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PROFILE SURVEYS
IN
WILLAMETTE RIVER BASIN
OREGON

PREPARED UNDER THE DIRECTION OF

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PROFILE SURVEYS IN WILLAMETTE RIVER BASIN, OREGON.

Prepared under the direction of R. B. MARSHALL, Chief Geographer.

GENERAL FEATURES OF WILLAMETTE RIVER BASIN.

Willamette River drains a trough-shaped area extending north and south between the Coast and Cascade ranges in Oregon. The area is roughly rectangular, approximately 140 miles in length and about 85 miles in width. The Willamette proper is formed by the junction of three main tributaries which unite in the vicinity of Eugene; these are the Middle Fork (considered the continuation of the main stream), the Coast Fork, and McKenzie River. The river is navigable for ocean-going vessels from the mouth to Portland, and for ordinary river steamboats from Portland to Corvallis, except during a few months of each year. From Corvallis to Eugene the river is navigable for light-draft boats during medium stages of the river. The falls of Willamette River at Oregon City are passed by a series of five locks, which are at present in private ownership.

The other principal tributaries of Willamette River are Santiam, Molalla, and Clackamas rivers. From the Coast Range flow Long Tom, Marys, Luckiamute, Yamhill, and Tualatin rivers. The drainage areas of this river and its principal tributaries are given below.

Drainage areas in Willamette River basin.

	Square miles.		Square miles.
Willamette at mouth	11,150	McKenzie River	1,040
Willamette at Oregon City	10,200	Santiam River	1,890
Willamette at Salem	7,520	Yamhill River	763
Willamette at Albany	4,860	Clackamas River	927
Coast Fork of Willamette	705	Tualatin River	690
Middle Fork of Willamette	1,450		

From the summit of the mountain ranges the slopes are steep, but they merge gradually into a wide alluvial valley or gently rolling agricultural lands.

The entire drainage area may still be considered densely forested. The portions of the basin that contribute most to the flow of the streams are almost entirely within the boundaries of national forests, and privately owned timber lands extend from the boundaries

of the national forests to the main stream in the valley, except where lands have been cleared.

Although records of precipitation at the summit of the Coast Range are meager, it is likely that the total annual rainfall is as much as 150 inches. On the eastern slope of the Coast Range the annual precipitation decreases very rapidly to about 40 inches, but it gradually increases again until at the summit of the Cascade Range it is approximately 100 inches. From north to south the same general variation is observed, although the differences are not so striking. At the mouth of the river the precipitation is approximately 50 inches, in the vicinity of Corvallis about 40 inches, and at the summit of the Callapooya Mountains, which form the southern boundary of the drainage area, 55 or 60 inches. Except on the summits of the mountain ranges this precipitation is almost entirely rain, 95 per cent falling during nine months, from September to May. On the mountain ranges part of the precipitation is snow, and the country is subject during the spring and fall to warm chinook winds, accompanied by rather sudden melting of these snows, which frequently cause considerable damage from floods. During the growing season, when the precipitation rarely exceeds 2 inches, the valley is practically arid. Although irrigation has not long been practiced in the valley, it is likely that before many years a large part of the agricultural bottom lands will be placed under irrigation. Small ditches and pumping plants have been constructed, and the returns from irrigated agricultural lands show an increase of 50 to 500 per cent in production over the nonirrigated lands.

Lying almost wholly within a narrow strip adjacent to the main divide of the Cascades, where the soil and underlying rock is porous, similar to that in the basin of Deschutes River, on the east side of the range, are a number of lakes and marshes which afford favorable sites for storage reservoirs. As a result the streams flowing through the lakes and marshes experience no pronounced floods and are characterized by a large low-water flow. The effect of reservoirs on the Willamette would not be so marked as on more flashy streams, but their operation would greatly enhance the value of the river for irrigation, power, and navigation.

The highest known flood in the Willamette Valley occurred December, 1861, when the discharge at Albany was 220,000 cubic feet per second. The highest gage reading at Portland since that date was in 1894 but was due to backwater from Columbia River. The years 1899 and 1907 were "wet years." The year 1905 was a comparatively dry year. The longest record of stream flow in this basin has been obtained by applying recent measurements made at Albany to records obtained by the United States Weather Bureau since 1895.

The results of profile surveys in the Willamette River basin are set forth in Plates I to III (at end of volume).

GAGING STATIONS.

The Survey has maintained in the basin of the Willamette the gaging stations shown by the following list. The stations are arranged in downstream order, the main stem of the river being determined by measuring or estimating its drainage area—that is, the headwater stream draining the largest area is considered the continuation of the main stream, and all stations from source to mouth are presented first; stations on the tributaries, in regular order from source to mouth, follow. Relations of the tributaries are indicated by indention. A dash following a date indicates that the station was being maintained June 30, 1913. A period after a date indicates discontinuance.

Willamette River, Middle Fork (head of Willamette River), near Hazeldell, Oreg., 1911–
Willamette River, Middle Fork, at Jasper, Oreg., 1905–
Willamette River near Springfield, Oreg., 1911–
Willamette River at Eugene, Oreg., 1911.
Willamette River at Albany, Oreg., 1895–
Willamette River at Salem, Oreg., 1910–
Willamette River at Oregon City, Oreg., 1909–
Kelsey River near Hazeldell, Oreg., 1909.
Willamette River, North Fork of Middle Fork, near Hazeldell, Oreg., 1909–
Fall Creek near Fall Creek, Oreg., 1912–
Willamette River, Coast Fork, near Goshen, Oreg., 1905–
Willamette River, East Fork of Coast Fork:
Row River near Disston, Oreg., 1910–
McKenzie River at outlet of Clear Lake, Oreg., 1911.
McKenzie River at McKenzie Bridge, Oreg., 1910–
McKenzie River near Springfield, Oreg., 1905–
Lost Creek near McKenzie Bridge, Oreg., 1911–
Horse Creek near McKenzie Bridge, Oreg., 1911–
Eugene power canal near Eugene, Oreg., 1911–
Santiam River, North Fork (head of Santiam River), at Detroit, Oreg., 1907–1910.
Santiam River, North Fork, at Mehama, Oreg., 1905–
Santiam River, North Fork, near Hoover, Oreg., 1911–
Santiam River, North Fork, at Niagara, Oreg., 1911–
Santiam River at Jefferson, Oreg., 1905–
Santiam River, Marion Fork, at Marion Lake, near Hoover, Oreg., 1907–
Puzzle Creek, North Fork, near Hoover, Oreg., 1910–
Puzzle Creek, South Fork, near Hoover, Oreg., 1910–
Permelia Creek near Detroit, Oreg., 1907–1910.
Whitewater Creek near Detroit, Oreg., 1907.
Breitenbush Creek near Detroit, Oreg., 1910–
Santiam River, South Fork, at Cascadia, Oreg., 1910–
Santiam River, South Fork, at Waterloo, Oreg., 1905–
Santiam River, South Fork, near Foster, Oreg., 1912–
Santiam River, Middle Fork, near Foster, Oreg., 1912–
Luckiamute River near Suver, Oreg., 1905–1910.
Yamhill River, South Fork, at Sheridan, Oreg., 1906–1910.

Willamette River at Oregon City, Oreg.—Continued.
Yamhill River at LaFayette, Oreg., 1908–
Molalla River near Molalla, Oreg., 1905–1909.
Clackamas River near Cazadero, Oreg., 1909–10.
Evaporation station near Cazadero, Oreg., 1911–
Clackamas River at Estacada, Oreg., 1908–1910.
Clackamas River at Park Place, Oreg., 1912–
Clackamas River near Barton, Oreg., 1905–1908.

PUBLICATIONS.

Information concerning stream flow at the stations listed in the preceding table has been published by the Survey in Water-Supply Papers 178, 214, 252, 272, 292, 312, 332,[1] and 362.[1]

Water-supply papers and other publications of the United States Geological Survey containing data in regard to the water resources of the United States may be obtained or consulted as indicated below.

1. Copies may be obtained free of charge by applying to the Director of the Geological Survey, Washington, D. C., but the edition printed for free distribution is small and is soon exhausted.

2. Copies may be purchased at nominal cost from the Superintendent of Documents, Government Printing Office, Washington, D. C., who will on application furnish lists giving prices.

3. Sets of the reports may be consulted in the libraries of the principal cities in the United States.

4. Complete sets are available for consultation in the local offices of the water-resources branch of the Geological Survey, as follows:

Albany, N. Y., Room 18, Federal Building.
Atlanta, Ga., Post Office Building.
St. Paul, Minn., Old Capitol Building.
Madison, Wis., Capitol Building.
Helena, Mont., Montana National Bank Building.
Denver, Colo., 302 Chamber of Commerce Building.
Salt Lake City, Utah, Federal Building.
Boise, Idaho, 615 Idaho Building.
Portland, Oreg., 416 Couch Building.
Tacoma, Wash., Federal Building.
San Francisco, Cal., 328 Customhouse.
Los Angeles, Cal., Federal Building.
Santa Fe, N. Mex., Capitol Building.
Honolulu, Hawaii, Kapiolani Building.

A list of the Geological Survey's publications will be sent on application to the Director of the United States Geological Survey, Washington, D. C.

[1] In preparation.