

REPORT

ON THE

CANALS OF THE UNITED STATES.

BY

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SPECIAL AGENT.

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LETTER OF TRANSMITTAL.

DEPARTMENT OF THE INTERIOR,

CENSUS OFFICE,

Washington, D. C., March 15, 1883.

Hon. CHARLES W. SEATON,

Superintendent of Census.

SIR: I have the honor to submit herewith a report on the canals of the United States, embracing a history of the important works in use, together with statistics of the operating canals, for the year 1880. Sketches of the abandoned canals of the country are given, together with a supplemental table, which in a measure shows the influence of railroad competition upon these great works of the past generation.

Very respectfully, yours,

T. C. PURDY,

Special Agent.

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fruitless, the state was thrown upon her own resources. The war of 1812 led to the dissolution of the board of canal commissioners, and the consequent suspension of all proceedings with regard to the object of its appointment. Soon after the cessation of hostilities, in 1815, the subject of internal improvement was revived and zealously pressed upon public attention; meetings were held in the city of New York and elsewhere, which resulted in memorializing the legislature in favor of the proposed improvements, and in 1816 a board of commissioners was again appointed, with powers similar to those exercised by the board of 1812. The new board displayed such energy and promptitude in the performance of its duties that the legislature was enabled to act definitely, and on the 15th of April, 1817, was passed the law upon which the system of internal improvement in New York is based. Contracts were immediately entered into, and on the 4th of July, 1817, the excavation of the Erie canal was commenced in the neighborhood of Rome. The whole line was divided into three sections: the western, extending from lake Erie to Seneca river; the middle, from Seneca river to Utica; and the eastern, from Utica to the Hudson. The middle section, including a branch from Syracuse to Onondaga lake, was rendered navigable in October, 1819.

In 1819 and 1820, 43 miles on the western section, chiefly on the east of the Genesee river, and in 1820, 26 miles on the eastern section, were put under contract. Operations were conducted on both sections simultaneously. In the early part of 1821 the residue of the eastern and that part of the western below the Genesee and Tonawanda creek were let, and in November of the same year boats descended as far as Little Falls, on the Mohawk river. Toward the close of 1822 boats navigated 220 miles of the canal; and in October, 1823, 280 miles were finished, and boats from the north and west entered the Hudson river at Albany. On the 26th of October, 1825, the first boat passed from lake Erie to the Hudson. The period between the commencement and the completion of this canal was eight years three and a half months. The union of the waters was appropriately celebrated in the city of New York on the 4th of November, 1825.

As early as 1834 the rapid increase of the trade of the lakes and canals made it apparent that the capacity of the Erie canal was no longer adequate to the exigency of the business on it, and on the 29th of January, 1834, the canal commissioners made a special communication to the assembly in favor of doubling the locks east of Syracuse and rebuilding the aqueduct at Rochester. In view of these demands, an act was passed the same year authorizing the canal commissioners to construct a second set of lift-locks, of such dimensions as they should deem proper, on the Erie canal from Albany to Syracuse; but at the session of 1835 the act of 1834 was repealed and another act passed for enlarging the Erie canal in its whole extent, and for reconstructing the aqueduct with a 40-foot water-way.

In July, 1835, the canal board resolved "that the canal be enlarged to give 6 feet depth and 60 feet width of water on the surface, and that the locks be 105 feet long and 15 feet wide in the clear". The following October they voted to increase the depth to 7 feet, its width to 70 feet, and the locks to 18 by 110 feet. Work was begun in August, 1836; but little was done, however, until 1837, when \$636,312 was expended. For the five years following about \$2,000,000 were expended annually, and in 1842, by act of the legislature, the work was suspended. In 1847 work was resumed, and it was completed in September, 1862. The total length of the canal was shortened 12.50 miles, making it 365.48 miles in length, and the total feet of lockage was reduced from 675.50 to 656.46 feet. Instead of 83 locks 90 by 15, there were 72 locks 110 by 18. The size of the prism is 70 and 52½ by 7 feet. This allows the passage of boats 98 by 17½ by 6½ feet, or 225 tons, as against the smaller craft measuring 78½ by 14½ by 3½ feet, or 75 tons.

The supply of water for about 155 miles, from Buffalo to the Seneca river, is almost entirely from lake Erie. From that point eastward it is supplied from streams, lakes, and reservoirs as far as Little Falls, whence it is supplied by the Mohawk river alone.

The section from Rochester west is much larger than the rest of the canal. The size of the prism at Rochester is 71 feet surface, 53 feet bottom, and 7.83 feet in depth, and it regularly increases to the size of the prism at Lockport, which is 98 feet on surface, 79 feet on bottom, and 8 feet in depth. From Lockport west the depth is from 9 to 9½ feet.

In view of the fact that the enlarged Welland and Saint Lawrence canals are diverting the grain shipments to Montreal, and the Canadians now have the advantage in this traffic, the most practicable suggestions to meet this emergency are made by Hon. Horatio Seymour, jr., state engineer and surveyor, who suggests that the canal bank be raised to secure 1 foot more of water. He says:

If 1 foot of water is added to the depth of the canal by raising its banks, the present boats can carry 50 tons additional load, and the relation between the size of the boat and the size of the canal will not be disturbed. The increase in depth would enable the boats to carry one-fifth more cargo. At the present rate of carrying, it would cheapen transportation 1 cent a bushel, which would be equivalent to removing tolls. This plan of deepening the canal recommends itself to the boatmen because it requires no outlay on their part, the boats now in use having a capacity for 50 tons more than the present depth allows them to carry. If no additional load were carried, this increase of depth, with the application of power to the locks for operating the gates and drawing the boats in and out, such as is used in New Jersey on the Delaware and Raritan canal, would enable boats to make thirty-seven hours better time in a round trip from Buffalo to New York. This gain in many instances would allow boatmen to make another trip a season. There is no sentiment in trade. Business goes where it can be done the cheapest, and the route that can carry for a few mills less per bushel than another will command it. The average freight (not including tolls) on a bushel of wheat from Buffalo to New York during the past season has been 5½ cents; if this charge could be reduced to 4½ cents, the Erie canal could offer such economical transportation that there would be very little danger from its northern rival.

He adds :

I have had careful surveys made for the raising of the banks of the canal 1 foot and for furnishing the necessary water; these show that the work can be done for about \$1,000,000. The gain that this improvement would have made in transportation during the past season would be equal to the cost of the work.

The policy of the state of New York toward the canal is in process of modification. Old and useless branches have been abandoned, and the tolls have been reduced from time to time, always with the effect of lessening the cost of transportation. This rate has been gradually diminished, until it was fixed at 1 cent per bushel, and finally removed altogether. The liberal policy as carried out within the past four years has produced the following result as to tolls and tonnage:

	1877.	1878.	1879.	1880.
Tolls	\$880, 896	\$993, 348	\$941, 574	\$1, 155, 257
Tonnage.....	4, 955, 963	5, 171, 320	5, 362, 372	6, 462, 290

The number of canal-boats has largely increased, and something like a score of the largest lake vessels—too large for the new Welland—have been built to connect with the Erie and the railroads at Buffalo. This prosperous state of affairs must continue under the new order abolishing the tolls on freight. The entire abolition of tolls, it is claimed, will give still further inducements to the canalmen to enlarge their business, which, in these days of monopolies, has the rare merit of being open and free to all.

The cost of all of the canals to the state is placed at \$61,890,206. According to the auditor's report for 1880, the funded debt for all of the canals of New York state was \$8,981,700, and the floating debt amounted to \$6,660. In 1882 the state constitution was amended, abolishing tolls on the canals of the state.

The number of boats employed on the canals were 4,349, with an average tonnage of 172 tons, the maximum tonnage being 250 tons. There were also 70 steamers, averaging 140 tons.

CHAMPLAIN CANAL, NEW YORK.

This canal is next in importance to the Erie canal, and extends from Whitehall, at the head of lake Champlain, to its junction with the Erie canal at Waterford, 7 miles from Albany, completing the water-way between the Atlantic seaboard and the navigable Saint Lawrence. Its construction was authorized in 1817, and the canal opened to business in 1822. Its length is 66 miles, including Waterford side-cut and Cohoes and Saratoga dams. The size of prism was 40 feet wide on the top water-line, 26 feet wide on the bottom, and 4 feet depth of water; the locks, 110 by 18 feet. The size in 1870 was changed to 58 feet wide on the top water-line, 44 feet wide on the bottom, with 6 feet depth of water. Boats the size of those navigating the Erie, drawing 5 feet of water, are now used on this canal. From its junction with the Erie canal to 1 mile north of Waterford the supply of water is from the Mohawk river at Cohoes; from 1 mile north of Waterford to the Saratoga dam at Northumberland the supply is from the Hudson river; from Northumberland to Whitehall the supply is from the waters of the upper Hudson through the Glens Falls feeder, supplemented on the north by Wood creek at Fort Ann. The supply from the water-sheds to the upper Hudson has decreased to such an alarming extent, caused principally by droughts and the destruction of the forests in this region, that no surplus water has existed during the past season, the quantity being sufficient only by economical management to meet the demand.

OSWEGO CANAL, NEW YORK.

This canal extends from lake Ontario, at the city of Oswego, to the Erie canal at Syracuse. Its construction was authorized in April, 1825, and it was completed in December, 1828. Its total length is 38 miles, made up alternately of seven river and ten canal portions, the former 18 miles in length and the latter 17 miles; section work connected with structures, 3 miles.

From the lake to the level of the Erie canal at Syracuse the rise was 156.85 feet, which was overcome by 18 lift-locks. Elevation above tide-water: lake Ontario, 243 feet; Syracuse, 399.85 feet. The size of the prism was 40 feet wide at the top water-line, 26 feet wide on the bottom; the depth of water, 4 feet. There were 18 locks, 90 by 15 feet, and 6 guard-locks.

The average burden of boats was 70 tons. In 1847 the enlargement of the locks on this canal, and in April, 1854, the enlargement of the canal, was authorized. It was completed in September, 1862. The size of the prism is 70 feet wide on the top water-line, 56 feet on the bottom, and 7 feet depth of water. It has 18 locks, 110 by 18 feet, and 5 guard-locks. The total lift is 155.55 feet, and the supply of water is from the Erie canal and the Oswego river. The burden of the boats is from 230 to 240 tons. Elevation above tide-water: lake Ontario, 245.15 feet; Syracuse, 400.70 feet.

ONEIDA LAKE CANAL, NEW YORK.

The Oneida Lake canal to South bay is 5.30 miles in length. Level No. 1 is 428.40 feet above tide-water; Oneida lake above tide-water, 366.40 feet. Total lockage, 62 feet. Owing to the scarcity of water on the Rome level and the insecurity of its banks, this canal has not been opened for navigation this season, and therefore is classed among the abandoned canals.

CANALS OF THE UNITED STATES.

ONEIDA RIVER IMPROVEMENT, NEW YORK.

The Oneida river improvement, extending from Three River point to Brewerton, is 20 miles in length, and consists of two lift-locks, one at the outlet of Oneida lake and one about half-way down the river, and an outlet lock at the Oswego river, securing a navigation from the Oswego canal to the lake, which is 24 miles long, and connects the Erie canal by the Oneida Lake canal.

CHENANGO CANAL, NEW YORK.

The part of this canal not abandoned but used as a feeder is 31 miles, extending from Utica to the first culvert south of Hamilton, and is only used as a feeder through which the waters from the reservoirs in Madison county are fed into the Erie canal, and is not navigable. It is classed with the abandoned canals.

BLACK RIVER CANAL AND IMPROVEMENT, NEW YORK.

The building of this canal, extending from Rome to Lyons Falls, was authorized in 1831, but was not completed until 1849. The summit level of this work is 1,121.40 feet above tide-water. Its total length is 35.50 miles; ascending lockages from Rome to summit, at Boonville, 693 feet; descending lockages from the summit level to the Black river, below Lyons Falls, 387 feet, with 110 locks.

The Black river improvement was authorized in 1836, the law requiring that the river be so improved as to make the same navigable for steamboats drawing 4 feet of water from the High Falls to Carthage. Work was not begun until September, 1857, and was completed in 1861.

CAYUGA AND SENECA CANAL, NEW YORK.

The Cayuga and Seneca canal, including the Ithaca inlet, at Ithaca, is 24.77 miles in length, and extends from the Erie canal at Montezuma to the Seneca and Cayuga lakes. The length of the main canal is 22.77 miles, and that of Ithaca inlet 2 miles.

It is an important canal, principally because of its connections, forming with it a line of interior navigation, formerly from Montezuma south to the Chesapeake bay. The work of construction was commenced in 1825 and completed in 1839. The enlargement was commenced in 1855.

Descending lockages from Geneva to Cayuga outlet, 63.58 feet; ascending lockages from outlet to Erie canal at Montezuma, 13 feet; level No. 1, at Geneva, 441 feet above tide-water; level No. 9, at Cayuga outlet, 378 feet; level No. 11, at Montezuma, 392.07 feet.

DELAWARE AND HUDSON CANAL, NEW YORK.

The original charter of the Delaware and Hudson Canal Company from the state of New York bears date of April 7, 1823. Ground was broken on the 13th of July, 1826, and the canal was opened for business in the fall of 1828, its total length, including 3 miles of slack-water navigation, being 108 miles, 83 miles of which are in the state of New York and 25 miles in the state of Pennsylvania. The canal extends from Rondout, on the Hudson river, to Honesdale, Pennsylvania. Its original construction was for boats of 30 tons capacity, and was 4 feet deep, with locks 76 by 9 feet, but it has been enlarged from time to time. Its capacity from 1828 to 1843 was for boats carrying 30 tons; from 1843 to 1846 for boats carrying 40 tons; from 1846 to 1848 for boats carrying 50 tons; from 1848 to 1853 for boats carrying 100 tons; from 1853 to present date for boats carrying 140 tons; but the present actual average per boat is 130 tons.

The railroad of the company, which connects the canal with the coal-fields, was completed in 1829, and is termed a gravity road. The transportation of coal commenced in 1830, and during that year 43,000 tons were sent to market, and of late years has been the principal business of the canal.

In 1846 the capacity of the canal was increased from 518,400 to 864,000 tons in a season. In 1848 a further enlargement was determined upon, and its present capacity is equal to the transportation of 2,000,000 gross tons of coal annually. The tonnage in a single year has been 1,845,958 tons, and 1,500,000 tons is a moderate estimate. The operating expenses, repairs, and taxes have been \$300,000 per annum, and the tolls collected have averaged \$50,000.

The amount with which the canal, including right of way and reservoirs, stands charged is \$6,339,210, of which New York has \$4,454,108, and Pennsylvania \$1,885,102. The actual cost has been more than double this sum.

The company has under its charter within fifty-four years secured an immense property. Besides constructing 108 miles of canal, it operates hundreds of miles of railway, has marketed millions of tons of coal and divided among its shareholders millions of dollars, and furnished employment to thousands of men. The company has some \$20,000,000 of capital invested in this canal and railroads, and had in 1880 a funded debt of \$19,837,000. There were 879 boats employed on this canal, averaging 130 tons, and they gave employment to 2,616 persons.

MORRIS CANAL AND BANKING COMPANY, NEW JERSEY.

The original charter of this company bears date December 31, 1824, the canal to extend from the Delaware river to Newark, New Jersey. Work was commenced in July, 1825, and 90 miles of it was completed between the Delaware river and Newark in August, 1831, and to Jersey City, 13 miles, in 1836. An act was passed on the 26th of January, 1828, authorizing this extension. The original dimensions were 31 feet width at top, 20 feet at bottom, and 4 feet depth; locks 75 by 9 feet, with a capacity for boats of 25 tons burden. The center of the summit level near Stanhope is 51 miles from tide-water at Newark and 39 miles from the Delaware river, and is elevated above the former 914 feet, and above the latter 760 feet. To pass boats over this elevation 23 incline planes and 23 lift-locks are employed, distributed as follows: East of summit: Planes, 12; lift, 758 feet. Locks, 16; lift, 156 feet. West of summit: Planes, 11; lift, 691 feet. Locks, 7 feet; lift, 69 feet; making a total ascent and descent of 1,674 feet. During the years 1840 and 1841 the lift-locks were enlarged to 98 by 12 feet. Immediately after the locks were enlarged the company failed and the effects were placed in the hands of receivers, by whom the canal was leased for a small annual rent until the close of the season of 1844. In October of that year the canal, its appendages, and the franchises of the company, were sold to foreclose a mortgage under a decree of the court of chancery. The purchasers and their associates reorganized under the name of the Morris Canal and Banking Company of 1844, and issued stock to the full amount (\$1,000,000) authorized by the charter.

On the 17th of April, 1845, \$500,000 in 6 per cent. bonds were issued. The new company commenced the improvement of the canal early in this year, and enlarged it from 32 to 45 feet at the top, and from 20 to 25 feet at the bottom. It was again opened for business in April, 1845, with a capacity to pass boats of about 65 tons. The company was again involved, and to pay its debts and provide means for further improvements the legislature, on the 9th of February, 1849, passed an act authorizing the company to issue 11,750 shares of preferred stock, bearing 10 per cent. interest, which was accepted by the stockholders in May, 1849, and issued in 1850. The canal was operated with 5 feet of water on all the levels, and in 1851, the section between Newark and Jersey City having been reconstructed, the entire line was opened in its enlarged capacity. The company had \$2,200,000 of capital invested, with a floating debt of about \$100,000. There were 350 boats on the canal, averaging 70 tons.

DELAWARE AND RARITAN CANAL, NEW JERSEY.

The Delaware and Raritan Canal Company and the Camden and Amboy Railroad Company, both chartered in February, 1830, were consolidated in 1831. In 1867 the New Jersey Railroad and Transportation Company was consolidated with the above, under the name of United New Jersey Railroad and Canal Company. In May, 1871, the canal and railroads were all leased to the Pennsylvania Railroad Company for nine hundred and ninety-nine years, at an annual rental equal to 10 per cent. on the share capital of the united companies. The capital stock of the original company, as provided in the act of incorporation, was \$1,500,000, but this was increased, until, on December 31, 1870, it amounted to \$5,847,400. The cost of the canal up to this period (December 31, 1870) was \$4,735,353.

The main canal is 44 miles in length from the Delaware to the Raritan, 80 feet in width on the top water-line, with an average depth of 7 feet. There are 14 locks, including a double lock at New Brunswick outlet, 6 ascending from the Delaware and 8 descending to the Raritan. The locks are 220 feet over all, and the smallest lock is 24 feet wide over all. The drop-gates and the lower gates on the berme bank side, the wickets, and where there is a bridge adjacent to the locks, are all operated by steam, which is also used to pull boats in and out of the lock. The feeder, a navigable canal, commencing at Bull's island, in the Delaware river, is 22 miles in length, and forms a junction with the main canal at Trenton. It is 60 feet in width and about 6 feet in depth.

Pivot bridges are erected throughout the whole line of the main canal, to permit the passage of masted sea vessels, for which the canal is in all respects adapted.

Steam vessels navigate the main canal, and the banks are walled the entire length.

Levels in length are, in miles, $3\frac{1}{2}$, $\frac{3}{4}$, $\frac{3}{4}$, 1, 1, 14, 4, 10, $2\frac{1}{2}$, $1\frac{1}{2}$, $5\frac{1}{2}$, 1, respectively.

Total tonnage for season of 1880, 1,203,645 gross tons. The number of boats and rafts that passed through the canal and feeder for 1880 was 11,123. They have \$5,847,400 of capital invested.

PENN'S NECK CANAL, NEW JERSEY.

A stock company was formed in the year 1800, with a perpetual charter from the legislature of New Jersey, designated the Penn's Neck Canal Company, with powers to cut a tide-water canal connecting the waters of the Delaware river with the headwaters of Salem creek, 2 miles and 8 rods in length. After the company had passed a vessel drawing 5 feet of water, they were empowered to dam the creek at some point below the canal, about 20 miles from the creek's mouth, thus forming two streams of the same length; but after expending about \$6,000 the work was abandoned.

In the year 1832, operations were again resumed by raising money from preferred stock, and, after an expenditure of some \$10,000, for want of funds the work was again abandoned.

In the year 1852 another effort was made under the same charter, when some \$10,000 were guaranteed by voluntary subscriptions, to be paid when the work was completed. This was done through the expectation of having a better drainage to meadow and lowlands on the creek.

In the year 1868 a new charter was procured, under the title of "The Salem Creek Consolidated Meadow Company", which includes all the meadow and lowland between Denn's canal and the head of tide-water on Salem creek. The charter gave power to organize by a two-thirds vote, which was done on the 13th day of November, 1869, by choosing a clerk, treasurer, and seven managers, the latter choosing a president out of their number. A contract was made with the American Dredging Company, of Philadelphia, in February, 1872, who completed said work at \$20 per lineal rod, at an aggregate cost of more than \$25,000. The work has been completed, and proves an entire success, opening out a valuable agricultural district and shortening the distance to Philadelphia by water some 40 miles, beside giving a very material increase of fall in tide-water, greatly to the benefit of meadow and lowlands. The first year's export through the canal after completion was some 40,000 bushels of corn, many loads of melons and truck of various kinds, beside imports of over 200 tons of coal, large quantities of lumber and building material, with manures and fertilizers.

The canal since being completed has doubled in size by natural wear, and dirt deposits have been precipitated in the creek till the navigation is destroyed except for small craft. The deposit was removed by those interested in navigation about five years ago, but, filling up again, application was made to the general government, when, after a survey, an appropriation was granted. This canal has cost about \$41,000, and 1,500 boats passed through it in 1880.

PENNSYLVANIA STATE CANALS, PENNSYLVANIA.

As early as 1791 a report was made by a committee of the legislature of the state of Pennsylvania, recommending the improvement of the Delaware, Lehigh, and Lackawanna rivers; a canal from the Schuylkill to the Susquehanna by way of the Tulpehocken and Swatara; the improvement of the Susquehanna, with its north and west branches, and a connection by way of the Sinnamahoning between the west branch of the Susquehanna and the Allegheny river and lake Erie. A portage connection was also proposed from the headwaters of the Juniata to those of the Conemaugh, in order to form a line of communication between the east and west, and a good turnpike was suggested across the summits of the mountains. Nothing, however, was done by the state till about the time that the Erie canal in New York was completed. In 1824 an act was passed authorizing the appointment of commissioners and the exploration of canal routes from Harrisburg to Pittsburgh and the west. The next year another act authorized the surveys of routes from Philadelphia to Pittsburgh, from Allegheny to Erie, from Philadelphia to the northern boundary of the state, toward Seneca or Cayuga lake, and one south to the Potomac river and the proposed Chesapeake and Ohio canal. On the 25th of February, 1826, operations were begun, and the canal commissioners were directed to locate and put under contract a canal on the east side of the Susquehanna river from the mouth of the Swatara to a point opposite the mouth of the Juniata, and one from Pittsburgh to the mouth of the Kiskiminitas, thus commencing the two sections of the main line of communication between Philadelphia and Pittsburgh. They were also authorized to construct the navigable feeder of a canal from French creek to the summit level at Conneaut lake, and to survey and locate a route for a canal from that point to lake Erie. On April 1, 1826, an internal improvement fund was established, the accounts of the fund to be kept separate from other public accounts, and consisted of tolls received, auction duties, and dividends on road, canal, and bridge stocks owned by the state, escheats, and sundry other appropriations. On April 9, 1827, the construction of the Juniata canal as far as Lewiston was authorized, and, on the western division, the construction as far as Blairsville was ordered, with also the construction of the Susquehanna division to Northumberland. By the same act a survey of the west branch and the Allegheny, the north branch from Northumberland to the state line, the Beaver and Chenango from Pittsburgh to Erie, and a rail line from Philadelphia to the Susquehanna was authorized. The construction of the French Creek feeder was ordered, and the canal commissioners were directed to examine a route for a canal from Philadelphia or Bristol up the valley of the Delaware to Carpenter's point, and if the route was practicable to locate and contract for the construction of such portion of it as should not exceed the cost of \$100,000. In

March, 1828, the extension of the canal on the Susquehanna from the mouth of the Swatara to Columbia; from Lewiston to Hollidaysburg, on the Juniata; from Northumberland, along the west branch, to the Bald Eagle; from Taylor's ferry to Easton, on the Delaware; and from Blairsville to Johnstown, on the Conemaugh, was authorized. The construction of the Allegheny Portage railroad and the Philadelphia and Columbia road were also ordered at this date. The construction of the main lines of communication between the east and west and the coal-fields in the northern part of the state and the markets of New York, Philadelphia, and Baltimore having been determined upon, the work was pushed with vigor. Money was abundant, and the credit of the state unimpaired; so that there was but little difficulty in obtaining funds for the prosecution of the work. Public opinion was strongly in favor of an extended system of internal improvements, and it was thought the connection of the eastern and western waters of the state would materially advance the commercial interests of Pennsylvania and prove a source of revenue. If the works undertaken had been less extensive, and had in the beginning been confined to the main line between Philadelphia and Pittsburgh, with perhaps the Delaware division included, and these lines had been constructed and managed with a strict regard to the public interest and economy, the anticipation of the people might have been realized. Tanner, in his *Connected View of Internal Navigation of the United States*, published in 1834, gives the following list of state works :

	Miles.
Central Division canal	171.75
Western Division canal	104.00
Susquehanna Division canal	39.00
West branch.....	65.75
North branch	75.48
Delaware division.....	59.75
Pittsburgh and Erie, with French Creek feeder.....	73.40
<hr/>	
Total canals.....	589.13
Columbia railroad.....	81.60
Allegheny Portage railroad.....	36.69
<hr/>	
Total.....	707.42
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From 1828 to 1836 repeated loans were authorized and heavy appropriations were made for the prosecution of the public works to completion, and some new surveys were made and further extensions ordered, among them a road from Gettysburg to connect with the Chesapeake and Ohio canal near Williamsport, for which \$200,000 was appropriated and the work immediately begun, but the road was never completed. The career of lavish expenditures was at last checked. The alarming increase of the state debt, the enormous excess in the cost in completing many of the works above the estimates of the engineers, and the failure in many cases of the finished lines to pay expenses and repairs, became subjects of serious consideration, and retrenchment was demanded. The work on some of the lines was suspended, and finally, in 1840, the state finances were in such a condition that the further prosecution of the public works was suspended.

It has been seen that canals were brought into use from 1830 to 1834, and the railroads in 1833-34. The Erie extension was transferred to the Erie Canal Company in 1845, and in 1870 the Pennsylvania Railroad Company bought a controlling interest in the canal and kept it open till the fall of 1871, when it was abandoned. The main line was sold to the Pennsylvania Railroad Company in 1857 for \$7,500,000, and the lateral canals to the Sunbury and Erie Railroad Company in 1858 for \$3,500,000.

The Sunbury and Erie company afterward sold the several canals as follows :

The upper and lower North branch divisions to the North Branch Canal Company, for	\$1,600,000
The west branch and Susquehanna division to the West Branch and Susquehanna Canal Company, for...	500,000
The Delaware division to the Delaware Division Canal Company, for	1,775,000
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Making a total amount of	3,875,000
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The North Branch Canal Company afterward sold that portion of the canal between Northumberland and Wilkesbarre to the Wyoming Canal Company, and the payments were made as follows :

By the North Branch Canal Company.....	\$590,000
By the Wyoming Canal Company.....	1,010,000

CANALS OF THE UNITED STATES.

The Wiconisco canal was transferred to a private company when yet incomplete. It cost the state nearly \$400,000, and took \$81,836 to complete it. The cost of these works to the state was, at the time of this transfer, given as follows:

Columbia railroad	\$5,277,278
Eastern Division canal	1,737,285
Juniata Division canal	3,575,966
Allegheny Portage railroad	2,708,672
Western Division canal	3,173,434
Total main line.....	16,472,633
Eric Extension canal	\$5,533,291
Susquehanna Division canal.....	897,160
West Branch Division canal.....	1,833,183
North Branch Division canal.....	1,623,117
Upper North Branch Division canal.....	5,643,491
Delaware Division canals	1,543,763
Total.....	17,074,005
Wiconisco	393,440
Making a total cost of the transferred works of.....	33,940,078

Some \$6,000,000, it is said, was expended on abandoned works, and about \$500,000 on bonds guaranteed by the state, and the difference between net earnings and interest paid was placed at about \$30,000,000; so that the total expense of these works to the state was not far from \$70,440,078, while she realized scarcely one-sixth of that sum. The present company, operating the canal in the interests of the Pennsylvania railroad, report the cost of the canals under their control at \$7,731,750, with \$4,501,200 of capital invested, a funded debt of \$3,090,000, and a floating debt of \$118,208. There were 515 boats employed on these canals, averaging 100 tons each.

STATEMENT OF THE REVENUE AND EXPENSES OF THE MAIN LINE OF THE PUBLIC WORKS OF PENNSYLVANIA FROM 1830 TO 1857, WHILE UNDER STATE CONTROL.

[NOTE.—The mileage and cost refer to the year 1857.]

Year.	Columbia railroad (81 miles; cost, \$5,277,278).		Eastern division of canal (46 miles; cost, \$1,737,285).		Juniata division of canal (127 miles; cost, \$3,575,966).		Allegheny Portage railroad (41 miles; cost, \$2,708,672).		Western division of canal (104 miles; cost, \$3,173,434).		Total of main line (399 miles; cost, \$16,472,635).*	
	Revenue.	Expenses.	Revenue.	Expenses.	Revenue.	Expenses.	Revenue.	Expenses.	Revenue.	Expenses.	Revenue.	Expenses.
1830.....			\$10,356	\$7,761		\$17,323			\$15,393	\$55,642	\$25,749	\$80,726
1831.....			17,685	10,895	\$4,492	53,172			12,999	66,901	35,176	130,968
1832.....			20,599	8,688	7,205	31,645			9,313	144,923	37,117	184,656
1833.....	\$5,003		49,737	19,633	15,331	34,303			25,437	59,631	95,508	113,567
1834.....	40,240		79,260	18,657	56,169	35,298		\$5,482	60,746	83,508	236,415	142,945
1835.....	183,610	\$163,691	142,854	19,274	70,078	41,722	\$97,740	98,744	103,300	59,754	597,672	383,185
1836.....	260,658	288,989	158,971	16,472	56,862	33,971	153,171	132,538	123,223	30,163	752,890	501,533
1837.....	353,566	403,997	136,379	49,300	79,436	46,855	148,523	158,038	132,523	75,769	850,477	733,969
1838.....	390,636	197,201	122,746	94,938	71,327	38,874	153,069	148,648	108,760	63,838	846,538	543,409
1839.....	389,974	264,287	166,564	32,142	75,140	41,818	151,330	141,867	146,480	23,941	923,488	504,045
1840.....	445,552	550,238	165,393	63,403	106,327	111,772	167,266	267,333	123,356	92,937	1,007,884	1,085,683
1841.....	411,537	339,170	146,188	35,188	88,178	53,660	145,435	133,799	117,049	43,743	902,387	605,500
1842.....	345,032	340,208	117,189	27,684	87,838	88,365	116,340	120,175	87,218	25,952	758,676	602,604
1843.....	369,496	288,503	108,748	30,693	87,768	58,363	175,476	159,920	99,603	22,098	841,091	559,577
1844.....	416,318	261,382	152,969	27,485	88,649	53,210	169,603	208,137	115,322	43,625	942,861	593,899
1845.....	418,502	209,596	117,363	25,593	70,379	63,773	160,212	189,757	144,580	18,839	911,036	507,558
1846.....	488,243	219,752	126,725	69,983	78,007	52,755	200,342	190,321	141,497	27,160	1,034,814	499,971
1847.....	564,356	246,377	160,653	46,844	67,312	59,959	232,587	160,290	205,514	25,258	1,230,422	538,728
1848.....	554,191	261,409	161,856	21,953	61,164	224,439	219,143	220,181	188,296	66,325	1,184,650	794,307
1849.....	571,589	322,904	196,456	43,616	68,793	94,544	218,470	205,702	183,412	63,762	1,238,720	730,528
1850.....	621,576	340,802	190,568	31,941	68,000	93,241	242,521	329,025	191,908	44,403	1,342,601	839,417
1851.....	653,268	338,659	117,723	60,626	63,484	93,940	234,532	341,325	160,055	59,611	1,229,062	894,461
1852.....	820,640	320,887	129,708	46,773	65,002	89,186	310,011	336,007	127,054	64,376	1,452,415	857,292
1853.....	716,242	422,631	141,854	53,183	59,478	100,356	224,627	507,508	161,278	78,975	1,303,479	1,162,653
1854.....	821,525	390,761	133,726	51,294	49,327	90,112	78,025	338,391	96,407	75,809	1,179,010	945,867
1855.....	857,059	442,188	132,048	59,448	48,383	85,493	18,150	256,458	62,577	72,294	1,118,217	915,831
1856.....	953,034	448,557	151,664	54,577	45,457	85,115	20,047	193,804	52,741	58,322	1,222,973	840,375
1857.....	648,655	368,101	55,632	43,351	21,552	94,535	11,982	82,850	24,442	50,913	762,263	639,750
	12,300,552	7,429,940	3,405,632	1,071,595	1,661,218	1,967,834	3,648,611	4,866,290	3,048,578	1,597,372	24,064,591	16,933,031
		‡ 68,193				‡ 337,546		10,044				415,783
Total.....	12,300,552	7,498,133	3,405,632	1,071,595	1,661,218	2,305,380	3,648,611	4,876,334	3,048,578	1,597,372	24,064,591	17,348,814

* Not including state tax on the tonnage of the Pennsylvania railroad.

† The revenue and expenses from December 1, 1835, to July 31, 1857.

‡ Damages by sparks from locomotives.

§ Cost of repairing the Huntingdon breach, 1838.

OPERATING CANALS.

STATEMENT OF THE REVENUES AND EXPENSES OF THE LATERAL CANALS OF THE STATE OF PENNSYLVANIA FROM THE COMPLETION OF THE SEVERAL WORKS TO THE DATE OF THEIR SALE AND TRANSFER.

[NOTE.—The mileage and cost refer to the year 1857.]

Year.	Delaware division (60 miles; cost, \$1,543,763).		Susquehanna division (41 miles; cost, \$897,160).		North Branch division (73 miles; cost, \$1,623,117).		West Branch division (76 miles; cost, \$1,833,183).		Beaver division (30 miles; cost, \$519,364).		French Creek division (49 miles; cost, \$817,779).		Total of lateral canals (329 miles; cost, \$7,234,366).	
	Revenue.	Expenses.	Revenue.	Expenses.	Revenue.	Expenses.	Revenue.	Expenses.	Revenue.	Expenses.	Revenue.	Expenses.	Revenue.	Expenses.
1880.....		\$9,365		\$8,379		\$15,277		\$2,166				\$2,060		\$37,247
1881.....	\$599	76,525	\$2,215	16,322		49,067		21,270						\$3,114
1882.....	8,043	51,715	5,748	65,056		27,654		25,866						13,791
1883.....	44,825	78,354	7,671	77,094	\$3,416	23,217		28,116				7,913		55,912
1884.....	57,135	46,049	11,431	43,278	3,915	48,083		30,158	\$555		\$336	17,539		73,372
1885.....	56,281	27,498	16,083	12,067	5,721	24,062	\$5,496	26,000	2,221	\$3,194	884	19,100		86,686
1886.....	57,175	40,630	13,029	2,155	9,824	9,528	3,992	36,116	504	32,265	388	30,229		84,912
1887.....	90,155	28,096	16,296	10,321	10,850	13,412	4,708	32,443	1,784	28,190	1,079	19,065		124,872
1888.....	72,133	39,782	20,701	17,702	8,816	15,903	9,300	39,199	1,202	11,139	555	10,107		112,797
1889.....	98,240	82,410	22,260	4,201	10,181	11,810	12,852	19,834	2,032	7,140	981	4,000		146,555
1890.....	111,735	85,750	30,127	32,886	14,165	110,079	28,003	72,926	3,192	49,740	645	16,263		187,867
1891.....	64,975	100,339	26,692	17,084	29,669	79,425	24,952	57,782	6,379	24,873	340	8,383		153,007
1892.....	73,228	145,493	17,460	42,435	39,590	84,075	16,043	38,663	6,580	12,084	516	4,585		153,417
1893.....	109,845	17,505	10,775	22,001	33,094	28,814	18,518	33,148	6,078	10,360		2,592		178,308
1894.....	114,556	49,044	19,652	32,704	51,031	29,234	29,089	30,768	6,586	27,385		796		221,464
1895.....	111,452	39,951	21,214	26,514	80,219	35,000	29,477	15,802	1,251	3,072	97	1,210		243,710
1896.....	164,203	44,010	23,632	43,513	89,269	30,347	45,156	22,762						322,260
1897.....	164,153	16,187	25,909	18,044	124,184	36,279	43,329	18,989						357,575
1898.....	180,223	19,589	26,262	15,230	120,842	11,505	58,578	58,827						365,905
1899.....	202,505	28,053	27,264	11,646	116,552	22,182	43,820	70,247						390,141
1890.....	200,719	43,265	26,073	14,406	102,026	26,233	42,500	31,672						371,318
1891.....	256,213	49,357	32,422	23,368	149,693	26,407	52,642	30,398						490,960
1892.....	260,037	40,097	33,548	32,077	136,621	28,962	55,951	33,844						480,157
1893.....	247,919	86,847	38,928	25,620	234,590	26,889	68,329	54,206						589,766
1894.....	377,663	75,979	42,236	27,747	225,072	45,245	62,816	29,798						708,087
1895.....	392,673	71,091	75,623	39,604	251,992	47,699	80,901	36,109						807,249
1896.....	349,222	83,159	64,662	45,234	270,355	53,293	91,658	29,249						776,027
1897.....	224,329	60,730	59,368	52,978	162,081	57,377	64,035	87,068						509,813
1898.....	32,141	26,117	6,712	25,114	17,321	26,573	14,160	30,269						70,334
Total ..	4,123,377	1,572,550	724,092	806,640	2,301,979	1,044,381	892,995	1,043,695	38,312	210,360	5,821	143,911		8,086,576

DELAWARE DIVISION CANAL, PENNSYLVANIA.

The Delaware Division canal was constructed by the state of Pennsylvania and completed from Bristol to Easton in October, 1830, at a cost of \$1,275,715. The Lehigh slack-water navigation was opened for use at the close of June, 1829, but it appears that very little traffic passed to the Delaware division for nearly three years after this date, as the contractors were allowed to use improper materials in its construction, and when completed it would not hold water; besides, the locks were only one-half as wide as those on the Lehigh, which also proved a detriment to the canal, and caused the failure of eight dividends to the Lehigh company, as they were obliged to continue the use of temporary boats, which were very expensively moved on their canal. The Delaware Division canal was operated by the state till 1858, when, on April 21, "an act for the sale of the canals of the state to the Sunbury and Erie Railroad Company" was passed by the state legislature.

The same act authorized the organization of the Delaware Division Canal Company, and letters-patent were issued by the governor on the 14th of July, 1858. The sum paid was \$1,775,000, and a large share of the purchase, money was paid in the bonds of the new company, secured by a mortgage on its works. It was enlarged in 1860 to its present size, to correspond with the Lehigh Navigation. The Delaware Division canal was leased to the Lehigh Coal and Navigation Company for ninety-nine years from April 1, 1866, at 4 per cent. on its capital stock, which is \$1,633,350, and 6 per cent. on its bonded debt, which is \$800,000, the total rental equaling \$113,334. The cost of the canal and fixtures up to 1880 was \$2,433,350, and the value of the real estate held by the company, exclusive of the canal, is estimated at \$5,000,000. The canal is 60 miles long, and the prism is 44 by 26 by 6 feet. It has 24 lift, 8 stop, and 1 guard-lock, 18 waste-ways, 12 overflows, measuring 1,500 feet, 88 bridges, and 10 aqueducts with 641 lineal feet of superstructure, and the feet of lockage is given at 165 feet.

CAPITAL STOCK.

Capital authorized by law.....	\$2,400,000
Capital paid in.....	\$1,633,350
Number of shares issued.....	32,667
Par value of each share.....	\$50

DEBT.

Total amount of floating and funded debt.....	\$800,000
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THE SCHUYLKILL NAVIGATION COMPANY, PENNSYLVANIA.

This company was incorporated by an act of the assembly of the state of Pennsylvania on March 8, 1815; so that in point of years it is one of the oldest of the organizations of this nature in the state, and may be classed among the most successful of the water routes tapping the anthracite coal regions of Pennsylvania. Soon after the organization of the company under its charter preliminary surveys were made and a small amount of work was done in 1816, and in 1818 a portion of the line was completed, as tolls are reported for that year amounting to \$233. In the report for the year 1821, the first one made, the president announced that "the navigation was completed from John Potts', at the coal mines, to within half a mile of Hamburg, below the mountains, and within 16 miles of Reading", and he states that some coal had been brought down from the mines to the neighborhood of Hamburg. This was the first recorded movement of coal on this line, though the production in this region dates back a few years, and the movement may have been included in the statements of traffic on the upper part of the line beginning as far back as 1818.

The following table shows the traffic and income of the company previous to 1822:

Year.	Tolls.	Rents.
1818.....	\$233	\$15
1819.....	1,202	60
1820.....	803	325
1821.....	1,792	426

Below Reading, Pennsylvania, the company had been busy building dams and locks and digging canals, with the intention of making the Schuylkill navigable, but nothing is said of traffic on this part of the route. It appears that the use of anthracite coal was still an experiment, and the president, at the close of his first report, says, by way of encouragement to the stockholders, that—

The daily experiments for the introduction of this fuel into the houses of our citizens, its applicability to all the purposes of manufacture, and the extensive purchase which has been made by a number of respectable citizens of New York of coal land at the head of the Schuylkill for the purpose of establishing a coal company for the supply of that city, warrant the belief that to meet the demand which both objects will create will require all the industry of those engaged in transportation on the river, and must necessarily give the company an ample remuneration for the cost of the works.

The reports in 1826 show that the canals were so far completed as to furnish uninterrupted water communication between Mount Carbon and Philadelphia during the previous year. The works as then constructed were 108 miles long, extending from the Lancaster Schuylkill bridge, Philadelphia, to Mount Carbon, and consisted of 62 miles of canal and 46 miles of pool navigation, and overcame a fall of 588 feet by means of 120 locks. The depth of water in the canals at this time was 3 feet, and the carrying capacity of the boats employed was 25 tons.

The company kept pace with the growth of the coal trade, and in the years that followed the whole work was changed. In 1832 an enlargement was made admitting boats of 80 tons. In 1846-'47 it was extended from tide-water at Fairmount dam, in Philadelphia, to Port Carbon, a distance of 108.23 miles, consisting of 50.5 miles of slack-water and 58.18 of canal navigation, and overcame a fall of 618.53 feet by seventy-one locks. The minimum depth of water was made 6 feet, and the average tonnage of its boats reached 170 tons. The amount of coal carried over the company's works in the year of their completion (1825) was 6,500 tons, and the total revenue from tolls thereon amounted to the modest sum of \$9,700, the total income from all sources in that year being \$20,485.91. The first dividend, however, was not declared till 1830, and amounted to \$3 50 per share. After this date, owing to the rapidly increasing coal trade and to the fact that the company had but little competition in the business, they were enabled for some years to pay very handsome dividends, and the value of their stock in the market had risen to three and one-half times its nominal value; a figure far beyond anything then known in the history of joint-stock operations in this country. Things went on thus happily until the completion of the Philadelphia and Reading railroad branch from the falls of the Schuylkill to Port Richmond in 1842, making direct connections with the coal regions by way of the Reading and Mount Carbon railroads, which were consolidated at that time, thus bringing into the field a formidable competition for this traffic, the profits of which had so long enriched the navigation company. It was soon found that, in order to retain any important share of the trade, they would be obliged to enlarge the capacity of their canal, and this was done in the years 1846-'47. From the time this sharp competition began, in 1842, dates the embarrassment of the company, which was increased by the enlargement of the canal; so that it appears no dividends were declared till 1853. In 1847 the earnings were not sufficient to pay the interest on the company's loans, and, having a large floating debt, they were compelled to fund it by issuing loan certificates at 50 cents on the dollar, which, with the enlargement expenses, increased the liabilities from \$4,000,000 to \$8,400,000. The affairs of the company were somewhat improved during the following years, and the payment of interest on the loans of the company was resumed. In September, 1850, a great flood swept the Schuylkill valley, and, when the waters had subsided, for miles along its line not a trace of the canal existed.

Dams, locks, tow-paths, and banks were swept away, and yet the management of the company by the 1st of April, 1851, opened the season with repairs completed. They were, however, again unable on this account to meet the interest on loans, and to protect the rights of creditors and to relieve the company from embarrassment an act was passed on April 7, 1852, for the readjustment of its affairs. The liabilities of the company at that time were \$10,260,814. By the terms of reorganization the loan prior to 1845 was to be extended to 1872 and a new mortgage created as a security for a loan of \$4,000,000, payable in 1882, in which each creditor agreed to convert 65 per cent. of his claim and take the balance in preferred stock, while the interest on the old mortgage loans was to be paid in cash, and the certificates of the loan were to bear interest from July 1, 1852. Dividends were declared in preferred stock from 1853 to 1856; again in 1860 the board of managers were authorized to declare a dividend of 6 per cent. on preferred stock, and were directed to discharge \$240,070 in charges on the books for discount on the improvement bonds of 1870. At the same time they authorized a loan of \$180,000 at 6 per cent., principal redeemable in 1876, with which the dividend was paid.

Steam-towing was tried upon the canal at this date, but was abandoned. In 1861 a contract was made with the Mine Hill and Schuylkill Haven railroad, to continue for ten years, which placed the company in a position to secure a fair proportion of the coal trade of the Schuylkill region. Previous to this date the tributary roads from the mines to the great trunk lines of the Schuylkill navigation canal and the Philadelphia and Reading railroad had been owned and managed by separate companies, whose policy and management of rates had been more inflexible than those of the main lines. The Philadelphia and Reading road succeeded in obtaining a lease of the Mill Creek and the Schuylkill Valley roads and the incompleting works of the Broad Mountain and Mahanoy railroad, which was really an extension of the Mill Creek road. The navigation company, to protect their future interests, secured a like contract over the Mine Hill and Schuylkill Haven road, which had been the source of a large proportion of their coal tonnage during the years preceding this date. Owing to a general depression of the coal trade in 1861, the balance of the income and expense account was only \$72,727 26 after interest on loans, bonds, and mortgages was paid. Dividends were declared on common and preferred stock in 1866 and 1867. In 1868 sharp competition and low prices for coal almost suspended operations in the Lehigh and Schuylkill region, and the tonnage for this year was materially reduced. From July to September tolls were \$124,000 less than during the same period in 1867. In 1869 the total tonnage was 204,681 tons less than in 1868, and the company was troubled by low water and, later in the season, by a very heavy flood, doing damage to their works amounting to \$57,295. The supply of coal was limited, owing to strikes among the miners; but notwithstanding these unusual embarrassments, affecting the business of the company, its income was sufficient to pay all expenses and interest and leave a surplus of \$3,073 in the hands of the treasurer. The Philadelphia and Reading Railroad Company in 1870 leased the canal, corporate rights, and franchises of the Schuylkill Navigation Company for a term of nine hundred and ninety-nine years, at a yearly rental of \$655,000, payable quarterly.

The number of shares issued and outstanding December 31, 1880, was as follows: Common stock, 17,182; preferred stock, 64,019. The par value of each share is \$50, and the average market value during 1880 was \$5 75 for common and \$11 50 for preferred; the par value, however, amounted to \$4,060,086, including thirty-six-fiftieths of common stock scrip. The total funded debt of the company amounted on December 31, 1880, to \$3,520,321, and the floating debt to \$141,748; the cost of the company's works, estates, and equipments, as charged on their books, was \$12,580,461.

The length of the main line of canal and slack-water from Mill creek to Callowhill-street bridge, Philadelphia, is 108.23 miles, and the channel varies from 60 to 300 feet, with a minimum width on the bottom of curves of 45 feet, and on straight lines of 40 feet, while the depth of water is 6½ feet. The locks are 110 by 18, and the guard-locks 112 by 24, and are as follows: Number of locks: lift, 47; guard, 7; guard, with lift, 17; total, 71. The lockage on the main line of the canal is 618.63 feet. The number of waste-ways is 47, overflows 2, with 3,300 feet in both; the number of bridges, 121; culverts, 22; dams, 31; aqueducts, 12, with 836 lineal feet of aqueduct superstructure.

LEHIGH COAL AND NAVIGATION COMPANY, PENNSYLVANIA.

During the year 1793 a company was incorporated for the purpose of working the Lehigh coal-fields. Purchases of land were made, and £10 was appropriated to open the necessary outlet to the Lehigh river and to a market. A road from the mines to the landings, a distance of 9 miles, was constructed. Many fruitless attempts were made to get coal over this nominal road and by the Lehigh river, which, in its unimproved state, defied the floating of a canoe over its rocky bed in seasons of low water.

The Lehigh Coal Mine Company at last became tired of the experiment, and for a time the objects of the company were abandoned. In the mean time they endeavored to get the navigation of the Lehigh improved, and several laws were passed by the commonwealth without effect. In December, 1813, the company made a lease for ten years of their lands, the whole consideration of the lease to be the annual introduction into market of 10,000 bushels of coal for the benefit of the lessees. Five ark loads of coal were dispatched from the landing at Mauch Chunk, two of which reached Philadelphia, the others having been wrecked in their passage. Four dollars

CANALS OF THE UNITED STATES.

per ton was paid to a contractor for the hauling of this coal from the mines to the landing over the road above referred to, and the contractor lost money. The principal part of the coal which arrived at Philadelphia was purchased at \$21 per ton; but even this price did not remunerate the owners for their losses and expenses in getting the coal to market, and they were compelled to abandon the prosecution of the business. In 1818 the legislature granted the privileges of the "act to improve the navigation of the river Lehigh". Great diversity of opinion soon appeared. Some were willing to join in the improvement of the navigation, but had no faith in the value of the coal, or that a market could ever be found for it among a population accustomed wholly to the use of wood. On the other hand, some were of the opinion that the navigation would never pay the interest of its cost, while the coal business would prove profitable. This gave rise to the separation of the two interests, and on the 10th of August, 1818, the Lehigh Navigation Company was formed. On the 21st of October of the same year the Lehigh Coal Company was formed, and in April, 1820, the two companies were consolidated under the title of the Lehigh Navigation and Coal Company. Three hundred and sixty-five tons of coal were sent to Philadelphia as the first fruits of the concern, and this amount so completely stocked the market that it was with difficulty disposed of in the year 1820. On the 1st of May, 1821, a new arrangement of the whole concern took place, the title of the company being changed to the Lehigh Coal and Navigation Company, and during that year 1,073 tons of coal were sent to Philadelphia. The unincorporated situation of the company, now that its operations were becoming more extensive, caused uneasiness among the stockholders, and to remedy all difficulties application was made to the legislature, who, on the 13th of February, 1822, granted the act of incorporation under which the company is now operating. In this year the capital stock of the company was increased, and 2,240 tons of coal were sent to market. The boats used on this descending navigation consisted of square boxes, or arks, from 16 to 18 feet wide and from 20 to 25 feet long. At first two of these were joined together by hinges, to allow them to bend up and down in passing the dams and sluices; and as the men became accustomed to the work, and the channels were straightened and improved as experience dictated, the number of sections in each boat was increased, until at last their whole length reached 180 feet, and they were steered with long oars, like a raft. Boats of this description were used on the Lehigh till the end of the year 1831, when the Delaware division of the Pennsylvania canal was partially finished. These boats made but one trip, and were then broken up in the city and the plank sold for lumber, the spikes, hinges, and other iron work being returned to Mauch Chunk by land, a distance of 80 miles. The hands employed in running these boats walked back for two or three years, when rough wagons were placed upon the road to carry them at reduced fares. In 1823, 5,823 tons of coal were sent to market, of which about 1,000 tons remained unsold in the following spring, wood still being largely used for domestic purposes. At this date the stock of the company was increased to \$500,000. In 1825 the demand for coal increased so much that 28,393 tons were sent down the Lehigh, and the coal trade was commenced on the Schuylkill by sending down 7,143 tons. In 1826 there were 31,280 tons of coal sent down the Lehigh. The descending navigation by artificial freshets on the Lehigh is the first on record which was used as a permanent thing. In 1827 the Mauch Chunk Gravity railroad, the second railroad in the United States, was completed. In the same year, the state having determined upon the construction of the Delaware division of the Pennsylvania canal, the company concluded to commence the construction of slack-water navigation, which was completed in 1829, with an available depth of 5 feet. The Gravity road to the Room Run mines was commenced in 1831, and the extension of the works of the company to the Beaver Meadow region was commenced in 1835 and completed in 1838.

The Lehigh and Susquehanna railroad was commenced in 1837 and completed in 1840. In 1841 the company's works were greatly injured by freshets, and the cost of repairing them and of enlarging the canal to a depth of 6 feet involved the company in embarrassment, which resulted, in 1842, in placing the property in trust for the benefit of its creditors. It appears that no dividends were paid from January 1, 1840, to July 1, 1852; but in that year 6 per cent. was paid, and at the same rate, and for each year, from that time to 1861, as provided in the mortgage of 1842. They were relieved from embarrassment, and the net earnings for fifteen years previous to 1860 were \$8,053,663, the dividends paid in the mean time being \$1,101,365, and the balance, after the payment of interest, went to the profit and loss account. The Lehigh Coal and Navigation Company owns the Lehigh and Susquehanna railroad, 155.70 miles, and the Trescow railroad, 6.59 miles, and lease the Nesquehoning Valley railroad, 17.62 miles. These roads are leased by the Lehigh Coal and Navigation Company to the Central Railroad Company of New Jersey for 33½ per cent. of the gross earnings. The Lehigh and Lackawanna railroad, 25 miles, is leased to the Lehigh Coal and Navigation Company, and operated by the Central Railroad Company of New Jersey at cost, the net earnings being paid to the Lehigh and Lackawanna Railroad Company.

The Delaware Division canal was leased to the Lehigh Coal and Navigation Company on April 1, 1866, at 4 per cent. on its capital stock, which is \$1,633,350, and 6 per cent. on its bonded debt, which is \$800,000. The cost of the Lehigh canal and fixtures was \$4,455,000 up to 1880. The value of real estate held by the company, exclusive of the canal, is about \$2,000,000. The capital paid in up to 1880 was \$10,259,250, and the number of shares issued 205,185, valued at \$50 per share. The amount of the funded debt, as per last report, was \$15,565,151, and the floating debt was \$800,796. The length of the main line of canal from Coalport to Easton is 48 miles, the prism

60 by 45 by 6 feet, and the length of locks 100 by 22 feet. There are 49 lift-locks, 2 stop-locks, 5 guard-locks, and 1 weigh-lock, making a total of 57 locks. The lockage on the main line is about 375 feet. The number of wasteways is 4 and overflows 36, of 3,600 lineal feet; the number of bridges, 10; culverts, 21; dams, 9; and aqueducts 4, of 285 lineal feet of superstructure.

The traffic on the Lehigh and Delaware Division canals for 1880 was as follows:

	Tons.
Lumber	25,001
Anthracite coal	483,850
Bituminous coal	3,105
Pig-iron	22,673
Castings	2,327
Iron ore	60,177
Lime and limestone	59,138
Agricultural products	18,227
Manufactures and merchandise	7,457
Other articles	37,427

UNION CANAL COMPANY, OF PENNSYLVANIA.

This company was incorporated by an act of the legislature of Pennsylvania on April 2, 1811. Previous to this two separate companies had been formed for the object of uniting the Schuylkill and Susquehanna. One was called the Schuylkill and Susquehanna Navigation Company, organized in 1791, and the other the Delaware and Schuylkill Canal and Navigation Company, organized April 10, 1792. The interest of the two companies being identical, they were finally consolidated.

The war of 1812 put a stop to the work of construction, and it was not resumed until 1821. The main canal was finally completed in December, 1827. In 1828 the Pine Grove branch was commenced as a feeder, and later carried 22 miles from its connection up into the coal regions. This branch was completed in 1832, and coal movements began in the following year. The canal was originally constructed for boats of 25 tons; but in 1850 an enlargement was begun and completed from Middletown to and including the branch, 52 miles in all, admitting the passage of 80-ton boats. In 1855 the eastern division was enlarged; and to complete this enlargement bonds for \$2,500,000 were issued, payable in thirty years. The business did not increase as expected, and the company in 1856 being unable to meet its interest, the canal was surrendered to the mortgage trustees in November, 1858. The enlargement gave the canal the capacity of the state canals, 36 by 4 feet.

There is a lockage of 501 feet, with 88 lift-locks, 3 guard-locks, and 2 weigh-locks, making a total of 93 locks. The tonnage has ranged from 18,124 tons, in 1828, to 205,517 tons in 1858, and 29,853 tons in 1880. Some 20 miles of the branch has been abandoned.

The capital of this company was \$2,907,850 in 1880, with a funded debt of \$3,000,000 and a floating debt of \$93,000.

There were 73 boats, averaging 100 tons, employed on this canal.

SUSQUEHANNA AND TIDE-WATER CANAL, PENNSYLVANIA AND MARYLAND.

This canal was originally chartered as two companies. The Susquehanna Canal Company was incorporated by an act of the Pennsylvania legislature on April 15, 1835. The act of March 21, 1836, granted the right to cross the river at Columbia, and that of January 25, 1838, gave the right to borrow money and pledge mortgage. The act to incorporate the Tide-Water Canal Company was passed by the legislature of Maryland in December, 1835; that fixing the terminal point at Havre de Grace in May, 1836; that limiting the capital stock to \$600,000, and one authorizing an increase to \$1,000,000, were of later date in this same year. The canal was about three-fourths finished in 1839. Under the Pennsylvania charter \$1,500,000 were subscribed, and when the Tide-Water Canal Company was chartered by the legislature of Maryland the Pennsylvania company subscribed the entire stock of the Maryland company, securing one ownership. The canal was completed in 1840, and the total receipts for that year were \$41,588.

This canal is in fact a prolongation of the great chain of Pennsylvania canals that cost the state so much money. It was looked upon as the only channel by which merchandise could reach Philadelphia without transshipment, as the Union canal, which ran smaller boats, required a transfer. At Columbia connection was made with the railroad then in operation, and great expectations were held in regard to this short connection in the Pennsylvania system, extending to Pittsburgh, 269 miles.

In 1872 the Pennsylvania and Reading Railroad Company leased the canal for a term of nine hundred and ninety-nine years at a fixed rental, equal to the interest accruing annually on the bonded debt of the company and

one-half of the net earnings of the canal, which was guaranteed to equal 3 per cent. on the capital stock at least. They also agreed to pay \$7,000 annually to keep up the corporate organization. Since that date tolls and tonnage have declined. The following table shows the movement and receipts for the past eighteen years:

Year.	Tonnage.	Tolls.	Year.	Tonnage.	Tolls.	Year.	Tonnage.	Tolls.
1863.....	507, 884	\$214, 115	1869.....	493, 671	\$165, 678	1875.....	430, 846	\$95, 830
1864.....	527, 805	278, 344	1870.....	483, 235	134, 138	1876.....	484, 317	101, 268
1865.....	325, 029	189, 980	1871.....	501, 674	144, 098	1877.....	433, 734	78, 019
1866.....	512, 505	234, 659	1872.....	426, 393	90, 150	1878.....	348, 560	71, 959
1867.....	413, 877	154, 589	1873.....	325, 083	87, 697	1879.....	371, 625	44, 718
1868.....	493, 586	152, 780	1874.....	420, 156	101, 797	1880.....	362, 295	53, 630

This company has \$2,002,746 invested, with a funded debt of \$2,898,310, and a floating debt of \$186,904.

MONONGAHELA NAVIGATION COMPANY, PENNSYLVANIA.

The proposition for the improvement of the Monongahela by locks and dams was made in a report of E. F. Gay, chief engineer, in 1828. Nothing was done, however, until 1832, when an effort was made in Congress to have it done by the national government under the act of 1824 for the improvement of the Ohio. Congress provided for the survey, and the engineer in charge planned for eight locks, 4½ feet lift, excepting No. 1, which was to have 6 feet lift. A public meeting at Waynesburg, in November, 1835, urged the improvement by the state, as Congress had declined further aid. The movement was at once seconded by the citizens of Pittsburgh and Brownsville, and legislation was sought and obtained.

The Monongahela Navigation Company was authorized by act of assembly of March 31, 1836. It was to make a slack-water navigation from Pittsburgh to the Virginia state line, and as much further as Virginia would allow it to go. The capital stock was to be \$300,000, in shares of \$50 each. The height of the dams was not to exceed 4½ feet.

Enough stock was subscribed to secure the charter early in 1837, when the company was organized. In chartering the United States bank the state required it to subscribe \$50,000 to the stock of the company on opening its books, and \$50,000 more when \$100,000 should have been subscribed by other parties and expended on the work. The company started in 1837 with \$258,100 subscribed, and this, until its works were completed, formed the base of its capital. After organizing and calling in some of the subscriptions, a careful survey was made. It was found that the distance from Pittsburgh to Brownsville was 55½ miles, and the ascent a little over 33½ feet; from Brownsville to the Virginia state line was a little over 35 miles, with an ascent of 41 feet, making 90½ miles, with 74½ feet to overcome, which would have required seventeen dams of 4½ feet. This was found impracticable, and accordingly the legislature authorized dams of 8 feet from pool to pool. By an authorized increase of one of the dams to 10 feet it was found that seven dams would answer. No. 1 dam, at Smithfield-street bridge, Pittsburgh, was let in December, 1838; No. 2, at Braddock's upper riffle, ten miles up-stream, was let in May, 1839. These two dams and locks were put in use in October, 1841. Lock and dam No. 3, at Watson's run, two miles above Elizabeth, was let in July, 1840, together with No. 4, fifteen miles below Brownsville. Lack of funds caused a suspension of work on these locks and dams in 1841. In 1842 the United States bank broke and failed to subscribe and pay its second \$50,000, and the state had to give bonds for a large portion of its \$100,000 subscription, which was sold at a loss of one-half. Many individuals resisted payment, and the company was over \$40,000 in debt. The works needed repair, and there was no money for it, and the state was not able to assist in any way. In 1842 an earnest effort was made to induce capitalists of Baltimore to replenish the company's treasury so as to enable it to carry improvements to Brownsville, and thereby make a connection with the Baltimore and Ohio railroad, which about this time was nearing Cumberland. This failed, and, to add to the embarrassment of the company, a breach of 100 feet was made in dam No. 1 in July, 1843, which became a very bad affair before it could be repaired. The company's credit was gone, and for two years the work made no progress.

The financial condition of the state became so depressed that the sale of all of its stock was ordered, and among them \$125,000 in this company. A number of capitalists, having faith in the improvement, bought this stock and went energetically to work to complete the works, and by November 13, 1844, repairs were completed. At the close of 1847 \$517,225 had been expended. Current revenues were hardly adequate to keep down current expenses and pay interest on old debts, but at this date a change for the better took place, and the revenues were almost doubled. Before the work had been completed to Brownsville the Baltimore and Ohio railroad had been built to Cumberland, 75 miles distant, over the national road, on which were "first-class accommodations for man and beast". The Pennsylvania railroad did not reach Pittsburgh until 1852. Here were eight years of harvest for the slack-water and the eastern division of the national road. It taxed the road's capacities to the utmost extent, and it was literally crowded with stage coaches and wagons. In 1850 the Navigation carried 18,379 stage passengers, and in each of the three preceding years a greater number. Notwithstanding the tolls from freights and passengers continued about the same for many years, such was the rapid increase of the coal trade that at the end of 1853

the entire indebtedness to Moorhead, Robertson & Co., amounting to \$237,000, was paid; and but for a few new debts incurred in making improvements, rendered necessary by the increase in the coal trade, the company would have been out of debt.

Though the toll on coal over the entire Navigation was but \$2 91 per 1,000 bushels—less than one-fourth of the rates for the same distance on the Schuylkill Navigation, which had been made the standard by the act of 1836—some parties on the upper pools raised, in 1848, a loud cry of complaint through the press, and town meetings were convened and the right of the company to dam the river was questioned. Rates were reduced, the storm abated, and the relations of the company to the coal owners and shippers have been amicable ever since.

In 1848 the success of the enterprise and the interests of Greene and upper Fayette counties began to call loudly for the extension. The legislature, therefore, by act of February 9, 1848, authorized a new opening of books to take stock in the five counties bordering on the river to the amount of \$200,000, to be expended on additional locks and dams above Brownsville. The stock was doubled accordingly.

In compliance with the act of January 25, 1854, the company promptly put Nos. 5 and 6 under contract—No. 5 just above Watkins' bar, two miles above Brownsville, and No. 6, at Rice's landing, 10 miles further up, and they were ready for use in November, 1856. Their cost, including raising dam No. 4 and some dredging, was nearly \$200,000. At the end of 1856 the construction account, including extension, damages, interest, repairs, etc., amounted to \$850,598, leaving the company in debt about \$217,000. Since 1856 the former account has been gradually increased by improvements, repairs, etc., and the latter gradually diminished; so that at the end of 1872 the construction account stood \$1,146,038 69, and the mortgage debt \$110,000.

Floods, unattended by ice, have been sometimes very mischievous; but since the flood of 1843, which in the end made such havoc to dam No. 1, the worst have been the two of seven days each in April, 1852, which entirely submerged the works, carrying away the office-houses at Nos. 2 and 3, and doing great injury to the locks, and that of May, 1856, which swept out about two hundred feet of dam No. 2. In May, 1858, occurred a greater flood than that of 1852, but it did little harm to the works. When attended by ice, floods are often fearfully destructive, and seem to be becoming yearly more and more so, baffling all the care and skill of the company and its officers to defend the works against their ravages. That which occurred in January, 1865—the same which tore out the two dams on the Youghiogheny—made great havoc of dam No. 4; but the fiercest assaults (unless those of 1873 surpassed them) were those of 1867 and 1868, the former carrying off the heaviest ice formed for twenty years, and greatly injuring dams Nos. 2 and 6 and the locks at Nos. 4 and 5. That in 1868 did like harm to dam No. 2.

The United States government has constructed a lock and dam at Hoard's rock, West Virginia (No. 9), and is now constructing a lock and dam at Dunkard's creek (No. 8).

The Monongahela Navigation Company is constructing a lock and dam (No. 7), which will soon be completed, and which, with the other locks and dams of the company, will furnish a slack-water navigation for steamboats and other vessels from Pittsburgh, Pennsylvania, to Morgantown, West Virginia, a distance of 102 miles.

When the slack-water of the Youghiogheny was being constructed, large expectations were indulged as to its auxiliary influence; but they have not been realized. Whether from defective construction or from miscalculation of the mighty power of the floods and ice in that river, the locks and dams upon it—two carrying the navigation to West Newton, 18 miles—were of short duration. They lasted for only fourteen years, with long intervals of uselessness for lack of repair, and the great ice flood of January, 1865, put an end to them. They are now in ruin, and the charter of the company is extinct.

The Monongahela Navigation Company has \$1,004,550 of capital invested, with a funded debt of \$84,000. In 1880, 9,143 boats passed through the locks of this company.

CHESAPEAKE AND OHIO CANAL, MARYLAND.

This canal was opened on October 15, 1850, from tide-water at West Washington to Cumberland, Maryland, a distance of 184.50 miles.

General Washington, probably as early as the year 1754, when he accompanied the unfortunate Braddock on his expedition to the Monongahela, conceived the project of a chain of internal improvements connecting the Potomac with the headwaters of the Ohio. In the year 1774 he procured the passage of a law by the legislature of Virginia empowering such individuals as were disposed to embark in the enterprise to open the Potomac so as to render it navigable to Will's creek, a distance of about 150 miles. He says, in a letter to Mr. Jefferson, dated March, 1784:

To get this business in motion I was obliged, even on that ground, to comprehend James river, in order to remove the jealousies which arose from the attempt to extend the navigation of the Potomac.

The scheme, however, was in a tolerably good train when I set out for Cambridge in 1775, and would have been in an excellent way had it not been for the difficulties which were met with in the Maryland assembly from the opposition, which was given (according to report) by the Baltimore merchants, who were alarmed—and perhaps not without cause—at the consequence of water transportation to Georgetown of the produce which usually comes to their market by land.

In the fall of this year he went over the route, to ascertain by personal examination the practicability of opening communication between the headwaters of these rivers. The journey was made on horseback, and the distance

traveled was 680 miles. On his return he gave, in a letter to the governor of Virginia, the first suggestions and sketches of the original outline of the system of internal improvements which has to some extent been carried out. Commissioners were appointed by the legislatures of Virginia and Maryland, General Washington being among those from the first-named state. Their meeting was held at Annapolis on December 22, 1784, and is described in the proceedings as a conference "upon the subject of opening and improving the navigation of the river Potomac and concerting a plan for opening a proper road between the waters of the Potomac and the most convenient western waters". The proceedings of this meeting, directed by Washington, as chairman, formed the basis of the Potomac Company. Bills were soon introduced into the legislature of each state authorizing the organization and subscribing for 50 shares of the capital stock, which was to consist of 500 shares, of £100 sterling each.

Such was the public confidence in Washington that nearly the whole of the capital stock was subscribed within a few months, and the company was organized on May 17, 1785, Washington being elected its first president, which office he held till elected to that of chief magistrate of the United States.

When the three years allowed by the charter for the completion of the works had expired but small advances had been made, and acts were passed by the legislatures of Virginia and Maryland in 1786 allowing a further time of three years. In 1790 the term was again extended for three years, and so on, from time to time, the Maryland legislature passing five and the Virginia legislature ten different acts on the subject, until 1820, when it became evident that the project would not pay.

The tolls collected by the Potomac Company were \$2,138 58 in 1800, and were reported at \$22,542 89 in 1811, which was the most prosperous year, and for the twenty-nine years from 1800 to 1828, inclusive, the total amount collected was \$282,183 36. Commissioners were appointed in 1822 to examine into the affairs of the Potomac Company, and their adverse report was communicated to the legislatures of the two states in the following year. About this time the project of a canal was brought forward, and met the approval of the commissioners, based on a report of the engineer that it would cost \$1,578,954 to construct it from Little Falls to Fort Cumberland, 182 miles.

On the 3d of February, 1823, the Potomac Company adopted a resolution signifying their willingness to surrender their charter to a new company upon liberal terms, and during the winter acts were passed by the legislatures of Virginia and Maryland authorizing a joint stock company, entitled the "Potomac Canal Company". As the co-operation of the United States was not provided for, these acts proved abortive. In a subsequent act, and in consequence of the authority conferred on the state of Maryland to extend the canal to the city of Baltimore, the name finally fixed upon was "The Chesapeake and Ohio Canal Company". After a series of legislative acts, by which an agreement was at last reached between the states of Virginia, Maryland, Pennsylvania, and the United States, a meeting of the Potomac Company was called on May 16, 1825, and the stockholders unanimously accepted the terms proposed and agreed to a surrender of their charter to the new company. The Chesapeake and Ohio Canal Company thus being incorporated, two years were allowed for the organization of the company and the commencement of the work and twelve years for the completion of the eastern section to Cumberland. The capital stock was to consist of \$6,000,000, divided into 60,000 shares of \$100 each.

On the 4th of July, 1828, the celebration of the formal commencement of the work was held, and John Quincy Adams, then President of the United States, took part in the ceremony and removed the first earth from the line of the canal. On the 15th of August of the same year the Potomac Company surrendered its charter, and by the 1st of September 17 miles were put under contract.

The canal at the time of its completion, in 1851, had cost \$11,071,176 21, or \$60,006 40 per mile. The Chesapeake and Ohio canal between Georgetown and Cumberland lies on the north, or Maryland, side of the river, with the advantages of a southern exposure, and pursues the immediate valley of the Potomac throughout its whole length, except at a point called the Pawpaw bend, about 27 miles below Cumberland, where it passes through the mountain by a tunnel 3,118 feet in length, by which about 6 miles in distance has been saved. From the Rock Creek basin, in Georgetown, where it first reaches tide-water, to the basin at Cumberland is 184.5 miles, and the total rise from the level of mid-tide at Georgetown to the Cumberland basin is 609.7 feet. This ascent is overcome by seventy-four lift locks and a tide lock that connects Rock Creek basin with the Potomac river. From a point just west of Georgetown the Alexandria canal, 7 miles in length, diverges from the Chesapeake and Ohio canal, crosses the Potomac river by an aqueduct 1,000 feet long, and connects with tide-water at Alexandria. The Chesapeake and Ohio canal is constructed for a depth of 6 feet throughout. From Georgetown to Harper's Ferry, 60 miles, it is 60 feet wide at the surface and 42 feet at the bottom; from Harper's Ferry to dam No. 5, 47 miles, the width at the surface is 50 feet and at the bottom 32 feet; and from dam No. 5 to Cumberland, 77½ miles, the surface width is 54 feet and the bottom 30 feet. The average lift of the locks is a little in excess of 8 feet. They are 100 feet long and 15 feet wide in the clear, and are capable of passing boats carrying 120 tons of 2,240 pounds.

The present supply of water for the canal is drawn entirely from the Potomac, and for this purpose dams have been constructed across the river at seven different points. This canal, though nominally owned by a stock company, is really owned by the state of Maryland by virtue of mortgage loans of \$6,375,000. Besides this, there are funded

debts, consisting of bonds issued for the completion of the canal, of \$1,699,500, and repair bonds of the act of 1878 amounting to \$87,000. The nominal floating debts were, in 1880, \$74,697 03, while the actual accumulations of debts in the past, including interest and claims of the state of Maryland, were estimated at \$20,000,000. No interest has been paid on the bonds for the completion of the canal since 1864, and, owing to floods and strikes in the Cumberland coal regions, the revenues of the company have been materially reduced since 1876.

OHIO CANALS.

The first movement toward the construction of canals in Ohio was made by Governor Brown, who, in his message dated January 8, 1819, recommended an appropriation for the survey of canal routes from lake Erie to the Ohio river. The legislature, however, postponed action till the following year, when authority was granted and preliminary surveys were made.

Acts authorizing further surveys were passed in 1822 and 1823, and finally, on February 15, 1825, the law directing the commissioners to construct the canals was approved. The Erie canal, in New York, was about completed, and great enthusiasm prevailed throughout the whole country, and Governor Clinton, of that state, was invited to participate in the opening ceremonies in Ohio, and was present.

Work was begun, and we find that in August, 1828, 42 miles of the Miami canal were in operation, and in the following year the 66 miles from Cincinnati to Dayton were completed. In 1831 the Ohio canal from Cleveland to Newark, 176 miles, was in operation.

The receipts for that year were \$64,864 17 from the Ohio canal and \$36,643 65 from the Miami, making \$101,507 82 in all.

In 1833 the canals were completed, as follows:

	Miles.	Miles.
Ohio canal.....	308.14	
Tuscarawas feeder.....	3.20	
Walhonding feeder.....	1.30	
Muskingum side-cut.....	2.58	
Granville feeder.....	6.14	
Columbus feeder.....	11.60	
	<u>332.96</u>	
Miami canal.....	66.00	
Hamilton side-cut.....	0.74	
	<u>66.74</u>	
Grand total.....		<u>399.70</u>

The canals of the state were leased in 1861 to a corporation for a period of ten years for an annual rental of \$20,775. They were leased again in 1871 for another period of ten years; but on December 1, 1877, the canals were surrendered, because of the state having allowed the destruction of the basin at Hamilton, Ohio. It will be seen by the following table that the lessees paid the state during the sixteen years \$331,237 50. A receiver was appointed when the company surrendered the canals, and he ran the canals from December 1, 1877, to May 15, 1878, at a cost of \$45,298 93, while the earnings reached \$69,765 59. The board of public works then took charge and ran them till November 15 of this same year, at a cost of \$96,118 58, while the receipts were \$112,760 24. These items are included under the receipts and expenses of the Ohio canals.

RECEIPTS AND EXPENSES ON THE OHIO CANALS, 1827 TO 1880.

Canals.	Years.	Receipts.	Expenses.	Canals.	Years.	Receipts.	Expenses.
Total.....		\$14,964,709 40	\$6,266,148 54	Muskingum improvement.....	1861 to 1878		
Ohio canal.....	1827 to 1845	4,145,798 22			1878 to 1879	\$14,591 76	\$10,050 78
	1845 to 1861	4,016,767 85	1,913,627 34		1879 to 1880	19,235 58	14,051 01
	1861 to 1877	*331,237 50		Hocking canal.....	1840 to 1845	27,820 02	
	1877 to 1878	†182,525 83	141,417 51		1845 to 1861†	188,178 00	237,317 74
	1878 to 1879	76,609 21	70,069 23		1861 to 1878		
	1879 to 1880	77,544 66	84,294 94		1878 to 1879	8,185 09	9,833 13
Miami and Erie.....	1828 to 1845	1,213,614 83			1879 to 1880	6,470 55	10,880 05
	1845 to 1861	3,834,991 41	2,878,578 60	Walhonding canal.....	1842 to 1845	4,427 00	
	1861 to 1877				1845 to 1861	19,564 41	35,155 22
	1878 to 1879	112,090 27	80,069 99		1861 to 1878		
Muskingum improvement.....	1879 to 1880	111,250 67	105,972 95		1878 to 1879	275 82	676 09
	1840 to 1845	110,980 88			1879 to 1880	880 29	473 85
	1845 to 1861	459,053 71	552,595 44	Water rents.....	1827 to 1845	3,105 54	
				Office rents.....	1827 to 1845		115,125 76

* Rental for all of the canals from 1861 to 1877.

† Receipts on all of the canals from December 1, 1877, to November 15, 1878.

CANALS OF THE UNITED STATES.

ILLINOIS AND MICHIGAN CANAL, ILLINOIS.

The state of Illinois completed in 1848 a canal connecting Chicago with La Salle, Illinois, on the Illinois river, a distance of 102 miles. This canal is now about the size of the Erie, 60 feet wide and 6 feet deep. The Illinois river, from La Salle to its mouth, is 227 miles in length. It has also been improved by five dams and locks, so as to make slack-water navigation with 7 feet of water. Two of these locks were built by the state of Illinois—the one at Henry, in March, 1872, at a cost of about \$400,000, and the one at Copperas creek, with the aid of the general government, in 1877, at a cost to the state of \$410,107. The locks are 350 feet long and 75 feet wide, admitting 12 canal-boats at a time. The receipts and expenses at these locks were as follows:

Year.	LOCK AND DAM AT HENRY.		LOCK AND DAM AT COPPERAS CREEK.	
	Receipts.	Expenses.	Receipts.	Expenses.
1872.....	\$8,484	\$4,148		
1873.....	6,879	5,150		
1874.....	8,509	4,871		
1875.....	7,038	2,025		
1876.....	4,403	2,288		
1877.....	6,062	1,605	\$414	\$453
1878.....	3,691	2,444	2,910	5,096
1879.....	3,486	1,278	2,770	6,691
1880.....	4,337	1,520	3,693	2,161
1881*.....	4,271	2,210	2,852	1,808
1882*.....	3,123	3,781	2,674	3,879

* Report of the canal commissioners, 1882.

This river and canal navigation, connecting the Mississippi river and the lakes, will, it is thought, become one of the most important channels of commerce in the country, and it has been proposed to enlarge the works still further. The *Engineering News*, in its issue of June 5, 1880, gives the following:

The cost of enlarging the Illinois and Michigan canal and improving the Illinois river so as to allow the passage of boats of 2,500 tons burden from Chicago to the Mississippi river, 327 miles, is estimated at \$18,200,000, or \$55,355 per mile.

The Erie canal has cost about \$90,000 per mile, with a capacity for boats of only 250 tons, or one-tenth that of those proposed on the enlarged Illinois canal, as per above estimate.

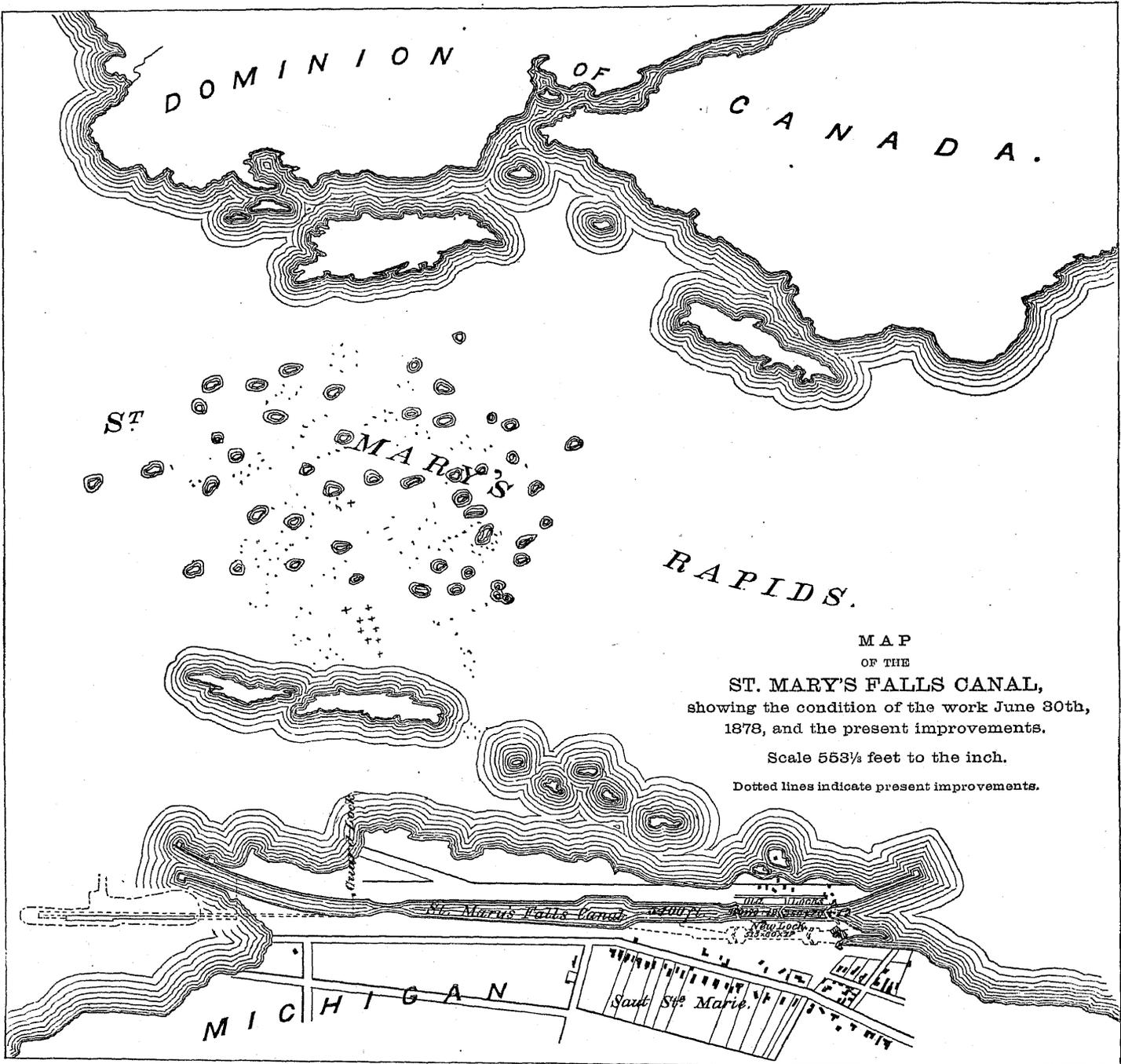
The following are the official statements of expenses and tolls on the Illinois canal:

Year.	Ordinary repairs.	Extraordinary repairs, renewals, and hydrographic works.	Gross expenses.	Tolls.	Year.	Ordinary repairs.	Extraordinary repairs, renewals, and hydrographic works.	Gross expenses.	Tolls.
1848.....	\$36,452	\$6,744	\$43,196	\$87,890	1866.....	\$43,716	\$72,647	\$116,363	\$302,958
1849.....	43,922	26,990	70,921	118,375	1867.....	46,152	116,504	162,656	252,231
1850.....	38,418	19,996	58,414	125,504	1868.....	52,984	69,067	122,051	215,720
1851.....	39,447	19,027	58,475	173,300	1869.....	49,514	42,251	91,765	238,759
1852.....	42,816	10,692	53,508	168,577	1870.....	43,098	65,597	108,695	149,635
1853.....	40,383	4,486	44,869	173,372	1871.....	54,555	42,007	97,222	150,050
1854.....	36,587	16,654	53,241	198,326	1872.....	42,785	40,090	82,875	165,874
1855.....	38,216	32,657	70,873	180,519	1873.....	53,525	27,573	81,098	166,641
1856.....	33,101	58,357	91,458	184,810	1874.....	49,139	24,659	73,798	144,831
1857.....	37,256	65,825	103,081	197,830	1875.....	46,241	28,270	74,511	107,081
1858.....	36,115	21,972	58,087	197,171	1876.....	42,418	49,167	91,585	113,293
1859.....	34,026	40,406	74,432	132,140	1877.....	54,965	55,053	110,018	96,913
1860.....	34,308	48,275	82,583	138,554	1878.....	43,826	39,013	82,839	84,330
1861.....	39,238	15,823	55,061	218,040	1879.....	44,076	53,625	97,701	89,064
1862.....	40,024	15,337	55,361	264,657	1880.....	47,004	77,997	125,001	92,296
1863.....	49,204	13,021	62,225	210,386	1881*.....	53,597	54,626	108,223	85,130
1864.....	47,535	18,572	66,107	156,607	1882*.....	57,309	48,103	105,412	85,947
1865.....	39,255	85,614	124,869	300,810					

* Report of the canal commissioners, 1882.

SAINT MARY'S FALLS SHIP-CANAL, MICHIGAN.

One of the most important canals in the country is the Saint Mary's Falls ship-canal, around the rapids between lakes Huron and Superior. This canal is situated on the American side of the river, 60 miles from lake Huron and 15 miles from lake Superior. The rapids, or falls as they are sometimes called, are about half a mile in length;



the mean fall is 18 feet. From lake Superior the fall on the navigable water is only about 0.1 foot; but from the foot of the rapids to lake Huron it is about 2 feet, distributed in a distance of 20 miles. These rapids are therefore the only impediment to navigation between the two lakes.

After the discovery and working of the copper and iron mines on lake Superior, or about the year 1845, these rapids were found to be so very serious an impediment to the prosecution of these enterprises that in 1850 Congress was induced to make a grant of 750,000 acres of land to the state of Michigan to defray the expenses of constructing a canal around them. In 1853 a company was formed, which undertook to construct for the state such a canal, the pay to be the grant of lands. It was begun in that year, and in 1855 it was opened for navigation. The cost was about \$1,000,000. It was 5,400 feet long, and 100 feet wide at the top water-line, and had a depth of water of 12 feet at mean stage. The sides, where the canal was not cut through rock, were paved with stone.

The locks were two in number, and were combined, each being 350 feet long and 70 feet wide, with a depth of water on the miter-sill of 12 feet. The lift of each lock was 9 feet. They were situated near the foot of the canal. There was also a guard-gate at the head of the canal.

At the time this canal was built it was deemed sufficiently large in every way to meet the needs of navigation, the locks being large enough to contain a tug and three vessels of ordinary construction, which generally constituted a tow. But by 1870 these dimensions no longer sufficed for the requirements of commerce on lake Superior, as only one vessel of the largest class could be passed through the locks at once, and that could not carry full loads with 12 feet of water in the canal, and the number of vessels had so increased that it became necessary to provide some method of more rapid lockage. The slope-walls were also found to be objectionable, as they damaged the vessels below the water-line.

In July, 1870, Congress made an appropriation for improving the canal, and in August, 1870, a project for that purpose was approved by the chief of engineers, which, after some amendments, embraced the following improvements: The canal is now $3\frac{1}{2}$ feet deeper than it was before the slope-walls were removed and a timber revetment substituted, and the guard-gate is moved 700 feet further up-stream than it was before. The walls of the old lock are prolonged up-stream far enough to receive a pair of guard-gates, and a new lock is made opposite the old ones, and 100 feet distant therefrom; it has but one chamber, 515 feet between the hollow quoins, 80 feet in width, 18 feet lift; depth of water on the miter-sills, 17 feet. The approach to the locks at the lower end is lowered to deep water, 18 feet. The approach at the head of the locks is made gradually, widening out from the guard-gates at their new position (where the old width of canal is retained) eastward until it becomes wide enough to open the way for vessels to the new as well as to the old locks. At the upper end of the canal the entrance, which curves toward the lake, is straightened so as to correspond with the general alignment of the canal. (a) (See accompanying map.) The whole cost of the improvement was about \$2,100,000.

In his annual message to the legislature of the state of Michigan, January 2, 1879, Governor Crosswell says:

The 23d of June last marked a quarter of a century since ground was broken for the construction of the Saint Mary's Falls ship-canal. The tonnage through it has increased from 106,296 tons in 1855 to 1,667,136 in 1878 (1879, 1,677,071 tons). Its gross revenues during the same time have multiplied by ten; more than 5,000 vessels, many of them of large tonnage, have passed its locks in a single year, making an average passage of one boat every two hours and ten minutes during the time of navigation. The legislature of 1869, by joint resolution, authorized the board of control to transfer the canal to the United States.

This transfer was made in 1880.

For twenty-five years the state of Michigan had conducted the business of the canal, charging the vessels only such tolls as would pay the operating expenses and repairs, the great aim being to make the tolls as light a burden as possible. The United States having offered to take the canal and manage it free of tolls, the state accepted the proposition; but, considering the interests which the state has in the business most affected in making such a transfer, those interests were guarded by requiring that the canal be made forever free beyond the power of reversal, except on condition of reversion to the state, should the policy of the government become changed regarding internal improvements. (b) Under the management of the state a reserve canal fund of several thousand dollars has been accumulated for use in case of extraordinary repairs being needed and for the completion of some much-needed improvements. This the state superintendent, John Spaulding, esq., recommends should be used in the construction of a dry-dock for the relief of disabled vessels at this point.

DISMAL SWAMP CANAL, VIRGINIA.

The Dismal Swamp canal was begun in 1787, under a joint charter of Virginia and North Carolina, and opened in 1794. Patrick Henry, it appears, was interested in the project, and subscribed liberally to its stock in 1791. The canal was enlarged and opened for navigation on the 31st of December, 1828. The first vessel that passed the Dismal Swamp canal after the enlargement was the schooner Rebecca Edwards, with a cargo of cotton, flour, pork, etc.

The Dismal Swamp canal connects the waters of Elizabeth river near Norfolk with the Pasquotank river in North Carolina, and was originally designed to bring out the lumber of the Dismal Swamp. Its importance, however,

a Engineer's report.

b Superintendent's report.

CANALS OF THE UNITED STATES.

was more particularly brought into notice during the war of 1812-'14, affording, as it did, a water communication for the transportation of military stores and products of the country free from the dangers of British cruisers during that period.

ALBEMARLE AND CHESAPEAKE CANAL, VIRGINIA.

This canal was built between the years 1855 and 1860, and it has cost to date about \$1,641,363. It connects by its two cuts Elizabeth river with Currituck sound and North river. The canal was originally intended for vessels of 250 tons, drawing 6 feet of water, but it has been deepened from time to time, so that it now passes a steamer of 800 tons, drawing 8 feet. In connection with the Chesapeake and Delaware and the Delaware and Raritan canals it forms a link in the inland navigation between New York, Philadelphia, and Baltimore, and North Carolina. The length and capacity of these canals are as follows:

Canals.	Length.	LOCKS.		
		Length.	Width.	Depth.
		<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>
Albemarle and Chesapeake canal	14	220	40	7
Chesapeake and Delaware canal	14	220	24	9
Delaware and Raritan canal	44	220	24	7
Erie, of New York, and branches	365	110	18	7

STATEMENT OF VESSELS PASSED THROUGH THE ALBEMARLE AND CHESAPEAKE CANAL, 1860 TO 1881.

Year.	Steamers.	Schooners.	Sloops.	Barges.	Lighters.	Boats.	Rafts.	Total.
1860.....	116	393	29	67	248	136	10	990
1861.....	671	1,139	74	153	300	179	8	2,524
1862.....	453	192	88	69	275	188	1,265
1863.....	377	62	71	16	292	125	943
1864.....	953	24	15	124	96	174	5	1,391
1865.....	1,300	266	190	122	79	602	3	2,562
1866.....	1,062	739	302	256	338	921	18	3,636
1867.....	1,112	907	358	313	763	761	29	4,243
1868.....	1,093	944	442	381	778	1,066	26	4,730
1869.....	1,093	752	398	297	950	1,077	36	4,603
1870.....	1,487	859	437	167	911	486	35	4,382
1871.....	1,659	941	555	183	1,030	483	49	4,900
1872.....	1,667	1,070	523	158	752	553	85	4,808
1873.....	2,075	1,380	592	225	886	469	152	5,779
1874.....	2,214	1,607	654	338	937	411	122	6,283
1875.....	2,406	1,837	722	340	697	425	73	6,502
1876.....	2,463	1,719	720	292	639	260	113	6,206
1877.....	2,376	1,626	508	344	587	277	123	5,841
1878.....	2,627	1,759	640	226	661	243	171	6,327
1879.....	2,798	1,615	569	334	552	379	180	6,433
1880.....	3,209	1,537	392	496	570	362	288	6,854
Total.....	33,213	21,368	8,279	4,901	12,341	9,577	1,532	91,211

FAIRFIELD CANAL, NORTH CAROLINA.

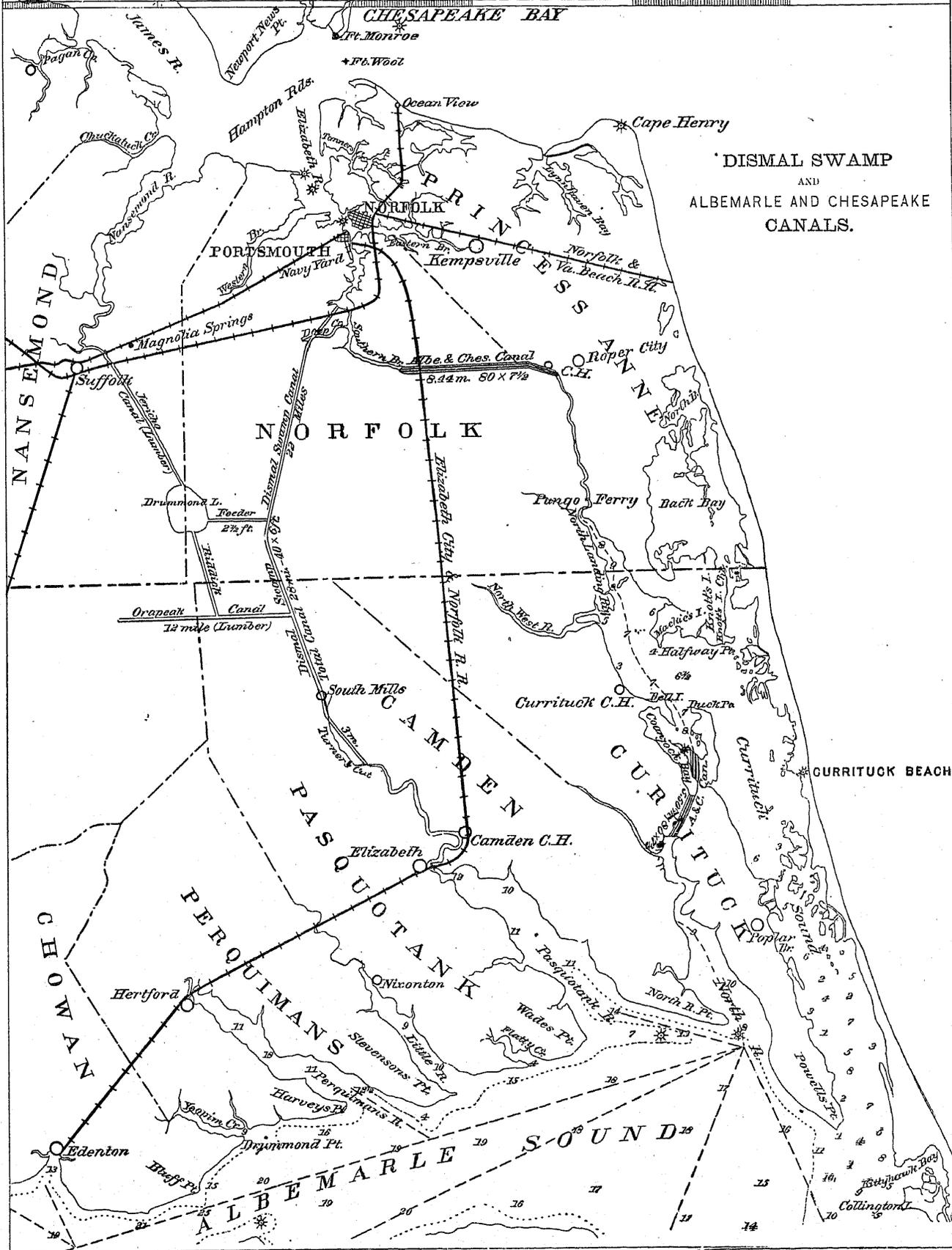
This canal, $4\frac{1}{2}$ miles in length, extends from the Alligator river to Mattimuskeet lake, in Hyde county, North Carolina. It was built by the Fairfield Canal and Turnpike Company, which had a paid-up capital of \$50,000. One-half of its stock is held by the Albemarle and Chesapeake Canal Company. This canal serves as a drain to the rich lands of that section, and affords a navigation for the transportation of the products in that region. A small steamer makes tri-weekly trips between Elizabeth City and Fairfield.

AUGUSTA CANAL, GEORGIA.

The Augusta canal was projected by a few citizens of that place about 1845 for the purpose of securing an abundant supply of water for the city and for manufacturing purposes. It was completed early in 1847, and enlarged in 1875. Originally it was managed by a company, although virtually owned by the city, and it is now managed entirely by the city. The main canal, or first level, extending up the Savannah river from the city, is 7 miles long, and the whole, including the second and third levels, is 9 miles. The minimum water-way is 150 feet at the surface, 106 at the bottom, and 11 feet deep. Arrivals in 1880 were 297 boats, that brought 7,452 bales of cotton from the upper Savannah, and returned loaded with merchandise. No tolls are charged.

76°30'

76°00'



BRAZOS CANAL, TEXAS.

The Brazos canal was dug out in 1850-'51, and was again cleaned out in 1866-'67. It originally cost \$340,000, and is owned by the Brazos Navigation Company. Beginning at the Galveston, Houston, and Henderson railroad bridge, the route to the canal is southwesterly through West Bay and Mud Island Pass; thence west, through Follet's Pass; thence southwest, through Christmas bay and the old Galveston and Brazos canal, to the Brazos river. The total distance is 38 miles, 8 miles of which is canal proper and the rest lake and bay navigation, as stated, with cuts where the water is shallow. This opens an inland navigation for steamboats and other vessels of four feet draught of water for about 150 miles at all times. The Brazos river has been navigated with steamboats, carrying from 600 to 1,000 bales of cotton, for a distance of 700 miles during the winter season when in good boating order. The river is not much used now, however, above tide-water, say about 100 miles.

There are several important river and bayou improvements of a similar nature in this state, most of which have been made by the general government.

LOUISIANA CANALS.

The low, level country of Louisiana admits of the construction of shallow canals connecting the numerous lakes and bayous of the state. Many of them are, however, of little importance. Those connecting New Orleans with lake Pontchartrain are of the most commercial importance. The old Carondelet canal was built by Governor Carondelet about 1794, partly as a drainage canal for the city. The citizens contributed a large force of slaves to aid him in its construction. The new canal, or Orleans Bank canal, was built about 1832, and cost about \$1,000,000, and is the most important canal in the state, though only $6\frac{1}{2}$ miles in length.

WILLAMETTE CANAL, OREGON.

Navigation was formerly obstructed on the Willamette river by the falls at Oregon City, but in 1868 a company called the "Willamette Falls Canal and Lock Company" was chartered, and the canal around the falls was finished, so that the first boat passed through on January 1, 1873. The state aided the company by issuing \$200,000 in 7 per cent. bonds, for which the corporation was to repay the state 10 per cent. of its net profits. The canal since its completion has been constantly in use, the tolls charged being 50 cents per ton on freight and 10 cents each on passengers. It is now owned by a company called the "Willamette Transportation and Locks Company", which corporation is controlled by the Oregon Railway and Navigation Company.

The canal cost about \$600,000. It measures 2,252 feet in length, with a depth of from 9 to 13 feet, and has five locks, 210 by 40 feet, overcoming a fall of 39.75 feet. In 1880 1,226 boats passed through, with 49,265 tons of freight and 16,618 passengers. The business of the canal is of importance, and is on the increase.

The following is the amount of merchandise and number of passengers passed through the canal when first completed:

	Tons.	Passengers.
From January 1 to December 31, 1873.....	18, 775	5, 426
From January 1 to December 26, 1874.....	32, 340	6, 883

OPERATING CANALS.

The accompanying table shows the length and capacity of the important canals operated by states and corporations within the United States. Adding the mileage and cost of operating canals as given in Table I, amounting to 2,515.04 miles of canal and 411.14 of slack-water, to that of the abandoned canals, as shown in Table II, amounting to 1,953.56 miles, we have a grand total of 4,879.74 miles of canals and slack-water which have been constructed in this country, at a cost of \$214,041,802, or at an average of \$43,863 per mile. Of the canals now in operation, as previously stated, 2,926.18 miles, including slack-water, and costing \$170,028,636, show an average cost of \$58,753, exclusive of the Galveston and Brazos canal, and, including this canal, \$58,106.

Works under the supervision of the general government are so fully treated in the annual reports of the engineer department at large that it was thought unnecessary to show them in this report.

CANALS OF THE UNITED STATES.

TABLE I.—STATEMENT OF THE CANALS OPERATED BY

[Canals in *italics* are operated by states.]

Canals.	Points connected.	When built and enlarged.	LENGTH.	
			Canal.	Slack-water.
UNITED STATES.			Miles.	Miles.
Grand total			2,515.04	411.14
NEW YORK.				
Total			607.75	115.00
1 Erie canal, branches and feeders	Albany—Buffalo	1817-1862	365.48	20.50
2 Oswego canal	Syracuse—Oswego	1825-1862	18.00	20.00
3 Cayuga and Seneca canal	Montezuma—Cayuga and Seneca lakes	1825-1855	24.77	
4 Champlain canal, feeder and dam	Whitehall—Waterford	1817-1870	81.00	
5 Black River canal and improvement	Rome—Carthage	1836-1861	35.50	42.50
6 Oneida River improvement	Three Rivers Point—Brewerton	1839-1850		20.00
7 Delaware and Hudson Canal Company	Honesdale, Pa.—Rondout, N. Y	1826-1828	83.00	3.00
NEW JERSEY.				
Total			171.02	
1 Delaware and Raritan Canal Company (ship)	New Brunswick—Bordentown	1834-1838	44.00	
2 Delaware and Raritan feeder	Bull's Island—Trenton	1838	22.00	
3 Morris Canal and Banking Company	Easton, Pa.—Jersey City	1825-1845	103.00	
4 Penn's Neck canal (ship) f	Salem creek—Delaware river	1800-1872	2.02	
PENNSYLVANIA.				
Total			628.57	146.05
1 Pennsylvania Canal Company, eastern division	Columbia—Duncan's island	1826-1834	46.00	
2 Pennsylvania Canal Company, Susquehanna division	Clark's Ferry—Northumberland	1828-1833	41.00	3.00
3 Pennsylvania Canal Company, northern division	Northumberland—Wilkesbarre	1830	64.00	4.00
4 Pennsylvania Canal Company, Juniata division	Junction—Huntingdon	1827-1834	90.00	
5 Pennsylvania Canal Company, west branch	Northumberland—Flemingtons	1828-1833	68.00	4.00
6 Pennsylvania Canal Company, Wiconisco branch	Clark's Ferry—Millersburg	1838-1839	13.00	
7 Susquehanna and Tide-water Canal Companies	Columbia—Maryland state line	1837-1840	30.00	
8 Union Canal Company	Middletown—Reading	1819-1827	84.64	
9 Schuylkill Navigation Company	Mill Creek—Philadelphia	1816-1826	58.18	50.05
10 Lehigh Coal and Navigation Company	Coalport—Easton	1819-1821	48.00	
11 Delaware Division canal	Easton—Bristol	1830	60.00	
12 Monongahela Navigation Company	Pittsburgh—Geneva	1838-1844		85.00
13 Muncy Canal Company	Muncy—Pennsylvania canal		0.75	
14 Delaware and Hudson Canal Company—see New York		1826-1828	25.00	
DELAWARE.				
Total			14.00	
1 Chesapeake and Delaware Canal Company (ship)	Delaware City—Chesapeake City		14.00	
MARYLAND.				
Total			194.50	5.00
1 Chesapeake and Ohio Canal Company	Washington, D. C.—Cumberland, Md	1828-1850	179.50	5.00
2 Susquehanna and Tide-water Canal Company—see Pennsylvania	Pennsylvania state line—Havre de Grace	1839	15.00	
VIRGINIA.				
Total			43.56	31.00
1 Albemarle and Chesapeake Canal Company (ship)	Norfolk—Currituck	1855-1860	78.44	30.00
2 Dismal Swamp Canal Company (ship)	Elizabeth river—Pasquotank	1794	28.00	1.00
3 Alexandria and Georgetown canal	West Washington, D. C.—Alexandria	1830	7.12	

a Cost per mile of operating canals and slack-water in the United States, \$58,756, exclusive of Galveston and Brazos; including this canal, \$58,109.

b Exclusive of 25 miles in Pennsylvania.

c 107 lift locks, 2 weigh-locks, 2 stop-locks, and 2 guard-locks.

d Miscellaneous freight earnings only; the canal is used in transporting coal for the company.

e Consisting of 23 inclined planes and 23 lift locks.

f "Salem Creek Consolidated Meadow Company."

g Now extending from Northumberland to Nanticoke, 60 miles.

OPERATING CANALS.

STATES AND CORPORATIONS IN THE UNITED STATES: 1880.

[Canals in *italics* are operated by states.]

WIDTH.		Depth.	LOCKS.				Cost of construction.	Freight traffic.	Gross income.	Total expenditures.				
Surface.	Bottom.		Number.	Length.	Width.	Rise and fall.								
Feet.	Feet.	Feet.		Feet.	Feet.	Feet.	Dollars.	Tons.	Dollars.	Dollars.				
							a 170,028,636	21,044,292	4,538,020	2,954,156				
							68,229,416	7,706,969	1,239,448	1,099,974				
70	52½	7	72	110	18	656.46	51,609,200	4,608,651	1,120,691	678,124				
70	56	7	18	110	18	155.55	8,077,429	427,863	14,388	37,877				
70	56	7	11	110	18	76.58	1,520,542	125,331	1,532	11,788				
58	44	6	33	110	18	179.50	2,378,910	1,200,503	51,267	136,520				
42	28	4	110	90	15	1,080.00	3,224,779	75,308	11,800	51,293				
80	60	4½	2	120	30½	6.00	79,340		270					
48	32	6	c 107	100	15	1,028.00	6,339,210	1,329,313	d 39,500	184,272				
							10,776,353	1,857,568	635,108	491,762				
80		7	14	220	24	150.00	4,735,353	1,348,082	419,431	331,344				
60		6	1	100	24									
45	25	5	e 46	88	20	1,674.00	6,000,000	503,486	215,677	160,418				
100	75	5					41,000	6,000						
							37,706,645	6,057,995	1,562,018	588,024				
50-100	32	6	15	180	17	132.00	7,731,750	861,798	368,770	177,826				
50-100	32	6	9	180	17	68.00								
50-100	32	6	7	180	17	68.00								
40-60	25	4½	36	85	14-17	255.00								
40-60	28	4½	18	90	17	123.00								
40-60	25	4½	6	90	17	32.00								
50	30	5½	43	170	17	230.00								
43	28	4½	93	90	17	501.00								
45		6½	71	110	18	619.00								
60	45	6	57	100	22	375.00								
44	26	6	33	90	11-22	165.00								
		5-6	8	100	56	61.00								
40	25	4½									1,115,452	3,450,400	236,929	59,585
											7,077	3,835	75	19
							3,730,230	959,146	201,783	62,245				
66		9	3	220	24	32.00	3,730,230	959,146	201,783	62,245				
							11,290,327	655,423	372,616	227,277				
50-60	40	6	75	100	16	809.00	11,290,327	655,423	372,616	227,277				
							4,042,363	532,662	104,048	71,632				
80	60	7½	1	220	40	2.00	1,641,363	400,000	86,138	50,432				
40-60		6	7	100	16½	35.00	1,151,000	m 6,731	13,524	6,000				
60	42	6	4	100	16	66.00	1,250,000	125,931	4,386	n 9,200				

h Exclusive of 15 miles in Maryland,
 i Amount paid for rent of canal, \$243,860.
 j Amount paid for rent of canal, \$417,645.
 k Jericho canal, a lumber canal 10 miles in length, not included.
 l Exclusive of 5.50 miles in North Carolina.
 m Seven months under repairs in 1880; freight movement in 1881, 105,000 tons.
 n Includes repairs to aqueduct, \$6,200.

CANALS OF THE UNITED STATES.

TABLE I.—STATEMENT OF THE CANALS OPERATED BY STATES

[Canals in *italics* are operated by states.]

	Canals.	Points connected.	When built and enlarged.	LENGTH.	
				Canal.	Slack-water.
				Miles.	Miles.
NORTH CAROLINA.					
	Total			13.00	
1	Albemarle and Chesapeake (North Carolina cut)—see Virginia (ship)	Canjoek bay—North river.....	1855	5.50	
2	Fairfield Canal and Turnpike Company	Alligator river—Mattamuskeet lake	1868	4.50	
3	New Berne and Beaufort Canal Company (ship)	Clubfoot creek—Newport river.....	1880-1882	3.00	
GEORGIA.					
	Total			25.00	
1	Augusta canal (ship) (c)	Savannah river—Augusta	1847	9.00	
2	Ogeechee Canal Company	Savannah river—Ogeechee river.....	1829-1840	16.00	
FLORIDA.					
	Total			10.50	
1	Santa Fé Canal Company	Waldo—Melrose	1877-1880	10.50	
LOUISIANA.					
	Total			19.00	9.00
1	Carondelet Canal and Navigation Company (old canal) (ship).....	New Orleans—Bayou Saint John	1794	2.00	
2	Orleans bank canal (new canal) (ship).....	New Orleans—Pontchartrain Lake	1832-1835	6.50	
3	Harvey's canal (ship)	Mississippi river—Lake Salvador	1830	5.75	
4	Company's canal (ship)	Mississippi river—Lake Salvador	1847	3.00	9.00
5	Tagliaferro canal (ship).....	Mississippi river—Bayou Barataria	1880-1881	1.75	
TEXAS.					
	Total			8.00	30.00
1	Galveston and Brazos Navigation Company (ship).....	Galveston—Brazos river	1850-1851	8.00	30.00
ILLINOIS.					
	Total			102.00	
1	<i>Illinois and Michigan canal</i> (ship)	Chicago—La Salle	1836-1848	102.00	
MICHIGAN.					
	Total			3.14	
1	<i>Saint Mary's Falls canal</i> (ship).....	Saint Mary's falls—Saint Mary's river	1853-1855	1.02	
2	Lake Superior Ship-Canal, Railway and Iron Company	Lake Superior—Portage lake.....	1868-1873	2.12	
OHIO.					
	Total			674.25	75.00
1	<i>Ohio canal and feeders</i>	Cleveland—Portsmouth	1825-1835	523.00	
2	<i>Waltonding branch</i>	Rochester, Ohio—Roscoe	1843	25.00	
3	<i>Hooking canal</i>	Carroll—Nelsonville	1843	42.00	
4	<i>Miami and Erie canal, branch and feeders</i>	Cincinnati—Toledo	1825-1835	284.25	
5	<i>Muskingum improvement</i>	Zanesville—Marietta	1840		75.00
OREGON.					
	Total			0.75	
1	Willamette Transportation and Locks Company (ship)	Oregon City	1873	0.75	

a The following drainage and lumber canals not included: Riddick, Orapeak, Collins, Fungo, and Mattamuskeet—total length, 40 miles.

b Not completed and no traffic reported.

c Owned by the city of Augusta.

d Wharf rents, \$909; water rents, \$20,000. The canal is free.

e Built by Governor Carondelet in 1794, with the aid of a large force of slaves contributed by residents.

f Cost up to 1870, the date of last report.

OPERATING CANALS.

AND CORPORATIONS IN THE UNITED STATES: 1880—Continued.

[Canals in *italics* are operated by states.]

WIDTH.		Depth.	LOCKS.				Cost of construction.	Freight traffic.	Gross income.	Total expenditures.
Surface.	Bottom.		Number.	Length.	Width.	Rise and fall.				
Feet.	Feet.	Feet.		Feet.	Feet.	Feet.	Dollars.	Tons.	Dollars.	Dollars.
							300,000	40,000	8,000	3,000
80		7½								
40		6					100,000	40,000	8,000	3,000
80		10					200,000	(b)		
							1,907,818	23,602	8,200	14,362
150		11					1,500,000	2,697	4,909	7,382
120		3	5				407,818	20,905	7,300	6,980
							70,000			
35		5					70,000	(b)		
							2,030,000	318,096	27,840	13,650
60		7					e 750,000	140,988		
85		7					1,000,000	177,108	20,340	13,650
45		6	3	200	35		150,000			
40		6	1				90,000		7,500	
30		4	2	110	20		40,000	(b)		
							340,000		4,535	3,454
50		3½					340,000		4,535	3,454
							6,557,681	751,360	107,605	125,601
60		6	15	110	18	141.00	f 6,557,681	751,360	107,605	125,601
							7,425,300	1,244,279	52,519	29,532
100		17	1	515	80	18.00	3,500,000	g 1,244,279	44,743	23,437
100		14					3,025,300		7,776	6,005
							h 15,022,503	i 837,252	214,891	223,643
40	26	4	150	90	15	1,207.00	4,695,202	420,626	77,545	223,643
40		4	11	90	15	90.00	697,269	3,309	j 380	
40		4	26	87	15	203.00	947,670	35,200	j 0,470	
50-60		5½	93	87-99	15	907.00	7,144,234	323,737	111,260	
			12			126.00	1,628,028	45,200	j 10,236	
							600,000			
40		9	5	210	40	39.75	600,000	(k)		

g In addition to above, 45,500,000 feet of lumber, 5,389,000 shingles, 1,139,000 lath, and 185,000 cubic feet of timber, approximating 143,000 tons, and also 25,766 passengers passed through the canal in 1880.

h A statement made to the legislature in 1846 increases this amount \$948,464.

i Includes movement of forest products, and stone, amounting to 350,274 tons.

j Clearances only.

k Freight traffic in 1874, 32,340 tons, and 6,383 passengers.

CHAPTER II.—HISTORY OF ABANDONED CANALS IN THE UNITED STATES.

CUMBERLAND AND OXFORD CANAL, MAINE.

The canal, as located under the original charter in 1820, extended from Harrison to Portland, having its chartered rights through Sebago lake and the ponds and rivers leading into the same, viz: Songo river, Bryant's pond, and Long pond. The original cost was about \$200,000. It was considered in its early history a public enterprise, destined to be of great advantage to the city of Portland.

The canal was operated continuously until about the time of the building of the Portland and Ogdensburg railroad, which runs for the first 15 miles nearly parallel with the canal, and since that time only portions of the canal have been operated.

The only means of connecting Sebago river and the ponds above, thereby reaching Bridgeton by water, is Songo lock, which has been used continuously since it was built many years ago, it being large enough to allow the passage of lake steamers through it. This lock has been recently repaired at considerable expense. The canal is wholly abandoned for commercial purposes, but appears to be well adapted to fish culture.

NEW HAMPSHIRE CANALS.

Bow Falls canal, Hooksett Falls canal, Amoskeag Falls canal, Union canal, and Sewall's Falls canal were a series of small canals built to overcome the falls of the Merrimac. They were abandoned for commercial purposes some thirty years ago. The cost of construction was about \$142,000.

VERMONT CANALS.

White River canal, Waterquechy canal, and the Bellows Falls canal were small canals around the falls of the Connecticut, and were abandoned for commercial purposes many years ago.

MIDDLESEX CANAL COMPANY AND MASSACHUSETTS CANALS.

The first canal connected with the Merrimac river, and probably leading to the construction of the Middlesex canal, was the short canal around Pawtucket falls, leading into the Concord river, and thence into the Merrimac river at Chelmsford.

The company, incorporated as "The Proprietors of the Locks and Canals on the Merrimac river", proposed to open water communication with Newburyport. Its charter was dated June 25, 1792, and the company had scarcely begun its work when other parties proposed another canal which would open communication with Charles river and Boston harbor.

Nevertheless it was opened in 1797, was about 1½ miles in length, had four sets of locks, cost \$50,000, and afforded a yearly dividend varying from 2 to 10 per cent. It entered Concord river near its junction with the Merrimac, and shortened the distance considerably, while it was the means of conveying craft safely around the dangerous falls. It is to be presumed that it was superseded by the Middlesex canal in 1804.

The Middlesex Canal Company was incorporated June 22, 1793. The work was begun about 1 mile above Pawtucket falls at the most southerly angle or bend of the Merrimac river, and was supplied with water by the Concord river in Billerica, where the surface of the water is elevated 107 feet above the tide in Boston harbor and 25 feet above the surface of the Merrimac river. The work was prosecuted with great vigor, and in 1804 it was completed as far as Woburn, and opened to that town; but the work was not finished and a regular system of business established until 1808. The cost of the work was \$605,000, and this sum includes about \$30,000 expended on the Merrimac locks and canals. The receipts in 1810 amounted to \$15,000 from a toll of one-sixteenth of a dollar per ton per mile, or about \$1 67 per ton from Chelmsford, now Lowell, to Charles river. In 1815 the tolls aggregated \$24,926; in 1816, by estimation, \$30,000. There were 7 aqueducts, so called, over rivers or streams, and 20 locks in the 27 miles of canal.

The canal established water communication between Concord, New Hampshire, and Charlestown, Massachusetts, on Charles river, and, by means of what was known as the Mill creek, across the peninsula of Boston, on the present line of the Boston and Maine railroad, with Boston harbor near the town dock.

The business of the company continued to increase until the building of the Boston and Lowell railroad, in 1835, when it began to decrease, so that on June 1, 1853, business was suspended, and in six years thereafter the rights of the company granted by the charter were forfeited and the ownership of the land reverted to the original proprietors.

In addition to the Pawtucket and Middlesex canals there were the Montague and the South Hadley, small canals around the falls in the Connecticut river.

BLACKSTONE CANAL, RHODE ISLAND.

Acts of incorporation were obtained for distinct companies in Massachusetts and Rhode Island, the canal to connect Worcester, Massachusetts, with Providence, Rhode Island. The charters of the Blackstone canal companies were obtained from the legislatures of Massachusetts and of Rhode Island in 1823. These companies were united July 5, 1825, under the name of the Blackstone Canal Company. Three commissioners being chosen from each state, in 1824 the excavation was commenced in Rhode Island, and in 1826, in Massachusetts, in the town of Worcester. The cost of the work was \$750,000, of which \$500,000 was paid by the citizens of Rhode Island, and \$250,000 by the citizens of Massachusetts. The first boat, the Lady Carrington, which passed through the whole extent of the canal arrived at Worcester October 6, 1828.

The amount of tolls collected on the Blackstone canal during the first nine years of its existence were as follows:

1828.....	\$1,000 00
1829.....	8,606 00
1830.....	12,016 82
1831.....	14,944 67
1832.....	18,907 45
1833.....	17,545 10
1834.....	16,464 45
1835.....	14,433 08
1836.....	11,500 00

The principal articles transported were coal, iron, cotton, wool, corn, salt, flour, molasses, oil, leather; and wood, which in 1834 amounted as follows:

Coal.....	tons..	2,759
Wool.....	bales..	2,100
Flour.....	barrels..	21,158
Leather.....	tons..	364
Iron.....	do..	635
Corn.....	bushels..	24,698
Molasses.....	gallons..	68,549
Wood.....	cords..	1,500
Cotton.....	bales..	3,829
Salt.....	bushels..	19,631
Oil.....	gallons..	49,957

The Blackstone canal was more useful to the public than profitable to the stockholders. Many mills and manufactories were built on its line, villages sprang up and increased, and an impetus was given to trade and manufactories, Providence and Worcester being greatly benefited.

Various causes contributed to the unprofitableness of the canal to the stockholders. A portion was located in the Blackstone river, and boats were more or less detained in high and also in low water, and in some seasons were detained for weeks with goods which were wanted for immediate use. In some years the canal was closed for four or five months with ice.

The Providence and Worcester railroad was chartered in 1844, and cars commenced running October 25, 1847, and from this cause the days of the Blackstone canal were numbered, the last toll being collected November 9, 1848.

FARMINGTON CANAL, CONNECTICUT.

The Farmington Canal Company was chartered in 1822. The legislature, in granting the charter, provided for the appointment of state commissioners, who should have authority to survey and lay out the canal. In July, 1823, subscription books were opened at New Haven, and in 1824 attempts were made to increase the subscriptions, and a charter was obtained for the Merchants' Bank of New Haven on condition that the bank should subscribe \$200,000 to the capital of the company, which was done. It was estimated that the canal could be built for \$420,698 88, and with a branch to Hartford for \$522,472 05. Work on the canal was commenced in 1825, and prosecuted with vigor till 1828. The canal was opened in the early part of the season as far as Cheshire, and in the latter part to Farmington. The company was somewhat embarrassed for the want of funds, and the canal was injured from freshets and by malicious individuals; but by the energy of the directors funds were raised, claims settled, and the canal kept navigable. Early in 1827 the city of New Haven subscribed \$100,000 to the stock of the company, and

many improvements were made and the work finished. As the Hampshire and Hampden Canal Company had now completed their canal from the Connecticut state line to Westfield, there was a continuous line of navigation from tide-waters in New Haven to Westfield, Massachusetts. From 1830 to 1836 there was a steady stream of business on the canal, and it is estimated that the receipts were about \$75,000 per annum, and towns along the line and the city of New Haven were materially benefited. This income, however, had only been sufficient to pay ordinary expenses, and the very extensive damages done to the canal in 1836 made it absolutely necessary that some measures of relief should be adopted, and a new company was formed under the name of the New Haven and Northampton Company, the old company relinquishing all the stock, amounting to \$537,195, and the creditors of the company relinquishing debts to the amount of \$232,736. The Hampshire and Hampden Canal Company was also merged into the New Haven and Northampton Company.

HAMPSHIRE AND HAMPDEN CANAL, CONNECTICUT.

The Hampshire and Hampden Canal Company was chartered in 1823. The original subscription amounted to 1,815 shares at \$100 each, and these shares were united with those of the Farmington Canal Company. In 1826 contracts were made for the construction of the canal, and the contractors were to receive \$190,000 in cash and 1,000 shares of stock, the canal to be finished in the spring of 1829. During 1827 and 1828 the work was prosecuted with vigor, but it appeared that the contractors could not fulfill their contracts by the time agreed upon, nor were they able to pay the installments upon the shares held by them. In 1829 special installments were collected, and the canal was completed from the Connecticut state line to a point $1\frac{1}{2}$ miles above Westfield. In the years 1830 and 1831 no work of importance was done. In 1832 \$160,000 was obtained by subscription and loans, and the canal was finished to the Connecticut river in 1835, the first boat having passed through on August 21 of that year. Owing to heavy expenses, the company being without funds and involved in debt, it united with the Farmington Canal Company in forming a new company. This involved the loss of the stock of the company, \$269,000, and \$110 61, which was not subscribed to the stock of the new company. Adding these losses to those of the Farmington Canal Company, as stated, and we have a grand total of \$1,039,041 62.

NEW HAVEN AND NORTHAMPTON COMPANY, CONNECTICUT.

This company organized in 1836, as stated above, the two companies giving to the new organization all their franchises and interests on condition that the new company should pay their debts, the creditors accepting stock in payment. Under this new arrangement the canal was navigated from tide-water to the Connecticut river at Northampton, the boats carrying from 20 to 25 tons. The canal was operated at a loss until 1845, and the stock had changed hands, much of it being owned in New York. The canal this year opened with good prospects, but it proved a most disastrous season, owing to drought and to breaks in the canal. The attention of the company was turned this year to the practicability of building a railroad to take the place of the canal. A survey was made, and at a meeting of stockholders, held in February, 1846, a petition was made to the legislature for power to substitute a railroad. A railroad charter was granted, and work was begun in June, 1847.

CHENANGO CANAL AND EXTENSION, NEW YORK.

The Chenango canal, extending from the Erie canal at Utica to the Susquehanna river at Binghamton, was authorized by an act passed in February, 1833. The work of construction was begun in 1833, and the canal was opened in 1837. That year there passed over it 8,213 tons, and the tolls collected were \$4,082, and the expenditures \$18,864. Its total length was 97.17 miles. The aggregate length of feeders was 17.50 miles, from which the canal was principally supplied by water. It was abandoned for commercial purposes about the year 1878, and is now used between Utica and Hamilton merely as a feeder, through which the waters from the reservoirs in Madison county are fed into the Erie canal.

The Chenango extension, extending from the Chenango canal at Binghamton to the state line of Pennsylvania, near Athens, was intended to connect with the Pennsylvania North Branch canal, but has never been brought into use. Its length is about 40 miles.

GENESEE VALLEY CANAL BRANCH AND EXTENSION, NEW YORK.

The Genesee Valley canal connected the Erie canal at Rochester with the Alleghany river at Olean and Millgrove, with a branch extending from the main line at Shakers, 4 miles south of Mount Morris, to the village of Dansville. Its construction was authorized May 6, 1836, and was completed in 1840. Work was commenced on the Millgrove extension in June, 1857, and completed in 1861. The entire line was abandoned under the law of September 30, 1878.

CHEMUNG CANAL AND FEEDER, NEW YORK.

This canal entered the valley of Catherine creek at the head of Seneca lake, which it followed to the village of Horseheads, 15 miles, and thence by the valley of Marsh creek was conducted to Elmira, on the Chemung river, forming part of a chain of communication reaching from the Erie canal to the Susquehanna, and thence to Chesapeake bay and the ocean. A navigable feeder, taking its waters from the Chemung river at Knoxville, extended to the summit level at Horseheads, a distance of 16.75 miles, making, with the main line, 39.75 miles of navigation. Its construction was authorized April 15, 1829, and work was commenced in 1830 and completed in 1833, at a cost of \$1,273,261. It was abandoned under the law of September 30, 1878.

CROOKED LAKE CANAL, NEW YORK.

The construction of the Crooked Lake canal was authorized April 11, 1829, and work was commenced in April, 1830. The canal was completed October 10, 1833, and connected the navigation of Seneca and Crooked lakes. Its length was 7.69 miles. The last traffic passed over it during the year of 1874, but it was not formally abandoned until 1878.

JUNCTION CANAL, NEW YORK.

The Junction canal was constructed by an incorporated company, with the design of connecting the Chemung canal at Elmira with the Wyoming or Upper North Branch canal of Pennsylvania, and was completed in 1859. It was 11 miles in length, and by means of this short link in the chain of canals a continuous navigation for boats of 180 tons was secured from the Erie canal at Montezuma to Chesapeake bay and the ocean.

ERIE CANAL, OF PENNSYLVANIA.

The Erie canal of Pennsylvania and its branches extended from Bridgewater, on the Ohio river, to Erie city, on lake Erie, a distance of 163 miles, and comprised the following divisions: Beaver division, 30.75 miles, completed in 1833; French Creek division, 27 miles, in 1834, the Erie extension between the pool above Newcastle and Greenville and a part of the Chenango line being brought into use in 1843. The amount expended by the state on these works was: Beaver division, \$519,364; Erie extension \$4,196,148; French Creek division, \$817,779; making a total of \$5,533,291. The Erie Canal Company was chartered on the 7th of March, 1843, and purchased from the state this line of canals on condition that they complete the work by the fall of 1844, which was done, but never paid half interest on the amount expended by the company, which was about \$900,000.

After the completion of the Erie and Pittsburgh railroad, which runs parallel with the canal, it was never able to pay, as the railroad could carry at a profit for prices that would not pay on small boats with the heavy lockage which this canal had.

In 1870 the Pennsylvania Railroad Company bought the controlling interest in the canal and kept it open until the fall of 1871 at a loss of about \$15,000, and then abandoned it and sold out the property, as under the laws of Pennsylvania the company owned the fee of all the lands, resources, etc.

UNION CANAL (BRANCH), PENNSYLVANIA.

In 1828 a branch of the Union canal was commenced, first as a feeder, but afterward carried on a distance of 22 miles as an avenue for trade to Pine Grove, into the heart of the anthracite coal region. This was completed in 1832, and the transportation of coal was commenced in the succeeding year. Of the 22 miles, 15 are now abandoned.

BALD EAGLE CANAL, PENNSYLVANIA.

This canal extended from the state dam, on the Bald Eagle creek, at the head of the Bald Eagle side-cut, to the town of Bellefonte, in Centre county; 25 miles was built in 1835.

SANDY AND BEAVER CANAL, OHIO.

Work was formally begun on the Sandy and Beaver canal in 1834, but was not completed until 1846. It connected the Ohio State canal with the Ohio river and the Pennsylvania State canal at Pittsburgh, leaving the Ohio canal at Bolivar, passing through the valley of the Sandy branch of Tuscarawas river, in Stark county, over the dividing ridge in Columbiana, and entering Pennsylvania near the mouth of Little Beaver creek, about 30 miles below Pittsburgh. Its length was 84 miles, and cost \$2,000,000.

The building of the Pittsburgh, Fort Wayne, and Chicago railroad and the Cleveland and Pittsburgh railroad damaged to a great extent the prospects of this canal. The lack of sufficient quantity of water for navigation, as the country was not naturally adapted for the supply, proved detrimental also, and the canal was abandoned in 1852. Its track may be traced over the entire original course, and traces of tunnels and reservoirs are still plainly to be seen; but these traces are all that remain of what promised to be an important highway for traffic.

OHIO AND PENNSYLVANIA CANAL, OHIO.

The survey and location of the route of the Ohio and Pennsylvania canal was made by Sebried Dodge, esq., in October, 1827, and the estimated cost was placed at \$764,372 by this engineer. Its object was to connect the great Pennsylvania system with the Ohio canal, and it extended from Akron eastward through Summit, Portage, Warren, and Mahoning counties. This canal was built about 1838 by subscription to the stock taken, citizens taking two-thirds and the state one-third. The Mahoning railroad was built in 1852 to Cleveland, the stockholders of the road owning a large share of the canal stock. About this time the legislature was asked to sell the state's interest in the canal, which was finally done, the state receiving some \$30,000 for its share. It was stipulated in the act that the purchasers should have all accrued earnings since the last settlement, which amounted to \$37,000, but it required that the canal should be kept in navigable condition. The Mahoning Railroad Company was the purchaser, and they raised the tolls so high that boating was not profitable. After boats ceased to run, persons at Kent and at Cuyahoga Falls, Ohio, cut the embankments and let the water out, and after much litigation the courts declared the canal abandoned.

JAMES RIVER AND KANAWHA CANAL, VIRGINIA.

An act for clearing and improving the navigation of James river was passed by the legislature of Virginia on the 5th of January, 1785. By this act the first or old James River Company was incorporated. They constructed a canal around the falls of James river, extending from the city of Richmond to Westham, a distance of about seven miles, and improved the bed of the river by sluices as high up as Buchanan.

The second James River Company, on state account, enlarged and reconstructed the former canal from Richmond to Westham, and extended the same to Maiden's Adventure, in Goochland county, a distance of 27 miles. This company also constructed a canal through the Blue Ridge, 7½ miles long, and a turnpike road from Covington to the mouth of the Big Sandy river, 280 miles long, and improved the Kanawha river by wing-dams and sluices from Charleston to its mouth, a distance of 58 miles.

The James River and Kanawha Company was incorporated March 16, 1832, and organized May 25, 1835. By the charter the whole interest of the commonwealth in the works and property of the then existing James River Company was transferred to the James River and Kanawha Company, the state being interested in the latter to the extent of three-fifths of its capital stock, and individuals and corporations to the extent of the remaining two-fifths.

The works of the James River Company were valued at \$1,000,000, the state receiving a credit for that amount in part of her subscription to the capital stock of the James River and Kanawha Company. The new company, moreover, was charged with the payment of the annuity of \$21,000 forever to the stockholders of the old James River Company; and as this sum is equivalent to a principal of \$350,000, at 6 per cent. interest, it will be seen that this company took the old works at the price of \$1,350,000.

The construction of the new canal from Richmond to Lynchburg was commenced in 1836, and the work was completed about the 1st of December, 1840. In that time the work of construction of the second division of the canal above Lynchburg was commenced and prosecuted up to the year 1842, when for want of funds it was abandoned. On the 1st of March, 1847, an appropriation of \$1,246,000 was made by the legislature for the purpose of completing the unfinished work between Lynchburg and North river and for the extension and completion of the canal to Buchanan. The work was commenced in July, 1847, and completed in November, 1851.

Fifteen miles of the third division of the canal, next above Buchanan, was put under contract in August, 1853, but for want of funds the work was suspended in the fall of 1856. The work done on this portion of the line consisted chiefly of stone locks, aqueducts, and tunneling. The original capital of the company was \$5,000,000, of which the state paid \$1,000,000 in old works; and of the private subscription there proved to be insolvent \$73,336, leaving \$3,926,664 as the actual available cash capital. All beyond the capital thus realized has been money either borrowed directly from the state treasury or on bonds guaranteed by the state, on which the company has been required to pay interest from the day it was received before it was expended, and, of course, long before it began to yield any return.

The actual cost of construction of the James river and Kanawha canal, including the incomplete works above Buchanan, has been as follows:

Dock and tide-water connection	\$851, 312
First division, Richmond to Lynchburg.....	5, 837, 628
South-side connections	162, 685
Rivanna connection.....	115, 043
Second division, Lynchburg to Buchanan.....	2, 422, 556
North river improvement.....	536, 551
Third division, work done.....	511, 094
Total.....	<u>10, 436, 869</u>

The Richmond and Allegheny railroad acquired under deed of April 4, 1880, all the property of the James River and Kanawha Canal Company, and they have also assumed outstanding obligations of the company to the amount of \$1,546,020 67.

BRUNSWICK AND ALTAMAHA CANAL, GEORGIA.

A company was chartered in 1835 to construct a canal to connect the Altamaha river and Darien with the Turtle river and Brunswick, and the work was done between the years 1837 and 1842. It was again worked out in 1852 and 1853, and locks put in, though it has never been operated for business, and no steps have been taken to open it since the war. It was sold under mortgages to secure bonds, and is owned by parties in New York.

ABANDONED CANALS.

The following table is of interest, showing as it does the influence that the introduction of railroads has had upon this mode of transportation. The abandonment of a large proportion of these works was undoubtedly a result of the competition they met with in competing lines of roads. Many of the canals have become railroad beds:

TABLE II.—STATEMENT OF THE LENGTH AND RECORDED COST OF CONSTRUCTION OF ALL THE IMPORTANT ABANDONED CANALS IN THE UNITED STATES.

Canals.	Points connected.	When built.	When abandoned.	Length.		Cost of construction.	
				Miles.	Dollars.		
Grand total.....				1,953.56	44,013,166		
MAINE.							
Total.....				20.50	200,000		
Cumberland and Oxford.....	Portland—Sebago pond.....	1820-1827	1875	20.50	200,000		
NEW HAMPSHIRE.							
Total.....				5.13	142,000		
Bow Falls.....	Around falls of the Merrimac.....	1812		0.75	25,000		
Hooksett Falls.....	Around falls of the Merrimac.....		1850	0.13	17,000		
Amoskeag Falls.....	Around falls of the Merrimac.....			1.00	50,000		
Union.....	Around falls of the Merrimac.....			3.00	50,000		
Sewall's Falls.....	Around falls of the Merrimac.....	1837		0.25			
VERMONT.							
Total.....				1.06			
White River.....	Around falls of the Connecticut.....			0.50			
Waterquechy.....	Around falls of the Connecticut.....			0.40			
Bollocks Falls.....	Around falls of the Connecticut.....		1865	0.16			
MASSACHUSETTS.							
Total.....				33.65	655,000		
Middlesex.....	Chelmsford (Lowell)—Charlestown.....	1804	1853	27.00	605,000		
Pawtucket.....	Lowell.....	1834		1.65	50,000		
Montague.....	Around Montague falls, Connecticut river.....			3.00			
South Hadley.....	South Hadley falls, Connecticut river.....			2.00			
RHODE ISLAND.							
Total.....				45.00	750,000		
Blackstone.....	Providence—Worcester.....	1824-1828	1848	45.00	750,000		
CONNECTICUT.							
Total.....				83.50	827,000		
Farmington (a).....	New Haven—Suffield.....	1825	1847	56.00	600,000		
Hampshire and Hampden (a).....	Southwick—Northampton.....	1826-1835	1847	22.00	227,000		
Enfield Falls.....	Around Enfield falls, Connecticut river.....			5.50			
GEORGIA.							
Total.....				12.00	500,000		
Brunswick.....	Brunswick harbor—Altamaha river.....	1837-1842	1860	12.00	500,000		

a Consolidated into New Haven and Northampton Company.

b Total amount expended on canals to date of abandonment, \$1,478,425 10, less value of property \$389,000, leaving \$1,089,425 10 loss.

TABLE II.—STATEMENT OF LENGTH, ETC., OF CONSTRUCTION OF ABANDONED CANALS—Cont'd.

Canals.	Points connected.	When built.	When abandoned.	Length.	Cost of construction.
				Miles.	Dollars.
VIRGINIA.					
Total				196.50	a 6,189,280
James River and Kanawha	Richmond—Buchanan	1785-1851	1880	196.50	6,189,280
NEW YORK.					
Total				356.66	10,235,314
Chenango	Utica—Binghamton	1833-1837	1878	128.17	2,782,124
Chenango extension	Binghamton—state line of Pennsylvania	1833-1837	1878	40.00	
Crooked Lake	Dresden—Penn Yan	1830-1833	1874	7.69	33,287
Chemung	Head of Seneca lake—Elmira	1830-1833	1878	23.00	1,273,261
Feeder	Horseheads—Knoxville			16.75	
Genesee Valley	Rochester—Olean	1837-1840	1878	107.00	
Dansville branch	Shakers—Dansville	1840	1878	11.00	5,827,813
Millgrove extension	Olean—Millgrove	1857-1861	1878	6.75	
Junction	Elmira—Pennsylvania state line	1850		11.00	240,000
Oneida Lake (b)	Oneida lake—South bay	1832-1836		5.30	78,829
PENNSYLVANIA.					
Total				477.00	12,745,780
Pennsylvania and New York Canal and R. R. Co	Wilkesbarre—Athens	1836-1850	1872	102.75	1,000,000
Pennsylvania Canal Company, Juniata division (part)	Huntingdon—Holidaysburgh	1830	1874	37.00	
Pennsylvania Canal Company, western division	Johnstown—Pittsburgh	1830	1863	104.25	3,173,432
Lehigh Coal and Navigation Company (part)	Coalport—Stoddardsville	1838	1862	36.00	1,455,000
Union Canal branch (part)	Union Forge—Pine Grove	1823-1832	1862	11.00	684,057
Erie and branches	Bridgewater—Erie	1833-1844	1871	161.00	6,433,291
Bald Eagle and Spring Creek Navigation Company	Bald Eagle creek—Bellefonte	1835	1865	25.00	
OHIO.					
Total				205.00	3,217,552
Sandy and Beaver	Bolivar, Ohio—Smith's Ferry	1834-1846	1852	84.00	2,000,000
Ohio and Pennsylvania	Akron—Pennsylvania state line	1838		87.00	c 1,000,000
Athens branch (part)	Nelsonville—Athens			14.00	
Lebanon branch	Middletown—Lebanon			20.00	217,552
INDIANA.					
Total				453.00	7,725,262
Wabash and Erie	Evansville, Ind.—Ohio state line	1832-1851		379.00	d 6,325,262
Whitewater	Lawrenceburg—Cambridge City			74.00	1,400,000
NORTH CAROLINA.					
Total				12.00	
Weldon	Roanoke river	1829		12.00	
SOUTH CAROLINA.					
Total				51.35	850,000
Santee	Charleston harbor—Santee River	1802		22.00	720,000
Winyaw	Winyaw bay—Kinlock Creek			7.40	
Catawba				6.50	
Wateree	Jones' mills—Ellicott's mills	1826		4.00	
Saluda or Columbia	Head of Saluda shoals—Granby Ferry (Congaree river)			6.20	
Drehr's	Around falls of Saluda river			1.50	
Lerick's	Broad river			1.00	
Lockhart's	Broad river	1818-1825	1852	2.75	130,000
DISTRICT OF COLUMBIA.					
Total				1.21	e 25,978
Washington Branch canal	Potomac—Eastern Branch			1.21	25,978

a Including work done on the whole line—Richmond to Kanawha river, \$10,436,869.

b Virtually abandoned.

c Original cost, \$420,000.

d Stocks chargeable to Wabash and Erie canal to 1851. (History of State Debts, Tenth Census.)

e The District issued stock to the amount of \$50,000 in 1831 for the purchase of the canal, and later issued stock to the amount of \$137,050 for completing and enlarging the canal.

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