

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

404 Federal Building
Tacoma, Washington.
February 21, 1927.

Mr. George Holmes Moore,
Lighting Department,
Seattle, Washington.

Dear Mr. Moore:

Your letter of February 15 requests information which is very difficult to compile. For example, we have no reasonable basis for estimating the extreme flood flow of Baker, Sauk, Cascade rivers or Thunder Creek. Mr. Stewart's report of July 1918 does give some rough estimates but in view of the fact that he materially increased the flood discharges wherever he made detailed investigations during the winter of 1922 and 1923, I believe that if he had been able to obtain as complete information regarding tributaries as he had for the main river, he would likewise have increased the flood discharge of the tributaries. The estimated crest discharge for a number of floods at the Dalles, and at Sedro Woolley are published in: Water Supply Paper 552; pages 60 and 62. The results shown there, however, are also indicated in the following table which includes the estimated discharge at Reflector Bar for the same floods.

Estimated flood flow, in second-feet, of
Skagit River and tributaries.

Location River or Tribu- tary.	Estimated crest discharges for floods of:					
	1805- 1825	1856	Nov. 18 or 19, 1897	Nov. 29 or 30, 1909	Dec. 29 30, 1917	Dec. 12 13, 1921
Skagit-Reflector Bar	115,000	95,000	48,000	70,000	43,000	63,000
Skagit-Dalles...	500,000	350,000	275,000	260,000	220,000	240,000*
Skagit-Sedro Woolley.....	400,000	300,000	190,000	220,000	195,000	210,000

*Note: The flood of Feb. 1932 was measured at the Dalles at 147,000 second feet. G.H.M.

We have no base data upon which the flood flow at Ruby can be derived. The characteristics of Thunder Creek and the upper Skagit River vary so greatly that drainage area ratios can not be used.

The mean annual flow of Skagit River and tributaries, as shown on the accompanying sheet, is based upon extensions of records to cover a period long enough for indicating fairly closely the mean annual flow.

Very truly yours,
(Signed: G. L. Parker,
District Engineer.

Enclosure.

Copied 5/18/53 Mc

"Past Floods in Skagit Valley and Advisable Protective Measures"
James E. Stewart, 1924

SKAGIT RIVER AT REFLECTOR BAR,
NEAR MARBLEMOUNT, WASH.

DRAINAGE AREA = 1,100 SQUARE MILES

<u>No.</u>	<u>Date</u>	<u>Gageheight</u>	<u>Discharge</u>	<u>Discharge in</u>	<u>Accuracy</u>
<u>in order of</u>	<u>of flood</u>	<u>in feet.</u>	<u>sec.</u>	<u>sec. feet</u>	<u>in</u>
<u>of</u>	<u>magnitude</u>		<u>feet.*</u>	<u>per sq.mile</u>	<u>percent</u>
1	Unknown	21.0	120,000	109	20
2	1815	20.5	115,000	105	20
3	1856	18.5	95,000	86	15
4	Nov.29,1909	15.4	70,000	64	10
5	Dec.12,1921	14.	63,000 **	57	10
6	Nov.18,1897	12.5	48,000	44	10
7	Dec.29,1917	12.5	43,000	39	10

*See Parker letter 2-21-27 for corresponding flow in lower valley.GHM

** W.S.Paper 552 gives this as 58,000 sec. ft. G.H.M.

Notes: The flood dated 1815 probably occurred between 1804 and 1824. This is based on the age of an Indian interviewed in 1879 concerning that flood.

The flood of 1856 did not occur after 1857 and probably not before 1850. This is known by precipitation data and by the age of trees on a bench which was cleared by the flood of 1856.

The flood of 1815 may have reached the stage given for flood No. 1. There are some slight indications, however, that it did not. It is certain that the peak stage of the flood of 1815 had been approximately reached several times prior to 1815. This is known from the alternative deposits of ground surface material and flood sand on a sand bar which was barely topped by the flood of 1856.

There is no flood sand above the stage reached by flood No. 1. The stage reached by that flood has not been exceeded, therefore, for thousands of years.

The stages of floods Nos. 2 and 3 were determined near the gage from the elevation of high water marks on canyon walls and from flood sand deposited by those floods.

The stage of flood No. 4 was determined from drift and flood sand at and above the gage.

The stage of flood No. 6 was determined from the stage one mile downstream in relation to floods Nos. 4 and 7.

If the rainfall readings indicate a probable total of around 10 inches within 34 hours, then a flood of the 1815 type may be expected. For a maximum flood, a warning should be sent out that a flood from 7 to 15 feet (according to the location) higher than that of 1921 might be expected. For a maximum flood the main effort should be to save human life, and until some adequate flood protection works are completed, the following places should be abandoned as soon as possible after the knowledge of such a flood has been received from the radio station.

1. All of Hamilton, Lyman, and Burlington.
2. Low lying portions of Concrete, Pedro Woolley, and Mount Vernon.

The above points should be abandoned mainly because of the danger of swift water and drift wrecking and carrying away houses. In some cases, however, it is because even in still water the second stories would be flooded.

For towns and ranches close to tide water, it would probably be safe for inhabitants to stay in the upper stories of their houses, provided the second floors are six or more feet higher than the crests of the 1909 and 1921 floods. Other houses in the valley where a six foot depth of water would occur on the surrounding ground, should be abandoned unless they are in locations where it would be

impossible for an overland current from the river to strike the house and carry it away by drift and force of the water.

The high land in Sedro Woolley and Mount Vernon should be the main concentrating ground for refugees, but undoubtedly there are many houses on high ground which can be used.

A maximum flood has not occurred in approximately the last 100 years, and possibly it may be many years before another occurs. On the other hand it may occur in the next year or two. A radio station is the cheapest insurance that can be obtained against such a great catastrophe as a maximum flood could easily be. The radio station due to earlier warnings, would more than pay for its original cost and upkeep at the time of each of the smaller type of floods, such as 1909 and 1921.

If a radio station can be established at the Skagit Power Camp for the present season, the preferable method of handling would be for a county employee or other property holder to stay up there for two months. If this cannot be done probably a City of Seattle employee could every day take meteorological readings, test the apparatus, and send a bulletin to Mt. Vernon. A county employee could then go up at once on the inception of a Chinook. With this last method it would be necessary to leave Mt. Vernon on the day previous to the morning of the critical precipitation readings.

FURTHER FLOOD DATA

Skagit County Population ... 1930 Census

Total	35,142
Subject to Flood (number)	28,000
" " " (per cent)	79.7%

Skagit County Area (Auditor's 1932 Report)

Total Improved (acres)	76,119
Subject to Flood (acres)	76,119
" " " (per cent)	100%

Skagit County Valuation (Report)

Total Assessed (30% of 1915 market)	\$ 23,168,237
" " (100% " " ")	\$ 77,227,457
Subject to Flood (dollars)	\$ 28,658,000
" " " (per cent)	37.1%

In addition to above flood-menace percentages, note following items, remembering that 100% of improved acreage is said to be subject to flood.

AGRICULTURAL INCOME - ANNUAL

Field crops ..	\$ 3,500,000
Dairy products ..	\$ 3,500,000
Poultry ..	\$ 1,250,000
Miscellaneous ..	\$ 1,750,000
Agriculture Total	\$ 10,000,000
Industrial Income	\$ 10,000,000

AGRICULTURE & INDUSTR. TOTAL....\$ 20,000,000

In above item of field crops is included \$700,000 per year for seed. Skagit County produces, among other seed output, 85% of the world's output of cabbage seed.

FURTHER FLOOD DATA - Contd.

There are 448 miles of rural and star-mail routes subject to flood interruption. An amount of \$225,000 has already been spent for repairing and replacing roads and bridges damaged by flood. This is County fund outlay.

Additional to this County outlay, twenty-one dyking district organizations have spent one and three-quarter million dollars for construction and maintenance; and this in turn is to be increased by over one million dollars to cover an item of individual flood losses not includible in dyking district costs.

U. S. Engineers reports on improvement of flood-plane, stream-discharge areas continue to stress the point that dykes and jetties so far constructed do not decrease the annual expenditure necessary for channel dredging and snag-removal. In other words, in spite of all past improvements, the rivers continue to drop about the same annual load of silt, snags and other debris, in the river channels and not in deep water of the Sound, as before improvements by dyking and dredging were begun.

On the other hand, while only a small percentage of the total dyke construction disappears in even a major flood, the area flooded by failure of even a small portion of the main river dykes is of formidable extent.

Finally, an inspection trip through the districts subject to flood menace, and even the most casual study of the broken and deserted dwellings which are scattered through the areas over which dyke-destroying floods make their escape, will drive home the lesson of this Flood Menace Hazard as no financial study can possibly do.

Farming is not usually classed as a hazardous occupation, but farming, and especially farm-house living, in Skagit County certainly should be so rated.

And when the Skagit County Auditor lists "improved acreage" at 76,119, and "area subject to flood" at the same figure, a certain aspect of home-owning in Skagit County becomes very evident indeed.

Or, if one doubts any or all of the above figures, let him refer to the events predicted and the activities recommended in the case of a major flood on the Skagit, by Stewart of the U.S. G.S. in his report to the Skagit County Commissioners in 1924.