

The average monthly precipitation with departure from normal for the month of July during the last five years is shown in the following table for the States of Oregon, Washington, and Idaho, and for those portions of Montana and Wyoming in District No. 12.

Years.	Oregon.		Washington.		Idaho.		Montana.		Wyoming.	
	Mean.	De- part- ure.	Mean.	De- part- ure.	Mean.	De- part- ure.	Mean.	De- part- ure.	Mean.	De- part- ure.
1909.....	1.20	+0.76	1.49	+0.88	1.24	+0.88	3.08	+1.92	1.40	+0.99
1910.....	0.17	-0.46	0.13	-0.60	0.37	-0.34	0.59	-0.66	1.02	+0.20
1911.....	0.08	-0.51	0.26	-0.46	0.20	-0.32	0.57	-0.68	0.35	-0.28
1912.....	0.65	+0.07	1.05	+0.22	1.15	+0.88	1.83	+0.51	2.80	+1.16
1913.....	1.19	+0.52	0.64	+0.09	1.92	+1.15	1.16	-0.17	3.15	+1.00

THE RIVERS.

Heavy local rains from the 22d to the 25th on the tributaries of the lower Snake River caused a small rise which was felt in the lower Columbia a few days later. These rains washed a large amount of soil into the streams and for several days the water was so charged with silt as to seriously interfere with salmon fishing.

The following table shows the highest and lowest stages, the dates on which they occurred, and the mean and normal stages at the river stations in this district for July:

Station	River.	High- est.	Date.	Low- est.	Date.	Mean.	Normal.
Albany.....	Willamette.....	5.9	5th..	2.0	31st..	3.4	2.1
Salem.....	do.....	4.7	5th..	0.9	31st..	2.5	1.3
Wilsonville.....	do.....	7.0	1st..	2.5	31st..	4.5	3.2
Oregon City.....	do.....	4.4	1st..	1.2	18th..	2.8	.....
Portland.....	do.....	20.6	1st..	9.3	28th..	14.3	13.3
Jefferson.....	Santiam.....	3.5	1st..	1.4	29th..	2.3	1.5
McMinnville.....	Yamhill.....	1.0	1st..	0.2	30th..	0.5	0.6
Cassero.....	Clackamas.....	2.8	1st..	1.5	30th..	2.0	.....
Kamiah.....	Clearwater.....	8.8	2d..	4.5	30th..	6.0	.....
Weiser.....	Snake.....	7.5	5th..	2.5	23d..	4.9	4.7
Lewiston.....	do.....	9.3	7th..	2.4	24th..	5.7	5.5
Riparia.....	do.....	9.4	1st..	3.8	26th..	6.3	5.6
Bonners Ferry.....	Kootenai.....	20.6	1st..	10.5	30th..	14.7	14.9
Newport.....	Pend d'Oreille.....	18.7	1st..	6.6	31st..	12.1	8.8
Northport.....	Columbia.....	29.3	1st..	13.2	31st..	20.0	20.4
Wenatchee.....	do.....	42.2	1st..	24.0	31st..	31.1	29.9
Umatilla.....	do.....	19.3	1st..	11.6	31st..	15.0	14.8
The Dalles.....	do.....	33.5	1st..	17.5	31st..	24.1	24.4
Cascade Locks.....	do.....	25.9	1st..	13.0	27th..	18.1	17.5
Vancouver.....	do.....	20.9	1st..	9.6	28th..	14.7	14.0

<sup>1</sup> The stage was observed on more than one date.

MISCELLANEOUS PHENOMENA.

Thunderstorms, occasionally with hail, were quite prevalent during the last decade in southern Idaho and eastern Oregon. Two fatalities from lightning were reported from southwestern Oregon and one from northeastern Washington; lightning was also the cause of several forest fires in the first named State which were subsequently extinguished by the heavy rains.

The prevailing winds were mostly northwesterly, with maximum velocities reported as follows: North Head, 54 miles from the south, and Tatoosh Island, 60 miles from the southwest, both occurring on the 6th. A wind storm partaking somewhat of the nature of a tornado occurred on the same date in the northeast suburbs of the city of Seattle, Wash., and while scarcely over a minute in duration caused considerable damage to buildings, trees and shrubbery. Dust storms were reported from stations in eastern Washington on the 6th which were injurious to standing grain.

Some frosts were noted during the second decade at stations in Montana and Oregon, and freezing temperatures were of general occurrence in the elevated portions of Idaho on the 14th which were slightly damaging to growing crops.

THE ANNUAL RISE OF THE COLUMBIA RIVER

[Portland, Oreg., Aug. 11, 1913.]

By THOMAS R. REED, Assistant Observer.

Weather conditions in the Columbia River watershed during the winter and spring of 1913 were favorable for a large run-off later in the year. That a larger flow of water than usual would occur in the early summer was foreseen by officials in the Weather Bureau and the Dominion meteorological service, and their estimates in this connection were published in the March issue of the Snowfall Bulletin. In order that the public might be informed as to conditions of snowfall in British Columbia, a supplement to the regular snowfall bulletin was issued on April 22, containing tabular data and a short written summary furnished by the Dominion meteorological service.

Taking the wet season as a whole the snowfall was not large as compared with normal amounts, but what there was did not undergo premature melting, for the low temperatures of the spring months conserved what had fallen until summer was almost at hand. When the first pronounced warm spell of any duration came there was a large accumulated deposit ready to swell the tributaries of the Columbia River. The following table, compiled from the Monthly Weather Review, shows the temperature and precipitation over the Northern Plateau during the snowfall season:

Mean temperature and precipitation over the Northern Plateau.

	Mean tempera- ture.	De- part- ure.	Mean precip- itation.	De- part- ure.
December, 1912.....	31.2	-0.1	Inches. 0.85	Inches. -0.8
January, 1913.....	25.2	-2.7	1.94	+0.4
February, 1913.....	25.8	-5.4	0.88	-0.7
March, 1913.....	37.5	-2.8	1.51	0.0
April, 1913.....	49.2	+0.3	1.14	-0.2

The annual high water in the Columbia finds its origin in two principal sources. The more important of these is the upper Columbia itself, augmented by the Kootenai and Pend d'Oreille tributaries. The other source is the Snake River, rising in Yellowstone Park and augmented near its lower end by the Salmon and Clearwater Rivers. The upper Snake River carried about the usual amount of water this year, but below the entrance of the Salmon River it reached the highest stages recorded since 1899.

Of the tributaries referred to as augmenting the upper Columbia, the Kootenai began to rise first and continued to increase rapidly reaching a maximum early in June. The Pend d'Oreille rose more slowly reaching a maximum 10 or 15 days later. Both streams fell gradually and united in maintaining a high stage in the lower Columbia for a long time. The Kootenai influenced the Columbia more than the Pend d'Oreille. It is said that the stages reached this year in that stream exceeded any on record, and this is not unlikely because the conditions of sub-normal temperature described as prevalent over the whole Northwest during the spring were accentuated in the Kootenai country, while the winter's snowfall there, unlike that on the Northern Plateau, was in excess of the average.

As usual the Snake River was carrying its maximum volume earlier than the Columbia and had begun to recede at the time the Columbia was showing its most rapid increase. In this way disastrous stages in the lower Columbia were avoided, but notwithstanding this the stages in the lower river were the highest since 1903. The 15-foot stage at Portland, which is rated as

the flood stage there, was reached on May 25 and the water remained above that point until July 14, a period of 50 days. It was above the 20-foot stage for over a month, which meant that nearly all the basements in the business district were wholly or partially inundated during that time, except where pumps were employed to keep them dry. The highest stage recorded was 24 feet on the evening of June 8, just equaling the maximum stage of the flood of 1903.

The industries in the city of Portland which were chiefly affected were the warehouse and dock interests along the water front, and the wholesale and retail houses which depended on their basements for storage or other purposes. These interests were in close touch with the local office of the Weather Bureau and received advice which enabled them to act intelligently in moving their merchandise to safer levels. Telegraph and telephone companies sustained some losses, chiefly to pole lines along the river. The underground system of the electric company was somewhat interfered with, but the loss in this direction was only nominal.

The heaviest financial losses occurred outside the city and were sustained by the railroads operating along the Columbia River and by the Columbia River fisheries. The latter are put to considerable expense each year repairing their fish wheels which have been damaged by drift material, but their main loss is less direct and not so easily estimated. It is involved in the loss of pack occasioned by the discontinuance of fish wheels, seines, and traps, for when the river is rising rapidly there is so much drift that none of these appliances can operate, and gill net fishermen are interfered with similarly.

Those depending on farm land and pasturage at low elevations are prepared to experience some loss each year from high water. Their loss is principally the loss of crops and the use of their cows, since the proceeds from the sale of milk and cream go to the party looking after the stock, when the owners themselves have no high land to pasture them on. Money loss from destroyed crops was large in many localities this year, but this may be offset to some extent by the crop planted after the flood.

Flood predictions were issued twice daily at the Weather Bureau office in Portland, and were given wide distribution by means of the weather map, the daily press, and the telephone. The circulation of the daily weather map was almost doubled during the time of high water, and the telephone was in such constant use that an employee was detailed for a time to the exclusive duty of answering calls. The forecasts were quite accurate and gave general satisfaction.

An interesting attempt to deduce a formula for forecasting river stages at The Dalles one day in advance from stages recorded at Lewiston, Idaho, on the Snake River, and at Wenatchee, Wash., on the Columbia, has been made by engineers in the United States Geological Survey. It is based on the assumption that an increase of 1 foot in gage height gives an increase in discharge of 12,000 second-feet at Wenatchee and 18,000 second-feet at Lewiston and at The Dalles.

*Statistics of estimated money loss from flood and amount saved by timely flood warnings.*

(1) Money value of property destroyed, or amount of damages, including railroads and excluding crops.....	\$107,388.47
(2) Money value of crops destroyed or amount of damage.	92,645.00
(3) Money value of losses occasioned by enforced suspension of business through flood, including wages of employees .....	91,220.00
(4) Cost of removing or protecting goods in flooded basements and warehouses (in city of Portland) .....	4,321.00
(5) Money value of property saved by flood warnings of the Weather Bureau.....	101,370.00

## FLOOD AT BOISE, IDAHO.

By EDWARD L. WELLS, Section Director.

On the afternoon of July 24, 1913, there occurred a most unusual flood at Boise. The city is situated on the river bottom, which slopes gently from the foothills of the Boise Mountains to the Boise River. Most of the gulches opening from the hills adjacent to the city are dry, except when the snow is melting or when unusual precipitation occurs. Hulls Gulch naturally carried a small flow of water, but most of this has been diverted to contribute to the water supply of the city and of the military post. The water coming down this gulch originally found its way to the river, over the surface, by a rather poorly defined channel, the course of which changed frequently, owing to the heavy deposit of sand carried. In recent years the small remaining flow has been confined in a wooden flume for several blocks and has then been turned into the sewer.

The latter part of July and fore part of August usually pass without the occurrence of any considerable amount of rain at Boise. The normal amount for the period from July 17 to August 11, inclusive, is but 0.08 of an inch. On July 23, 1913, rain began in the afternoon and from that time until the evening of the 26th showers were of frequent occurrence. On the 24th rain fell almost continuously from 6.25 a. m. until after midnight. At 2.42 p. m. the intensity of the rainfall suddenly increased and in the next 7 minutes 0.13 of an inch of rain fell. After the heavy rain was over in the city the shower could be seen passing over the hills to the northeast of the city. About 3.45 p. m. the water began to flow out of Hulls Gulch in such quantities that the flume was no longer sufficient to carry it, and in a few minutes the water came over the dam at the head of the flume and overspread that part of the city. An area approximately three blocks wide and extending from the mouth of Hulls Gulch to Fairview Addition was more or less seriously flooded. Cellars were filled with water and lawns were covered with sediment. The damage was worst above the Perrault Canal, where water entered many houses and many lawns were ruined. The flow ceased almost as suddenly as it had begun, and by 6.30 p. m. the water had receded from most of the flooded district.

Later in the evening the writer made a short trip up the gulch, locating the high-water marks and ascertaining that practically the entire flow had come from above the upper reservoir of the Boise Artesian Hot & Cold Water Co., which is about 1 mile above the mouth of the gulch.

On the afternoon of the 26th the writer walked over the greater part of the watershed, to note the effects of the storm. The entire watershed above the reservoir showed evidence of heavy precipitation, but there was no evidence of any particularly heavy downpour in any one place. The erosion was greatest about 4 miles above the mouth of the gulch, but this was probably due to the steep pitch and sandy nature of the soil in that section. That a great quantity of water had fallen was evidenced by the fact that pools were standing practically on the tops of the ridges, and even the crowns of the ridges bore marks of running water.

On the afternoon of the 29th Mr. J. B. Marcellus, deputy city engineer, took measurements from which to compute the flow of water. His report follows:

In company with Edward L. Wells, section director of the Weather Bureau, we attempted an approximation of the quantity of water that came down Hulls Gulch, due to an extremely heavy downpour of rain on the afternoon of July 24.

We went up the gulch to where the water was confined to a channel approximately 56 feet wide, and the point of cross section was taken