

Cost of 10,552 cubic yards.

Description.	Average cost per cubic yard.	Total cost.
— cubic yards rock at 97 cents per cubic yard; 612 cubic yards rock at 92½ cents per cubic yard; 3,529 cubic yards brush at \$1.15 per cubic yards	\$1 02.8 0 08.2	\$10,843 16 874 51
Superintendence and office expenses		
Total	1 11.0	11,717 67

ABSTRACT OF APPROPRIATION MADE FOR IMPROVING THE MISSISSIPPI RIVER AT LA CROSSE, WISCONSIN.

By act approved June 18, 1878..... \$12,500

No further appropriation asked for.

Money statement.

July 1, 1878, amount available.....	\$12,500 00
July 1, 1879, amount expended during fiscal year.....	11,717 67
July 1, 1879, amount available.....	782 33

Abstract of proposals received and opened August, 1878, by Maj. F. V. Farquhar, Corps of Engineers, U. S. A., for building dams and riprapping shores in the Mississippi River opposite La Crosse, Wis.

Name.	Residence.	For brush, including putting same in place and securing it in the dam, estimated quantity 3,337 cubic yards.		For stone placed in the dam as specified, estimated quantity 4,129 cubic yards.		For stone used in the form of riprap, deposited on the banks, estimated quantity 1,500 cubic yards.		For brush sunk under riprapping, estimated quantity 220 cubic yards.		Aggregate.
		Per cubic yard.	Total amount.	Per cubic yard.	Total amount.	Per cubic yard.	Total amount.	Per cubic yard.	Total amount.	
E. M. Callahan.....	La Crosse, Wis.....	\$0 90	\$4,067 35	\$1 25	\$4,005 13	\$1 25	\$1,455 00	\$0 90	\$253 00	\$9,780 68
Donald A. McDonald.....	do.....	1 15	3,006 45	2 25	9,250 25	1 85	2,775 00	1 15	143 00	15,214 70
Lindholm & Pier.....	Dubuque, Iowa.....	85	2,016 09	1 49	6,322 21	1 50	2,250 00	65	125 40	10,678 70
Andrew J. Whitney.....	Keokuk, Iowa.....	57	3,183 30	1 45	5,987 05	1 55	2,325 00	57	132 00	11,627 35
Arthur & Edwards.....	La Crosse, Wis.....	90	4,421 25	1 10	4,541 90	1 50	2,250 00	60	275 00	11,488 15
J. S. Brown.....	Hamilton, Ill.....	1 25	4,421 25	1 10	4,541 90	1 50	2,250 00	1 25	275 00	11,488 15
L. S. Davidson.....	La Crosse, Wis.....	1 00	2,652 75	2 00	8,258 00	2 00	3,000 00	75	165 00	14,075 75
Henry Becker.....	Dreshbach, Minn.....	75	1,591 65	1 50	6,193 50	1 50	2,250 00	45	90 00	10,134 15
Meyer & Rossiter.....	La Crosse, Wis.....	45	1,591 65	1 50	6,193 50	1 50	2,250 00	45	90 00	10,134 15
Archibald McArthur.....	Chicago, Ill.....	1 20	4,244 40	1 00	4,129 00	1 00	1,500 00	1 00	220 00	10,093 40

* Informal; no seals.

Q 5.

IMPROVEMENT OF THE MISSISSIPPI RIVER AT QUINCY, ILLINOIS.

Funds not being available, no work was done during the fiscal year. It is proposed to expend the amount available, \$20,000, in building as much of 3 spur and 1 closing dam from the right bank of the river just below the railroad bridge as it will permit of.

If the plan submitted in my report of January 13, 1879, is adopted, at least \$50,000 should be appropriated for fiscal year ending June 30, 1881.

Money statement.

Amount appropriated by act approved March 3, 1879.....	\$20,000 00
July 1, 1879, amount available.....	20,000 00
Amount (estimated) required for completion of existing project.....	204,109 87
Amount that can be profitably expended in fiscal year ending June 30, 1881.	50,000 00

SURVEY OF THE HARBOR AT QUINCY, ILLINOIS.

UNITED STATES ENGINEER OFFICE,
Rock Island, Ill., January 13, 1879.

GENERAL: I have the honor to make the following report of the results of a survey, made under my direction, of the harbor of Quincy, Ill., together with plans and estimates for the improvement of the same, all of which are made in accordance with letter of instructions from your office dated July 8, 1878.

A tracing, showing the results of the survey, is sent this day to your address per express.

Quincy Harbor consists of the Mississippi River in front of the city of Quincy, Ill., and Quincy Bay, which is the lower end of a slough formed by part of an old bed of the Mississippi.

I. The navigation of the Mississippi River in front of the city is obstructed at low stages of water by a wide flat bar, which extends diagonally across the river from the island that forms the west shore of Quincy Bay to the island that is near the right bank of the river below the bridge. This bar has been very troublesome during the past two seasons. To remove this obstruction it is proposed to construct the three spur-dams and one closing dam from the right bank of the river (marked 1, 2, 3, and 5 on tracing). This will contract the low-water way to about 1,800 feet, which will insure at least 6 feet in depth of water. The outer ends of the dams will be built up to the low-water level, and the top of the dams will gradually rise toward the bank. The assumed low-water flow is 24,000 cubic feet per second and the slope $\frac{5}{10}$ foot per mile. The cost of the dams will be as follows:

10,113 cubic yards of brush, at \$1.25.....	\$12,641 25
10,876 cubic yards of stone, at \$1.25.....	13,595 00
Total.....	26,236 25

II. Quincy Bay is the part of an old bed of the Mississippi River, and extends along the foot of the high bluffs above Quincy for about $3\frac{1}{2}$ miles. Near its upper end Bear Creek empties into it; it also has a connection by a slough with the Mississippi River above.

The width of the bay varies from 200 to 700 feet, and the depth of water at lowest stage from 2 to more than 20 feet. Four thousand feet above its mouth it is crossed by a railway bridge, which has a pivot draw in it with two openings 80 feet in the clear. In years gone by, before the lower end of the bay filled up, it was used as a winter harbor for steamboats; but the area of water over $4\frac{1}{2}$ feet deep at lowest stage (which generally occurs in winter) is so small, that the harbor is not now used at all. It will be seen that the sand and gravel brought down by a small stream from the bluffs have formed a large part of the filling up of the bay.

To improve this bay for use as a winter harbor and to accommodate commerce it is proposed to dredge, 1st, sections A, B, and C (see tracing) to a depth of 6 feet at low-water. These sections have a width of 400 feet; 2d, to dredge over the areas D and E to the same depth and a width of 600 feet; and 3d, to dredge over the areas F, G, and H, to reach the deep water above. This dredging finished, there will be a harbor with an area of about 90 acres. The total amount of material to be dredged amounts to 680,000 cubic yards, which, at 25 cents per cubic yard, will cost \$170,000.

This dredging could be done gradually, by first dredging a channel through the whole length of 100 feet in width and afterward widening it to the widths shown on the map.

The bank of the islands near the mouth of the bay should be protected with riprap both on the bay and river side. It may also be necessary to riprap the sides of the cut at places where it touches the banks. Twenty-five thousand linear feet of riprap is therefore estimated for, which will cost \$7,500.

RECAPITULATION.

Spur-dams on Mississippi River.....	\$26,236 25
Dredging in bay.....	170,000 00
Shore protections of riprap.....	7,500 00
	203,736 25
Add 10 per cent. for contingencies.....	20,373 62
	224,109 87

COMMERCE.

Quincy, Ill., is a city of about 30,000 inhabitants. It is in the fourth Illinois internal-revenue collection district, in which \$1,389,206.49 were collected during the fiscal year ending June 30, 1877, and in the customs collection district of New Orleans, and is a port of delivery of the same.

The commercial statistics will be forwarded as soon as they are received from the city authorities. It is supposed that the improvement of the harbor will furnish a much-needed winter harbor for vessels, and will increase the commerce and manufactures of Quincy.

Hoping this may meet with your approval,

I am, very respectfully, your obedient servant,
F. U. FARQUHAR,
Major of Engineers.

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

Q 6.

IMPROVEMENT OF ROCK ISLAND RAPIDS, MISSISSIPPI RIVER.

One thousand eight hundred and fifty-three and one-half cubic yards of rock were broken and 3,363 cubic yards of rock were removed from Moline Chain, thus completing the project for improving Rock Island Rapids, except the rounding of some sharp corners of rock at the entrance to several of the cuts and the widening of the passage through the Saint Louis Chain. The cuts through the several chains should be buoyed out and a careful examination made of the rapids, to ascertain whether any loose rock or bowlders remain in the cuts.

Maj. E. F. Hoffmann, who has been in local charge of the work since its commencement, is deserving of much credit for the intelligent and energetic way he has carried on the work. The details of the steam-drill scow are all due to him. Twelve thousand dollars should be appropriated to complete this work. The report of Major Hoffmann, together with the abstract of bids received, are hereto appended.

The work of breaking up the rock was done by machinery (chisel-boat and steam-drill) operated by hired labor. The dredging of the broken rock was very efficiently done by the contractors Whitney & Son.

The work is very greatly indebted to the Ordnance Department, which, through the commanding officer of the Rock Island Arsenal, Maj. D. W. Flagler, very kindly allowed many repairs to machinery and much other work to be done in the arsenal shops, the work being of the best character and done at a minimum cost.

Rock Island Rapids.

Description of work.	Cubic yards.
Rock drilled and blasted	682.4
Rock chiseled	1,171.1
Rock dredged and removed	3,362.9

TABLE OF COST.

Cubic yards broken	1,853.5
Cubic yards dredged	3,362.9

Description.	Average cost per cubic y'd of work.	Total cost.
Cost of breaking 1,853.5 cubic yards	\$4 57	\$8,465 47
Cost of steam-drill and tools on hand		2,240 00
Cost of dredging 3,362.9 cubic yards	3 75	12,610 79
Superintendence and office expenses		6,358 18
Total		29,674 44

ABSTRACT OF APPROPRIATIONS MADE FOR IMPROVEMENT OF ROCK ISLAND RAPIDS.

By act approved June 23, 1866	\$100,000
By act approved March 2, 1867	200,000
By allotment from appropriation of July 25, 1868	156,000
By allotment from appropriation of April 10, 1869	133,650
By act approved July 11, 1870	150,000
By act approved March 3, 1871	150,000
By act approved June 10, 1872	50,000
By act approved March 3, 1873	50,000
By act approved June 23, 1874	50,000
By act approved March 3, 1875	50,000
By act approved August 14, 1876	25,000
By act approved June 18, 1878	30,000
By act approved March 3, 1879	6,000
	<u>1,150,650</u>

Money statement.

July 1, 1878, amount available	\$32,851 37
Amount appropriated by act approved March 3, 1879	6,000 00
	<u>\$38,851 37</u>
July 1, 1879, amount expended during fiscal year	29,674 44
	<u>9,176 93</u>
July 1, 1879, amount available	12,000 00
Amount (estimated) required for completion of existing project	12,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1881	12,000 00

Abstract of proposals received and opened January 22, 1879, by Maj. F. U. Farquhar, Corps of Engineers, U. S. A., for dredging rock on Rock Island Rapids, Mississippi River.

Names and residence of bidders.	For dredging 3,500 cubic yards rock.		Remarks.
	Per cubic yard.	Total amount.	
Whitney & Son, Keokuk, Iowa	\$3 75	\$13,125 00	Contract awarded.

REPORT OF MAJOR E. F. HOFFMANN, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Rock Island, Ill., June 30, 1879.

SIR: I have the honor to submit my annual report of operations for the "improvement of the Rock Island Rapids of the Mississippi River" during the fiscal year ending June 30, 1879.

In my last annual report I stated that an amount of 1,207 cubic yards remained to be worked during the fiscal year ending June 30, 1879.

This amount has been exceeded 646.5 cubic yards, so that the total of work for the year amounts to 1,853.5 cubic yards of rock broken by the chisel boat and the steam-drill scow introduced by you at these works on October 1, 1878. The following table shows the work for each month:

July, 1878, exhibited 81.8 cubic yards of rock broken by the chisel-boat.
 August, 1878, exhibited 236.4 cubic yards of rock broken by the chisel-boat.
 September, 1878, exhibited 256 cubic yards of rock broken by the chisel-boat.
 October, 1878, exhibited 290.9 cubic yards of rock broken by the chisel-boat.
 October 16 to 30, 1878, exhibited 104 cubic yards of rock broken by the steam-drill scow.
 November, 1878, exhibited 261 cubic yards of rock broken by the chisel-boat.
 November, 1878, exhibited 278.4 cubic yards of rock broken by the steam-drill scow.
 December, 1878, exhibited 45 cubic yards of rock broken by the chisel-boat.
 December, 1878, exhibited 82 cubic yards of rock broken by the steam-drill scow.
 May, 1879, exhibited 218 cubic yards of rock broken by the steam-drill scow.
 June 30, 1879, exhibited 00 cubic yards of rock broken by the steam-drill scow.
 Total 1,853.5 cubic yards of rock broken at the foot of Moline Chain.
 The working season for the chisel-boat commenced July 21 and ended December 6.

The steam-drill scow actually commenced work October 10 and was withdrawn December 6. The river being full of ice at that date prevented any continuance of work.

Proposals for bids in reference to dredging the broken rock at the foot of Moline Chain were advertised by you in the newspapers, and on January 22, 1879, the bid of Whitney & Son to dredge about 3,600 cubic yards at the foot of Moline Chain for the price of \$3.75 per cubic yard was accepted by the higher authorities and a contract drawn accordingly.

The time to commence work of dredging was stipulated to be the 1st of March, 1879, or when the river should be free of ice, and the work should be accomplished June 30, 1879. Mr. Whitney actually commenced work of dredging on March 28, 1879, at the above-named chain, and continued it till the 1st of June, when the high stage of water in the river caused him to make an application for extension of time of his contract, stating as a reason that the high stage of water and the violent current of Moline Chain would interfere with his intention of giving good quality of work. You approved of it, and the dredge was temporarily withdrawn from the place of work, but returned and completed the work June 27.

During the time from March 28, 1879, to June 27, 1879, there have been excavated by the dredge 3,363 cubic yards of rock, and dumped between the main shore of the island belonging to United States arsenal, and the stone dam of the so-called Benham's Island. Eighteen flatboats loaded with 403 cubic yards of rock were given to the city of Davenport, by your permission.

During the month of April several patches of rock varying in size were found by the dipper of the dredge which were not broken by the chisel, and consequently hindered dredging, to grade 4.5 below low-water 1864. I can state that in regard to the large surface of 87,507 square feet where the chisel worked such places are few, and show very good work on the part of the crew employed on the chisel-boat. The fact of skipping such places results mainly from swinging out the chisel-boat to give room to passing steamers and rafts, and the difficulty of coming with the chisel-point to the last stroke within the limits of even a foot.

The interruption of the work by steamers and rafts has been here at the Moline Chain very annoying, and notwithstanding this the skipped places are not as numerous in comparison as experienced at contract work on different chains.

You ordered me on the 1st of May to move the steam-drill scow again to Moline Chain, and to remove by subaqueous blasting these skipped patches of rock, and finish the work left undone by the chisel at the close of the season. The greatest part of the work of breaking these patches has been accomplished during the month of May, and the rest was blasted during the time from June 19 to June 26, 1879. The water being high, the steam-drill scow was likewise temporarily withdrawn from the place of work from June 1 to June 19.

When you took charge of the work of improving the Rock Island Rapids the chisel-boat in use only being able to break daily in the average not more than 10 cubic yards of rock induced you to think that subaqueous blasting with dynamite in connection with a steam-drill would render better results, and would reduce the cost per cubic yard considerably.

During the month of September a steam-drill scow was built, and on the 1st of October towed up to Moline Chain, at which place both machines, the chisel-boat and steam-drill scow, worked for the period of 45 actual working days side by side, if I may say so, disregarding a distance of a few hundred feet.

A comparison between the two machines can be fairly made at this date in reference to their usefulness of breaking rock and to the cost of the work accomplished by both.

A conscientious estimate proves that the steam-drill scow broke on the average 17 cubic yards of rock daily; meanwhile the chisel-boat does not come up to 10 cubic yards. The cost of 1 cubic yard by the chisel-boat amounts to \$3.50, and the cost for 1 cubic yard by the steam-drill scow is \$1.62, but a proof quite more striking will be given for the superiority of the steam-drill scow.

The capital invested in a new chisel-boat is from \$4,500 to \$5,000; leaving out of consideration the costs of royalty attached to the use of the chisel with movable points and taking the lowest figure of \$4,500 as a basis for comparison with the cost of the steam-drill scow (1,800), it will be seen that the steam-drill scow is 2½ times cheaper in its construction, and therefore 2½ scows could be built with the cost of one chisel-boat.

The superiority of the steam-drill scow becomes still more evident when I add that a sum of \$600 would be abundantly sufficient to lengthen the present scow 10 feet and purchase another steam-drill.

The invested capital would then amount to \$2,400, about half of the cost of a chisel-boat, and the effectiveness of both machines, chisel-boat and steam-drill scow, would be at the lowest figuring as 1:3.

There is in my mind no doubt at all, that subaqueous blasting in connection with the steam-drill, should be everywhere used where the cutting or breaking of rock is 1 foot

and more, and this depth of rock will be found probably wherever the removal of obstructions is desirable. I will add that for removing rock under 6 inches in thickness the chisel will perhaps be more convenient, especially if the surface is a large one, i. e. thousands of square feet.

The steam-drill scow, introduced by you, is a perfect success, and time and money would have been saved at these rapids by an earlier knowledge of the above specified facts.

I will mention that during the latter days of April of this year you ordered me to remove with the steam-drill scow a number of bowlders at Horseshoe Island, 3 miles from this place. The scow did most excellent work. An erratic block of the hardest sienite washed into the middle of the channel, contained about 38 cubic yards. Its dimensions were 16 feet by 6 feet, and a height of 11 feet, imbedded in the river-bed, and reaching in its height with the top 1 foot under the plane of low-water of 1864. Five holes of ¾ inches diameter were drilled averaging in depth 5½ feet and charged with 12 pounds of dynamite number 1. The charges were simultaneously fired by an electric battery and the bowlder annihilated.

During the above-mentioned working season of 45 days in fall of 1878, 1,001 running feet of ¾ inch holes have been drilled, or, daily, 22.22 feet, 680 running feet ¾ inch holes, to 170 drill holes 4 feet; 249 running feet ¾ inch holes, to 83 drill-holes 3 feet; 72 running feet ¾ inch holes, to 24 drill holes 3 feet = lost by passing rafts.

Four hundred and fifty-one pounds of dynamite have been used, of which 99 pounds were of No. 1, and 352 of No. 2. Two hundred and forty-seven charges were fired by the electrical battery, of which 20 were single and 227 coupled.

3 times a simultaneous blast of 8 charges was fired.
4 times a simultaneous blast of 7 charges was fired.
11 times a simultaneous blast of 6 charges was fired.
10 times a simultaneous blast of 5 charges was fired.
9 times a simultaneous blast of 4 charges was fired.
5 times a simultaneous blast of 3 charges was fired.
4 times a simultaneous blast of 2 charges was fired.

The steam-drill scow worked over 7,302 square feet of ground and would have accomplished more if the moving from one to the other of the scattered patches of rock and the necessity of swinging the boat out of way of rafts and large steamers had not materially interfered with the work. Besides this, the current of the river at Moline Chain is very strong, and the charging of the holes as well as connecting leading wires had to be attended to carefully, demanding time. No misfire has been experienced with the electrical battery and fuses.

During the period of working the steam-drill scow at Horseshoe Island and later at Moline Chain from the 16th of April to the 30th of June, 1879, 350 pounds of dynamite have been used—100 pounds of No. 1, 250 pounds of No. 2. Eleven hundred and eighty-six running feet of ¾ inch holes have been drilled. Sixty-eight running feet of ¾ inch holes have been lost, and 281 charges were fired by the electrical battery. It is not possible to give the exact amount of rock broken up at these skipped patches, but a fair investigation proves that a cubic yard of rock (limestone very hard intermixed with silica) has been removed by ¾ to 1 pound of dynamite No. 1 and No. 2, the proportion of the two dynamites used in a charge being as 1:3.

The steam-drill scow in its construction is as follows: A decked flatboat 36 feet long, 12 feet wide, and 3 feet deep, was built and furnished with 3 spuds and head, and side lines; on this was put an upright boiler 57 inches by 42 inches, and a 4-inch Ingersoll drill was purchased. This drill was taken from its tripod and attached to a cross-head that moved between two slides. The cross-head was held in place by a screw 14 feet long. The slides were hinged at the deck of the scow, so that the drill could be given any desired inclination. The feed-screw of the drill was 2½ feet long, but it has been replaced by another 5 feet long. By means of the long screw the steam-drill could be raised or lowered as might be necessary, and a hole of any depth, not exceeding 12 feet, could be drilled without changing the bits. A small winding engine facilitates the handling of ropes and lowers and raises the slides with drill when-ever a change of depth of water calls for a longer extension of the slides. The operation of changing depth of slides is simply effected by withdrawing the upper bolt passing through both arches and the slides; the slide then resting upon the lower bolt, passing likewise through both arches, is lowered by the chains running upon rollers fastened to the top of the arches, and entering beneath the bottom timbers of the arches into the hull of the boat, where they again pass the foot of the arches, behind which they are connected by a single-tree. To this single-tree, and to the end of the boat inside, a double-block gearing is attached; the end of the rope running over an iron pulley is passed through the deck of the flatboat, where a shaft of the above-mentioned winding-engine carries a drum for the purpose of serving as a capstan. When the slides with drill are lowered on the deck, they rest upon small rollers, the lower bolt is then withdrawn, the slides then pass between the arches as much as the depth of water requires, and the lower bolt put again into arches and slides. The steam-

engine raises the slides, the upper bolt is put also through arches and slides, and the steam-drill is ready to work in another stage of water. The accompanying drawings show the details of the arrangement of the boat.*

Figure 1 shows a longitudinal section through the axes of the steam-drill boat; figure 2 is a plan of boat; figure 3 shows an end elevation of boiler and of boat, and figure 4 shows end elevation of steam-drill end of boat. The guide of the lower end of the slides through which the drill passes was necessary to steady the bit and prevent it from vibrating under the influence of the current. The mode of handling the boat and drill was as follows: The boat being brought into position by means of head and side lines, the spuds were set so that a strong pressure was put upon them. A bit (the shortest used was 10 feet long) was attached to the drill, and the drill with its feed-screw moved home by the long screw until the bit touched the bottom. The drill was set in motion and kept going by means of long screw and feed-screw, until the hole was drilled to the required depth. The drill was then withdrawn and a gas-pipe set in the hole to mark it, the position of the boat shifted, and another hole bored, and so on. In charging the holes the cartridge was inserted through a galvanized-iron pipe reaching from the bottom to above the surface of the water. After the cartridge was pushed home a quantity of sand was run into the hole through the pipe. The connecting wires or the electric-fuse wires, which were purchased from the Atlantic Giant Powder Company, broke at once in the strong current, and it was necessary to make a connection in the top disk of the charge between a fuse-wire and a heavier insulated one. This heavier wire connected the different charges together, and the end charges with the leading wires to the battery. In order to relieve the connecting wires from the strain to which they would have been subject had they been connected with the leading wires in the ordinary way, a peculiar anchor was used at which this connection was made. This anchor consisted of a heavy iron cylinder furnished with several legs normal to its surface, and had a clamp on it in which the connection was made. The leading wires were paid to the lines leading from this anchor to the boat. The battery used was a 12-inch Smith's Friction battery. The charges were prepared by one man, and also the connecting wooden clamps between the different charges. I can state that only two misfires occurred among the hundreds of blasts during the working season. The fault was a defective electric fuse in both cases. There has been no accident to be recorded in the handling of the 850 pounds of dynamite used so far.

After the work at Moline Chain was closed last fall the river froze over, and you ordered me to make certain ice soundings on Saint Louis Chain. A small party was sent to the place, and a very good hydrographic map would be later platted in the office, which will do good service whenever the steam-drill scow is moved to that place for removing about 500 cubic yards of rock which intrude into the channel of the river, and the removal of which you took into consideration.

During the winter in the office you ordered the drawing of a map of the rapids, showing the present improved channel of the river, having everywhere a width of 200 feet and a depth of 4 feet below low-water of 1864, and a project of making the width of the channel 400 feet at the different depths of 4 feet, 5 feet, and 6 feet, such to be below low-water of 1864.

Besides this work, various maps and calculations have been drawn and accomplished.

I desire to bring the faithful services of Assistant Engineer C. H. Benck, Draughtsman A. J. Stibolt, and of the foreman of the steam-drill scow, P. Lutze, to your notice. All of which is most respectfully submitted.

E. F. HOFFMANN,
Assistant Engineer.

Maj. F. U. FARQUHAR,
Corps of Engineers U. S. A.

Q 7.

IMPROVEMENT OF HARBOR AT MUSCATINE, IOWA.

Owing to the fact that there was only one dredge available for the work on the Mississippi River, and that the very bad condition of the landing rendered the necessity of some immediate dredging, under authority from the Chief of Engineers the dredge was hired at the rate of 20 cents per cubic yard of material dredged. Seventeen thousand five hundred and ninety cubic yards were dredged during the months of May and June, 1879.

*Drawings omitted.

The dredging will be continued until the funds available are exhausted. The remainder of the amount estimated (\$11,750) for the completion of this work should be appropriated for the fiscal year ending June 30, 1881.

Cost of dredging 17,590 cubic yards in harbor at Muscatine, Iowa.

Description of work.	Per cubic yard.	Sand, cubic yards.
Dredging	\$0.20	\$3,518
Superintendence and office expenses	0.0178	313
	0.2178	3,831

Money statement.

Amount appropriated by act approved March 3, 1879	\$7,500 00
July 1, 1879, amount expended during fiscal year	\$1,474 60
July 1, 1879, outstanding liabilities	2,356 40
	3,831 00
July 1, 1879, amount available	3,669 00
Amount (estimated) required for completion of existing project	11,750 00
Amount that can be profitably expended in fiscal year ending June 30, 1881 ..	11,750 00

EXAMINATION OF THE LANDING-FRONT OF MUSCATINE, IOWA.

UNITED STATES ENGINEER OFFICE,
Rock Island, January 25, 1879.

GENERAL: I have the honor to acknowledge the receipt of a letter from your office, dated September 10, 1878, directing me to make an examination of the landing-front of Muscatine, Iowa, and report what is practicable and necessary to its improvement.

The landing at Muscatine was never a very good one, owing to the rock in place along the river bank. A sort of levee was built out, and at this the boats have landed. A deposit of mud has accumulated along the front of the landing, which, during the low-water of last season, rendered it very difficult for steamboats to make the landing. This deposit of mud comes in part from the drains that enter the river just above the landing. (See inclosed tracing.)

The river, owing to the island below the town and a sharp bend, has a very flat slope, and at present not much scouring force.

To give immediate relief, this deposit should be dredged away.

To prevent its reforming and to improve the river channel in the vicinity, certain works may be necessary. These will be reported upon when the subject of through navigation is considered.

There is a bad crossing just above the town, and two narrow channels below. The estimated cost of this work is as follows:

70,000 cubic yards dredging, at 25 cents	\$17,500
10 per cent. contingencies	1,750
	19,250

Very respectfully, your obedient servant,

F. U. FARQUHAR,
Major of Engineers.

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

Q 8.

IMPROVEMENT OF RUSH CHUTE AND HARBOR AT BURLINGTON, IOWA.

Two thousand eight hundred and seven cubic yards of stone were placed on the dam at the head of Rush Chute. Fifteen thousand and seven cubic yards of material were dredged from in front of the landing.

In a letter of January 25, 1879, a new project for this work was submitted, and the estimate of cost for the same was \$55,336.87. The amount then on hand, \$5,680, and the amount (\$5,000) appropriated by act approved March 3, 1879, leaves \$44,656 still to be appropriated. It would be economical if this whole amount could be appropriated in a single sum and the work completed in a single season.

With the amount now available it is proposed to protect the caving banks in Rush Chute and do some dredging away of the sand-bar that is moving down into Rush Chute.

IMPROVING HARBOR AT BURLINGTON, IOWA.

Dams:	1,100
Linear feet.....	2,807
Stone, cubic yards.....	
Dredging, 15,007 cubic yards.	

Cost of 2,807 cubic yards of stone put on work.

Description.	Cost per cubic yard.	Total cost.
2,807 cubic yards rock.....	\$1.25	\$3,508 75
Superintendence and office expenses.....	0.163	459 56
Total.....	1.413	3,968 31

Cost of dredging 15,007 cubic yards.

Description.	Cost per cubic yard.	Total cost.
Dredging 15,007 cubic yards.....	\$0.20	\$3,001 40
Superintendence and office expenses.....	0.026	393 38
Total.....	0.226	3,394 78

ABSTRACT OF APPROPRIATIONS MADE FOR IMPROVEMENT OF RUSH CHUTE AND HARBOR OF BURLINGTON, IOWA.

By act approved August 14, 1876.....	\$10,000
By act approved June 18, 1878.....	10,000
By act approved March 3, 1879.....	5,000
	<u>25,000</u>
Original estimate for former project.....	\$35,221 00
Remaining to be appropriated for same.....	10,221 70

Money statement.

July 1, 1878, amount available.....	\$10,034 01
Amount appropriated by act approved March 3, 1879.....	5,000 00
	<u>\$15,034 01</u>
July 1, 1879, amount expended during fiscal year.....	7,347 35
July 1, 1879, outstanding liabilities.....	15 74
	<u>7,363 09</u>
July 1, 1879, amount available.....	7,670 92
	<u>\$49,656 87</u>
Amount (estimated) required for completion of existing project.....	49,656 87
Amount that can be profitably expended in fiscal year ending June 30, 1881.	

Abstract of proposals received and opened August 10, 1878, by F. U. Farquhar, Major of Engineers, U. S. A., for furnishing stone at Rush Chute, near Burlington, Iowa.

Name.	Residence.	For furnishing and putting in place stone.	Remarks.
Archibald McArthur.....	Chicago, Ill.....	Per cu. yd. \$1 25	} Informal, not in duplicate.
James Kelly.....		
Adolph Schei and.....		
Thomas Field.....		
Nicholas Young.....	Burlington, Iowa.....	1 30	
John Hussel.....	do.....	1 30	
John Brady.....	do.....	1 29	
Samuel Sample.....	Keokuk, Iowa.....	1 49	
Michael Cahill.....	do.....	1 79	
H. S. Brown.....	Hamilton, Ill.....	1 59	

Q 9.

IMPROVEMENT OF HARBOR AT FORT MADISON, IOWA.

Three thousand five hundred and eight cubic yards of stone ballast were put in the dam closing Niota Chute, bringing the whole dam up to the level of low-water. It is proposed to build a spur dam from the head of Niota Island towards the Iowa shore to contract the channel and direct the current along the Fort Madison landing. There is sufficient money available for this purpose.

Fort Madison.

Description of work.	No. linear feet.	Rock.
Dams.....	1,000	Cub. yds. 3,508
Shore protection.....		
Total.....	1,000	3,508

Cost of 3,508 cubic yards.

Description.	Per cubic yard.	Total.
Material.....	\$1.19	\$4,174 39
Superintendence and office expenses.....	0.166	584 06
Total.....	1.356	4,758 45

ABSTRACT OF APPROPRIATIONS MADE FOR IMPROVING HARBOR OF FORT MADISON, IOWA.

By act approved August 14, 1876.....	\$10,000
By act approved June 18, 1878.....	8,000
By act approved March 3, 1879.....	3,600
	<u>21,600</u>
Original estimate for existing project.....	30,186 87
Remaining to be appropriated.....	8,586 87