

APPENDIX T.

ANNUAL REPORT OF MAJOR WM. R. KING, CORPS OF ENGINEERS, FOR THE FISCAL YEAR ENDING JUNE 30, 1879.

UNITED STATES ENGINEER OFFICE,
Chattanooga, Tenn., August 23, 1879.

GENERAL: I have the honor to submit annual reports on the works under my charge for the fiscal year ending June 30, 1879.

Very respectfully, your obedient servant,

W. R. KING,
Major of Engineers.

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

T I.

IMPROVEMENT OF TENNESSEE RIVER.

ABOVE CHATTANOOGA.

At the beginning of the fiscal year the work of reorganizing the working parties, repairing and building boats, and making other preparations for resuming work, which had been suspended some eighteen months, had been commenced. The appropriation being small, a considerable proportion of it in that way, and the balance was principally expended on Chota and Coulter's Shoals.

At Chota Shoals, which had been left in a half-finished state from the exhaustion of the previous appropriation, a large quantity of rock was quarried and placed in the dam at the head of the shoals, and in riprapping the bank to prevent washing.

At Coulter's Shoals the large and serious breaks in the dams were repaired in December, and the gap in the island effectually closed. The completion of this work will have the effect to render the work done at Chota Shoals immediately useful though some additional work there will be necessary.

On a personal examination of most of the dams on the Upper Tennessee, some of which have been standing six or seven years, I found that with few exceptions, they are almost uninjured, and, with trifling repairs, they will doubtless remain so for many years to come. As this improvement has never been completed according to the original plans, and as the improvement, as far as it has been extended, has been perfectly successful, it is very desirable that an appropriation be made sufficient to complete it as far as Knoxville without delay. On the opening of the Cincinnati Southern Railroad, which will take place within a few months, it is quite probable that there will be a considerable increase in the commerce on the Upper Tennessee between Knoxville and

Kingston, or some other point where a connection can be made between the railroad and river, and it is also probable, when the river is put in good navigable condition all the way to Knoxville, the amount of commerce between that city and Chattanooga will be greatly increased.

There are eight or nine steamboats on the river between Knoxville and the Muscle Shoals, and the following table gives an approximate statement of the quantities of the different articles of commerce on this river for the year ending July 1, 1879, arriving at Chattanooga:

| | | |
|-----------------|-----------|------------------------|
| Pig-iron | tons.. | 8,951.71 |
| Iron-ore | do... | 4,573.71 |
| Limestone | do... | 6,300 |
| Coal | bushels.. | 625,000 |
| Grain | do... | 413,800 |
| Hay | bales.. | 742 |
| Flour | barrels.. | 2,162 |
| Bacon | pounds.. | 45,000 |
| Saw-logs | feet.. | 3,500,000 to 5,000,000 |

Besides large quantities of cattle, lumber, wood, sand, corn-meal, dried fruit, peas, &c., about 125 flatboats came down the river laden with produce, &c.; the steamboats made about 200 landings at Chattanooga Wharf during the year.

Assistant Engineer John S. Crary has continued in charge of the work during the year, with an average of 72 men under his supervision.

Estimates of cost of improving the Tennessee River above Chattanooga .. \$225,000 00

| | |
|---------------------------|------------|
| Amounts appropriated..... | 191,500 00 |
| Amount expended..... | 179,991 77 |

Money statement.

| | |
|---|--------------------|
| July 1, 1878, amount available..... | \$15,071 17 |
| Amount appropriated by act approved March 3, 1879..... | 11,500 00 |
| | <u>\$26,571 17</u> |
| July 1, 1879, amount expended during fiscal year | 15,062 94 |
| | <u>11,508 23</u> |
| July 1, 1879, amount available | 33,500 00 |
| Amount (estimated) required for completion of existing project | 33,500 00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1881. | 33,500 00 |

BELOW CHATTANOOGA.

This work, as in last report, will be considered in five parts, as follows:

1. Elk River Shoals.
2. Big Muscle Shoals (canal).
3. Little Muscle Shoals.
4. Colbert Shoals.
5. Duck River Shoals, and other obstructions below Florence.

The first three of these, viz, Elk River, and Big and Little Muscle Shoals, constitute what is known as the Great Muscle Shoals obstruction, and form an impassable barrier to navigation, except at high stages of water, when flatboats and, at great risk, steamboats, can descend; but there is no navigation upstream at any stage of the water except by warping. Below the Muscle Shoals, between Florence and Paducah, a distance of 255 miles, and above the shoals for a distance of 349 miles, the river is now navigated, except during the extreme low-water, and on the completion of certain contemplated improvements, which can be made at a comparatively trifling cost, will be navigable at all seasons of the year.

At *Elk River Shoals* the work of excavating the rock reef at the head of the shoals was continued until the end of November, when the water rose so high as to put a stop to this work for the season. The force was then put at work in quarrying and boating stone, and building the retaining dam, which forms the channel around Milton's Bluff. Some 30,000 cubic yards of rock were thus quarried and built into the dam during the season, forming about 2,347 linear feet of completed dam and 2,385 feet more which was raised above the water. As soon as the water became low enough to resume work in the channel, which occurred in June last, the force was again removed to the head of the shoals, and after putting up cabins to accommodate 300 men, and making some repairs to the temporary dam, which had stood almost uninjured through the high-water season, the rock excavation was resumed, and was making considerable headway at the close of the fiscal year. During the year, 1,500 cubic yards of rock were excavated from the channel. It is hoped that during the present low-water season all the channel excavation at this point will be completed, or at least cut through the reef to a width of 80 feet, which will make the work practically independent of the stage of water in the river, as the dams can be built at almost any time during the year. The short piece of canal required just below Milton's Bluff can also be built without waiting for low-water, and there will be nothing but want of funds to interfere with the speedy completion of the Elk River Shoals improvement, so that it will be available as soon as the Big Muscle Shoals Canal is completed. Mr. Samuel Whinery has continued during the year as assistant engineer in charge of this work, and has had an average of 180 men under his supervision.

At *Big Muscle Shoals* work has been continued on the canal trunk and on the masonry of the locks. The following table gives the quantities of various kinds completed during the year:

| | |
|------------------------------|--------------|
| | Cubic yards. |
| Earth excavated | 225,955 |
| Rock excavated..... | 12,571 |
| Hard pan excavated | 7,315 |
| Old masonry removed | 2,534 |
| Earth embankment built | 84,870 |
| Rock embankment riprap..... | 4,590 |
| | Acres. |
| Clearing | 58 |
| Grubbing | 30 |

Besides the foregoing, a large amount of work has been done in building, repairing buildings, bridges, machinery, &c., all of which are now in better condition than at any previous time.

This completes the canal trunk for about 8½ miles, with 4 miles more fully three-fourths completed, which may be considered as equivalent to 11½ miles completed out of 14½ miles, the entire length of canal to be rebuilt and enlarged. The balance of the canal trunk could easily be completed in one year with the present force of laborers if there were funds available to keep them employed.

The foregoing includes all the additional excavation and embankment required to reduce the number of locks from 17, the number in the old canal, to 9, the number now required, and to raise the tow-path embankment at all points above extreme high-water in the river, as well as to carry the canal trunk over Shoal Creek in an aqueduct, instead of crossing it by means of a dam.

Work on the locks has been continued during the year by hired labor, and under the contract of S. N. Kimball for building locks 6, 7, 8, 9, and 10, which was modified on the 12th of May to relieve him from building

locks 6 and 7, and extend the time for completing 8, 9, and 10 until September, November, and January, respectively. The following are the aggregate quantities of work done during the year under this contract:

| | Cubic yards. |
|--|-----------------------|
| Earth excavation | 8, 156 |
| Hard-pan and loose rock excavation | 773 $\frac{1}{4}$ |
| Solid-rock excavation | 5, 497 |
| Old-locks excavation | 2, 830 $\frac{1}{10}$ |
| Cut-stone masonry built | 270 $\frac{2}{10}$ |
| Rock-face masonry built | 481 $\frac{6}{10}$ |
| Rubble masonry built | 2, 535 |

The contractor has made slow progress with his work. A part of the delay may be fairly attributed to unavoidable circumstances, but, in addition to this, there has been a manifest disposition to work at the more profitable parts of the contract to the neglect of those not so profitable.

During the year he has completed only about $\frac{1}{4}$ of the work called for by his contract, and unless a better showing is made when the Little Muscle Shoals become navigable for his stone-barges, I shall be obliged to recommend the annulment of the balance of his contract.

On the completion of the contract work of George Williams, in July, 1878, all his railroad track, engines, cars, derricks, buildings, tools, and unused materials were bought at an aggregate cost of about \$35,000; and on the modification of Mr. Kimball's contract, relieving him from building locks 6 and 7, his derricks, tools, &c., to the amount of \$3,182, all of which will be available in completing and operating the canal. There was also bought from the Atlantic and Pacific Telegraph Company a line of double-wire telegraph, extending from Blue Water Camp to the lower end of the canal, some 10 miles in length, which will be useful in communicating between different parts of the work and in directing the lockage of boats when the canal is in operation.

As the trunk of the canal can easily be completed long before the locks and aqueduct are ready for use, it is very desirable that the latter should be pushed forward as rapidly as possible; and with this object three of the best quarries in the vicinity have been stripped and the quarrying and cutting of dimension stones and rubble by hired labor has been commenced. On the 1st of July the following quantities of stone had been prepared:

| | Cubic yards. |
|-----------------|--------------|
| Cut stone | 418 |
| Rock face | 342 |

A quantity of stones has also been prepared for rubble, and a supply of sand and cement been procured ready to begin laying masonry.

In excavating for the foundation of lock No. 5, it was found that the first stratum of rock rested upon a bed of gravel and had to be removed, thus carrying the lock-walls from 2 to 3 feet below grade. Lock No. 6, of 5 feet lift, also required to be carried about 3 feet below grade for similar reasons; and it was found that by giving lock 5 a 12-foot lift, which, for the reasons stated, can be done without much additional cost, since the walls must be of that height even if the lift is only 10 feet, and giving lock No. 7 3 feet additional lift, which can also be easily done, and regulating the grades of the canal trunk accordingly, lock No. 6 can be dispensed with, thus saving from \$15,000 to \$20,000 on original cost, and a perpetual saving of expense for repairs and maintenance. The whole number of locks required will therefore be only 9,

and their present condition is as follows. All the locks and the aqueduct piers are to be founded on solid and nearly level rock:

No. 1, guard and regulating lock, capable of lifting 10 feet, if necessary, to pass boats at all stages of the river. Foundation pit excavated, quarry opened, and a quantity of dimension-stone cut; sand and cement ready to begin masonry.

No. 2, 5 feet lift. Masonry completed; ready for gates, &c.

No. 3, 10 feet lift. Masonry completed; ready for gates, &c.

No. 4, 12 feet lift. Masonry completed; ready for gates, &c.

No. 5, 12 feet lift. Foundation pit nearly completed, quarry opened; 260 cubic yards dimension stones cut, and sand, cement, &c. ready to begin masonry.

No. 6, thrown out.

No. 7, 13 feet lift. Foundation pit excavated and 2,503 cubic yards of masonry laid.

No. 8, 12 feet lift. Foundation pit excavated and 1,708 cubic yards of masonry laid, a quantity of dimension-stones have also been cut at a quarry below Florence, and are waiting for high-water or the completion of the channel at head of Little Muscle Shoals to be boated to the work.

No. 9, 10 feet lift. One side of this lock is to be natural rock in position, foundation pit excavated, ready to begin the other wall.

No. 10, 10 feet lift. Very little has been done on this lock.

The building of the last three of these locks constitutes Mr. Kimball's contract, and are by its terms to be all completed before the 1st of January next; but it is not probable that this will be accomplished. It is very desirable, however, that the masonry should be pushed as rapidly as possible, for the reason that the completion of the masonry will determine when the whole work can be utilized, and any delay in it must, therefore, delay the time when the river can be opened to navigation. Owing to the want of funds for carrying on this work an appropriation should not only be made as soon as possible after Congress meets, but it should be large enough to admit of the employment of a larger force than has yet been employed upon the work, especially as to stone-cutters and masons, and at the same time the gates and wickets should be put in the three locks now ready for them, and into the others as soon as they can be got ready.

Assistant Engineer J. C. Long has continued in charge of the work between the head of the canal and Six Mile Creek with an average force of 417 mechanics, laborers, &c., while Assistant Engineer William M. Gordon has superintended the balance of the work, including Mr. Kimball's contract, with a force of 211 men working by the day.

As the economical working of the canal when completed will be a matter of some importance owing to its length and to the number of locks to be operated, I have devised the following plan, which can easily be tried, as all the appliances necessary will be at hand when the canal is opened. The plan involves the use of the railroad track along the tow-path with one or more of the locomotives, and the telegraph line also located along the tow-path. Instead of having a force of lock-tenders at each of the 9 locks, there would be only two small parties located at the ends of the canal. The locomotives could be kept at some central station or one at each end of the canal.

When a steamer approached either end of the canal within whistling distance, the necessary information could be telegraphed, and an engine could be on hand within a quarter of an hour of the vessel's arrival. The locomotive could then give her a tow-line and tow her into the lock. The power of the locomotive would also be available for opening and closing the lock-gates, using simply a rope and snatch-blocks for the purpose. The engine could then tow the boat to the next lock, and so on through the entire canal. By this method boats would be prevented

from using their own machinery in the canal, thus avoiding the usual damages to locks from careless handling, and making it unnecessary to protect the canal embankments by slope-wall, while the entire passage and lockage would be effected in the shortest time consistent with safety. I believe it will be perfectly practicable to tow a boat through the 14 miles of canal and make the 9 lockages in less than 4 hours.

At *Little Muscle Shoals* the work of channel excavation has been continued and a large quantity of rock has been placed in the wing-dams designed to contract the waterway and check the velocity of the current at certain points.

| | |
|------------------------------------|--------------|
| | Cubic yards. |
| Solid rock taken from channel..... | 19,298 |
| Rock placed in dams..... | 11,458 |

It having been found desirable to extend the cutting at the head of the shoals so as to secure the full depth of channel without throwing more water into it, a series of coffer-dams have been constructed and are being worked in succession; the rock by this means being removed very rapidly and economically, while the materials of the coffer-dams are used several times over in successive dams.

Assistant Engineer James E. Willard has been in charge of this work during the year with an average force of 173 men, and there is every reason to believe that the channel will be completed this season so as to give 3 feet of water from Florence to Bainbridge, the lower end of the canal, thus establishing water communication at all times with the work on the principal obstruction, Big Muscle Shoals. The cost of the improvement of Little Muscle Shoals up to July 1 has been \$77,232, and to complete all that will be required to make this part of the river navigable at all times by any boat that can reach Florence will hardly cost \$150,000, while the original estimate for improving these shoals by canal and locks was over \$900,000.

At *Colbert Shoals* but little work was done during the year. A force of laborers, with a steamboat and barges, was detached from Little Muscle Shoals in September, 1878, and employed for a few days in repairing the dams at this point, 86 cubic yards of rock being put in them, and removing some 80 cubic yards of boulders and solid rock from the more troublesome parts of the shoals. But little more can be done to advantage on these shoals until the general improvement of the river below Florence is undertaken.

At *Duck River Shoals* the working party just referred to opened a quarry and blasted out about 700 cubic yards of rock for the proposed wing-dams, when the winter rise of the river put an end to operations in that vicinity. The shoal at Duck River is one of the few gravel-bars on this river that is subject to considerable change from the action of the current, and river men report that it is now much less deserving of attention than other obstructions below Florence.

In removing from Colbert to Duck River Shoals the party stopped at the *Bee Tree Shoals*, and removed some 190 cubic yards of troublesome boulders.

The Tennessee River is in the collection-district of New Orleans. The amount of revenue collected at that port is unknown to me.

The original estimate of cost of improving Tennessee River below Chattanooga was \$4,133,000; of this amount, \$1,545,500 have been appropriated, and \$328,178.74 expended. There was also paid by special Treasury settlement of June 25, on the claim of George Williams, contractor, \$101,536.72, leaving a balance of \$2,587,500 to be appropriated.

Money statement.

| | | |
|---|--------------|--------------|
| July 1, 1878, amount available..... | \$518,027 50 | |
| Amount appropriated by act approved March 3, 1879..... | 210,000 00 | |
| | | \$728,027 50 |
| July 1, 1879, amount expended during fiscal year..... | 328,178 74 | |
| June 25, 1879, special Treasury settlement, claim of George Williams, deceased..... | 101,536 72 | |
| July 1, 1879, outstanding liabilities..... | 30,264 04 | |
| | | 459,979 50 |
| July 1, 1879, amount available..... | | 268,048 00 |
| Amount (estimated) required for completion of existing project..... | | 2,587,500 00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1881. | | 700,000 00 |

REPORT OF BOARD ON CLAIM OF THE LEGAL REPRESENTATIVES OF GEORGE WILLIAMS, DECEASED.

KEOKUK, IOWA, April 9, 1879.

SIR: The Board of Engineers constituted in pursuance of an "act of Congress approved January 13, 1879," and by Special Orders No. 56 and 60, Headquarters of the Army, A. G. O., copies of which are hereto appended, respectfully report that they assembled at Chattanooga, Tenn., on Wednesday, March 19, 1879.

Mr. C. L. Williams, administrator of the estate of George Williams (deceased), being present, submitted to the Board a large number of papers in regard to the claim the board was called to consider, and progress was made in their examination until the evening of the next day, when the Board, accompanied by Mr. Williams and by Maj. W. R. King, engineer officer in charge of the "Muscle Shoals Canal" improvement, proceeded, via Florence, Ala., to examine the work done under the contracts of George Williams and that of Matthew G. Kennedy.

The party arrived upon the work next day (Friday, March 21), and devoted the remainder of that day and more than half of the next to the special object of the visit, reaching Chattanooga again, via "Milton's Bluff" and "Wheeler's Station," on Monday evening, March 24. The next three days and part of the fourth were devoted to further examination of the papers of Mr. Williams in the case, as well as such as the Board had obtained from Major King and his assistant engineers, Messrs. J. C. Long and Robert Hooke, both of whom have been engaged upon the work during the whole period of time covered by the claim under the contracts of George Williams and M. G. Kennedy.

The Board, finding it impossible to arrive at final conclusions in regard to the claim from the data brought by Mr. C. L. Williams to Chattanooga, then at noon on Friday, March 28, started for Keokuk, Iowa, where all books and papers of the late George Williams were supposed to be stored, reaching there on the evening of Monday, March 31. Here the work of the Board was greatly facilitated, but it nevertheless involved a large amount of patient labor, extending over the period of an entire week.

The duty which the act of January 13, 1879, prescribes for the Board of Engineers therein provided for is "to inquire into and report upon the character and value of the work done and the merits of the claim."

With regard to the *character* of the work done, the Board find that it is essentially as provided for in the contracts, being slightly modified

by the mutual consent of the parties thereto. The modifications were of such a character as not to increase but rather to lessen the aggregate cost of the work. It is extremely difficult, if not impossible, to arrive at a measure of the "value of the work done." It is probably not much, if any, less than the amount already paid under the terms of the contracts themselves, and it is not probable that it exceeds the amount of the disbursements by the contractor and his legal representatives. These two extremes differ by more than \$100,000, which is nearly fifty per cent. of the smaller amount; with so great a difference between the probable limits of value, the Board find it impracticable to fix a definite sum as the actual "value of the work done." Next, as to the "merits of the claim." Upon the basis of the contracts alone, it is the opinion of the Board that a fair and just settlement has been made by the local engineer officer. But the large excess of expenditures by the contractor and his legal representatives, over and above the amount paid on account of the contracts, indicates a considerable loss, and, in view of the spirit of the act of Congress, the claim is meritorious. To what extent will be discussed further on.

The orders convening the Board of Engineers makes it their duty, after complying "with such of the requirements of the act mentioned as are contemplated for its action," to "also report"—

- 1st. The actual expenditures of the said contractor, George Williams, and his legal representatives, upon the works described in said act.
- 2d. The character and quality of the work done.
- 3d. Whether the expenditures in the prosecution of the said work were reasonable and proper.
- 4th. What would be a reasonable compensation for the use of tools and for money advanced in the prosecution of said work.
- 5th. What sum, if anything, should be allowed under the provisions of said act in adjusting and settling the claim upon just and equitable terms.
- 6th. Any other matter or recommendation which may occur to the Board as proper to be submitted.

The records of the late George Williams, and of C. L. Williams, the administrator of his estate, have been examined, vouchers compared with them, and the abstract of disbursements, marked "Exhibit B," accompanying this report, verified so far as to show that the several amounts were actually expended, and for objects appropriate to such works as those in question.

It further appears that the greater portion of the disbursements were made at or in the vicinity of the "Muscle Shoals Canal," thus strengthening the inference that they were actually made on account of the works.

With these preliminary remarks the Board report—

- 1st. That "the actual expenditures of the said George Williams and his legal representatives, upon the works described in said act," amount to the sum of \$337,495.23.
- 2d. That "the character and quality of the work done" was essentially the same as specified in the contracts, the difference being in the items "timber and plank," "concrete," "wrought iron," and "cast iron." Except a very small quantity of concrete, no portion of the material or labor covered by these items has been used in the construction. Their omission was determined upon with the free consent of the contractor, for reasons satisfactory to the engineer in charge, and in the exercise of powers reserved to him in the contracts themselves. The changes involved in this course were manifestly to the advantage of the contractor, as is shown by the prices named in the contracts for such materials and labor, notably in the item of "timber and plank."

"The quality of the work done," as far as it is now practicable to in-

spect it, is such as to justify the acceptance it has already received at the hands of the local engineer officer. It is apparently good work of the kind specified in the contracts.

3d. That in finding upon the question "whether the expenditures in the prosecution of said works were reasonable and proper," the Board has been embarrassed by the natural inference that the contractor in undertaking the works did so with a desire to make a profit, and brought into the enterprise a considerable degree of experience, which with the end in view would direct him in the way of a reasonable economy.

To determine if possible whether the facts confirm this inference the Board has analyzed the expenditures covered by Exhibit B, the result being such as to lead to the conclusion that while the expenditures are in their nature "reasonable and proper" enough, yet, in amount, some of them cannot well be called reasonable. Among them may be named—

| | |
|----------------------------|------------|
| Traveling expenses..... | \$7,035 56 |
| Interest and exchange..... | 12,688 61 |
| Feed for stock..... | 1,478 90 |
| Telegrams..... | 1,438 07 |
| Boats, skiffs, &c..... | 1,169 61 |

These items, while they are not very great in the aggregate, yet indicate some degree of extravagance in the prosecution of the work.

Two-thirds of the amount of the disbursements is made up of pay-rolls for labor. An inspection of these showed that the rates of pay were high, and the Board cannot resist the conclusion that this was due, in some degree, to the high rate charged the men for boarding, namely, \$4 per week, or 57 cents per day. A proper economy in this respect would have suggested some arrangement by which the men could have been boarded for one-half that amount (the government now boards laborers at the same point for still less), resulting in a corresponding reduction of laborers' wages, still leaving the laborers the same net pay, but reducing the aggregate amount of the pay-lists about \$40,000. The computation upon which this estimate is made is as follows: There were probably not less than 160,000 days' labor expended upon the works included in the contracts in question; a saving of 25 cents per day in the board bill of each man would be \$40,000 in the aggregate.

4th. "What would be a reasonable compensation for the use of tools and for money advanced in the prosecution of said work?"

The compensation for use of tools has been difficult to determine, for the reason that the administrator of the late contractor could not furnish the Board with an inventory and appraisal of the tools, machinery, &c., taken to the works at the commencement of operations. The administrator's estimates of their value is, however, \$60,000, which the Board has accepted in the absence of the detailed information. On that basis, the Board are of the opinion that \$21,000 would be a "reasonable compensation for use of tools," for 28 months' time, the period covered by the contracts. This amount (\$21,000) the Board have tested by various calculations upon both the estimate and present inventories, all of which give practically the same sum.

As to what would be a reasonable compensation "for money advanced in the prosecution of the work," attention is invited to the aggregate admitted in the abstract of disbursements under the head of interest (see Exhibit B), amounting to \$12,306.21. At 10 per cent. per annum it represents a capital of \$105,481.80 for a period of fourteen months, or half the time occupied in the prosecution of the work. The moment this item of interest is allowed in the disbursements, *i. e.*, is assumed by