Skagit River Flood Peaks

Memorandum of Review

Reference is made to the following memorandums:

1. Proposed revision of Skagit River flood peaks by Riggs and Robinson, dated November 15, 1950.

2. Skagit River near Sedro Woolley, revision of historic flood peaks by Flynn, dated January 25, 1951.

3. Skagit River near Concrete, Washington, verification study by Benson and Flynn, dated August 1952.

4. Skagit River near Concrete, Washington by Hidaka, dated December 17, 1953.

5. Skagit River near Sedro Woolley, Washington by Hidaka, dated January 12, 1954.

A decision must be made soon concerning the revision of the flood peaks determined by J. E. Stewart at the gaging stations on Skagit River near Concrete and near Sedro Woolley. This must be done in order to complete the Skagit River flood report and the Compilation report. The writer has considered all memorandums and available basic data in an effort to settle the question of revisions.

Skagit River near Concrete, Washington

The 1921 flood peak near Concrete seems to be the logical point through which to extend the rating curve for this station. Benson's computed discharge of 225,000 cfs has been checked and seems to be a reliable figure. A logical extension of the rating curve passes through this point and the 1815 flood peak of 500,000 cfs.

The following table shows the discharges from the Stewart report and from the new curve:

Year	Stewart (discharge in cfs)	New curve (discharge in cfs)	Percent difference
1815	500,000	500,000	0
1856	350,000	340,000	2.9
1897	275,000	265,000	3.6
1909	260,000	240,000	7.7
1917	220,000	205,000	6.8
1921	240,000	225,000	6.2

The newly suggested values all differ from those of Stewart by less than 10% so perhaps they should not be revised. On the other hand, they are based on a recomputed discharge for the 1921 flood that we believe to be the most logical answer based on our latest methods of computing peak flow. The 1921 flood peak would be reduced about 6.2%. The greatest advantage in revising

these peaks would be to obtain consistency and to use one rating curve. It seems to be generally agreed that one rating curve probably is applicable at this site.

The writer recommends that Stewart's values be used because of the small percentage differences and the fact that these figures have been published in Water Supply Papers. However, the new curve could be used as the present rating.

Skagit River near Sedro Woolley, Washington

There is no firm basis for extending the rating curve for this gaging station because of dike breakage and the lack of good high water measurements.

Measurements 1-10 were made before Sterling Bend was cut off in November 1911. During the next few years considerable changes took place and by 1917 the low water rating had changed by about 3 feet. The effect on the high water rating is unknown because it was not well defined before Sterling Bend was cut off. Measurement No. 7 is the only high-water measurement made before the cutoff and its accuracy may be questioned. It was made on June 13, 1911 and the notes are not as complete as might be desirable. Presumably, a 15# weight was used because those weights were in use at the time. No soundings were made for the major part of the measurement but the depths were computed using the previous measurement. Scour is an unknown factor. Velocity readings were taken 1 foot below the surface and a coefficient of 0.90 was applied to them. This seems reasonable except for the unknown factor of surface turbulance. If this measurement was assumed to be 10% low, then a very reasonable curve could be drawn through a point 10% to the right that would pass through Stewart's 1815 peak discharge and near to the others. Another reason for thinking that measurement No. 7 may be slightly low is that it plots more than 3 feet above the later rating curve.

A small piece of evidence that the river did shift considerably after Sterling Bend was cut off lies in a letter Mr. Veatch received from Mr. Nordmark of the Washington State Planning Council in June 1944. Mr. Nordmark stated, "As you know the floor of the river dropped several feet and the water table as measured in wells in the vicinity dropped about 6 feet." This statement was made in reference to the elimination of Sterling Bend. The Ground Water Branch has no well records in this area dating back to 1911.

The writer questions the theory that the peak discharges near Sedro Woolley will always be less than those near Concrete. This factor is dependent upon channel storage, duration of flood peak, and intermediate inflow. In November 1949 the peak discharge near Concrete was 154,000 cfs while that near Mt. Vernon was 114,000 cfs which shows quite a reduction. However, in February 1951 the peak discharge near Concrete was 139,000 cfs while that near Mt. Vernon was 144,000 cfs which shows a slight increase. It is not known how many Skagit River floods may have been affected similarly.

Stewart stated that the 1917 peak was of long duration so it quite easily could have been of about the same magnitude near Sedro Woolley as it was near Concrete if conditions were similar to those of 1951.

If the 1951 peak discharge at the Mt. Vernon gage is plotted on the Sedro Woolley rating curve to its proper gage height, it plots a little to the

(recorded at Sedro Woolley)

right of the proposed main channel extension. The 1951 flood just reached the top of the dikes just downstream from Sedro Woolley but did not break through them. This point, then, should represent main channel flow. These same dikes broke in 1917 and in 1921 so the discharge could easily have increased to 200,000 cfs with little additional change in gage height as is indicated on the rating curve.

The writer believes the 1917 and 1921 peak discharges suggested by Stewart to be quite reliable based on the above discussion.

The writer's suggested curve for the period before 1911 is about 3 feet above the 1917 and 1921 peaks which may add a little support to the position of the new curve.

The following table shows the discharges from the Stewart report and from the new curve:

Year	Stewart (discharge in cfs)	New curves (discharge in cfs)	Percent difference
1815	400,000	400,000	0
1856	300,000	290,000	3.3
1896	185,000	165,000	10.8
1897	190,000	170,000	10.5
1906	180,000	165,000	8.3
1909	220,000	200,000	9.1
1917	195,000	195,000	0
1921	210,000	210,000	0

The maximum change from the Stewart report is about 10.8% so perhaps the peaks should be revised to obtain consistency and the use of specific curves.

The dikes are known to have failed just below Sedro Woolley in 1909, so they probably failed in 1906 also. There were no dikes at the time of the floods before 1900. In fact the dikes were not as high or strong in 1909 as they are today. This could account for the 1951 peak plotting so close to the suggested curve for the period before 1911.

The writer recommends that Stewart's values be used. A maximum change of 10.8% seems small when all of the possible errors are considered.

If it is decided that the Sedro Woolley peaks should be revised, then the writer recommends the use of the new values in the above table. Also, the peaks near Concrete probably should be revised if those near Sedro Woolley are changed.

G. L. Bodhaine
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