

Several abrupt bends have been straightened by removing stumps and logs and allowing the river to cut through at high-water. During the year there were 1,370 snags and logs removed and 44 overhanging trees cut down.

July 1, 1878, amount available.....	\$16,987 31	
Amount appropriated by act approved March 3, 1879.....	7,000 00	\$23,987 31
July 1, 1879, amount expended during fiscal year.....	10,976 92	
July 1, 1879, outstanding liabilities.....	1,150 85	
		12,127 77

July 1, 1879, amount available.....	11,859 54
Amount (estimated) required for completion of existing project.....	19,240 00
Amount that can be profitably expended in fiscal year ending June 30, 1881.....	19,200 00

(See Appendix T 7.)

8. *Improvement of Oconee River, Georgia.*—On this river, as on the Ocmulgee, the obstructions consist chiefly of snags and rafts of logs, and the improvement consists in their removal. During the year 209 snags and logs were removed from the river between the Georgia Central Railroad bridge and Dublin.

A steam derrick-boat with propelling power was built at Milledgeville, and worked down to the Central Railroad bridge, where it is now at work.

A loaded boat can ascend with 18 inches less water in the river than formerly, although the improvement is but partially completed.

July 1, 1878, amount available.....	\$10,000 00	
Amount appropriated by act approved March 3, 1879.....	1,500 00	\$11,500 00
July 1, 1879, amount expended during fiscal year.....	4,182 15	
July 1, 1879, outstanding liabilities.....	1,752 50	
		5,934 65

July 1, 1879, amount available.....	5,565 35
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Amount (estimated) required for completion of existing project.....	3,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1881.....	3,500 00

(See Appendix T 8.)

EXAMINATIONS AND SURVEYS FOR IMPROVEMENT.

To comply with the provisions of the river and harbor act of June 18, 1878, Major King was charged with and has completed the following:

1. *Caney's Fork and Obey's River, Tennessee.*
2. *Falls of the Cumberland, Kentucky.*

The results of these examinations and surveys were transmitted to Congress and printed as House Ex. Doc. No. 106, Forty-fifth Congress, third session. (See also Appendixes T 9 and T 10.)

3. *Etowah River, Georgia.*—Report not yet received. (See Appendix T 6.)

4. *Chattahoochie River, Georgia, above Columbus.*—Report not yet received.

And to comply with provisions of river and harbor act of March 3, 1879, he has been charged with the following, the results of which will be duly submitted when received:

1. *Duck River, from its mouth to Centerville, Tennessee.*
2. *Caney Fork, Cumberland River, Tennessee.*—This was provided for in the river and harbor act of June 18, 1878, and has been made. See above.

IMPROVEMENT OF THE NAVIGATION AT THE FALLS OF OHIO RIVER—SUPERINTENDENCE AND MANAGEMENT OF THE LOUISVILLE AND PORTLAND CANAL.

Officer in charge, Maj. G. Weitzel, Corps of Engineers, with Capt. A. Nisbet Lee, Corps of Engineers, under his immediate orders.

1. *Improvement of the Falls of Ohio River.*—During the past year, owing to the brevity of the low-water stage of the river, but little was accomplished.

The two abutments for the movable dam in the cross-dam at the head of the falls were built and 45 cubic yards of the trench excavated.

A partial survey of the Indiana chute of the falls was made.

July 1, 1878, amount available.....	\$47,360 67
July 1, 1879, amount expended during fiscal year.....	4,694 04

July 1, 1879, amount available.....	43,666 63
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(See Appendix U 1.)

2. *Superintendence, management, and repair of the Louisville and Portland Canal.*—During the year 2,582 boats have been passed through the canal; the platform near the capstan at the upper gates was paved with stone; the ravine to the east of the engineer's office was partly filled with earth; new suspension masts have been placed at all gates, and the chains at the upper and lower gates were replaced by new ones; shade trees were planted on top of north slope along the locks, and fences erected near the toll-collector's house and the machine-shops; a small engine was placed in position on north wall at middle gates of new locks and the gates operated by steam; wooden shelter sheds were placed over the capstans for the protection of lock-hands; concrete has been laid from the foot of the slope of north and south banks between upper and middle gates of the lock walls, and a stone retaining wall was built to protect the foot of the slope of the north bank at the lower lock chamber; the grading and sodding of the lock banks and the work of improving the old locks by converting three chambers into two was continued.

Tolls were again reduced about one-fifth on January 29, 1879. The receipts during the year were \$42,966.09, and the expenditures \$73,720.91. The cash on hand at the end of the year was \$51,014.96.

(See Appendix U 2.)

IMPROVEMENT OF OHIO RIVER; OF ALLEGHENY RIVER, PENNSYLVANIA; MONONGAHELA, LITTLE KANAWHA, AND GUYANDOTTE RIVERS, WEST VIRGINIA; BIG SANDY RIVER, WEST VIRGINIA AND KENTUCKY, AND OF KENTUCKY RIVER.—HARBOR OF REFUGE NEAR CINCINNATI, AND ICE HARBOR AT THE MOUTH OF THE MUSKINGUM RIVER, OHIO.

Officer in charge, Maj. William E. Merrill, Corps of Engineers, who has under his immediate orders Lieut. F. A. Mahan, Corps of Engineers.

1. *Improvement of the Ohio River.*—Work on the Davis Island dam was begun on the 19th of August, 1878. At the close of the fiscal year nine-tenths of the upper gate recess, two-thirds of the lower gate recess, and one-fifth of the land wall were built. In addition to the above the lock-keeper's house was finished, a large drainage sewer nearly finished, and a considerable amount of filling put in place.

At "The Trap" the cross-dam was built up to the 6-foot stage and

connected by a gentle curve with the lower dike, which was extended to a point 1,800 feet below the cross-dam. The total amount of crib-work at White's and The Trap is 5,392 linear feet. A length of 120 feet has been taken from the lower end of the upper dike in order to facilitate entrance to the fine harbor which the new works have made at Middletown.

Repairs were made on the French Island dike, and were in progress at the close of the fiscal year.

Two small steamboats with crane-boats in tow were employed for about a month in taking rocks from the channel of the Upper Ohio, removing 187 large rocks, 232 of moderate size, and a large number of small ones. They also removed 5 wrecks and 12 snags.

At the Grand Chain the ledge called the "Arkansas Rocks" was removed by surface blasting.

The snagboat E. A. Woodruff worked four months and a half, during which time 499 snags and 26 wrecks were lifted and destroyed. The average weight of the snags was 7½ tons; the heaviest weighed 84 tons.

Dredging was done during the year by the government dredges Ohio and Oswego, amounting to 82,443 cubic yards. The average cost per cubic yard was 23½ cents. This increase over preceding seasons was due to a short season and the prevalence of high water.

The officer in charge submits the following estimate:

For dredging, snagging, building dikes, &c.....	\$500,000 00
For Davis Island dam.....	200,000 00
Total	<u>700,000 00</u>

July 1, 1878, amount available (including \$391.72 outstanding liabilities).....	\$390,107 05
Amount appropriated by act approved March 3, 1879.....	250,000 00
July 1, 1879, amount expended during fiscal year.....	272,176 20
July 1, 1879, outstanding liabilities.....	28,821 35
July 1, 1879, amount available.....	<u>339,109 50</u>

Amount that can be profitably expended in fiscal year ending June 30, 1881, as revised in this office.....	500,000 00
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(See Appendix V 1.)

2. *Improvement of Allegheny River, Pennsylvania.*—To comply with requirements of the river and harbor act of June 18, 1878, an estimate of \$51,425 was transmitted to Congress in December last, for the improvement of this river from the mouth of French Creek to Pittsburgh, by the removal of obstructions of all kinds, and the improvement of the worst shoals by dams and dikes built of cribs filled with stone.

The appropriation of \$10,000 of March 3, 1879, will be expended during the fiscal year in furtherance of this plan, and it is deemed that \$20,000 can be profitably expended on its continuation during the fiscal year ending June 30, 1881.

Amount appropriated by act approved March 3, 1879.....	\$10,000 00
July 1, 1879, amount available.....	10,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1881.....	<u>20,000 00</u>

3. *Improvement of Monongahela River, West Virginia.*—A considerable amount of work was done on the dam at Hoard's Rocks, but its completion was prevented by high water. At the close of the fiscal year the work was progressing well, with every prospect of being finally completed before winter.

As the Hoard's Rocks lock and dam is isolated and does not connect with the existing slackwater, the officer in charge submits an estimate of \$115,000 to build a lock at Laurel Run.

July 1, 1878, amount available (including \$2,903.15 outstanding liabilities).....	\$25,279 54
Amount appropriated by act approved March 3, 1879.....	24,000 00
July 1, 1879, amount expended during fiscal year.....	23,284 47
July 1, 1879, outstanding liabilities.....	3,405 30
July 1, 1879, amount available.....	<u>22,589 77</u>

(See Appendix V 2.)

4. *Improvement of Little Kanawha River, West Virginia.*—During 1878 2,036 snags were removed from this river, 311 leaning trees cut down, 58 trimmed, and 57 deadened; in addition, 861 cubic yards of rock were excavated and nine wing-dams built. Work was resumed in May, 1879, and by the close of the fiscal year the following additional work had been done: 2,570 snags had been removed, 1,652 leaning trees cut down, 306 trimmed, and 687 deadened; 219 cubic yards of rock and 497 cubic yards of gravel had been excavated, and 5 wing-dams built.

The officer in charge submits an estimate of \$65,000 for the construction of a lock near Burning Springs.

July 1, 1878, amount available.....	\$18,930 69
Amount appropriated by act approved March 3, 1879.....	18,000 00
July 1, 1879, amount expended during fiscal year.....	6,434 03
July 1, 1879, outstanding liabilities.....	2,852 72
July 1, 1879, amount available.....	<u>27,643 94</u>

(See Appendix V 3.)

5. *Improvement of Guyandotte River, West Virginia.*—The following work was done during the season of 1878: 110 cords of drift, 1,058 cubic yards of rock-filling, 2,257 cubic yards of earth, and 3,378 cubic feet of timber were removed from the old lock and dam near Barboursville. From the old lock and dam at the "Falls," 417 cubic yards of rock-filling, 161 cubic yards of earth, and 122 cubic feet of timber were removed. In addition, 34 snags were taken out of the river.

The navigation of this river is greatly obstructed by mill-dams, and by the relics of the old navigation dams.

The officer in charge recommends that measures be taken to restore the river to its natural condition, and asks for an appropriation of \$5,000 for this purpose.

July 1, 1878, amount available.....	\$2,000 00
Amount appropriated by act approved March 3, 1879.....	1,000 00
July 1, 1879, amount expended during fiscal year.....	1,851 91
July 1, 1879, amount available.....	<u>1,148 09</u>
Amount that can be profitably expended in fiscal year ending June 30, 1881.....	<u>5,000 00</u>

(See Appendix V 4.)

6. *Improvement of Big Sandy River, West Virginia and Kentucky.*—During the season of 1878 there were removed from this river 6,758 snags, 1,257 fallen trees, 4,098 cords of drift, 4,013 cubic yards of rock, and one wreck, the work having been carried up to Long Bottom on the

Tug Fork, 68 miles above Louisa, and to a point on the Louisa Fork 88½ miles above Louisa and 2 miles above Pike-ton. The officer in charge recommends the construction of a lock and dam below Louisa at an estimated cost of \$110,000, and submits an estimate of \$30,000 for the continuance of the improvement of the natural navigation, in case it should be considered unadvisable to build a lock and dam.

July 1, 1878, amount available.....	\$12,000 00	
Amount appropriated by act approved March 3, 1879.....	12,000 00	\$24,000 00
July 1, 1879, amount expended during fiscal year.....	11,995 99	
July 1, 1879, outstanding liabilities.....	296 00	
		12,291 99
July 1, 1879, amount available.....	11,708 01	
Amount that can be profitably expended in fiscal year ending June 30, 1881, as revised in this office.....		15,000 00

(See Appendix V 5.)

7. *Improvement of Kentucky River, Kentucky.*—The application of this appropriation has been deferred to await the settlement of certain legal questions of jurisdiction over the sites of the existing locks and dams. The lower 95 miles of the river was improved many years ago, at the expense of the State of Kentucky, by the construction of 5 locks and dams, all of which structures are now in a dilapidated condition, and require extensive repairs. It is estimated that 12 more locks and dams will be needed to carry slackwater navigation to the Three Forks.

Amount appropriated by act approved March 3, 1879.....	\$100,000 00
July 1, 1879, amount available.....	100,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1881.....	100,000 00

8. *Harbor of Refuge, near Cincinnati.*—The question as to the best use of the appropriation of \$50,000 for this work was referred to a Board of engineer officers, whose report is hereto attached as appendix. On the recommendation of the Board the construction of two crib-dikes at Four-Mile Bar has been authorized, and a contract made for the work.

July 1, 1878, amount available.....	\$50,000 00
July 1, 1879, amount expended during fiscal year.....	121 93
July 1, 1879, amount available.....	49,878 07

(See Appendix V 6.)

9. *Ice Harbor at the mouth of the Muskingum River, Ohio.*—The application of this appropriation has been deferred to await the transfer to the United States of the sites of the proposed works.

Amount appropriated by act approved March 3, 1879.....	\$30,000 00
July 1, 1879, amount available.....	30,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1881 ..	70,000 00

EXAMINATIONS AND SURVEYS FOR IMPROVEMENT.

To comply with the provisions of the river and harbor act of June 18, 1878, Major Merrill was charged with and has completed the following examinations and surveys, the results of which have been transmitted to Congress:

1. *The Muskingum River, Ohio, below the second dam, to ascertain its adaptability for an ice harbor, for the protection of steamers and other*

craft on the Ohio River. Printed as House Ex. Doc. No. 42, Forty-fifth Congress, third session. (See also Appendix V 7.)

2. *The Allegheny River up to the mouth of French Creek.* Printed as House Ex. Doc. No. 21, Forty-fifth Congress, third session. (See also Appendix V 8.)

3. *The Kiskiminetas and Conemaugh Rivers, Pennsylvania, from the mouth of the Kiskiminetas to the mouth of Stony Creek, on the Conemaugh.* Printed as House Ex. Doc. No. 105, Forty-fifth Congress, third session. (See also Appendix V 9.)

4. *The Kentucky River and navigable tributaries, Kentucky.* Printed as House Ex. Doc. No. 47, Forty-fifth Congress, third session. (See also Appendix V 10.)

5. *The Licking River, Kentucky.* Printed as House Ex. Doc. No. 103, Forty-fifth Congress, third session. (See also Appendix V 11.)

And to comply with the provisions of the river and harbor act of March 3, 1879, Major Merrill has been charged with and is now engaged upon examinations and surveys at the following localities, the results of which will be duly submitted when received:

1. *Ohio River and mouth of Little Kanawha River, West Virginia, to ascertain the adaptability of that locality for an ice harbor, including a report on the cost and merit of that point compared with the mouth of the Muskingum at Marietta, Ohio, surveyed under the provisions of the act of June 18, 1878.*

2. *Green River and its tributaries, Muddy and Barren Rivers, Kentucky.*

3. *Allegheny River, from French Creek to Olean, New York.*

IMPROVEMENT OF WABASH RIVER, INDIANA AND ILLINOIS, AND OF WHITE RIVER, INDIANA.

Officer in charge, Maj. J. A. Smith, Corps of Engineers.

1. *Improvement of Wabash River, Indiana and Illinois.*—The dam across New Harmony Cut-off was entirely completed early in November.

During the winter the surface pavement and many timbers from the top and slope were torn away by drifting snags. To prevent a recurrence by checking the passage of drift, 10 large cribs have been placed in the channel and filled with stone to a height of 6 feet above the crest of the dam.

At Grand Chain the work of raising and prolonging the east dike was continued. A substantial shore protection has been built of timber cribs and stone, and a dike extended a distance of 625 feet to connect with the stone dike at the head of the chute. The stone dike has been raised to a height of 7 feet above low water for a length of 1,600 feet, 528 feet of which has been paved. It is proposed to complete this east dike the ensuing season and to widen the chute.

Near Grayville, Ill., the banks have been protected with piles, brush, and stone for a total length of 4,400 feet. On the neck of the peninsula a levee has been constructed, containing 11,000 cubic yards of earth, to retain the channel in its present place and preserving connection with the railroad at Grayville.

To improve the channel at Kingdom Bar a wing-dam was built of piles, brush, and stone 400 feet in length. The channel is already much improved, and it is proposed to extend the dam somewhat further.

The chute at Turkey Island has been closed by a dam 62 feet wide and 350 feet long, made with 6 rows of piles, the spaces being filled

with loose brush weighted with stone. It has added at least 2 feet to the other channel, and has improved the navigation for several miles.

At Warwick's Ripple, timbers remaining of the old coffer-dam have been removed. It is proposed to remove some of the surface stone, so as to make a clear channel of 200 feet.

Regular readings of three permanent water-gauges have been taken during the year. Careful surveys have been completed at the reef at and near Warwick's Ripple and at Little Chain; also, a continuation of former surveys to a distance of 6 miles below the mouth of the Little Wabash River.

On the 15th of May a contract was entered into for the construction of two steam snagboats, to be completed on or before the 15th of August, 1879.

During the present fiscal year it is proposed to complete the repairs of the dam at New Harmony, and the bank protection at Grayville, to cut the channel at Warwick's Ripple, to complete the east dike at Grand Chain, to work the boats as late as practicable removing snags, to extend the survey to the Ohio River, and to put in some works of piles, brush, and stone for removing bars and protecting banks.

July 1, 1878, amount available.....	\$91,604 93	
Miscellaneous receipts.....	19 26	
Amount appropriated by act approved March 3, 1879.....	20,000 00	
		\$111,624 19
July 1, 1879, amount expended during fiscal year.....	73,920 79	
July 1, 1879, outstanding liabilities.....	3,007 84	
		76,928 63
July 1, 1879, amount available.....		34,695 56
Amount that can be profitably expended in fiscal year ending June 30, 1881, as revised in this office.....		75,000 00

(See appendix W 1.)

2. *Improvement of White River, Indiana.*—The appropriation of March 3, 1879, for the improvement of this river from the Wabash to Portersville and the falls on the West Fork, will be expended in the removal of snags and in deepening the channel by means of jetties, wing-dams, or dikes at such places where bars exist and where it can be done to the best advantage.

Detailed surveys will be made to determine the nature and extent of the works required for the further prosecution of this improvement.

As at present informed, the officer in charge estimates that \$75,000 can be profitably expended during the next fiscal year in continuation of the work.

Amount appropriated by act approved March 3, 1879.....	\$25,000 00
July 1, 1879, amount available.....	25,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1881, in continuing improvement.....	50,000 00

(See Appendix W 2.)

EXAMINATIONS AND SURVEYS FOR IMPROVEMENT.

To comply with the provisions of the river and harbor act of June 18, 1878, Major Smith has been charged with and has completed the following examinations and surveys:

1. *The Kankakee River, Illinois and Indiana.* Printed as House Ex. Doc. No. 73, Forty-fifth Congress, third session. (See also Appendix W 3.)

2. *White River, Indiana, including the East Fork to the new bridge in course of construction near Bedford, and the West Fork to the town of Gosport.*

And to comply with the provisions of the river and harbor act of March 3, 1879, he has been charged with and is now engaged upon survey of *Kankakee River, Indiana and Illinois*, the results of which will be duly submitted when received.

BRIDGING THE NAVIGABLE WATERS OF THE UNITED STATES.

1. *Bridging the Ohio River.*—In consequence of questions arising in a proposition to build a railroad bridge across the Ohio at or near Evansville, Indiana, the Board of engineer officers, consisting of Lieutenant-Colonel Warren and Majors Weitzel and Merrill, which had been constituted in 1870, in compliance with the provisions of the river and harbor act of that year, for the examination of all bridges at that time built on the Ohio, was reconvened, and met at Evansville, but were unable to reach any conclusions for want of surveys at high-water.

The designers of a bridge at this place had in contemplation to solicit some modification of the existing general law for bridging the Ohio, which was adopted mainly upon the investigations of this Board in 1870-'71, and this led to their being called together again to consider the subject of the modifications proposed.

Some important modifications were suggested by the bridge interests in the requirements of existing laws, but surveys sufficiently thorough to enable the Board to make a final report have not yet been furnished by the parties interested.

2. *Grades and curvature upon bridges.*—In order to furnish ready answers to questions about grades on railway bridges, Lieutenant-Colonel Warren has prepared a tabular statement of the grades on the bridges across the Mississippi between Saint Paul and Saint Louis, taken from his final report, to which he has added a similar table from the report of the Board of Engineers on the Ohio River Bridges, printed in the annual report of this office for the year 1871.

The bridges on the Ohio furnish more numerous examples of grades than those on the Mississippi River. These tables are accompanied by remarks and general considerations relating to the subject.

(See Appendix X.)

LAKE HARBORS AND RIVERS.

IMPROVEMENT OF HARBOR AT DULUTH, MINNESOTA, AND OF THE ENTRANCE TO SUPERIOR BAY, LAKE SUPERIOR—IMPROVEMENT OF THE HARBOR AT GRAND MARAIS, MINNESOTA.

Officer in charge, Capt. C. J. Allen, Corps of Engineers.

1. *Improvement of harbor at Duluth, Minnesota.*—The work for this improvement has consisted mostly in dredging the inside harbor, and in renewing 250 linear feet of crib-work at the bay end of the north face of canal. During the fiscal year, 158,179 yards of material were dredged.

It is proposed, with the balance of funds from former appropriations and with the appropriation of March 3, 1879, to continue the work of dredging and the repairs of piers, &c. Fifty thousand dollars can be profitably expended during the next fiscal year in dredging the inside

harbor, and in addition \$15,000 should be held in reserve from which to repair injury to the works from storms.

July 1, 1878, amount available.....	\$33,634 04	
Amount appropriated by act approved March 3, 1879.....	25,000 00	\$58,634 04
July 1, 1879, amount expended during fiscal year.....	21,007 94	
July 1, 1879, outstanding liabilities.....	5,361 16	26,369 10
July 1, 1879, amount available.....		32,264 94
Amount (estimated) required for completion of existing project.....	159,293 18	
Amount that can be profitably expended in fiscal year ending June 30, 1881.....	65,000 00	
For dredging.....	50,000 00	
For repair of piers.....	15,000 00	

(See Appendix Y 1.)

2. *Improvement of the natural entrance to Superior Bay, Wisconsin.*—The work consisted during the season of 1878 in repairs to the outer cribs of both piers; in the protection of Minnesota Point from the action of wind and waves by a wall of brush and stone extending along the point from the inner end of the protection crib-work, and the closing of the breach in Minnesota Point known as the "opening."

The following spring about 3,000 willows and other plants were set out upon the beach near the old light-house to arrest the movement of sand. In June last a small amount of dredging was done to give a 10-foot depth of channel between the harbors of Duluth and Superior. It is proposed during the coming year to apply the balance from former appropriations and the appropriation of March 3, 1879, in keeping the works in repair.

It is estimated that \$10,000 can be profitably expended during the fiscal year ending June 30, 1881, in maintenance and repairs of existing works.

July 1, 1878, amount available.....	\$4,505 27	
Amount appropriated by act approved March 3, 1879.....	5,000 00	\$9,505 27
July 1, 1879, amount expended during fiscal year.....	1,713 87	
July 1, 1879, amount available.....		7,791 40

Amount that can be profitably expended in fiscal year ending June 30, 1881.. 10,000 00
To be used in maintenance and repairs of piers and beach protection.

(See Appendix Y 2.)

3. *Improvement of the harbor at Grand Marais, Minnesota.*—The original estimate for the work, based upon the results of a survey made in 1874, was \$139,669.40, the work to consist in dredging the harbor and narrowing the entrance by piers of timber ballasted with stone. It is proposed to apply the appropriation of March 3, 1879, to dredging the harbor and to commence the pier-work for narrowing the entrance. The sum of \$40,000 can be profitably expended during the fiscal year ending June 30, 1881, in continuing the work.

Amount appropriated by act approved March 3, 1879.....	\$10,000 00	
July 1, 1879, amount available.....	10,000 00	
Amount (estimated) required for completion of existing project.....	129,669 40	
Amount that can be profitably expended in fiscal year ending June 30, 1881.....	40,000 00	
To be used in dredging and construction of piers.....		

(See Appendix Y 3.)

HARBORS ON LAKE SUPERIOR (EAST OF SUPERIOR CITY); ON GREEN BAY, AND ON THE WESTERN SHORE OF LAKE MICHIGAN, NORTH OF MILWAUKEE, WISCONSIN.

Officer in charge, Maj. Henry M. Robert, Corps of Engineers.

1. *Improvement of Ontonagon Harbor, Michigan.*—The repairs in progress last season were completed. Six cribs without superstructure were placed in extension of the last pier. It is proposed to continue the pier extension as rapidly as the appropriations will permit. The original project required piers about 2,500 feet in length. The west pier has been extended about 1,000 feet, exclusive of inside pile revetment. The east pier has been extended about 1,600 feet, inclusive of cribs sunk last season and yet without superstructure.

This is an important work, being the only available harbor of refuge on a length of coast of 85 miles.

July 1, 1878, amount available.....	\$19,008 18	
Amount appropriated by act approved March 3, 1879.....	17,000 00	\$36,008 18
July 1, 1879, amount expended during fiscal year.....	11,521 37	
July 1, 1879, outstanding liabilities due contractor.....	992 15	12,513 52
July 1, 1879, amount available.....		23,494 66
Amount (estimated) required for completion of existing project.....	161,170 00	
Amount that can be profitably expended in fiscal year ending June 30, 1881, as revised in this office.....	40,000 00	

(See Appendix Z 1.)

2. *Improvement of Eagle Harbor, Michigan.*—The removal of the rock obstructing the harbor entrance was completed in September, 1877.

During the past fiscal year guiding-cribs were placed on either side of the channel for the purpose of defining its limits and guarding vessels from contact with the edges of the rock cut.

The original project contemplates a further expenditure of \$176,362, which the officer in charge does not consider called for by the present requirements of the lake commerce or the local interests of the harbor.

July 1, 1877, amount available.....	\$10,397 11	
Amount appropriated by act approved March 3, 1879.....	2,000 00	\$12,397 11
July 1, 1879, amount expended during fiscal year.....	8,300 13	
July 1, outstanding liabilities.....	82 25	8,382 38

July 1, 1879, amount available..... 4,014 73

Amount (estimated) required for completion of existing project..... 176,362 36

(See Appendix Z 2.)

3. *Improvement of Marquette Harbor, Michigan.*—The exposed position of this work makes it necessary to have on hand sufficient funds to meet any emergency that might occur. The breakwater needs refilling and replanking, and it is proposed to hold for this purpose the available funds, with such appropriations as may be made, until their amount will enable it to be undertaken thoroughly. The breakwater should be extended 400 feet farther, in the opinion of the officer in charge.