179.5	798.1
1949	315.3	207.8	217.4	164.7	176.2	236.8	846.5	2599.4	2006.0	990.7	326.5	207.1	691.2
1950	357.9	863.8	556.0	226.5	162.5	290.2	406.2,	1473.9	3096.3	1838.2	478.7	172.1	826.9
1951	417.4	567.8	696.6	408.1	796.9	324.3	1007.6	2253.2	2118.0	891.0	239.0	144.8	822.1
1952	358.5	315.5	174.7	123.2	143.7	154.4	826.5	1738.8	1361.5	660.4	192.2	120.0	514.1
1953	77.0	66.2	72.9	366.1	515.2	265.6	532.6	1638.9	1731.0	1481.4	410.8	159.5	609.8
1954	156.1	251.6	402.9	246.4	206.3	251.2	496.2	2017.9	2244.3	2291.6	763.6	334.7'	805.2
1955	261.2	516.5	323.4	200.3	205.5	148.9	275.6	1019.4	2957.3	1572.9	443.0	1793	675.3
1956	382.7	919.3	343.4	207.1	158.1	161.9	1015.9	2797.7	2655.3	1608.6	385.0	210.8	903.8
1957	339.9	332.4	735.6	213.1	161.4	239.6	569.2	2428.1	1421.6	453.6	186.2	149.2	602.5
1958	126.7	146.1	165.3	156.9	223.8	273.4	495.4	2627.1	1453.3	373.1	151.2	137.1	527.4
1959	274.2	594.1	801.0	505.7	312.3	303.9	891.2	1506.5	2494.3	1363.6	342.2	379.8	814.1
1960	703.1	1048.8	925.2	280.6	197.5	321.6	812.8	1303.2	1922.9	712.3	208.0	124.3	713.4
1961	135.1	250.2	155.0	280.3	441.1	399.2	713.0	1927.6	2845.0	729.0	208.6	143.5	685.6
1962	239.6	189.9	184.8	579.1	446.8	223.0	934.9	1011.2	1865.0	884.3	307.4	141.7	584.0
1963	242.2	613.6	521.8	341.2	607.0	366.4	397.2	1252.6	1223.0	441.1	203.8	147.4	529.8
1964	144.5	207.2	221.3	288.2	171.6	188.7	361.3	1121.7	2805.7	1476.7	388.2	191.7	630.6
1965	254.3	177.5	306.6	258.8	398:1	355.7	874.5	1439.9	1989.5	867.7	299.9	136.6	613.3
1966	130.3	235.1	146.4	122.8	96.9	158.5	726.2	1710.3	1496.5	833.9	269.7	105.5	502.7
1967	152.2	159.9	378.6	300.6	335.8'	212.6	274.7	1473.4	2896.0	909.7	220.7	114.3	619.0
1968	462.1	564.9	565.3	812.9	709.9	616.5	366.0	1349.5	1753.7	919.0	268.6	281.2	722.5
1969	273.7	451.1	303.2	356.6.	190.2	226.2	676.0	2444.2	2386.6	511.4	180.3	158.9	679.9
1970	268.3	238.4	152.4	129.0	137.5	195.7	347.0	1407.4	2339.8	592.5	167.6	133.7	509.1
1971	108.0	160.0	146.5	270.7	633.5	260.8	362.8	2132.2	2254.3	1695.5	484.5	178.2	723.9
AVG	244.2	338.2	342.1	268.8	273.4	262.2	652.3	1748.2	2000.8	922.7	270.6	164.6	624.0

WENATCHEE RIVER AT PESHASTIN, WASH.
USGS STATION: 12459000

FLOW (CFS)

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	AVG
1929	.0	.0	.0	.0	.0	805.9	1475.2	6355.2	6680.7	2672.9	861.9	441.8	.0
1930	375.5	329.4	474.2	420.7	952.7	1676.1	4929.7	5025.5	4510.7	2420.3	782.9	458.2	1863.0
1931	577.4	696.7	482.5	700.5	1221.4	1535.8	2763.7	8228.4	5588.0	1728.3	572.2	506.0	2050.1
1932	509.3	1219.4	626.7	894.7	2157.0	3529.7	4407.7	8130.3	8977.3	4054.2	1299.8	602.3	3034.0
1933	866.9	4458.7	2710.3	1680.3	962.4	970.7	2898.0	5919.7	11713.7	8583.9	2817.1	1254.3	3736.3
1934	3640.0	4546.0	5648.4	3697.4	3042.5	5172.3	11249.0	8911.3	6079.3	2643.9	1118.9	683.14	702.7
1935	1085.8	3897.0	1887.7	3505.2	3131.4	2095.5	2779.7.	8208.4	9941.3	4944.5	1447.0	853.8	3648.1
1936	612.5	525.4	496.9	550.4	485.9	1018.3	4692.8	11088.7	8934.0	2257.1	789.8	587.8	2670.0
1937	474.7	339.0	728.0	493.4	476.4	839.1	1922.7	6601.9	11442.7	4480.6	1071.3	636.9	2458.9
1938	719.7	1777.8	1697.1	1445.1	871.5	1293.6	4695.7	9777.4	10068.7	3344.5	816.5	522.1	3085.8
1939	621.5	844.7	1310.3	1840.6	901.3	1372.4	4234.3	7447.4	5516.3	3480.6	980.9	494.9	2420.4
1940	611.3	1151.1	2037.4	883.3	922.6	1855.7	4385.0	7772.9	5213.7	1586.0	659.8	542.8	2301.8
1941	1045.4	777.9	1071.6	643.0	618.1	1866.5	4334.3	4414.2	3190.7	1163.6	587.1	953.1	1722.1
1942	2089.0	1761.3	2307.7	887.2	705.4	879.8	3660.7	5770.0	5499.3	2801.0	788.8	426.1	2298.0
1943	335.8	782.4	1122.5	1189.6	971.9	1239.3	5501.0	6853.9	10065.3	7572.3	1835.2	688.5	3179.8
1944	627.3	647.5	.1444.2	616.2	650.6	1125.7	2518.3	5676.8	5061.7	1576.1	577.0	766.5	1774.0
1945	780.1	846.1	1292.8,	2124.8	1854.6	1089.8	1712.3	7403.5	6809.3	2666.8	784.9	682.1	2337.3
1946	1044.2	1451.9	819.8	849.3	656.8	1113.0	3418.0	12111.6	9592.3	4992.9	1393.7	683.1	3177.2
1947	930.5	849.0	1862.8	1457.4	1822.5	2883.5	5249.7	10144.8	7097.3	3264.5	1124.5	732.5	3118.3
1948	2306.1	2288.0	1576.5	1050.3	979.0	972.3	2440.7	9432.6	14752.3	4233.5	1639.0	933.1	3550.3
1949	1506.8	1161.3	1174.6	688.7	988.6	1450.3	4572.0	12406.5	9379.0	4560.3	1533.4	1046.4	3372.3
1950	1454.6	4001.0	2964.8	1494.5	1120.9	1843.2	2539.0	7448.4	14647.3	9491.3	2687.1	1016.8	4225.8
1951	2254.9	2892.7	3562.6	2194.2	3943.6	1861.9	5379.0	11248.1	9754.3	4650.6	1357.0	802.3	4158.4
1952	1847.7	1764.7	1080.6	809.0	830.2	947.8	3979.0	8313.5	6722.7	3366.8	1081.4	614.9	2613.2
1953	463.4	383.9	421.2	2075.8	2917.1	1587.7	2882.7	7954.8	8182.7	6888.4	1%7.1	802.5	3043.9
1954	978:6	1557.7	2043.2	1371.0	1143.3	1324.5	2729.0	9399.7.	10231.3	10353.5	4002.6	1746.0	3906.7
1955	1328.8	2889.3	1731.9	1019.3	1139.7	880.5	1705.7	5304.8	13323.3	7694.8	2419.7	942.2	3365.0
1956	2034.1	4510.7	2106.8	1213.2	906.4	1001.3	5718.7	13795.8	13029.0	8358.1.	2149.0	1105.0	4660.7
1957	1900.9	1853.0	3793.9	1199.4	932.1	1473.9	3348.0	12432.3	7723.3	2576.8	1069.2	699.1	3250.1
1958	654.5	903.3	992.1	872.5	1330.2	1594.2	3008.7	12390.6	7734.3	2018.7	808.1	653.2	2746.7
1959.	1453.2	2892.0	3855.2	2447.7	1512.1	1845.5	5007.7	8160.0	11428.0	7075.8	1840.0	1997.2	4126.2
1960	3653.5	4622.3	4364.5	1439.7	1080.7	1639.8	4432.3	6537.1	9141.3	4537.7	1214.9	704.2	3614.0
1961	757.6	1351.3	826.8	1552.6	2364.6	2318.1	4023.7	9037.4	12565.0	3791.0	1161.7	745.9	3374.6
1962	1187.6	1031.8	907.2	2721.3	2243.6	1166.5	4599.0	5140.3	8046.0	4155.2	1474.5	711.0	2782.0
1963	1217.6	2864.0	2404.2	1898.7	2887.1	2128.4	2270.3	6089.0	6476.7	2521.9	1174.7	736.5	2722.4
1964	812.4	1235.1	1262.0	1500.0	938.6	1110.5	2320.0	5704.5	12818.7	7865.8	2492.3	1047.6	3258.9
1965	1557.8	1010.2	1666.5	1216.9	2125.4	2115.5	4559.7	7867.1	9624.0	4491.3	1599.9	746.5	3215.1
1966	855.1	1404.6	%2.9	855.3	654.0	985.0	4085.0	7713.2	6952.0	4027.4	1257.8	618.7	2530.9
1967	841.2	928.0	1992.9	1704.2	1718.9	1286.8	1582.7	6977.7	13494.3	5455.5	1467.2	766.2	3184.6
1968	2272.0	3057.7	2798.1	3760.3	3647.9	3918.4.	2442.0	6792.9	8806.0	4364.8	1470.0	1349.2	3723.3
1969	1274.4	1%1.3	1532.3	1690.3	966.3	1252.6	4157.7	11759.4	11738.3	2781.3	995.4	877.6	3415.6
1970	1444.8	1160.1	809.1	733.2	825.6	1179.8	2069.0	6549.7	10194.7	3022.6	868.8	743.2	2466.7
1971	630.4	855.7	761.2	1435.5	3739.6	1455.8	2298.0	10944.2	10834.7	8859.0	2975.2	990.8	3815.0
1972	842.3	1458.5	1020.6	1060.5	1882.1	5607.4	4183.7	11776.1	15292.7	9455.2	3719.0	1575.7	4822.8
1973	1183.2	948.4	1496.1	1557.7	877.1	1044.6	2186.3	5611.0	5221.7	2482.3	952.5	613.3	2014.5
1974	861.7	1247.4	1188.6	2769.7	1743.9	1658.7	3760.7	7255.2	16176.3	9754.5	3%9.4	1343.7	4310.8
1975	644.3	789.2	1215.5	1725.0	1188.9	1170.0	1928.7	7440.0	11881.0	7451.3	2015.8	987.2	3203.1
1976	1221.3	2%1.0	6201.9	2679.0	2264.8	1478.4	2864.7	9214.2	8411.3	8274.8	3837.7	1537.3	4245.5
1977	781.3	1043.4	1055.8	1575.2	1356.3	1114.6	2785.9	3506.1	4566.0	1255.2	942.8855	.11736.5	

1978	744.6	2426-.0	4627.7	1314.5	1131.8	2558.1	4451.7	6904.8-	9833.0	4893.2	1458.8	1514.8	3488_2
1979	898.9	1544.0	798.3	530.3	628.8	1739.0	2375.3	7679.0	5444.3	2212.6	866.8	646.1	2113.6
1980	610.2	575.2	3200.5	1223.5	992.8	1700.3	4671.7	8530.0	6190.3	3151.6	1079.8	809.1	2727.9
1981	574.8	2227.4	5262.6	3209.4	2729.3	2297.4	2801.7	6066.1	5533.0	3350.3	1214.6	642.2	2992.4
1982	1190.6	1516.0	1005.7	1141.9	3152.1	2439.7	2518.3	7645.8	13218.7	5968.7	1867.1	981.2	3553.8
1983	1148.3	992.2	1555.5	2418.4	1555.4	2999.0	3705.0	8703.9	8118.7	4188.1	1762.9	1049.5	3183.1
1984	652.6	2112.1	994.5	3759.0	1991.7	2291.6	2568.7	4329.0	9710.7	5854.5	1799.5	800.4	3072.0
1985	1032.5	1140.5	725.9	645.6	604.7	895.0	4031.0	7278.1	7361.0	2412.9	777.3	695.3	2300.0
1986.	1436.1	2544.3	789.7	1139.5	2102.6	4265.5	3990.0	6191.9	7321.0	2151.6	921.4	613.8	2789.0
1987	625.8	2196.7	1302.1	792.5	794.2	2320.4	4619.3	9365.8	5184.3	1872.3	708.9	482.0	2522.0
1988	330.6	354.9	535.2	431.7	645.4	1443.2	5003.3	7004.8	6746.7	3549.0	1101.6	645.8	2316.0
1989	1494.1	2156.3	1770.6	1490.0	1224.9	1131.2	4893.0	6917.7	7611.0	2707.1	945.7	505.5	2737.3
1990	578.5	2562.1	3016.1	1631.3	1492.9	1841.0	6758.3	5846.8	8101.7	4361.3	1366.5	710.7	3188.9
1991	1853.1	8800.0	3097.7	2059.7	3871.4	2395.8	4056.7	7239.0	8099.3	6759.7	2227.7	868.2	4277.4
1992	586.9	1301.7	1544.6	1302.2	2135.2	3331.3	4597.3	6641.6	4310.0	1449.5	724.5	609.5	2377.9
1993	608.0	967.0	687.2	961.5	866.5	1304.6	2516.0	8970.6	4874.3	1648.1	.0	.0	.0
AVG	1117.7	1833.5	1823.5	1503.8	1540.2	1795.8	3696.1	7928.6	8750.6	4439.7	1488.7	834.3	3062.7

1 MISSION CREEK ABOVE SAND CR NEAR CASHMERE, WASH.
USGS STATION: 12461400
FLOW (CFS)

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	AVG
1959	.0	.0	.0	18.4	13.0	33.8	43.6	35.6	20.2	7.9	3.6	4.2	.0
1960	6.0	12.6	6.7	5.0	8.7	29.4	48.4	68.0	27.0	8.8	4.8	2.7	19.0
1%1	3.0	5.2	4.0	5.5	26.0	33.6	36.2	46.4	25.5	8.6	3.5	2.2	76.6
1962	3.1	3.6	3.8	6.0	11.9	10.0	28.5	25.7	17.4	7.4	3.7	2.3	10.3
1963	4.4	11.3	12.8	6.0	18.1	8.1	22.6	28.7	16.2	6.4	3.3	2.4	11.7
1964	3.7	11.1	4.6	4.7	8.8	10.9	17.9	16.4	14.7	5.2	3.0	2.1	8.6
1%5	2.3	2.9	3.3	10.9	25.5	18.0	30.9	22.9	14.4	5.5	2.9	2.1	11.8
1966	2.0	3.4	3.2	2.9	5.5	20.2	26.5	18.2	10.4	6.8	2.4	1.4	8.6
1%7	2.6	4.3	12.5	8.8	10.7	6.8	18.4	60.7	27.2	7.7	2.9	1.8	13.7
1968	4.3	4.6	10.2	17.8	43.9	29.3	14.8	21.4	11.4	4.7	3.8	2.6	14.1
1%9	4.6	9.9	7.8	14.5	10.3	25.9	56.7	58.8	24.5	6.5	2.9	3.3	18.8
7970	3.9	3.3	2.9	3.1	10.9	21.1	21.9	33.2	17.8	4.5	2.0	1.7	10.5
1971	2.3	4.2	2.5	25.3	27.3	10.7	28.8	44.3	20.9	11.7	3.1	2.4	15.3
AVG	3.5	6.4	6.2	9.9	17.0	19.8	30.4	37.0	19.7	7.1	3.2	2.4	13.5

WENATCHEE RIVER AT MONITOR, WASH. USGS STATION: 12462500

FLOW (CFS)

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	AVG
1963	1229.3	3328.3	2725.5	2026.8	3325.7	2289.0	2374.3	6296.8	6245.3	2420.0	1037.1	683.2	2831.8
1964	816.9	1297.3	1313.2	1563.9	1016.6	1215.8	2473.3	6047.1	13495.0	7834.8	2547.4	1028.7	3387.5
1965	1590.3	1082.5	1715.2	1341.9	2410.4	2292.3	4991.3	8196.8	9838.3	4336.5	1490.2	685.4	3330.9
1966	858.8	1432.7	1023.7	898.1	717.6	1166.0	4390.3	8096.1	7045.3	3947.7	1132.7	544.6	2604.5
1967	867.9	998.0	2157.1	1838.7	1900.7	1389.7	1678.0	7450.0	13908.7	5252.9	1333.1	673.2	3287.3
1968	2300.7	3164.7	2947.4	4020.6	3991.7	4191.0	2656.7	6942.6	8735.7	4246.8	1395.1	1324.5	3826.5
1969	1344.4	2103.7	1673.1	1893.1	1103.4	1582.0	4699.7	12437.1	12218.3	2728.7	916.4	839.6	3628.3
1970	1514.5	1260.2	890.4	836.2	936.5	1421.5	2326.3	6968.1	10758.0	2973.5	760.0	674.8	2610.0
1971	660.5	958.1	865.6	1605.8	4103.6-	1663.2	2638.0	11672.3	11404.7	8961.6	2900.3	967.5	4033.4
1972	881.5	1588.3	1113.1	1217.6	2225.5	6852.9	4754.7	12969.4	16486.3	9702.3	3690.0	1558.3	5253.3
1973	1210.9	1019.6	1652.3	1717.7	973.5	1167.4	.2246.3	5785.5	5329.3	2378.1	816.1	544.4	2070.1
1974	902.0	1398.3	1378.7	3270.6	2109.6	2081.0	4541.0	7773.2	17017.3	9879.7	3971.3	1256.6	4631.6
1975	667.5	846.8	1319.8	1891.7	1300.4	1361.9	2229.7	8179.7	12609.7	7688.7	1989.7	1004.1	3424.1
1976	1319.2	3330.0	6982.9	3032.6	2594.1	1725.2	3327.0	9974.5	8813.0	8583.5	3930.3	1526.7	4594.9
1977	824.0	1122.9	1133.5	1642.2	1431.1	1161.9	2864.7	3565.2	4508.3	1134.6	802.9	796.4	1749.0
1978	775.7	2603.7	5305.8	1500.0	1350.7	3049.4	5101.3	7570.3	10495.7	5137.7	1447.5	1627.7	3830.5
1979	1016.1	1722.0	927.3	646.5	771.8	2005.6	2581.0	8189.7	5528.0	2117.2	739.8	605.9	2237.6
1980	626.7	656.7	3474.5	1312.9	1152.6	2097.7	5425.0	9225.2	6468.0	3155.5	968.7	769.2	2944.4
1981	591.9	2370.9	5922.9	3610.3	3218.2	2634.2	3060.0	6511.9	5715.7	3278.4	1114.0	589.6	3218.2
1982	1233.6	1599.0	1111.5	1297.5	3680.4	2836.1	2784.0	8300.3	14377.3	6367.4	1900.5	993.6	3873.4
1983	1286.4	1144.7	1745.8	2752.3	1879.6	3812.9	4222.0	9647.1	8837.3	4376.1	1709.0	1096.0	3542.4
1984	712.2	2303.0	1136.8	4308.7	2231.7	2673.9	2845.0	4641.0	10413.0	6085.2	1744.3	802.5	3324.8
1985	1113.0	1251.7	833.4	736.8	714.8	1066.1	4460.0	7747.1	7757.7	2325.8	682.6	685.5	2447.9
1986	1499.9	2715.7	868.1	1274.4	2455.1	4910.3	4386.3	6521.9	7702.7	2115.8	827.4	632.0	2992.5
1987	678.8	2324.1	1401.0	897.1	913.3	2667.2	4914.0	9952.6	5248.3	1819.1	604.7	421.6	2653.5
1988	346.0	425.8	655.7	526.5	797.6	1660.3	5435.7	7397.1	7022.3	3521.0	1012.8	592.1	2449.4
1989	1556.2	2263.0	1903.2	1616.5	1343.2	1299.0	5341.7	7352.6	7886.3	2648.7	857.5	439.5	2875.6
1990	621.7	2662.0	3181.0	1796.8	1637.5	2077.7	7260.0	6019.4	8435.3	4318.7	1287.4	665.7	3330.3
1991	1903.7	9636.3	3346.1	2235.8	4232.5	2633.2	4364.0	7703.9	8448.3	6864.5	2146.8	882.6	4533.1
1992	616.4	1379.3	1683.4	1407.6	2377.6	3523.9	4786.7	6869.0	4186.3	1378.9	599.7	544.0	2446.1
1993	603.9	1021.7	729.1	881.1	917.0	1413.3	2704.7	9280.6	5000.3	1578.6	.0	.0	.0
AVG	1037.8	1968.1	2036.0	1793.5	1929.5	2320.1	3802.0	7912.4	9094.7	4489.0	1545.2	848.5	3231.4

Appendix C

WAC Instream Flows
WRIA

Chapter 173-545 WAC
ISTREAM RESOUCE PROTECTION PROGRAM – WENATCHEE RIVER BASIN, WATER RESOURCE INVETORY AREA (WRIA) 45

WAC 173-545-010 General provision. These rules apply to waters within the Wenatchee River basin, WRIA 45, as defined in WAC 173-500-040. This chapter is promulgated pursuant to chapter 90.54 RCW (Water Resources Act of 1971), chapter 90.22 RCW (minimum water flows and levels), chapter 75.20 RCW (state fisheries code) and in accordance with chapter 173-500 WAC (water resources management program). [Statutory Authority: Chapters 90.54, 90.22 and 75.20 RCW. 83-13-016 (Order DE 83-8), § 173-545-010, filed 6/3/83.1

WAC 173-545-020 Purpose. The purpose of this chapter is to retain perennial rivers, streams, and lakes in the Wenatchee River basin with instream flows and levels necessary to provide protection for wildlife, fish, scenic, aesthetic, and environmental values, recreation, navigation, and water quality. [Statutory Authority: Chapters 90.54, 90.22 and 75.20 RCW. 83-13-016 (Order DE 83-8), § 173-545-020, riled 6/3/83.]

WAC 173-545-030 Establishment of instream flows. (1) Stream management units and associated control stations are established as follows:

Stream Management Unit Information

Control Station No. Stream Manage-mcnt Unit Name	Control Station by Rivcr Mile and Section, Township, and Range	Affected Stream Reach(es) including Tributaries
12-4570.00 Wenatchee River at Plain	46.2 Sec. 12, T. 26N., R. 17E. W.M	From Plain Road Bridge. R.M. 46.2, to headwaters
12-4585.00 Icicle Cr. Near Leavenworth	1.5 Sec. 24. T. 24N., R. 17E. W.M	Headwaters of Icicle Creek to its mouth
12-4590.00 Wenatchee River at Peshastin	21.5 Sec. 8, T. 24N., R. 18E. W.M	From confluence of Derby Creek to Plain Road Bridge. R.M. 46.2 excluding Derby Creek and Icicle Creek
12-4625.00 Wenatchee River at Monitor	7.0 Sec. 11, T. 23N., R. 19E. W.M	From mouth to confluencc of Derby Creek. including Derby Creek and excluding Mission Creek
12-4620.00 Mission Creek near Cashmere	1.5 Sec. 8, T. 23N, R. 19E. W.M	From mouth to head-waters

(2) Instrearn flows are established for the strcam management units in WAC-173-545-030(i) as follows:

Instrearn Flows in the Wenatchee River basin
(instantaneous cubic feet per second)

Month	Day	12-4570.00 Wenatchee R. at Plain	12-4580.00 Icicle Cr. Near Leavenworth	12 4590.00 Wenatchee R. at Peshastin
Jan	1	550	120	700
	15	550	120	700
Feb	1	550	120	700
	15	550	120	700
Mar	1	550	150	750
	15	700	170	940
Apr	1	910	200	1300
	15	1150	300	1750
May	1	1500	450	2200
	15	2000	660	2800
Jun	1	500	1000	3500
	15	2000	660	2600
Jul	1	1500	450	1900
	15	1200	300	1400
Aug	1	880	200	1000
	15	700	170	840
Sep	1	660	130	820
	15	620	130	780
Oct	1	580	130	750
	15	520	130	750
Nov	1	550	150	750
	15	550	150	750
Dec	1	550	150	750
	15	550	150	750

Instrearn Flows in the Wenatchee River basin (cont'd)
(instantaneous cubic feet per second)

Month	Day	12-4620.00 Mission Cr. near Cashmere	12-4625.00 Wenatchee R. at Monitor
Jan	1	16	820
	15	6	820
Feb	1	6	820
	15	6	800
Mar	1	6	800
	15	11	1040

(6/9/88)

Month	Day	12-4620.00 Mission Cr. near Cashmere	12-4625.00 Wenatchee R. at Monitor
Apr	1	22	1350
	15	40	1750
May	1	40	2200
	15	40	2800
Jun	1	28	3500
	15	20	2400
Jul	1	14	1700
	15	10	1200
Aug	1	7	800
	15	5	700
Sep	1	4	700
	15	4	700
Oct	1	4	700
	15	5	700
Nov	1	6	800
	15	6	800
Dec	1	6	800
	15	6	800

(3) Instrearn flow hydrographs, as represented in 'the document entitled "Wenatchee River basin instream resources protection program, rigs. 7, 8, 9, pgs. 30 and 3 1," shall be used for identification of instream flows on those days not specifically identified in WAC 173-545- 030(2).

(4) Future consumptive water right permits issued hereafter for diversion of surface water from the main stem Wenatchee River and perennial tributaries shall be expressly subject to instream flows established in WAC 173-545-030 (1) through (3) as measured at the appropriate gage, preferably the nearest one downstream, except for those exemptions described in WAC 173-545-- 070 (1) through (3).

(5) Projects that would reduce the flow in a portion of a stream's length (e.g.: hydroelectric diversion projects) will be considered consumptive with respect to the by- passed portion of the stream and will be subject to specific instream, flow requirements as specified by the department for the bypassed reach notwithstanding WAC 173-545-030(l) through (3). The department may require detailed, project-specific instrearn flow studies to determine a specific instrearn flow for the bypassed reach.

(6) If department investigations determine that with- drawal of ground water from the source aquifers would not interfere significantly with stream flow during the period of stream closure or with maintenance of mini- mum flows, then applications to appropriate public ground waters may be approved and permits or certificates issued. [Statutory Authority: Chapters 90.54, 90- .22 and 75.20 RCW. 83-13-016 (Order DE 83-8), § 173-545--030, Filed 6/3/83.1

WAC 173-545-040 Stream closure. The department has determined that additional diversions of water from Peshastin Creek during the period June 15 to October 15 would deplete instrearn flows required to protect in- stream values. Peshastin Creek is, therefore, closed to further consumptive appropriation from June 15 to October 15 each year. During the nonclosed period, minimum instream flows will be controlled and measured from the control station on the Wenatchee River at Monitor. [Statutory Authority: Chapters 90.54, 90.22 and 75.20 RCW. 83-13-016 (Order DE 83-8.), § 173- 545-040, Filed 6/3/83.1

WAC 173-545-050 Policy statement for future permitting actions. Consistent with the provisions of chapter 90.54 RCW, it is the policy of the department to pre- serve an appropriate base flow in all streams and rivers as well as the water levels in all lakes in the Wenatchee River basin by encouraging the use of alternate sources of water which include (1) ground water, (2) storage water, or (3) purchase of other valid water rights. [Statutory Authority: Chapters 90.54, 90.22 and 75.20 RCW. 83-13-016 (Order DE 83-8), § 173-545-050, filed 6/3/83.]

WAC 173-545-060 Lakes. In future permitting actions relating to withdrawal of lake waters, lakes and ponds shall be retained substantially in their natural condition. Withdrawals of water which would conflict therewith shall be authorized only in those situations where it is clear that overriding considerations of the public interest will be served. [Statutory Authority: Chapters 90.54, 90.22 and 75.20 RCW. 83-13-016 (Order DE 83-8), § 173-545-060, riled 6/3/83.1

WAC 173-545-070 Exemptions. (1) Nothing in this chapter shall affect existing water rights, riparian, appropriative, or otherwise existing on the effective date of this chapter, nor shall it affect existing rights relating to the operation of any navigation, hydroelectric, or water storage reservoir or related facilities.

(2) Future requests for group domestic uses, including municipal supply, may be exempted from the minimum instream flow provisions of this chapter when it is determined by the department, in consultation with the departments of fisheries and game, that overriding considerations of the public interest will be served.

(3) Single domestic and stockwatering use, except that related to feedlots, shall be exempt from the provisions established in this chapter. If the cumulative impacts of numerous single domestic diversions would significantly affect the quantity of water available for instrearn uses. then only single domestic in-house use shall be exempt if no alternative source is available.

(4) Nonconsumptive uses which are compatible with the intent of the chapter may be approved. [Statutory Authority: Chapters 90.54, 90.22 and 75.20 RCW. 83- 13-016 (Order DE 83-8), § 173-545-070, filed 6/3/83.1

WAC 1173-545480 Future rights. No rights to divert or store public surface waters of the Wenatchee River basin, WRIA 45, shall hereafter be granted which shall conflict with the purpose of this chapter. [Statutory Authority: Chapters 90.54, 90.22 and 75.20 RCW. 83- 13-016 (Order DE 83-8), § 173-545-080, filed 6/3/83.1

WAC 173-545-M Enforcement. In enforcement of this chapter, the department of ecology may impose such

sanctions as appropriate under authorities vested in it, including but not limited to the issuance of regulatory orders under RCW 43.27A.190 and civil penalties under RCW 90.03.600. [Statutory Authority: Chapters 43- .21 B, 43.27A, 90.22 and 90.54 RCW. 88-13-037 (Order 88-11), § 173-545-090, riled 6/9/88. Statutory Authority: Chapters 90.54, 90.22 and 75.20 RCW. 83--13-- 016 (Order DE 83-8), § 173-545-090, filed 6/3/83.1

WAC 173-545-095 Appeals. All final written decisions of the department of ecology pertaining to permits, regulatory orders, and related decisions made pursuant to this chapter shall be subject to review by the pollution control hearings board in accordance with chapter 43- .21 B RCW. [Statutory Authority: Chapters 43.21 B, 43- .27A, 90.22 and 90.54 RCW. 88-13-037 (Order 88-11), 173-545-095, riled 6/9/88.1

WAC 173-545-100 Regulation review. The department of ecology shall initiate a review of the rules established in this chapter whenever new information, changing conditions, or statutory modifications make it necessary to consider revisions. [Statutory Authority: Chapters 43.2111, 43.27A, 90.22 and 90.54 RCW. 88- 13-037 (Order 88-11), § 173-545-100, riled 6/9/88. Statutory Authority: Chapters 90.54, 90.22 and 75.20 RCW. 83-13-016 (Order DE 83-8), § 173-545-100, riled 6/3/83.1