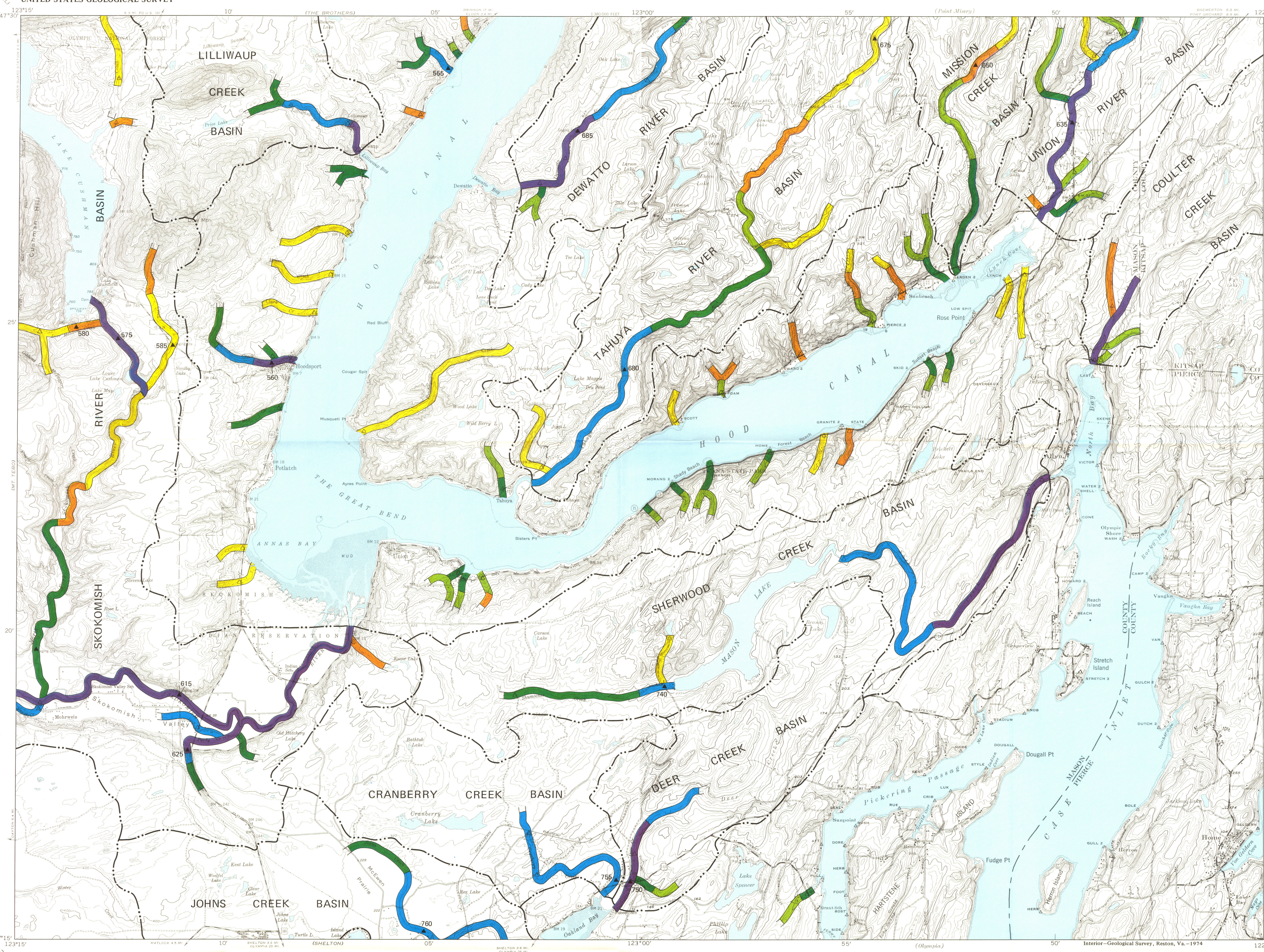
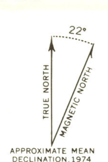
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

FOLIO OF THE SOUTHERN HOOD CANAL AREA, WASHINGTON
MAP I–853–C



Base from U.S. Geological Survey
Potlatch, 1952 and Allyn, 1938

Interior–Geological Survey, Reston, Va.–1974



SCALE 1:62 500

1 ½ 0 1 2 3 4 MILES

1 .5 0 1 2 3 4 KILOMETERS

CONTOUR INTERVALS 40 AND 20 FEET
DATUM IS MEAN SEA LEVEL
DEPTH CURVES IN FEET–DATUM IS MEAN LOWER LOW WATER
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE AVERAGE RANGE OF TIDE IS APPROXIMATELY 8 FEET

INTRODUCTION

This report deals with streamflow—mainly with low flows—adjacent to southern Hood Canal in east-central Mason County. Such information is important because low-flow conditions largely determine the useable amounts of stream water available for existing and potential land uses. Present land uses are mainly for forestry, recreation, and rural and suburban homes; urban development is minor. Intensification of the recreation-oriented uses in recent years, particularly for second-home sites, has created a pressing need for information on local surface-water conditions to assist in planning and managing water supplies. This is one of a series of reports being prepared through the cooperation of several agencies to present basic information and interpretations of an environmental nature to assist land-use planning, resources development, and environmental protection in the southern Hood Canal area and other parts of the Puget Sound basin.

As new properties in this area are developed near lakes and streams each year, more water will be needed and, at the same time, the threat of water pollution will increase. Recreation and home development, two of the principal activities in the area, could both be seriously affected by surface-water depletion or by deterioration of surface-water quality. Continuous records of streamflow conditions, including floods, are necessary for certain water-management studies and decisions. However, many planning needs require special consideration of the low flows of streams, for two principal reasons. First, in spite of a general abundance of water, the area has a distinctly dry summer season and this season of lowest streamflow is also the time of greatest water needs. Second, adequate low flows are essential for sustaining migratory fish that utilize many of the streams in the area (Collings and others, 1972; Findlay, 1973). Low-flow data also are needed to evaluate the impact of waste discharge on stream quality.

SEASONAL VARIATION IN AVERAGE STREAMFLOW

Streamflow data, compiled to show periods of maximum, mean, and minimum monthly discharge, illustrate the extent to which precipitation and the geologic setting cause marked variations in streams. Monthly streamflow data from 2 stream-gaging stations, on the Skokomish and Dewatto Rivers, of the 13 for which continuous records were obtained for a year or more, are shown in figure 1 and reflect the wide range in flow characteristics in the southern Hood Canal area.

The Skokomish River (fig. 1*A*) drains about 240 square miles of the eastern slopes of the Olympic Mountains and has by far the largest flow in the map area. It discharges more freshwater into Hood Canal than the combined flow of all the other streams in this part of Mason County. A large part of the annual streamflow for the Skokomish River occurs during the winter months of heavy precipitation. A relatively high flow during the spring is sustained by the melting of snow in the mountains to the west and decreases as the snowpack melts. Minimum flows normally occur in August, during the season of least precipitation, but may occur as late as October.

Sustained spring runoff does not occur in other, smaller stream basins that do not have high snow-collection areas; variations in monthly runoff in those basins near Hood Canal are probably closely related to short-term precipitation.

Most of the flow in the main stem of the Skokomish River is contributed by the South Fork. Streamflow in the North Fork Skokomish River has been regulated at Cushman Dam since 1925 and normally all the flow from Lower Lake Cushman is diverted to a powerhouse on Hood Canal. Except on rare occasions, when flow is spilled or released at the dam impounding Lower Lake Cushman, the only water in the lower North Fork channel is from drainage of adjacent slopes.

The flow of the Skokomish River is larger than flows of the other streams in the area not only because the river has a larger drainage basin (see table), but also because of the much greater precipitation in its drainage basin. In the western part of its basin (beyond the map area), the annual precipitation approaches 200 inches per year, as compared to about 60 inches in the Dewatto River basin, for example. The effect is seen by comparing the drainage areas and average flows of the North Fork of the Skokomish (sta. 575) and the Dewatto (sta. 685), as listed in the table. Although the North Fork gaging station has a drainage area about five times larger than that of the Dewatto station, the average discharge is nearly 11 times greater than at the Dewatto station.

Except for Lake Cushman, Lower Lake Cushman, and a smaller reservoir at the head of Union River (north of the map area), the only stored water available to maintain summer streamflow in the area is from ground water and natural lakes. Because there is little change in the amount of water stored in natural lakes during the summer, the low streamflows are sustained mainly by ground-water discharge into the stream channels. The area contributing ground water to a stream is generally unknown, but is not necessarily the same as the surface-drainage basin as shown on the map. Ground-water contributions differ considerably in response to local geologic and hydrologic conditions but tend to be greatest in the lower reaches of the streams. The Dewatto River has little variation between the maximum and minimum flows during the summer months (fig. 1*B*), indicating that it is fed largely by ground water during that season. Many of the other streams in the area do not receive enough ground water to sustain their flow, especially in their upper reaches, and usually go dry in the summer.

LOW FLOW

For the southern Hood Canal area, as for many other places, sufficient low-flow information can be derived from various sources to provide considerable guidance for land-use planning. Besides the continuous stream-gaging records listed in the table, much additional information on the low flows of many streams in the area is provided by miscellaneous streamflow measurements. These measurements were made at various times and locations (but largely during the low-flow season) by the Washington Division of Water Resources (now Department of Ecology) and the U.S. Geological Survey, in cooperation with various other agencies. The generally good coverage of the area by the miscellaneous low-flow measurements (see map) provides the experienced stream hydrologist with a basis for estimating the low-flow ranges of many streams that lack continuous flow records, although these estimates can be considered valid only to the degree that conditions in the drainage basins have not been changed significantly by activities of man since the measurements were made.

The low-flow information shown on the map was developed by adjustments and correlations of the miscellaneous-measurement data with the longer-term records from the gaging stations. By this approach, the low flow at each miscellaneous site in this area was estimated, in terms of the minimum flow for 7 consecutive days that might be expected on the average of once in 2 years. These low-flow estimates were then segregated into six ranges and were plotted on the map. Finally, the flow ranges were extrapolated upstream and downstream from the measurement sites, the extent of extrapolation being based on information about channel conditions, tributaries, and ground water. No estimates are shown for streams on which the flow has not been measured. The estimates of low-flow ranges shown on the map are adequate for general planning purposes and serve to indicate where the greatest deficiencies exist in low-flow data. Many more discharge measurements are necessary for detailed planning studies and water management.

CONCLUSIONS

Despite the lack of information for some streams and the imprecise nature of the low-flow estimates presented here, the available data allow several important conclusions regarding streamflow and its relation to land use in the southern Hood Canal area:

1. Streamflow conditions and present developmental trends indicate that most development of stream water in the southern Hood Canal area in the near future will probably be for relatively small community supplies. In the rolling uplands, more stream water probably will be used also to maintain levels of lakes with developed shorelands. Obstacles to the development of major supplies of stream water, as for industrial or municipal uses, include the small size of most streams, scarcity of good surface-reservoir sites, and likelihood of conflicts with existing water rights, including minimum flows needed for fish propagation.
2. Because of its comparatively large volume, the flow of Skokomish River is not likely to be affected much by foreseeable development in the area. Seasonal variations in the flow of the river are not expected to change significantly from the values shown (fig. 1*A*), unless there is future hydropower development on the South Fork. In the smaller streams, low flows are more likely to be affected significantly by future development.
3. Because low flows are largely sustained by ground-water discharge, the summertime ground-water levels are of critical importance in maintaining those flows. Wells that tap the ground-water zones feeding those streams can intercept some of the ground water that otherwise would reach the channels. Therefore, pumping from wells, especially shallow wells near the streams, may be reflected as a reduction in low stream flows.
4. Streamflow records for drainages other than in the Skokomish River basin are minimal; the only other stream now being measured regularly in the southern Hood Canal area is the Dewatto River (see table). As land use in the area intensifies, more data on all aspects of the water resources will be needed for assessing the influences of changing land use on the area's lakes and streams, and for guiding the development of additional water supplies.

SELECTED REFERENCES

Collings, M. R., Smith, R. W., and Higgins, G. T. 1972, The hydrology of four streams in western Washington as related to several Pacific salmon species: U.S. Geol. Survey Water-Supply Paper 1968, p. 11–30 (Dewatto River).

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Garling, M. E., Molenaar, Dee, and others, 1965, Water resources and geology of the Kitsap Peninsula and certain adjacent islands: Washington Dept. Conserv. Water Supply Bull. 18, 309 p.

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______1964, Compilation of records of surface waters of the United States, October 1950 to September 1960, Part 12: U.S. Geol. Survey Water-Supply Paper 1736, 415 p.

______1965–72, Water resources for Washington, part 1, Surface Water records, 1965–72: Tacoma, Wash., Water Resources Division. (Oct. 1964 to Sept. 1972 in 8 vol).

Washington Department of Conservation, 1964, Miscellaneous streamflow measurements in the State of Washington 1890 to January 1961: Washington Dept. Conserv. Water Supply Bull. 23, 292 p.

EXPLANATION

Low flow of streams shown on the map is equivalent to the lowest average daily streamflow that can be expected for 7 consecutive days on an average of once in 2 years.

Estimated low-flow ranges are shown only for streams that have been measured during a low-flow period.

LOW FLOW, IN CUBIC FEET PER SECOND (CFS)

1 cfs = 0.646 mgd (million gallons per day)
1 cfs = 28.32 liters per second

- 0–0.10 (yellow)
- 0.10–0.50 (orange)
- 0.50–1.0 (light green)
- 1.0–5.0 (dark green)
- 5.0–10 (blue)
- Greater than 10 (purple)

Points at which data are inadequate for extending estimates of low flow

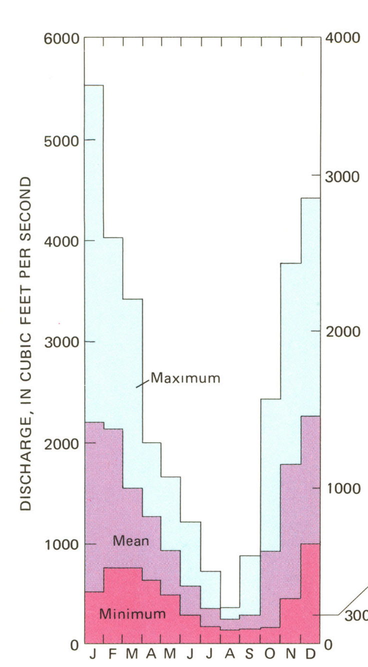
△ Miscellaneous low-flow measurement site

585▲ Gaging station location and number (listed in table)

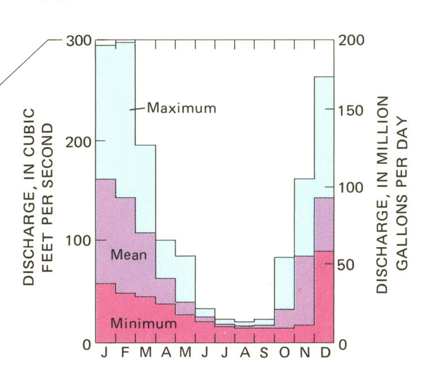
—··— Surface drainage divide

EXPLANATION FOR FIGURE 1

Each bar of the superimposed graphs represents an average monthly streamflow (discharge) past the gaging station. A bar of the "maximum" graph represents the average discharge during the month of greatest flow for the entire period of record, regardless of the year in which that month occurred. Similarly, the "minimum" graph is made up of bars reflecting minimum monthly discharges during the period of record. Each bar of the "mean" graph shows the average of all the monthly discharges for that month—an average of the averages—for the period of record. Data for the graphs were taken from reports of the U.S. Geological Survey (1955, 1961–64, 1964, and 1965–72) and the Washington Department of Conservation (now Department of Ecology), listed in the "References".



A. Skokomish River station 615; period of record 1943–72.



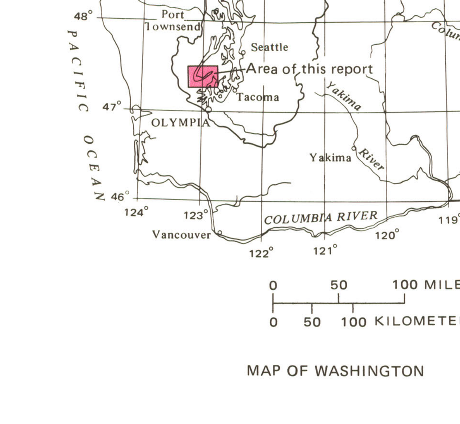
B. Dewatto River station 685; period of record 1947–54 and 1958–72.

FIGURE 1. – Maximum, mean, and minimum monthly discharges, Skokomish River (*A*) and Dewatto River (*B*).

SUMMARY OF GAGING-STATION RECORDS IN THE SOUTHERN HOOD CANAL AREA
[See map for location of stations]

Station No.[a]	Station name	Drainage area (sq mi)	Period of record	Years of record	Average discharge (cfs)[b]	Minimum discharge (cfs)[b]
555	Eagle Creek	6.90	June-Sept, 1951	--	--	6.9
560	Finch Creek	3.52	June-Sept, 1951	--	--	11
575	North Fork Skokomish River	93.7	1911–72	61	758	0[c]
580	Deer Meadow Creek	1.83[d]	1950–51, 1952–72	20	7.4	0.2
585	Dow Creek	1.77	1950–54	4	9.4[e]	0.02[e]
595	North Fork Skokomish River	117[f]	1944–49, 1950–72	27	118	1.3
615	Skokomish River	227[f]	1943–72	29	1,210	125
625	Purdy Creek	3.73	1954–60	5	23.5	5.9
635	Union River	19.8	1947–59	12	54.7	11
650	Mission Creek	4.43	1945–53	7	12.4	0
675	Tahuya River	15.0	1945–56	11	48.4	0
680	Tahuya River	42.2	July-Oct, 1947	--	--	6.9
685	Dewatto River	18.4	1947–54, 1958–72	21	69.9	9.0
740	Shumocher Creek	11.0	June–Oct, 1951	--	--	4.0
750	Deer Creek	13.3	1942–43, 1948–50	2	53.0	16
755	Cranberry Creek	16.6	1942–43, 1948–51	3	51.4	4.7
760	Johns Creek	13.5	1942–43, 1948–50	2	35.2	3.9

[a]Station numbers shown here are abbreviations; to conform with official station numbers in the data reports (see "References") add "120" before the numbers listed here.
[b]Values of average and minimum discharge are for the periods of record shown.
[c]Minimum daily discharge 1913–25 (before construction of Cushman Dam), 79 cfs.
[d]Drainage area includes 1.35 sq mi in McTaggart Creek basin, from which most of flow is diverted to Deer Meadow Creek.
[e]Does not include about 0.3 cfs diverted to supply Cushman powerplant village.
[f]Includes 99 sq mi above dam impounding Lower Cushman Lake, normally noncontributing because of diversion to powerhouse on Hood Canal.



MAP OF WASHINGTON

STREAMFLOW IN THE SOUTHERN HOOD CANAL AREA, WASHINGTON, AS RELATED TO LAND-USE PLANNING

By
Donald Richardson

1974

For sale by U.S. Geological Survey
Denver, Colo. 80225 and Reston, Va. 22092, price 75 cents