APPENDIX C C.

ANNUAL REPORT OF MAJOR JARED A. SMITH, CORPS OF ENGINEERS, FOR THE FISCAL YEAR ENDING JUNE 30, 1879.

(For letter of transmittal, see Appendix W.)

C C 1.

IMPROVEMENT OF THE HARBOR OF MICHIGAN CITY, INDIANA.

By act approved June 18, 1878, there was appropriated for improving harbor of Michigan City, Ind., $75,000, of which it was required that $25,000 should be applied to the inner harbor.

OUTER HARBOR.

As the works were only assigned to my charge at the beginning of the fiscal year, some little delay was experienced in obtaining an acquaintance with the necessities of the work and submitting projects for its prosecution. This was done as early as possible; and by letter from the Chief of Engineers dated July 23, 1878, authority was given to proceed at once to repair the breakwater by hired labor and open purchases of material; the construction of additional cribs to be deferred until after consideration by a board of engineers.

The 12 cribs of the breakwater had been completed, and a superstructure 4 feet in height had been added, the funds not being sufficient to complete it to its full height of 8 feet. This had been badly injured in the winter of 1877–'78; 7 of the 12 cribs had been torn apart, so that when the splintered fragments were removed the tops were at the following depths below the water surface, viz: No. 1, 9 feet; No. 4, 5 feet; Nos. 5 and 6, 6 feet; No. 7, 7 feet; No. 8, 5 feet; No. 9, 3 feet. Nos. 2, 3, 10, 11, and 12 were not broken away, but the superstructure was much injured. (See sheets Nos. 3 and 5.)

The removal of broken timbers and bolts consumed much time, as the water was sufficiently smooth for work less than half the time.

I quote the following from my monthly report for August:

> * * * The work has been of such a nature that the whole force has been constantly in the water when it was sufficiently smooth to work.
>
> Most of the month has been rough, and it has only been by breaking the sea with scows fastened outside of the cribs, much of the time, that the force has succeeded in working 15 days. * * *

The cribs were built to the water surface by fitting each timber separately to its place, boring the holes with long augers, and driving the bolts with a follower driven by heavy rammers and subsequently by a small pile-driver fitted up for the purpose. To be sure of sufficient

strength, the bolts were made in extra lengths and more than the usual number were used.

Cribs 4 to 8, inclusive, were forced inward and somewhat out of position in other respects.

In order to prevent the superstructure from overhanging the cribs, that portion was made but 28 feet wide, being secured to the cribs by bolting to extra timbers secured inside the compartments where necessary.

The repairs of cribs Nos. 2 to 12 were completed and the superstructure added to its full height of 8 feet in the month of November.

Much rough weather was experienced in the autumn months, but no damage was done save washing out a few cords of stone where the work was incomplete.

Attempts were made to complete crib No. 1, but the water was too rough to work in that depth. In the month of June, 1879, this repair was resumed; 5 courses of timber have been added, and the compartments filled with stone.

But few appliances were on hand or in order for carrying on the work, necessitating the purchase and construction of scows, hoisting apparatus, and other plant.

In the repairs and superstructure of breakwater there were used—

34,660	linear feet of 12 by 12 inch timber.
26,759	pounds drift-bolts.
4,875	pounds of spikes.
1,431.33	cords of stone.
69,117	feet, board measure, pine plank.
3	oak piles.

The Board of Engineers constituted by Special Orders No. 80, Headquarters Corps of Engineers, dated July 24, 1878, considered the subject of completing the harbor at Michigan City, Ind., the following being the report thereon and the letter to which reference is made. The design mentioned for a crib is shown on sheets Nos. 1 and 2:

HARBOR OF MICHIGAN CITY, INDIANA.

The Board is of the opinion that the present plan of this harbor, in connection with the extension of the inner harbor, for which an appropriation of $25,000 was made at the last session of Congress, is sufficient for the purposes of navigation and commerce. By dredging above the railroad bridge, all additional room required can be obtained.

The Board has carefully considered the subject of crib construction adopted for the breakwater at this harbor. Experience has shown that the locality presents unusual difficulties for harbor construction, and the Board therefore recommends that in future the plan of sinking cribs on bearing piles recently carried out by Captain Lydecker at Calumet Harbor be adopted at Michigan City. This plan appears to the Board the best yet devised for crib-construction on yielding bottoms.

Maj. J. A. Smith, Corps of Engineers, has written a letter to Maj. D. C. Houston, president of this Board, making certain recommendations in reference to this harbor, and has prepared a plan of crib on bearing piles, adapted to the locality, to be used in future work. The crib proposed is 30 feet wide and 50 feet long, and is strengthened by the introduction of vertical timbers on the lake side.

The Board recommend the adoption of this plan for the completion of the breakwater, and the extension of the east pier of the outer harbor, a distance of 100 feet.

The letter of Major Smith, and plan of crib, accompany this report.

D. C. HOUSTON,
Major of Engineers, Bvt. Col., U. S. A.
HENRY M. ROBERT,
Major of Engineers.
JARED A. SMITH,
Major of Engineers.
S. M. MANSFIELD,
Major of Engineers, Bvt. Lieut. Col., U. S. A.
G. J. LYDECKER,
Captain of Engineers.

LETTER OF MAJOR JARED A. SMITH, CORPS OF ENGINEERS, ADDRESSED TO THE BOARD OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Chicago, Ill., November 5, 1878.

MAJOR: In accordance with the resolution of the Board of Engineers, of which you are the presiding officer, adopted at its last meeting, I have to make the following report regarding the harbor at Michigan City, Ind.

In considering this subject it has not seemed necessary to enter into any statistics in relation to the business of the place, other than to remark that it is a receiving and shipping point for large amounts of lumber, besides considerable other commerce. I am informed that as a lumber market it was last year the third on the lakes, while in some years it has taken the second place.

At present, vessels can only receive or discharge their cargoes while lying alongside the wharves bordering its inner harbor, which has been formed by dredging and protecting a portion of Trail Creek. The room thus afforded has been much overcrowded, and as a measure of relief plans were devised for extending the harbor further up the creek a distance of a little more than 2,000 feet in a channel 120 feet wide and 15 feet deep.

This design was made by the city engineer, under direction of the city authorities, and at the last session of Congress an appropriation of $25,000 was made for that work. Should the proposed extension be completed, it will afford all the room which at present seems to be required.

The plan of outer harbor, as adopted by a Board of Engineers March 12, 1877, contemplates closing the present entrance by prolonging the breakwater to the west pier and leaving an entrance of 400 feet next the east pier.

This plan leaves the entrance less direct to the inner harbor than the first design. A direct entrance, however, affords an opportunity for heavy seas from northerly directions to be concentrated by the converging piers, which confine the entrance to the creek, and sends them throughout the present inner harbor in sufficient force to be a serious annoyance to vessels at the wharves. These seas in the fall and winter storms form one or more bars across the channel in the creek, which require an annual expense for their removal.

These considerations favor the retention of the opening as indicated at the east end of the breakwater. It is not likely that this will prevent the forming of bars to some extent by shifting sands and drift brought down the creek in sudden rises.

The making of a second cut through the sand into the inner harbor near the east pier has been heretofore proposed, and I have recently had levels taken to indicate the necessary excavation for such a work.

The cut, if made 150 feet wide, would require the removal of 108,136 cubic yards of material, and must be protected on both sides to prevent its rapid filling. It would be open to the same objections which now exist in the present channel, and its interference with both private and corporate rights would be both troublesome and expensive. I do not, therefore, recommend its consideration.

As the completion of the breakwater will afford sufficient protection to the shore for the construction of docks, I would recommend the adoption of a dock limit. A line parallel to the breakwater and 1,000 feet inside would give all the practicable searoom in the harbor and length for the wharves. The construction of such docks would tend to prevent the filling of the harbor with sand from the shore. The water may then be deepened along this front, and it is probable that a portion of the pier at the east of the entrance to the creek could be removed. This would improve the entrance to the inner harbor, and would reduce the amount of pier which the government has to maintain.

In 1875, 12 cribs, making a length of 600 feet of the breakwater 30 feet in width, were constructed to the water surface, and in a subsequent year 4 feet in height of the superstructure was added.

This part of the work has been severely damaged at times, tearing away portions of the cribs and destroying their alignment. In some places the cribs were broken away to a depth of 8 feet, and forced from their positions in such manner that their tops when raised to the water surface were 23 inches outside their proper position. This was partly due to a tipping or unequal settling and partly to a movement of the entire crib, from the force of the sea.

During the past summer and present autumn 11 of these cribs have been entirely repaired, and the superstructure is now completed to its full height of 8 feet.

In order to prevent overhanging of the superstructure on 6 of the cribs, its width for that portion was reduced to 28 feet, and an arrangement devised for securely fastening it to the portions below.

The 12th crib, known as No. 1, at the west end of the work, is now at a depth of 8 feet below water. Every preparation has been made for placing it in repair as soon

as weather will permit. This leaves a little more than 600 feet of breakwater required for its completion.

In accordance with instructions received I have prepared a plan of cribs to be used in the further prosecution of the work, following the plan of sinking the cribs on bearing piles. The essential features of the crib devised and used by Captain Lydecker at Calumet Harbor have been retained.

The cribs are, however, strengthened by constructing all the walls solid, and by introducing vertical pieces firmly bolted in each of the angles along the sea-wall. I have also introduced additional drift-bolts, and in such manner as to secure a uniform strength throughout, save in the lower courses, where a greater strength is obtained by the extra timbers and screw-bolts.

The cribs as designed are 50 feet long and 30 feet wide, each crib to rest on 28 bearing piles. These piles should be driven through the sand, and at least 5 feet into the underlying clay, making their length average about 15 feet. I would recommend the extension of the east pier by one or more cribs of the same general dimensions and construction as those of the breakwater. This will form a more substantial heading for the pier, which is now too light to withstand the shock of a vessel which might strike it on entering the harbor, and will form a better foundation for the light which will probably be transferred to that position. I believe it will also facilitate an entrance in heavy seas, and may tend to prevent the shoaling of the entrance by drift.

I may add that to complete the harbor protection there remains to mention only some repairs to the east and west piers. This consists principally in refilling them with stone and driving some additional piles to close openings through which the stone has escaped.

The following is the estimated cost of completing the breakwater:

1,868,000 feet, board measure, timber, at $15	$28,020
Labor, framing and placing cribs and superstructure, at $10 per M	18,680
11,000 pounds screw-bolts, at 3½ cents	385
251,000 pounds drift-bolts, at 2½ cents	6,275
7,500 pounds spikes, at 3 cents	225
3,000 cords of stone, at $7	21,000
350 oak piles, at $2.50	875
Driving and cutting piles, at $8	2,800
Engineering contingencies	6,740
	85,000

For extending the east pier 200 feet:	
660,000 feet, board measure, of timber, at $15	9,900
Labor framing and placing	6,600
3,000 pounds screw-bolts, at 3½ cents	105
88,000 pounds drift-bolts, at 2½ cents	2,200
4,800 pounds spikes, at 3 cents	144
1,300 cords stone, at $7	9,100
120 oak piles, at $2.50	300
Driving and cutting piles, at $8	960
Contingencies	2,691
	32,000

This estimate for extending the pier is based on the same construction as breakwater and an additional depth of 3 feet.

It is possible that a somewhat cheaper construction might be made to serve the purpose.

Very respectfully, your obedient servant,

JARED A. SMITH,
Major of Engineers.

Maj. D. C. HOUSTON,
Corps of Engineers, President Board of Engineers.

In accordance with a recommendation from this office, authority was given in letter from the Chief of Engineers, dated January 29, 1879, to apply the remaining balance of the appropriation for outer harbor, in extending the breakwater, by hired labor and purchase of material in open market. Materials were purchased after communicating with all the well-known dealers accessible to the work, and accepting the offer most advantageous to the government.

Four cribs were constructed to a height of 15½ feet, according to the

design shown on sheets 1 and 2. Fifty-six oak piles, forming the foundation for two cribs, have been driven and cut off by a diver at a depth of 16½ feet below the water surface.

It is proposed to drive the remaining piles by means of a follower which shall leave their tops at the proper grade. This method was impracticable for the foundations of the first two cribs, owing to a large quantity of stone which had been placed to aid in forming the foundations by the old method.

One of the new cribs was towed to its position June 28, and filled with stone, its level and alignment being reported as perfect. The other three cribs will follow immediately, and with the appropriation now available it is expected to extend the breakwater to the east entrance, a distance of 400 feet, the present season.

Sheet No. 5 shows in rear elevation the dimensions of the breakwater at the beginning and end of the fiscal year.

A steam pile-driver has been purchased, it being constructed specially for the work at this harbor. It is set up, with all fittings complete, on board a very strong scow constructed for the purpose.

A large scow, a diver's complete outfit, and many other tools and appliances for the work have been procured.

As the work of towing cribs and scows is not sufficient to keep a tug constantly employed, it was found that the expense would be less to hire this class of work at usual rates than to retain the tug in service. Authority was therefore asked and granted for its sale to the works at Chicago, where its services were more needed.

PROJECT FOR THE ENSUING YEAR.

A project has been submitted and approved for applying the funds now available in the extension of the breakwater to its eastern limit, and with the balance then remaining to repair the east and west piers.

This will leave to complete the work in accordance with the present design, the extension of the east pier, the closing of the present entrance, and the deepening of the harbor by dredging.

Works of improvement have been made at Michigan City in various years, beginning with 1836, but no definite plan for a complete work was adopted until 1870, and for this the estimated cost was $324,421.40.

There has been appropriated for this work the following sums, viz:

June 16, 1872	$50,000
March 3, 1873	50,000
June 23, 1874	50,000
March 3, 1875	50,000
August 14, 1876	35,000
June 18, 1878	50,000
Allotment from appropriation for repairs, preservation, extension and completion of river and harbor works	2,500
March 3, 1879	40,000
Total	327,500

The excess over the original estimate, has been due to the unusual difficulties experienced with a sand bottom at the most exposed position on the lake. Added to this has been the large amount for repairs, made necessary from unavoidably leaving the work incomplete and unable to resist the heavy seas and ice. The repairs for the last two years alone have cost not less than $35,000.

It is believed that the design now adopted for cribs will, to a large extent, enable the officer in charge of the work to prevent damages, as the superstructure can be completed at once after sinking the cribs.