

FORT DELAWARE, October 7, 1878.

COLONEL: In accordance with the instructions contained in letter from your office of August 24, I have the honor to submit the following report of a survey of Salem Creek, from Sharptown, N. J., to the Delaware River through the canal.

Salem Creek, having its origin some distance above Sharptown, N. J., formerly flowed, by a long circuitous course, into the Delaware River, near Elsingborough Point. At a point, however, 10 miles below Sharptown and 16 miles from its mouth, a new connection with the river has been made by means of a canal 2 miles in length. Just below a dam has been thrown across the creek, completely cutting off the flow of water and thus severing the old Salem Creek into two entirely distinct streams. The canal forms a continuation of the upper portion, and is in fact its mouth.

Commencing at the river, for the first mile and a half the canal passes through a gravelly loam, the banks rising from 6 to 12 feet above the water. The original cut here was 25 feet wide, but it is now from 60 to 70 feet wide at the water-level, with a depth at low-water of from 5 to 8 feet. The remaining half mile is through low swampy land, and the banks are lined with bushes and trees. The cut here was 50 feet, and has not widened much. The depth is from 6 to 11 feet. The flow of water in the canal is irregular, and without prolonged observations cannot be determined with accuracy. I append to this report a tabular statement of tidal observations at Stout's Bridge, about a mile from the mouth of the canal, taken through one tide and part of another; and also the surface velocities. The rise was $3\frac{1}{2}$ feet, while in the river on that day it was 6 feet. The next morning the high-water only reached 2 feet 7 inches.

From the head of the canal to Hoxie's Bridge, one-half mile, the creek is 150 feet wide, and was formerly deep, but is now filled up with sand-bars.

From Hoxie's Bridge to Course's Landing is $6\frac{1}{2}$ miles. For a large portion of this distance the creek passes through a maple swamp, without banks; the dense woods and vines shutting in the stream on either side.

There are a few openings where the fast land approaches near enough to afford a landing-place. The average width is about 100 feet, and depth generally from 6 to 10 feet with occasional deeper places.

From the head of the canal to Course's Landing, the usual rise and fall of the tide is about 1 foot. At times, however, it rises a few inches above or runs a foot or more below the average. The extremes are rare, and depend upon the duration of the high or low water in the river, the capacity of the canal being so much less than that of the creek; so that it is only when the water is kept low in the river by off-shore winds that the extreme low tides occur. The original object of the canal was the better drainage of the low lands above, but the result is that the tide does not fall so low by a foot or more as it did before the building of the dam.

From Course's Landing to Sharptown is nearly 3 miles. For a short distance there is good water, and then follow two broad reaches, with a tortuous channel of 3 to 5 feet, winding among the lily-pads. Thence to Friendship Island, about a mile below Sharptown, the creek is narrow with wooded banks, the channel depth decreasing gradually to 2 feet. Further progress with a boat was impossible. On the eastern side of this island the way is completely choked with grass, bushes, and fallen trees. On the western side there is a passage for the small push-boats used here, drawing 3 or four inches. Beyond the island is a marsh, and then for the remainder of the distance the creek winds through a pasture, its width varying from 15 to 30 feet and the depth generally from 1 to 2 feet. The banks are lined with willows, and are from 1 to 3 feet above the water.

The flow of water in this portion of the creek is small, and the influence of the river tides barely perceptible.

Course's Landing is the present head of navigation. There are here a lime-kiln, a coal and lumber yard, and store. It is also a shipping point for grain and produce of all kinds. A steamer of 90 tons runs twice a week to Philadelphia, and several sloops ply regularly up and down the creek.

The four bridges below Sharptown, viz, that at Course's Landing, at Hoxie's, and the two crossing the canal, are all drawbridges. They have no regular keepers, but are opened and closed by the crews of passing vessels.

Between Course's Landing and the canal the principal obstruction to navigation is at Biddle's Landing, of which portion of the creek an enlarged sketch is given in the accompanying map. Around this bend there were formerly from 10 to 15 feet of water, but, owing partly to the faulty location of the canal, the wash of its banks, brought in by the flood tides, finds here its resting place, and in the 6 years that the canal has been open has so filled it with sand-bars that there is hardly a 4-foot channel now practicable. The improvement here would consist in dredging a channel to the required depth—say 5 feet—through the shoal, and as the canal has gradually widened, that tendency to fill up here will not be so great.

Shoal places occur a little above Hoxie's Bridge and at Webber's Landing. They can be passed without much difficulty, but in case the improvement of the creek is undertaken, a small expenditure on them may be advisable.

At the mouth of the canal there is a bar of shifting sand over which a channel of 4 feet at low-water can generally be found. Dredging here would afford but temporary relief.

In order to extend navigation from Course's Landing to Sharptown it would be necessary to commence deepening the channel in the first reach a little between "Mile Run," say to 5 feet. Through the next reach the channel should be straightened as well as deepened. Thence the natural channel should be followed, excavating to the desired depth where necessary, passing to the southward of Union Island, to the northward of Liberty Island, and probably to the southward of Friendship Island. After passing the marsh it would be better, on account of the sinuous course of the creek and the difficulty of removing the roots of the large willows along its banks, not to attempt to follow its windings, but to excavate a canal in a direct line to the dam at the mill-pond where navigation is expected to end.

I respectfully submit herewith a map and tracing of the creek and canal on a scale of 300 feet to 1 inch, and on the same sheet minor sketches as follows:

Shoal at Biddle's Landing, scale 100 feet to 1 inch.

Shoal at mouth of canal, scale 100 feet to 1 inch.

Section of canal below Stout's Bridge, scale 30 feet to 1 inch.

There are also appended a statement of amounts received and shipped by the creek, and estimate of cost of proposed improvements.

Very respectfully, your obedient servant,

JOHN J. LEE,
Assistant.

Col. J. N. MACOMB,
Corps of Engineers, U. S. A.

Tidal observations in the canal at Stout's bridge.

Time.	Height above low-water.*	Velocity in feet per second.		Remarks.
		Ebb.	Flood.	
Sept. 19, 1878, 6.30 a.m.	1.5	1.1	} Low-water in Delaware River. Approximate: Found by adding 24 minutes to the time at Fort Delaware. Low-water at the bridge.
7 a.m.	1.2	1.4	.....
7.30 a.m.	.9	1.8	.....
8 a.m.	.8	2.4	.....
8.30 a.m.	.7	2.4	.....
9 a.m.	.7	2.2	.....
9.30 a.m.	.6	2.5	.....
10 a.m.	.5	2.7	.....
10.30 a.m.	.4	2.5	.....
11 a.m.	.3	2.9	.....
11.30 a.m.	.2	2.5	.....
12 m.	.0	2.5	.....
12.30 p.m.	.3	1.3	.....
1 p.m.	.5	0.5	.....
1.30 p.m.	1.1	.....	0.9
2 p.m.	1.6	.....	1.7
2.30 p.m.	2.0	.....	2.2
3 p.m.	2.4	.....	2.9
3.30 p.m.	2.8	.....	3.1
4 p.m.	3.2	.....	2.9
4.30 p.m.	3.5	.....	2.9
5 p.m.	3.6	.....	3.1
5.30 p.m.	3.6	.....	3.1
6 p.m.	3.4	.....	2.4
6.30 p.m.	3.0	.....	1.7
Sept. 20, 1878, 5.30 a.m.	2.7	.....	2.0
6 a.m.	2.5	.....	1.8
6.30 a.m.	2.4	.....	1.1
7 a.m.	2.1	.....	.....
7.30 a.m.	1.9	.....	0.6
8 a.m.	1.6	.....	1.4
8.30 a.m.	1.3	.....	1.7
9 a.m.	1.0	.....	2.1

*Low-water of the day of observation is assumed as (0'). The observations commenced at about 2 ours' ebb.

COMMERCIAL STATISTICS.

The population of Sharptown is 600; that of Woodstown, 1½ miles further up the creek, 3,000.

The annual amounts received and shipped by the creek are about as follows:

Lumber	feet..	2,000,000
Coal	tons..	300
Fertilizers	do..	1,500
Phosphates	do..	200
Corn	bushels..	50,000
Potatoes, melons, fruits, &c., value		\$25,000
Miscellaneous, value		10,000

Much produce is also taken from the lower landings by open boats.

It is estimated by the business men of Sharptown that if a channel were opened to that place the business of the creek would be increased fourfold.

Estimate of cost of improving the navigation of Salem Creek from the Delaware Canal to Sharptown, based on providing, whenever necessary, a channel 50 feet wide and 5 feet deep at low-water.

Name of place.	Amount to be dredged.	Rate.	Cost.
At Biddle's Landing	<i>Cubic yds.</i> 6,100	\$0 20	\$1,220 00
Above Hoxie's Bridge	300	20	60 00
<i>From Course's Landing to Sharptown.</i>			
Below Mile Run	7,222	20	1,444 40
Mile Run to head of reach	9,260	20	1,852 00
Head of reach to Kiger's Landing	2,962	20	592 40
Union Island to north end Liberty Island	4,444	20	888 80
Thence to point of leaving creek	11,111	20	2,222 20
Creek to basin (canal)	45,185	20	9,037 00
Basin at Sharptown	17,778	20	3,555 60
	104,362	20	20,872 40

E 22.

SURVEY OF WOODBRIDGE CREEK, MIDDLESEX COUNTY, NEW JERSEY.

UNITED STATES ENGINEER OFFICE,
Philadelphia, Pa., December 27, 1878.

GENERAL: I have the honor herewith to forward, with my approval, report and tracing of the survey of Woodbridge Creek, New Jersey, made under my direction by Mr. A. Doerflinger, assistant engineer.

The proposed method of effecting the desired improvement is that which appears the most feasible and economical and promises the best result.

The amount of business to be facilitated by the proposed improvement is very large, as is shown by the commercial exhibit appended to the report.

Very respectfully, your obedient servant,

J. N. MACOMB,
Colonel of Engineers.

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

REPORT OF MR. A. DOERFLINGER, ASSISTANT ENGINEER.

PHILADELPHIA, December 19, 1878.

COLONEL: I have the honor to report as follows upon the survey of Woodbridge Creek, New Jersey. Like the Elizabeth and Rahway Rivers, Woodbridge Creek empties into Staten Island Sound, and like them follows a tortuous course through low meadow-lands. It derives its importance as a navigable stream from the numerous clay banks that are found in the section of country traversed by it, said to be the finest and most valuable clay region in the United States. Numerous fine brick, tile, and drain-pipe works are located on the banks of the creek, and clay is shipped from its docks to all parts of the country.

The survey embraced the navigable portion of the stream from its mouth to Boynton Beach road. The field-work was executed between September 27 and October 4, 1878. Three base-lines were measured, from which a triangulation was extended over the area embraced by the survey. From the trigonometrical points thus determined, such other points as were necessary for the development of the hydrography and topography were located.

A tide-gauge was set up at Boynton's dock, near the mouth of the creek, and levels run to a permanent bench-mark, and mean high and low water determined by simultaneous tidal observations at the latter place, and on the gauge at the entrance to Elizabeth River. From these observations the mean rise and fall of tides at Boynton's dock was found to be 5 feet. A second gauge was set up at the dock of the Salamander Fire-Brick Works, the uppermost dock on the creek, 1.72 miles distant from the lower gauge. From simultaneous observations at the two gauges we find that the tidal wave in its passage up the creek undergoes but very little change, the range being practically the same at both gauges, which shows that no undue obstruction to the tidal flow exists between the two points, and accounts for the generally good depth of water in the lower part of the creek, the 12-foot curve extending up-stream as far as Cutter's clay docks, and being separated from the 12-foot curve of Staten Island Sound by the bar at the mouth of the creek. The principal difficulty complained of is the shoaling of the stream in the reach between Valentine's dock and the town dock, where the depth becomes less than 8 feet at an ordinary high-water. Many of the vessels carrying clay draw from 7 to 8 feet when loaded, and hence cannot pass this shoal at high-water when the tides run low, and are often obliged to wait several days for a tide sufficiently high to carry them over. This shoal seems, in great part, to be due to the circumstance that a small brook, draining a considerable area of adjacent country, formerly emptied into the creek at a point where the slip now is, between Berry's dock and the Salamander dock. During heavy rainfalls this brook brought down large quantities of sand, which were emptied into the creek, and deposited below the turn where the creek suddenly widens out, and where a consequent reduction in the velocity of the current takes place. The old mouth of this brook has been closed and filled in, and its course further up changed by digging a trench through the meadows, so that it now discharges into the creek above Boynton's Beach road, below which there was formerly a mill-dam, some portions of which still remain. By this change the material brought down by the brook is probably all deposited before it reaches the navigable part of the creek. But we have another cause still acting. An inspection of the map shows a sudden contraction in the cross-section of the creek in the bend above the shoal, produced by the extension of the docks located there. Above this point the creek widens out again. The consequence is that we have a strong local current during the ebb where this change in section takes place. This strong current scours out the material of the bottom, as is shown by the deep hole on the upper turn, carries it along, and deposits it in the wider section of the creek.

The plan proposed to remedy this difficulty is to widen the creek by cutting away the bank opposite the docks and to contract the section below the bend where the shoal exists, by the construction of a dike and filling in behind it. This will at the same time protect the bank, which is much cut up along this part of the creek. If the shoal is then dredged it is not likely that it will form again, but that the improvement will prove permanent. Another source of trouble is found in the bar at the mouth of the creek. Vessels leaving the upper docks at high-water are often detained here, the tide having fallen in the mean time to such an extent that they cannot cross the bar, and are obliged to wait for the next high-water, being thus caused a delay of many hours. Again, vessels bound up stream cannot cross the bar until high-water, and are thus prevented from carrying the flood tide up with them, and consequently often ground in the upper reaches of the creek before getting to their docks. If the channel across this bar were deepened to 12 feet at mean high-water the larger vessels could cross before half tide and the smaller craft at low-water, and proceed up stream without difficulty with a rising tide.

The bar consists of sand and gravel, and can easily be dredged. The estimated cost of these improvements is as follows:

	Cubic yards.
Dredging channel between Valentine's dock and Town dock, 80 feet wide and 10 feet deep at mean high-water, and widening channel opposite upper docks	9,394
Dredging channel through bar at the mouth of creek, 12 feet deep at mean high-water, and continuing the same up stream as far as Valentine's dock, 80 feet wide, material consisting of mud, sand, and gravel.....	19,618
	29,012
Dredging 29,012 cubic yards, at 30 cents per cubic yard	\$8,703 60
500 feet of pile dike, at \$4 per running foot	2,000 00
Contingencies and engineering, 15 per cent.....	1,605 54
	12,309 14
Total cost of improvement.....	12,309 14
To continue the 12-foot channel up as far as the Salamander dock, thus providing a uniform depth of 12 feet at mean high-water from the mouth of the creek, would require additional dredging to the amount of 5,000 cubic yards, at 30 cents.....	1,500 00
	13,809 14

Making the total cost of this improvement.....

The subjoined statement, kindly furnished by Mr. W. H. Berry, of Woodbridge, as to the average annual tonnage of the shipments of clay, coal, and merchandise through the creek, shows the amount of commerce that will be benefited by the contemplated improvement.

I am, very respectfully, your obedient servant,

A. DOERFLINGER,
Assistant Engineer.

Col. J. N. MACOMB,
Corps of Engineers, U. S. A.

Statement of the average of annual tonnage for the last ten years of the shipments of clay and fire brick and receipts of coal and merchandise through Woodbridge Creek.

Shippers and receivers.	Shipped.	Received.	Total.
Ayres, David.....	1,453	.....	1,453
Anness & Son, C.....	3,195	897	4,092
Berry & Co., William H.....	3,220	1,580	4,800
Boynton, C. W.....	524	323	847
Cutter & Sons, H.....	14,206	.....	14,206
Cutter, David.....	300	.....	300
Campbell, J. H.....	936	.....	936
Cook, Henry.....	1,284	.....	1,284
Dalley, Charles M.....	6,868	.....	6,868
Dalley, Samuel.....	362	.....	362
Demarest, William H.....	.....	600	600
Drummond, Warren.....	1,832	.....	1,832
Edgar, William P.....	2,707	.....	2,707
Forbes, C. S.....	2,800	.....	2,800
Flood, David A.....	5,498	.....	5,498
Hall & Son, A.....	4,524	.....	4,524
Inslee, Isaac, jr.....	4,116	.....	4,116
Kreisler & Son, B.....	15,377	.....	15,377
Longling & Powers.....	8,734	.....	8,734
Melick Brothers.....	5,280	.....	5,280
Martin, Albert.....	1,925	.....	1,925
Mauver, Henry.....	5,500	.....	5,500
McHose & Co.....	80	.....	80
Salamander Works.....	4,500	1,800	6,300
Thompson, E. J.....	1,746	.....	1,746
Valentine & Bro., M. D.....	6,200	.....	6,200
Weidner, William N.....	5,768	.....	5,768
Watson, John R.....	432	.....	432
Actual	109,367	5,200	114,567

Statement of the average annual tonnage for the last ten years, &c.—Continued.

Shippers and receivers.	Shipped.	Received.	Total
ESTIMATED.			
Edgar & Bro.....	11,000	.....	11,000
Meeker & Son.....			
Valentine, James.....			
Valentine, William.....			
Manure.....	.....	1,000	1,000
Total.....	120,367	6,200	126,567

WOODBRIDGE, November 25, 1878.

I believe the above to be a just and true statement of the average annual shipments and receipts, in tons, through Woodbridge Creek for the past ten years.

WM. H. BERRY.

E 23.

SURVEY OF ELIZABETH RIVER, NEW JERSEY.

UNITED STATES ENGINEER OFFICE,
Philadelphia, Pa., December 27, 1878.

GENERAL: I have the honor herewith to forward, with my approval, report and tracing of the survey of Elizabeth River, New Jersey, made under my direction by Mr. A. Doerflinger, assistant engineer.

The proposed method of effecting the desired improvement is that which appears the most feasible and economical and promises the best result.

The amount of business to be facilitated by the proposed improvement is very large, as is shown by the commercial exhibit appended to this report.

Very respectfully, your obedient servant,

J. N. MACOMB,
Colonel of Engineers.

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

REPORT OF M. A. DOERFLINGER, ASSISTANT ENGINEER.

PHILADELPHIA, December 17, 1878.

COLONEL: I have respectfully to report as follows upon the survey of Elizabeth River, New Jersey:

The survey embraced the course of the river from its entrance into Staten Island Sound to the first permanent bridge across the stream at Broad street, Elizabeth, a distance of 2.7 miles. The river is a shallow, sluggish stream, winding in a tortuous channel through banks of meadow-land, the general level of the banks being that of mean high-water.

The field-work of the survey was executed between August 28 and September 7, 1878. A traverse-line was run along the banks of the river, from which the shore-lines were measured in. The soundings were run on ranges and their positions determined by intersections, the angle to the sounding-pole being taken for each sounding by means of a transit stationed on shore. No continuous tidal observations were made; mean low-water at the mouth of the river was taken from the bench-mark at Elizabethport established by General Newton's survey of 1872. From general observation considerable difference was found to exist between the rise and fall of tides at the entrance and in the upper sections of the river.