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Department of Ecology

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DEPARTMENT OF ECOLOGY
STREAMFLOW PRESERVATION PROGRAM

by

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DEPARTMENT OF ECOLOGY
STREAMFLOW PRESERVATION PROGRAM

FLOW PRESERVATION CONCEPTS

Low Flow Restrictions

The need to maintain flows in streams in sufficient quantity to support game and food fish populations was originally set forth as a state policy under Title 75 RCW in 1949. Under Section 75.20.050 RCW it was established that the Supervisor of Hydraulics (now the Director, Department of Ecology) shall notify the directors of the departments of Fisheries and Game of applications for permits to divert surface waters and he may refuse to issue such permits if, in the opinion of the directors of Fisheries or Game, the diversions might result in lowering the flow of water in any stream below the flow necessary to adequately support food fish and game fish.

Since the enactment of this law, the involved agencies have communicated their interests in water right applications primarily through biweekly or monthly meetings in which the respective impacts of proposed diversions are thoroughly aired with respect to their effects on the fishery resource. Through such discussions, low-flow or other restrictive permit provisions are recommended by the Fishery and Game agencies to accommodate their interests and, where appropriate, these are accepted and applied to the respective water right permits. Many such low-flow provisos have been applied to individual rights over the years, but because of changing personnel and a lack of data, in many cases, there is little justification or uniformity among the low-flow values selected for different streams.

Minimum Flows

Recognizing the inadequacy of existing flow preservation activities, the Legislature enacted a new law in 1967 to provide a more definitive systematic approach to solving this problem. Under this law, codified as Chapter 90.22 RCW and entitled "Minimum Water Flows and Levels," authority was granted to the Department of Ecology to establish minimum stream flows and lake levels by administrative rule for purposes of protecting fish, game, birds, or other wildlife resources, or recreational or aesthetic values, or to preserve water quality. The initiation of such action may either be at the request of the Department of Fisheries, the Game Commission, or by the Department of Ecology (which presently includes the former Department of Water Resources and the Pollution Control Commission). In this law, hearing procedures were established but no attempt was made to define criteria for determining how much flow should be retained in each stream to protect instream resources and environmental values.

To develop suitable methodology for evaluating instream flow requirements, several investigations were initiated by the involved agencies. These

studies produced some results, but it became evident that considerably more research is needed on this complex subject area before truly usable relationships can be established between streamflow quantities, the fishery resource, and other environmental parameters. Consequently, to date, although much effort has been expended in evaluating many streams, only one minimum flow regulation has been promulgated under Chapter 90.22 RCW.

Base Flows

In the Water Resources Act of 1971, the Legislature took additional action to affirm the state's interest in preserving instream values through a declaration of fundamentals for utilization and management of state waters. Contained in the third fundamental is a statement that the quality of the natural environment shall be protected and, where possible, enhanced through the retention of sufficient base flows in perennial streams to provide for preservation of wildlife, fish, scenic, aesthetic, and other environmental and navigational values.

From a hydrologic sense, the term base flow normally refers to:

1. Those flows sustained in a stream during periods of fair weather or;
2. That component of streamflow primarily derived from ground-water effluent.

In perennial streams, ground water usually contributes to streamflow to some degree throughout the year, consequently, it is reasonable to view base flow as a year round phenomenon. Base flows, as described in the Water Resources Act, have therefore, been broadly interpreted as the lower levels of flow that occur in a stream.

Although base flow and minimum flow concepts are similar in intent, legal and technical procedures associated with development and promulgation of base flow regulations are somewhat less cumbersome than those related to minimum flow. Considering this advantage, and the need for expeditious implementation of a state-wide flow preservation program to prevent further deterioration of instream values, the Department of Ecology has decided to concentrate its efforts on the development of base flow regulations.

In addition to stated environmental purposes, base flows constitute an allocation of part of the resource and, as such, serve as a foundation for water resource accounting and further planning activities, including allocation of the remaining resource among competing uses.

BASE FLOW ACTIVITY

Within the state water resource program, the base flow activity, as currently envisioned, consists of four basic elements. Descriptions of these elements, together with procedures that will be followed in the development and implementation of base flow regulations, are presented in the following sections.

Stream System Analysis

Fundamental to sound base flow management is the need for a well designed streamflow measurement network that is capable of adequately controlling water diversions in all parts of each basin. Since the effectiveness of a flow control station is inversely related to the size of the drainage system it measures and, similarly, to distance from the various diversions within that drainage system, it is necessary to employ enough flow measurement stations to obtain a reasonable degree of sensitivity to the the water diversions being monitored.

Considering the critical nature of the monitoring network, the initial step in base flow analysis is to examine existing streamflow records to identify those sites best suited for flow management. Generally, existing or former continuous record stream gaging stations will be used for base flow control whenever possible while, in areas devoid of such record, sites are selected where a few or more miscellaneous flow measurements have been made. Usually it is preferable to select flow control sites that are located near the mouth of the main stem stream and the mouths of major tributaries.

Concurrent with streamflow station selection, the basin (usually a water resource inventory area) is subdivided into logical segments (tributary drainages or stream reach units) that can be managed by each control station. Ideally, flow from or through each management unit should be controlled by a station at or near its downstream end or outlet. With control at such locations, all diversion activity above the station is reflected in flows measured at the station.

Upstream control (control station located above all or some of the diversions in a management unit), while possible, presents exceedingly complex management problems. Unlike downstream control, water diversions below an upstream control station do not affect flows at the station. Consequently with this type of control, different regulatory flow levels are necessary for each affected diversion. Upstream control stations should, therefore, be avoided whenever possible and employed only where downstream control is not feasible. Detailed descriptions of management procedures for both types of control situations are presented below in the section on water right regulation.

For purposes of clarity and organization, designated control stations and management units are identified on water resource inventory area (WRIA) base maps and tabulated in downstream order on forms developed for the environmental stream rating process. A sample of a stream system analysis as prepared for the Chehalis River Basin, is shown in Figures 1, 2, 3, and 4 and Tables 1 and 2.

In the control station sections of Tables 1 and 2, each management unit is identified by stream name, reach description, control station number, and location of the station by river mile, section, township and range. If a management unit is described by stream name only, the entire stream system from headwaters to mouth, including tributaries, is included within the unit. Abbreviated description, in addition to the stream

name (nonstandard reach description), is provided if the unit consists of only a part of the total named stream basin.

Small triangles on Figures 1 and 3 identify beginning and end points of stream reaches or end points of entire streams and tributaries described in the stream system analysis.

Figures 2 and 4 show the location of flow measurement sites, designated as control stations, and some information about the type of streamflow record that is available for each site. Numbers assigned to each station generally correspond to the middle four digits of identifying numbers for United States Geological Survey stream gaging stations.

Stream Classification

Since stream and watershed environments vary widely, not only among different stream systems but also within each drainage, it is reasonable to assume that some streams will require higher levels of base flow than others to adequately preserve their environmental values. A procedure was, therefore, developed whereby these differences could be identified and, in turn, used as a foundation for defining different levels of base flow.

As discussed previously, Section 90.54.020(3) RCW of the Water Resources Act requires that base flows be retained in perennial streams to preserve various environmental and navigational values. Following this guidance, a simple rating system was devised for differentiating the relative environmental value of these parameters. The parameter rating system is based on a scale of numerical values ranging from "four" for very high value or usage to "zero" for no value or usage. Water quality standards are incorporated in the system using a similar scale ranging from "four" for the highest class (AA) to "one" for the lowest class (C). Parameter definitions and the rating system are presented in condensed form in Tables 3 and 4.

To maintain a resonable degree of uniformity and balance in the rating process, a stream classification committee was formed consisting of representatives from seven different state agencies that have a general interest or responsibility in the area of stream related activities. The representative of the Department of Ecology serves as chairman of this group (see Table 5). Although the rating process is generally controlled by the committee, each committee member is free to utilize other expertise from within his organization or from other suitable sources, including other governmental agencies or quasi-governmental groups, in developing rating values that represent his agency's views.

Prior to the actual rating process, member agencies are assigned those parameters most closely associated with their area of interest and authority. Each committee member then rates these parameters for the management units identified through stream system analysis. In geographic areas where member agencies lack authority or background, a committee member may choose to withdraw from the rating process for that particular area or stream system. Finally, after all rating forms are submitted to the chairman, composite total rating values are prepared

for each management unit, by adding average rating values for each parameter.

A stream classification rating for the Chehalis River Basin is shown in the right half of Tables 1 and 2. Generally, total rating values for all management units in this basin ranged from 9 to 21 with the median value being about 15. It should be noted that the maximum possible rating for a stream management unit is 24 while the lowest score would be 1.

Base Flow Level Definition

Discharge-Duration Hydrograph

In order to establish specific base flow levels at control stations by a consistent standardized procedure, a hydrographic framework was developed, based on commonly used and accepted statistical techniques. This framework, called a discharge-duration hydrograph, shows the relative year-round expectancy of different levels of streamflow for a particular stream location based on an analysis of historical streamflow record for that location. Flow expectancy or frequency of occurrence is shown on a discharge-duration hydrograph in terms of the percent-of-time that the indicated daily discharges (or flows) have been equaled or exceeded during the period of record analysis. To show a complete flow-picture, a discharge-duration hydrograph is constructed as a family of hydrographic curves with each individual curve displaying a specific percent-of-time exceedance frequency level.

Since most streams experience a wide range in flows between wet and dry periods, it is normally more practical to use a semi-logarithmic plot for discharge-duration hydrographs, with daily flow values as ordinates along the logarithmic scale and time in days as abscissa on a uniform scale. Such a plot, because of mathematical relationships, has an additional value of displaying recessional streamflow, which normally occurs in spring and summer, as a straight line or nearly a straight line.

Computer programs have been developed for calculating and plotting discharge-duration hydrographs from continuous record streamflow data. Where only miscellaneous or short-term flow records are available, it is possible to construct duration hydrographs through regression relationships with highly correlated long-term records collected at nearby gaging stations. Sample discharge-duration hydrographs for Chehalis Basin control stations are shown in Figures 5 and 6.

Conversion Curve

Base flow levels are developed within the discharge-duration hydrograph framework through a conversion curve defining the relationship between environmental stream rating and percent-of-time flow duration (Figures 7 and 8). The conversion curve relationship evolved through interagency negotiations, an analysis of minimum flow requirements for fish and an assessment of other instream needs. Studies of fish requirements, particularly in western Washington, pointed to a general critical need

for flow during the spring to summer rearing period, while flow needs for fish spawning and migration are more easily met during the high-flow period. These relationships indicated that it would be desirable to use different conversion curves for high-flow and low-flow periods. After considerable debate, it was the concensus of involved agency participants that the 95 percent-of-time flow-duration hydrograph would serve as a guide for base flows during all high-flow periods while a variable percent duration, based on stream rating value, would be used during low-flow periods.

High-flow periods of the hydrograph are distinguished from low-flow periods by a simple process of comparing the median daily flow for the entire period of record analysis to the 50 percent-of-time discharge-duration hydrograph curve. High-flow periods are those where the 50 percent of time hydrograph curve exceeds the median flow and, conversely, low-flow periods are identified by the time when the 50 percent curve is below the median flow.

Base Flow Hydrograph Construction

The controlling hydrograph curve that serves as a basis for final base flow level definition is constructed as follows:

1. Identify high and low-flow periods.

2. Delineate the 95 percent of time hydrograph curve during high flow.

3. Delineate a low-flow period curve parallel to adjacent hydrograph curves at the appropriate percent level.

4. Connect the two curves with a smooth transition line covering a two month period of time, starting one month before the time when the 50 percent of time curve crosses the median flow and extending one month beyond this date.

Detailed hydrographs prepared in this manner are then used as the basis for developing final working hydrographs. The working hydrographs are constructed by a series of connected straight lines that closely approximate the detailed hydrograph shape but eliminate anamolous irregularities that distort general flow trends. Normally the basic semi-log plotted hydrograph can be closely approximated with about four to six straight line segments. In regulation form, specific points along each straight line segment of the final base flow hydrograph are described by flow value and date.

Base Flow Management

Administrative Rules

RCW 90.54.040(1) directs the Department of Ecology to adopt appropriate rules and regulations to assure that waters of the state are utilized for the best interests of its people. Rules defining base flow levels and describing management procedures are therefore being developed for

adoption as an integral part of each comprehensive basin water management program. Each basin regulation will be tailored to accommodate specific problems and usually, in addition to base flow, only appropriate elements will be included in each regulation. Considering base flow and related aspects, each regulation will normally include sections to establish base flows, to confirm historical stream closures and define new closures, to establish appropriation limits and to define management procedures and relationships among these elements. To amplify the regulations, it is anticipated that much of the administrative detail on base flow management will be incorporated in agency standard operating procedures.

Streamflow Control

As stated previously, the foundation for base flow management is an adequate flow measurement network for controlling out-of-stream water diversions. In the conduct of field activities to maintain base flow levels, certain key control stations will be designated as regional streamflow indicators. These stations could be incorporated as part of the Columbia River Operational Hydro-Meteorological Management System (CROHMS), an integrated system run essentially by federal agencies for the rapid or real time monitoring of hydrologic and meteorlogic data. The key control station network shall be used to monitor general streamflow conditions and will serve to identify where flows are approaching required base flow levels, thus signaling when water right regulation will be necessary. During periods of critical flow, all control stations will be monitored directly in the field as conditions require.

Water Right Regulation

The implementation of any type of flow preservation program greatly increases the complexity of water right regulation activities. With the addition of base flow requirements, water right regulation can essentially be divided into three different phases:

1. Water rights established later than the effective date of a base flow regulation -

    a. For management units with downstream control, when streamflow recedes to established base flow levels, the upstream diversions under such rights are stopped in order of priority until there is sufficient flow at the control station to meet or exceed the required base flow.

    b. For management units with upstream control, to assure the maintenance of established base flow levels below the station, a specific downstream water diversion within the management unit must be stopped when the flow at the gage is equal to the established base flow, plus the amount of the water right diversion in question added to the amount of other downstream diversions in the management unit that have water right priority dates between the time when the base flow was established and the priority date of the specified diversion.

2. Water rights established before the effective date of a base flow regulation that are subject to low-flow restrictions-

   a. For water rights with low-flow restrictions that are equal to or less than base flow requirements, diversion shall be controlled in priority sequence according to individual conditions of each low-flow proviso.

   b. For water rights with low-flow restrictions that exceed base flow requirements, the Department of Ecology, in concert with the principle of priority based on time, shall take no action to regulate such rights until all diversions under rights subject to base flows have been curtailed.

3. Water rights established before the effective date of a base flow regulation that are not subject to low-flow restrictions. Such rights are regulated in priority sequence only when there is insufficient water available to accommodate all rights in this category and only after diversion has been curtailed under all other rights that are subject to flow restrictions.

In addition to the foregoing, minimum flow regulations may be promulgated under authority of Chapter 90.22 RCW to supersede base flow regulations and, in such cases, a fourth phase would be superimposed on the water right regulation system. Here base flow requirements, specified for water rights in existence prior to the effective date of the minimum flow regulation, remain in force, while water rights holding priorities later than that date are only subject to the minimum flow restrictions. If base flows can be established, however, that will adequately accommodate instream requirements, there will be little need for imposing additional restrictions on streams through the minimum flow procedure.

BASE FLOW CLASSIFICATION

STREAM REACHES

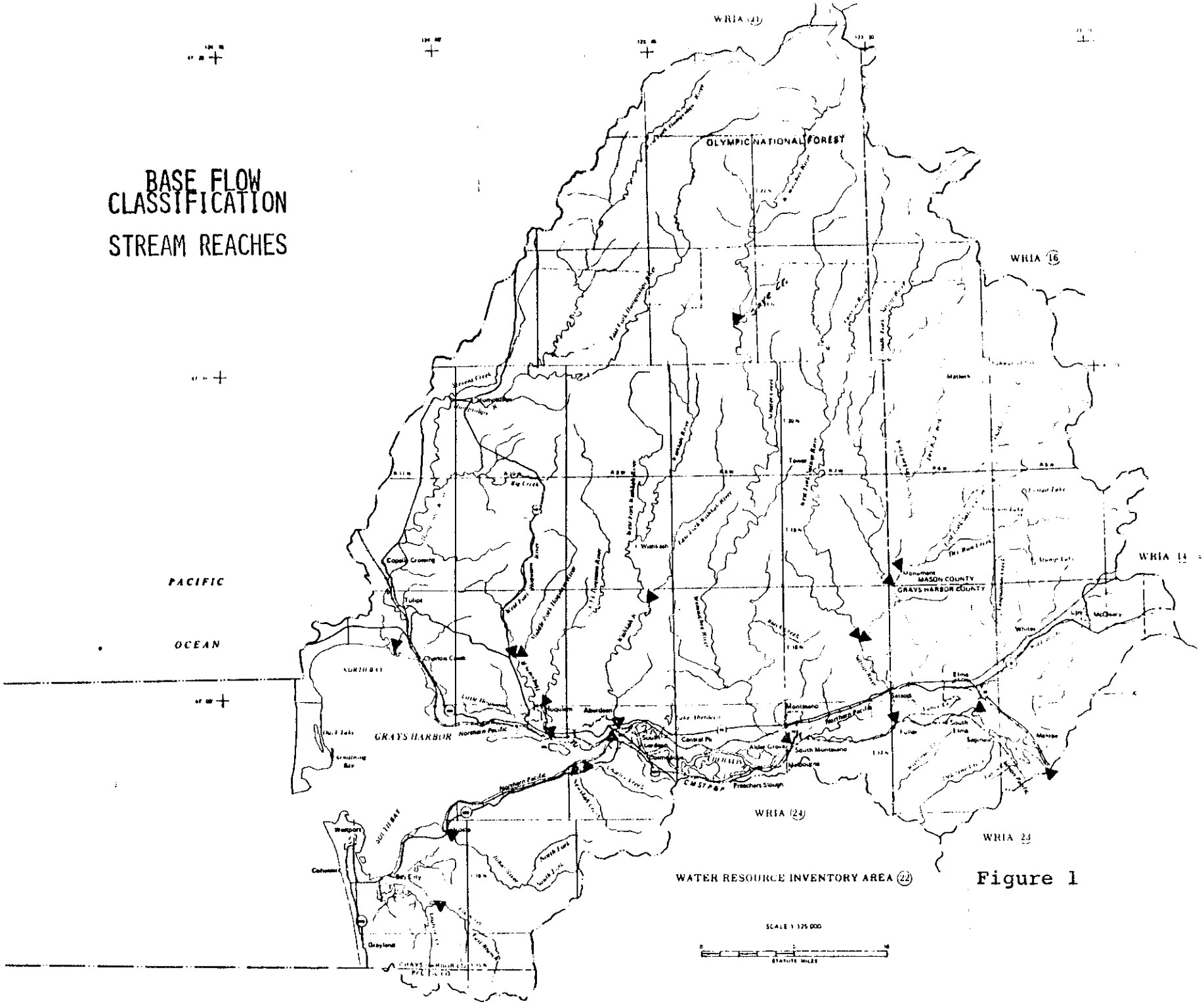
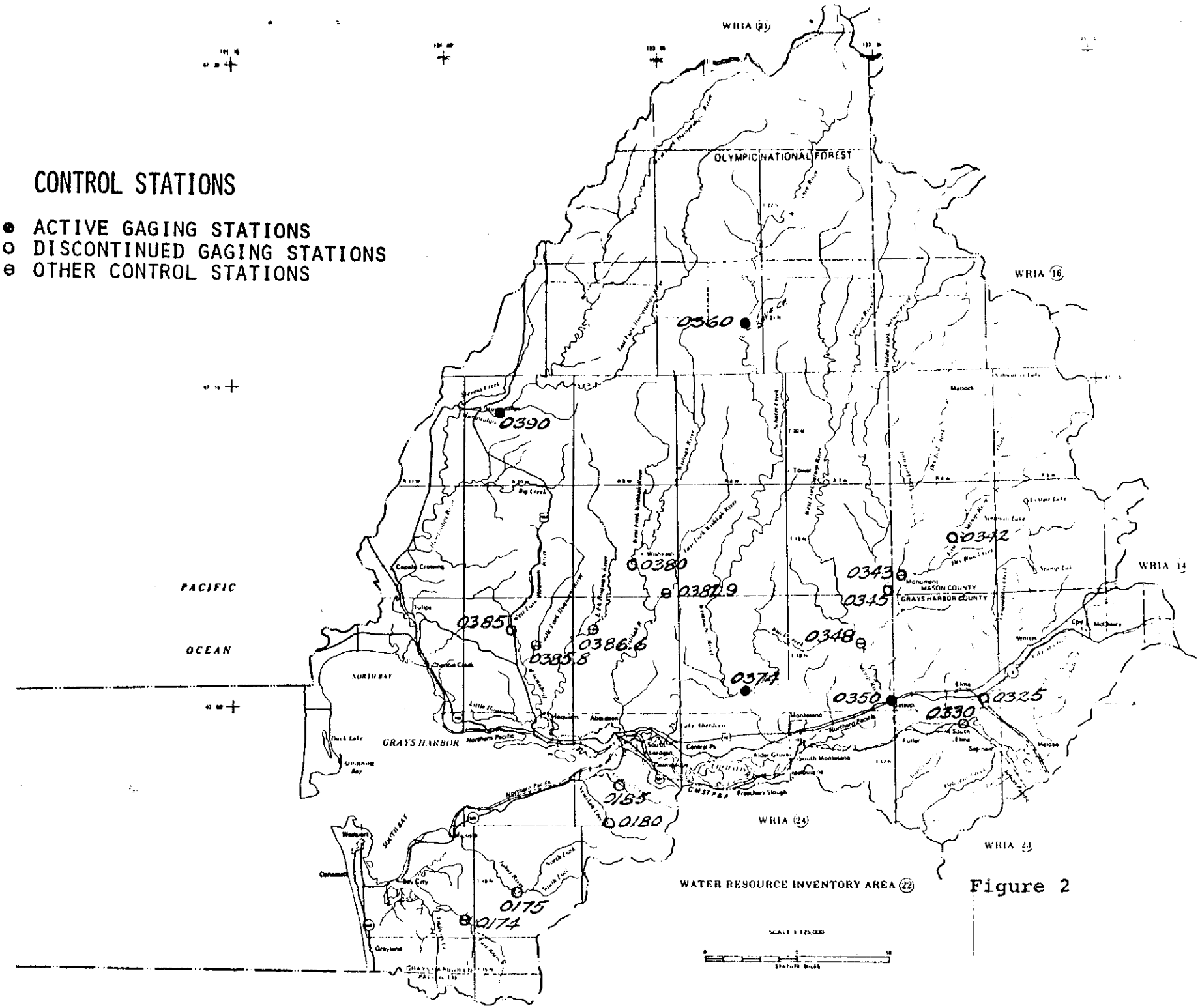


Figure 1


CONTROL STATIONS
● ACTIVE GAGING STATIONS
○ DISCONTINUED GAGING STATIONS
⊖ OTHER CONTROL STATIONS
WRIA (21)
WRIA (16)
WRIA (14)
WRIA (24)
WRIA (23)
OLYMPIC NATIONAL FOREST
PACIFIC
OCEAN
GRAYS HARBOR
MASON COUNTY
GRAYS HARBOR COUNTY
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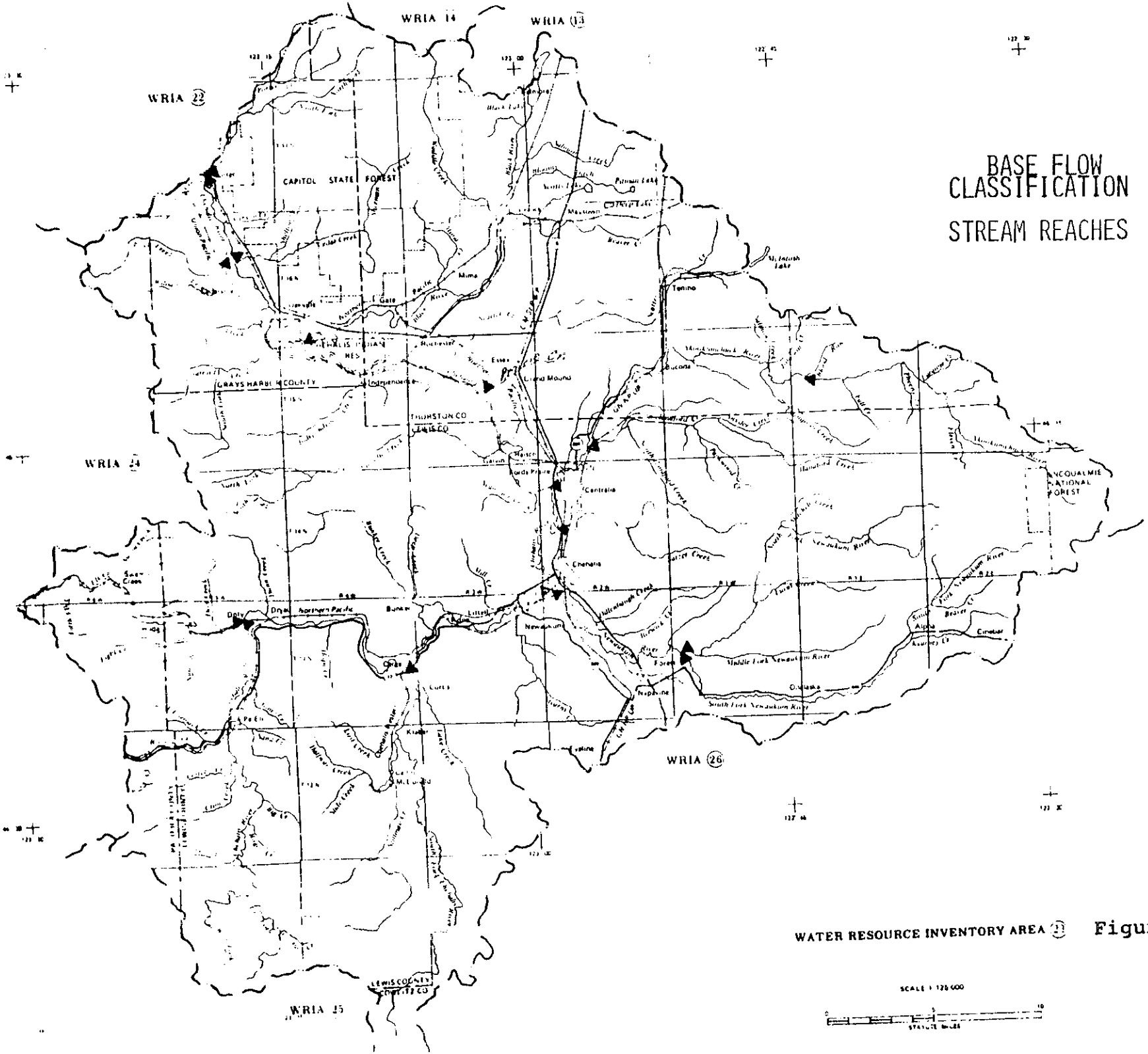
0390
0380
0382.9
0385
0385.8
0386.6
0342
0343
0345
0348
0374
0350
0325
0330
0185
0180
0175
0174
WATER RESOURCE INVENTORY AREA (22)

Figure 2



BASE FLOW CLASSIFICATION

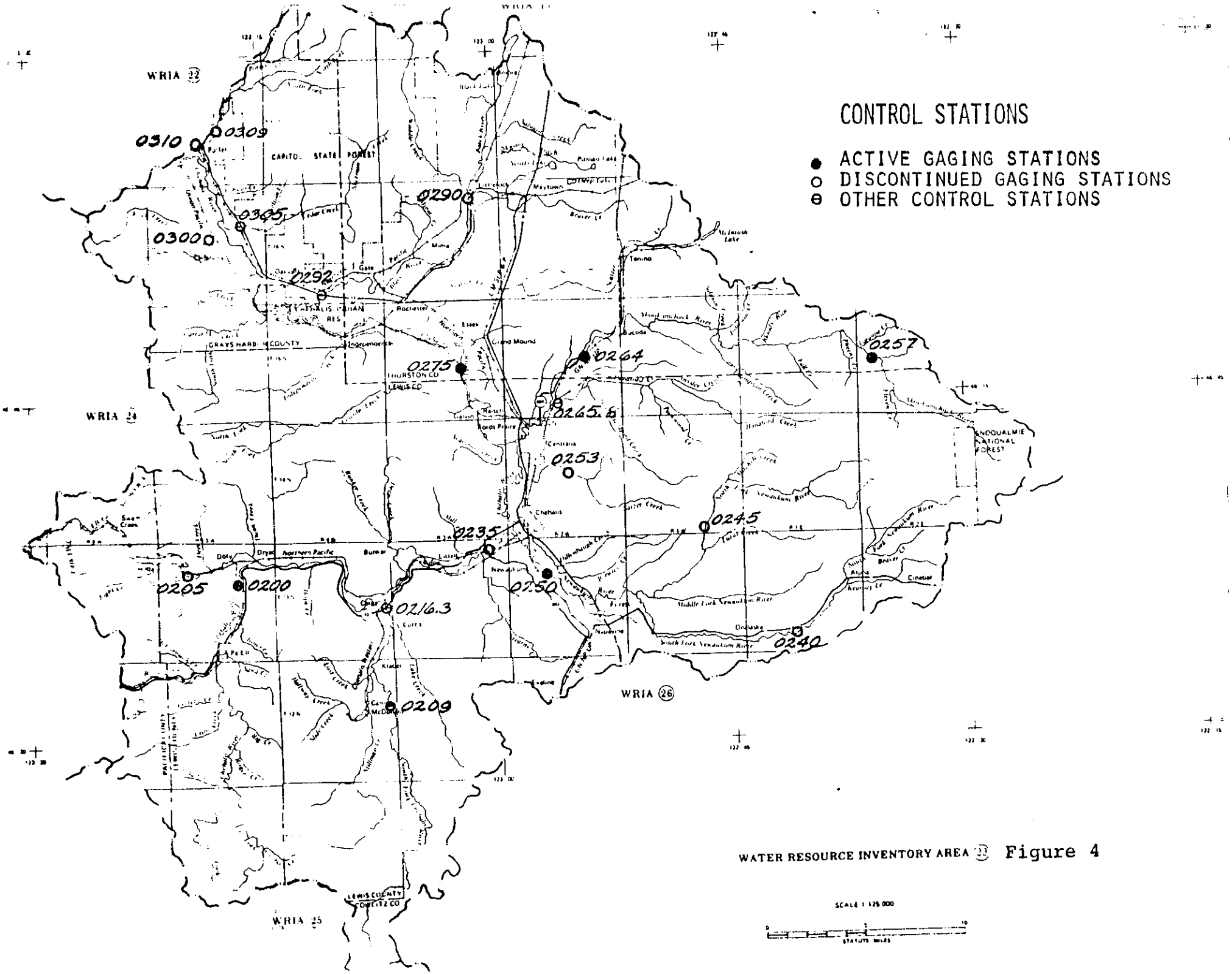
STREAM REACHES

WATER RESOURCE INVENTORY AREA 23

Figure 3

SCALE 1:125,000

STATUTE MILES



WATER RESOURCE INVENTORY AREA (23) Figure 4

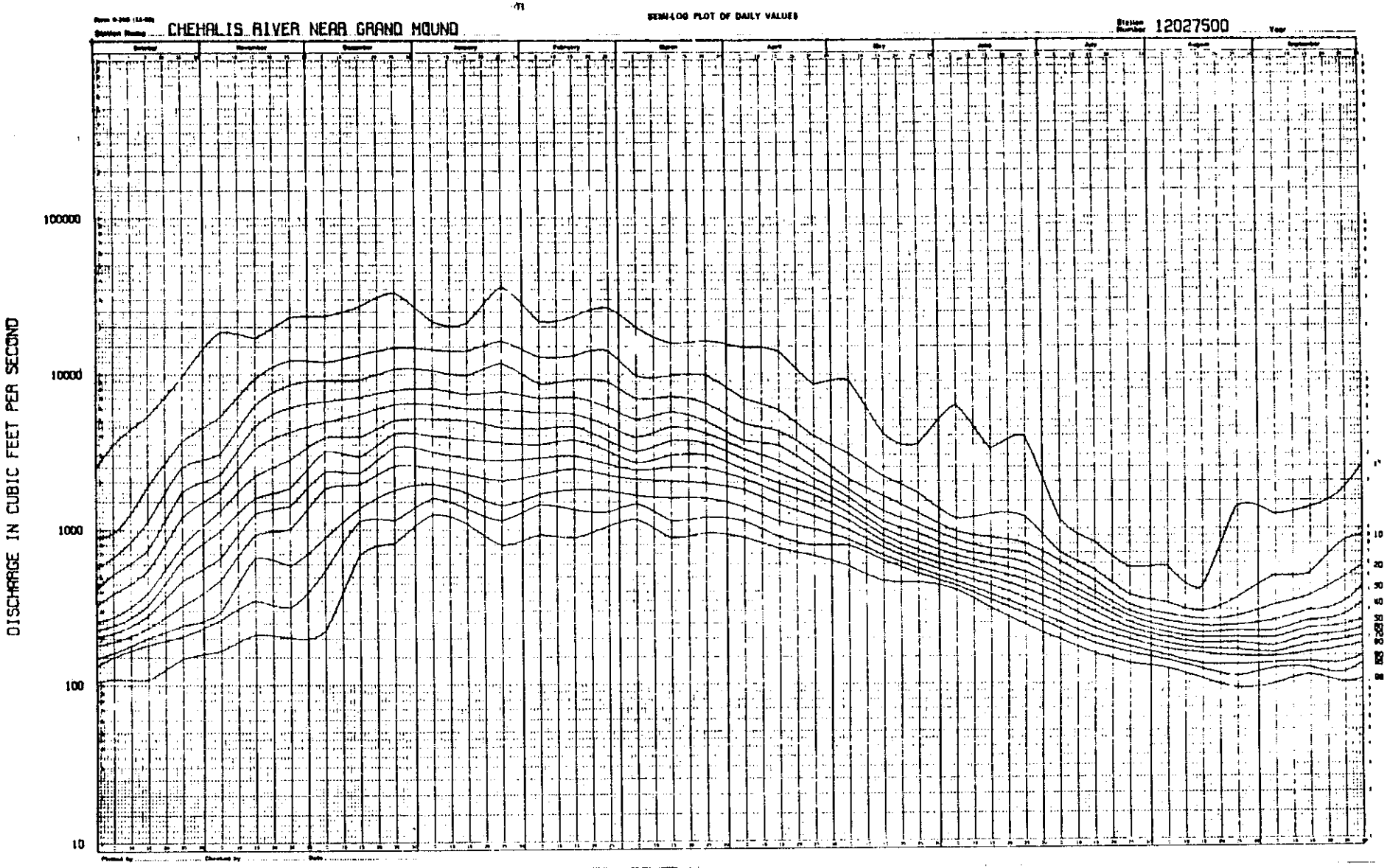
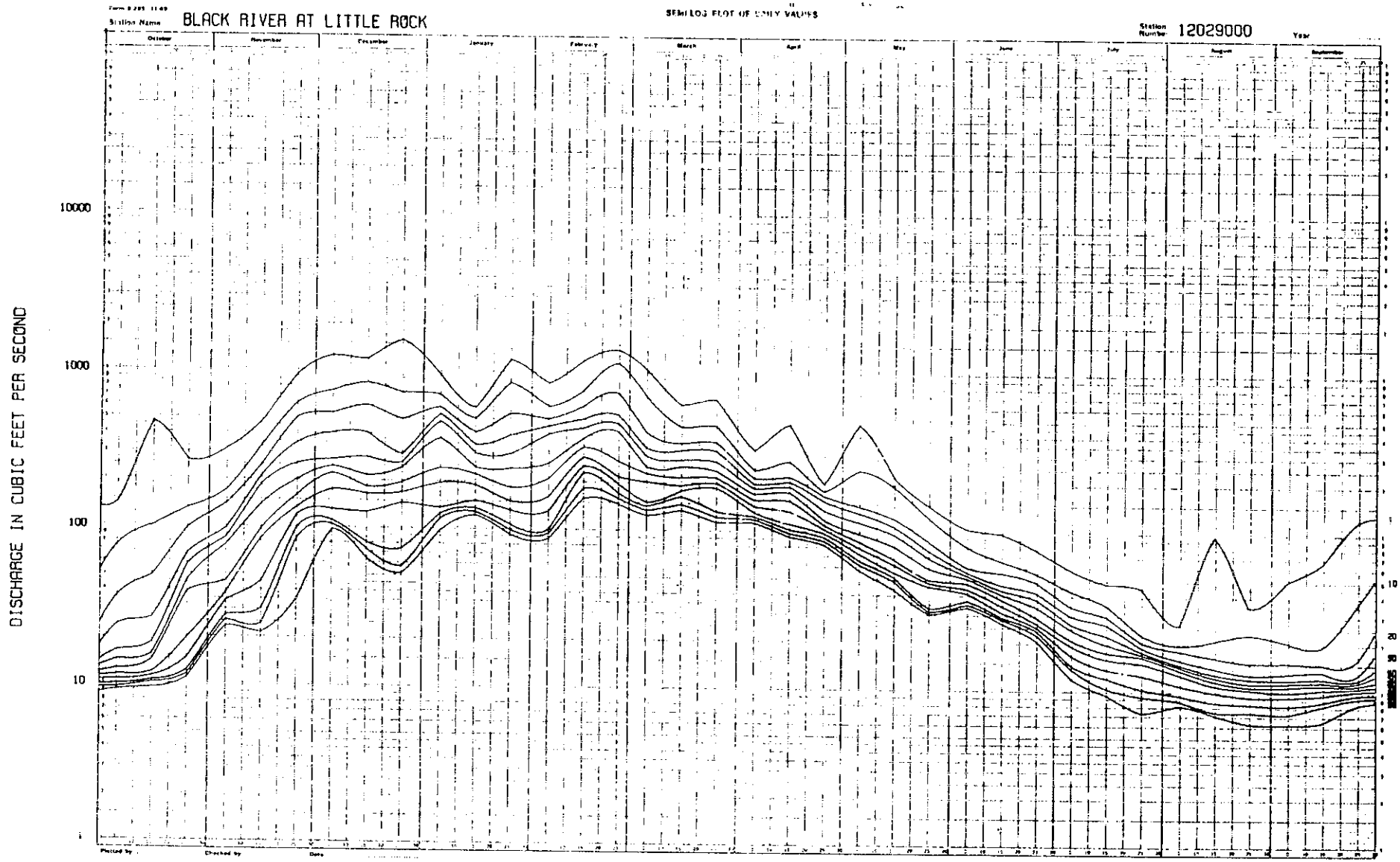

CHEHALIS RIVER NEAR GRAND MOUND
SEMI-LOG PLOT OF DAILY VALUES
12027500
DISCHARGE IN CUBIC FEET PER SECOND
100000
10000
1000
100
10

Figure 5


BLACK RIVER AT LITTLE ROCK
SEMILOG PLOT OF DAILY VALUES
Station Number 12029000
Year
October
November
December
January
February
March
April
May
June
July
August
September
DISCHARGE IN CUBIC FEET PER SECOND
10000
1000
100
10

Figur 5

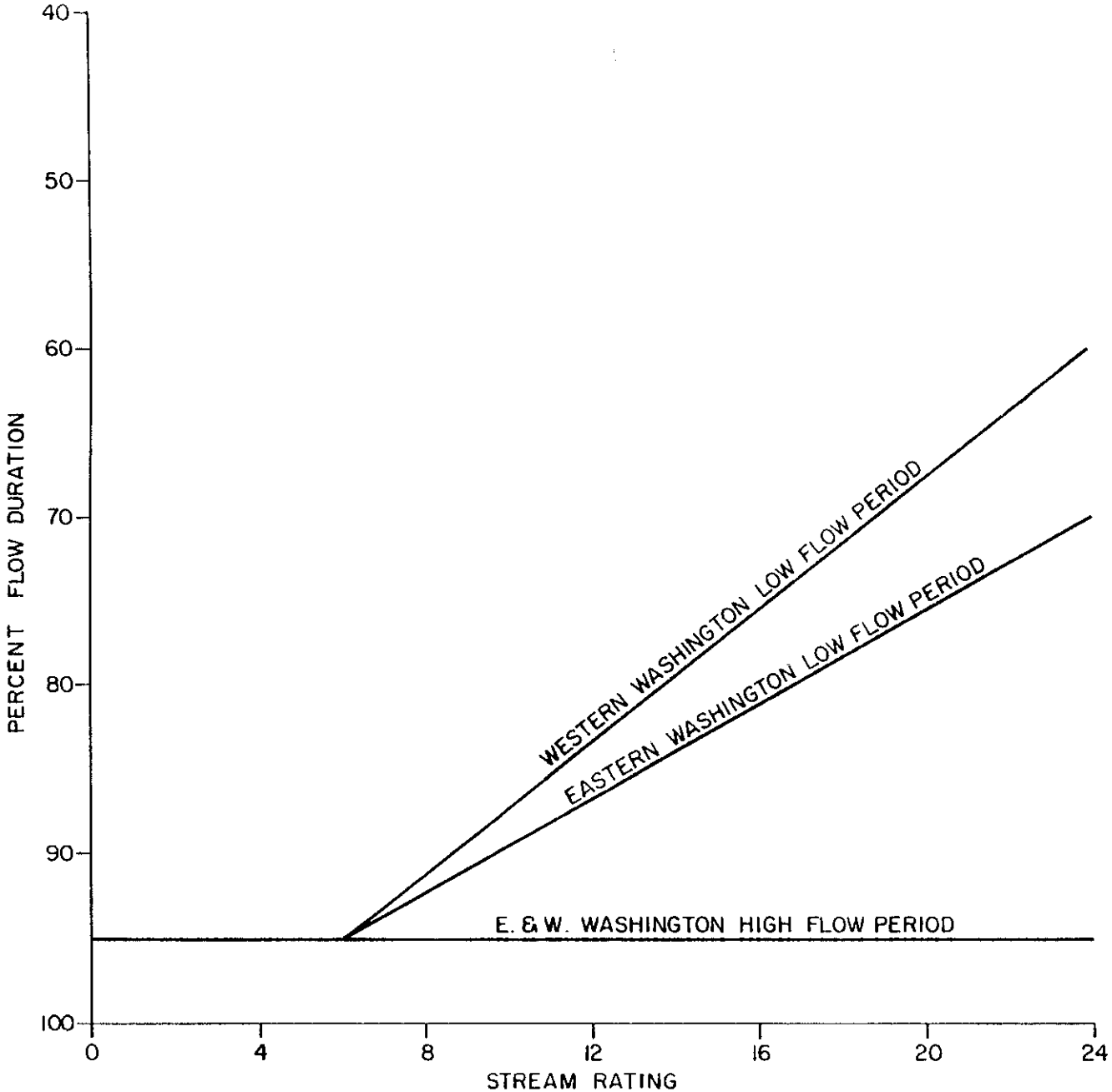
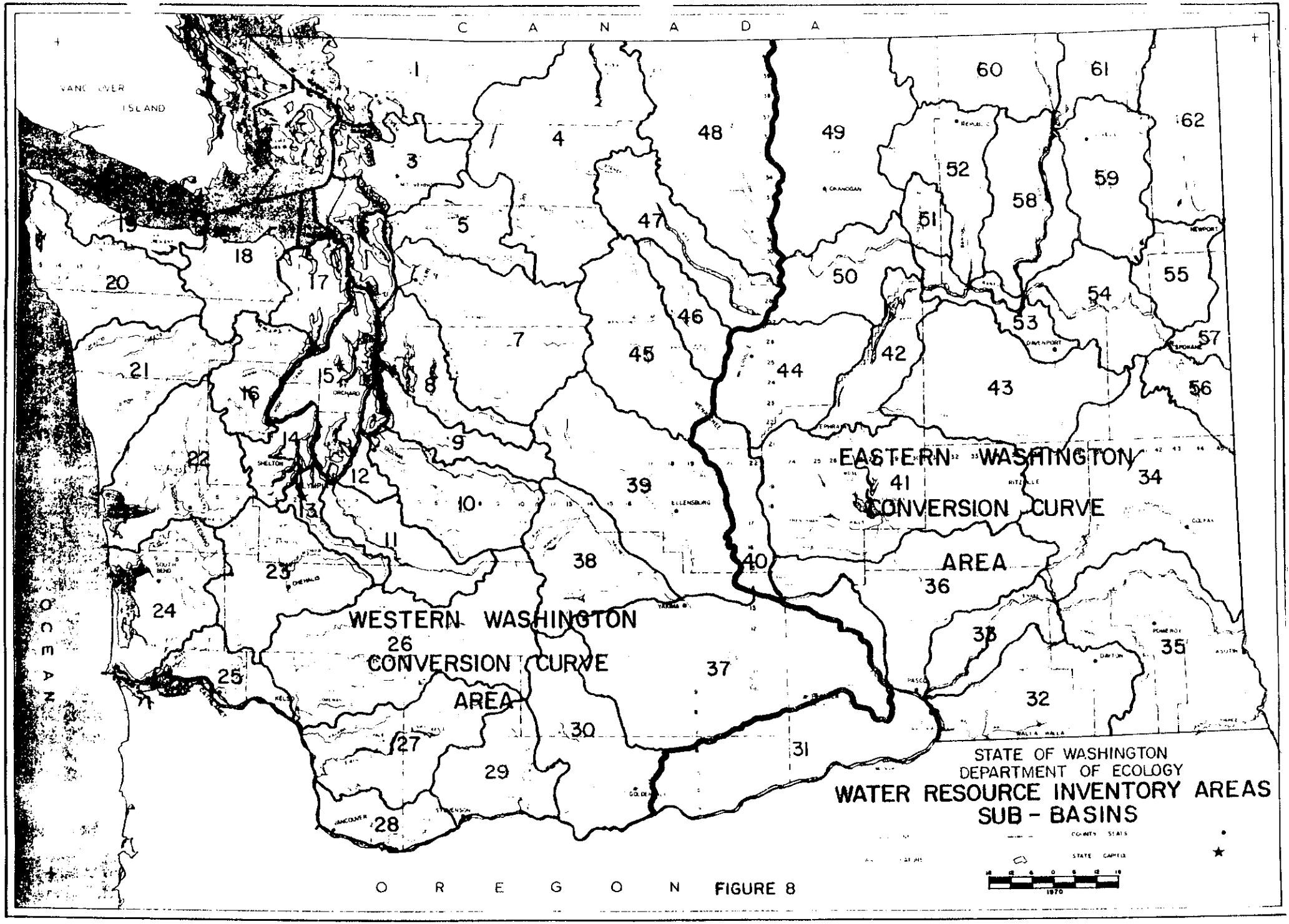


Figure 7. CONVERSION CURVES
STREAM RATING TO PERCENT FLOW DURATION


C A N A D A
VANCOUVER ISLAND
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EASTERN WASHINGTON
CONVERSION CURVE
AREA
WESTERN WASHINGTON
CONVERSION CURVE
AREA
O R E G O N
STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
WATER RESOURCE INVENTORY AREAS
SUB - BASINS
COUNTY SEATS
STATE CAPITAL
1970

FIGURE 8

BASE FLOWS in WRIA-22

1 of 3

Control Station / Stream Name / (Non Standard Reach Description)	Number / River Mile / Sec.Twp.Rge.	Stream Rating: Wildlife	Fish	Scenic Aes.	Navigation	Other Environ.	Quality Std.	Total Rating (Flow Levels)	Required Quantities in Cubic Feet per Second: Jan / May / Sep 1	15	Feb / Jun / Oct 1	15	Mar / July / Nov 1	15	Apr / Aug / Dec 1	15
Elk R.	12.0174.00	4.0	3.0	2.[illegible]	1.0	0.5	3.0	13.5	50							50
	3.0							(81)	43	37	31	26	22	19	16	16
	36-16-11W							(95)	16	16	20	25	32	40	50	50
Johns R.	12.0175.00	4.0	4.0	2.[illegible]	2.0	0.5	3.0	15.5	70						70	59
	6.0							(77)	50	42	35	29	24	21	17	17
	21-16-10W							(95)	17	17	17	24	35	49	70	70
Newskah Cr.	12.0180.00	3.0	3.0	1.5	0.7	0.5	3.2	11.7	17							17
	3.5							(84)	13.4	10.7	8.3	6.5	5.2	4.1	3.2	2.5
	32-17-9W							(95)	2.5	2.5	3.2	4.0	8.4	17	17	17
Charley Cr.	12.0185.00	2.0	3.0	1.2	0.7	0.5	3.0	10.4	14							14
	2.0							(87)	11.0	8.6	6.7	5.4	4.2	3.3	2.5	2.0
	21-17-9W							(95)	2.0	2.0	2.6	3.5	7.1	14	14	14
Cloquallum R.	12.0325.00	3.0	4.0	2.3	0.7	1.5	3.0	14.5	150							150
	1.9							(78)	118	92	70	55	43	34	29	24
	36-18-6W							(95)	24	24	27	30	52	88	150	150
Chehalis R. (Mouth to confl. w/ [illegible] Cr. ex. [illegible] [illegible] Cr.)	12.0[illegible]	4.0	4.0	1.8	4.0	3.5	3.0	20.3	2700							2700
	23.94							(67)	[illegible]	1550	1150	860	660	500	380	290
	10-17-6W							(95)	[illegible]	[illegible]	360	450	580	1500	2700	2700
E. Fk. Satsop R. (Confl. w/ W. Fk. to [illegible] ex. M. Fk. Satsop & Decker Cr.)	12.0342.00	4.0	4.0	3.0	3.0	2.0	4.0	20.0	280							280
	15.9							(63)	240	210	175	152	130	112	104	95
	15-19-6W							([illegible])	86	80	80	80	125	185	280	280
Decker Cr.	12.034[illegible]	4.0	4.0	1.3	2.7	0.5	4.0	15.0	130							130
	0.3							(77)	115	103	91	81	72	64	56	50
	31-[illegible]							(95)	50	50	54	58	77	100	130	130
W. Fk. Satsop R.	12.034[illegible]	4.0	4.0	2.6	2.3	2.0	4.0	18.9	260							260
	0.1							(70)	203	160	125	98	78	61	48	38
	36-19-7W							(95)	38	38	41	45	83	145	260	260

Table 1

BASE FLOWS in WRIA-22

Control Station / Stream Name (Non Standard Reach Description)	Number / River Mile / Sec. Twp. Rge	Stream Rating: Wildlife	Fish	Scenic & Aesth.	Navigation	Other Environ.	Quality Std.	Total Rating (Flow Level)	Required Quantities in Cubic Feet per Second: Jan May Sep 1	Jan May Sep 15	Feb Jun Oct 1	Feb Jun Oct 15	Mar July Nov 1	Mar July Nov 15	Apr Aug Dec 1	Apr Aug Dec 15
W. Fk. Satsop R.	12.0348.00	4.0	4.0	2.6	2.3	2.5	4.0	19.4	400							400
	0.5							(69)	325	260	205	165	133	107	84	68
	14-8+7W							(95)	68	68	76	85	144	240	400	400
Satsop R. (Mouth to confl. W/E. & W. Fks. Satsop R.)	12.0350.00	4.0	4.0	3.0	3.7	2.0	3.0	19.7	1100							1100
	2.3							(68)	910	750	600	500	425	340	300	260
	36-18-7W							(95)	260	260	280	300	475	720	1100	1100
Wynoochee R. (Cave Cr. to Mouth)	12.0360.00	4.0	4.0	3.4	1.7	2.5	4.0	19.6	430							430
	40.6							(68)	430	430	430	340	275	220	175	173
	23-21-5W							(95)	143	143	143	205	300	430	430	430
Wynoochee R. (Mouth to confl. W/F inch Cave Cr.)	12.0374.00	4.0	4.0	2.2	3.7	2.5	3.0	20.0	560							560
	5.9							(68)	560	560	450	340	290	230	185	150
	27-15-5W							(95)	150	150	150	230	360	560	560	560
Wishkah R. (Ex. E. Fk. Wishkah R.)	12.0382.00	4.0	4.0	1.6	3.7	2.0	3.0	18.5	135							135
	16.2							(71)	135	113	95	80	68	57	47	47
	22-19-9W							(95)	47	47	53	60	91	135	135	135
E. Fk. Wishkah R.	12.0382.90	3.0	4.0	2.0	0.3	1.0	3.0	13.3	33							33
	0.9							(81)	33	27	21	17	14	11.3	9.0	9.0
	36-19-9W							(95)	9.0	9.0	10.4	12.0	20	33	33	33
W. Fk. Hoquiam R.	12.0385.00	4.0	4.0	2.0	1.3	3.0	3.0	17.3	32							32
	2.4							(73)	32	26	20	16	12.8	10.0	8.0	8.0
	9-15-10W							(95)	8.0	8.0	9.4	11.0	17	32	32	32
M. Fk. Hoquiam R.	12.0385.80	4.0	4.0	1.6	1.3	1.0	3.0	14.9	27							27
	1.6							(78)	27	21	16	12.2	9.5	7.4	5.6	5.6
	14-14-10W							(95)	5.6	5.6	6.7	8.0	15	27	27	27
E. Fk. Hoquiam R.	12.0386.60	4.0	4.0	2.2	1.7	1.5	3.0	14.4	44							44
	7.1							(76)	44	38	33	29	25	22	19	12
	6-14-9W							(95)	19	19	19	25	34	44	44	44

Table 1 Continued

BASE FLOWS in WRIA 22

Control Station / Stream Name / Number / River Mile / Sec. Twp. Rge. (Non Standard Reach Description)	Stream Rating: Wildlife	Fish	Scenic & Aesth.	Navigation	Water Quality	Total Rating (Flow Level)	Required Quantities in Cubic Feet per Second: Jan May Sep 1	Jan May Sep 15	Feb Jun Oct 1	Feb Jun Oct 15	Mar July Nov 1	Mar July Nov 15	Apr Aug Dec 1	Apr Aug Dec 15
Hoquiam R. (Mouth to confl. w/ N. & W. Frks. ex. E. Fk. Hoquiam R.)	2	4	0	4	3	3 1 5 2 0	13.6 (60) (95)							
Humptulips R.	4.0	4.0	3.0	3.7	2.5	3.0	20.2 (67) (95)	600 600 170	500 170	400 205	325 250	265 390	215 600	170 600	600 170 600
12.0 39 20.00 24.8 17-20-10W														

Table 1 Continued

BASE FLOWS in WRIA-23

Control Station / Stream Name (Non Standard Reach Description)	Number / River Mile / Sec. Twp. Rge.	Wildlife	Fish	Scenic-Aes	Navigation	Other Envir.	Quality Std.	Total Rating (Flow Levels)	Jan/May/Sep 1	Jan/May/Sep 15	Feb/Jun/Oct 1	Feb/Jun/Oct 15	Mar/July/Nov 1	Mar/July/Nov 15	Apr/Aug/Dec 1	Apr/Aug/Dec 15
Chehalis R.	12.02[illegible].00	4.0	4.0	2.3	1.7	1.0	4.0	16.9	260	—	—	—	—	—	—	260
(Confl. w/Elk Cr. to hwrs)	101.8							(73)	195	146	108	82	62	46	37	31
	14-13-5W							(95)	31	31	39	47	88	150	260	260
Elk Cr.	12.0225.00	3.0	3.0	1.8	0.0	0.5	3.0	11.5	100	—	—	—	—	—	—	100
	2.5							(85)	76	57	43	32	25	19	16	14
	5-13-5W							(95)	14	14	15	17	31	56	100	100
S. Fk. Chehalis R.	12.0209.00	3.0	4.0	1.7	1.0	1.5	3.0	14.2	85	—	—	—	—	—	—	85
(Also see P-3 for	8.0							(72)	60	43	31	22	16	11.5	8.2	6.0
Alternate Control)	13-12-4W							([illegible])	[illegible]	[illegible]	9.2	11.0	22	43	8.5	8.5
Chehalis R. (Confl. w/	12.0235.00	4.0	4.0	3.0	2.7	2.0	3.0	18.7	700	—	—	—	—	—	—	700
Newaukum R. to confl. w/	77.6							(71)	525	400	300	250	175	130	98	75
Elk Cr. ex S. Fk. Chehalis R.)	2-13-5W							(95)	75	75	92	115	215	390	700	700
S. Fk. Newaukum R.	12.02[illegible].00	3.0	4.0	1.8	0.7	1.5	3.0	14.0	125	—	—	—	—	—	—	125
	22.8							(77)	110	88	70	56	45	36	29	27
	28-13-1E							(95)	27	27	33	40	58	85	125	125
N. Fk. Newaukum R.	12.0245.00	3.0	4.0	1.8	0.3	3.0	3.0	15.1	62	—	—	—	—	—	—	62
	6.6							(77)	51	38	27	20	14.7	10.8	7.6	7.0
	35-14-1W							(95)	7.0	7.0	[illegible]	[illegible]	19	34	62	62
Newaukum R. (Confl. w/	12.0250.00	3.0	4.0	1.8	1.3	1.5	3.0	14.6	250	—	—	—	—	—	—	250
Chehalis R. to confl. w/N. & S.	4.1							(78)	210	160	118	90	68	52	38	35
Fk. Newaukum R.)	9-13-2W							([illegible])	35	35	43	51	91	150	250	250
Sulzer Cr.	12.025[illegible].00	2.0	3.0	1.2	0.0	0.5	3.0	9.7	11.0	—	—	—	—	—	—	11.0
	3.3							(85)	5.6	2.8	1.4	0.75	0.55	[illegible]	0.10	[illegible]
	22-[illegible]-[illegible]							([illegible])	0.25	0.25	0.14	0.40	1.35	3.9	11.0	11.0
[illegible]	12.0257.00	4.0	4.0	2.3	1.7	[illegible]	4.0	15.5	105	—	—	—	—	—	—	105
[illegible]	29.3							(71)	105	86	70	57	47	32	31	26
[illegible]	20-15-2E							(95)	26	—	—	26	42	66	105	105

Table 2

BASE FLOWS in WRIA-23		Stream Rating							Required Quantities in Cubic Feet per Second							3
Control Station / Stream Name / (Non Standard Reach Description)	Number / River Mile / Sec. Twp. Rge.	Wildlife	Fish	Scenic-Aes	Navigation	Other Envir	Quality	Total Rating (Flow Levels)	Jan May Sep 1	15	Feb Jun Oct 1	15	Mar July Nov 1	15	Apr Aug Dec 1	15
Skookumchuck R.	12.0264.[illegible]	3.0	4.0	3.3	1.3	2.5	3.0	17.1	160							160
(Mouth to confl. w/tinel. Black	6.4							(73)	160	130	103	83	67	54	43	35
Run Cr. ex. Hanaford Cr.)	22-15-2W							(95)	35			35	59	96	160	160
Hanaford Cr.	12.0265.80	2.0	3.0	1.8	0.0	2.0	3.0	11.8	4.0							4.0
	0.4							(84)	2.8	2.0	1.4	10.0	7.0	5.0	3.5	2.5
	33-15-2W							(95)	2.5	2.5	3.3	4.5	6.0	11.0	21	4.0
Chehalis R. (Confl. w/	12.0275.00	4.0	4.0	2.3	3.0	2.5	3.0	19.0	1300							1300
Newaukum R. to confl. w/Prairie	59.9							(70)	1000	780	600	460	355	275	210	165
Cr. ex. Skookumchuck R. & Salzer Cr.)	22-15-3W							(95)	165	165	200	250	440	760	1300	1300
Black R.	12.0290.00	4.0	4.0	2.6	3.0	2.0	3.0	18.6	100							100
(Confl. W/Beaver Cr. to	17.2							(71)	76	57	42	32	24	18	13.0	10.0
[illegible])	2-16-3W							(95)	10.0	10.0	10.5	11.0	24	49	100	100
Black R. (Mouth to confl.	12.0292.00	4.0	4.0	2.6	3.0	2.0	3.0	18.6	200							200
w/and incl. Beaver Cr.)	4.1							(71)	170	145	120	104	88	75	70	66
	33-16-4W							(95)	66	66	68	70	100	140	200	200
Rock Cr.	12.0303.00	2.0	4.0	1.4	0.0	2.5	3.0	12.9	4.0							4.0
	1.2							(86)	2.6	1.8	1.5	7.7	5.2	3.5	2.3	1.5
	15-16-5W							(95)	1.5	1.5	1.9	2.5	6.5	16	40	4.0
Cedar Cr.	12.0305.00	4.0	3.0	2.2	0.3	1.5	3.0	14.0	90							90
	1.1							(77)	70	54	40	31	24	19	14	11.0
	14-16-5W							(95)	11.0	11.0	13.8	17	30	52	90	90
Porter Cr.	12.0309.00	4.0	4.0	2.7	0.0	2.5	3.0	16.2	90							90
	1.3							(75)	56	35	27	24	21	17	14.2	12.0
	22-17-5W							(95)	12.0	12.0	13.3	15	28	50	90	90
Chehalis R. (Confl. w/Black	12.0310.00	4.0	4.0	2.0	3.0	2.0	3.0	18.0	2500							2500
Cr. to confl. w/Prairie Cr. ex. Black	33.3							(72)	1800	1420	1050	810	610	460	340	260
R., Rock, Cedar & Porter Crs.)	28-17-5W							(95)	260	260	320	400	760	1380	2500	2500

Table 2 Continued

BASE FLOWS in WRIA-23

3 of 3

Control Station / Stream Name / (Non Standard Reach Description)	Number / River Mile / Sec. Twp. Rge	Stream Rating: Wildlife	Fish	Scenic & Aesth.	Navigation	Other Equip.	Quality Std.	Total Rating (Flow Level)	Required Quantities in Cubic Feet per Second: Jan May Sep 1	Jan May Sep 15	Feb Jun Oct 1	Feb Jun Oct 15	Mar July Nov 1	Mar July Nov 15	Apr Aug Dec 1	Apr Aug Dec 15
S. Fk. Chehalis R. (Alternate Control)	12.02 No. 30 a3	3	0	4	0	1	7	1.0	1.5	3.0	14.2	200						200
											(79)	145	105	75	55	40	29	21	15
	24-13-4W										(95)	15	15	21	28	56	105	200	200

Table 2 Continued

TABLE 3

PARAMETER DEFINITIONS

Wildlife Values

Includes use values for wild animals and birds. Fish are excluded.

Fish Values

Includes use values for propagation, rearing, and migration of fish, and values of streams for fishing.

Scenic and Aesthetic Values

Includes audible and visual values of natural beauty associated with flowing streams and their surroundings.

Navigational Values

Refers to commercial and recreational boating, including canoeing, kayaking, and rafting.

Other Environmental Values

Refers to other miscellaneous environmental values not covered under the above parameters and includes other forms of recreation, such as swimming and wading.

Water Quality Standards

Refers to Washington Water Quality Standards as revised and adopted on June 19, 1973.

TABLE 4

STREAM CLASSIFICATION SYSTEM FOR DETERMINING BASE FLOW LEVELS
BASED ON RELATIVE ENVIRONMENTAL PRESERVATION INTEREST

Parameters	Basis of Rating		Rating Value
Wildlife Values Fish Values Scenic and Aesthetic Values Navigation Values Other Environmental Values			
	Very high value or heavy usage	(VH)	4
	Generally high value or usage	(H)	3
	Moderate value or usage	(M)	2
	Low value or light usage	(L)	1
	No value or usage	(N)	0
Water Quality Standards			
	Class AA		4
	Class A or Lake Class		3
	Class B		2
	Class C		1

TABLE 5

BASE FLOW STREAM CLASSIFICATION
COMMITTEE MEMBERSHIP AGENCIES

Department of Ecology

Department of Fisheries

Department of Game

Department of Natural Resources

Department of Highways

Interagency Committee for Outdoor Recreation

State Parks and Recreation Commission