LOCK NO. 3.

At the close of the last annual report quarries had been opened, tramways had been laid from the quarries to the site, and dredging for the lock site and the placing of the coffer-dam were in progress. The tramways have been extended until now they reach from the quarries to the site and through the stone yard into the coffer-dam. A pumping-engine, engine-boats, pumps, and derricks have been added to the supply of machinery and appliances.

A supply of coal has been obtained from the adjacent hill-side whence we obtained the privilege of taking it at the cost of mining. The frequent rises in the season of 1878 caused delays in the placing of the coffer-dam, but very little injury was otherwise sustained. A well has been dug and supplied with a pump.

Stone-cutting was under way early in August. The coffer-dam was completed early in October, and was pumped out and excavation commenced about the middle of that month.

A large quantity of the excavation for the lock was yet to be removed, it having been necessary to send one of the dredges to the contractor's work down the river quite early in the working season. This excavation was fairly under way when all work was suspended October 25 by violence from badly disposed workmen supported by lawless sympathizers. Secret-society notices were posted up ordering the foreman of stone-cutters to leave the vicinity; some colored men placed at work were objected to on account of their color and were ordered off, with threats of violence if they remained. The men responsible for this outrage were discharged, whereupon they, with their backers, ordered out those employed in and around the coffer-dam, and notices were posted in the night at dam 4 warning the inspector not to employ white and colored men in the same gang.

No remedy for these evils could be looked for from the local authorities and courts, so recourse was had to the power of the United States court; a number of indictments and arrests were made, and under the wholesome protection of this, the only available power, work was resumed on November 25 after the loss of an entire month of the working season.

It was now too late to carry on operations in the river, the high-water season setting in.

Work throughout the winter was limited to the stripping of quarries and the quarrying of the rougher stone.

The quarrying of dimension stone was resumed in March, and stone-cutting in April.

The pumping of the coffer began early in June, and excavation proceeded at once. Some of the bed rock is now exposed, a derrick is raised in the lock pit, and masonry is about to commence.

DAM NO. 3.

Search for stone on the abutment shore was made during the winter. A quarry privilege has been obtained a short distance up Paint Creek, and the quarrying of the stone is begun. A tramway has been graded from the quarry to the site, a distance of about 4,000 feet, and the rail is now on the way.

LOCK NO. 4.

At the close of the last annual report the masonry of the lock walls required but a portion of the coping to complete, the paving back of the land wall was nearly laid, and the slope-wall protection was in progress. The coping, paving, slope wall, riprap, and protection cribs, at head and tail of land wall and at head of river wall, have all been placed, and the construction, under the contract with Charles McCafferty, was completed by the close of the season of 1878. The lock is now ready to receive the gates, the timber for which is on hand and is stored, there being no necessity for placing the gates in advance of the completion of the dam. A flight of stone steps from the top of the bank down the slope to the lock is now in course of construction. Some filling and riprapping has been placed to protect the shore below the lock, where the winter freshets had caused washing of the slope.

DAM NO. 4.

At the close of the last annual report the removal of the wrecked coffer-dam left by the failing contractors was in progress, and the preparation of stone was under way, the framing of the new coffer-dam had begun, and a dredge was upon the site ready to commence the excavation therefor; the abutment masonry was laid to the coping with the bank unprotected.

The new coffer-dam incloses a space next the lock, and includes 204 feet of the pass. The work has been carried on by hired labor.

The removal of the old coffer-dam was completed and the dredging for the new section began on July 8. A rise on July 30 suspended the placing of this coffer, and overset 66 feet of that which was in. The removal of the *débris* began on August 5, and the placing was renewed on August 13.

This work was temporarily suspended by a rise on August 19, and again on September 2, but little damage being sustained. The great rise of September 14 stopped work and damaged the coffer considerably. Dredging for this section was resumed on September 19, and was completed October 3. The framing was finished October 30, and the banking was so far advanced that pumping was commenced on November 17. A rise on November 22 suspended pumping for the season of 1878. The coffer was then protected, so far as possible, against injury during the winter.

The dredges were kept busily occupied at lock No. 3, lock No. 4, and at coffer for dam No. 4, till late in the season, and work, consequently, could not be commenced upon the placing of the retaining crib below the abutment till October 21. This delay in dredging was in great part caused by the frequent rises during the summer, suspending dredging and rendering necessary the removal of work already placed.

This crib was placed, the bank was partially filled and graded, and the slope temporarily protected against washing during high water by a covering of riprap and spalls before the winter set in. On March 19, 1879, the filling behind the abutment and this crib was resumed. The material was still wet from the winter rains, and working over it reduced it to a semi-fluid condition. This caused the giving way of a portion of the retaining crib, the bank slipped pretty badly, and some of the material rose upon and pushed over the crib into the river. The filling of the bank was then suspended to await a more favorable opportunity for the repair and replacing of the retaining crib. The slope is temporarily protected by riprap and spalls.

During the season of 1878 the iron work for the movable dam (Ramsay & Latrobe, of Baltimore, Md., contractors) was received, and a shed was built over it for protection against the weather. Work upon the coffer-dam was resumed at the end of April, 1879, placing it in order for pumping. Some of the filling had been taken out and a portion of the banking had been washed away by the winter's freshets. The covering of plank, brush, and stone, placed to protect the filling, was removed; the coffer was then filled with clay nearly to the top and covered with planking; the banking was restored; and a crib was placed at the up-stream outer corner to hold the banking at that point. The coffer was pumped out by May 12, and excavation within commenced. On May 17 a rise flooded the coffer. High water prevailed till June 4, on which date pumping was resumed. The work has progressed night and day, and at the close of this report the setting of concrete and the placing of the timbers is under way. The entire quantity of stone required is on hand and prepared for placing.

LOCK NO. 5.

At the close of the last annual report it was only necessary to replace a couple of coping stones broken in doweling to complete the masonry of this lock; the placing of protection cribs, the paving back of land wall and the slope wall and riprap protection of the bank were in progress.

All this was completed and the contract with Messrs. D. M. & C. P. Dull was fulfilled about the middle of August, 1878, the lock then being in condition to receive the gates. These gates are to be of iron, and were under contract at the close of the last annual report. The iron for these gates only arrived at Brownstown on October 14, and a very insufficient force was employed by the contractors in the placing of them. Work upon the two leaves of the lower gate was begun, but the flood of November 27 threw one leaf down and the flood of December 11 threw down the other. A force is now upon the ground to remove the fallen gates and to complete the setting as required by the contract.

DAM NO. 5.

At the close of the last annual report the abutment, the protection of the abutment shore, and the masonry of the pier were practically complete, except the doweling of the coping; the construction of the coffer-dam for the pass was under way; the iron for the movable part of the dam was delivered complete, and a portion of the timber for the wickets was stored at the site; the work was suspended by a strike among the laborers for $1.50 per day. Work was resumed on July 1, at the old wages, $1.25 per day.

The coping of the abutment and pier has been doweled. The timber for the wickets has all been obtained and stored. The pumping of the pass coffer began on July 12; a rise interrupted this on July 14, but it was resumed on July 18. Excavation within the coffer began on July 20. A break on lower side next the pier suspended work on July 22. This break was repaired, and pumping was resumed on the 23d. Operations were interrupted by rises on July 30, August 12, August 19, August 27, September 2, September 12, October 25, October 31, November 3, November 13, and November 26. Each rise carried away more or less of the banking, the replacing of which and the pumping of the coffer caused expenses and delays ruinous to the contractor, who was limited in means; for this work of repairing the coffer-dam and pumping he could

receive no payment under the contract. On October 30 the contractor voluntarily suspended from financial inability to proceed further.

The excavation of the rock for the trenches for the anchor disks had been commenced by the contractor on October 2, and was in good part accomplished at the time of suspension. From that time the work has been carried on by the United States with hired labor. The setting of the anchor rods and disks and the laying of concrete began on November 5. The rise of November 26 practically ended operations for the season of 1878.

A road from the site of No. 5 to the highway has been opened, embanked, and covered with broken stone and cinders. A cement house has been built.

The failure of the contractors left the work without a quarry from which to procure stone. In the spring (1879) a quarry privilege was obtained about a mile below the site. The stripping of this quarry began April 21; cleaning round the coffer and the embanking of the same commenced at the end of that month, and pumping was resumed May 5, and cleaning out within the coffer on the 7th. The setting of timber and the laying of concrete was resumed on the 9th and 10th respectively. A rise filled the coffer on the 18th; embankment and pumping was resumed on the 24th, but were immediately suspended by high water. On June 4 pumping was again in progress, and work within the coffer-dam has proceeded uninterruptedly from that date. At the close of this report the anchor disks upon the line of trestles and about two-thirds of those on the line of wickets are set and covered with concrete to the level of the rock; blasting for the latter line of disks is about complete; about two-fifths of the concrete for the pass and about one-third of the timbers are placed and the placing of the boxes has begun. The preparation of stone for the weir is under way.

TWO MILE DAM.

At the close of the last annual report, repairs required by the break caused by the flood of November, 1877, were in progress. These repairs were completed in July. In the flood of September 12–14, 1878, the bank at the shore end of this work had washed somewhat and the water commenced to wash round this flank of the dam. This was repaired in October by the deposit of a quantity of stone. During the ice freshet in January, 1879, a portion of the crest of this dam was carried away. A few days' work last April was sufficient to repair it.

SURVEYS.

The survey of the river below Charleston, which was suspended near the mouth of the Pocotaligo River in the autumn of 1877, was resumed in July, 1878. At the close of the latter season the line had been carried to the Ohio River at Point Pleasant, but there is yet about 6 miles of the lower river to be sounded to complete the survey. A local survey was made below Staton's Sun Shoal to determine if lock and dam No. 2 might not be there located to save the expensive site at the incline of the Cannelton Coal Company near the foot of Lyken's Shoal.

The survey showed that the desired change of location should not be made. Cross sections were taken of the lower end of Blaine's Island to aid in the detailed location of lock No. 7. Borings were made to rock in the pool above Sacket's Shoal to assist the study for the locations of dam No. 8. In March of this year cross sections were taken of the right bank of the river above Tyler Shoal to fix the location of the abutment of dam No. 6.

The completed survey of the river will be made this season. It is gratifying to note that these surveys, with your approval of the location of dam No. 7 below the mouth of Coal River, enable such locations to be made below Charleston as to save one lock and dam in the series, thereby diminishing the cost of the entire improvement by the sum necessary to build a lock and dam. A complete report, with maps and profiles for illustration, will be made when soundings, now lacking near the mouth of the river, shall be made.

STATISTICS OF RIVER COMMERCE.

The report of the secretary of the Kanawha Board, December 1, 1878, gives the following statistical statement, "showing, as nearly as can be gathered from the collector's reports of actual collections, the exports from the valley during the present year (1878) up to date; that is, during eleven months:

Coal, in tons of 2,000 pounds	222,642
Salt, in bushels	125,000
Lumber in feet, B. M	1,128,500
Staves	3,671,000
Railroad ties	16,800
Tan-bark, in cords	1,648
Hoop-poles	20,000
Miscellaneous tolls paid by packets	$1,484.26

"Of the miscellaneous tolls paid by packets a part should be for salt with which they freight down the river; part is for other exports, and a large part for imports. The actual commerce is greater than is indicated by the foregoing statistics. Owing to the present imperfect law under which the collectors operate, it is impracticable to collect toll on the entire commerce of the river."

Very respectfully,

THOMAS TURTLE,
First Lieutenant of Engineers.

Maj. WM. P. CRAIGHILL,
Corps of Engineers, U. S. A.

F 13.

IMPROVEMENT OF ELK RIVER, WEST VIRGINIA.

An appropriation of $5,000 was made for this work June 18, 1878. In September of that year the Secretary of War decided not to expend it. March 3, 1879, Congress directed the expenditure of the money in the removal of obstructions to open navigation from Braxton Court-House to the mouth of Big Sandy, with permission to expend $500 at Jarrett's Ford.

There had been an examination made of Elk River in 1875. (See Report of Chief of Engineers 1876, part 2, page 166.) Two estimates were prepared from data collected at that time. The first was for slack-water navigation from Braxton Court-House to the Kanawha River, $1,543,080. The second was for sluice-ways through the shoals, $100,000, the sluice-ways to be 10 or 12 feet wide and 10 or 12 inches deep at low-water.

The amount appropriated, $5,000, seemed manifestly too small to commence either of the kinds of improvement mentioned above. From Braxton Court-House to the mouth of the Big Sandy the traffic consisted almost exclusively of logs floated in the stream, of canoes and small flat-boats carrying country produce and returning with groceries, provisions, and other necessaries, and of staves (brought down on flat-boats) and hoop-poles (rafted).

It was understood that the lumber and rafting interests were those intended to be benefited by the use of the appropriation. It was known that a rise of about 5 feet was needed at Braxton Court-House to permit logs to be started down the river. It was thought by those acquainted with the stream that upon the removal of certain classes of obstructions logs could be run out at a less stage of water and consequently at more frequent intervals. These obstructions were rocks, stones, and snags in the channel and on the shoals, overhanging trees and stumps; some mill-dams also seemed in the way of free navigation. The dams were mostly above Strange Creek. The other obstructions were chiefly between Strange Creek and Big Sandy.

It was recommended to the Chief of Engineers, reserving the $500 for Jarrett's Ford, that a force be organized, consisting of a competent superintendent, with two or three gangs of men, each with a foreman, the force to work down the river during the low-water season, removing obstructions as they should go; the force to be provided with two or more light-draft flats to work from and to live upon.

It was proposed that the work should be done between May 20 and October 20, the usual season of low-water. This project was approved and is in course of execution at the date of this report, June 30, 1879. It is supposed the funds already available will suffice to do what is

required on this river in the direction indicated above. If not, a supplemental estimate will be made.

Money statement.

July 1, 1878, amount available	$5,000 00
July 1, 1879, amount expended during fiscal year	29 25
July 1, 1879, amount available	4,970 75

F 14.

IMPROVEMENT OF CAPE FEAR RIVER, NORTH CAROLINA.

An account of this improvement up to June 30, 1876, may be found in the report of the Chief of Engineers for 1876, Part I, page 321.

During the fiscal year ending June 30, 1879, as previously since January, 1876, Mr. Henry Bacon has been the faithful and capable resident engineer. The principal work of the year has been the continuance of the construction of the dam across New Inlet from Federal Point to Zeke's Island, the repairs of the suction-dredge Woodbury, and its operation in the Baldhead Channel at the mouth of the river. Mr. G. T. French delivered 1,346 yards of stone on the dam and 1,869 yards for repairs of the old work near Smith's Island. This was done chiefly in August, 1878, the purchase being in open market. A contract for the delivery of about 50,000 yards of stone was also made in August, to be completed by June 30, 1879. Under this contract 49,487 yards were delivered. The closure is complete at the end of the fiscal year June 30, 1879, but more stone, natural or artifical, will be necessary to fill out the slopes and to give a proper covering to the top. Up to the last, a gap had been left in the dam to enable vessels of light draft to pass in and out as they had been accustomed to do for a century, but in June, 1879, it was found to be dangerous to leave it open longer and it was closed. Some parties objected strenuously to this closure, and a special report on the subject was made to the Chief of Engineers May 14, 1879. Zeke's Island has grown very much. The shortest distance across what was New Inlet is now 3,240 feet, whereas, in 1875 it was 4,150. In 1870 it was very much more.

The beneficial effect of the dam is apparent at the mouth of the river, as well as in the Horseshoe Channel and the Snow's Marsh Channel. At the end of June, 1879, the depth in the Baldhead Channel is nowhere less than 12 feet at low-water, which has not been attained at any entrance of the Cape Fear for at least 50, probably for 100, years.

The repairs of the suction-dredge Woodbury were completed in March, 1879, amounting almost to a rebuilding. She has done good service since. The increase of depth in the Baldhead Channel is doubtless due very much to her work. After some small changes are made in her arrangements she will probably average 8,000 yards per month, at a cost of from 10 to 12 cents per yard, in an exposed locality where no dredge could work dependent on anchors or spuds for holding.

Baldhead Point, which has been wearing rapidly away for several years, is now growing again, and may soon connect again with Woodbury's jetty, from which it has been detached since 1872.

The condition of the long narrow beach of Smith's Island has improved. Of the two swashes which were open some time, and were regarded by some as threatening, one is entirely closed and the other is reduced to about half its width of a year ago. This will soon close like the other, and the beach in that part will then be stronger than ever.

The following extract is given from a recent letter from Mr. A. H. Van Bokkelen, chairman of the Chamber of Commerce of Wilmington:

The official report to the Commission of Navigation and Pilotage, of Wilmington, N. C., on the 1st day of July, 1870, gave depth of water as follows:

Western Channel, outer bar, 10 feet 10 inches at low-water.

Western Channel rip, or inner bar, 7 feet 10 inches at low-water.

New Inlet, outer bar, 9 feet at low-water.

New Inlet, inner bar, 9½ feet at low-water, to which must be added 4 feet for neap-tides and 6 feet for spring-tides to give the depth at high-water.

In 1870 Baldhead Channel was not reported. The recollections of persons who should know place the depth of water on the obstructions in same at 6 to 6½ feet at low-water.

At present, June 30, 1879, there are 12 feet at low-water on the Baldhead Bar, and for the Western Channel, 12 feet on the outer bar and nearly 9 feet on the inner. The New Inlet outer bar has shoaled to less than 5 feet at low-water. The shortest soundings in the best channel that could be found were 4½ feet. Of course, as New Inlet is now closed, there is nothing to record as to its inner bar.

All that remains to give 12 feet at low-water to Wilmington is to reopen the Snow's Marsh Channel, but the cut at the logs should be widened. The business of lighterage is nearly destroyed. The little that is done is mostly at Smithville, in place of over the rip or inner bar of the Western Channel

Until very lately vessels lightering out would go out Baldhead Channel and in over the Western outer bar, thus involving extra pilotage and greater cost of lighterage than at present.

Mr. W. P. Canaday, collector of the port of Wilmington, states the amount of revenue collected during the fiscal year to be $48,852, and the value of exports, $4,670,331. The number of vessels arrived, engaged in foreign trade, 332. Number of vessels, of 100 tons and over, arrived, engaged in coastwise trade, 223.

For operation of the suction-dredge, for repairs, contingencies, surveys, superintendence, &c., there will be required for the year ending June 30, 1881, $50,000.

Money statement.

July 1, 1878, amount available	$160,558 24	
Amount appropriated by act approved March 3, 1879	100,000 00	
		$260,558 24
July 1, 1879, amount expended during fiscal year		131,467 06
July 1, 1879, amount available		129,091 18
Amount (estimated) required for completion of existing project		50,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1881		50,000 00

Abstract of bids for stone for Cape Fear River, North Carolina, opened at 1 p. m., August 5, 1878.

No.	Name.	Residence.	Time.		Price per cubic yard.	Remarks.
			Commence—	Complete—		
1	French & Dolby	Wilmington, N. C.	Sept. 1, 1878	June 30, 1879	$1 75	
2	Walter Doty	New York	Aug. 20, 1878	June 30, 1879	2 29	Northern stone, $2.79 per cubic yard.
3	Willis Ney	Fulton, N. Y		June 30, 1879	1 78	
4	Heman Clark	Orange, N. J	Sept. 1, 1878	July 1, 1879	2 95	
5	D. V. Howell	New York	Aug. 25, 1878	June 30, 1879	2 57	

Contractors, French & Dolby, at $1.75.

REPORT OF MR. HENRY BACON, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Smithville, N. C., June 20, 1879.

MAJOR: I have the honor to submit the following report of operations for the improvement of Cape Fear River, North Carolina, during the eleven months ending May 31, 1879.

The principal work has been in continuation of the construction of the stone dam across the New Inlet from Federal Point to Zeke's Island; the repairs of the suction-dredge Woodbury, and its operation on the Baldhead Channel, at the mouth of the river.

At the close of the last fiscal year, the dam was built nearly to low-water mark throughout its length of 4,650 feet, and an aggregate of 1,500 feet length from the shores was built to high-water mark. The slopes were nowhere full, and the dam consisted of a narrow ridge with steep slopes. The work of the year has been to widen this ridge and add to the slopes, which has been done by piling the riprap stone on the dam, and allowing it to fall into the slopes—assisted often by the force of tidal currents and waves. The ridge has been washed down in several places at different times, in some instances to several feet below low-water mark; thus widening the foundation, but causing no waste of material.

When the foundation is made to the proper width and the slopes filled, it is proposed to cover the top and sea-slope to low-water mark with large stones which will resist the force of waves and currents. If the large stones cannot be obtained at reasonable rates, but few if any need to be used. The necessary strength may be obtained by the use of Portland cement, with small stones and concrete, forming a solid mass for the top of the dam; or the top and slopes may be covered with blocks of concrete.

The delivery of stone was begun towards the latter part of July, 1878, by purchase in open market from Mr. G. Z. French. He delivered in July and August 3,215 cubic yards, at $1.75 per yard; of which 1,346 cubic yards were placed on the dam, and 1,869 yards were used in repairing the old works near Smith's Island. The work in September was done under the contract of Messrs. French & Dolby, since which time they have been constantly delivering stone. The following are the amounts delivered and placed on the dam under the contract for 50,000 cubic yards at $1.75 per yard:

	Cubic yards.
September, 1878	3,316
October, 1878	3,885
November, 1878	4,606
December, 1878	3,088
January, 1879	3,618
February, 1879	4,690
March, 1879	6,721
April, 1879	7,037
May, 1879	5,400
Total	42,361

The condition of the dam, its form, and the completion proposed are shown by the accompanying cross-sections and plan. The slopes of two to one on the sea side and one and one-half to one on the river side are adopted, as they appear to be the natural slopes which the material takes after being exposed to the waves and currents. The rock has nearly all been deposited at or near the top of the ridge, and allowed to form its own slopes.

The whole amount of stone placed on the dam is as follows:

	Cubic yards.
Delivered by Messrs. Bangs & Dolby on original mattresses in 1875–'76	16,534
Delivered by Messrs. Bangs & Dolby on second contract in 1877–'78, at $1.89	49,129
Delivered by W. H. French in 1878, at $1.66⅔	11,715
Delivered by G. Z. French in 1878, at $1.75	1,346
Delivered by French & Dolby in 1878–'79, at $1.75	42,361
Total cubic yards to May 31, inclusive, 1879	121,085

The estimated amount of stone required for the completion of the dam to high-water mark is 54,000 cubic yards, of which 6,000 cubic yards should be of large stone for coping the top and facing the sea-side slope.

The height proposed is about 2 feet above mean high-water and nearly a foot above ordinary spring tides, and about half a foot below extraordinary high tides, like that of April 13, 1877. It is a little below the level of the beaches and general surface of Federal Point and Zeke's Island.

The cost of completion is estimated as follows:

4,800 cubic yards riprap stone at $1.75	$84,000
6,000 cubic yards large stone in place at $4.50	27,000
Total	111,000

This, with the amounts previously expended, exceeds the original estimate. The result was occasioned by the scouring on each side of the dam by the overfall of the water, which finally caused the mattress foundation to settle on all the shoaler por-

tions of the work, as reported last year, and also the necessity of adopting greater height, top-width, and slopes than were originally proposed. The scouring and subsidence ceased several months since; and, though adding much to the cost of the dam, it will prove a perfect, and, perhaps, the only attainable security for its permanency.

As the filling on the central portions of the dam has approached to high-water mark, there has been an accumulation of mud and sand on each side of the same. The accretion of sand at each end, and the advance of the shores of both Federal Point and Zeke's Island on the sea side have continued, so that the shortest distance across the New Inlet, which at the beginning of the dam in 1875 was 4,150 feet at high-water, is now reduced to 3,240 feet.

The forces contended with in the closure of the New Inlet are further illustrated by the fact that, as the work proceeded nearer completion, the water on the river side toward the last of the ebb-tide has several times been observed to be 2½ feet higher than on the sea side, against 2 feet as reported last year. The difference in level on the flood-tide is nearly as great. There is no doubt of an ultimate difference of 3 feet at times, as predicted then. Thus it appears that the New Inlet was in no proper sense one of the mouths of the river, but rather a *crevasse*, alternating from the river and the sea. Its pernicious effects in disturbing the tidal currents and diminishing their force at the mouth proper are obvious.

From a comparison of tidal observations made in 1876 and 1877 with those made since the partial closure in 1878 and its nearer completion in 1879, it appears that the range of the tides is as great in all portions of the tidal reservoirs since the approximate closure as before the work was begun. This will add a vast force to the scouring power at the natural mouth of the river.

On May 31, 1879, the ridge of the dam was built nearly to the level of ordinary high-water, excepting for a distance of about 200 feet, where the depth was from 2 to 6 feet at low-water. This gap was left for the convenience of passing scows to the sea side for the construction of the work, and it was also used by small vessels from the coast northerly from the New Inlet. The necessity for closing this gap was becoming apparent, and it will be closed during the present month. The beneficial effect of the dam is already apparent at the mouth of the river as well as at the Snow's Marsh Channel and at the Horseshoe Channel. A sketch of the vicinity of the head of Snow's Marsh Cut is presented herewith. Comparison with the survey of 1877 shows a decided deepening of the water along the line of the proposed cut. This is slightly changed from that proposed in 1878, being more in the axis of the currents, as shown by the scouring and trials with floats. A comparatively small expenditure will secure a permanent channel of fully 12 feet depth at mean low-water, which will not be liable to changes like those of the Horseshoe Channel. The whole of Snow's Marsh Channel, excepting that shown in the sketch, not only maintains its original depth of 12 feet, but the depth is gradually increasing.

There has been a general advance in the shore lines of Federal Point and Zeke's Island near the dam, and for a considerable distance along the sea-beaches the general surface has risen. If the growth should continue at the rate of the past six months, Federal Point and Zeke's Island will be united by a wide tract of land on the sea side of the dam within six years. The rate of growth will naturally increase after the dam is completed.

The outer bar of the New Inlet has been steadily shoaling during the year. At present there is barely 5 feet depth at mean low-water in a crooked channel. The long shoals which separate the New Inlet Bay from the sea, called the Caroline Shoals, have risen so as to be bare in places at low-tide. The two breaches in the old superstructure near the junction with Smith's Island, amounting to nearly 500 feet in length, were thoroughly repaired in July and August, 1878; 1,869 cubic yards of riprap were placed in the gaps, filling them to high-water mark, with good slopes and a top width of 10 feet. The sand soon completely covered the work, and has since been washed over it in large quantities in addition to that previously washed through, so there is a wide bank on the river side, making the work more than ever secure. The condition of the long, narrow beach of Smith's Island, which separates the sea from the bay, has improved by a general rising and by shoaling in the adjacent bay. There has been some abrasion on the sea side, caused by washing of sand through the "swashes." Of the two "swashes" spoken of in the last report, the southerly one is entirely closed and the other reduced to about half the width at June 1, 1878. The process of natural closure has been slow but continuous, and there seems to be no further occasion for anxiety in regard to them. The result is a wide extent of shoals in the rear and vicinity of the swashes, which will be soon set in grass and form the best fortification against future breaches, thus repeating the history of former swashes.

It will be remembered that the storm of April 13, 1877, broke across this beach, so that about 3 miles in length was covered at half-tide. This is nearly all repaired by natural forces, and the beach is stronger than before. No great changes have occurred in the shore lines of Bald Head Point or the opposite point of Oak Island. There has

been some further recession on the sea side and some advance inward at Bald Head Point, but the distance from point to point remains about the same. Within the last two months a shoaling is noticed, extending from Bald Head Point towards the old stone jetty, which has been cut off from the point for several years. This shoal is now bare at low-water for about 300 feet from the point towards the jetty.

The repairs of the suction-dredge Woodbury were begun early in September, 1878, and diligently prosecuted until she was ready for service, April 1, 1879. The work of repairs on the hull and house was fully equal to that of building an entirely new vessel from the keel up. The only saving was of the old lower timbers, which were mostly sound.

A large new boiler (12 feet in length, 7½ feet diameter, with steam-chimney 5½ feet in diameter and 6 feet high) and a new surface-condenser and propeller-wheel have been placed in her; the cost of repairing the machinery proved unexpectedly large. The whole cost was $18,600, and the result is practically a new vessel, and machinery, much better adapted for efficient service than the old dredge. She is a propeller, 102 feet in length, 20 feet beam, and 6½ feet draft. The capacity of the sand-bins is about 50 yards. They are mostly below the deck, the top being even with the rail. When loaded, the port-holes for discharge from the bins are below the water-level. The height of the discharge from the pump is from 5½ to 7 feet above the water-level, according to the load. The discharge from the pump leads directly through a 9-inch pipe branching into two 6-inch pipes (one for each bin), the only elbow being that from thwartship forward at the pump. The pump (Andrews's 9-inch centrifugal) is on the main deck near mid-ships. The 6-inch suction-pipes (of galvanized iron) lead to it from the drags on each side of the vessel. Each suction-pipe has a flexible section (10 feet in length) next to the side, which allows the drag to keep its proper position on the bottom. It is drawn by a chain attached to the pipe below the flexible section. This position and attachment of the drags and pipes obviates the difficulty of operation in ordinary rough weather.

Improvements are being made in working the dredge, mostly in the details of the drags. As it is, the dredge has nearly reached the average work expected. It is now 1,700 cubic yards per week. The greatest amount dredged and dumped in one day is 361 cubic yards. This was all in very hard and compact sand and in short turns across the outer bar of the Bald Head Channel. It is hoped that the average work will be brought up to at least 8,000 cubic yards per month; this would make the cost 11¼ cents per yard. The amount dredged and dumped in May, 1879, was 5,570 cubic yards.

The efficiency of the dredge in windy weather is beyond expectation. Good work has been done with wind blowing *on shore* at a velocity of 20 miles an hour.

The monthly expenses are as follows: For wages of master, 1 mate, 2 engineers, 1 fireman, 1 cook, and 3 deck hands, $460. Fuel: 3 cords wood or 2 tons coal daily, averaging $200 per month. Repairs: oil, waste, and deterioration, $240. Total, $900.

The good effect of the dredging is already apparent in the increased depth on the bar. The shortest soundings are now (May 31) 11 feet at mean low-water, having increased 6 inches during the past month. A general increase of depth in other portions of the channel is noted.

The dredging is being done in a channel 200 feet in width and about one-fourth of a mile in length. This is well defined by land-mark ranges.

A sketch showing a plan and elevation of the *Woodbury* is appended.

The "rip" of the western channel has been in its usual unstable condition, varying in position and in depth. For several months past the depth has been from 7 to 8 feet at mean low-water. The new cut below the "Logs" preserves its depth of 12 feet at mean low-water. It is but 130 feet in width, and should be widened to 250 feet. The present project for the improvement of Cape Fear River was made in 1875 (see Report of Chief of Engineers, 1875, Part I, page 99). It embraced the final closure of the New Inlet, the initial step of which was then taken. It also included the completion of the Snow's Marsh Channel, the widening of the cut below the Logs, some dredging at the Logs and at the upper jetty, the removal of the Confederate obstructions below Wilmington, and the operation of the suction-dredge one year from July 1, 1875. The amount available July 1, 1875, was $211,287.43. The additional amount asked for was $210,000. The closure of the New Inlet was estimated at $300,000. This project has been steadily pursued as far as the funds available from time to time allowed. The dredging of Snow's Marsh Channel was completed in 1876. A small part of the dredging was done below the Logs and at the upper jetty. The Confederate obstructions were removed, and the suction-dredge was kept in operation till February 1, 1876, when she was laid up as unfit for service till thoroughly repaired.

The principal work, which has always been kept in view, is the completion of the New Inlet Dam. The cost of this has gone far beyond the estimate of 1875 for the reasons before mentioned. Had the real difficulties of the work been fully anticipated at the time of the estimate, no doubt its amount would have been doubled. As it is, the work has been done cheaply, especially that of the stone filling since the foundation was laid in 1875 and 1876.

The estimate for the original project embraced the operation of the *Woodbury* for one year. She was in operation for seven months and then laid up. Since then she has been repaired, as before mentioned, and the present project includes her operation for the next fiscal year. It also embraces the repairs of the Snow's Marsh Channel, which was originally dredged to 12-feet depth at mean low-water and has since shoaled to 8½ feet at the upper end. It is now proposed to dredge a new channel, avoiding this shoal and its cause, as before mentioned.

PROBABLE OPERATIONS FOR THE COMING FISCAL YEAR.

It is of the utmost importance that the New Inlet Dam should be rapidly and thoroughly finished, and that the adjacent works from the head of Zeke's Island to the head of Smith's Island should be kept in thorough repair. Although no repairing seems necessary at present, a small reserve should be estimated for contingencies. It is essential, next, to keep the suction-dredge efficiently at work on the Bald Head Channel.

It will appear from the estimate below that the above, with attendant expenses, will nearly exhaust the present appropriation.

The following appropriations have been made by Congress for improving Cape Fear River:

By act approved July 11, 1870	$100,000 00
By act approved March 3, 1871	75,000 00
By act approved June 10, 1872	100,000 00
By act approved March 3, 1873	100,000 00
By act approved June 23, 1874	150,000 00
By act approved March 3, 1875	150,000 00
By act approved August 14, 1876	132,500 00
By act approved June 18, 1878	160,000 00
By act approved March 3, 1879	100,000 00
Total	1,067,500 00
The amount available of the appropriation of 1878 May 31, 1879, was	143,429 06
The appropriation of March 3, 1879, was	100,000 00
Total	143,429 06

The following is the estimate for the completion of the present project. In view of the instability of all channels passing over the shifting sands of the sea-coasts of this portion of the country, it is recommended that an annual appropriation of $15,000 be provided for continuing the operations of the suction-dredge for assisting and directing the natural forces and insuring good results.

ESTIMATE.

48,000 cubic yards of stone riprap for New Inlet dam, at $1.75	$84,000
6,000 cubic yards of large stone for New Inlet dam, at $4.50	27,000
Repairs of old works (contingent)	7,000
Operation of suction-dredge 12 months	12,000
90,000 cubic yards dredging at Snow's Marsh Channel	22,500
60,000 cubic yards dredging at cut below the Logs, at 30 cents	18,000
Additional dredging at the Logs, as per estimate of 1875	11,250
Add 10 per cent. for superintendence, surveys, contingencies, &c	18,125
Total	199,375

Amount required for the fiscal year ending June 30, 1881 (allowing $15,000 for operation and repairs of the suction-dredge for that year), $70,946.

The work is in the collection-district of Wilmington, N. C.

The nearest port of entry is Wilmington, N. C. It is near Oak Island light-house at the mouth of Cape Fear River, and Federal Point light-house at the New Inlet.

The amount of revenue collected will be reported at the end of the year.

The commercial statistics will also be reported then.

Respectfully submitted.

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Assistant Engineer.

Maj. WM. P. CRAIGHILL,
Corps of Engineers, U. S. A.