VIII.—THE EDISTO RIVER AND TRIBUTARIES.

THE EDISTO RIVER.

The streams flowing into the Atlantic between the Santee and the Savannah are, in general, valueless as sources of water-power, only one of them, the Edisto river, being worthy of mention. They rise for the most part below the fall-line, flow through a low and swampy country, and are entirely without power, except on some of their small upper branches, which belong to the class of sand-hill streams. The Edisto river, however, rises farther inland than the others (both of its forks having their sources in Edgefield county, above the fall-line), and some of its branches are worthy of mention. Although these streams cross the fall-line, there are no falls of importance on them so far as I could learn, or, if there are, they occur where the streams are very small. The greater part of the course of the Edisto lies in a swampy country, and has no water-power; but on the north fork and its tributaries, and especially on the south fork and one of its branches (Shaw's creek), there is considerable available power. Shaw's creek belongs to the class of sand-hill streams, and drains an area of about 119 square miles, uniting with Rocky creek, which drains an area of 195 square miles, to form the south fork of the Edisto. My information regarding these streams is necessarily very meager. They are utilized to some extent by saw- and grist-mills, and could doubtless be made to afford considerable power, their flow being probably from one-half to one cubic foot per second per square mile, with facilities, generally, for storing the water during the night. Shaw's creek has been used in half a dozen places, and it has been considered a better and larger stream than Horse creek, described further on. It is said to be even more constant than Horse creek, but its fall is probably less.

These streams are no doubt worthy of attention as regards power, although I can give no information regarding particular sites.

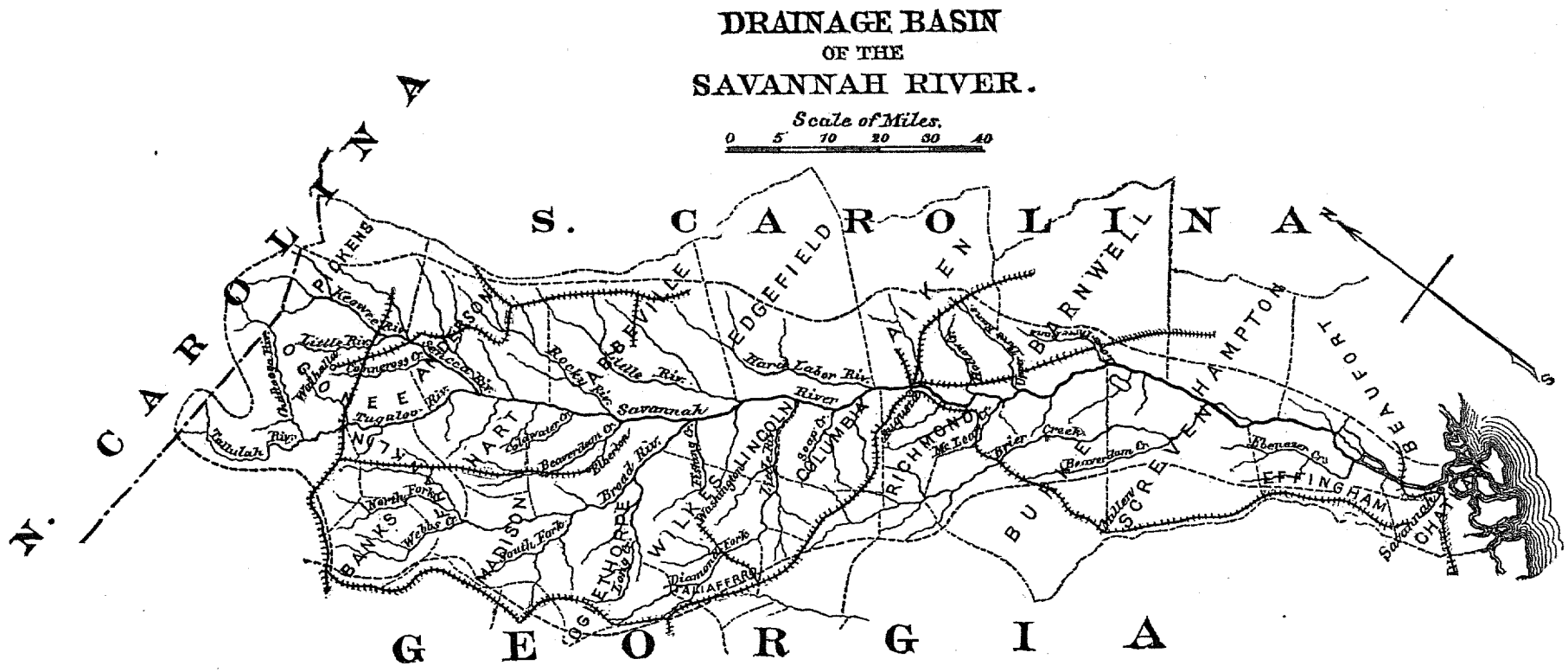
Table of power utilized on the Edisto river and tributaries.

Stream.	Tributary to what.	State.	County.	Kind of mill.	No. of mills.	Fall used.	Horse-power used.
						Feet.	
Tributary to	Edisto	South Carolina	Barnwell	Saw	2	20.0	26
Do	do	do	do	Flour and grist	2	18.0	16
Do	do	do	do	Cotton-gin	4	30.0	21
Do	do	do	Orangeburgh	Flour and grist	8	81.5	88
Do	do	do	do	Saw	9	97.0	112
Do	do	do	do	Cotton-gin	8	61+	42
Do	do	do	Aiken	Flour and grist	16	145.0	209
Do	do	do	do	Stone and earthen ware	1	8.0	40
Do	do	do	do	Saw	17	152+	325
Do	do	do	do	Cotton-gin	4	14+	21
Do	do	do	Edgefield	Flour and grist	2	20.0	31
Do	do	do	Lexington	do	4	46.0	56
Do	do	do	do	Saw	9	81.5	139

IX.—THE SAVANNAH RIVER AND TRIBUTARIES.

THE SAVANNAH RIVER.

The Savannah river, which constitutes for its entire length the boundary-line between the states of South Carolina and Georgia, is formed by the union of the Tugaloo and the Seneca rivers, both of which streams rise in the Blue Ridge, in the southern part of North Carolina, uniting on the line between Anderson county, South Carolina, and Hart county, Georgia. The Savannah pursues a nearly straight course to the ocean in a southeasterly direction, its length being about 180 miles in a straight line, and about 355 miles by the course of the river. The upper part of the stream is more nearly straight than the lower, the distance between Augusta and the head of the river being about 85 miles in a straight line and 107½ by the river. The stream crosses the fall-line at Augusta, which is the only important town on the river, and the head of steamboat navigation.


DRAINAGE BASIN
OF THE
SAVANNAH RIVER.
Scale of Miles.
0 5 10 20 30 40
N. CAROLINA
S. CAROLINA
GEORGIA
PICKENS
OCONEE
ANDERSON
PENDLETON
EDGEFIELD
AIKEN
BARNWELL
HAMPTON
BEAUFORT
JASPER
EFFINGHAM
CHATHAM
BULLOCH
SCREVEN
RICHMOND
COLUMBIA
LINCOLN
WILKES
OGLETHORPE
MADISON
BANKS
HART
FRANKLIN
Keowee River
Little River
Tugaloo River
Tallulah River
Chattooga River
Seneca River
Rocky River
Broad River
Savannah River
Hard Labor Cr.
Beaverdam Cr.
Kettle Creek
Fishing Cr.
Little River
Brier Creek
Ebenezer Cr.
Ogeechee River
Little River
Diamond Fork
South Fork
North Fork
Webbs Cr.
Tallulah River
Savannah

As will be seen from the map, the drainage-basin of the river is long and narrow. Its total area is between ten and eleven thousand square miles, the maps differing to such a degree that it is impossible to determine it accurately. That part above the fall-line, or the head of the Augusta canal, measures about 6,850 square miles. Below that point the only water-power in the basin is on some tributary creeks, some of which are true sand-hill streams. Above Augusta there is considerable power on the river itself and on its principal tributaries, viz: Broad, Little, and Rocky rivers (the last two from South Carolina), which drain respectively 1,500, 530, and 240 square miles, as well as on the Tugaloo and Seneca, which drain respectively 870 and 908 square miles. Of the 107½ miles between Augusta and the head of the river 28½ miles are occupied by shoals. The general character of the drainage-basin is the same as that of the Santee, Congaree, and Broad rivers. The rainfall is about 50 inches, distributed as follows: spring, 13; summer, 13; autumn, 10; winter, 14. It varies from 44 inches and less below Augusta to 56 inches and over in the mountains. The table on page 131 gives better data regarding the variation in different parts of the basin. The stream is subject to heavy freshets, due to the melting of snows in the mountains and to heavy falls of rain. The average rise in freshets is about 16 feet, but sometimes this is greatly exceeded. In August, 1852, the stream rose 44 feet in 48 hours at Petersburg (about 59 miles above Augusta), and in 1875 it rose at the same place 38 feet in 36 hours. At Augusta it has been known to rise about 40 feet, inundating the streets to a depth of 4 feet or more. Freshets occur most frequently during May and August. They subside much less rapidly than they rise. Below Augusta the rise is smaller as the ocean is approached, being 18 feet at a point 133 miles lower down, and 5 feet at a point 15 miles above Savannah.

The bed of the stream above the fall-line, like that of the other streams we have described, is rock, sometimes overlaid with clay, gravel, and sand. The fall of the stream is shown by the following table:

Table of declivity of the Savannah river.

Place.	Distance from mouth.	Elevation above tide.	Distance between points.	Fall between points.	Fall between points.
	Miles.	*Feet.*	*Miles.*	*Feet.*	*Feet per mile.*
Mouth	0.0	0.0			
			170.0	68.6	0.40
Steel creek	170.0	68.6			
			33.0	10.3	0.31
Haynes' cut	203.0	78.9			
			27.0	29.1	1.08
Silver bluff	230.0	108.0			
			18.0	22.4	1.24
Augusta	248.0	130.4			
			107.5	270.0	2.51
Andersonville	355.5	400.0			

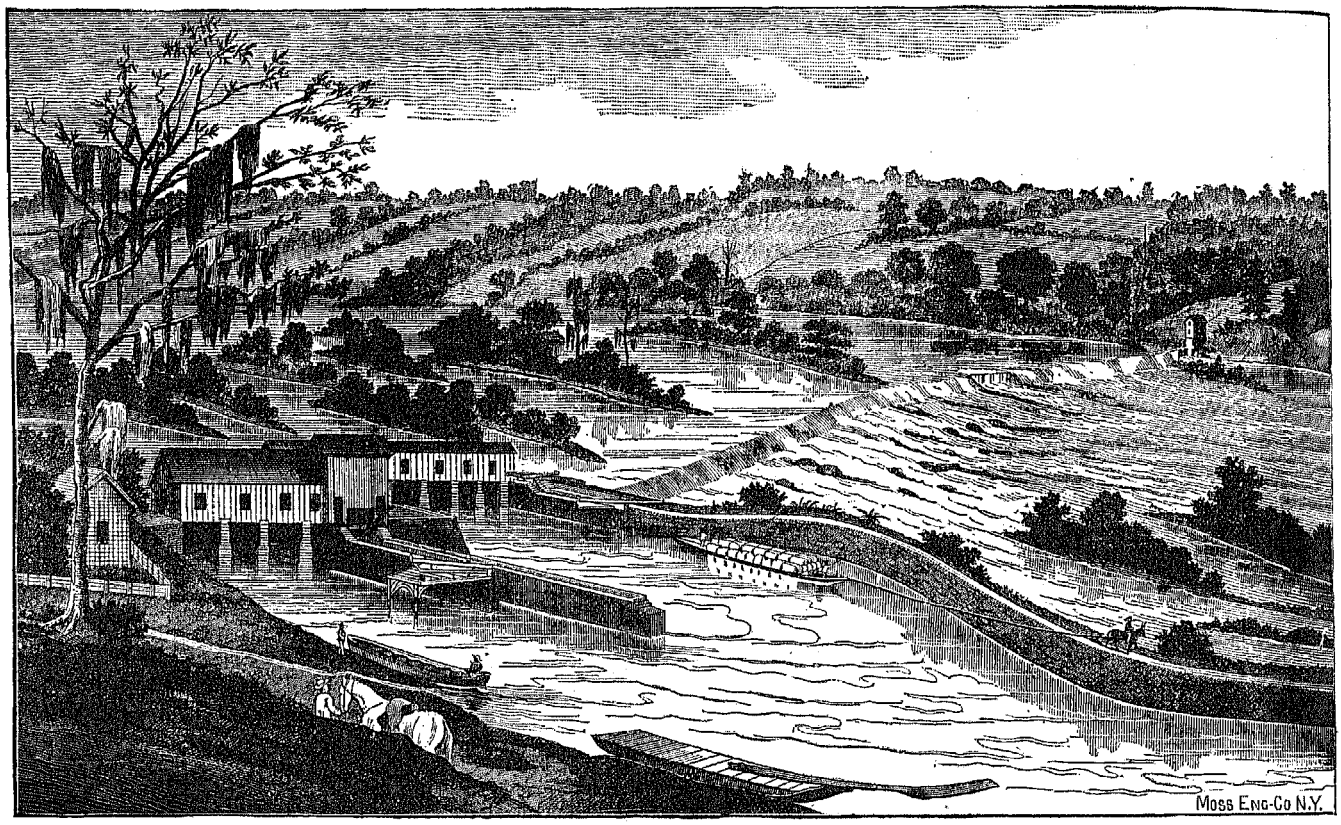
No gaugings of the stream of any value could be obtained.

The principal productions of the drainage-basin are corn and cotton, with some tobacco. The country is well timbered, and there are several gold and iron mines near the river. The map will show that the stream is not very accessible, the nearest railroad points above Augusta being Washington, Elberton, Hartwell, and Anderson, their distances from the river varying from 6 to 25 miles. The Savannah Valley railroad, now being constructed, will run from Augusta up the river for 15 miles on the Georgia side, then, crossing and running within 8 miles of the stream for 25 miles in South Carolina, to Greenwood, on the Greenville and Columbia railroad.

The Savannah river has been examined by United States engineers under the direction of General Q. A. Gillmore, whose report is to be found in the *Annual Report of the Chief of Engineers* for 1879, page 747, and from which most of the following information regarding the shoals on the river has been obtained. A reconnoisance of the river above Augusta was also made in 1874 by W. W. Thomas, civil engineer, for the city of Augusta.

Water-powers.—The first power met with in ascending the stream is at Augusta, Georgia, at which city we find one of the largest and most important utilized powers in the South, supplied from a canal 7 miles long, at the head of which is a dam entirely across the river. Before giving its technical features, a few points regarding the history of the development of this power will be interesting. The canal was commenced in 1845 and completed in 1847, under the direction of the board of commissioners appointed by the city "for the purpose of constructing a canal from a point on the Savannah river about seven miles above to the city of Augusta for manufacturing purposes, and for the better securing of an abundant supply of water to the city". Its original dimensions were as follows: width at surface, 40 feet; at bottom, 20 feet; depth, 5 feet. It was soon found, however, that these dimensions were too small to supply the demand for power and for water-supply, and the banks were raised, increasing the depth to 7 feet, but still without increasing the capacity to a sufficient extent. In 1872 it was decided to enlarge the dimensions very materially, and the work was commenced in March of that year, and completed about the middle of the year 1875. An embankment was constructed on the river side, but on the land side the water was not confined, except in places where cutting was necessary, but was allowed to flow back, cutting a contour line from the surface of the ground, and forming a number of ponds at points where valleys run down to the river,

having a total area of 275 acres, exclusive of what may be considered the canal proper. The total area of ponds and canal is about 400 acres. The dimensions of the latter are: length, 7 miles; surface width, 150 feet; bottom width, 106 feet; depth, 11 feet; area of cross-section, 1,408 square feet. The bottom is graded to a fall of about half a foot per mile, giving, if the surface of the water has the same inclination, a velocity of about 2.7 feet per second, or a discharge of about 3,800 cubic feet per second. The dam at the head of the canal, which is located in a very favorable place, is shown in the accompanying illustration. It is 1,720 feet long, 10.63 feet high on the average,



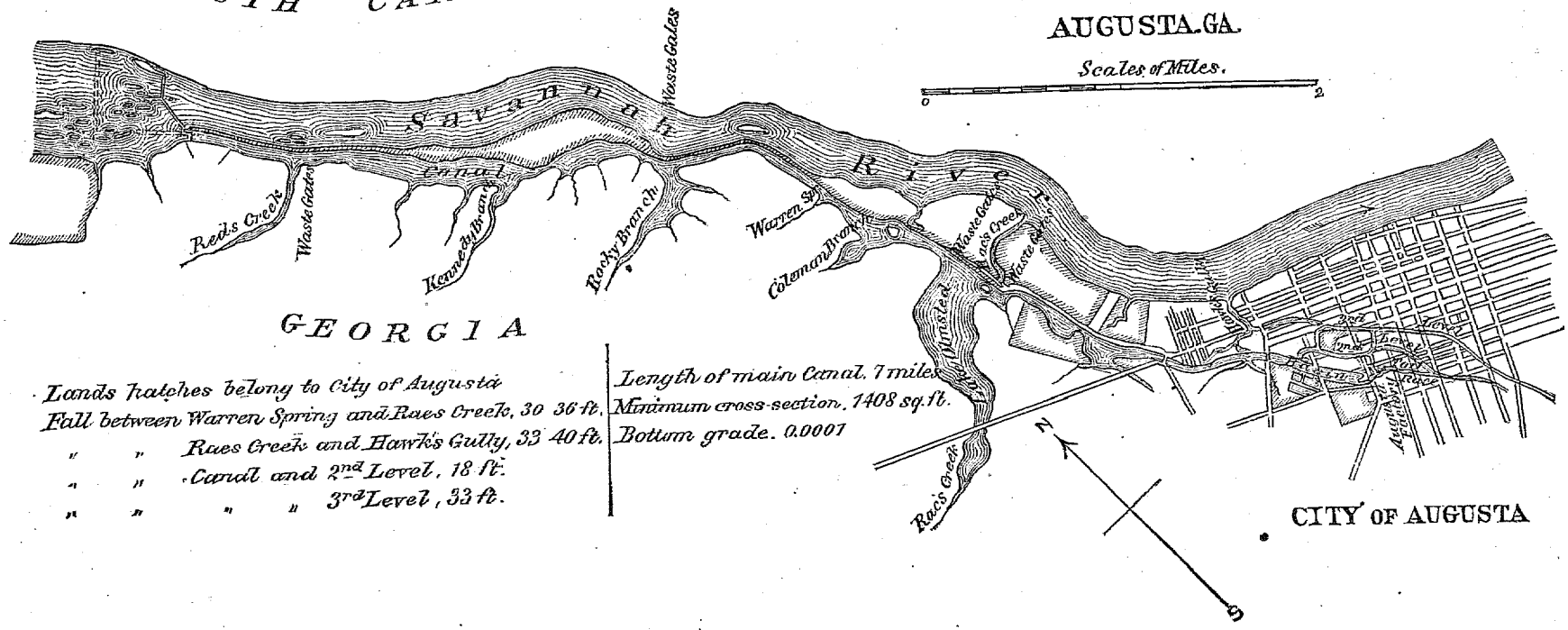
DAM AND BULKHEAD OF AUGUSTA WATER-POWER.

varying from 6 to 15 feet, and is built of solid stone, in cement, on a foundation of solid rock. It extends diagonally up stream for 1,000 feet from the bulkhead, and then 720 feet straight across, and is provided with four waste-weirs, three of them 20 feet wide and the other 15 feet, which may be closed by needles. In section it is a trapezium, its face sloping at an angle of 45°, its back one-half horizontal to one vertical, and its top at an angle of 15° backward and downward. The horizontal width of its top is 6½ feet. At one end are the locks and bulkhead, all built in the most substantial manner of granite, laid in hydraulic cement, the stone having been all obtained within a mile of the place. The cost of the dam, which was completed in 1876, was about $87,000, and that of the remaining works at the head of the canal was $132,000, making a total of $219,000. The pond extends for about 1½ or 2 miles, with an average width of 1,500 feet, interspersed with islands and rocks. The dam has never been injured by freshets or ice, and is built in such a solid way that there is no danger of its ever being disturbed—the water having stood, in one instance, 9 feet above its crest.

The fall at Augusta between the level of the canal and low water in the river is in the neighborhood of 50 feet, but the fluctuations in the river render it impossible to utilize this fall economically. Below the main canal are two other levels, aggregating about 2 miles in length, the second and third levels being, respectively, 18 and 33 feet below the first or main canal. Power is used from all three levels, the table on the following page showing in what way and to what extent. The mills can generally be run at full capacity all the time, those on the second level being troubled sometimes, but not often, with backwater from the river. The Summerville mills have worked under 16 feet of backwater.

The power at Augusta is owned entirely by the city, water being leased to the different mills at the rate of $5.50 per horse-power. The method of determining the amount of power used is optional with the city engineer, who can actually gauge the water consumed when the machinery is in full operation, or, if he chooses, judge from the size of wheel, without measurement. All the works connected with the canal were built by the city, under Mayor Charles Estes, the moving spirit of the enterprise, the total cost, including 400 acres of land, amounting

MAP
OF THE
ENLARGED AUGUSTA CANAL
AUGUSTA. GA.



Lands hatches belong to City of Augusta
Fall between Warren Spring and Raes Creek, 30 36 ft.
" " Raes Creek and Hawk's Gully, 33 40 ft.
" " Canal and 2nd Level, 18 ft.
" " " " 3rd Level, 33 ft.

Length of main Canal. 7 miles
Minimum cross-section. 1408 sq. ft.
Bottom grade. 0.0001

to $822,000. This land includes fine building-sites, as well as space for operatives' houses, the available fall between the canal and the river varying between 33 and 40 feet. The accompanying map will show the location of these lands.

The drainage area of the Savannah river above the head of the Augusta canal is about 6,830 square miles, and the rainfall about 50 or 52 inches, distributed as follows: spring, 14; summer, 13; autumn, 10; winter, 15. I have therefore estimated the power as follows:

Table of power at Augusta, Georgia.

State of flow (see pages 18 to 21).	Drainage area.	Fall.	Flow per second.	Horse-power available, gross.			
	Sq. miles.	*Feet.*	*Cubic feet.*	*1 foot fall.*	*33 feet fall.*	*40 feet fall.*	*50 feet fall.*
Minimum	6,830	*33 to 40+	1,700	193.2	6,375	7,728	9,660
Minimum low season			2,100	238.7	7,877	9,548	11,935
Maximum, with storage			6,000	681.8	22,500	27,272	34,090
Low season, dry years			2,400	272.7	9,000	10,908	13,635

*See description.

The existing canal is of sufficient capacity to carry the entire flow of the stream in dry seasons. The storage room offered by the canal and ponds would be sufficient to allow of the power used during 12 hours being increased to some extent above that afforded by the stream in the low season of dry years, but not to any great extent. The utilization of the maximum power could only be effected at great cost.

The power just described is one of the finest in the South. The advantages of transportation are of the best, building-stone of the best quality can be had with ease, the locality is healthy, and large amounts of power can be rented from the city on favorable terms. These advantages are being rapidly improved. The Sibley mills, now being built, will use 1,000 horse-power, and the company expect to double their capacity within a short time, and eventually to triple it. As the advantages become more widely known the surplus power here available must be rapidly utilized.

Table of power utilized at Augusta, Georgia.

I.—WATER TAKEN FROM MAIN CANAL (FIRST LEVEL) AND DISCHARGED TO RIVER.

[The powers given are those to which the different mills are entitled. The figures differ from those in the statistics of the special agent on cotton-mills.]

Name and kind of mill.	Fall.	Horse-power.	Remarks.
	Feet.		
1. Summerville cotton-mills	32.00	170.00	Hercules wheel. Fall of 11 feet to tail-race at low water. Highest mill on the canal, 2 miles above the basin, or lower end of main canal.
2. Sibley Manufacturing Company, cotton	38.00	1,000.00	Now building. 100 looms and 3,000 spindles. Expect to double capacity soon.

II.—WATER TAKEN FROM FIRST LEVEL AND DISCHARGED TO SECOND.

1. Enterprise Manufacturing Company, cotton	16.44	395.00	
2. Augusta flour-mills	13.00	200.00	John M. Clark's Sons. Have lately increased power above that given.
3. Augusta cotton factory	15.25	1,200.00	850 horse-power actually used.

III.—WATER TAKEN FROM SECOND LEVEL AND DISCHARGED TO THIRD, OR TO RIVER.

1. Schley's grist-mill	12.07	54.50	
2. Globe cotton factory	12.30	91.00	John M. Clark's Sons.
3. Augusta Paint Company	12.30	25.00	
4. Southern Cross cotton factory	12.20	61.88	
5. Cottonseed-oil mill	11.50	56.00	
6. Excelsior flour-mill	11.00	152.00	George T. Jackson & Co.
7. Foundry and planing-mill	11.00	13.00	Pendleton & Bro.
8. City water-works pump	11.00	45.00	
9. Arctic Ice Company	11.00	62.26	
10. Crescent flour-mill	10.63	125.00	L. F. & L. J. Miller.

The next power above Augusta is at Blue Jacket shoal, where the fall is 10 feet in 200 yards. Then comes Long shoal, with a fall of 35 feet in 5 miles. The average width of the river is 600 yards. The head of the shoal is

about 5 miles below the mouth of Little river, South Carolina. Then follow a number of smaller shoals, many of which may offer good sites for power, to determine which a survey would be necessary. The most important shoal, however, is Trotter's shoal, which is 7 miles long, with a total fall of 74.88 feet. The head of the shoal is at the mouth of Rocky river, South Carolina, and the foot 5 miles above the mouth of Broad river, Georgia. This shoal probably offers the finest power on the river above Augusta, and is now almost entirely unutilized, being only used for a couple of small grist-mills. The river descends over a series of ledges of solid rock, and is, on the average, 800 yards wide. The banks are said to offer no difficulties as regards the construction of canals or buildings. The river rarely rises so much as 10 feet during freshets, and there is of course no trouble with ice. Fine building-materials—granite, timber, clay for brick, and soapstone—abound in the neighborhood, and iron and gold are said to have been found close by the river. The surrounding country is well adapted for the cultivation of corn and cotton, the climate is healthy, and although the site is at present rather inaccessible, being about 15 miles distant from Elberton and Abbeville, the nearest railroad points, yet the proposed Savannah Valley railroad will pass close by the shoals on the South Carolina side, while the Hartwell and Augusta railroad, now talked of, will, if built, pass close to them on the Georgia side.* As regards water communication, it may be mentioned that steamboat navigation can probably be opened up to the foot of the shoals, the estimated cost of securing a channel 3 feet deep and 90 feet wide being $124,000,† while the cost of improvement for a pole-boat channel 3 by 30 feet was estimated at $45,000. The sum of $16,000 has been appropriated to the work.

I am indebted for much valuable and detailed information concerning these shoals to Colonel James Edward Calhoun. The power available has been estimated as in the following table:

Estimate of power at Trotter's shoals.

State of flow.	Drainage area.	Fall.	Rainfall.					Flow per second.	Horse-power available, gross.	
			Spring.	Summer.	Autumn.	Winter.	Year.			
	Sq. miles.	*Feet.*	*In.*	*In.*	*In.*	*In.*	*In.*	*Cubic feet.*	*1 foot fall.*	*75 feet fall.*
Minimum	2,664	74.88	15	14	10	16	55	670	76.1	5,700
Minimum low season								950	108.0	8,100
Maximum, with storage								2,550	290.0	21,750
Low season, dry years								1,075	122.2	9,165

Although all of the other falls on the Savannah were ascertained by measurement with an aneroid barometer, the fall of Trotter's shoal was measured more accurately with a leveling-instrument. I did not visit this shoal, and all my information is therefore derived from reports and correspondence. It is proper to say, however, that every one whom I questioned regarding it said it afforded one of the finest powers they had ever seen. It is therefore certainly worthy of attention.

The remaining shoals on the river, with estimates of the power available, will be found in the table. Regarding them I have meager information. Cherokee shoal is 5 miles below the mouth of Van's creek, Georgia; Gregg's shoal is just above the mouth of Pickens' creek, Georgia, and just at the line between Anderson and Abbeville counties, South Carolina; Middleton's shoal is just below the mouth of Little Generostee creek, South Carolina; and McDaniell's shoal is 2 miles above Cedar creek, Georgia. Some of these shoals, and some of the smaller falls between them, have been used at different times for small grist- and saw-mills, but there is no other manufacturing of any kind on the river above Augusta except at one small woolen-mill. To determine the availability of these shoals personal examination would be necessary. It is improbable that much power will be used on the river for some time, for the great width of the stream renders dams expensive, and except at places where considerable fall can be secured, as at Trotter's shoal, it would perhaps hardly pay to utilize power very extensively, although small mills with wing-dams could be located at many places. In Anderson county the banks of the river are said to be quite bluffy, so that canaling would be difficult and costly; but below that county the country is said to be more open, and canals to be practicable. It was stated by persons acquainted with the river that Gregg's and Middleton's shoals would be hard to utilize on account of the high banks, although both have been used to a small extent for saw-mills; but that Cherokee shoal, on the contrary, could be easily used, and the whole fall rendered available. There is now a mill at these shoals with a wing-dam 5 feet high, a canal a mile long, and a fall at the mill of 16 feet.

The table on the following page gives the power utilized on the river. The only dam across the stream is the one at Augusta.

* Information from Colonel James Edward Calhoun.

† *Annual Report of Chief of Engineers*, 1879, p. 749.

Summary of power on the Savannah river.

Place.	Distance from Augusta.	Drainage area.	Rainfall.					Fall.		Horse-power available, gross.*				Utilized.		Per cent. of minimum utilized.	Remarks.
			Spring.	Summer.	Autumn.	Winter.	Year.	Height.	Length.	Minimum.	Minimum low season.	Maximum, with storage.	Low season, dry years.	Horse-power used.	Fall.		
	Miles.	*Sq. miles.*	*In.*	*In.*	*In.*	*In.*	*In.*	*Feet.*							*Feet.*		
Augusta	0.00	6,830	14	13	10	15	52	33-40	7 miles.	6,375	7,877	22,500	9,000	3,650	38	.....	See description.
Blue Jacket shoal	19.00	5,860±	14	13	10	15	52	10	600 feet	1,650	2,050	5,800	2,350	.....	.....	.....	Only power utilized is for small grist- or saw-mills.
Long shoal	30±	5,135	14	13	10	15	52	35	5 miles.	5,100	6,350	18,000	7,250	.....	.....	.....	
Trotter's shoal	64.00	2,664	15	14	10	16	55	75	7 miles.	5,700	8,100	21,750	9,165	.....	.....	.....	
Cherokee shoal	75.50	2,212	15	14	10	16	55	9	0.5 mile.	560	800	2,100	900	.....	.....	.....	
Bowman's ledge	83.00	.....	15	14	10	16	55	3	120 feet	.....	.....	.....	.....	.....	.....	.....	
Gregg's shoal	85.50	2,100	15	14	10	16	55	14	1 mile.	825	1,150	3,200	1,325	.....	.....	.....	
Middleton's shoal	88.50	2,078	15	14	10	16	55	18	1 mile.	1,060	1,500	4,000	1,700	.....	.....	.....	
Ferrill's ledge	89.75	.....	15	14	10	16	55	3	360 feet	.....	.....	.....	.....	.....	.....	.....	
McDaniell's shoal	95.50	1,900.	15	14	10	16	55	30	5 miles.	1,600	2,275	6,100	2,600	.....	.....	.....	
TUGALOO RIVER (see beyond).																	
Hatton's shoal	110.00	845	15	15	10	16	56	39	1½ mile.	936	1,131	4,095	1,287	0	0	0	No power utilized on the river.
Guest's shoal	113.50	775	15	15	10	16	56	17	1 mile.	375	450	1,650	520	0	0	0	
SENECA RIVER (see beyond).																	
Portman's shoal	113.00	740	15	15	10	16	56	60	2 miles.	1,290	1,700	5,620	1,950	0	0	0	No power utilized on the river.

*See pages 18 to 21.

TRIBUTARIES OF THE SAVANNAH RIVER.

The first considerable tributary of the Savannah river is Briar creek, which rises in Warren county, Georgia, and pursues a southeasterly course through a distance of about 85 miles in a straight line, draining an area of 830 square miles, and entering the Savannah river in Screven county. It crosses the fall-line near its source, but with no great fall at that point, and its water-power is of little consequence. Some of its tributaries may be classed as sand-hill streams, and afford small powers.

Lower Three runs and Upper Three runs, from Barnwell and Aiken counties, South Carolina, are two sand-hill streams, which could be made to afford considerable power, although at present only a small amount is utilized. Lower Three runs drains an area of 140 square miles, and is some 25 miles long, while Upper Three runs drains 165 square miles, and is over 30 miles long. Both have gradual declivities, beds of sand and clay, and considerable swamp-land along their courses. Lower Three runs has a few corn- and saw-mills in operation, and several old mill-sites not in use. It has a gradual fall of 12 or 15 feet per mile in its upper parts, according to Mr. James E. Crossland, civil engineer and surveyor, of Aiken, South Carolina, and it offers good facilities for storage. If we take its flow at from one-half to one cubic foot per second per square mile (see page 85), it will be found that the stream will afford at its mouth 8 to 16 horse-power per foot. Gaugings only can determine whether this estimate is correct. At the mouth of the stream, however, there are no sites for power. Upper Three runs, the larger stream of the two, is also a better stream. It has not so much swamp-land, has better banks, and has a greater fall, amounting to from 18 to 20 feet per mile in places, according to Mr. Crossland.* It is crossed at its mouth, near Ellenton, by the Port Royal and Augusta railroad, and near its headwaters by the South Carolina railroad. Its width varies from 120 feet at its mouth, and 100 feet a few miles above, to 75 feet at a distance of 15 miles above. The first power is at Newman's, just above the railroad bridge, where there was formerly a mill having a fall of 7 feet. The dam is still there, and is of dirt, and the site is said to be a very good one. A few miles above is a second good power, at Rouse's bridge, not now used. According to Mr. Crossland, there are now in operation on the stream and tributaries twelve grist- and saw-mills, and one cotton-yarn mill running the Clement-attachment, and also six sites formerly used, but now idle. According to the supposition above made regarding the flow of the stream, it would afford at its mouth from 9 to 18 horse-power per foot fall.

The tributaries to the Savannah from Richmond county, Georgia, afford some power, and some of them are sand-hill streams, but none are of much importance. There are also in this county some sand-hill tributaries to Briar's creek which afford good small powers, with large ponds, allowing of concentration of power during working

*I am indebted to Mr. Crossland for considerable information regarding these streams and for a map of Upper Three runs.

hours, the principal one of these streams being Sandy run. Of the streams flowing directly into the Savannah the principal are McBean's creek and Spirit creek, the former draining 92 square miles. They are used by grist- and saw-mills, with ponds so large that there is no waste except by leakage; and there have been a few cotton factories in the vicinity. There are sites on almost all of these streams, but the powers are too small to be specified in detail.

As regards power utilized, one of the most important tributaries to the Savannah river is Horse creek, a small stream about 20 miles in length, measured in a straight line, and draining about 143 square miles. It enters the Savannah from Aiken county, South Carolina, a few miles below Augusta, and is one of the most important manufacturing streams of South Carolina. It is a true sand-hill stream, and in addition it crosses the fall-line, and has a rapid fall, offering excellent advantages for power. The bed is rock in places, and in others clay and grit, and sometimes sand. The banks are good, and also the facilities for storage, as will be seen from what follows. The stream was early utilized for power, and at present all the good sites are occupied (although one is lying idle), so that it only remains to describe the powers in use: In ascending the stream the first power is at the Bath paper-mills, now not in use, situated 6 miles from the mouth, a mile above the head of boat navigation, and above the mouth of Little Horse creek, the principal tributary of Horse creek, and which drains about 36 square miles. The dam is of earth, 900 feet long and 20 feet high; the pond covers 150 acres to an average depth of 10 or 12 feet; and the head and fall was 38 feet. The dam was built in 1854, and was washed out in 1871 by the breaking of the next dam above (Langley), the damage done amounting to $33,000, the rebuilding of the dam having cost that sum. It was again washed out in 1877, and has not yet been rebuilt. The damages to dam and mill are estimated at $50,000. The power used is stated at 500 to 600 horse-power, there being scarcely ever waste of water. The drainage area above being about 100 square miles, I would estimate the available power due to the natural flow of the stream at from 6 to 12 horse-power per foot fall. It is possible, however, that this site is below the mouth of Little Horse creek, in which case the power would be about one-third greater.

Two miles above Bath is the Langley cotton-mill. The dam is of earth and crib-work, 1,000 feet long and 24 feet high, built in 1870 at a cost of $15,000, and ponding the water over 700 acres to an average depth of 10 feet. The head-race is 300 feet long, the fall 21 feet, and the power used is stated at 500 horse-power, which can be obtained at all times, no steam-power being used, and there being no waste at night in dry weather. I would estimate the power at about the same as for Bath, which would give from 275 to 550 horse-power gross during 11 hours.*

Three miles above Langley, at the town of Graniteville, is the factory of the Graniteville Manufacturing Company, the most important mill on the stream. The dam, which is a continuation of the canal bank, is principally of earth, and extends across Horse creek and one of its tributaries (Bridge creek) just above their junction, the two ponds being connected by a canal about 500 feet long. The dam across Bridge creek is of earth, about 500 feet long and 10 to 20 feet high, and is 10 feet wide on top and 30 or 40 feet at the bottom. It carries the railroad across the creek. The dam across Horse creek is 700 to 800 feet long, and is of earth, with the exception of a rock dam in the center, about 60 by 20 feet, founded on solid rock. There is also a waste-weir about 100 feet long, and the height of both waste-weir and dam can be raised by flash-boards. These dams were built in 1848 and 1867, the rock dam costing $15,000, and the earth dam $35,000. The total pond area is about 100 acres—75 on Horse creek, and 25 on Bridge creek. The canal is half a mile long, 45 to 60 feet wide, and 10 feet deep. The fall used is 43 feet, and the power 600 horse-power, which can be obtained for 300 days in the year by drawing down the water in the pond at night (at all seasons generally), the factory being run during 12 hours. No steam-power is used. The mill is sometimes obliged to stop in dry weather, generally for from 5 to 8 days per year, but in 1879 it was stopped for 17½ days. The dam has been twice carried away, but only once in the last twenty-two years, in 1867, when a heavy rain caused the breaking of 2 dams above. The drainage area above Graniteville being about 81 square miles, if we assume the net power available in dry seasons at 300 horse-power, or the gross power at 400 horse-power, with storage, or 200 horse-power with the natural flow of the stream, we shall find the discharge to be one-half cubic foot per second per square mile. The ordinary power being 600 horse-power net, with storage during the night, or 400 gross due to the natural flow, the corresponding flow is one cubic foot per second per square mile. The flow may be taken to vary between these limits.

Two railroads—the Charlotte, Columbia, and Augusta railroad, and the South Carolina railroad—pass through the town of Graniteville.

The next power above Graniteville is the Vaucluse factory of the Graniteville Manufacturing Company, 3 miles above. As in the case of Graniteville, there are two ponds, one formed by a dam across Horse creek, and covering 100 acres, and the other formed by the railroad embankment across Good Spring, and covering 42 acres, the two being connected by a conduit 4½ feet square and 450 feet long, 16 feet below the level of the ponds, and built at a cost of $2,500. The dam across Horse creek is of rock, 300 feet long and 28 feet high, the length of overfall being 60 feet, and was built in 1877 at a cost of $30,000. An iron tube 6½ feet in diameter and 350 feet long, which cost $7,000, conveys the water to the wheels, where the fall is 51 feet. The power used is 300 horse-power, which

* Power stated at 300 horse-power in statistics of special agent on cotton-mills.

can be obtained at all times by drawing down the water in the pond at night. The drainage area being about 56 square miles, the flow is calculated at about 0.6 cubic foot per second per square mile. It probably varies between one-half and one cubic foot.

Above Vancluse there are only a few small grist- and saw-mills on the stream, and none of importance.

Horse creek offers a good example of the large amount of power which can be obtained at small expense from a comparatively insignificant stream if it is only properly developed, and it is the best example of a sand-hill stream in South Carolina. Crossing the fall-line, however, near Graniteville, it offers better facilities for dams, and has more fall than most sand-hill streams, and is therefore peculiarly favorable for power. The rock bed which is found at Graniteville extends only a short distance below, but is found above for some distance. Below the Graniteville dam the bed of the stream is only about 15 feet wide, and it seems wonderful that such a seemingly small stream can afford so much power. As before mentioned, there are no other sites worth mentioning on the stream, and there are said to be few sites for reservoirs.

Some of the small tributaries of Horse creek afford good small powers. Little Horse creek has one site about 3 miles from Graniteville, where there used to be a saw-mill; but the power is not large, and I have no data regarding it.

The next tributary to the Savannah worth mentioning is Big Stevens creek, from Edgefield county, South Carolina, but I was unable to obtain information regarding its power. It is formed by the confluence of several smaller streams which have their sources in Abbeville and Edgefield counties, and the total area which it drains comprises about 650 square miles. From all I could learn, its water-power is not of much importance, and it is stated on good authority that on a great part of its drainage-basin the prevailing rock is a clay-slate, which sheds the water very rapidly, so that the flow of the stream is very variable, like that of some streams in North Carolina to which we have referred. Nevertheless, at its mouth the flow ought to be at least 75 cubic feet per second in very dry seasons, and perhaps 90 to 100 cubic feet in ordinary years in the low season. There are some mills on the stream and its tributaries, but they are of no importance.

The next tributary is Little river, from Georgia, which rises in Greene and Oglethorpe counties, flows in a general easterly direction, forming the boundary-line between Wilkes and Lincoln counties on its left, and Taliaferro, Warren, McDuffie, and Columbia counties on its right, joining the Savannah about 24½ miles above Augusta. Its length, in a straight line, is about 55 miles, and its drainage area about 695 square miles. It is 150 feet wide at its mouth. Its water-power, however, is not of much value. Flowing, as it does, at a small angle with the strike of the rock strata, its fall is not very great, and there are no precipitous descents. Its bed is sand, clay, and gravel, to a greater extent than that of the Savannah, and its banks are tolerably low. There is some trouble in securing good locations and foundations for dams. The power of the stream is used for only grist- and saw-mills, as will be seen from the table on page 141; and although there are several places where there are shoals with falls of a few feet, some of which have heretofore been utilized, yet there are no very good sites on the stream. The flow of the stream is so variable, and its water-power so small, that estimates of its flow are not necessary.

Little river, South Carolina, is the next stream worth mentioning. It takes its rise in the eastern corner of Anderson county, and flows in a southerly direction, most of its course lying in Abbeville county, entering the Savannah almost on the boundary-line between that county and Edgefield. Its length in a straight line is about 45 miles, and it drains about 530 square miles, receiving as its principal tributary Long Cane creek, from the east or north, which drains an area of about 183 square miles. It is bordered with many fine bottom-lands, which are often overflowed, and the banks, as a rule, are not very high. Its fall is moderate, perhaps about as large as that of the Savannah, or rather greater. Its elevation at the crossing of the Savannah Valley railroad, 3 miles above the Edgefield county-line, is 222 feet; and that of Long Cane creek, at the crossing of the Greenville and Columbia railroad (see map), is 481 feet. It is used for grist- and saw-mills, and has several sites not used, offering good powers. Below the mouth of Long Cane creek there is only one mill, a grist- and saw-mill (and a Clement-attachment cotton factory in course of erection), situated about a mile from the mouth of the river. Above the mouth of Long Cane creek the next power is an unutilized site known as Martin's shoal, 19 miles from Abbeville, and 8 miles above the first mill. The fall is said to amount to 15 feet in 1,500. The bed is rock, and the banks high and precipitous. I am not able to say whether this power is easily available. Above come two grist-mills, with falls of 7 and 14 feet, and then a second site, not used, known as the Trimble shoals, 13 or 14 miles from Abbeville. The shoal is half a mile long, but the fall is not known, although it is said to be considerable. The bed is very rocky, and can be crossed at low-water, by jumping from rock to rock, without wetting one's feet. The banks are said to be very steep, and the construction of a canal would present difficulty. Above this point are only a few small grist- and saw-mills. Long Cane creek, which enters Little river about 5 or 6 miles from its mouth, has more bottom-land than the latter, and probably not so much fall. It is utilized for grist- and saw-mills, and has a few shoals not used, but none of much importance.

The rainfall on the drainage-basin of Little river is about 50 inches—14 in spring, 13 in summer, 9 in autumn, and 14 in winter. I would therefore estimate its flow and that of Long Cane creek as in the table on page 134.

Estimate of flow and power of Little river, South Carolina.

Stream and place.	Drainage area.	Rainfall.					Flow per second.				Horse-power available, gross.*			
		Spring.	Summer.	Autumn.	Winter.	Year.	Minimum.	Minimum low season.	Maximum, with storage.	Low season, dry years.	Minimum.	Minimum low season.	Maximum, with storage.	Low season, dry years.
	Sq. m.	*In.*	*In.*	*In.*	*In.*	*In.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*1 ft. fall.*	*1 ft. fall.*	*1 ft. fall.*	*1 ft. fall.*
Little river at mouth	531	14	13	9	14	50	79	106	450	123	9.0	12.0	51	14.0
Little river above mouth of Long Cane	320	14	13	9	14	50	44	57	282	66	5.0	6.5	32	7.5
Long Cane at mouth	183	14	13	9	14	50	22	28	158	32	2.5	3.2	18	3.6

* See pages 18 to 21.

The next important tributary to the Savannah is Broad river, from Georgia, the largest affluent of the stream. Its headwaters are in Banks and Habersham counties, whence it flows southeast through Franklin and Madison counties, and between Elbert county on its left and Madison and Oglethorpe counties on its right, where it turns to the left and flows nearly east between Elbert county on its left, and Oglethorpe, Wilkes, and Lincoln counties on its right, joining the Savannah on the line between Elbert and Lincoln counties, and at a point about 59 miles above Augusta. Its length along its general course is about 78 miles, and it drains a total area of 1,500 square miles. It is navigable for pole-boats for a distance of 5 miles from its mouth, its width in that distance being about 300 feet. It receives as its principal tributaries the South fork, which enters between Madison and Oglethorpe counties and drains 275 square miles; the Hudson river, which enters in Franklin county and drains 213 square miles; and the Middle fork, which also enters in Franklin county, draining 192 square miles, all three entering from the west or south. The North fork, or main stream, drains an area of 167 square miles above its junction with the Middle fork.

The general character of the drainage-basin is somewhat similar to that of the lower Saluda. The country is rolling, but not rough, except in the extreme upper parts, where it is broken. The soil is, as usual, clay and loam. The flow of the stream is said to be quite variable, and the freshets heavy, overflowing large areas of low ground. The declivity is broken by shoals in various places, but they are generally not of very much importance; only in one case is a very large power produced. Regarding these shoals I was able to obtain very little information, but it is probable that none of them are worth much for power except the single one referred to. The following brief notes comprise all the information I could obtain:

Smith's shoal, about 2 or 3 miles from the mouth of the stream, is not used, the fall being stated to amount to as much as 6 to 10 feet in half a mile, capable of being increased by a dam, with good banks and bed.

Anthony's shoals, about 5 or 6 miles from the mouth, is the finest shoal on the river, and the only one of importance. I was prevented by the inclemency of the weather from visiting this site, so that the following notes are from hearsay. The shoal is situated just above the lower corner of Wilkes county, about 16 miles from Elberton and 20 miles from Washington, the nearest railroad points. It should be mentioned, however, that a road is projected between Augusta and Elberton which will pass close by the shoal, rendering it easily accessible. The fall of the shoal was variously stated at from 25 to 75 feet in a distance of one and a quarter miles. I am inclined to believe that it is in the neighborhood of 40 feet. The descent is continuous for the entire distance over a bed of rock, the channel of the stream being interspersed with islands, and the width varying from about 750 feet at the head to 1,200 feet near the middle and 600 at the foot of the shoal. The rise in freshets is probably small. The banks are favorable on the north side, where it is said that the whole fall could be utilized by a canal. On the south side they are very bluffy on the lower half of the shoal, and the whole fall could not be utilized. The location for mills is safe, and not liable to overflow in high water. Power has been used on the north side for a cotton factory—the Hopewell factory—which was burned some time ago, and on the south side for two grist-mills, only one of which is now in use. At the head of the shoal is a dam of wood and stone, 18 inches high and 500 feet long, entirely across the river, and from it a race 1,200 feet long leads to the grist-mill on the right bank, where the fall is 12 feet. Above the tail-race of this mill a wing-dam of wood and stone, 18 inches high and 160 feet long, extends from the left (north) bank across to an island, and from it a race about a quarter of a mile long leads to the old cotton factory, where the fall is 18 or 20 feet. The fall continues for three-quarters of a mile below the factory, and in this distance there was once a mill on the right bank, not now used. The exact fall below the factory is not known.

The drainage area above this site is about 1,467 square miles, and the rainfall about 55 inches—15 in spring, 14 in summer, 10 in autumn, and 16 in winter. It is greatest in the upper part of the basin. Having no record of gaugings of the river, I have estimated the power as on page 135.

Table of power at Anthony's shoals, Broad river, Georgia.

State of flow (see pages 18 to 21).	Drainage area.	Fall.*	Flow per second.	Horse-power available gross.	
	Sq. miles.		*Cubic feet.*	*1 foot fall.*	*40 feet fall.*
Minimum	1,467	.....	370	42	1,680
Minimum low season			528	60	2,400
Maximum, with storage			1,450	165	6,600
Low season, dry years			606	68	2,720

*See description; probably not less than 40 feet.

The topography of the drainage-basin is such that it would probably be very expensive to secure the maximum with storage. I am unable to state whether a large pond could be secured or not.

This power was stated by every one who had seen it, and with whom I communicated on the subject, to be one of the finest in the vicinity, and easily controlled. The above estimates show that the power is very large. The facilities for transportation are at present poor, but if the projected railroad is built there will be no difficulty on this score. Good building material can be obtained near at hand. I am indebted for much information regarding the site to Mr. John Thompson.*

At Baker's ferry, 4 to 5 miles above Anthony's shoals, there is said to be a natural fall of 3 feet in 600, not used; and 4 or 5 miles farther up there is a mill in Oglethorpe county, near the edge of Wilkes, with a fall of 3 or 4 feet. Above that there is no power below the mouth of the South fork, which enters some 20 miles above Anthony's shoals; and even above the mouth of the South fork, although there are a few small shoals, there are no powers of importance. Mention was made of Dedwiler's shoal, Thicket's Ferry shoal, Moore's old mill, King's Ferry shoal, Murray's shoal, and of a shoal near Franklin springs, none of them used or of any consequence. The water-power of the Broad river, with the exception of that at Anthony's shoal, seems to be of little value.

The South fork, or South Broad, has a few powers worth mentioning. A mile or two above its mouth is Eberhart's mill, at Pogg's shoal, where the fall is considerable. The stream flows over a ledge of rock, and the total fall is said to amount to 80 feet in a distance of a mile. The banks are high, but not bluffy. A fog at the head of this shoal turns the water into a race 100 feet long, which conveys it to a grist-mill, where the fall used is between 20 and 30 feet. This shoal is a good one, but the power is small. Four miles above is a similar shoal, a quarter of a mile long, with a fall of some 25 or 30 feet, used by Watson's grist-mill. There are other precipitous falls on small streams in the neighborhood. Hudson river is said to have no power except near its headwaters. Middle Broad river has no mills. Near its mouth the country is said to be very broken, and it is probable that the stream is shoaly for several miles above its junction with the North Broad. Above that the stream has a good deal of bottom-land and low banks along its course, subject to frequent overflow. The North Broad has several mills, but no great falls, the power at the mills being in all cases obtained with high dams. This fork, like the previous one, has generally low banks and large areas of bottom-land overflowed in times of high water. As regards the flow of these streams detailed estimates are not necessary. I would judge that the three forks and the Hudson might be depended upon at their mouths for at least 0.18 to 0.22 cubic foot per second per square mile during the low season of very dry years and 0.26 to 0.32 during the low season of ordinary years. The drainage areas having been previously given, the power can be easily calculated.

The next tributary of the Savannah is Rocky river, which rises in Anderson county, South Carolina, and flows nearly south, entering the Savannah in Abbeville, just at the head of Trotter's shoals. Its length in a straight line is about 40 miles, and its drainage area 241 square miles. It passes within a few miles of Anderson Court-house, and its elevation, where it is crossed by the Greenville and Columbia railroad, about 2 miles east of that place, is 669 feet above tide, while at the crossing of the Savannah Valley railroad, 3 miles below Lowndesville, it is 356 feet. The general character of its drainage-basin is similar to that of Little river, South Carolina, but there are fewer bottoms than on the latter stream, the banks are higher, and the rises more sudden. The stream offers considerable power, but is used only for grist- and saw-mills. The flow is quite variable—more so than that of Little river. The first power on the stream is at the mouth; but from all I could learn the fall is small and the power of little value, although formerly there was a mill there. The stream at this place is about 90 feet wide. The next power above is a grist-mill, with 12 feet fall, 3 miles from the mouth of the stream. Above it are four more mills in Abbeville county, one of which (Burdett's), 5 miles northeast of Lowndesville, is situated on a fine shoal, the fall being stated at 47½ feet in 1,500. The mill uses 31 feet and a small amount of power. There are no important sites not used in Abbeville county. In Anderson county there are three grist-mills with small falls. They are troubled sometimes for want of water, but the dams are not tight. There are also two sites not used in this county: the lowest one, not far from the county-line, known as Lee's shoal, with a natural fall of 10 feet in a short distance, capable of

*In a letter of recent date Mr. Thompson writes that he has measured the fall with a spirit-level and finds it to be over 70 feet.

being increased to 15; and the upper one, known as High shoals, 6 miles above the first, a mile above the mouth of Broadaway creek and 5 miles from Anderson Court-house, with 38 feet fall in 200 yards, not capable of being increased.

The remaining tributaries of the Savannah below the junction of the Seneca and Tugaloo are not of much importance. Beaverdam creek, from Elbert county, Georgia, which enters nearly opposite the Rocky river, is well utilized by grist-mills, there being no fewer than nine mills on it, although its length is only about 30 miles in a straight line, and its drainage area 185 square miles. The mills have falls of from 12 to 20 feet. At Gray's mill, the second as the stream is ascended, although only about 10 feet fall is used, the total fall of the shoal is stated to be nearly 25 feet in a distance of a mile. At Flat shoals, some 25 miles from the mouth of the stream, there is a fall of about 18 feet, not used, and at several other places there is unutilized power. Near its mouth the stream will run 2 pair of stones all the year with a fall of 10 feet and a good motor. The other tributaries to the Savannah—Coldwater and Cedar creeks, from Georgia, and Little and Big Generostee creeks, from South Carolina—all have shoals and afford small powers. The last-named drains about 75 square miles, and has two shoals, known as Hard-Scrabble and Hamilton shoals, the former only a quarter of a mile from the mouth, with an available fall of 16 feet at the mill and considerable fall above and below not utilized.

THE TUGALOO RIVER.

This stream, one of the two headwaters of the Savannah, is formed on the line between Georgia and South Carolina by the union of the Tallulah and Chatuga rivers, the former of which rises in Rabun county, Georgia, and Macon county, North Carolina, and flows in a general southeasterly direction through Rabun county, draining an area of 155 square miles, and the latter of which rises in Jackson county, North Carolina, and flows in a southwesterly direction, forming the boundary-line between Georgia and South Carolina, and draining an area of about 294 square miles. The Tugaloo flows in a southeasterly direction between the two states, its length being about 35 miles in a straight line and 49 by the course of the stream, and its total drainage area at its mouth being 870 square miles, or 421 square miles exclusive of the Chatuga and the Tallulah. Its principal tributaries are: from South Carolina, Big Beaverdam, Choestoe, and Chauga creeks, the last draining 71 square miles; and from Georgia, Shoal, Toccoa, and Panther creeks, all small streams.

The drainage-basin of the Tugaloo river proper has no peculiarities that have not been already referred to in describing the middle and western divisions of the southern Atlantic water-shed in the introduction. There is some limestone in the upper part of the basin. The river flows over a rocky bed, broken in places by shoals, but by none of importance except in the last 8 miles of its course. Its declivity is gradual, and its water-power not of much value. It is bordered by considerable tracts of fertile bottom-land, sometimes overflowed, although the freshets were not stated to be very violent. The elevation of the stream at the crossing of the Atlanta and Charlotte Air-line railroad, about 36½ miles from its mouth, is about 638 feet, while that of its mouth is 400 feet; so that the fall is 238 feet in 36½ miles, or at the rate of 6½ feet per mile. The rainfall in the whole drainage-basin is about 56 inches—15 in spring, 15 in summer, 10 in autumn, and 16 in winter. There are no records of gaugings. The stream is not very accessible, as will be seen from the map, the nearest railroad point to the mouth being Hartwell, 5 miles distant, while the Atlanta and Charlotte Air-line railroad crosses the river almost at right angles.

There is not a mill on the stream, and there are only a few places suitable for power. The first site is Hatton's shoal, one and a half miles long, with a fall of 39 feet, as ascertained by the barometer.* The foot of this shoal is about 2½ miles above the mouth of the stream, and its head is just below the mouth of Beaverdam creek. The width of the stream at the foot is 150 feet, but in the course of a quarter of a mile it widens to 1,400 feet, and the water is very shallow. At one point there is a perpendicular fall of 2 feet, but the fall is, with this exception, quite gradual. The country is quite broken from the mouth of the river up to above the shoal, and at the shoal itself the banks are quite high, especially on the South Carolina side, so that a canal could be built only with great difficulty on this side. The Georgia side is more favorable, and could probably be canaled; but I had no opportunity to examine the site thoroughly. There was once a mill near the foot of the shoal on the Georgia side with a wing-dam and a fall of 5 or 6 feet, the banks being tolerably low on that side for half a mile or so. The drainage area above the shoal being about 845 square miles, I have estimated the power as in the table, p. 137. It must be remarked, however, that the fall, as determined by the barometer, is so liable to error, that little dependence is to be placed on the result; and it was thought by persons acquainted with the river that the fall does not amount to 39 feet.

*Annual Report of Chief of Engineers, 1879, p. 754.

Table of power on Hatton's shoals, Tugaloo river.

State of flow (see pages 18 to 21).	Drainage area.	Fall.	Flow per second.	Horse-power available, gross.	
	Sq. miles.	*Feet.*	*Cubic feet.*	*1 foot fall.*	*39 feet fall.*
Minimum	845	*39	211	24	936
Minimum low season			255	29	1,131
Maximum, with storage			925	105	4,095
Low season, dry years			290	33	1,287

* As determined by barometer.

The next shoal is Guest's, the fall being stated at 17 feet in a mile, as found by the barometer. This shoal was stated to be of little value for water-power. In the table on page 131 is an estimate of the power, assuming the fall at 17 feet.

As the mountains are approached the fall of the stream becomes more rapid, and for a mile and a half below the junction of the Chatuga and the Tallulah the fall is at the rate of 30 feet to the mile.* The country is rough here, the banks abrupt, and the site inaccessible. Its value for manufacturing is probably small.

The width of the Tugaloo is 310 yards at its mouth, 50 yards above Guest's shoal, 40 yards at the crossing of the Atlanta and Charlotte Air-line railroad, and 150 yards at the junction of the Chatuga and the Tallulah.

There is some power on a few of the tributaries of the Tugaloo, although it is not extensive. Little Beaverdam creek, which enters at the mouth from South Carolina, has one power at its mouth, where there used to be a yarn-mill, using the Clement attachment, but the power is now used for a saw- and grist-mill. The fall used is 20 feet, but it could be increased to 25 or 30 feet by raising the dam. The power, however, is very small, not over 25 to 30 horse-power in a low season. Big Beaverdam creek, which enters at the head of Hatton's shoals, has a large fall near the mouth, said to be 65 feet or more in a mile, and at one place almost 30 feet in one pitch. This stream, however, is also small, and in dry weather will give probably not over one horse-power per foot fall. Shoal creek, Georgia, enters 10 miles above Guest's shoal, and has several shoals and mills, including one cotton-mill, a mile or so from the mouth, using 26 feet fall and 15 or 20 horse-power. The falls on the creek are large, Parker's grist-mill having a fall of 16 feet, and his wool-carding mill a fall of 20 feet. Choestoe creek, from South Carolina, is a similar stream, but its water-power is not so extensive. Chauga creek, from South Carolina, is a more considerable stream, and enters 2¼ miles below the railroad crossing. It drains about 71 square miles, according to the map used, which, however, is inaccurate. The stream has little bottom-land, and is subject to heavy freshets, which sometimes rise very suddenly. The first power on it is Gilmer's mill, half a mile above the railroad and one and a half miles from Fort Madison, with a fall of about 12 feet. Farther up are other sites, and near its head is a fall of 60 feet in one-fourth of a mile. On its upper waters are a number of precipitous descents, but of no value for water-power. One little tributary to the Tugaloo above the Chauga has a perpendicular fall of 60 feet near its mouth; and on Toccoa creek, a very small stream, draining 25 or 30 square miles, are the famous Toccoa falls, where the stream falls 183 feet perpendicularly. The place is much frequented by tourists, but the water-power is of no practical value.

The Chatuga river is a mountain stream, with considerable fall, and no doubt numerous sites for power, but nothing could be learned of any particular ones. Its flow is subject to great fluctuations, and its inaccessibility renders its water-power of small value. It is 150 yards wide at its mouth, with very precipitous banks, and the surrounding hills are from 800 to 1,000 feet high.

The Tallulah river is similar in character to the Chatuga. The Tallulah falls, about 15 miles from Toccoa city, on the railroad, and 10 miles above the mouth of the stream, is a noted place of resort, and one of the wildest and most picturesque spots in the state. The stream flows through a narrow gorge, with very high banks, and descends in a series of pitches (four of which have perpendicular heights of from 50 to 80 feet), falling, it is said, 500 or 600 feet in a mile. Its width varies from 15 to 100 feet. At the head and the foot of the falls the banks are of ordinary height, but in the intermediate distance they are from 200 to 800 feet high, rising almost perpendicularly from the bed of the stream, and rendering the utilization of the water-power quite impracticable. There are, in fact, only two or three places where it is at all possible to descend to the bed of the stream, and these are the beds of small rivulets emptying into the river.† The drainage area above these falls is about 147 square miles, so that I would estimate the flow in the low season of ordinary years at about 44 cubic feet per second, corresponding to 5 horse-power per foot fall. The theoretically available power is therefore large, but practically the power is of no value. The romantic beauty and wildness of this place is said to be beyond description, and its praises are sounded by all who have visited it.

Before leaving the Tugaloo river, it is to be mentioned that its headwaters are not far distant from those of the Hiawassee, a navigable branch of the Tennessee, and that it is proposed to open a line of water communication between the Atlantic coast and the West by connecting the two streams by a canal.

* *Annual Report of Chief of Engineers*, 1879, p. 755.

† White's statistics of the state of Georgia, 1849.

THE SENECA RIVER.

This river, with the Tugaloo, makes up the Savannah, and, like so many streams in this part of the country, is formed by the junction of two smaller streams—the Keowee river and Twelve-Mile creek (or river)—which unite on the line between Oconee and Pickens counties, South Carolina. The Keowee has its headwaters in the mountains of Jackson county, North Carolina, and pursues a southerly course between the two counties above mentioned, draining an area of about 405 square miles, while Twelve-Mile creek rises in the northern part of Pickens county, and flows a little west of south, draining about 118 square miles. From the junction of these two the Seneca flows in a general southerly direction, its length being nearly 20 miles in a straight line, and the total area drained being 908 square miles, or 385 square miles exclusive of the basins of the two headwaters. It receives as its principal tributaries: from the east, Deep creek, formed by the union of Twenty-three Mile and Twenty-six Mile creeks, and draining 150 square miles, and Eighteen-Mile creek, draining 49 square miles; and from the west, Conneross creek, draining about 93 square miles. The character of the drainage-basin is similar to that of the Tugaloo, except that there are perhaps more bottom-lands, the banks being generally rather low. It is said not to rise so suddenly or so high as the Tugaloo; and, like that stream, it has not a single mill. The stream is crossed nearly at right-angles just below the junction of its headwaters by the Atlanta and Charlotte Air-line railroad, and several miles below by the Blue Ridge railroad. The fall of the stream averages between 7.3 and 8.75 feet per mile, if its length is assumed at 25 or 30 miles. Its elevation at its head is 619 feet, and at its mouth 400. The rainfall is the same as in the basin of the Tugaloo.

There are several small shoals on the stream, but only one of importance. There is a small shoal at the mouth, with a fall of 3 or 4 feet, capable of being increased, and another similar one at Earle's bridge, 4½ miles above; but the principal one is Portman's shoal, 5 miles from the mouth, just below the mouth of Eighteen-Mile creek, and just above the mouth of Deep creek, and of which the shoal at Earle's bridge is simply a continuation. This shoal is the most important one in the vicinity, and is now entirely unimproved, although some years ago a small amount of power was used for iron works. There is said to be an abundance of high-grade iron ore in the vicinity, but a great scarcity of fuel, and no lime within ten miles. For my information regarding these shoals I am indebted to Major T. B. Lee, civil and hydraulic engineer, of Anderson, who owns the shoals, or a part of them. The total fall is about 60 feet in a distance of 2 miles, but there is no prominent fall, except at the lower end, where there is in one place a natural fall of 9 feet in a short distance. A dam 6 feet high and a race of 500 yards long would give a fall of 20 feet with a favorable building location, and a dam 10 feet high, with a race of 800 yards long, would afford a fall of 30 feet. The dam would be about 600 feet long, and there is in the immediate vicinity an abundance of material for building. The bed of the stream is rock and gravel, and the banks favorable for canals and for building, except in a few places, where the banks are bluffy. This shoal is 10 miles from Anderson and 6 miles from the Blue Ridge railroad. A new railroad is said to be projected, which will pass less than a mile from the place.

The drainage area above being about 740 square miles, I have estimated the power as in the following table:

Table of flow and power at Portman's shoals.

State of flow (see pages 18 to 21).	Drainage area.	Fall.	Flow per second.	Horse-power available, gross.		
	Sq. miles.	*Feet.*	*Cubic feet.*	*1 foot fall.*	*20 feet fall.*	*60 feet fall.*
Minimum	740	60	189	21.5	430	1,290
Minimum low season			250	28.4	570	1,700
Maximum, with storage			825	93.7	1,875	5,629
Low season, dry years			286	32.5	650	1,950

It must be especially mentioned here that Major Lee, who is an engineer of eminence and of long experience, and well acquainted with the country, writes that "1,000 cubic feet of water per second all the year round—two-thirds of the year double this flow—is to be had". I do not, however, understand this result to be based on a continued series of gaugings, but I have thought best to call attention to it, and to the differences between this and the estimates in the table above. I have in many places sufficiently emphasized the fact that the latter must be liable to many errors; and I must further state here that just in this part of the state of South Carolina I have discovered a number of errors in the map I have used. I can scarcely think, however, that the measurement of the drainage area is in error by more than 10 per cent., and even if my estimates are increased by that fraction they will still be very much less than Major Lee's. As for my method of making the calculation, I have already said enough in the introduction, and on pages 107 and 108. Major Lee states that there are facilities on the upper Seneca, as well as on the Saluda, for the construction of storage-reservoirs. It is therefore possible that the maximum power, with storage, might be rendered practically available, and it might even be possible to concentrate

the power to some extent into working hours. This power, situated in a fine cotton-growing country (Anderson county produced last year 40,000 bales, according to Major Lee), having a healthy and salubrious climate, is worthy the attention of capitalists.

Above Portman's shoals there are a few small shoals on the Seneca, but none of value. Hen shoal, sometimes spoken of, has, according to Major Lee, only a fall of a few feet. It is just above the mouth of the Conneross, 6 miles from Pendleton and 11 miles from Seneca.

Estimates of the total theoretical power of the Seneca, and other streams tributary to the Savannah, are not given, because they would have no value, on account of such a small proportion of that power being practically available.

TRIBUTARIES OF THE SENECA RIVER.

The power of the tributaries of the Seneca is of more importance than that of the main stream if Portman's shoals are not considered. The first tributary is Deep creek, which enters just below the shoal just named, draining 150 square miles, and formed by the union of Twenty-three Mile and Twenty-six Mile creeks. It is a deep and sluggish stream, with no power whatever. Twenty-six Mile creek is a small stream, entirely in Anderson county, and drains some 50 square miles. Above Centreville it is very flat, with small fall and low banks. The bed is sand, mud, and gravel, the banks clay, and the course of the stream tortuous. At and near Centreville, which is 2 miles from its mouth (junction with Twenty-three Mile creek), the stream falls quite suddenly, and for the rest of its course flows considerably below the general level of the surrounding country. There are two grist-mills on the stream above Centreville, and one at that place using a fall of 14 feet; but the available fall is said to amount to 26 feet, which could be utilized by building a dam higher up. The place is favorable for building, and the power is a good one, though small. The tributaries near Centreville have large falls near their mouths; for example, on Emery creek there is a fall of 60 feet, and on Hurricane creek a similar one. Twenty-three Mile creek is considerably larger than the last, draining 87 square miles or thereabout. It has its sources in Pickens and Anderson counties. The upper part is flat, like the stream last described, and its general character is the same; while on the lower part there are several powers. Descending the stream, the first power is at Pendleton cotton factory, where the fall is 25 to 30 feet. I have received no information regarding the power, but it probably does not exceed 60 horse-power.* Below it is Burns' shoal, not used, where a dam 15 or 20 feet high could be built without interfering with the factory above, and that amount of fall utilized. Below is a grist-mill, with a fall of 6 feet, although 14 could be got, with a good building-place. The country is high and rocky on each side. The lowest power on the stream is a mill about three-fourths of a mile from its mouth, where there is a natural fall in the stream of 35 feet or more in 300 yards, but not a very favorable place to build, and difficult of access. The stream is very rapid, and shut in by hills on both sides. This fall corresponds to Portman's shoal on the Seneca, and is probably caused by the same ledge of rocks.

The next tributary is Eighteen-Mile creek, which enters the Seneca just above Portman's shoal. It drains about 50 square miles, corresponds in general character with the two streams last described, and has no power except near its mouth, where there is a mill with a fall of 12 feet, and nearly twice as much available. It is not a noteworthy site.

Conneross creek, from the west, is the next tributary. It is about 22 miles long in a straight line, and drains an area of about 93 square miles, all in Oconee county, except a few square miles near the mouth. Its drainage-basin is long and narrow, and its fall rapid. Its bed is rock, its banks generally good, and it is in all respects a better stream for water-power than the tributaries thus far named, except that it may be subject to heavier freshets. The lowest shoal on the stream is owned by Mr. J. B. Sitton, of Pendleton, and is 5 or 6 miles from the mouth. It is utilized by a grist- and saw-mill, using 18½ feet fall, with a dam 30 inches high and a race 80 feet long. The total available fall is stated at 31 feet, over a solid rock ledge—there being two falls, the lower one only being used, and the upper one being only 250 or 300 feet above. The stream is about 70 feet wide, and the banks favorable. This shoal is favorably located, and is 5 miles from Seneca, on the Atlanta and Charlotte Air-line railroad.

A mile and a half above is another large shoal, known as Swepson's or High shoals, also 5 miles from Seneca. It was formerly known as Anderson's mill-site. The fall is very large, amounting, it is said, to 50 feet or more in a few hundred yards. It is said, however, to be difficult to utilize, on account of the high bluffs on each side. A large reservoir could be formed above the shoals, but not without overflowing much good land. Above this there are no large falls, except far up the stream, where there is in one place a fall of 26 feet, and probably there are others. Major Lee states that Conneross creek is a remarkably constant stream, varying very little in flow from season to season. Estimates of power are omitted as unnecessary. If desired, they may be arrived at by comparing with those given for some of the following streams.

Twelve-Mile creek, one of those streams which unite to form the Seneca, is comprised entirely in Pickens county, and is formed by the union of three forks. As already mentioned, it drains an area of 118 square miles. Its basin is mountainous in the upper part, and the three forks have large falls, but are very small streams. After leaving the

* Power stated at 40 horse-power in statistics of cotton-mills.

mountains, the stream flows through a level country and resembles Eighteen-Mile, Twenty-three Mile, and Twenty-six Mile creeks, only in this case the country is not quite so flat as in the others, and the banks are generally higher and not so subject to overflow. The stream is subject to heavy freshets and to more sudden fluctuations than the others; its bed and banks are rockier, and its fall greater. Toward the mouth of the stream the fall is rapid, and there are several powers worth mentioning. The first one met with in ascending the stream is Winn's, not improved, about 2 or 3 miles from Central, on the Atlanta and Charlotte Air-line railroad. This shoal has a length of about one and a quarter to one and a half miles, with an almost continuous fall. In the lower half mile the fall is not less than 25 feet, as ascertained with a pocket-level, and it is said to continue at the same rate to the head. The shoal is, however, confined between steep banks, which would present difficulty in canaling, although a canal would be practicable on the left bank. There is building room at the foot of the shoal. I was unable to examine it from head to foot, but I think that a large fall could be obtained here, although it might be best to obtain it by a dam near the foot and with a short canal. The left bank is low for 100 feet from the river, but this part is liable to overflow to some extent, and further back the bank is exceedingly steep. The river is about 125 feet wide, and the bottom is favorable for dams; so that I think there would be no difficulty in developing the power. At the head of the shoal there is an abrupt fall of 10 feet, known as Clayton's shoals, used by Robertson's saw- and grist-mill, about three miles from Central. The dam is only 1½ feet high and 175 feet long, diagonally across the stream, and the banks are favorable and safe. The fall continues for one-eighth mile above the dam, which could be made 10 feet high, and a fall of 20 feet used, if desired. The fall occurs over a ledge of gneiss-rock, and the power is an excellent one, though small. It should be mentioned that about three-fourths of a mile or so below is a place known as the "narrows", where the stream rushes swiftly between steep banks, and is very narrow.

I subjoin an estimate of the power at this place, based on analogy, as an approximation:

Table of flow and power of Twelve-Mile creek.

State of flow (see pages 18 to 21).	Drainage area.	Fall.	Flow per second.	Horse-power, gross.	Remarks.
	Sq. miles.	*Feet.*	*Cubic feet.*	*1 foot fall.*	
Minimum	118	(*)	15	1.70	Drainage area given is that of the stream at its mouth—too large for the shoal just described.
Minimum low season			21	2.40	
Maximum, with storage			135	15.40	
Low season, dry years			24	2.75	

* Probably in all not less than 50 to 60.

If the stream is fed extensively by springs, its flow will be larger in dry seasons. In ordinary years it would afford in the low season, according to the above estimate, 3½ horse-power per foot, and two or three times as much for nine months of the year. It may be remarked that the flow of Conneross creek would probably not differ much from that of the one under consideration.

Half a mile above Robertson's mill there is a small shoal with a fall of about 5 feet, and then the stream is sluggish for over a mile, when we come to a second shoal, extending for a quarter of a mile or more, at the head of which is Hunter's mill, with a dam 5 or 6 feet high and a fall of 11 feet, and no race. Above this there are no shoals for 8 miles, where the stream is so small that it is not necessary to particularize further. The estimates given above are, I think, rather too small, and it would seem as though the streams in this vicinity were subject to smaller variations in volume than would be expected. I have already referred to the constant flow of Conneross creek, and it is probable that this stream is similar in that respect. I was told at Hunter's mill that they could run four pair of stones all the time. Data, however, are entirely wanting for an accurate estimate.

The Keowee river, which, with Twelve-Mile creek, forms the Seneca, has its sources among the mountains, and is formed by the union of the Toxaway and the Big Estatoe creeks in the northern part of Pickens and Oconee counties. It flows south, and drains a total area of 405 square miles. The upper part of the basin abounds in precipitous falls and cataracts of great beauty, although valueless for water-power. The Whitewater creek is so named on account of its numerous cascades; and at one place there is a fall of 600 feet in 300 yards,* with numerous smaller falls. On another stream in the vicinity there is a fall greater in height than that of Niagara in one pitch.* Another small branch of the Keowee has two falls of nearly 50 feet, each close together, and 200 yards below a fall of 80 feet. Another has a perpendicular fall of 130 feet. The Keowee itself—whose name is said to mean *clear water*—is a beautiful stream, flowing with a gradual fall over a rock bed, and draining a very picturesque valley. It is entirely unutilized for power, and I was unable to learn of any particular sites, although there must be some. Among its tributaries, many of which are utilized to some extent, the principal one is Little river, a stream rising in the northern part of Oconee county, only a few miles from the Chatuga river, and flowing a little east of south for a distance of 18 or 20 miles, draining about 140 square miles. It is a good stream for power, and has several falls and mills in various places. The rainfall on all this upper part of South Carolina is about the same

* MILLS: Statistics of South Carolina.

as on the drainage-basin of the Tugaloo, viz, 56 inches—15 in spring and summer, 10 in autumn, and 16 in winter. I would therefore estimate the flow of the Little river at its mouth about as follows:

Table of flow and power of Little river.

State of flow (see pages 18 to 21).	Drainage area.	Flow per second.	Horse-power, gross.
	Sq. miles.	*Cubic feet.*	*1 foot fall.*
Minimum	140	20	2.3
Minimum low season		30	3.4
Maximum, with storage		168	19.1
Low season, dry years		35	4.0

The first power on the stream is Seaburn's shoal, a mile from the railroad and the mouth of the stream, and three or four miles from Seneca. It was formerly used by a saw-mill, but is now unimproved. The fall is 13½ feet, which could be used with a canal 800 feet long, very easy to cut. The proper location for a mill is on the left bank, at the foot of the shoal, the right bank being steep. Just above this shoal Cain creek, the principal tributary of Little river, enters. Less than a mile above is a second unutilized shoal, but I am unable to state the fall. The next power is High shoals, a beautiful shoal, where the river falls over a ledge of solid gneiss-rock, descending 24 feet almost perpendicularly, with rapids above for some distance, and a total fall of about 35 feet. The banks are high, but very favorable for building, and the power is in all respects an excellent one. It is used by a tannery on the left bank, utilizing a fall of 14 feet and 15 to 16 horse-power, with a flume 500 feet long and 2 feet square, and an overshot-wheel, and on the right bank by a saw- and grist-mill and cotton-gin, using 10 horse-power and 24 feet fall. The dam is of wood, 2 to 3 feet high, and 125 to 150 feet long, extending in a broken line entirely across the stream. Just above this is a fall of 6 feet in 500, and a 3-foot dam at the upper end of this last shoal, it is said, would back up the water a mile or over. The power is 9 miles from Seneca, 10 miles from Walhalla, and is owned by Sligh & Woodin, High Falls post-office. The drainage area above this shoal being not over 60 or 70 square miles, I should estimate the power in the low-season of dry and ordinary years at 1.2 horse-power and 1½ horse-power per foot fall respectively, and three times as much during nine months. But as my measurements of drainage areas, especially of so small ones, are liable to considerable error, these figures are not very valuable. Above these falls there are several others, one with 14 feet fall, used by a tannery; two others, 150 yards apart, with falls of 20 and 16 feet respectively, and another right at the foot of the mountains with a fall of 50 or 60 feet.

Cain creek, the principal tributary of Little river, drains 50 or 60 square miles, and has one shoal, not used, with 40 feet fall—the Schroeder shoal.

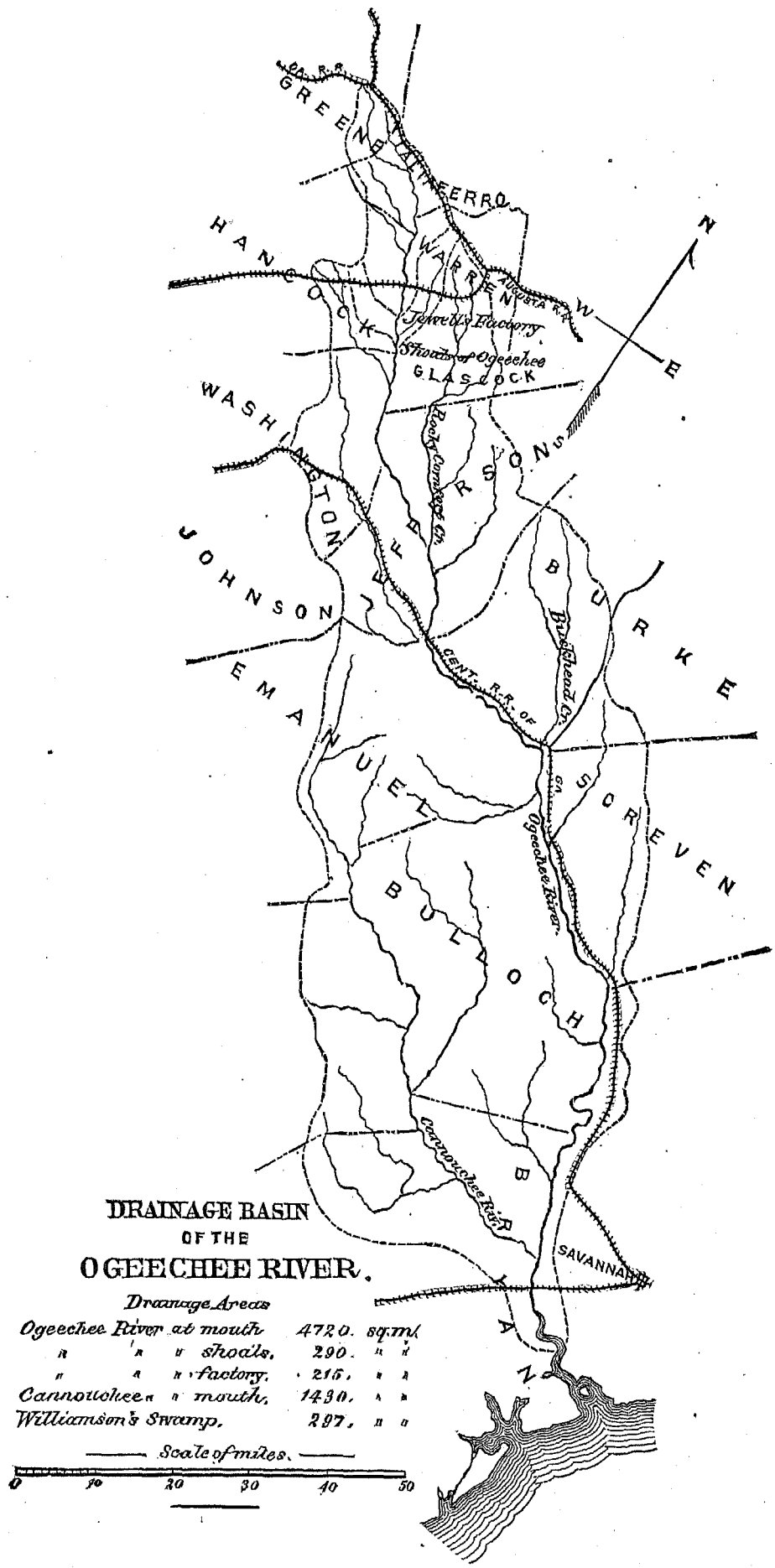
Table of utilized power on the Savannah river.

Name of stream.	Tributary to what.	State.	County.	Kind of mill.	Number of mills.	Total fall used.	Total horse-power used, net.
						Feet.	
Savannah	Atlantic ocean	Georgia	Richmond	Miscellaneous*	15	.....	3,650
Do	do	South Carolina	Abbeville	Flour and grist	1	12.0	8
Do	do	do	do	Saw	1	8.0	8
Do	do	do	Anderson	Woolen	1	12.0	20
Do	do	Georgia	Lincoln	Flour and grist	3	14.5	32
Do	do	do	Elbert	do	2	19.0	115
Tributaries of	Savannah	do	Effingham	Saw	1	6.0	20
Do	do	do	Burke	Flour and grist	8	72.0	96
Do	do	do	Richmond	do	11	125.0	190
Do	do	do	do	Saw	8	160.0	209
Do	do	do	do	Cotton factory	1	9.0	50
Do	do	do	do	Woolen	1	9.0	45
Little river	do	do	Lincoln	Saw	3	24.0	45
Do	do	do	do	Flour and grist	4	30.0	60
Do	do	do	McDuffie	do	1	9.0	60
Do	do	do	Wilkes	do	1	8.0	8
Do	do	do	Warren	do	1	8.0	30
Do	do	do	Greene	Saw and grist	1	14.0	15
Other tributaries to	do	do	Columbia	Flour and grist	5	69.0	91
Do	do	do	do	Saw	1	10.0	25
Do	do	do	McDuffie	do	3	.....	.....
Do	do	do	do	Flour and grist	7	127.0	152
Do	do	do	Warren	do	1	20.0	15
Do	do	do	do	Saw	1	12.0	12

*See Augusta.

Table of utilized power on the Savannah river—Continued.

Name of stream.	Tributary to what.	State.	County.	Kind of mill.	Number of mills.	Total fall used.	Total horse-power used, net.
						Feet.	
Broad river and tributaries	Savannah	Georgia	Oglethorpe	Flour and grist	10	105.0	175
Do	do	do	Madison	do	10	145.0	281
Do	do	do	do	Saw	5	61.0	64
Do	do	do	Elbert	Flour and grist	3	44.0	39
Do	do	do	Franklin	do	9	.....	163
Do	do	do	do	Saw	4	56.0	54
Do	do	do	do	Cotton-gin	6	83.0	53
Do	do	do	Banks	Saw	1	18.0	20
Do	do	do	do	Flour and grist	12	169.0	279
Other tributaries of	do	do	Wilkes	do	7	85.0	75
Do	do	do	Elbert	do	6	73.0	134
Do	do	do	do	Saw	1	14.0	12
Do	do	do	Hart	Flour and grist	11	104.0	176
Do	do	do	do	Saw	1	14.0	15
Do	do	do	do	Cotton-gin	8	99.0	70
Tributaries of	Tugaloo	do	do	Saw	1	30.0	10
Do	do	do	do	Flour and grist	2	27.0	45
Do	do	do	do	Cotton factory	1	26.0	20
Do	do	do	do	Wool-carding	1	20.0	44
Do	do	do	Habersham	Flour and grist	4	47.0	46
Do	do	do	do	Leather	1	16.0	6
Do	do	do	do	Saw	3	46.0	78
Do	do	do	do	Woolen	1	.....	6
Do	do	do	Rabun	Saw	1	14.0	8
Horse creek	Savannah	South Carolina	Aiken	Paper	1	38.0	500
Do	do	do	do	Cotton factory	3	115.0	1,200
Do	do	do	do	Flour and grist	2	26.0	40
Do	do	do	do	Stoneware	2	24.0	67
Little river	do	do	Abbeville	Flour and grist	3	33.0	83
Do	do	do	do	Saw	1	9.0	15
Do	do	do	do	Flour and grist	1	7.0	12
Rocky river	do	do	do	do	5	.....	112
Do	do	do	do	Saw	4	37.0	52
Do	do	do	Anderson	Flour and grist	3	62.0	69
Other tributaries of	do	do	Barnwell	do	6	54.0	80
Do	do	do	do	Saw	1	8.0	20
Do	do	do	do	Cotton-gin	4	36.0	48
Do	do	do	Aiken	do	3	23.0	32
Do	do	do	do	Saw	6	63.0	122
Do	do	do	do	Cotton yarn	1	.....	.....
Do	do	do	do	Flour and grist	15	144.0	296
Do	do	do	Edgefield	do	21	.....	467
Do	do	do	do	Saw	2	19.0	32
Do	do	do	Abbeville	do	2	16.0	25
Do	do	do	do	Flour and grist	10	210.0	207
Do	do	do	Anderson	do	13	105.0	140
Do	do	do	do	Saw	5	124.0	66
Do	Seneca	do	do	do	4	56.0	84
Do	do	do	do	Flour and grist	9	175.0	135
Do	do	do	do	Cotton-gin	8	.....	.....
Do	do	do	do	Cotton factory	1	26.0	402
Do	do	do	Oconee	Woolen	2	.....	18
Do	Tugaloo	do	Anderson	Cotton-gin	5	94.0	72
Do	do	do	do	Flour and grist	5	87.0	106
Do	do	do	do	Saw	2	22.0	35
Do	do	do	Oconee	Flour and grist	7	155.0	80
Do	do	do	do	Saw	1	25.0	10
Do	do	do	do	Cotton factory	1	21.5	10
Do	Seneca	do	do	Saw	3	48.0	45
Do	do	do	do	Leather	3	54.0	42
Do	do	do	do	Wheelwright	1	16.0	7
Do	do	do	do	Flour and grist	16	287.0	226
Do	do	do	Pickens	do	14	277.0	211
Do	do	do	do	Saw	4	81.0	60
Do	do	do	do	Cotton-gin	9	163.0	136



DRAINAGE BASIN
OF THE
OGEECHEE RIVER.

Drainage Areas		
Ogeechee River at mouth	4720.	sq. mls.
" " " shoals.	290.	" "
" " " factory.	215.	" "
Cannouchee " " mouth.	1430.	" "
Williamson's Swamp.	297.	" "

Scale of miles.

0 10 20 30 40 50

X.—THE OGEECHEE RIVER AND TRIBUTARIES.

THE OGEECHEE RIVER.

This stream, which is the next one south of the Savannah that has any water-power worth mentioning, rises in Greene county, Georgia, and flows southeast through Taliaferro; then between Warren and Glascock on its left, and Hancock and Washington on its right; thence through Jefferson, finally forming the boundary-line between Burke, Screven, Effingham, and Chatham on its left, and Emanuel, Bulloch, and Bryan on its right, and emptying into the Atlantic about 16 miles below the mouth of the Savannah. Its length in a straight line is about 160 or 170 miles, and it drains a total area of 4,720 square miles. Of this drainage area, however, by far the greater part lies below the fall-line, and offers no water-power, except here and there on a sand-hill stream. The river crosses the fall-line between Hancock and Glascock counties, and below that point the general character of the drainage basin corresponds so closely to that of the Savannah below Augusta, of the Santee, or of the Pee Dee below Cheraw, that it need not be described. Above the fall-line the river flows through a rolling and hilly country, the bed being rock, overlaid between the shoals by sand, gravel, and clay. The bottoms are said to be narrow. The elevation of the stream at the crossing of the Macon and Augusta railroad, at Mayfield, about 8 miles above the fall-line, is 270 feet, so that the fall from that point to the mouth will average about 1.6 feet per mile. The fall below the fall-line will probably not average 1 foot per mile, and the stream could probably be made navigable for some distance. It is said that boats used to ascend the river as far as Georgetown, 4 miles below the fall-line. At present the stream is navigable for a distance of 25 miles from its mouth for boats drawing 16 feet, and for a distance of 35 miles from its mouth for boats drawing 5 feet. The average annual rainfall on the drainage-basin above the fall-line is 49 or 50 inches, of which 11 fall in spring, 14 in summer, 10 in autumn, and 14 in winter.

The first power on the stream is at the fall-line, known as the Shoals of Ogeechee. They are situated 8½ miles from Mayfield, which is the nearest railroad point, and are above the mouth of the Little Ogeechee. The power is utilized by a grist- and saw-mill, with a wooden-frame dam about 225 feet long and 8 or 9 feet high, backing the water 1½ miles, with an average width of 150 feet. The race is 300 feet long, the fall utilized 18 feet, and the power perhaps 30 to 40 horse-power, which can only be obtained ten months of the year on account of leakage. The shoal is of solid rock, and the total available fall is 21 or 22 feet at low water. The drainage area above the shoal being about 290 square miles, I have estimated the power as follows:

State of flow (see pages 18 to 21).	Drainage area.	Fall.	Flow per second.	Horse-power available, gross.		
	Sq. miles.	*Feet.*	*Cubic feet.*	*1 foot fall.*	*18 feet fall.*	*21 feet fall.*
Minimum	290	21	25	2.8	50	59
Minimum low season			35	4.0	72	84
Maximum, with storage			250	28.4	511	596
Low season, dry years			40	4.5	81	94

Four miles above is D. A. Jewell's cotton factory, 4½ miles from Mayfield. The dam is a wooden-frame dam, composed of triangular frames set up and down the stream, tied together and planked over on the sloping up-stream side, and is 280 feet long and 15 feet high, 50 feet at one end being of stone. It backs the water a mile, with an average width of 150 feet, and the fall at the factory, which has no head-race of any length, is 16 feet. The power utilized is 150 horse-power, which can only be obtained eight months of the year, the average during the remaining four months being two-thirds or three-fourths, and the water gets so low at times that the wheels are stopped. During the low season, steam-power is put on to the extent of 125 horse-power. The mill is run about 12 hours in summer out of the 24, and there is no waste at night; and, in fact, the pond does not fill up in one night. I have estimated the power at this place as follows:

State of flow (see pages 18 to 21).	Drainage area.	Fall.	Flow per second.	Horse-power available, gross.	
	Sq. miles.	*Feet.*	*Cubic feet.*	*1 foot fall.*	*16 feet fall.*
Minimum	215	16	17	1.9	30
Minimum low season			25	2.8	45
Maximum, with storage			189	21.5	340
Low season, dry years			30	3.4	54

The stream is said to be very variable in its flow, and to get very low in summer. Its absolute minimum is probably below that given above. Mr. Jewell states that he stopped eight days once, and during that entire time his pond only rose a few inches. According to the above estimate, during nine months of an ordinary year about 180 horse-power gross would be obtained, or about 130 horse-power net, which is perhaps a little too high.

Above the factory are several small grist- and saw-mills, most of which have to stop in summer. There are no sites not used.

The tributaries of the stream are of no consequence. On Little Ogeechee there are two sites, both used at one time, but now abandoned. The stream is small, draining only 55 square miles.

Table of power utilized on the Ogeechee river.

Name of stream.	Tributary to what.	State.	County.	Kind of mill.	No. of mills.	Fall used.	Horse-power used, net.
						Feet.	
Ogeechee river	Atlantic	Georgia	Warren	Flour and grist	2	20	30
Do	do	do	Hancock	do	2	13	40
Do	do	do	do	Woolen	1	.....	8
Do	do	do	Warren	Cotton factory	1	16	150
Do	do	do	Taliaferro	Flour and grist	1	22	15
Tributaries of	Ogeechee	do	Liberty	do	1	9	20
Do	do	do	do	Saw	2	.....	27
Do	do	do	Bulloch	Flour and grist	5	36	20
Do	do	do	do	Saw	2	17.5	24
Do	do	do	Screven	Flour and grist	1	10	8
Do	do	do	do	Saw	1	10	12
Do	do	do	Burke	Flour and grist	9	75+	117
Do	do	do	Jefferson	do	9	82	189
Do	do	do	Washington	do	1	21	33
Do	do	do	Glascock	do	4	60	54
Do	do	do	do	Saw	2	23	27
Do	do	do	Hancock	Flour and grist	2	42	30
Do	do	do	Warren	do	1	9	12

XI.—THE ALTAMAHA RIVER AND TRIBUTARIES.

THE ALTAMAHA RIVER.

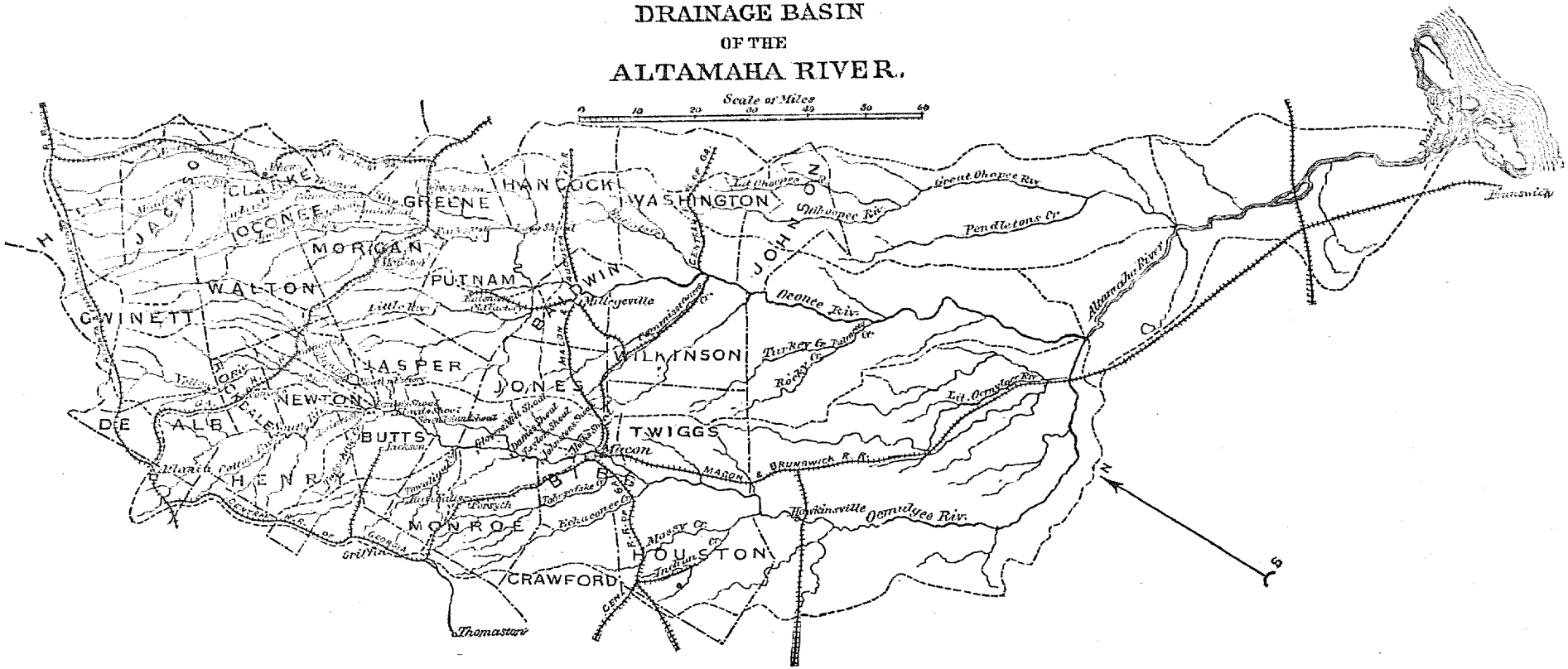
This river, with all its tributaries, lies entirely within the state of Georgia, and is the most southerly stream flowing into the Atlantic whose water-power is worthy of special mention. It is formed by the union of the Oconee and the Ocmulgee rivers, on the line between Montgomery and Appling counties, whence it pursues a southeasterly course, forming the boundary-line between Tattnall, Liberty, and McIntosh counties on its left, and Appling, Wayne, and Glynn on its right, emptying into the Atlantic ocean, through Altamaha sound, just below the town of Darien. Its length is about 75 miles in a straight line and 155 by the river, and its total drainage area comprises about 14,400 square miles, of which the Ocmulgee drains 6,000, the Oconee 5,400, and the Altamaha proper 3,000. Its principal tributary is the Great Ohoopee, from the north, draining about 1,400 square miles. The Altamaha is navigable for its entire length for boats drawing 5 feet of water, its fall being very slight. There are no important towns on the river. The mean rise and fall of the tides in Altamaha sound is 7 feet, and the tidal wave is felt for 30 miles or so above Darien.

The Oconee and the Ocmulgee rivers will be fully considered below. As regards the Altamaha, its drainage area lying entirely below the fall-line, it offers no power whatever, and the power on its tributaries is not worth mentioning. Some of them are sand-hill streams, but none offer large powers. Near the coast, and along the rivers, are extensive cypress swamps, and further inland there are large pine forests. Timber, turpentine, rice, cotton, fruits, and vegetables are the principal productions. The stream resembles the lower Savannah, the Santee, or the lower Pee Dee.

THE OCONEE RIVER.

I pass to the consideration of the Oconee and the Ocmulgee rivers, the only ones regarding whose water-power anything is to be said. The Oconee has its headwaters in Hall county, but the stream proper is formed by the union of its two forks, the North and the Middle, which unite just below the town of Athens, on the line between Clarke and Oconee counties, whence the stream pursues a course a little east of south for a distance of about 140 or 150 miles in a straight line, draining a total area of 5,400 square miles. It forms the boundary-line between Clarke, Oglethorpe, Greene, and Hancock counties on its left, and Oconee, Morgan, and Putnam counties on its right, flows through Baldwin, and between Wilkinson on its right and Washington and Johnson on its left, and finally through Laurens and Montgomery, to join the Ocmulgee. The only town of importance on the stream is Milledgeville, near which place it crosses the fall-line. The drainage area above this point being about 2,973 square miles, it will be seen that nearly half of the total area drained by the river offers no water-power of importance.

DRAINAGE BASIN
OF THE
ALTAMAHA RIVER.



There is a navigable depth of 5 feet up to the Central railroad bridge, 135 miles from the mouth of the stream. In White's *Statistics of Georgia* it is stated that a boat 60 feet long once ascended to Barnett's shoals, 8 miles below Athens, but that no produce had ever been carried above Milledgeville. An examination of the river up to that town was made in 1874 under the direction of General Gillmore, whose report may be found in the *Annual Report of the Chief of Engineers*, 1875, Appendix U, and in which improvements by the general government were not recommended, as almost all the transport on the river is that of timber.

The accompanying map will show the form and dimensions of the drainage-basin of the Oconee, and of its principal tributaries. The rainfall on the basin above the fall-line averages about 48 or 49 inches—12 in spring, 13 in summer, 10 in autumn, and 14 in winter. The table on page 147 gives more detailed information on this subject. Some idea of the declivity of the stream may be obtained from the following table:

Table of declivity of the Oconee river.

Place.	Distance from mouth.	Elevation above tide.	Distance between points.	Fall between points.	Fall between points.
	Miles.	*Feet.*	*Miles.*	*Feet.*	*Feet per mile.*
Mouth of Altamaha	—155	0			
			290	201	0.70
Crossing of Georgia Central railroad*	135±	201			
			60	20	0.33
Crossing of Georgia railroad (Milledgeville)†	195±	221±			
			60±	87	1.45
Crossing of Georgia railroad (Augusta to Atlanta)†	255±	308			
			40±	269	6.72
Crossing of North-Eastern railroad (2 miles north of Athens, north fork of Oconee)‡	295±	577			
			45	628	14.00
Second crossing North-Eastern railroad, 2 miles south of Lula‡	340	1,205			

* For this elevation, and others on the same road, I am indebted to Mr. William Rogers general superintendent.

† For these elevations I have to thank Major Wilkins, engineer of the road.

‡ These figures were furnished by Captain J. C. Turner, chief engineer of the road, at the request of the general superintendent, Mr. Lyman Wells.

The declivities given in the preceding table are of very small value because of the inaccuracy in the distances, which could only be roughly estimated.

No gaugings of the Oconee are on record. The flow is said to be quite variable, and there seems to be no doubt that it fluctuates to a greater extent than in the case of some streams which have been discussed on account of the smaller rainfall in the warm season. The freshets are violent and very sudden. The sources of the river being east of the mountains, and the soil clay or loam, the water is shed quite rapidly, and rises sometimes 8 or 10 feet in a few hours, overflowing its banks in many places, and flooding large areas of bottom-land. The map will show how accessible the river is in its various parts.

A detailed description of the water-powers of the stream will now be given.

Below Milledgeville the stream is very tortuous, distances by river being usually reckoned at three times those by land. The bed is generally of sand, the banks of clay, and the principal obstructions to navigation are snags and fallen trees. Near Milledgeville occurs the first fall, there being a series of shoals there extending over a distance of 5 or 6 miles, where the stream crosses the fall-line. A survey of these shoals was made several years ago by Colonel B. W. Frobell, of Atlanta, who found the fall between the mouth of Fishing creek, which empties into the river from the right just at Milledgeville, and the head of a shoal known as Carter's, to be 34.2 feet. The development of this power by leading a canal from the head of Carter's shoals down to the city, rendering available a fall of between 30 and 40 feet, has been often proposed, but nothing has yet been done toward carrying out this scheme. At present Carter's shoal is used for a cotton-gin, and formerly there used to be a grist- and saw-mill there; and just opposite Milledgeville there is a grist-mill with a wooden wing-dam extending across to an island, and using a fall of 5 feet. The topography of the country between Carter's shoal and the city is said to be such that a canal would be practicable, although there are bluffs in places. I have estimated the flow and power as follows:

Table of flow and power at Milledgeville.

State of flow (see pages 18 to 21).	Drainage area.	Fall.	Flow per second.	Horse-power available, gross.	
	Sq. miles.	*Feet.*	*Cubic feet.*	*1 foot fall.*	*34 feet fall.*
Minimum	2,973	34	500	56.8	1,930
Minimum low season			650	73.8	2,500
Maximum, with storage			2,600	295.5	10,000
Low season, dry years			740	84.1	2,860

Passing over one shoal, where there is said to be a fall of 3 or 4 feet, the next power is at Fraley's mill, 7 miles above Milledgeville, where there is an abrupt fall of 5 feet in 200, and about 8 feet in one-fourth of a mile, known

as Cedar shoal. A fall of 5 feet is used by a mill on the left bank, with a wing-dam, mostly of rough rock, extending about one-third across the stream. The available fall is probably 6 or 8 feet. The mill is stopped often on account of high water.

At Satcher's shoal, 15 miles above Milledgeville, and above the mouth of Little river, which enters from the west, there was formerly a grist-mill, not now in operation, but the fall is said to be only 4 or 5 feet. The river is narrow, with bluffs on each side, and the dam extends entirely across.

Graybill's old mill, not in use now, is said to have a fall of 4 or 5 feet.

Lawrence's grist-mill has a dam across to an island and no race. The dam is said to be 6 feet high, and the fall used 6 or 7 feet.

Riley's shoal is said to have a fall of 7 or 8 feet, but it is not improved.

One mile above is the site of the old Long shoal factory, or the mill of the Atwood Manufacturing Company, situated some 20 or 22 miles from Eatonton, which is the nearest railroad point. The fall is about 12 feet in one-fourth of a mile, as ascertained with a pocket-level, but it could probably be increased by a dam to 15 or 20 feet, as the banks are said to be quite steep for 2 miles above. The banks at the shoal are favorable for building. The old factory was located on the left bank, with a wing-dam extending for 500 yards or so up the river, the fall used being about 8 feet. This factory has not been used since the war, and at present the only power used is for a grist-mill on the right bank, with a dam only 50 feet long and 7 or 8 feet high, across to an island not subject to overflow, at the head of which is a little wing-dam to turn the water between the island and the shore. The location is safe on either side of the river, and considerable power could, no doubt, be developed at this place. The following table gives my estimate:

Table of flow and power at Long shoal.

State of flow (see pages 18 to 21).	Drainage area.	Fall.	Flow per second.	Horse-power available, gross.	
	Sq. miles.	*Feet.*	*Cubic feet.*	*1 foot fall.*	*34 feet fall.*
Minimum	2,122	12	360	40.9	490
Minimum low season			460	52.2	625
Maximum, with storage			1,860	211.3	2,535
Low season, dry years			530	60.0	720

Reid's mill-site, 6 or 7 miles above this shoal, is not now in use, the dam having been washed out fifteen or twenty years ago, and there being nothing there now. The dam extended entirely across, and a fall of 6 feet was used, but there was often difficulty with high water.

Passing a shoal where there is only a small fall, said to be 2 feet or so, capable of being increased to 5 feet, the next power is at Park's old mill, now used as a grist-mill, with four pair of stones, and a fall of 8 feet. The dam is of wood and stone, 350 feet by 8, ponding the water for 2 or 3 miles, with an average width of 300 feet, but without throwing the river out of its banks. The mill is troubled occasionally in times of high water, but there is never trouble from lack of water. It is 2 miles below the crossing of the Georgia railroad.

Just above the railroad the Oconee receives a large tributary, the Appalachee, from the west. Three miles above, at Willis' ferry, there is said to be a small shoal, but of no consequence, the next power worth mentioning being Scull shoal, 14 miles northwest of Greensborough, 8 miles from Maxey's, the nearest railroad point (on the Athens branch of the Georgia railroad), 12 miles from Madison, and about 15 miles above the railroad bridge. It is used by the cotton factory and grist-mill of the Powell Manufacturing Company. The dam is of wood and stone, 300 feet long and 10 feet high, and was built about the year 1860, having never been carried away. It ponds the water for about 2 miles, with an average width of 200 feet. From it a race 300 or 400 feet long leads to the factory, where the fall is 10 feet. The mill runs 3,200 spindles, and is never troubled with scarcity of water; but it is obliged to stop entirely during one or two months on account of backwater. No steam-power is used.

The next shoal, and the last of importance on this stream, is Barnett's or Veal's, 8 miles below Athens, and the finest shoal on the river. It is popularly supposed that the fall amounts to 60 feet within a distance of three-fourths of a mile. I visited the place, and, although unable to make any accurate observations, some rough measurements with a pocket-level rather inclined me to believe that this figure is too high, and that 45 or 50 feet would be nearer the truth. Not all of this fall, however, is easily available, on account of the character of the banks, which are steep on both sides on the lower half of the shoal. At the head a fall of 25 feet could be easily rendered available, with room for buildings on the left bank. The bed of the stream is rock, and at the head a natural dam extends entirely across, diagonally down stream from the left bank to the right, and, therefore, not just favorable for turning the water to the left bank. Over this ledge occurs the most rapid fall, amounting to 25 feet in about 300 yards. The rest of the fall would be very difficult to utilize fully by canaling, though it probably could in some way be developed if necessary. The river is about 180 feet wide above the shoal, and very deep, and the banks are low and sandy. In a heavy freshet the river rises here 6 or 7 feet, while three-fourths of a mile above it rises 17 feet, and on the shoal itself scarcely ever over 3 or 4 feet. This shoal is at present unutilized, although it has been

proposed to establish a cotton factory there. It is one of the finest sites in this part of the state. Fine building-stone is found in the immediate vicinity, the climate is healthy, and it is said that a branch road could, without much difficulty, be run from the Georgia railroad. The following table will give an idea of the available power:

Table of flow and power at Barnett's shoals.

State of flow (see pages 18 to 21).	Drainage area.	Fall.*	Flow per second.	Horse-power available, gross.		
	Sq. miles.		*Cubic feet.*	*1 foot fall.*	*25 feet fall.*	*45 feet fall.*
Minimum	860	.....	137	15.6	390	700
Minimum low season			180	20.5	510	920
Maximum, with storage			900	102.3	2,560	4,609
Low season, dry years			206	23.4	585	1,050

* Twenty-five feet, easily available; total, 45 feet or more.

From what has been said, it will be seen that the Oconee does not offer a remarkable amount of power, but, on the contrary, that it has few powers of much importance, and none to compare with the great powers on the Catawba, Broad, and Yadkin rivers. The following table gives a summary of power, in which it has not been thought desirable, on account of uncertainty of the data, and the fact that the estimate is of no practical value, to insert estimates of the total theoretical power.

It may be mentioned that in January, 1827, the Oconee was frozen over near Milledgeville, and the Savannah at Augusta—a circumstance never before known. In February, 1835, the thermometer fell to 3° below zero in Eatonton, and to 8° below zero in Milledgeville.*

Summary of power on the Oconee river.

Place.	Distance from Milledgeville (or mouth).	Drainage area.	Rainfall.					Fall.		Horse-power available, gross.*				Utilized.		Per cent. of minimum utilized.	Remarks.
			Spring.	Summer.	Autumn.	Winter.	Year.	Height.	Length.	Minimum.	Minimum low season.	Maximum, with storage.	Low season, dry years.	Horse-power, net.	Fall.		
		Sq. ms.	*In.*	*In.*	*In.*	*In.*	*In.*	*Feet.*							*Feet.*		
Milledgeville	0	2,950	12	13	9	14	48	34.0	5–6 miles	1,930	2,500	10,000	2,860	<50	6.0	<4	
Shoal	.....	.....	12	13	9	14	48	4.0	.....	.....	.....	.....	.....	0	0.0	0	
Fraley's mill	7	2,900±	12	13	9	14	48	8.0	1,200 feet	450	580	2,320	660	<50	5.0	<17	
Satcher's shoal	15	.....	12	13	9	14	48	5.0	.....	.....	.....	.....	.....	0	0.0	0	
Graybill's mill	.....	.....	12	13	9	14	48	4.0	.....	.....	.....	.....	.....	0	0.0	0	
Lawrence's mill	.....	.....	12	13	9	14	48	6.0	.....	.....	.....	.....	.....	.....	6–7	.....	
Riley's shoal	46	.....	12	13	9	14	48	7–8 (?)	.....	.....	.....	.....	.....	0	0.0	0	
Long shoal	47	2,122	12	13	9	14	48	12+	1,300 feet	490	625	2,535	720	<50	0.0	<15	
Hill's shoal	.....	.....	12	13	9	14	48	Small	.....	.....	.....	.....	.....	0	0.0	0	
Reid's shoal	54	.....	12	13	9	14	48	6.0	.....	.....	.....	.....	.....	0	0.0	0	
Park's mill	58	1,635	12	14	9	14	49	8.0	0	240	310	1,400	350	50	8.0	30±	Mill at dam.
Scull shoal	75	1,000	13	15	10	15	53	10.0	0	180	240	1,140	275	80±	10.0	60±	Dam 10 feet.
Barnett's shoal	90	860	13	15	10	15	53	45±	¾ mile	700	920	4,600	1,050	0	0.0	0	
LITTLE RIVER.																	
Gage's shoal	0.75	690	10	12	9	13	44	Small	.....	.....	.....	.....	.....	0	0.0	0	
Moultrie's shoal	2.00	675±	10	12	9	13	44	Small	.....	.....	.....	.....	.....	0	0.0	0	
Humber's mill	3.00	600±	10	12	9	13	44	9.0	0	.....	.....	.....	.....	25	9.0	.....	
Pierson's mill	.....	.....	10	12	9	13	44	6–8	0	.....	.....	.....	.....	.....	6–8.0	.....	
Grist-mill	.....	.....	10	12	9	13	44	13.5	.....	.....	.....	.....	.....	25	13.5	.....	
Grist-mill	.....	.....	10	12	9	13	44	8.0	.....	.....	.....	.....	.....	25	8.0	.....	
Old factory	15.00	250	10	12	9	13	44	18.0	600 feet	.....	.....	.....	.....	0	0.0	0	

* See pages 18 to 21.

TRIBUTARIES OF THE OCONEE RIVER.

Below Milledgeville the tributaries are not of very much importance, except a few which may be classed as sand-hill streams, but regarding which I could obtain no information, as none of them are utilized to any great extent. Power could no doubt be developed on many of them, and perhaps large powers on some of them, but no

* SHERWOOD: Gazetteer of Georgia, 1860.

special sites could be specified. Of these tributaries Palmetto creek drains 375 square miles, Big Sandy creek 284, Commissioner's creek 196, and Buffalo creek 286. In the table of utilized power will be found a statement of the power used on these tributaries.

The first tributary worthy of special mention is Little river, which rises in Walton and Newton counties, flows southeast through Morgan and Putnam counties, passing within 3 miles of the town of Eatonton, and joining the Oconee between Putnam and Baldwin, about 8 or 10 miles above Milledgeville, and above Fraley's mill. Its length in a straight line is about 40 or 45 miles, but 60 or more by the course of the stream, and its drainage area is about 690 square miles. It has two tributaries worth naming, viz, Cedar and Murder creeks, both entering from the west. The stream is said to be "remarkable for its rapid current",* and it offers a number of good sites for small powers. Proceeding up the river, the first shoal met with is about three-fourths of a mile from the mouth, known as Gage's shoal, not improved, and with an unknown fall. A mile and a quarter further up is Moultrie's shoal, also unimproved. Both of these shoals are subject to backwater from the Oconee river, and their falls are stated to be small. They are probably not of much value for manufacturing. The next power is at Humber's mill, 3 miles from the mouth, with no important tributaries below it. The dam is of wood, 130 feet long and 9 feet high, and the fall used is 9 feet, with 28 horse-power, which can be obtained all the time. The fall could be increased to 11 feet, and the available power in the low season of ordinary years with this fall would probably be at least 100 horse-power. I would, by analogy, estimate it at a considerably larger figure, but as Colonel Humber, who is well acquainted with the stream, writes that 60 horse-power would be available with a fall of 11 feet, it must be that for some reason the flow of the stream is quite variable indeed, or else that the drainage area is much smaller than I measured it from the map. For this reason I do not venture to give estimates for the stream. The rainfall on the drainage-basin is, it is true, considerably smaller than on most streams thus far considered, being only about 44 inches, distributed unfavorably, too, for rendering the flow uniform, viz: spring, 10; summer, 12; autumn, 9; winter, 13 to 14; hence, without further data, I would have assumed the flow in the low season of ordinary years at about 0.18 cubic feet per second per square mile, or 108 cubic feet per second for 600 square miles, which would give a power of 12.3 horse-power per foot fall.

The next power above Humber's is at Pierson's mill, but the fall is only 6 or 8 feet, with a dam of the same height. Then follows a second mill, with a fall of 13½ feet and 25 horse-power utilized, and then a shoal, part of which was at one time used by the old Eatonton factory. This shoal, which is the first of importance on the river, is 3 miles from Eatonton, and about 15 miles from the mouth of the stream. The fall is about 25 feet in a distance of about 300 yards, over a bed of solid rock, with banks not subject to overflow, and offering good facilities for the construction of canals and buildings. At the lower end of this shoal there is a grist-mill, using a fall of 8 feet, with a wooden dam 200 feet long and 4 feet high, backing the water about 100 yards. This mill has four pair of stones, but two of them cannot be run in summer; the dam, however, is leaky, and the wheel very poor. At the head of the pond, on the right bank, the old factory was located, using a fall of 15 or 18 feet, with a race about 200 yards long, and a dam not over 4 or 5 feet in height at the head of the shoal. From measurements with a pocket-level, I think that 18 feet could easily be utilized. The bed of the stream at the head of the shoal is exceedingly favorable for the construction of a dam, but a high one could probably not be built without overflowing considerable good land. The factory was burned in 1864, since which time the power has not been utilized. The drainage area above is about 250 square miles, and I should think that a power of at least 75 horse-power could be utilized with 18 feet fall in the low season of ordinary years; but, as before mentioned, there may be circumstances rendering the flow of this stream very variable.

Above this site there are a few grist-mills on the stream which it is not necessary to specify. On some of the tributaries to the stream there are also mills, and on Murder creek, about 3 miles from its mouth, it is said that a fall of 18 feet could be utilized with a dam 6 feet high and a race 200 yards long.

The next tributary worth naming is the Appalachee river, which has its sources in Gwinnett county, whence it flows southeast, and joins the Oconee just above the railroad bridge. Its length in a straight line is about 54 miles; by the river, 80 miles or over. It drains an area of about 506 square miles, receiving as its principal tributary Hardlabor creek, from the west, which drains about 173 square miles. Data regarding its flow or fall could not be obtained. The rainfall on the basin is about 47 inches—11 in spring, 13 in summer, 9 in autumn, and 14 in winter. The stream is quite inaccessible, as the map will show. The following are the powers in their order as the river is ascended:

About a mile and a half above the railroad there is said to be a small shoal, not used, and probably of no value. Four miles further up is Reid's mill, not now used, the available fall being stated at 7 or 8 feet, and perhaps more. The mill was burned during the war, but the greater part of the dam, which was of rock, and 4 or 5 feet high, is still there, though out of repair. This site is 4 miles below the mouth of Hardlabor creek, and 2 miles from Buckhead, the nearest railroad depot. It is owned by Mr. W. H. McWhorter. Estimates of the flow are liable to considerable uncertainty, as remarked in the case of Little river, but I would estimate the flow and power at this place as in the table on page 149.

* WHITE: Statistics of Georgia, 1849.

Flow and power at Reid's mill, Appalachee river.

State of flow (see pages 18 to 21).	Drainage area.	Fall.	Flow per second.	Horse-power available, gross.	
	Sq. miles.	*Feet.*	*Cubic feet.*	1 *foot fall.*	8 *feet fall.*
Minimum	500	8	60	6.8	55
Minimum low season			66	7.5	60
Maximum, with storage			525	60.0	480
Low season, dry years			76	8.6	70

Ten miles up the river, and above the mouth of Hardlabor creek, is Furlow's grist-mill, where a fall of 8 feet and 30 horse-power are used. The dam is of wood, 300 feet long, 5 feet high, and backs the water 300 yards. The head-race is 150 feet long. The drainage area above is about 310 square miles, and I would therefore estimate the power as follows:

Flow and power at Furlow's mill and shoal.

State of flow (see pages 18 to 21).	Drainage area.	Fall.*	Flow per second	Horse-power available, gross.			Remarks.
	Sq. miles.		*Cubic feet.*	1 *foot fall.*	8 *feet fall.*	18 *feet fall.*	
Minimum	310	.....	37	4.2	34	76	Fall of shoal from information from Mr. Furlow.
Minimum low season			41	4.7	38	85	
Maximum, with storage			325	37.0	296	666	
Low season, dry years			47	5.4	43	97	

* Eight feet at mill; 18 feet at shoal above mill.

The shoal referred to in the above table is one-quarter of a mile above the mill, and is a better site than the one where the mill is located. The fall is said to be about 14 feet in 250 yards, and a dam 4 feet high could probably be built, giving a total available fall of 18 feet. The bed is rock, and the banks steep and rocky at the upper end of the shoal. It is to be remarked that the Appalachee exhibits the same phenomenon—of filling up with sand—that has already been referred to at length in the case of the tributaries of the Broad river in South Carolina. At Furlow's mill the fall was formerly 12 feet, but is now reduced to 8. The shoal just referred to has never been used. It is owned by C. M. Furlow, of Madison.

The next power is 5 or 6 miles above, at Price's mill, a grist- and saw-mill, using a fall of 16 feet and 25 horse-power, the dam being 4½ feet high, and the race 225 feet long. The owner states that by carrying the race 100 feet farther down the stream a fall of 20 feet would be obtained, and by going farther still even more could be used, the shoal being half a mile long. This shoal is, no doubt, a fine one, and in the table below I have estimated the power as nearly as possible:

Table of power at Price's mill.

State of flow (see pages 18 to 21).	Drainage area.	Fall.	Flow per second.	Horse-power available, gross.	
	Sq. miles.	*Feet.*	*Cubic feet.*	1 *foot fall.*	16 *feet fall.*
Minimum	300+	16	36	4.1	65
Minimum low season			40	4.5	72
Maximum, with storage			315	36.0	575
Low season, dry years			46	5.2	83

The next power is 4 miles above Price's, at High shoals, situated 14 miles from Athens and 16 from Madison. The stream is said to fall about 55 feet in 300 or 400 yards, but the principal part of the fall occurs in the lower half of this distance. The fall is utilized by the cotton factory of the New High Shoals Manufacturing Company, and by a grist-mill and a cotton-gin. The bed of the stream is solid rock, the banks high and difficult to canal, and the width of the stream 200 to 400 feet. The cotton-factory dam is located about the middle of the shoal, and is of wood, straight across the stream, 400 feet long and 5 or 6 feet high, built in 1873 at a cost of $500, and backing the water only one or two hundred yards. The race is 200 feet long, the fall 20 feet, and the power 100 horse-power, which can be secured during 11½ months as a rule, and 75 horse-power for the remaining time, there being no waste in summer while running.* Just above the pond is a fall of 4 or 5 feet, used for running a gin, while just below the factory is a grist-mill with no dam, a wooden flume about 120 feet long and a fall of 20 feet running 4 pair of stones. Below this mill there is a fall, not used, of 6 or 8 feet.

The drainage area above this shoal is about 300 square miles. I have based my estimates of power for the river principally on the above data regarding the factory as furnished by Dr. Powell, the president of the company. Although not of so much interest here, I subjoin a table. Taking 75 horse-power net as the power, with a fall of 20

* The power is stated in the statistics of cotton-mills at 179 horse-power.

feet during the low season of dry years, or assuming the efficiency of the motor to be 75 per cent. and the gross power 100 horse-power, the power per foot fall is 5 horse-power. On this the following estimates are based:

Table of power at High shoals.

State of flow (see pages 18 to 21).	Drainage area.	Fall.	Flow per second.	Horse-power available, gross.		
	Sq. miles.	*Feet.*	*Cubic feet.*	1 *foot fall.*	20 *feet fall.*	55 *feet fall.*
Minimum	300	55±	36	4.1	80	226
Minimum low season			40	4.5	90	250
Maximum, with storage			315	36.0	720	1,980
Low season, dry years			46	5.2	100	228

Above this shoal comes a site not utilized, said to have a fall of 15 or 20 feet; but no information could be obtained regarding it.

Five miles above High shoals is Snow's grist-mill, with a fall of 10 or 12 feet and a dam of about the same height; and further up the stream are other small grist-mills, but they are not worthy of special mention.

The Appalachee has one tributary worth naming, viz, Hardlabor creek, from the west, which drains 173 square miles. It is, however, not a good stream for water-power, and has only one site worth mentioning, about 3 miles from its mouth, and just above where Sandy creek joins it. This site was formerly used, and the available fall is stated at 10 feet; but the power is small, and the fall subject to being diminished by backwater from the Appalachee. The stream is sluggish and without power above this. Sandy creek, a tributary of Hardlabor creek, drains about 72 square miles, and is said to have a shoal about 2 miles long, on which there were formerly 4 mills, but now only 1 remains. This shoal is about 8 miles from Madison.

The Oconee river is formed by the union of the North and Middle forks a few miles below the town of Athens. It remains to describe these two streams. The North fork rises in Hall county, and flows through Jackson and Clarke counties, its length in a straight line being about 43 miles, and its drainage area 433 square miles. It flows directly by the town of Athens, the most important place in the vicinity. The table of declivity on page 145 will show that the stream has quite a rapid fall. There are, however, few mills on it, and few sites were brought to my notice. It is probable that the greater part of the fall occurs in the upper parts, before the stream is large enough to be of much value for power.

The first shoal is sometimes known as Smith's, and is less than a mile above the junction of the two forks; but according to all accounts the fall is small and the power not valuable.

The next power is at the factory of the Georgia Manufacturing Company, where the fall is 20 feet in a distance of one and a half miles or thereabout. The dam is of wood and stone, but built in a rather peculiar way. A stone dam of triangular or trapezoidal section is first carried entirely across the stream, and on top a wooden sill is laid; while at the bottom and on the up-stream side a second sill (mud-sill) is also laid, both extending from bank to bank. On these two sills the planking is laid, sloping thus upward and down stream and projecting down stream beyond the almost vertical face of the stone dam. This dam of the Georgia factory is 300 feet long and 10 feet high, and was built in 1840. The foundation is solid rock, and the pond is about a mile long and 150 feet wide. A race, 600 yards long, leads to the factory, where the fall is 20 feet, using 150 horse-power, which can be obtained at all times, but with no waste during working hours in the dry season. These data give a net capacity of 7½ horse-power per foot, or, say, 10 horse-power gross per foot, during the low season of ordinary, or, perhaps, dry years, corresponding to 0.20 cubic feet per second per square mile of drainage area. I have taken this as referring to dry years, because it is to be expected that the flow of this stream is more regular than that of the other tributaries of the Oconee thus far considered, since the rainfall is both larger and more favorably distributed, being as follows: spring, 15; summer, 15; autumn, 10; winter, 16; year, 56. The following table, therefore, gives my estimate of flow and power here:

Table of power at Georgia factory, on the North Oconee river.

State of flow (see pages 18 to 21).	Drainage area.	Fall.	Flow per second.	Horse-power available, gross.	
	Sq. miles.	*Feet.*	*Cubic feet.*	1 *foot fall.*	20 *feet fall.*
Minimum	433	20	70	8.0	160
Minimum low season			85	9.7	194
Maximum, with storage			475	54.0	1,080
Low season, dry years			100	11.4	228

This factory is a mile above the junction of the two forks.

Above this power comes a small shoal, where it is said that a fall of 6 feet could be obtained, known as the Lumpkin shoal, but it is probably not of much consequence.

The next important power is the Athens cotton factory, at Athens, about 4 or 5 miles above the junction of the two forks. The dam is constructed like that at the Georgia factory, and is 300 feet long and 10 feet high. It was built in 1847, and would perhaps cost $5,000. The foundation is solid rock. The race is only a few feet in length and the fall 12 feet, and 180 horse-power is used. Opposite the factory, on the east bank, is a grist-mill, with a race about 330 feet long and a fall of 13 feet, with 60 horse-power. The total power used is therefore 240 horse-power; but this cannot be obtained all the time, and the grist-mill is sometimes stopped in dry weather to allow the factory to use all the power. Still, I was informed that the factory could not be run at full capacity more than about 10 months of the year, the power during the rest of the time being considerably less, even by drawing down the water at night in the pond (which is 3 miles long and 100 to 150 feet wide) to a certain extent, the factory being run 11 hours a day. These data give the power in the low season at somewhere in the neighborhood of 8 or 10 horse-power per foot fall gross, and as the data from the Georgia factory are the more reliable, on account of the fact that in this case it is impossible to say to what extent the water is drawn down in the pond, I take the figures used in the previous table, which give for 12 feet fall powers of, respectively, 96, 116, 650, and 137 horse-power for the natural flow of the stream, and in ordinary years, of course, about 170 horse-power. The dam of this factory was partially washed away by a freshet in the spring of 1881.

There is no power on the stream for 12 or 13 miles above the Athens factory, the next power being at Burn's mill, now Hood's mill, where the fall is 10 feet, with a dam 9 feet high, the power not being of much importance.

The next shoal is Hurricane shoal, in Jackson county, 16 or 17 miles above Athens, where the fall is 26 feet* in a short distance, and the location is said to be safe. The power, if used at all, is only used to run a small grist-mill, with a few pair of stones. As nearly as I could locate the place, the drainage area above it is about 230 square miles, the rainfall being the same as already given. I would therefore estimate the power about as follows:

Table of power at Hurricane shoal.

State of flow (see pages 18 to 21).	Drainage area.	Fall.	Flow per second.	Horse-power available, gross.	
	Sq. miles.	*Feet.*	*Cubic feet.*	*1 foot fall.*	*26 feet fall.*
Minimum	230	26	36	4.1	107
Minimum low season			45	5.1	133
Maximum, with storage			257	29.2	759
Low season, dry years			52	5.9	153

This site is conveniently located about 3 miles from the North-Eastern railroad, and is said to be a very good power.

Above this there are other shoals, some of them utilized to run small grist-mills; but regarding them I have no data, and as the stream is small it is needless to specify them. This part of the state has a healthy and salubrious climate, and offers many inducements to manufacturers. Its water-powers will doubtless be developed before long.

The Middle Oconee, or Middle fork, takes its rise in Hall county, and, like the North fork, flows through Jackson and Clarke counties, to join the latter stream. Its length in a straight line is about 40 miles, and it drains a total area of 407 square miles, receiving as its principal tributaries Mulberry fork, draining 97 square miles, and Barber's creek, draining 74 square miles. The fall of the stream I am unable to state, but it probably does not differ much from that of the North fork, which it resembles in all respects. If anything, the latter is more rapid, the Middle Oconee being said to have many low, flat, and rich bottom-lands along its banks, and to be rather sluggish in many places.

The first shoal on the stream is known as the Simalton shoal, and is a mile or so from the mouth, but the fall is small, and of no value for manufacturing.

The next is the Princeton factory (cotton), 2 miles from the mouth and 3 miles from Athens, which is the nearest railroad point. The dam is similar to those already described on the North fork, and is 320 feet long, 9 feet high, and was rebuilt in 1880 at a cost of about $5,000, having been constructed originally about 40 years ago. The foundation and abutments are of rock, and the pond is 2 miles long, with an average width of 150 feet. The length of the head-race is 300 yards, and it is 20 feet wide and 2 to 3 feet deep. The fall at the factory is 20 feet, and 100 horse-power is used, and can be obtained all the time, with a waste of water at all seasons. The wheels are stopped by high water several days in the year, and sometimes two weeks or more in all. The freshets on the stream are quite severe, and in 1880 there were several very large ones—the largest since the "Harrison freshet" of May, 1840. In April, 1880, the water rose 27 feet at the factory, and was 7 feet over the dam, overflowing the canal, and causing a stoppage of work for six days. In 1879 the head-gates and canal banks were washed out during a freshet, and the factory was stopped for one month. I have estimated the power at this site as in the table on page 152.

*JANES: Handbook of Georgia.

Table of power at Princeton factory.

State of flow (see pages 18 to 21).	Drainage area.	Fall.	Flow per second.	Horse-power available, gross.		Remarks.
	Sq. miles.	*Feet.*	*Cubic feet.*	*1 foot fall.*	*20 feet fall.*	
Minimum	330	20	52	6.0	120	Low season of ordinary years, 215 horse-power.
Minimum low season			66	7.5	150	
Maximum, with storage			363	41.2	825	
Low season, dry years			77	8.7	175	

The next power is Jennings' grist-mill, 3 miles above, where the fall is 8½ feet, with a dam 4 feet high. The power utilized is very small. That available may be calculated by comparing with the above table for the factory, the quantity of water being about the same at both places.

McElroy's mill is the next power, 1½ miles above, and 4 miles from Athens. The fall is 13 feet, with a dam 6 feet high and a race 300 feet long. The mill runs 3 pair of stones, and can be run all the year. The power available can be approximated to as above, there being no tributaries of importance between this place and the factory.

The next power is at Tallassee falls, 8 or 9 miles from Athens, and about 4 miles above McElroy's mill. This shoal is 1,200 yards long, and the total fall is stated to be 51 feet.* Part of this fall was at one time used by a cotton factory, but now only by a grist-mill, located at about the center of the shoal, with a wing-dam, a race 300 yards long, and a fall of 14 feet. The whole fall of the shoal could without difficulty be utilized, but in two parts—the upper part being used on the left bank, and the lower on the right. There was formerly a saw-mill on the right bank near the foot of the shoal. The bed of the stream is rock, gravel, and bowlders, and its width is from 150 to 200 feet. The following table shows my estimate of the power:

Table of flow and power at Tallassee falls.

State of flow (see pages 18 to 21).	Drainage area.	Fall.	Flow per second.	Horse-power available, gross.	
	Sq. miles.	*Feet.*	*Cubic feet.*	*1 foot fall.*	*51 feet fall.*
Minimum	307	51	50	5.7	290
Minimum low season			61	7.0	360
Maximum, with storage			340	38.6	1,970
Low season, dry years			70	8.0	410

Above this shoal there are said to be no large powers on the stream, although there are some sites where grist-mills might be located, and some mills in operation.

Of the tributaries to the Middle Oconee, the first is Barber's creek, which enters below the Princeton factory from the west, draining 74 square miles.

Half a mile from its mouth is the Pioneer paper-mill, using a fall of 20 feet and 120 horse-power, which can be obtained during nine months, while for the rest of the year only 60 horse-power can be obtained. Steam-power to the extent of 30 horse-power is used all the time, and 80 horse-power during three months. Three miles from the mouth is an unutilized power known as Epps' shoal, the fall being stated at 24 feet in 60 yards, all available. Four miles above is a third site, not used at present, the fall being stated at 20 feet in 300 yards.

Mulberry fork, which enters the Middle Oconee above Tallassee falls, drains 97 square miles, and has some shoals, used and idle, on the main stream and tributaries, many of which might doubtless be utilized with advantage, affording good powers, though small.

THE OCMULGEE RIVER.

This stream has its sources in Fulton, De Kalb, and Gwinnett counties, but the stream proper is formed by the union of the South and the Yellow rivers between Butts and Newton counties, whence it flows in a general direction rather east of south to join the Oconee, passing by the city of Macon, the town of Hawkinsville, and a few other small towns. It crosses the fall-line at Macon, which is the head of navigation, and below which there is no power. At present the stream is navigable as far as Hawkinsville, 200 miles, for boats drawing 5 feet. Regarding the length of the river I have no data, but the distance from Macon to the sea is generally called about 500 miles.† It drains a total area of 6,000 square miles, of which about 2,250 are above Macon, so that the water-power district is not quite so large as in the case of the Oconee. The character of the stream, of its flow, of the drainage-basin, and

* By Mr. J. W. Bromby, of Athens, who measured it.

† *Annual Report Chief of Engineers*, 1872, p. 516.

of the rainfall, is about the same as in the case of the Oconee. The declivity is probably also about the same, though I have few data regarding it. The elevation of the river at Macon is probably about 275 feet, and, according to the report on the canal route to connect the Ocmulgee and Tennessee (*Annual Report Chief of Engineers*, 1872, p. 531), it seems that the fall between this point and the head of the river is 270 feet, but I am not able to state with any accuracy the distance between the two places.

I proceed to describe the river as a source of water-power more in detail.

The first power is near Macon, where the stream crosses the fall-line, and where, like the Oconee and the Savannah, it forms a long shoal, several miles in length. It has at various times been proposed to construct a canal from a point on the river 10 miles above the city down to a small stream called Vineville branch, which enters the Ocmulgee half a mile above the city limits, and to utilize the water-power for manufacturing, at the same time supplying the city with water; and it is said that the available fall at Vineville branch would be 42 feet or thereabout. The project was started in 1871, and the Macon Canal and Manufacturing Company was organized; but as yet nothing has been done. It is said, on good authority, that the scheme is perfectly practicable, but opinions differ as to the difficulties involved. The difficulty in bringing the canal down to the city lies in the fact that between the latter and Vineville branch is a ridge which would be difficult to cut through, and a cemetery which could probably not be crossed. It is asserted by some that the canal could be built for $250,000, and that little blasting would be required,* the length of the canal being 9½ miles. It was proposed to build a dam 5 feet in height at its head, where the bed of the stream is solid rock, there being a very favorable site for its location. Along the line of the canal there are said to be fine clay deposits, and near its head an abundance of very fine granite. The shoals on the river below the proposed head of the canal are known as Healy's, Wicked, Wimbush's, and Cemetery. At the former, which is 7 miles above Macon in a straight line, it is said that there is a fall of nearly 10 feet in 300 yards; and at Wicked shoals it is said that the fall is 8 feet in a mile, while the Cemetery shoal, which is below the mouth of Vineville branch, has only a small fall.

The project of utilizing this power is not now spoken of much, and I was unable to see the original reports and estimates, which have been lost. The only report that I could find is one by F. P. Holcomb, engineer, published some years ago in one of the Macon daily papers. It is there stated that the fall from the head of Healy's shoals to Macon, a distance of 7.6 miles by the canal, is 31 feet; adding 7 feet for a dam, and subtracting 4 feet for friction, the available fall is 34 feet. By going further up stream with the canal, this may be increased to 40 feet or thereabout.

The drainage area above Macon is about 2,250 square miles, and I have estimated the power in the table below. The flow of the stream is said to be quite variable, indeed—a characteristic we have noticed in the case of the Oconee. The freshets are very heavy, and the stream rises sometimes 22 feet at Macon. There have been no continued gaugings of the river, but it is stated that the flow at average low water is about 1,100 cubic feet per second. The fact that in Holcomb's report, above referred to, the ordinary low-water flow is given at 481 cubic feet per second will show the unreliability of a single measurement. It is said that in 1839 the flow was at its minimum, and was 360 cubic feet per second.

Table of power at Macon canal (projected).

State of flow (see pages 18 to 21).	Drainage area.	Fall.	Flow per second.	Horse-power available, gross.	
	Sq. miles.	*Feet.*	*Cubic feet.*	*1 foot fall.*	*40 feet fall.*
Minimum	2,250	40±	360	41.0	1,640
Minimum low season			475	54.0	2,160
Maximum, with storage			2,150	244.3	9,770
Low season, dry years			540	61.3	2,450

It is to be remarked here that the above estimates have been made entirely independent of the measurements referred to above, and the agreement is surprising. The minimum is found by taking the discharge at 0.16 cubic foot per second per square mile, the same figure that was assumed for the Oconee above Milledgeville, and arrived at by a careful consideration of all the circumstances.

The economical location of Macon is very favorable, and the map will show that a number of railroads diverge from the city. The Ocmulgee is navigable (or can be made so) up to the place for boats carrying 1,000 bales of cotton. The navigation is unobstructed as far as Brunswick, but above that point it is obstructed by two bridges.

The river has been examined above Macon by Colonel B. W. Frobel, under the direction of Major King, of the United States engineer corps, and his report is to be found in the *Annual Report of the Chief of Engineers*, 1876, Appendix P, p. 20. From this report most of the following information has been condensed. All the shoals specified in the report will be found mentioned in the table on page 154; but regarding many of them I have no information in addition to what is there given.

Holt's shoal, in the upper part of Bibb county, is not utilized. The stream is about 325 feet wide.

*BUTLER: Historical Record of Macon and Central Georgia, p. 292.

At Johnston's shoal the river is divided by three small islands, and the total width of the stream above the shoal is 450 feet, and below it 350. Harris' shoal is in Monroe and Jones counties, as are all the following shoals up to Head's shoal, which is just at the upper corner of Jones. The most important in this distance is Glover's Mill shoal, or Long shoal, which is used on both sides of the river, and is 4 or 5 miles below the upper corner of Monroe county, and about 10 miles from Forsyth. It is said that the entire fall is available, with good facilities for canals and buildings. The next shoal is Seven Islands shoal, in Butts and Jasper counties, and about 20 or 25 miles from Forsyth. There was at one time a cotton factory at this place, but now there is only a grist- and saw-mill. The width of the stream at the head of the shoal is 350 feet, but it rapidly expands, and is 500 feet wide near the foot. It is said that the entire fall is available, and the site is called one of the best on the river. Roach's shoal is the next one which is utilized, there being a grist-mill on the left bank, with a canal nearly the whole length of the shoal, and a dam across a narrow arm of the river over to an island. The width of the stream at the head of the shoal is about 400 feet. The most important shoal above Macon, however, is Lloyd's, the total fall being over 39 feet in less than 2 miles, the principal part of which occurs at the head, in a distance of 2,000 feet, but the whole of which is probably available. The bottom is solid rock, and the banks generally high, except that on the left bank there is a bottom near the foot of the shoal. At Cap's shoal the river is divided by islands into three channels, the width just above the shoal being 350 feet. Just above Harvey's shoal the Alcovee river enters from the north. At Lemon shoal, the next one above, a natural rock dam extends almost entirely across the river, leaving an opening of about 50 feet, called Bull sluice. The last shoal on the river, Barnes', is just at the junction of the South and the Yellow rivers, and is utilized for a grist-mill. The head of the shoal is on both streams, and just at the junction of the two is a rock ledge, crossing both, and forming an almost perfect dam, with deep water above it. The width of the South river is about 325 feet; that of the Yellow river about 275 feet; and that of the Ocmulgee about 500 feet.

Not having visited any of the shoals on the river, I am unable to give detailed information regarding the practicability of utilizing them. It is evident, however, that the stream presents a large amount of theoretically available power and several fine sites almost entirely unimproved. Estimates of the power are in the following table.

The chief difficulty in the way of the utilization to a large extent of the water-power of the Ocmulgee is the inaccessibility of the stream. A new railroad, however, is now in course of construction from Macon to Atlanta, which will, I believe, follow the river quite closely, and thus remove this difficulty.

Summary of power on the Ocmulgee river.

Locality.	Distance from Macon.	Drainage area.	Rainfall.					Fall.		Horse-power available, gross.*				Utilized.		Per cent. of minimum utilized.	Remarks.
			Spring.	Summer.	Autumn.	Winter.	Year.	Height.	Length.	Minimum.	Minimum low season.	Maximum, with storage.	Low season, dry years.	Horse-power, net.	Fall.		
	Miles.	*Sq. miles.*	*In.*	*In.*	*In.*	*In.*	*In.*	*Feet.*							*Feet.*		
Macon canal, projected	0	2,250	11	13	9	14	47	40±	10 miles.	1,640	2,160	9,770	2,450	0	0	0	
Bibb county:																	
Holt's shoal		2,235	11	13	9	14	47	3.714	400 feet.	150	200	900	230	0	0	0	Width, 325 feet.
Holman's shoal		2,200+	11	13	9	14	47	1.204	1,400 feet.					0	0	0	Width, 400 feet.
Monroe and Jones counties:																	
Johnston's shoal		2,200+	11	13	9	14	47	5.125	1,500 feet.	200	270	1,200	310	0	0	0	
Harris' shoal		2,200+	11	13	9	14	47	2.312	3,000 feet.					0	0	0	Width, 350–400 feet.
Bowman's shoal		2,200+	11	13	9	14	47							0	0	0	
Taylor's shoal		2,200	11	13	9	14	47	5.732	2,100 feet.	230	300	1,360	350	0	0	0	Width, 500 feet.
Rum Creek shoal		2,000+	11	13	9	14	47	Small						0	0	0	
Dame's shoal		2,000	11	13	9	14	47	3.644	400 feet.	130	175	790	200	0	0	0	Width, 400–600 feet.
Falling Creek shoal		2,000–	11	13	9	14	47	1.566	3,200 feet.					0	0	0	Width, 400 feet.
Clark's shoal		2,000–	11	13	9	14	47	Small						0	0	0	
Jarrell's shoal		2,000–	11	13	9	14	47	...do						0	0	0	
Mitchell's shoal		2,000–	11	13	9	14	47	...do						0	0	0	
Glover's Mill shoal		1,974	11	13	9	14	47	17.916	1,600 feet.	650	850	3,870	980	50±	12±	11±	Width, 400 feet.
Head's shoal		1,640	11	13	9	14	47							0	0	0	
Butts and Jasper counties:																	
Island shoal		1,600±	11	13	9	14	47							0	0	0	
Seven Islands shoal		1,512	11	13	9	14	47	19.515	1,600 feet.	530	700	3,350	800	<50	20?	13±	
Lamar's shoal		1,500±	11	13	9	14	47	3.953	1,300 feet.	110	140	680	160	0	0	0	Width, 500 feet.
Roach's shoal		1,450±	11	13	9	14	47	7.500	3,000 feet.	200	260	1,240	300				
Pitman's shoal		1,450±	11	13	9	14	47	3.510	1,800 feet.	90	120	580	140	0	0	0	Width, 400 feet.
Lloyd's shoal		1,350±	11	13	9	14	47	39.627	9,500 feet.	975	1,280	6,100	1,400				Width, 300–450 feet.
Cap's shoal		1,350±	11	13	9	14	47	5.580	400 feet.	140	180	860	210	0	0	0	
Leverett's shoal		1,350±	11	13	9	14	47							0	0	0	
Harvey's shoal		1,340	11	13	9	14	47	4.000	600 feet.	100	130	620	150				
Lemon's shoal		1,020	11	13	9	14	47	2.500	700 feet.	50	70	325	80	0	0	0	
Barnes' shoal		1,017	11	13	9	14	47	11.645	500 feet.	210	280	1,350	325				

TRIBUTARIES OF THE OCMULGEE RIVER.

Some of the tributaries below Macon are sand-hill streams, but none have large powers utilized, although such might perhaps be developed in places. On Mossy creek, a small stream flowing into Indian creek, which joins the Ocmulgee about 10 miles above Hawkinsville and drains a total area of 300 square miles, there is a cotton factory, with a fall of 12 feet and 60 horse-power, the dam being 10 feet high and the race 50 feet long.* This stream is said to be quite constant in flow, and drains about 116 square miles; and it seems probable that more power could be obtained on it. If its flow and its general character resembles that of the other sand-hill streams which we have considered, it would afford considerable power. I have no information of the streams below this. The largest tributary is probably the Little Ocmulgee, which drains a total area of 776 square miles, but it is so far below the fall-line that it is not probable that it affords much power.

Echaconnee creek, which joins the Ocmulgee from the west about 15 miles below Macon, is a considerable stream, draining 272 square miles. Its power, however, was not spoken of as remarkable, and it is utilized only by small grist- and saw-mills. It is probable that it partakes to some extent of the character of a sand-hill stream, and that its flow does not vary so much as that of the streams above the fall-line; but as I was not able to learn much regarding the stream I submit no estimates.

Tobesoffkee creek is a stream similar to the one last mentioned, rising in Monroe county, and flowing through Monroe and Bibb into the Ocmulgee, about 10 miles below Macon. It has a few small grist-mills, but no large powers were heard of. Its drainage area is 260 square miles.

The next tributary worth naming is the Towaliga river, which takes its rise in the western part of Henry county, and flows southeast, forming the boundary-line between Henry and Spalding, and then flowing through Butts and Monroe, joining the Ocmulgee just opposite the upper corner of Jones, after draining a total area of about 320 square miles as nearly as I could measure it, its length being about 33 miles in a straight line. Its total length is stated at 70 miles.† It is said to be quite a rapid stream, with not much bottom-land, except in its lower part. It has the following shoals:

Willis' shoal, 3 miles from the mouth, not used, though formerly there was a grist-mill there. The available fall is stated at 10 feet, with a dam.

High falls, about 15 miles from the mouth of the stream, 7 miles from Indian spring, 9 miles from Milner, the nearest railroad point, and 14 miles from Forsyth, is the best water-power on the stream or in the vicinity. The stream falls here 81½ feet in a distance of between 300 and 400 yards, but of this fall 49 feet is in one perpendicular pitch.‡ The power is used as follows:

At the head of the shoal is a wooden dam, 400 feet by 10, straight across the stream, with a race on each bank, one leading to a grist-mill, and the other to a saw-mill, the fall used being 13 feet. About 500 feet below the first dam is a second one, 200 feet by 3, its crest being 10 feet higher than the top of the high fall, 300 feet below. From this dam there is a race on each side, one leading to a cotton-gin, and the other to a gin and a wool-carding machine. The high fall is 49 feet perpendicular, and 200 feet below it is another shoal with about 10 feet fall, not used, followed for some distance by smaller shoals. The bed of the stream is solid rock, and the banks such that the entire fall of 71 or 72 feet is available. The drainage area above this place was measured and found to be about 200 square miles. I have therefore estimated the power as in the table below. Mr. Boardman states the flow at extreme low water at 162 cubic feet per second, but if my measurement of the drainage area is correct within a reasonable amount the flow must either be very much smaller than this or there must be some very exceptional features in the drainage-basin. The table below is estimated on analogy, and such features, if they exist, would modify the figures given. I have used nearly the same proportions in calculating this table that I used in the case of the Appalachee river.

Table of power at High falls, Towaliga river.

State of flow (see pages 18 to 21).	Drainage area.	Fall.*	Flow per second.	Horse-power available, gross.		
	Sq. miles.	*Feet.*	*Cubic feet.*	*1 foot fall.*	*49 feet fall.*	*71 feet fall.*
Minimum	200		26	3.0	147	213
Minimum low season			31	3.5	172	248
Maximum, with storage			211	24.0	1,176	1,704
Low season, dry years			35	4.0	196	284

* Total, 82 feet; perpendicular, 49 feet; total in shoal proper, 71 feet.

The rainfall on the basin of the Towaliga is about as follows: spring, 10; summer, 12; autumn, 10; winter, 14. The site above described is worthy the attention of those seeking a location.

* Power stated in statistics of cotton-mills at 120 horse-power.

† WHITE: Statistics of Georgia.

‡ All of my information regarding this power is due to Mr. Arthur Boardman, of Macon, who has surveyed the power.

Flat shoal, 4½ miles above High shoal, is about 250 yards long, and the fall is said to be 10 or 12 feet. It is not improved, but is probably available. One mile above it is a second shoal, with a small fall, and 1 or 2 miles further up is another, but neither are probably of value. A short distance above, and about 10½ miles east of Griffin, in Spalding county, is Heflin's shoal, about half a mile in length, with a rock bottom, and banks 8 or 10 feet high, the fall being stated at 12 to 15 feet, with a dam 4 feet high; and it is said that a much higher dam could be constructed. Above are several small powers, but they are not worthy of special mention.

Little Towaliga creek, which drains about 55 square miles, and enters the main stream a few miles below High shoal, has 2 mills using a small amount of power, one of them with a fall of 27 feet.

The next tributary of the Ocmulgee worthy of mention is the Alcovee river, which enters from the left only about a mile below the junction of the South and the Yellow rivers. It takes its rise in Gwinnett county, pursues a course nearly south through Walton and Newton counties, entering the Ocmulgee on the line between Newton and Jasper, its length in a straight line being about 45 miles, and its drainage area about 320 square miles. In its upper part it is not favorable for power, being flat, and with no falls; and it is only below the Georgia railroad that there is any power worth mentioning. Its elevation at the crossing of the Georgia railroad is about 550 feet. The following are the powers on the stream as it is ascended:

Newton Factory shoal, or High shoal, about 5 or 6 miles from the mouth, and 11 or 12 miles from Covington, the nearest railroad point, is about half a mile in length, and the fall was variously stated at from 50 to 70 feet, the former of which I believe to be the more nearly correct, though I did not visit the place. At the upper part of the shoal is the Newton factory (W. R. Phillips, Atlanta), but the dam was washed out in the freshet of May, 1881. It was 200 feet by 6, affording a fall of 12 feet at the cotton-, saw-, and grist-mills, with a race of 25 feet. The lower part of the fall is used by the cotton factory of H. & T. M. White, with a dam of loose rock 50 or 60 feet long and 3 or 4 feet high, reaching only part way across the stream. A head-race of 60 feet gives a fall of 6 feet, and the power used is 20 horse-power. Above the factory is a grist-mill, with a small power. The total fall at this place is said to be available, and it is no doubt a fine power. The rainfall on all the drainage-basins of the Alcovee, South, and Yellow rivers may be given here once for all. It is: spring, 12; summer, 13; autumn, 10; winter, 13; year, 48. I have therefore estimated the power at the shoal above described as in the following table:

Table of power at Newton factory or High shoal, on the Alcovee river.

State of flow (see pages 18 to 21).	Drainage area.	Fall.*	Flow per second.	Horse-power available, gross.	
	Sq. miles.	*Feet.*	*Cubic feet.*	1 *foot fall.*	50 *feet fall.*
Minimum	266±		37	4.2	210
Minimum low season			48	5.4	275
Maximum, with storage			264	30.0	1,500
Low season, dry years			55	6.2	315

*Probably 50 feet or over.

The next shoal is at Henderson's mill, 6 miles south of Covington, where the fall is 9 feet, with a dam 5 feet high and 180 feet long, which backs the water 4 miles. Above this the stream is sluggish, and there is said to be only one shoal, known as Hinton's, with a fall of 5 feet over a ledge of rock.

The principal tributary of Alcovee river is Bear creek, which enters from the left below High shoal, draining about 31 square miles.

The Yellow river, one of the two streams which form the Ocmulgee, takes its rise in Gwinnett county, and pursues a course a little east of south, cutting off a corner of DeKalb, and passing through Rockdale and Newton counties, draining a total area of about 422 square miles, its length being about 45 miles in a straight line. It passes within 3 miles of the towns of Conyers and Covington. It is a better stream for water-power than the Alcovee, and is said to be a bolder stream, with more rapid fall and less low ground. It is "very tortuous, presenting many abrupt turns, with high, sharp spurs jutting in and frequent rock cliffs, particularly for from 10 to 15 miles in the vicinity of Stone mountain".* The finest quality of granite is found in this vicinity in inexhaustible quantities.

The shoals will now be described in their order:

The first is Indian Fishery shoal, where the fall is 12.2 feet in 400. At the head of the shoal a natural rock-dam extends entirely across the river, with deep water above it. A fall of 11 feet is used by a grist-mill on the right bank, which is the most favorable side for building, the left bank being steep. The width of the stream is about 320 feet. The table on page 157 gives estimates of the power.

Annual Report Chief of Engineers, 1872, p. 530.

Table of power at Indian Fishery shoal, Yellow river.

State of flow (see pages 18 to 21).	Drainage area.	Fall.	Flow per second.	Horse-power available, gross.	
	Sq. miles.	*Feet.*	*Cubic feet.*	1 *foot fall.*	12.3 *feet fall.*
Minimum	420	12.277	59	6.7	82
Minimum low season			76	8.6	106
Maximum, with storage			420	47.7	587
Low season, dry years			87	9.9	122

Allen's shoal has a fall of 1.8 feet in 400, not, used, and, unless a dam of considerable height could be built, of course useless. There was once, however, a mill here. The width of the stream at the head of the shoal is about 200 feet.

Lee's shoal, not improved, has a fall of 3.9 feet in 1,400. The width of the stream is about 275 feet at the head of the shoal, and the bed is exposed rock, for 400 feet, when the stream bends abruptly to the right. The power is probably available. The drainage area of the stream being but little smaller than at its mouth, the available power can be calculated from the preceding table.

Webb's shoal and Flat shoal are two shoals with small falls, and are of no value.

Dried Indian shoal, not improved, has a fall of 7.2 feet in 1,500, all of which is probably available, and could perhaps be increased by a dam. The width of the stream at the head is about 200 feet, and the bed is rock. Dried Indian creek enters below the head of the shoal. The following table gives an estimate of the power:

Table of power at Dried Indian shoal, Yellow river.

State of flow (see pages 18 to 21).	Drainage area.	Fall.	Flow per second.	Horse-power available, gross.	
	Sq. miles.	*Feet.*	*Cubic feet.*	1 *foot fall.*	7.2 *feet fall.*
Minimum	400	7.241	56	6.4	46
Minimum low season			72	8.2	59
Maximum, with storage			400	45.4	327
Low season, dry years			82	9.3	67

Cedar shoal is the next above, and is the most important one on the river, the fall being 62.6 feet in 4,875, or less than a mile. The stream is very variable in width, and the channel is interspersed with islands. At the head of the shoal the width is 290 feet, and about 300 feet below is a dam, extending diagonally across, 327 feet long and 4 feet high, of wood and stone, built in 1878 at a cost of $1,500. It is bolted to the rock, and has never been injured by freshets. It backs the water for 3 miles with an average width of 300 feet or so. A race 300 feet long leads to a cotton-yarn factory and a grist- and saw-mill on the right bank, the factory using a fall of 16 feet and 70 or 80 horse-power perhaps, and the grist- and saw-mill using a fall of 21 feet and about 50 horse-power. Full capacity can always be obtained, with a waste of water at all times. Just below the mills is a large island. The banks on the right are high and hilly near the factory and below, but not bluffy till near the foot of the island above referred to, where they are very steep and rocky, and continue so to the foot of the shoal. The entire fall could not be utilized on this bank. The left bank is not so steep or hilly, and power has been used on that side, a dam 700 feet long having been built below the island, extending diagonally across the stream, and supplying power to mills below by a race 700 feet long. No power is used here now, and the dam is almost entirely washed away. The power could doubtless best be utilized in two parts, the upper part, as now used, on the right bank, and the lower part, with a fall of 43 feet or so, on the left bank. The width of the stream below the shoal is 200 feet.

The following table contains estimates of the power:

Table of power at Cedar shoal, Yellow river.

State of flow (see pages 18 to 31).	Drainage area.	Fall.	Flow per second.	Horse-power available, gross.		
	Sq. miles.	*Feet.*	*Cubic feet.*	1 *foot fall.*	20 *feet fall.*	62.664 *feet fall.*
Minimum	376	62.664	53	6.0	120	376
Minimum low season			68	7.7	154	482
Maximum, with storage			376	42.7	854	2,676
Low season, dry years			78	8.8	176	551

This shoal is 3 or 4 miles above Indian Fishery shoal, and 3 miles from Covington, which is the nearest railroad point. The factory above described is known as the Covington Mills (O. S. Porter).

The next shoal above Cedar shoal is Crew's shoal, at the mouth of Turkey creek. The fall is not large, perhaps 4 feet or so. The power available can be obtained from the preceding table with sufficient accuracy. Hendrick's and Meriwether's shoals follow, but are too small to be of special value. A fall of 6 feet could be obtained by a dam.

The next shoal is 5 miles above, at the crossing of the Georgia railroad, and is known as Bridge shoal. The fall is 4.3 feet in 1,000, but the principal part occurs in the first 500 feet. The power is unimproved, but formerly there was a mill there, and the remains of the dam are still to be seen. The width of the stream at the head is about 125 feet. The banks on the left are steep, the hills running close up to the river for the entire length of the shoal; the right bank is 8 or 10 feet high, of rock and clay. The drainage area above this shoal is only a little smaller than above Cedar shoal, so that the power available may be approximated by taking the power per foot fall the same as there given. All the falls thus far given may be capable of being increased by building dams.

A short distance above the bridge is the mouth of Big Haynes creek, the principal tributary of the Yellow river, and 2 miles above is Glenn's shoal, 5 miles from Conyers, with a fall of perhaps 12 feet or a little more. Four miles further up is the Rockdale paper-mill, 2 miles from Conyers, situated on a fine shoal between a quarter and a half mile in length, with a total fall of between 50 and 60 feet. The bed of the stream is rock, and the banks, though not bluffy, are sufficiently high to allow of perfectly safe locations, without much difficulty in building canals. At the head of the shoal is a dam 150 feet long and 10 feet high, built of crib-work in 1871 at a cost of about $1,000. The foundation is solid rock. The pond is 2 miles long and 200 feet wide or thereabout. At the dam, on the right bank, is a saw-mill, using a fall of 12 feet and 12 horse-power. A race 700 feet long leads on the same side to the paper-mill, where the fall is 20 feet, the water being discharged, not to the river, but to a lower race leading to a grist-mill, where the fall to the river is 13 feet. The paper-mill uses 60 horse-power, and the grist-mill 30. Below the tail-race of the grist-mill the fall is at best 15 feet in a quarter of a mile, all of which is available. Full capacity can be obtained at these mills all the time as a rule, but with very little waste of water in dry weather during running hours. The water is not drawn down in the pond during working hours. The following table gives my estimate of power at this shoal. It has served as a guide in my calculations for other shoals on the river:

Table of power at Rockdale paper-mill, Yellow river.

State of flow (see pages 18 to 21).	Drainage area.	Fall.	Flow per second.	Horse-power available.	
	Sq. miles.		*Cubic feet.*	1 *foot fall.*	50 *feet fall.*
Minimum	222	About 50 feet.	31	3.5	175
Minimum low season			40	4.5	225
Maximum, with storage			222	25.2	1,260
Low season, dry years			46	5.2	260

This table will serve to show the available power at Glenn's mill below, the drainage area being about the same.

Six or seven miles above this shoal is Baker's mill, with a fall of 9 or 10 feet, and 2 pair of stones. Above it, but not worthy of special mention, are four other small grist-mills.

Big Haynes creek, already referred to as the principal tributary of Yellow river, drains about 85 square miles. It has a number of good small powers not used, and is said to be less variable than most of the streams in the neighborhood. It is said on good authority that it has more available powers than any stream of its size in the vicinity, and that it is an excellent stream in all respects. One of its tributaries, Little Haynes creek, has a couple of small mills, and below its mouth there is no power on the main stream, but above there are several shoals. The lowest is Kennedy's, with a fall of 28 feet, all utilized, the dam being 2½ feet high, and the race 500 feet long. The next is an unutilized power, with an available fall of about 20 feet within a distance of a quarter of a mile. Then comes a grist-mill with 16 or 17 feet; then a shoal not used, known as Indian shoal; then a grist- and saw-mill with 25 feet available and 19 feet used. Above are other and smaller powers.

It is evident from the foregoing that the Yellow river, with its tributaries, offers a large amount of very fine power. It is, in fact, one of the best streams in the vicinity, and it should not be long before more of its available power is utilized.

South river, the other of the two streams which form the Ocmulgee, rises in Fulton county, not far from the city of Atlanta, flows east into DeKalb county, and thence southeast, forming the boundary-line between Rockdale and Newton counties on its left, and Henry and Butts on its right. Its length, in a straight line, is about 45 miles, and its drainage area is 595 square miles, or greater than that of the Yellow or that of the Alcovee river. In general character, rainfall, etc., it resembles them; and, like the former, it has a number of good shoals, affording considerable power. For almost all my information regarding the water-powers on South river I am indebted to Mr. A. O. Brown, of Conyers, who is thoroughly acquainted with all the powers in the vicinity, and whose statements are entitled to the utmost reliance.

The first is Pine Log shoal, not utilized, but the fall is small, and the power unimportant.

The next is Island shoal, 5 or 6 miles from the mouth and 15 miles from Covington. The fall is about 17 feet in a quarter of a mile, all of which is available, and about 11 feet of which are used by a grist- and saw-mill, with a dam 2½ feet high. The banks and the bed are said to be favorable. The following table gives an estimate of the power, assuming the fall at 17 feet:

Table of power at Island shoal, South river.

State of flow (see pages 18 to 21).	Drainage area.	Fall.	Flow per second.	Horse-power available, gross.	
	Sq. miles.	*Feet.*	*Cubic feet.*	1 *foot fall.*	17 *feet fall.*
Minimum	578	17	81	9.2	156
Minimum low season			104	11.8	200
Maximum, with storage			578	65.7	1,117
Low season, dry years			119	13.5	229

Three miles above is Snapping shoal, above the mouth of Snapping Shoal creek, and about 15 miles from Conyers and Covington. The available fall is 16 feet or more in a quarter of a mile, of which 14 are used by a grist- and saw-mill with a wing-dam.

Table of power at Snapping shoal.

State of flow (see pages 18 to 21).	Drainage area.	Fall.	Flow per second.	Horse-power available, gross.	
	Sq. miles.	*Feet.*	*Cubic feet.*	1 *foot fall.*	16 *feet fall.*
Minimum	495	16±	69	7.8	125
Minimum low season			89	10.1	162
Maximum, with storage			495	56.2	900
Low season, dry years			102	11.6	186

Above it is a shoal known as the Pearsal old shoal, now not used, but with a fall said to amount to 10 or 12 feet in a short distance. It is above the mouth of Walnut creek, and the flow is probably about four-fifths of that at Snapping shoal.

Eight miles above Snapping shoal is Peachstone shoal, above the mouth of Cotton river, a considerable stream, which enters from the south or west. It is said that a fall of 15 feet is available in one-third of a mile, of which a grist- and saw-mill and furniture shops use 10 feet.

Table of power at Peachstone shoal.

State of flow (see pages 18 to 21).	Drainage area.	Fall.	Flow per second.	Horse-power available, gross.	
	Sq. miles.	*Feet.*	*Cubic feet.*	1 *foot fall.*	15 *feet fall.*
Minimum	253±	15±	35	4.0	60
Minimum low season			45	5.2	78
Maximum, with storage			253	28.7	430
Low season, dry years			52	6.0	90

Passing one small shoal not used, and of no value, the next power is 7 miles above Peachstone shoal, at McNite's grist- and saw-mill. A fall of about 12 feet is used, and it is said that by raising the dam 20 feet could easily be rendered available. This power is 7 miles from Conyers, and above the mouth of Honey creek.

Table of power at McNite's mill.

State of flow (see pages 18 to 21).	Drainage area.	Fall.*	Flow per second.	Horse-power available, gross.		
	Sq. miles.		*Cubic feet.*	1 *foot fall.*	12 *feet fall.*	20 *feet fall.*
Minimum	200	.....	26	3.0	36	60
Minimum low season			34	3.9	46	78
Maximum, with storage			200	22.7	272	454
Low season, dry years			39	4.4	53	88

* Utilized, 12 feet; available, 20 feet ±.

The next in order is the Powell shoal, which is not utilized. It is about half a mile long, with a gradual fall for the whole distance.

The Albert shoal, 4 miles above McNite's, and unimproved, is said to have an available fall of over 18 feet. The bed is rock, and the banks good.

Four miles above is Flat shoal, where is located the cotton factory of the Oglethorpe Manufacturing Company (Robert M. Clark, president). A wooden dam, 200 or 250 feet long and 4 feet high, bolted to the rock, extends across the stream in the shape of a V, with the apex up stream. The race is 250 feet long, and on one side of the river is the factory, with a fall of 23 feet, and on the other a cotton-gin, flour- and saw-mill, with a fall of 16 feet; and there was formerly a second factory on that side, but it was burned a short time ago. It is said that the total fall available is 28 feet. The factory is a yarn-mill, with 3,000 spindles; and the one which was burned had 6,000. The flow of the stream here is considerably influenced by the fact that the city of Atlanta takes its water-supply from a point further up, pumping the water up by steam. The exact amount thus taken from the stream, however, I am unable to state. Nevertheless, Mr. Clark states that he could run all his mills, including the factory which was burned, at full capacity for nine months of the year by running 12 hours a day and drawing down the water in the pond at night. I submit no estimate of the power here for these reasons. The shoal is 16 miles from Atlanta and 7 miles from Lithonia, the nearest railroad point. The drainage area above this place is about 170 square miles. The estimates given for the shoals below this are of course almost as much liable to error as those for this one would be. As the stream is descended and becomes larger, they become less so.

There are no powers worth mentioning above this. The most important tributary of South river is Cotton river or Cotton Indian creek, which rises in Clayton county and flows east, joining the South river in Henry county. It is said to be a good stream in dry weather, and has several mills and sites. Its drainage area is about 125 square miles.

The South river, like the other streams in this region, is subject to heavy freshets. The year 1881 was remarkable in this respect, there having been no fewer than five freshets in the spring within six weeks, one of which was the heaviest in twenty years. Half of Mr. Clark's factory was carried away in the third one, with machinery and all; and the fourth one washed out his head-gates and races and part of the dam. On Cotton river one dam was carried away four times, and in the fourth freshet the mill also was carried away.

As regards the facilities for the construction of storage-reservoirs on all these streams, it is only to be said that topographically numerous suitable sites could be found, but the difficulty is, as in the case of southern streams generally, that the lands which would be flowed are the finest farming lands to be had—the bottom-lands along the streams.

Table of power utilized on the Altamaha river and tributaries.

Name of stream.	Tributary to what.	State.	County.	Kind of mill.	Number of mills.	Total fall used.	Total horse-power used.
						Feet.	
Tributaries to	Altamaha	Georgia	Tattnall	Flour and grist	3	.....	62
Do	do	do	do	Saw	2	21	55
Do	do	do	Johnson	Flour and grist	2	15	24
Oconee	do	do	Baldwin	do	2	12	70
Do	do	do	Putnam	do	2	15	70
Do	do	do	Greene	Cotton factory	1	10	.....
Do	do	do	do	Flour and grist	3	26	104
Do	do	do	Clarke	do	1	8	6
Little river	Oconee	do	Putnam	do	4	32	165
Do	do	do	do	Saw	1	7	20
Do	do	do	Morgan	Flour and grist	2	22	25
Do	do	do	Newton	do	2	47	30
Do	do	do	do	Cotton-gin	1	25	15
Do	do	do	Walton	Flour and grist	1	40	45
Appalachee	do	do	Morgan	do	1	20	20
Do	do	do	Walton	Cotton factory	1	20	100
Do	do	do	do	Flour and grist	5	42	124
Do	do	do	Gwinnett	do	1	22	10
Other tributaries of	do	do	Laurens	do	3	34	50
Do	do	do	do	Saw	2	22	50
Do	do	do	Johnson	Flour and grist	2	16	23
Do	do	do	Twiggs	do	3	.....	63
Do	do	do	do	Saw	1	6	28
Do	do	do	Washington	Flour and grist	3	.....	58
Do	do	do	Wilkinson	do	12	69	140
Do	do	do	do	Saw	8	40	102
Do	do	do	do	Agricultural implem'ts	1	3	4
Do	do	do	Hancock	Flour and grist	6	94	95
Do	do	do	Jones	do	4	60	68

Table of utilized power on the Altamaha river and tributaries—Continued.

Name of stream.	Tributary to what.	State.	County.	Kind of mill.	Number of mills.	Total fall used.	Total horse-power used, net.
						Feet.	
Other tributaries of	Oconee	Georgia	Baldwin	Flour and grist	3	37	60
Do	do	do	Jasper	do	2	30	32
Do	do	do	Putnam	do	6	73	178
Do	do	do	do	Saw	1	8	25
Do	do	do	Morgan	Flour and grist	7	.....	90
Do	do	do	Walton	do	6	91	122
Do	do	do	Greene	do	1	16	50
Do	do	do	do	Saw	1	23	32
Do	do	do	do	Cotton-gin	2	41	11
Do	do	do	Oconee	Flour and grist	1	22	30
Do	do	do	Oglethorpe	do	2	56	30
Do	do	do	do	Saw	4	128	100
Do	do	do	Gwinnett	Woolen	1	16	12
North Oconee	do	do	Clarke	Cotton factory	2	32	330
Middle Oconee	do	do	do	do	1	20	100
North and Middle Oconee and tributaries.	do	do	do	Saw	1	12	10
Do	do	do	do	Paper	1	16	75
Do	do	do	do	Flour and grist	4	52	82
Do	do	do	Gwinnett	do	2	32	26
Do	do	do	do	Saw	1	12	12
Do	do	do	Madison	Flour and grist	2	29	13
Do	do	do	Hall	do	11	170	130
Do	do	do	do	Saw	1	16	15
Do	do	do	Jackson	do	8	146	141
Do	do	do	do	Flour and grist	13	201	187
Do	do	do	do	Cotton-gin	5	82	70
Do	do	do	do	Leather	1	30	10
Do	do	do	do	Woolen	1	8	6
Ocmulgee	Altamaha	do	Monroe	Flour and grist	1	12	.....
Do	do	do	Jones	do	1	12	.....
Do	do	do	Butts	do	4	48	103
Do	do	do	do	Saw	1	12	40
Do	do	do	Jasper	Woolen	1	12	6
Do	do	do	Henry	Flour and grist	2	34	14
Tributaries of	Ocmulgee	do	Wilcox	do	1	6	4
Do	do	do	do	Saw	1	6	24
Do	do	do	Dodge	Flour and grist	1	.....	10
Do	do	do	Pulaski	do	5	45	46
Do	do	do	do	Woolen	1	9	4
Do	do	do	do	Saw	1	9	15
Do	do	do	Houston	do	3	25	46
Do	do	do	do	Flour and grist	10	.....	186
Do	do	do	do	Cotton factory	1	12	60
Do	do	do	Twiggs	Flour and grist	1	8	11
Do	do	do	Crawford	do	3	36	90
Do	do	do	Bibb	do	1	9	20
Do	do	do	do	Saw	1	9	30
Do	do	do	do	Cotton-gin	1	13	8
Towaliga	do	do	Monroe	do	1	9	12
Do	do	do	do	Saw	1	11	15
Do	do	do	do	Flour and grist	3	39	76
Do	do	do	do	Wool-carding	1	5	4
Do	do	do	Henry	Flour and grist	2	100	120
Do	do	do	do	Saw	2	30	36
Alcovee	do	do	Newton	Cotton factory	1	6	20
Do	do	do	do	Flour and grist	2	30	40
Do	do	do	do	Saw	1	19	15
Do	do	do	do	Cotton*	1	12	.....
Do	do	do	Walton	Flour and grist	2	66	18
Do	do	do	Gwinnett	do	3	34	54
Do	do	do	do	Wheelwrighting	1	14	5
Yellow river	do	do	Newton	Cotton factory	1	16	76
Do	do	do	do	Paper	1	20	60
Do	do	do	do	Flour and grist	1	21	25

*Newton factory—not now in operation.

Table of power utilized on the Altamaha river and tributaries—Continued.

Name of stream.	Tributary to what.	State.	County.	Kind of mill.	Number of mills.	Total fall used.	Total horse-power used.
						Feet.	
Yellow river	Ocmulgee	Georgia	Newton	Saw	2	.....	80
Do	do	do	Rockdale	Flour and grist	2	24	70
Do	do	do	do	Saw	1	14	10
Do	do	do	do	Cotton-gin	1	14	10
Do	do	do	do	Furniture	1	14	10
Do	do	do	De Kalb	Flour and grist	1	7	15
Do	do	do	do	Cotton-gin	1	7	6
Do	do	do	Gwinnett	Flour and grist	6	66	126
Do	do	do	do	Furniture	1	8	10
Do	do	do	do	Saw	1	14	15
South river	do	do	De Kalb	Cotton factory	1	23	.....
Do	do	do	Henry	Flour and grist	1	8	20
Do	do	do	do	Agricultural implem'ts	1	9	3
Do	do	do	do	Furniture	1	9	3
Do	do	do	do	Saw	1	9	20
Do	do	do	Newton	do	1	30	10
Do	do	do	do	Flour and grist	1	30	25
Do	do	do	Rockdale	do	2	24	30
Do	do	do	do	Cotton-gin	1	10	4
Do	do	do	do	Furniture	1	9	6
Do	do	do	De Kalb	Flour and grist	2	35	65
Do	do	do	do	Saw	1	10	15
Do	do	do	do	Cotton-gin	1	10	12
Do	do	do	do	Furniture	1	10	5
Do	do	do	Fulton	Saw	1	22	9
Do	do	do	do	Flour and grist	2	34	24
Do	do	do	do	Cotton-gin	1	22	9
Other tributaries of	do	do	Pike	Flour and grist	2	74	55
Do	do	do	Monroe	do	11	157	148
Do	do	do	do	Saw	1	11	9
Do	do	do	do	Cotton-gin	1	11	5
Do	do	do	Henry	Flour and grist	3	78	38
Do	do	do	do	Saw	2	33	23
Do	do	do	Butts	Flour and grist	4	52	45
Tributaries of	South	do	Henry	do	3	119	26
Do	do	do	do	Saw	1	10	10
Do	do	do	do	Woolen	1	.....	5
Do	do	do	Clayton	Flour and grist	2	36	33
Do	do	do	Rockdale	do	3	62	48
Do	do	do	do	Saw	1	18	6
Do	do	do	do	Cotton-gin	2	31	22
Do	do	do	do	Leather	1	8	4
Do	do	do	Newton	Flour and grist	1	30	12
Do	do	do	De Kalb	do	10	181	128
Do	do	do	do	Saw	3	44	30
Do	do	do	do	Cotton-gin	6	108	54
Do	do	do	do	Paper	3	99	153
Do	do	do	Newton	Leather	1	15	20
Do	do	do	do	Cotton-gin	1	15	15
Do	Yellow	do	do	Flour and grist	2	37	18
Do	do	do	do	Cotton-gin	1	12	8
Do	do	do	Rockdale	Flour and grist	3	70	73
Do	do	do	do	Saw	1	.....	13
Do	do	do	Walton	do	1	15	8
Do	do	do	do	Flour and grist	3	35	22
Do	do	do	Gwinnett	do	2	51	10
Do	do	do	De Kalb	do	2	26	25
Do	do	do	do	Saw	2	55	20
Do	do	do	do	Cotton-gin	2	32	33
Do	do	do	do	Furniture	1	15	8
Do	Alcovee	do	Walton	Flour and grist	1	18	8
Do	do	do	Gwinnett	do	2	54	32
Do	do	do	do	Cotton-gin	1	15	5
Do	do	do	do	Saw	1	18	30

XII.—THE STREAMS SOUTH OF THE ALTAMAHA.

These streams offer so small an amount of power that they are not worthy of special mention. None of them reach above the fall-line, so that they have no falls of importance, the larger ones being generally sluggish and navigable, and bordered by swamp-lands. Some of the smaller ones may be classed as sand-hill streams, and offer some power, which is utilized to a certain extent by saw- and grist-mills, and it may be that on some of them moderately large powers could be developed. There are no powers in Florida which are worthy of special mention, and the tables of power show that there is only a small amount of power used in the state. There is only one point which it is interesting to notice in this connection, namely, the amount and distribution of the rainfall in the peninsula. The average fall in spring is about 9 inches over the whole peninsula, or not more than in the New England states; but in summer it is greater than in any other part of the Union, ranging from 18 to 26 inches. In autumn the fall is still large, varying from 10 to 14 inches, while in winter there is only between 8 and 10 inches fall, or considerably less than in some parts of New England. This distribution of the rainfall must have for its effect a very uniform flow in the streams, and it does not seem improbable that they may even be lowest in winter, like some of the western streams, instead of in summer and autumn, like the other streams on the Atlantic slope; but I have no data with which to test the truth of this supposition.

CONCLUDING REMARKS.

In glancing over the previous pages one cannot fail to be struck with the very large amount of power remaining unutilized in the middle and western parts of the region we have been considering. That this power is very large the numerical data which have been given leave no room to doubt; that a very large amount is practically available is also evident; but it will perhaps add to the clearness of these two facts if we devote a few lines here to a brief recapitulation of the principal general results to which we have been led.

We have seen that, leaving out of consideration the eastern, or navigable, district, the topography of the region is very favorable for power; that the rivers have steep declivities, and that they often have cataracts or rapids of considerable magnitude. If we compare the declivities of the southern streams with those of streams in the middle states and in New England, we shall find, in fact, that the former are at least as great, and probably greater, than the latter. We have seen that the elevation of the Atlantic plain at the foot of the mountains is greater in the region we have considered than anywhere else along the Atlantic coast, and that the slope of that plain does not vary correspondingly from north to south; and we have found, as would be expected, that the streams, in their course across this plain, from the mountains to the sea, develop an enormous amount of power. And of this total power, much of which is necessarily unavailable, we have, nevertheless, found that a large amount can be developed and utilized if desired, on account of the ledges of rock across which the streams flow, and the falls and rapids which they occasion. But, while the southern streams are confined entirely to the Atlantic slope of the mountains, taking their rise on the extreme eastern ridge of the system, many of the streams in the middle states have their sources far to the west, nearly or quite on the other side of the system. Topographically, then, the chief difference between the northern and the southern streams is the fact, that in the case of the former the greater part of their drainage-basins is included in the western or mountainous district, and the smaller part in the eastern or tide-water district; while in the case of the latter the reverse is true, and the eastern district extends far above the head of tide-water. There is one respect in which this difference in configuration acts unfavorably on the water-powers of the south, namely, as regards transportation, for not only does the large extent of the eastern district render navigation of the rivers difficult, and transport by sea less easy than in the north, but the railroads, in the water-power district, are not so constrained to follow the river valleys as in the case of the northern streams, which often flow between parallel ranges of hills, so that the most convenient and economical location for a road, and often the only practicable one, is along their banks. In the southern states, on the contrary, we often find the railroad following the divides, instead of the water-courses, and the consequence is that many of the finest water-powers are at present very inaccessible. But it is evident that the evil is of a kind which is easily remedied, and which will be remedied as soon as the manufacturing interests of the region demand it. We have seen that the beds of the streams are everywhere favorable for the construction of dams, and that the banks are generally favorable for the construction of canals and buildings at the points where the water-powers occur.

As regards the flow of the streams, we have been altogether without data derived from actual measurement, and have been obliged to draw our conclusions from a study of the circumstances influencing flow. We have seen that the southern states are probably better wooded than the middle or New England states; that the soil is deep, and quite pervious, although shedding sudden showers with considerable rapidity; and that the mountains are wooded and covered with soil; all of which circumstances act to render the flow of the streams constant. And the topography is also favorable in this respect, for we shall see that in the case of the James and the Potomac rivers,

which drain a large extent of mountain region, consisting of parallel and narrow valleys between high hills, such a configuration is favorable to the sudden discharge of rain-water, and that those two streams are therefore probably much more variable in flow on this account than they would otherwise be. We have seen, further, that the principal carriers of moisture in the district we have considered are the winds from the Gulf of Mexico and from the Atlantic, but principally the former. In the summer these winds are deflected from their normal northeasterly course by the tendency of the atmosphere to move toward the heated continent, and winds from the south and southeast are more frequent than at any other season; and these winds, reaching the coast either directly from the sea or after having passed over only a small extent of low land, deposit a considerable portion of their moisture, the rainfall decreasing as we proceed inland, until what remains is condensed by the lofty mountains. In the winter, on the contrary, the winds which bring the rain, being mostly from the southwest, deposit the greater part of their moisture on the mountains and the high ground in the middle region, so that the rainfall is small on the coast. Just here lies a most important difference between the rainfall in the south and that in the middle and New England states, for while in the latter the rainfall in summer always exceeds that in winter, in the middle and western parts of the former it is sometimes greatest in winter, and rarely greatest in summer. If we exclude from consideration a few streams, like the James and the Potomac, whose flow is probably rendered variable to a large extent by the topography of their drainage-basins, the conclusion seems justified that the flow of the southern Atlantic streams is more variable than that of streams in the New England and the northern part of the middle states; and this statement is further strengthened by the entire absence of lakes in the southern states. In so far, then, the water-power of the south is inferior to that in the north; but we have also seen that the rainfall in the south is often very much greater than in the north, and it is therefore probable that these two circumstances offset each other to some extent.

We have further seen that, as regards freshets, although some of the southern streams, like the Cape Fear and the Roanoke, are subject to very heavy ones, the southern streams, as a rule, do not compare unfavorably with those in the north. In the great freshet of 1854 the Connecticut river rose 29 feet 10 inches at Hartford, which would be an extraordinary rise for most of the southern streams. The trouble in the south as regards freshets lies in the fact that on the large streams such large areas of bottom land are subject to overflow, a drawback which is no doubt felt more than in the north, and which, combined with the large width of the streams, has probably prevented the utilization of more than one power.

We have seen a great advantage of the water-power in the south to lie in the fact that the streams never freeze over, and that there is scarcely any trouble with ice or ice freshets. We have come to the conclusion that the disadvantages of the higher mean temperature have been exaggerated, and we have seen that it is in many respects a very favorable circumstance. As regards the increased evaporation, we could not form any definite ideas.

In view of these facts, then, may we not, from a purely technical point of view and without reference to manufacturing advantages, answer in the affirmative, and with emphasis, the question whether or no the advantages for the utilization of water-power in the southern Atlantic states are fine? I think it must be acknowledged that they are, in many respects, as good as could be desired; and when we consider the advantages offered in those states for particular manufactures, like that of cotton, it would seem that the time cannot be far distant when these powers will be turned to account.

In closing this report, I must once more take occasion to caution the reader against supposing that the estimates of power which have been given can pretend to exactness. Although four states of flow have been distinguished, and the estimates may therefore present an appearance of accuracy and detail, this distinction has been made merely with the object of conveying definite ideas, and of leaving no room for misunderstanding in regard to what was meant, it being thought essential to accomplish this end, even at the risk of giving the estimates an appearance of accuracy which they do not, and cannot, possess.

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