

Portage Lake is one of the largest of the many little lakes lying just inside the east shore-line of Lake Michigan, forming a striking peculiarity. It embraces within its contour about $3\frac{3}{4}$ square miles, with bold shore, and depth of 4 to 7 fathoms and more, and being entirely land-locked, it presents naturally two of the conditions essential to a good harbor of refuge, viz, protection against all winds and ample room for all vessels likely to resort to it. For the remaining essential feature, viz, perfect facility for access at all times, nature has favored its easy attainment.

The shortest distance between the 18-foot curves is 2,000 feet on the line of the deepest depression of the divide and marks the center line of the proposed channel, which is laid down on the map 300 feet wide. This dimension is taken chiefly from motives of economy in dredging; we can just as well have a channel of 500 feet; the works for its maintenance will be the same. The width, depth, and character of works should be governed by the necessities of the case.

We wish a harbor of refuge for the largest class of vessels on the lakes; ordinarily 500 feet width of entrance would be about right. Here certain shelter is afforded by Point Au Sable against southwest seas, and Point Aux Becs Scies against northwest seas, and the direction of piers (west), perpendicular to the shore, is so favorable that 300 feet width of entrance may be considered sufficient. The depth is put at a minimum of 18 feet, and the character of the works of maintenance is such as is used at all harbor improvements on the lakes, viz, a revetment of piles, and piers of cribs. The estimate is made accordingly.

For dredging:	
265,000 cubic yards sand, at 20 cents per cubic yard.....	\$53,000
1,500 feet of pile revetment, at \$10 per lineal foot.....	15,000
1,000 feet of pile-pier, at \$25 per lineal foot.....	25,000
1,050 lineal feet of crib-work, 24 feet wide, at \$60 per lineal foot.....	63,000
200 lineal feet of crib-work, 30 feet wide, at \$83 per lineal foot.....	16,600
	172,600
Add 10 per cent. for contingencies.....	17,260
Total.....	189,860

Portage Lake is located in the Michigan collection-district, Michigan. The nearest light-house is at Manistee. The nearest port of entry is Grand Haven, Mich.

Mr. Strohmann's report on the survey and a letter from Mr. A. W. Farr (to whom I am indebted for many courtesies) accompany this report. From them much information is learned of the character and importance of the place. The latter contains statistics which I could gather from no other source, and show the local importance of making improvements at Portage Lake.

Very respectfully, your obedient servant,

S. M. MANSFIELD,

Major of Engineers, Bvt. Lt. Col. U. S. A.

Brig. Gen. A. A. HUMPHREYS,
Chief of Engineers, U. S. A.

REPORT OF MR. ROBERT STROHMANN, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Detroit, Mich., November 13, 1878.

SIR: I have the honor to submit my report on the survey of Portage Lake, Manistee County, Michigan, made between the 9th and 23d of September, 1878, in obedience to

your instructions, with a view to its adaptability as a harbor of refuge, and an estimate of cost for improvement proper.

Portage Lake is situated in Manistee County, about 8 miles north of the city of Manistee. The accompanying tracing of county and township map shows the relative position it occupies to other parts of the country and to the coast of Lake Michigan. It has an extension from west to east of about $3\frac{1}{2}$ miles, a width varying from $\frac{1}{2}$ to $1\frac{1}{2}$ miles, and a depth of water sufficient for any purposes of navigation.

The neck of land between the lakes is very high and well timbered, and the lake is completely land-locked. The land rises gradually around, and back from the lake is timbered in places nearly down to the lake, while clearings made by farmers join it in other places. There is no river emptying into the lake, but there are many brooks of clear water running into it; some of them, heading on high hills, are large enough to run saw-mills.

Previous to 1871, the outlet of the lake was through what is marked on the township map as "Natural Outlet." On this outlet, which is now closed, a mill and store were and are now operated, and, to facilitate the mill operations, a dam across the outlet was maintained by the mill-owners, causing a rising of Portage Lake of 5 or 6 feet, and a proportionate overflowing of its adjoining lands. Some owners of the lands commenced, in 1869, a lawsuit against the mill company, and a decree was issued by the circuit court, ordering the removal of the dam before December 25, 1870; but, owing to the fact that the defendants were non-residents, no notice could be served upon them, and the decree became thus inoperative. In the spring of 1871, the complainants, and one Theodore Heiss, who bought a piece of land in the north end of section 33, one mile south of the "Natural Outlet," cut a ditch across this piece of land separating the two lakes (a distance of about 30 rods), and, as the level of Portage Lake was some 8 or 9 feet above that of Lake Michigan, the terrific force of the water made, in a few hours, a cut nearly 500 feet wide and over 12 feet deep, thus bringing the two lakes on the same level and making Portage Lake practically a bay to the big lake. As nothing was done to keep the sand along the beach from filling up this cut, it had almost closed, since which time piers of temporary character have been put in by the residents from time to time as necessity compelled. These piers, as they exist, are of logs and slabs piled up in shoal water, about 130 feet apart, and are worthless and cannot be utilized in any future improvement. At the time of the survey there was an available water-way between the piers of less than 4 feet. A small tug of $3\frac{1}{2}$ feet draught is doing the towing, &c., there, and is compelled to dredge from time to time in order to enable her to use the channel between the two lakes.

In regard to the features and characteristics of the coast of Lake Michigan, it is perceived by examining a map of the east shore that Portage Lake is about the most inland point on the curve formed by the shore line between the two prominent projecting points, "Aux Becs Scies" (near Frankfort) and "Big Point Au Sable" (near Ludington), and in its immediate vicinity it is protected by projecting bluffs, especially to the south. This configuration of coast line forms a kind of bay, and as such maintains a comparative quiet sea by south and north winds in the vicinity of the east, and thus greatly facilitates the access to a harbor that would be located there. But these same features of the coast make it also very dangerous for vessels, which are caught in this bay by westerly storms, as it is with the greatest difficulty and at instances impossible to work out of this locality.

The nearest harbors to Portage Lake are Manistee, 8 miles south, and Frankfort, 20 miles north. These harbors are not at present deep enough to admit of vessels of the largest class. Ludington Harbor, which is 30 miles south of Manistee, will probably, after this season's dredging is accomplished there, admit vessels of 14 feet draught. Thirty miles north of Frankfort are the Manitou Islands, which afford shelter to the larger class of vessels. There is thus a length of coast of about 150 miles, where vessels of the larger class can find no harbor.

From the foregoing remarks it is apparent that for the benefit of the general commerce and for the safety of navigation on Lake Michigan a harbor of refuge is needed at this part of the lake, and that Portage Lake seems to possess the requirements for such a harbor. By locating it there the local commerce would also be greatly benefited, as the surrounding country is the best agricultural district of Manistee County, and its products and the products of several saw-mills could be shipped at a greatly reduced expense and risk.

The survey made at Portage Lake with a view to its adaptability as a harbor of refuge, and for an estimate of cost of improvement proper, covers only the surroundings of the new outlet as far as needed for said purposes, as even a superficial examination of the territory establishes the fact that this new outlet is the only proper location for a harbor at Portage Lake. The old outlet, which is now entirely filled up, has, even in a straight line, more than three times the length of the new outlet, and had partially a very small bed with high banks, making an excavation for a wide channel not only impracticable but almost impossible, while the new outlet at the time of its opening had reached a width of nearly 500 feet, and although now filled

up a few feet above the lake level on both sides of the piers, possesses all advantages and is the only locality to make at moderate expense a channel-way between the two lakes as required for a harbor of refuge.

The survey of this locality and its immediate vicinity necessarily to be covered by any improvements is embodied on the accompanying map, which is drawn on a scale of $\frac{1}{24,000}$, and which gives the topography and hydrography of both lakes and their connection.

From the deductions to be drawn from the foregoing remarks and from an examination of the map, it is seen that the present outlet or channel between the two lakes admits of such improvements as are required to make and maintain there a channel-way with easy access and exit for all classes of vessels for a harbor of refuge.

To accomplish that purpose I would respectfully suggest the following plan of improvement, marked — on the map:

To dredge a cut for a channel-way of 300 feet of width across the stretch of land covering the location of the present outlet, the depth of the cut to be 18 feet, from the 18-foot curve in Portage Lake to the 18-foot curve in Lake Michigan (a distance of about 2,000 feet), and to protect this new cut by parallel piers of stable constructions, to be placed 300 feet apart in a direction perpendicular to the shore-line (bearing north 86° west, magnetic meridian).

The north pier to be of the following constructions and respective lengths:

From the inner Portage Lake end (a point of the new 12-foot curve) westward to the shore-line of Lake Michigan, pile revetment 14 feet wide for a distance of.....	700 feet.
Thence from the shore-line out into Lake Michigan, pile pier 20 feet wide for a distance of.....	500 feet.
Thence 24 feet wide crib-work for a length of.....	450 feet.
Thence 30 feet wide crib-work to the 18-foot curve in Lake Michigan, a distance of.....	100 feet.

A total length of north pier of..... 1,750 feet.

The south pier to be of the following constructions and their respective lengths:

Pile revetment 14 feet wide from inner Portage Lake end (12-foot curve) to shore-line of Lake Michigan, a distance of.....	800 feet.
Thence out into Lake Michigan, pile pier 20 feet wide for a distance of...	500 feet.
Thence crib-work 24 feet wide for a distance of.....	600 feet.
Thence crib-work 30 feet wide to the 18-foot curve in Lake Michigan, a distance of.....	100 feet.

Total length of south pier..... 2,000 feet.

ESTIMATE OF COST FOR ABOVE WORK.

Excavation of cut for a channel-way 300 feet width and 18 feet depth, calculated at 265,000 cubic yards, supposed to be mainly sand and some clay, at an average cost of 20 cents per cubic yard.....	\$53,000
1,500 linear feet pile revetment 14 feet wide, at \$10 per linear foot.....	15,000
1,000 linear feet pile pier 20 feet wide, at \$25 per linear foot.....	25,000
1,050 linear feet crib-work 24 feet wide, at \$60 per foot.....	63,000
200 linear feet crib-work 30 feet wide, at \$83 per linear foot.....	16,600
	172,600
Contingencies, 10 per cent.....	17,260
Total.....	189,860

Very respectfully, your obedient servant,

ROBT. STROHMANN,
Assistant Engineer.

Maj. S. M. MANSFIELD,
Corps of Engineers, and Brevet Lieutenant-Colonel, U. S. A.

LETTER OF MR. A. W. FARR.

ONEKAMA, MICH., August 12, 1878.

DEAR SIR: Your valued favor of July 17 was duly received, and in order to get somewhat closely at the amount of shipping done from Portage Lake, have delayed replying longer than I intended. I send herewith a tracing of 4 townships nearest to Port-

age Lake; and from State map you can easily see the relative position this occupies to other parts of the country and coast.

Previous to 1871 the outlet of the lake was through what is marked on map as "Natural Outlet." I should judge that it was naturally 4 to 6 feet higher than Lake Michigan, but a dam across the stream raised it from 8 to 9 feet. In the spring of 1871 a cut was made across the narrow neck of land (30 rods) nearly on the section-line between sections 28 and 33. The closeness of the two lakes, the great depth of water in the little lake, and a fall of some 8 or 9 feet, combined to cause so large a cut as to put the lakes practically on the same level, and make Portage Lake more of a bay to the big lake than anything else. Nothing was done to keep the sand along the beach from filling it up till it had almost closed; since which time slab and log piers of a temporary character have been put in from time to time as necessity compelled. The original cut was about 500 feet wide; but the piers which have been put in are 130 feet apart, and at present the water is as shoal as four feet in places.

As before stated, the distance between the lakes was 30 rods; and where the western boundary of the little lake was there is now about 8 feet of water, which deepens rapidly as you go east, there being about four fathoms 150 feet from that point, and continuing directly east there is from 4 to 7 fathoms of water for about $\frac{1}{2}$ miles, there being 7 fathoms where the red line crosses the lake, then shoaling gradually to the east shore. Northeast from channel, I am told, there is as much as 90 feet of water, and 30 feet only a short distance from shore all the way from the tug-landing (marked A) to the channel. The lowering of the lake did not materially affect its size. The point on the north shore projects somewhat farther, but does not affect the navigation. The shores for the most part are dry; there being a road around the lake and for the most part close to it. The land rises gradually back from the lake, is timbered in places nearly down to the lake, while clearings made by farmers join it in others. There is no river emptying into the lake, but there are some 20 brooks of clear water running all the year, and some of them heading on high hills. The brook on section 22 now runs a small saw-mill, and two, which empty from section 36, are still larger, one of them having run a mill, which was burned.

Before the channel was made there was one mill and store at the old outlet, which still remain, and are operated, although the logs have to be carried a distance of 80 rods to get them from the water to the mill. Soon after, however, a good steam saw-mill was built at the south side of channel, and quite a little place sprung up, but the mill was burned some two or three years ago, and owing to low price of lumber and difficulty in loading, the rebuilding was postponed in hopes of getting something done on the channel first. The mill-docks still remain (at B).

Williamsport was platted for a village. There is a saw and grist mill near the lake, which lies a little south and east of Portage Lake and some three miles distant, but it runs by water instead of by steam, as indicated on map. The outlet of products of this mill is Portage Lake, and the owner built a good bridge-pier at Portage Lake (as indicated by F). A new steam saw-mill has been built this year at the lake a little north of east from Portage, the owner of which also owns a store and large bridge-pier (at G), and expects to attach a grist-mill to his power.

Besides the piers enumerated, are good, substantial bridge-piers at C, E, and H, and a log one, but which is planked in good shape, at D. These are for shipping wood, stave-bolts, hemlock-bark, &c., in which this country abounds, and have all been built within the last two years.

At the village of Bear Lake is a large saw and grist mill. They ship to other ports annually large quantities of lumber which is hauled to Pierport, and there shipped from a pier at considerable cost and risk, while it is a mile nearer to Portage Lake, and would be a permanent shipping point.

There is a store, a small saw-mill, and a stave-mill, at Pierport, and a grist-mill in process of erection.

The lands surrounding the lake are good for farming purposes, and rapidly settling up. Thousands of cords of valuable timber are annually destroyed in clearing up land, which would be shipped only for the expense of getting it scowed out and put on vessels. It is not a pine country; although there are two quite large tracts which will come here. Hemlock found here is superior for lumber to that found in most sections; and this year from 2,000,000 to 3,000,000 feet will be shipped from here to Chicago. And considering that the bark is valuable for tanning purposes, the logs for lumber, and then the land for farming, it makes it a desirable location. East from Portage Lake tracts of cedar, with elm, maple, ash, cherry, &c.; north and northeast is mostly beech, maple, hemlock, and basswood. This is (north and south) about the center of the county and the natural outlet for the farm products which mostly come from north and east of here; and I have before me now paper of date of 10th August, placing the wheat crop of this county, young as it is, at 27,000 bushels. In regard to the shipping done, no track was kept of it till last year; but do not think it varies much from two or three years before. More bark was shipped, but less lumber. As near as I can get at it, from registration of vessels, the shipments last year were about 11,000 tons.

There were about 6,000 cords of bark, 700 cords of wood, 16,000 railroad ties, some cedar, and the balance lumber. I am satisfied that some day there will be a harbor here, and if it could be done soon it would save to the people several times its cost.

Taking it from 16 feet of water inside to the same outside, I should think the distance from 700 to 900 feet, and each way then goes into deep water; so there would be no sand to be brought down from the bed of a river higher than the channel and deposited at its mouth, as in many of the harbors, but a connecting link between the big lake and a bay. The neck of land between the lakes is very high and timbered, and the lake completely land-locked. In regard to its value for outside vessels in a storm, I am told by vessel captains, especially those who come from the other lakes, that a good harbor here would be a great relief; for, as they pass Point Betsey, they are afraid to keep this shore, even though the wind may be such that it would be still water, as it is a sort of bay (see map), and should the wind shift into the west they could not work off, while if there was a channel here they could run in. I am told that several vessels have been lost trying this experiment; even enough between Frankfort and Manistee to build several harbors; and should you think it would be advantageous I would get statistics, and also the statements of vessel-men in regard to it.

Feeling, as I do, that it is a much-needed improvement, and that it will ultimately be accomplished, I wish fairly to put the matter in shape and try to have it done while it will do the most good; and I sincerely hope that before reporting—at least unfavorably—you will endeavor to come here and see it yourself.

Were it some hole in which to put public money that would do no good, or to only a few, I could not conscientiously take part in it, and shall be ready at any time to assist all I can in giving you correct information in regard to it. Anything which I may have omitted or blindly represented, I shall take pleasure in explaining.

We find that our log piers are not sand-proof, and occasionally one goes out and nearly fills the channel up; but when we can keep them in shape the water keeps pretty good channel.

Very truly, yours,

Maj. S. M. MANSFIELD,
Corps of Engineers

A. W. FARR.

APPENDIX E E.

ANNUAL REPORT OF MAJOR G. WEITZEL, CORPS OF ENGINEERS, FOR THE FISCAL YEAR ENDING JUNE 30, 1879.

(Letter of transmittal under Appendix U.)

E E I.

IMPROVEMENT OF SAINT MARY'S RIVER AND SAINT MARY'S FALLS CANAL, MICHIGAN.

The progress of this work during the past fiscal year is given in the appended report of Mr. Alfred Noble, assistant engineer, who has been from its commencement in immediate charge of this work.

A full history of this improvement was given in my annual report for the fiscal year ending June 30, 1877, and appears in the Report of the Chief of Engineers, 1877, Part II, pages 922-924. In the appended report of Mr. Noble the history is brought up to date.

With regard to the transfer of this work, to the general government, I have to report that on January 11, 1879, I addressed a communication to the Chief of Engineers, of which the following is a copy:

UNITED STATES ENGINEER OFFICE,
Detroit, Mich., January 11, 1879.

GENERAL: I have the honor to state that in the annual report of the improvement of the Saint Mary's Falls Canal, Michigan, for the fiscal year ending June 30, 1878, my assistant, Capt. A. Mackenzie, Corps of Engineers, at my suggestion, referred to the transfer of this canal in the following language:

"The time has arrived when it is desirable for the good of the improvement that the management and control of the present canal should pass into the hands of the government. To ascertain the present amount of the canal debt, which, in accordance with act of the Michigan legislature, is to be assumed by the United States as the only condition of transfer, a correspondence, of which the following is a copy, was entered into with his excellency Governor Croswell, of Michigan:

"UNITED STATES ENGINEER OFFICE,
"Detroit, Mich., April 30, 1878.

"SIR: With a view of recommending in my next annual report the acceptance of the Saint Mary's Falls Canal in accordance with the joint resolution of the Michigan State legislature, approved April 3, 1869, I would respectfully ask for information as to the terms upon which the transfer will now be made and the amount of the indebtedness to be assumed by the government.

"Very respectfully, your obedient servant,

"G. WEITZEL,
"Major of Engineers.

"His Excellency CHAS. M. CROSWELL,
"Governor of Michigan.

"STATE OF MICHIGAN,
"EXECUTIVE OFFICE,
"Adrian, May 1, 1878.

"SIR: I have yours of the 30th ultimo, asking information as to the terms upon which the Saint Mary's Falls Canal will be transferred to the United States, together with