APPENDIX W.

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

UNITED STATES ENGINEER OFFICE,
Indianapolis, Ind., July 19, 1879.

GENERAL: Herewith I forward annual reports for works in my charge for the fiscal year ending June 30, 1879.

Very respectfully, your obedient servant,

JARED A. SMITH,
Major of Engineers.

Brig. Gen. H. G. WRIGHT,
Chief of Engineers, U. S. A.

W 1.

IMPROVEMENT OF WABASH RIVER, INDIANA.

All the works of improvement during the year have been carried on by hired labor and open purchases of material.

Wherever it has been possible to make a comparison between this method and that of doing the work by contract, it has been found not only much cheaper in point of cost, but far superior in quality, and vastly more satisfactory to the various interests and people of the vicinity. This method was therefore recommended as most economical and desirable.

DAM ACROSS NEW HARMONY CUT-OFF.

On the 1st of July, 1878, work was in progress closing a break which had been made the previous January in the work of 1876. An opening of 24 feet still remained, besides completing the superstructure and a re-enforcement to the entire work. The following paragraph from my last report is repeated here, viz:

* * * The difficulty of closing this gap may be estimated when it is considered that the water has at no time been less than 9 feet deep, and so rapid that in rushing through the break its surface falls 2½ feet in the width of the dam. This work will be pushed rapidly, and it is confidently expected that the present summer will find it all completed in a thoroughly substantial manner.

The repair and re-enforcement was entirely completed early in November, 1878, the following being a summary of the work of the season:

Logs cut, boated to, and framed into the dam, 33,724 linear feet.
Iron drift-bolts made and driven, 10,185 pounds.
Stone quarried or purchased, and boated 14 miles to the dam, 3,785 cubic yards.
Earth, shale and stone boated and carted into embankment above dam, 6,125 cubic yards.
Paving on top and slopes of dam, 283 square yards.

The total expense of the season's work at this point, including contingencies and superintendence, was $13,450.20.

The same work at the prices with which the contractors failed to complete the work, or to do any part of it well, would have cost, excluding all superintendence and contingencies, $13,999.80.

The expense of an inspector and other contingencies on the part of the government would increase the cost by contract at least $1,000, making the total about $15,000.

The comparison may be approximated as follows:

Cost of season's work on dam	$13,450
What same would cost by contract	15,000
Difference in favor of doing the work by hired labor	1,550

The work by hired labor was done under far greater difficulties, and its quality is better beyond comparison.

The dam as thus completed may be best described in connection with its history.

Below New Harmony the main channel forms a large bend, or ox-bow, about 10 miles in length, the parts being connected by what is known as the cut-off, about 2 miles in length. (See sheet No. 1.)

The cut-off having five times the declivity of the main stream—a total given approximately as 8 feet—besides being more direct and over a rocky bottom, was gradually becoming the main channel. It not only destroyed all through navigation, save in extremely high water, but it deprived the town of New Harmony of one of its best routes, and only competing one, for its extensive shipments.

It is in one of the finest agricultural sections in this country, and without the dam at New Harmony, the farms adjacent to 14 miles of the river banks would be deprived of any convenient outlet for produce, or inlet for supplies.

On the 2d of June, 1875, a contract was made with Messrs. J. M. & R. B. Kerr, for the construction of a dam across the cut-off, including all necessary materials and labor.

The length of dam then required was 350 feet. The depth at low-water 6 feet, and the work designed was to be of open timber cribs, built up "log-house fashion," 12 feet high and 12 feet wide. An embankment of earth was placed against the upper side of the crib-work.

The dam rested on a soft shale, one end being against the same material at the foot of a high bluff, the other end against the island bank, which was composed of a very sandy loam. The island bank was protected by a pavement on the graded slope, with a footing of riprap below water.

The work was commenced in September, 1875, but in November, 1876, was still incomplete.

Owing to high water and their own incompetence, the contractors had sustained constant losses, and the river for 25 miles below was strewn with fragments of their work. The contract was, therefore, annulled and the work was completed January 17, 1877, by hired labor and open purchases of material.

Early in February, 1877, the water rose about 5 feet over the dam; the cribs next the island gave way, and a channel was cut around the end of the remaining part, carrying away a portion of the island more than 200 feet wide and nearly 1,000 feet in length. The surface of the rock-bottom having a dip towards the island, the cut was made to an average depth of 10 feet below extreme low water. The half acre of land at the end of the dam, which had been donated to the government,

was so washed that its location was in mid-channel, and the owner of the island refused to donate, sell, or give the use of any more land for the purpose of completing the dam in that locality, as he considered that it would inevitably result in a further destruction of his lands.

To decide the question between the necessary repairs and extension of the old work, or the construction of a new one at some other point, a Board of Engineers, consisting of Major G. Weitzel, Major W. E. Merrill, and Major J. A. Smith, Corps of Engineers, assembled at Indianapolis, June 19, 1877. After visiting the works the Board adopted the recommendations made by the officer in charge—to prolong the dam across the break, to raise the end as high as the island bank, which was to be carefully protected by crib-work and paving.

This was completed during the ensuing season, the main portion of the gap being closed while the water to a depth of 7½ feet was rushing rapidly through the break.

The old contract work of 1876 was so badly done that I had no confidence in its strength, and therefore completed designs and procured some of the material for its re-enforcement.

The following extract from a report of Mr. Bateman, dated January 2, 1878, given in my last annual report, is repeated here, as it describes the situation at that time:

* * * The clumsy construction, large size of and numerous gaps between the timbers, great spaces between the cribs, and the small amount and careless packing of the stone contained in the cribs, gave rise to serious apprehensions as to the ability of that part of the work to withstand its share of the pressure through the winter's floods, or until the work of re-enforcing them can be resumed.

Nothing but the compactness of the earth-work above the cribs would appear to give any strength, and on that is the only reliance until spring.

Your instructions were to build a line of crib-work below this part of the dam to strengthen it, but the height of the river since those instructions were received has prevented the accomplishment of that part of the work. * * *

Two days after the above was written the work mentioned gave way, resulting in an opening 120 feet long, the closing of which has already been described.

The work as completed in November is shown on sheet No. 1.

INJURIES TO DAM.

In the month of January, 1879, the river rose sufficiently to float a large amount of drift, among which were many trunks of immense trees.

A sudden fall of the water left its surface so low that the logs would not freely float over the dam, so that the protruding knots, limbs, and roots tore away some of the paving.

Each opening thus made gave fresh opportunity for further injury, resulting in openings sufficient to admit ends of floating logs, which then swung round in the rapid water, and became immense levers, by which some of the strongest timbers of the dam were broken like twigs. The injury was principally on the slope of the dam, and was entirely within the line followed by the drift.

Although the damage was due to a combination of circumstances which could rarely occur, and could not be foretold save as the result of a similar experience, I have thought best to secure the work against a possible recurrence of such injury.

The work has not broken away, and can be readily repaired. Its cross-section will be modified, and the roof will be covered with pine plank 3 inches in thickness. Designs of these modifications are shown on sheet No. 1.

The auxiliary cribs above the dam, which were used during its construction, have been built up to a height of 6 feet above the level of the crest of the dam. Other new cribs have been added, making 10 in all, so located as to check the movement of drift and retain it to fill the channel. The 10 cribs are completed, save covering the tops. In their construction there have been used—

13,203 linear feet of logs.
5,075 pounds drift-bolts.
1,356.5 cubic yards stone.

Most of the material for the repairs has been procured, and the tools, boats, and machinery have been put in good condition.

During the months of April, May, and June but few men have been employed, as the water has been too high to work profitably.

All the repairs and other work at New Harmony will probably be completed in August.

GRAND CHAIN.

At the date of the last annual report a small party was employed on the repairs and extension of the east dike.

At the place on the shore to which it was proposed to extend the dike, a line of crib-work, 330 feet long, 10 feet wide, and 7 feet high, was constructed along the shore in a depth of about 3 feet below low-water. The space in and behind this crib was filled with stone and paved. The timber dike was then constructed, 625 feet in length, with a wing 75 feet in length crossing the shore protection and running into the bank.

The work has an average height of 9 feet, and a width of 15 feet.

The cribs were constructed 5 to 6 feet high and 30 feet long, and a superstructure of two or more courses was made continuous.

Behind the cribs, at each junction, counter-forts were constructed 10 feet square and as high as the dike.

A map of the river and details of the work are shown on sheets Nos. 2 and 3.

The top of the timber work is about 5¼ feet above low-water at the lower end and 11¼ feet at the shore.

The lower end of the east dike has been raised for a distance of 1,600 feet to a height of about 7 feet above the low-water in the chute, and the upper portion of this work has been carefully paved a distance of 528 feet.

To aid boats, when necessary, in ascending the chute, rings 6 inches in diameter of 2-inch round iron were secured flush with the grade. The fastening of each consisted of an iron rod 8 feet long, holding the ring in an eye at its upper end, and the lower end firmly secured through the middle of a white oak "dead man" buried below the level of low-water. Twenty of these rings were made and set at intervals of 200 feet.

Seventy-five linear feet of crib-work 10 feet wide and 5 feet high was placed across mouth of slough and filled with stone in rear of bank protection.

The following is a detailed summary of the work, which was closed November 28 for the season:

Cubic yards of stone quarried from reef and carted into dike	7,570
Cubic yards of stone purchased and boated 10 miles to the work	2,779
Cubic yards of excavation for end of dike	50
Cubic yards of gravel hauled into shore protection	110
Square yards of paving on dike	323
Square yards of riprap paving on shore protection	778

Linear feet of logs purchased and framed into crib-work	45,075
Pounds of drift-bolts made and driven	18,190
Anchors and rings set in dike	20
Water-gauges established and read daily	3
Sunken barges, unloaded, raised and calked	1

Two small temporary buildings were constructed for a boarding-house, office, &c., as the work is 15 miles from the nearest town.

Entire cost of the season's work, including superintendence, but excluding tools and boats, $16,931.24. This does not exceed two-thirds of what the same work would have cost at the lowest contract prices heretofore obtained for similar work on the river.

The coming season it is proposed, if practicable, to complete the filling and paving of the east dike.

The work of the last season has already greatly improved the navigation at this place, but many defects remain which should be removed. These defects are, 1st. The narrowness of the chute, which should be increased to at least 125 feet, its present width being only 100 feet. 2d. The small depth at low-water in the cut.

This may be in part remedied by cutting deeper at the head of the chute and prolonging the dikes to give a less declivity, resulting in a less rapid flow. It is probable also that it will be necessary to connect the west dike with the Illinois shore by a wing-dam as high as the low-water level. This will throw all the river through the cut at low-water.

The west dike should be left but little above low-water level; when the water rises, it can then have sufficient room for its flow, while the east dike will serve as a guide to the channel until a sufficient depth obtains for any boats to pass in safety over the entire reef. The part which has heretofore been known as the most difficult navigation on the river will then be easily and safely passed.

It is proposed to complete the east dike the present year.

ESTIMATED EXPENSE OF THE OTHER IMPROVEMENTS.

Removing 12,000 cubic yards of stone, at $1.50	$18,000
Wing-dam or a prolongation of dike across west channel	7,000
	25,000

It will be greatly to the interest of the navigation to complete this work at as early a day as possible.

BANK PROTECTION AT GRAYVILLE, ILLINOIS.

At this place the river forms a bend about 3 miles in length. (See sheet No. 4.) The long peninsula has a width of about 1,000 feet, and across its neck runs a deep cut or ravine through which flows a rapid current at high-water. The banks on each side were rapidly being cut away, and the ravine was yearly growing deeper. To prevent the flow of water across, a levee had years ago been built, but it had long since broken away and was of no further use.

It was evident that but a few years would be required to cut the river channel entirely across this place, and thus leave Grayville with its railroad connections too far from the river to be of any further service, while the old river-bed would soon form another fruitful source of malaria in a location already too well supplied.

The Cairo and Vincennes Railroad passes through Grayville, and forms a part of one of the through routes by which large amounts of produce are shipped from the river to Western and Southern markets.

In July the protection of the banks was begun and the work was completed in November.

The revetments are of piles, driven in two rows, and about 5 feet apart, the spaces being filled with brush weighted in layers by stone. The general design of the work is the same as the bank protection at Turkey Island, shown on sheet No. 5.

The work above Grayville was constructed 3,500 feet and that below on the opposite side of the peninsula 900 feet in length. The levee between these works was entirely rebuilt, using in its construction brush, posts, and earth. A small brush-dam was constructed across the ravine in rear of the lower bank protection.

In addition to the above, a wing-dam 400 feet long, of piles, brush, and stone, was constructed to improve the channel at Kingdom Bar. The position of this dam is shown on sheet No. 4. A similar wing-dam was begun a short distance above on the opposite shore, but was not completed, as the rocky bottom prevented the driving of piles sufficiently deep to hold.

The inspector in local charge of this work was directed to drive the piles to a depth which would hold them securely, and to place most of the brush with tops toward the water and protruding a few feet beyond the outer row of piles. This was to prevent a crowding outward of the piles, which would obtain with the brush laid longitudinally.

The owners of adjacent lands gave the privilege of cutting all the brush and piles needed for the work without payment other than the benefit received from the protection of their property. The same privilege has been extended for the purpose of making the repairs which are now progressing.

The expense of the works as described at this point was $17,134.70.

The following is a summary in detail:

Piles 20 feet long cut, hauled, and driven	1,578
Cords of brush cut and hauled to the work	17,913
Cubic yards of stone quarried or purchased and boated to the work	3,973
Posts set 3 feet deep to hold brush in levee	764
Cubic yards of earth moved in levee and bank slopes	11,020

INJURIES TO THE WORK.

During the winter the bank revetment above Grayville was considerably injured in seasons of high water; this was due chiefly to the failure of the inspector to comply with his instructions regarding filling of brush and driving of piles.

The piling in many places was not sufficiently deep, and much of the brush was placed longitudinally, so that the weight of stone tended to force the piles into the stream. These methods were corrected as soon as observed, and the inspector's services dispensed with as early as practicable.

Another defect seems to have been the height of piles above the top of brush, as ends of drifting logs would catch, and, by swinging with the current, would wrench the piles out of place.

On the 19th of May a small party commenced replacing the missing piles, driving the outer row to a greater depth, and cutting them off, so that they will project but a few inches above the brush and stone. The new piles which are being put in the work are 30 feet in length, and are driven an average depth of 15 feet. The tops are allowed to project but about 4 feet above low water, in order to reduce the liability to injury from drifting trunks of trees.

The repairs thus far have comprised cutting and hauling to the work 243 piles, 199 cords of brush, redriving 204 old piles, and driving 223 new ones. These repairs will probably be finished in July.

TURKEY ISLAND DAM.

About 3 miles below New Harmony the river channel divides and forms Turkey Island. The newer and straighter channel is called the chute, and the division of water rendered both nearly impassable for boats at low stages of water.

As the main channel was the more useful and freer from snags than the chute, it was determined to close the latter. The work was begun in September and closed in November.

The owners of the island and other adjacent lands freely gave the privilege of cutting and taking away the piles and brush necessary for the work.

The location of this dam is shown on sheet No. 6 and the details of its construction on sheet No. 5.

It has not only made an increase of about 2 feet in the portion of channel adjacent to the island, but the change in the direction of the water has so modified the channel as to cause a decided improvement for some miles below.

The dam is about 350 feet in length, 62 feet in breadth, and 13 feet high.

The piles are allowed to remain as driven, the tops being about 5 feet above the brush and stone; they are 30 feet long and are driven an average of 12 feet.

The cost of this dam, exclusive of tools and machinery, was $6,144.96.

The following is a summary in detail:

Piles cut, hauled, and driven	638
Average number of blows to each pile	130
Cords of brush cut and hauled into the dam	5,030
Cubic yards of stone quarried or purchased and boated to the work	2,528

The piles and brush were hauled an average distance of 1 mile and the stone was boated 17 miles.

The work is now covered with the trunks of large trees and other drift, but it has received only trifling injuries, which can be repaired in a few days during the present summer.

WARWICK'S RIPPLE.

At the date of the last annual report no immediate necessity for further work at this place was anticipated. During the low-water of the summer passing boats and barges frequently struck upon some remaining timbers of the old coffer-dam.

One of the steamboats with a small party, in a single day, removed the troublesome timbers and a few loose stones.

Boats and barges were constantly passing this place, and for two or more months a failure to strike the rocky bottom was a rare occurrence.

The steamboat Ada once lay upon the reef for several days before it could be pulled off.

An improvement of the channel at this place has therefore become desirable, and as far as possible it will be made while the water is low the present season.

A map of the place is shown on sheet No. 7, indicating the location and extent of the proposed cut.

The surface of the reef is irregular, some small portions rising above the low-water level; these will be removed in such manner as to obtain a clear channel 200 feet wide and 3 feet deep at the lowest stage. It is located in the position most easily passed by steamboats, and where the result can be accomplished with the least removal of stone.

TOOLS, MACHINERY, ETC.

The prosecution of the work by hired labor has rendered necessary the purchase of considerable plant, most of which is still on hand and serviceable for future use.

One of the principal items on the list is a pile-driver with a new portable engine of nominal 8 horse-power; the whole is fitted on board a substantial barge.

A second pile-driver was constructed on board a barge, and was used for two months or more with horse-power. The machinery of the latter has now been taken off, leaving the barge for service in carrying materials.

For the purpose of boarding the employés at works remote from towns, a large flat-boat was procured and fitted with all necessary accommodations. No rations were furnished, but persons were employed to board the men, charging therefor rates not exceeding those in neighboring villages.

Other small boats and appliances have been purchased or made, the amount expended for tools, machinery, &c., being $4,251.76.

STOREHOUSE.

As no suitable or secure place was available for storing the plant when not in use, a wooden building has been constructed for the purpose.

The storehouse is near the dam at New Harmony; its dimensions are, length, 60 feet; width, 18 feet 6 inches; height of post, 10 feet. Articles used at various points along the river have been transported to New Harmony and stored in the new building.

HIRE OF STEAMBOATS AND BARGES.

To transport the large amounts of material used in the different constructions two steamboats and several barges were constantly employed during the summer and autumn of 1878.

In the month of August the steamboat A. L. sunk and was run aground on Kingdom Bar. The place of this steamer was immediately supplied by the steamer Hope. The other steamer was a small but convenient towboat called the Oil City.

The hiring of steamboats and barges was an expensive but indispensable item, amounting to $9,024.50.

The lowest prices at which suitable boats can be hired are such that it will be great economy to purchase or build such as may be needed in future.

SUNKEN BARGES.

Two barges heavily laden with stone sank at different points while being towed to the works. One of these was in deep water, and to unload, raise, and repair it without special appliances was both difficult and expensive.

WATER-GAUGES.

Regular daily readings of the standard water-gauges at Vincennes, Mount Carmel, and Grand Chain have been made throughout the year.

Owing to the small amount of money available for the ensuing year these readings were discontinued June 30.

A temporary gauge has been kept by each of the working parties; at Grand Chain three of these gauges were kept at different points to assist in determining the effect of the improvements.

The entire expense of attending water-gauges during the year was $181.50.

SURVEYS.

A complete survey of the channels and reef at Grand Chain, from the bend of the river to the Saint Louis and Southeastern Railroad bridge, has been made, and also a second of about equal extent at Warwick's Ripple. These surveys, and also those of Little Chain and Grand Rapids, have been reduced to maps on a scale of 100 feet to 1 inch.

The sheets with this report, numbered 2, 4, 7, 8, and 9, are reductions by pantograph from these maps, most of the soundings being omitted.

The connected survey of the river was continued from the mouth of the Little Wabash River, a distance of 7 miles, leaving about the same distance to connect with the Ohio River. These surveys have been platted, and the maps are nearly completed on a scale of 200 feet to 1 inch.

The interval to the Ohio River would have been surveyed during the last season, but it became necessary to transfer the party to the White River to make the examinations required by the act of June 18, 1878.

The entire amount expended upon surveys during the year was $1,055.

MALARIAL FEVERS.

The months when the water is at a most favorable stage for the works are so unhealthy at the points where improvements and surveys have been made, that it has been difficult to preserve any organization in the working parties.

Much of the time fully one-third of the force employed would be so much affected with chills and fevers as to be unable to work. Although these fevers are not generally fatal, four of the employés died from that cause.

SNAG-BOATS.

During the winter designs were prepared for the construction of two light-draught snag-boats. These boats are to be 120 feet in length, 24 feet in breadth, and 4½ feet in depth of hull. They are to be propelled by stern wheels, and will have hoisting apparatus consisting of shears, blocks, and falls, with steam-power capstans on the forward deck.

Sealed proposals for the construction of these boats were invited by advertisement in the usual manner, and the bids were opened May 3, 1879.