

IMPROVEMENT AT MOUTH OF COLUMBIA RIVER

Mistakes of the Past and Plans for the Future Present Jetty in Wrong Direction and Leaves Discharge Channel Too Wide Proposed \$2,500,000 Extension Unwise Columbia Capable of Best Bar-Harbor Entrance in the United States.

The Columbia is the great river of the West. It drains an empire and breaks through all mountain barriers on its way to the sea, and along its water levels artificial highways of modern commerce easily come and go.

It flows along the line of trade and commerce and westward with its waters the star of progress has taken its way. It is a natural outlet to the Orient. Unlike the Atlantic, there are few commercial harbors along the Pacific, and the engineer reports say that the Columbia is the only deep-water harbor between San Francisco and the Straits of Fuca—a distance of 700 miles, equal to that between South Carolina and Maine—and its entrance performs the function of a harbor of refuge and a commercial gateway. Last year only four American ports excelled Portland in wheat and flour shipments, and no prophet can estimate the immensity of our future developments.

Accompanying are two maps. On the first, A-A is a recommendation of Colonel Gillespie for a pile jetty of 8000 feet, estimated cost, \$430,000, to be extended towards Cape Disappointment at will. This plan the writer in 1882 submitted to Captain James B. Eads, receiving the earnest approval of that famous engineer of Mississippi jetty fame. Colonel Gillespie's plan, however, had been referred by the Chief of Engineers to his advisory board in New York City, who condemned it, but suggested nothing in its stead, not deeming improvement of sufficient merit.

This adverse report stood a lion in our way. The writer attacked it before the river and harbor committee and April 4, 1882, on the floor of Congress, finally, in a clause drafted by the writer in an act passed in 1882, we were granted an appropriation of \$7500 for a board of engineers to investigate and, if found feasible, report a plan. The board reported the mouth was capable of being greatly improved—a minority, Colonel Mendell, favoring a jetty along a line about parallel with that of Colonel Gillespie toward the cape, and to be extended until the mouth was normally concentrated—the majority favoring a jetty running a little more outward and built up only to low tide and terminating at a point leaving the mouth three miles wide.

B-B is the jetty recommended by Colonel Mendell. It is a jetty extending northward about 14,000 feet, and four feet higher than the majority plan and extended as occasion required, costing, with contingencies, \$3,375,000. He said that the controlling natural feature, which seemed entitled to credit for past generations, was the occasional elevation of Clatsop Spit, and added:

"It is practicable to restore and magnify the condition of Clatsop Spit by a work which shall present no unusual difficulties of construction, which shall be subject to a minimum of expense and one which is practicable at a moderate cost and capable of being built in three years. To concentrate the river within moderate width and to discharge it as a unit to the sea, are the objects sought. This condition attained gives the best assurance of good results. The most favorable position for work which shall fulfill these conditions appears to be a line on the north side of Clatsop Spit and about parallel to the crest. The object to be secured by the work is merely the practical elevation of Clatsop Spit."

It is regretted that Colonel Mendell's plan was not followed. The sooner we conform to it the sooner the best results will be attained.

C-C is the jetty as approved and built.

D-D is the proposed three miles' extension estimated to cost \$2,500,000.

While the results have not been satisfactory, yet they are not unsatisfactory as they would have been had Mendell's plan been adopted.

When the jetty was commenced in 1885, there had been a main ship channel flowing around southwesterly, and a small unused channel flowing nearly northwesterly. The main ship channel last used in 1885 in depth was 20 feet; five years after, in 1890, it was 24 feet; in 1897, 27 feet; in 1902, 25 feet; and in 1895, when the jetty was done, 31 feet. By 1897 this channel unsatisfactorily dropped to 20 feet; in 1898, to 23 feet; in 1899, to 28 feet; in 1900, to 24 feet, and now to 22 feet. These soundings mean low water. Tide adds about 8 or 9 feet. The channel used by ships just before had in 1885 scoured out about two miles northward towards the place where it ought to run.

Though the channel was shifting by a while properly northward, it was, however, to be expected when such a large mouth had been left that more or less variation of bar depth would occur, owing to many causes. While the building of the present jetty, even in the mistaken direction and only to low tide, has been beneficial, yet the hopes of the Government have not been realized. In fact have been attended with disappointment, and naturally enough.

While the mouth has been partially contracted advantageously, it has not been contracted enough for desired results, and if the present jetty is extended seaward, as contemplated, the extension is sure to disappoint and be abandoned. The plan has failed because it ran in the wrong direction, and also because not yet built high enough.

HOW NATURE DOES THE WORK.

Crowded Mouth of the Columbia Over From Clatsop Plains.

Ages ago the mouth extended from Tillamook Head to the cape. Years of the strong southerly winds and currents prevailing on this coast the greater part of each year gradually carried sand and silt and filled in Clatsop Plains and drove the current northward toward the cape. After building up Clatsop Plains terminating at Point Adams, the resisting action of the crowded-over channel of the Columbia retarded land formation, and the outgrowing spit of sand continued under water, constantly growing longer and higher (owing to the same cause) in the submarine Clatsop Spit running on out under the six miles' mouth space between Point Adams and the cape.

Nature, in her prevailing southerly winds and attending southerly currents, has been and is now at work the greater portion of each year trying to narrow

the six-mile mouth by this Clatsop Spit growth, whose end, in some storm between Vancouver's survey in 1792 and Belcher's in 1839 slung off and grew, from these same physical causes, into Sand Island, which island has continued to move inward northeast towards Baker's Bay, Nature, building only with sand, which has had to contend with wave and storm and current washing over it, has not been capable of permanently sustaining the spit sand growth under water, so as properly to narrow the mouth, and, now, man whose need requires a deep and permanent channel of the river to the sea, must aid and build and hold by a stone jetty the contraction which nature so happily is trying to accomplish. The end desirable is a narrowing of a mouth heretofore and yet too wide.

Six miles for the proper discharge of the waters of the Columbia at this tide, is six times too large. This abnormal width wastes the force and affords no independence or stability of channel. Contracted to normal width, the strong outward current will go straight to sea in one place, will deepen with powerful scouring effect, and will carry far into deep water the sand bar which ever forms at the mouth of any outlet of a river (or bay fed by a river) into an ocean. Rivers carry silt in solution and sand, and as they pour into the ocean, meeting resisting wave and tide, the current demands and silt and sand are deposited as force meets force, forming a sort of half-circle or half-ellipse cordon, deepest, of course, where the current is strongest, which deepest portion is known as the "bar," and through which tides flowing in and out scour deeper still, and thus the "bar" is sought by ships entering or departing. To concentrate the force of the mouth to normal width, rendering permanent a single channel to the sea, secures the deepest and safest entrance, and this is the problem presented.

A river with too big a mouth, like a wide hose-nozzle, "scatters" to much. Its current can have no straight, enduring channel. The mouth of the Columbia has had at times, and will have until normally adjusted, divided and shallow channels with shoaling sand banks at one place one year and another next. In its abnormal width it has yet much wastage of current water over shallow sand spits and even the jetty itself, with resulting diffusion of channel. Every river should have a normal width of mouth and then its ebbing concentrated current will drive out against the counter-wave action into the deep sea, with all its current and tidal force, in the center of the mouth, and on the sides, with universal result that there will, and ever must be, a half-moon or cordon of sand around the mouth in the sea with the deepest cut or "bar" in its outer center. The stronger the current the farther out will be the ever-extending "bar." Observation of the channel of the Columbia wherever it passes through headlands or at the mouth suggests that one mile between Point Adams and the cape would be ample and therefore proper. Experience with river harbor entrances confirms this.

SAN FRANCISCO'S GOLDEN GATE.

Bar There, but Narrow Mouth Carries It Out to Sea.

The Golden Gate at San Francisco is less than a mile between the heads. The Sacramento and other rivers, with waters of the tidal basin, flow out as the tide ebbs, twice every 24 hours. The heads hold the current permanently in place and the water goes out in a straight, ever-enduring channel, with the "bar" far out. It may be seen that there is a bar at San Francisco. Men talk of the 50 or 60 feet of water in the Golden Gate, but overlook the "bar" far out, and unheard of, except by pilots. It is seven miles out from the heads, but its sand bottom is down only about 32 or 33 feet, and the tide only raises the water over it about four or five feet more, so that they only have about 28 feet at high tide over their bar, nevertheless, it is sufficient for the shipping of the world.

The San Francisco bar is a quarter of a mile across and out over this narrow bar, seven miles at sea, all their deep-draft ships must pass, under guide of pilot. Our bar today is not out over three miles from the cape. Our powerful Columbia, however, sends to sea annually nearly as much water as the Mississippi. It now has one head for a Golden Gate in Cape Disappointment at the mouth. Give it another head on the south, about a mile or so away, and we, too, will have a Golden Gateway for the deepest of deep-draft ocean liners, freighted with the goods of our world, with our bar thrown twice as far out as it is today.

The great prevailing winds and currents from the south and southwest are working to build up this Head on the south, the immense growing and rising Clatsop Spit. Uncle Sam and an appropriation and a jetty of stone will combine with the ever-upbuilding forces of nature, and also prevent destructive inroads of sloughing or wasting waves or currents, which otherwise occasionally sweep or tear out the upbuilding of Clatsop Spit "Head."

A deep channel was once washed out and ran to sea right through where the jetty now crosses and along where it is built, and near the mainland at Point Adams, as Belcher's survey of 1839 shows; but it later on filled up, or rather moved northward with the Sand Island cut off. Again, by the time of the commencement of the jetty in 1885, the same deadly swash again was threatening, in what was termed "Tillamook Chute," and but for other things would have had another channel to the sea, destroying or weakening the main channel, and another Sand Island.

Nature is ever struggling to build up and hold Clatsop Spit. To aid nature is the key of success at the mouth of the Columbia. Uncle Sam has but a simple problem on his hands. Nature points out the system and is constantly at work attempting to build up a south bank and the Government has but to run its stone dam and pile jetty out and hold it. Nature does the rest.

Stone is cheap and plentiful, and no terebo attacks wood in the fresh water of the mouth. Suppose Tillamook Head could be closed in with the ages of Clatsop growth, narrowing the wide waters of the mouth towards the cape, like the closing of the under jaw against the upper, until Tillamook Head rested on the end of Clatsop Spit a mile or less from the cape, does anyone suppose we would

have had a fluctuating or divided channel, or talk of any kind of a jetty? To ask is to answer the question.

DEFECT OF PRESENT JETTY.

Appears to Narrow Channel, but Does Not Really Do So.

People gazing at the remarkable sight of cars running apparently 4½ miles in ocean (though really over wasting water)

member of the river and harbor committee, to all such improvements in this country, and have spent some thought on this work, and what I say is earnest conviction. It is the universal experience elsewhere that harbor improvements cost far above estimates, but it is notable that the mouth of the Columbia has been the exception. The estimates for the present jetty were \$5,710,000, without contingencies.

It was, however, built for \$1,948,223, a little over half. The sand filled in and built up, giving more shallow water to work in and less depth of jetty to build up. These great southerly winds and coast currents do the main work. These winds blow hard, as each Oregonian can attest, and they blow the greater portion of the year, and they build up the great Clatsop spit by natural operation. There, however, is a small sand growth on the north, the result of light northerly Summer winds, known as sea breezes. They have a somewhat contracting effect and produce Peacock Spit, and par-

terns on a sand spit between river current and ocean) think they see a jetty, but they see only a pile of sand for carloads of stone to be dumped along the jetty on Clatsop Spit and not yet raised high enough.

The jetty, as built, only comes to low water on what was a shoal sand spit, and three miles space of real depth of water is yet left. But little has been done in the way of concentration of diffused water. It has been a narrowing in looks, but not in reality.

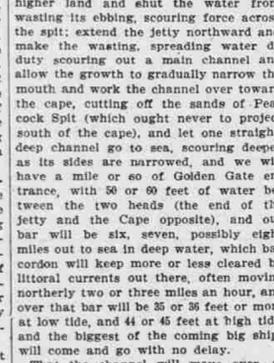
Build your jetty eventually high enough so the sand drifting or flowing will form

higher land and shut the water from washing its ebbing, scouring from across the spit; extend the jetty northward and make the wasting, spreading water do duty scouring out a main channel and allow the growth to gradually narrow the mouth and work the channel over toward the cape, cutting off the sands of Peacock Spit (which ought never to project south of the cape), and let one straight, deep channel go to sea, scouring deeper as its sides are narrowed, and we will have a mile or so of Golden Gate entrance, with 50 or 60 feet of water between the two heads (the end of the jetty and the Cape opposite), and our bar will be six, seven, possibly eight miles out to sea in deep water, which bar cordon will keep more or less cleared by littoral currents out there, often moving northward two or three miles an hour, and over that bar will be 35 or 36 feet or more at low tide, and 44 or 45 feet at high tide, and the biggest of the coming big ships will come and go with no delay.

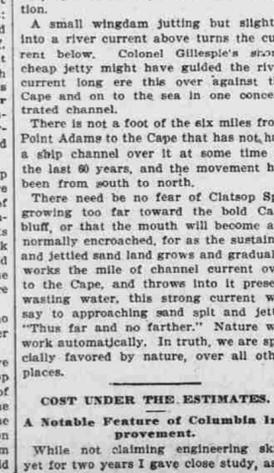
MAP NO. 1—MOUTH OF COLUMBIA RIVER, BASED ON SURVEY OF 1901.



MAP NO. 2—MOUTH OF COLUMBIA RIVER.



MAP NO. 3—SHIP CHANNEL FROM SAN FRANCISCO.



ternally neutralize the great southerly Winter winds in building up Clatsop Spit, but for which these Winter winds and currents would, without any jetty, drive the current completely over to the cape. A stone jetty on Clatsop Spit, helping it to grow in height and length, would make headland on the south, and by concentrating the present wasting water, the current would scour out the sand of Peacock Spit until the river current would wash against the opposite cape. If we only had headland on the south as now on the north, with only a mile or so between, and all the great ebbing current of the river had to go to sea between these two heads, we would have a permanent straight and deep channel, with the bar sands thrown six or seven miles out, as at the Golden Gate, and no more need of a jetty than San Francisco. Nature's strong southerly winds and currents are constantly building up a head for us, and

that the ¾ miles between Chinook Point and Point Adams is normal was error, for most of the width there is shoal and dead current, with scarcely a mile of channel ways, and channels shallower because of water diffused in surplus width. Every drop would easily flow out even if Point Adams and Chinook Point were only a mile apart.

MISTAKE OF PRESENT JETTY.
Extension of It Like Adding Flaring Mouth to Hose Nozzle.

While the jetty built has done much, it confessedly has not done enough. Time has shown its failure to secure desired results, and now to fail to profit by mistakes of the past, and worse yet, to base a new plan on a continuation of past errors and go yet farther and do what was not anticipated, by extending the outer end into the sea and three-quarters of a mile farther away than ever from the cape, thus widening the mouth of the river when narrowing was the purpose, like adding a flaring mouth to a hose nozzle, will be a striking departure, do but little good in any event, complicate matters and delay final complete success. The proposed extension is wrong in principle. The jetty so far has been confined to Clatsop Spit, a local product of southern winds and currents and along which a jetty can properly be built, had it been built in the right direction, as proposed, the proposed extension, however, is to be out in the sea off from Clatsop Spit sands and over sands constituting the bar product of inevitable conflict between all river mouths and ocean, and over which it is useless to ever build a jetty.

The two sand formations should never be confounded. While running into each other they are, as distinct in production and function as the heads at San Francisco or lands at each side of a mouth of a river are distinct from the sand half-moon cordon which encircles San Francisco's entrance or the entrance of any river outlet into an ocean. (See maps 2 and 3.)

The mouth was left too wide. Experience has demonstrated the mistake, and matters will never be permanently helped by extending the mistaken jetty clear out into the sea, where no jetty should ever be built.

In 1882 the majority of the board in narrowing the mouth did not desire to

obstruct unduly free entry of the flood tide into the basin at the mouth of the river, from which it is to be abated and the work required of it, but in San Francisco Bay three times our tidal basin water easily enters through heads scarcely one mile apart. However, if anything would "obstruct unduly," certainly the proposed extension out around in the sea opening three miles would. The controlling feature of any improvement should be concentrating the force in normal passage-way of the outgoing immense Columbia water, which never returns, and nature, as at San Francisco, will take care of the rest. The strong river, enforced with the tidal back water through only a mile opening even, will in its powerful ebb scour out its own deep way to the sea. It is a mistake to leave the top of the jetty at low-water line, that incoming tide may flow over to fill a tidal basin inside the mouth. What flows in that way, and has nothing, besides, so much more flows out over a low jetty (and uselessly, too) than flows in, for what flows in flows slowly against the backing-up waters of the strong Columbia current, while what flows out goes with the current and flows rapidly. The ebbing scour of this excess should be utilized. There need be no fear by engineers but the "tidal basin" inside will once get a straight permanent channel to the sea, it will scour and carry out the sands of the bar to the deepest outer water possible, and we shall have a deeper bar entrance than any leading American city and the finest river water entrance in the world.

NO USE TO BUILD IN DEEP WATER.
Less Red Tape and More Independent Thinking Advisable.

To run the present jetty out a total of 7½ miles when the mouth of the river was only six miles, is wasteful and useless and would only delay final success. To extend the three miles, as contemplated, is not only contrary to a correct system, but is also to build into deep water, where that deepens as the jetty extends, and costing \$2,500,000, with, at best, uncertain results. To run a spur, however, from the present jetty is to build with nature, and in shallow water and where incoming sands will reduce expenditures below estimates on present depths, and narrow the excessive throat or river mouth. Extensions of the present jetty cost too much money and promise too doubtful results. Far less expended on Clatsop Spit on line to the cape, as Colonel Gillespie and Mendell recommended, would surely accomplish the desired results, and quickly. Results are what we want.

The present jetty, while too much to sea, can be utilized to good purpose, and any abandoned part will contribute to the support of Clatsop Spit and serve as a buffer for the spur extension.

It may prove harder to change Government plans than the river channel itself, but if the able and well-intentioned engineers will but care less for red tape and precedent all along up to a well-meaning Congress, and do a little independent thinking, all will be well.

Now is the time to reason this matter over. Colonel Gillespie and Colonel Mendell and Captain Eads had the true idea, but the Government plan as carried out, mistakenly swung too much outward and now threatens to "drift to sea" in more senses than one.

Visions of "40-foot channel clear to sea" will be Dead Sea fruit and but ashes to the lips. Let us think twice before we leap. Time is too precious to throw away. In fact, no one stands sponsor for desired success in the proposed extension. The local engineer, realizing, as he said, that "in its present state the condition of the bar channel is unsatisfactory" (see report of November 6, 1899), and that since work stopped in 1885 "this channel has deteriorated in depth," proposed the plan of extending the present jetty. His idea of results is in these words:

"Since the 40-foot depth in the channel extends considerably over a mile seaward of the sea end of the jetty, a prolongation of the latter suitably would certainly induce an extension of the former," probably until this depth (40 feet) "broke through the bar and the desired 40-foot channel be obtained." This is his strongest recommendation for this expensive extension. The report, "endorsed" by officials through which it passed, finally arrived at Congress and has been waiting action now nearly two years. With all of us the "wish is father to the thought," and we jumped to the conclusion that the Engineering Department assured us that if we can only get \$2,500,000 from Congress for such an extension, we shall have 40 feet of low water to the sea. A little observation will undeceive us. He is possibly right that an extension of the present jetty would induce an extension of the present bar and a 40-foot channel be obtained (through the present bar), but even if it did, the bar would merely be driven out some farther and probably a little deeper, but how far and how deep, the report is silent. If out a mile and a half, it might indeed be true that a 40-foot channel had been driven through the bar," but the bar would simply be a little beyond, but not out two or three miles farther into deeper water, where it should be forced to insure desired depth.

It may be desirable, of course, to extend the 40-foot depth out and cut through where the bar is at present, if it can be done, but the mistake the public makes is in assuming that then there would be no bar beyond, and 40 feet obtained clear to the sea, but the report does not so predict, and no engineer will so assert. No engineer has or will place himself on record that there will be no bar beyond, nor have any predicted what depth of forms will be over any new bar as it forms, as form it must.

That there will be a bar beyond, everybody on a moment's thought must see. There must ever be a bar at the ocean mouth of any river. These are the cold facts, notwithstanding prevailing impressions that engineers have created as a result what is devoutly desired, namely, a 40-foot channel reaching permanently to the sea. The \$2,500,000 extension proposed in any such assurance will prove but words of promise to the ear but broken to the hope. Indeed, a 40-foot channel at low water to the sea is questionable. However, a 40-foot channel at high tide can easily be secured at the mouth of the Columbia, but never by extension from the present end of jetty in the direction proposed.

WHOLE THING IMPRACTICABLE.

Present Scheme—All Wrong and Could Be Easily Righted.

Another thought. Any extension into the sea and away from the real throat of the river should be accompanied by a companion three-mile parallel project on the opposite side from the cape to the sea; but as that would be no better than the three-mile throat existing, there is

nothing practical in the idea, especially as jetties out there are exposed to all destructive elements of the ocean itself. In other words, the whole thing is impracticable.

Again, suppose the three-mile extension disappears, what then? And what is to become of the mass of stone lying outside along our ship channel to the sea and buffeted by storm and wave? The whole extension project is utterly out of the question. The engineer in his recommendation of 1889 conceded that the bar had decreased from 31 feet in 1886 to 25 in 1890. No wonder he said "the decrease in depth since 1885 is serious." As it has, since decreased to 24 feet in 1890, and the present year to 22 feet, but three feet more than when the jetty was commenced, it is more serious.

The great flood of 1894 helped drive the bar further out, and scoured it deeper, resulting in 31 feet in the next survey of 1895, and our comparative freedom from flood since, and the consequent weakening of the force, has contributed to deterioration of depth since. During all these times the low jetty leaving a three-mile mouth has not properly concentrated any of the time, and allowed too much wastage at all times. Another 1894 flood would "extend the 40-foot channel" farther out than any proposed \$2,500,000 jetty. The flood of 1894 extended the 40-channel and bar a long way farther out than ever since. Though the entrance is not nearly so bad as in the past, the truth is it is still so wide that the channel vends and crooks, is subject to shifting sands and shoaling currents, one depth one year and another next, and bar and channel buoys have to be adjusted and readjusted to mark the changing shipway. This is all wrong, and can easily be righted, and should be without further needless delay. The river throat has been left so excessively wide that even in the last year a sand bank is cropping up like an embryo sand island over a half-mile from the cape on a line to Point Adams, right in the throat of the river, and where the ship channel came from Baker's Bay 20 years ago, and directly where the ship channel ought now to go out to sea. (See map No. 1, marked "X.")

Why not contract the too-wide mouth, where nature and sound judgment indicate, and cut out such growth as "X" shows? Let us call a halt, and be sure we are right. I feel sure we are wrong in agitating for the extension of the jetty as proposed. Let the coming river and harbor bill, as in the last one talked to death by Senator Carter, contain an appropriation for the improvement of the mouth of the Columbia, but to be expended on such plan as may be approved by the present Chief of Engineers. Colonel Gillespie has fortunately recently become Chief of Engineers. Let him be given a fair chance again at this great work, and after this lapse of 20 years, and empower him at his discretion to appoint a board of engineers to review, with all the light we now have, and let Colonel Gillespie, who for years was local engineer in charge, now say what plan of jetty extension and from what point will secure the greatest benefit.

The quicker we conform to practical ideas of such eminent engineers as General Gillespie and Colonel Mendell and Captain James B. Eads, the sooner we shall attain the destined grandeur of the harbor of the great Columbia.

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Again, suppose the three-mile extension disappears, what then? And what is to become of the mass of stone lying outside along our ship channel to the sea and buffeted by storm and wave? The whole extension project is utterly out of the question. The engineer in his recommendation of 1889 conceded that the bar had decreased from 31 feet in 1886 to 25 in 1890. No wonder he said "the decrease in depth since 1885 is serious." As it has, since decreased to 24 feet in 1890, and the present year to 22 feet, but three feet more than when the jetty was commenced, it is more serious.

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The great flood of 1894 helped drive the bar further out, and scoured it deeper, resulting in 31 feet in the next survey of 1895, and our comparative freedom from flood since, and the consequent weakening of the force, has contributed to deterioration of depth since. During all these times the low jetty leaving a three-mile mouth has not properly concentrated any of the time, and allowed too much wastage at all times. Another 1894 flood would "extend the 40-foot channel" farther out than any proposed \$2,500,000 jetty. The flood of 1894 extended the 40-channel and bar a long way farther out than ever since. Though the entrance is not nearly so bad as in the past, the truth is it is still so wide that the channel vends and crooks, is subject to shifting sands and shoaling currents, one depth one year and another next, and bar and channel buoys have to be adjusted and readjusted to mark the changing shipway. This is all wrong, and can easily be righted, and should be without further needless delay. The river throat has been left so excessively wide that even in the last year a sand bank is cropping up like an embryo sand island over a half-mile from the cape on a line to Point Adams, right in the throat of the river, and where the ship channel came from Baker's Bay 20 years ago, and directly where the ship channel ought now to go out to sea. (See map No. 1, marked "X.")

WHOLE THING IMPRACTICABLE.

Present Scheme—All Wrong and Could Be Easily Righted.

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