

Seattle, Wash., February 11, 1911.

To the Hon. Board of Co. Com. for Skagit Co.,
Mount Vernon, Wash.

Gentlemen:

1. I have the honor to transmit herewith a map of Skagit River from Sedro Woolley to its mouth made from surveys and in compliance with your order of December 19th, 1910, and upon which are also delineated the banks of the river as they were in 1897 and in 1907 respectively, together with the following report and estimate of cost of controlling the erosive action at the bends for the purpose of preventing the recurrence of breaks in the diking system and less by reason of inundation.

2. The Skagit River is the largest in western Washington; is navigable throughout the whole year as far as Aven, 16 miles from its mouth and during the freshet seasons, as far as "the portage", a distance of about 95 miles from the mouth.

3. It has its source in the Cascade Range of Mts. flows in a general westerly direction and empties thru a number of mouths into Skagit Bay, an arm of Puget Sound.

4. Throughout its course it is joined by a number of important tributaries, chief among which are the Sauk and the Baker. The source of the Sauk is free from snow for a few weeks in the year only, while the Baker and its tributaries have their sources in the constantly snow-clad sides of Mt. Baker and Shuksan.

5. The warm Chinook winds so prevalent in this country are responsible for a rapid melting of the snow, which causes the freshet and floods to occur in this valley. These are due any month in the year. Periodically these floods are of an extreme height, and almost invariably at such times the river banks at the sharp bends are eroded and under mined the expensive dikes built at great cost by the owners of adjacent property, and which tumble into the river resulting in a great sea of water, rushing like a torrent across the low lying fertile farms, between the river and the salt water, and which for weeks at a time remain inundated.

6. At low water times, the Skagit and its tributaries flow about 4,000 cu.ft. of water per sec.; at freshet season this approaches 50,000 cu.ft. of water per sec. and at flood periods, it is estimated the flow is 100,000 to 120,000 cu.ft. per sec. It has a drainage area of 2834 sq.mi.

7. Between Baker and Sedro Woolley, the fall of the River is approximately $2\frac{1}{2}$ ft to the mi; between Sedro Woolley and Mt. Vernon about $1\frac{1}{2}$ feet to the mi, and between Mt. Vernon and the mouth of the river about 1 ft to the mile.

8. The Skagit Delta including the LaConner Flats embraces a rich bottom land, about 20 miles long by 10 miles wide and is considered to be the most fertile in the State. Much of this land has been cleared of trees and stumps and brought to a high state of cultivation at great cost to the owners. Part has been reclaimed from the sea, and part protected from the freshets of the Skagit River by means of dikes. The river and the sound shores are divided into diking districts, but there is a lack of one general and systematic plan for the construction of these dikes. In some places, they are unnecessarily high, in others dangerously low, and in a good many places, they are weak and thin, and for a long stretches they are too near the river banks. The placing of dikes too near the river banks confines the waters so much that at times of freshets and floods an abnormal rise is produced, and also exposes the dike to the swift current, which at times washes it away. The greater part of the breaks in the dikes along the river in the past has been due to this fact or to the fact that the yielding river bank unprotected by a systematic revetment erodes away until it met the dike when the bank gave out underneath and actually tumbled the dike into the river.

9. It therefore seems to me that the proper solution of this problem is to form the entire part of the Skagit Valley needing dike protection into a single district and the appointment of a competent, experienced Civil Engr to take entire charge of the planning, building and maintenance of all the dikes, and to revet the yielding banks in such a manner that erosion will be arrested and the channel of the river be confined to a stable location. Two things are thereby accomplished; namely - First the dikes are under the control of one directing head, are systematically located and constructed in the most economical manner as regards first cost and cost of maintenance; Second the river is prevented from changing its banks at every succeeding freshet.

10. By consulting the map you will observe that there are places where the river has actually wandered 400, 500 and 700 feet into the rich farming lands in the interval of time between surveys carrying away dike after dike and placing a tax upon the lands which is not in instances burdensome, and amounts to from \$3, to \$8 per acre per annum.

11. The loss in taxation revenue alone due to these periodic breaks in the diking system, has already in the past 10 years cost the state and county of Skagit, many thousands of dollars, and has impoverished many if not prosperous farmers who lost their cattle, their crops and the use of their land for several seasons, and in instances imperiled human lives. I dare venture to say that not a family lives behind these dikes, but is most uneasy and feels insecure at every freshet season, and keeps within its dooryard a boat ready at a moment's notice to convey that family to safety, should the river wash away its banks, and the dikes fail. This insecurity, this constant fear and dread, should be removed at once, and this fertile valley made as secure from inundation and disaster, as the Cities "built upon a hill".

12. The cost of this should be borne in part by the State and the money so expended by the state will be repaid many times in regular taxation.

13. The U.S. has for many years been operating a snag boat upon this river in the interests of commerce and navigation. Its function is to remove the troublesome snags and trees from the channels of the river, wherever that channel is then located, whether it be next year upon the adjacent farm, or elsewhere, and doubtless this will continue to be the function of the U.S. in the matter of its improvement work.

14. The State of Washington should bear the cost of revetting the eroding banks in accordance with some systematic plan.

15. The County of Skagit should systematize its diking plans and bear the expense of location, construction and maintaining them.

16. Under such an arrangement, the cost will be much less and the work done by the U.S. with its snag boat and otherwise will be a permanent character, and will result no doubt in a navigable channel of greater depth year after year, extending farther and farther inland.

17. Between Sedro Woolley and the G.N.Ry Bridgell, 32 miles, there are 32000 ft of river bank, that should be protected by revetment.

18. Between the G.N.Ry bridge and Mt.Vernon 4.72 mi. there are 22,000 ft of river bank that should also be protected by revetment.

19. Between Mt.Vernon and the mouth of the river 13 mi there are 36,000 ft of river bank that should be reveted.

20. This revetment aggregating 90,000 ft should consist of sloping bank, giving it a uniform grade of not greater than 1ft vertical to 2 ft hor. covering this graded bank with a compact layer of willow & brush fascines woven together with wire and well staked to the bank. This carpet of brush fascines, should be securely weighted with stones which can be obtained from quarries located near the mouth of the river.

21. The cost of doing this work will amount to about 5 dollars per running foot of river bank.

22. Estimate:

Between Sedro Woolley and the G.N.Ry bridge	32,000 feet.
" G.N.Ry. Bridge and Mount Vernon	22,000 "
" Mount Vernon and mouth of river	36,000 "
Total 90,000 lineal feet at \$4.00 per lin.ft.	\$360,000

23. This work should be undertaken at an early date; otherwise the difficulties and expense are multiplied by the continual increase in curvature and change of directions at the bends, and to this end I would suggest that you ask for cooperation on the part of the State and the County governments, that funds may be supplied for the purpose to be expended under a commission to be appointed by the governor of the State and in accordance with the wishes of the people of the county interested. All of this work does not have to be done at once it might be extended over a period of years, but there is about 1 quarter of it that should receive immediate attention. The object lesson shown by this start I feel sure will prove most convincing to all interested in the county and its prosperity that the whole river where necessary will be controlled in less time than now seems possible.

24. In addition to the above a safety levee should be constructed to prevent the inundation of the LaComner Flats should the freshets or floods reach such extraordinary heights as to spill over the dikes or to undermine them.

25. In this respect I would suggest that cooperation with the G.N.Ry. System be arranged and it induced to raise the grade of the road between Sedro Woolley and Burlington and Burlington and the bridge to a level well above the previous flood heights.

26. All trestles in this length should be filled in to prevent a cross country current West of the railroad and the culverts should be provided with flood gates that will automatically close with the rise of water.

27. The dike system from where it joins the G.N.Ry at the bridge to Avon should be strengthened and raised to a level well above the flood heights.

28. At the mouth of Gages Creek it should branch into a dike and levee the dike following the present dike and the levee be located a safe distance therefrom and about as suggested on the map.

29. From Avon to a point just below Storrs Eddy the levee should run fairly direct and be built upon a right of way 100 feet wide, and have a cross section 20 ft wide on top with side slopes of one on two on the river side and one on one on the land side. The surface of this levee raised well above the flood heights should be ballasted and the ballasted levee used as a county road connecting Avon with Mt. Vernon

30. The function of this levee will be to prevent inundation of the lands lying W of it and between it and the salt water known as the LaComner flats and embracing nearly 200 sq.mi. should the dikes fail at any point due to excessive rises or to an undermining of them?

31. The dike below its junction with the proposed levee near Storrs Eddy should be strengthened where necessary and raised to a level well above flood heights as far as Pleasant Ridge.

32. The cost of this safety levee and dike strengthening should be borne by the lands so protected.

33. It is estimated the cost of these things will amount to the following

Strengthening dike from G.N. Bridge to Avon	\$15,000
Right of way for levee Avon to Storrs Eddy	
30 acres @ \$300 per acre	9,000
Construction of 16,000 lin.ft. of levee	35,000

Strengthening dike from Storrs Eddy to Pleasant Ridge	25,000
Engineering and contingencies	16,000
Total	\$100,000

As there are some 40,000 acres of land within this levee the total cost per acre will amount to about \$2.50 per acre, an amount exceeded in instances by the annual dike tax. This extended over 5 years will cost about 50¢ per acre per annum plus the interest charge. It seems to me that the annual saving will amount to quite as much as the total cost.

34. I have been informed that committee has been named to look into the matter of legislation needed to do the things here outlined and I would respectfully suggest that they meet with attorneys versed in the diking laws and find out whether they can proceed under the present statutes and if not then to prepare a bill for action by the present session of the legislature. It occurs to me that a law that will permit sections of a county to organize diking districts and include any lands whether now included in other diking districts or not will do. This would be combining the work of all districts interested in a specific work to assist in its payment. Should this feature meet with favor and the citizens of Skagit County desire to do the work there is great necessity of a law that will permit it.

35. On the south side of the river below the G.N.Br crossing if there is great necessity for a strong and substantial dike. Its location is a matter of vital importance and should be given study and careful consideration, as upon its proper location depends the cost of maintenance and worry to your citizens.

It is my opinion that it should be kept back from the river bank a good safe distance so that the swift current of the river will not attack it and destroy it. In front of it there should be a county road of proper width, and here too the river banks should be properly revetted, and the wearing away of the banks stopped. I would strongly urge that the system of dolphin driving be discontinued and the bank revetment substituted. When once done this is good for all times with only a small maintenance charge. With these things done at this point I feel certain that the lands between Mt. Vernon and the bridge will not be inundated.

36. On the Mt. Vernon side of the river opposite Storrs Eddy the point of the old jam should be removed and the river at this point straightened. This will have the effect of reducing the force of the current at the place below Storrs Eddy where the dike system and river bank were badly eroded.

37. For the relief and protection of the district embracing Skagit Island or immediately below the source of North Fork I would strongly advocate the straightening of the river in that vicinity, leading the river known as the South Fork across the neck of land at the mouth of Britt's Slough. By so doing the great blow of the swiftly running water is lead away from the point just above Skagit City and instead of erosion there will be a fill and the annual expense here necessary will cease.

38. For this work it might seem proper for this district to buy the right of way and the State and County to make the cut. This proposed cut will also work in the interest of navigation by cutting out a bad bend and directing a direct flow over several bad shoals just below Skagit City, and near which the banks from time to time erode badly.

39. Accompanying this report are 8 maps, one an index map of the country below Sedro Woolley and the Sound while the others are maps on a larger scale showing sections of the river in greater detail.

Respectfully submitted

Your obedient servant,
J.M. Clapp,
Consulting Engineer.