

1890

Good letter about Petoskey
asking for breakwater



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Statement showing amount in tons (estimated) of each staple article of freight.

Articles.	Tons.	Articles.	Tons.
Received:		Shipped:	
Lumber.....	143	Coal.....	40
Shingles.....	6,510	Grain.....	55
Laths.....	633	Mechandise.....	265
Posts.....	679		
Wood.....	1,070		
Salt.....	8,483		
Pig-iron.....	2,853		
Potatoes.....	15		
Total.....	20,380	Total.....	360

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PRELIMINARY EXAMINATION OF PETOSKEY HARBOR, MICHIGAN, FOR BREAKWATER AND HARBOR OF REFUGE.

UNITED STATES ENGINEER OFFICE,
Detroit, Mich., October 23, 1888.

SIR: In compliance with the requirements of section 13 of the last river and harbor act, and letter from your office, dated August 28, 1888, I have the honor to submit the following report of an examination of Petoskey Harbor for breakwater and harbor of refuge.

I have had occasion to visit Petoskey several times during the past twelve years in connection with my duties on the east shore of Lake Michigan.

Petoskey is a small village of 3,500 people, occupying a picturesque site on the bluffs overlooking Little Traverse Bay, and near its head. The bluffs descend almost vertically to the narrow gravelly beach of the bay, which here is fully exposed to the winds from the north and north-west. The present and prospective business of the place is small, and it is chiefly noted as a popular summer resort, and being at the terminus of an important railroad, is a point of departure to numerous like resorts in the neighborhood of the Straits of Mackinac, between which places small steamers ply during the season, while during the past season one large steamer has made regular trips there from Chicago.

During high winds from the north and west these vessels find it difficult to make a landing at the one small dock at Petoskey, and at times find it impossible to do so, and must seek shelter in the commodious natural harbor 3 miles across the bay.

This harbor at Harbor Springs is one of the finest harbors of refuge on the Lakes, and therefore a harbor of refuge at Petoskey is not called for in the general interests of commerce; all that is desired is a breakwater, to insure a safe and certain landing place in all weather for these vessels.

I consider this claim of Petoskey for a breakwater as a good one, and am not sure but that it is justified by the circumstances. All the facts bearing in the case are contained in the accompanying report of a personal examination made on the 12th instant by my assistant, Lieut. Joseph E. Kuhn, Corps of Engineers, and a document furnished him by leading citizens of Petoskey.

A comparatively cheap structure of timber cribs and stone, the material being abundant at the place, costing probably \$75,000, could be built, which would amply provide for quiet water at the wharf, and

would enable vessels to take on and discharge their cargoes in all weather.

Such a breakwater need not be of any great length, nor need it be built in very deep water to meet all the desired requirements.

It is therefore recommended that a survey be made having this object in view. Said survey will cost about \$600.

Very respectfully, your obedient servant,

S. M. MANSFIELD,
Lieut. Col. of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

REPORT OF LIEUTENANT JOSEPH E. KUHN, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Grand Rapids, Mich., October 19, 1888.

COLONEL: I have the honor to state that in obedience to your instructions I made a personal examination of Little Traverse Bay, in the vicinity of the village of Petoskey, Mich., on the 12th instant, and now respectfully submit my report as follows:

The clause in the river and harbor act of August 11, 1888, calling for an examination or survey of this locality, states that the examination or survey is "for breakwater and harbor of refuge."

Little Traverse Bay is between 20 and 25 miles south of the western entrance to the Straits of Mackinac. Its general direction is east and west, and it is exposed directly to winds coming from the northwest and west. Its shores are bold and in most places rocky.

The village of Petoskey, with a population of 3,500, is situated on the south side and near the head of the bay. It is the northern terminus of the Grand Rapids and Indiana Railroad, at present the only railroad running to the village.

I do not consider a harbor of refuge at Petoskey as necessary, or even desirable, for the reason that on the north shore of Little Traverse Bay, and distant about 5 miles from Petoskey, there already exists a natural harbor of refuge which is practically sheltered on all sides and possessed of ample depth and area with a wide entrance marked by a light-house.

Furthermore, as stated by Maj. D. W. Lockwood, in a report by him on this subject dated October 25, 1884, Little Traverse Bay lies so far to the east of the course of vessels bound between the Straits of Mackinac and Lake Michigan ports that such vessels would find it more convenient to seek shelter under the lee of some of the islands near their course, or in Grand Traverse Bay, than in Little Traverse Bay.

In conversation with some of the representative citizens, I was informed that a harbor of refuge at Petoskey was not what was asked for, but a breakwater to insure a safe and certain landing place in all weather for vessels plying to the village. During westerly and northwesterly winds vessels are prevented from lying at the dock and are compelled to make for the harbor of Harbor Springs, on the opposite shore. In the inclosed communication, submitted in behalf of the citizens of Petoskey by three of their representatives, the necessity of a breakwater is made to rest on the necessity for a safe and secure landing place, and on the necessity for protection to the dock from destruction by storms. In my opinion the first necessity is the only one possessing any weight, as the dock itself can be constructed sufficiently strong to resist destruction by any storms that may visit Little Traverse Bay. The present dock at Petoskey is not adapted to withstand any very heavy storms, being built of cribs formed of logs, notched at the ends and insufficiently bolted together. The cribs are placed at intervals on the natural bottom and covered with a decking.

A comparatively cheap breakwater, costing probably \$75,000, could be built which would amply provide for quiet water at the wharf, and would enable vessels to take on and discharge their cargoes in all weather. Such a breakwater need not be of any great length nor need it be built in very deep water to meet all the desired requirements. The inclosed document from the citizens of Petoskey gives all the resources of the village and country tributary to it, as well as the present commerce. From this document it appears that 104 landings per week are made by boats in the summer-time at the Petoskey dock. These boats are mostly engaged in the passenger

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business. For the year 1887 the following commercial statistics are given, showing the business over the dock:

General merchandise.....	tons..	5,000
Fish	pounds..	1,000,000
Cedar, tan-bark and lumber.....	cargoes..	25

Petoskey is an important distributing point for the numerous summer resorts about Little Traverse Bay, which depend on the village for their supplies. Large forests of hemlock, cedar, and hardwood abound around Petoskey, and an increase of commerce may be reasonably looked for from the shipment of the products of these forests.

Very respectfully, your obedient servant,

JOSEPH E. KUHN,
First Lieutenant of Engineers.

Lieut. Col. S. M. MANSFIELD,
Corps of Engineers, U. S. A.

COMMUNICATION FROM CITIZENS OF PETOSKEY, MICHIGAN.

PETOSKEY, MICH., *October 15, 1888.*

SIR: In the matter of a breakwater at Petoskey.

In compliance with your request for information relative to the commercial necessities of Petoskey, as requiring the need of Government aid in the construction of a breakwater at this point, we have the honor to submit the following:

Up to the year 1875 the lands all about Little Traverse Bay were embraced within an Indian reservation and not open for sale or settlement. During that year the Grand Rapids and Indiana Railroad completed its line and began running regular trains to Petoskey, the terminus and objective point fixed by the act of Congress of 1856, aiding and encouraging its construction through leagues of unbroken forest.

About this time the reservation of lands in Emmet and Charlevoix counties expired, and settlers poured into every part of these counties, starting out from Petoskey, then but a railroad station and post-office.

Homesteads were selected and rude houses erected and improvements begun by men, as a general rule, without means enough to carry themselves and families through the first winter. From these beginnings, though retarded and delayed by lack of means, have steadily grown and developed thrifty farms and comfortable houses, scattered through the woods in all directions from Petoskey, the central supply and trading point.

A glance at the map of northern Michigan will show how naturally travel and trade concentrated at this point from all along the shores of Lake Michigan southwesterly, including the traffic seeking the railroad from all Charlevoix County by boat from Pine Lake, the channel of Pine River having been opened and protected by Government aid.

The trade of Petoskey has steadily grown from that date till now.

Our mercantile community now embraces five dry goods and general stores, four boot and shoe stores, three clothing stores, three furniture stores, two hardware stores, fourteen grocery stores, two flour and feed stores, four drug stores, two harness shops, two agricultural implements sales-rooms, three livery stables, one book and stationery store, two jewelry stores, four millinery, and other shops and lines of business usually represented in towns of this size.

In 1876 the Methodist denomination in this State conceived the purpose of securing a State camp-ground for religious meetings and health-resort purposes. A committee finally decided upon a spot on the shore of the bay a mile northeasterly from Petoskey. The railroad company purchased and presented them with a magnificent tract with nearly a mile frontage on the bay, on condition that camp meetings should be held for ten successive years. The people of Petoskey graded the highway and railroad track to the resort.

The growth of this resort has been phenomenal, a surprise alike to its projectors and the transportation companies. Others have sprung up around the bay, at Harbor Point and We-que-ton-sing, others at Charlevoix and Bear Lake.

The Michigan branch of the Chautauqua educational work has been located and is now in full working operation at Bay View every summer.

This has attracted other educational interests, till Bay View is and promises to be as well known and established as the eastern and original Chautauqua. The permanent summer cottage population of Bay View amounts to 2,500, not including the crowds who are there temporarily.

No traffic of any account is permitted on the grounds, so that all the trade and supplying of this population becomes a part of the established business of Petoskey.

The regular all the year round population of Petoskey proper must now reach 3,500. The school census this year was nearly 800. The public schools of the village employ one superintendent and principal, two assistants, and nine grade and primary teachers. The cost of maintaining the schools for 1887-'88 exceeded \$6,000.

Churches are well represented and supported, there being nine organizations, eight church edifices, and six resident clergymen.

In addition to the thousands of people who come to Bay View and the other resorts for educational and other advantages, great numbers come every season for health and recreation, so that large hotel accommodations have been required and provided. Petoskey already has nine regular hotels, to say nothing of numerous private boarding-houses, and more are required each year. And we neither exaggerate nor misrepresent the fact when we say that Petoskey is the radiating point and port of the tourist and resort travel of northern Michigan.

The railroad company's records show a total of * passengers landed into Petoskey during the season of 1887 (the official reports of 1888 are not yet accessible).

The steam-boats running on the bay from Petoskey to Bay View, We-que-ton-sing, Harbor Springs, and Harbor Point removed and landed at Petoskey dock over 50,000 passengers in the same year.

Steamers running from Petoskey to Pine Lake via Charlevoix handled, say, 15,000, Hannah, Lay & Co's line of boats the same or more, and the Manistique Line, say, 10,000. In all 80,000 or 90,000 people. This year the *Petoskey*, a large new steamer plying between here and Chicago, has been added, but official figures as to passengers and freight for this season are not complete or obtainable.

In order to understand the situation and peculiar needs of Petoskey in the way of transportation facilities, and to explain the past and prospective growth of the substantial and permanent industries of the town, allow us again to refer to any map of the region. The town grew up at the terminus of the railroad and about the mouth of Bear River, a stream heading in Bear Lake, a body of water of 6 miles in length, flowing thence through a heavy forest for nearly 20 miles to the bay. Down this stream are annually floated thousands of pieces of cedar for shipment over the Petoskey docks. Hemlock and elm in immense quantities is standing untouched waiting to be floated from the shores of Bear Lake and River to Petoskey for manufacture and shipment.

The stream, with a fall of nearly 75 feet within a mile of its mouth, furnishes motive power already for a number of substantial manufactories, among which we would mention William L. McManus, saw and planing mills; Birkett Brothers' wood pulp mill; Hankey & Riggs' cable and flouring mills; F. G. Winsor's wooden-ware works; Petoskey Electric Light and Power Company, and the city water-works.

The lake forms an immense storage reservoir, maintaining an adequate and uniform supply through the year.

In addition to these manufactories we already have others operated with steam. The Bauerle and Fay Wooden Ware Company are just completing a large plant; the "Kegomic Tanneries," owned and operated by W. W. Rice, just above Bay View; the Newberry Mill, in same vicinity; M. S. Plank's handle factory, at Carpenter, shipping point at Petoskey, as well as other smaller manufacturing industries, employing an aggregate capital of \$250,000 and employing upwards of 370 men, turning out a product of nearly \$400,000 annually.

The product of many smaller mills and factories located inland, back from the bay, should also be taken into account, as Petoskey is their nearest and most natural shipping point, as no other passenger and freight dock is maintained between Charlevoix and Harbor Springs.

The farm products are gradually increasing from year to year. The wheat product now supplies the requirements of the country, and soon will be exported in increasing quantities. Potatoes are a large article of export from this port, one firm having shipped by rail and water during the season of 1886 upwards of 35,000 bushels. The potato season of 1888 is just opening and promises to be a good percentage larger than that of 1886.

For years to come the manufactured and crude forest products will require larger shipping facilities from this point. The immense body of heavy timber south and east of the bay will naturally come to the water at this point for shipment.

Immense quantities of cedar and hemlock every year go from this port to Chicago and other lake markets. Hemlock bark is shipped largely every season.

The report of the Petoskey Dock and Warehouse Company shows handled over

* We are unable at this date to give the required data. Mr. Lockwood, of Grand Rapids, will be able to give approximate figures. It is safe to say that the persons stopping here by rail greatly exceed those by vessel. If necessary we can obtain the number later.

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this stock during 1857 upwards of 5,000 tons of general merchandise, 1,000,000 pounds of fresh fish, and 25 full cargoes of cedar, tan-bark, lumber, etc., and although a full report of the season of 1888 is not obtainable as yet, their books show a satisfactory increase of income and business over last year.

The fish business above referred to has been developed to an industry of considerable importance already. Connable & Sons fish with two steam-tugs from this point, and they and other dealers purchase, cure, and ship also the catch of a considerable number of men fishing on their own account.

The celebrated Petoskey lime is produced and shipped from here. H. O. Rose manufactures now about 35,000 barrels yearly, and the Petoskey Lime Company a less quantity. Large shipments of the rock for building purposes are also made.

The convenience and cheapness of excellent building material, brick, stone, lime, and lumber has contributed to and stimulated the erection of many substantial brick business blocks in Petoskey.

The following steam-boat lines have run regularly to this port during the season of 1888:

	Boats.	Landings per week.
Northern Michigan Line.....	2	4
Hannah Lay & Co. Line.....	1	6
Chicago and Little Traverse Line.....	1	4
Pino Lake Line.....	2	12
Caskey's Line:		
Beaver Island and Mackinaw.....	1	6
Harbor Springs Ferry.....	1	24
Crysler Line, Harbor Springs Ferry.....	2	48

Other transportation companies have contemplated coming here and establishing regular lines to Chicago and Milwaukee, but have as yet not done so, giving as a reason that they do not feel assured that our dock facilities are secure and permanent. In explanation of this, and to illustrate what has been required of the citizens of this village in constructing and maintaining docks at this point, it may not be out of place to mention what has actually been done and expended.

The first dock at this point was built by private parties at an expense of, say, \$3,000 as early as 1874 or 1875. This was swept away by the storms. Next, H. O. Rose, esq., constructed one in 1876 at an expense of about \$7,000. This stood till the fall of 1883, when the waves destroyed it.

No private capital seemed available to supply another to take its place; so the village voted to bond itself to erect a dock to furnish shipping facilities, which were imperatively demanded not only for the prosperity of the village but for the surrounding country at large.

The indebtedness of \$8,000 was incurred (and is not yet all paid) and the dock erected and used only for the season of 1884, when it, too, was strewn along the beach by a furious storm from the west.

During the winter following, enterprising public-spirited citizens contributed \$5,000 to erect the present dock, which has, fortunately, withstood the storms thus far, though, judging from the past, its destruction may be but the pastime and sport of November storms.

We, therefore, representing the citizens of Petoskey, and in behalf of its present substantial industries and the undeveloped resources of the country surrounding, appeal to the Government to aid us in securing and protecting landing and transportation facilities for our products as well as for the thousands of travelers who come to us every year.

We do so very earnestly, and yet boldly, because we are compelled to do so from our position and situation.

The hasty examination of the shore and bay at this point that you were able to make during your recent visit must have disclosed to you the difficulty of maintaining a dock or wharf on the rock-bottomed shore adjoining Petoskey. And the facts just mentioned show what has been done by our citizens. The village has yet the burden of paying for one dock destroyed before hardly complete.

There is no provision under which the county or townships, interested in a general way in common with our village, can raise money to assist in building and maintaining wharves to furnish shipping facilities for the forest and farm productions of the country. Then when local, municipal, and private enterprise have been taxed beyond its reach, and beyond its interest as well, what shall be done?

We have the docks constructed, and, without doubt, would be able to maintain ample wharfage for even prospective commerce were it not for our peculiarly exposed

shore. What we want, and all we ask, is some kind of protection to our wharves and to shipping while landing and lying at the wharf for passengers and freight.

We believe that we were but discharging our duty as citizens of the United States in thus laying before you, as the proper representative of the department of the Government for the expenditure of money for the improvement of harbors, information as to the needs not only of the village of Petoskey, for they are not limited to the town, but of the country back of us, for such protection for our wharves as will assure and encourage capital and labor in development of trade, manufactures, agriculture, lumber, fruit, and in short every resource of the country.

Beyond the limits of the village, the imperative necessities of the country tributary can only appeal to the General Government for aid.

There is no help elsewhere. So far as those interests are concerned we simply come to you with the facts from which you may be able to determine whether the aid of the Government shall be extended in the development of the resources of the country by protecting facilities for its travel and commerce.

There is no equality nor justice in heaping upon the citizens and property of this village the burden and responsibility of providing wharves and protecting them from destruction for the general benefit of the country surrounding it for miles in all directions. So far as our own interests go there would, of course, be no injustice, provided we could accomplish it, but there is no more reason for the municipality or citizens of this village being required to do this simply because we are located at the point where the commerce of the country naturally concentrates, than there would be in requiring the owner of the land around the mouth of Pine River at Charlevoix to dredge out its channel to permit the passage of vessels to carry through the commerce of all the country back of and surrounding Pine Lake. The principle is the same.

The circumstances only, requiring the reasonable expenditure of Government aid, are different; the object, in both cases, the same.

Assistance has been granted liberally, and we believe wisely, at Charlevoix and Cheboygan. We believe that our needs are as great and that the benefit that would result from a reasonable work such as we have mentioned, at Government expense, would be equally as extensive and expense much less.

We probably are ourselves at fault for not presenting sooner a full and fair statement of our situation and necessities.

A survey alone, we suppose, will conclusively determine the feasibility and cost of constructing a breakwater for such purpose. We believe the matter feasible, and know that the materials required for its construction are convenient and cheap. Sawed hemlock, sawed timbers, and planking can be delivered on the beach at \$6.50 per thousand, in large quantities. Excellent rock for all cribbing purposes can be put into the cribs at from \$4.50 to \$5 per cord, in any quantity required.

We therefore most earnestly ask and hope that the matter may receive a patient, candid, and just consideration at the hands of the Department, with the hope and belief that our prayer will be granted, a survey made, and that an appropriation may follow adequate to what your office may find our needs to be.

We are yours, most respectfully,

HENRY T. CALKINS,
President of the Village.

C. F. HANKEY,

President Petoskey Business Men's Association.

ISAAC D. TOLL,

Postmaster at Petoskey, Mich.

Lieut. JOSEPH E. KUHN.

SURVEY OF PETOSKEY HARBOR, MICHIGAN, FOR BREAKWATER AND HARBOR OF REFUGE.

UNITED STATES ENGINEER OFFICE,
Detroit, Mich., December 21, 1889.

SIR: In compliance with letter of April 1, 1889, allotting \$600 for the purpose of making a survey of Petoskey Harbor, Little Traverse Bay, Michigan, I have the honor to forward herewith a chart of the survey, and to report as follows with reference thereto:

According to the river and harbor act of August 11, 1888, the survey was to have for its object the preparation of a project for the construction of a "breakwater and harbor of refuge," designed, presumably, for the benefit of the general lake commerce.

The relation of Petoskey to the general navigation is indicated on the tracing by a copy of the official State map of Michigan on a scale of 12 miles to the inch, covering the vicinity of Little Traverse Bay between the Straits of Mackinac and Sleeping Bear Point, from which it appears that, taking into account the numerous indentations of the coast and the facilities for anchorage under the lee either of the mainland or the outlying islands, this portion of the lake is already tolerably well supplied with natural harbors of greater or less security and readiness of access.

Little Traverse Bay, upon the south shore of which Petoskey is situated, lies open to the winds from west to northwest, and the landing in front of the village is directly exposed to the fierce gales from that quarter; but immediately across the bay, and but 4 miles distant from Petoskey, is the excellent natural harbor of Harbor Springs, affording perfect security in any weather. It is evident, therefore, that so far as the general navigation is concerned, there is no need for the construction of an artificial harbor of refuge in front of Petoskey.

On this point Captain Lockwood, in pursuance of a provision in the river and harbor act of July 5, 1884, for an examination of Petoskey, "with a view to constructing a harbor of refuge," reported as follows, under date of October 25, 1884:

Little Traverse Bay is between 20 and 25 miles south of Waugoshance Light, which marks the western entrance to the Straits of Mackinac. Its general direction is east and west, and it is exposed directly to winds from the northwest around to southwest. The shores are bold and in most places rocky.

I do not consider the locality worthy of improvement for the following reasons:

(1) There already exists on the north shore of the bay, and about 5 miles from Petoskey, a natural harbor of refuge, which is sheltered from winds from the north around to southwest. During the past summer a light-house was built to mark the entrance, which is an easy one, with a sufficient depth of water to admit the largest vessels on the lake.

(2) Little Traverse Bay is so far to the east of the course taken by vessels bound from the Straits of Mackinac to the different ports of Lake Michigan, or *vice versa*, that in nearly if not in all cases such vessels would find it more to their advantage to seek shelter under the lee of the islands or in Grand Traverse Bay than in Little Traverse Bay, even if an additional place of refuge existed at its head.

The harbor at Harbor Springs is sufficient for the present needs of commerce, and as its use is, and will continue to be, confined to vessels engaged in the coasting trade only, there is little fear but that it will answer for years to come all the demands that may be made upon its capacity.

To establish a harbor of refuge on the south shore of the bay near Petoskey would require the construction of an extensive breakwater, which would have to be built in deep water in order to secure the requisite area for shelter. If located at Petoskey it would serve to protect the piers used by steam-boats during the summer; but, except in special cases, would offer no advantages over Harbor Springs Harbor as a refuge in bad weather.

Following the provisions of the act of August 11, 1888, Lieutenant-Colonel Mansfield reported October 23, 1888, as follows:

Petoskey is a small village of 3,500 people, occupying a picturesque site on the bluffs overlooking Little Traverse Bay and near its head. The bluffs descend almost vertically to the narrow gravelly beach of the bay, which here is fully exposed to the winds from the north and northwest. The present and prospective business of the place is small, and it is chiefly noted as a popular summer resort, and, being at the terminus of an important railroad, is a point of departure to numerous like resorts in the neighborhood of the Straits of Mackinac, between which places small steamers ply during the season, while during the past season one large steamer has made regular trips there from Chicago.

During high winds from the north and west these vessels find it difficult to make a landing at the one small dock at Petoskey, and at times find it impossible to do so, and must seek shelter in the commodious natural harbor 3 miles across the bay. This harbor at Harbor Springs is one of the finest harbors of refuge on the lakes, and therefore a harbor of refuge at Petoskey is not called for in the general interests of commerce.

All that it requires is a breakwater to insure a safe and certain landing place in all weather for these vessels.

In the general view indicated by these reports I concur. In fact, it is evident from the communication from the village authorities, dated October 15, 1888, which was originally forwarded with Colonel Mansfield's report, and a copy of which is inclosed herewith, that the primary object sought is the protection of the landing wharf in front of the village, in the interest of the considerable shipments from and to adjacent localities and the large number of passengers carried by the steamers that touch there.

From the fact that the first wharf built was almost immediately destroyed by the sea and that apprehensions are felt for the security of the existing one, it would seem that the methods of construction were too economical, considering the rocky slope of the bottom and the exposure to northwest gales; since, no doubt, a landing wharf, if built out from the shore of solid crib-work, properly ballasted, with a return or "L" at its outer end, extending eastward, of such length as to furnish shelter against a sea running from the north and west, and reliable means of making fast, should be at least as stable as a "breakwater" of similar construction in deeper water, and exposing the full length of its side to the impact and action of the sea.

Were the question one merely of furnishing safe landing facilities at Petoskey, the most obvious and least expensive method would be to rebuild the existing wharf as above indicated. What is asked, however, is not the reconstruction of the present wharf, but the construction of an outer and detached work, so designed as to shelter the landing and possibly to furnish additional area within which vessels could take shelter on occasion.

I have indicated on the tracing a means of doing this.

Westward from the landing wharf is a projection of the shore-line where a line of detached cribs has been already built, and which would afford a favorable starting-point for the "breakwater."

As shown on the tracing, the work would be continuous, increasing in width and solidity as the depth increases, and reaching 26 feet of water. The "breakwater" proper would thence deflect eastward, approximately parallel to the contours to such distance as to overlap the landing. As drawn, this length is 1,200 feet, with an inclosed area of about 12 acres, open only to the eastward, and leaving about 400 feet for passage past the end of the landing wharf into the sheltered angle.

The bottom being hard, the anchorage would of necessity be to mooring-posts built into the works.

The cost of these constructions is estimated as follows:

For the off-shore portion, 550 feet, 11 cribs 50 feet long, increasing in width to 24 feet, at an average of \$60 per foot.....	\$33,000
For the breakwater proper, 1,200 feet, 24 cribs 50 feet by 24 feet, at an average of \$100 per foot.....	120,000
Contingencies, etc.....	17,000
Total cost.....	170,000
<hr/>	
To rebuild the outer 500 feet of the landing wharf would cost, at \$60 per foot.....	30,000
To construct 300 feet of an "L" northeasterly from the outer end of the wharf would cost, at \$100 per foot.....	30,000
Total cost, with allowance for contingencies, etc., say.....	70,000

Respectfully,

WILLIAM LUDLOW,
Major of Engineers,
Bvt. Lieut. Col., U. S. A.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.