GEOLOGICAL SURVEY OF GEORGIA
S. W. McCALLIE, State Geologist

U. S. DEPARTMENT OF AGRICULTURE

OFFICE OF PUBLIC ROADS AND RURAL ENGINEERING
LOGAN WALLER PAGE, Director

DRAINAGE INVESTIGATIONS
S. H. McCRORY, Chief

BULLETIN NO. 32

AGRICULTURAL DRAINAGE

IN

GEORGIA

BY

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AND
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AND

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VIEW ALONG THE HEBARD LUMBER COMPANY'S RAILROAD, SHOWING TYPICAL CONDITIONS IN THE TIMBERED AREA OF THE OKEFENOKEE SWAMP, CHARLTON COUNTY, GEORGIA

THE ADVISORY BOARD

OF THE

Geological Survey of Georgia

IN THE YEAR 1917

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LETTER OF TRANSMITTAL

GEOLOGICAL SURVEY OF GEORGIA,
Atlanta, December 20, 1917.

To His Excellency HUGH M. DORSEY, *Governor and President of the Advisory Board of the Geological Survey of Georgia.*

SIR:—I have the honor to transmit herewith a report on Agricultural Drainage in Georgia, to be published as Bulletin No. 32 of this Survey.

Very respectfully yours,

S. W. MCCALLIE,
State Geologist.

TABLE OF CONTENTS

ILLUSTRATIONS

MAPS

INTRODUCTORY NOTE

BY

S. W. McCallie, State Geologist.

In presenting this report on Agricultural Drainage in Georgia to the public, I feel that it would not be out of place to add a few words concerning the progress of drainage in the State since Bulletin No. 25, Drainage Investigations in Georgia, was issued by this Department.

The bulletin here referred to was published in 1911, at which time no drainage district had been formed in the State, nor had the drainage law which permitted the establishment of such district been enacted by the State Legislature. During the latter part of August, 1911, the present drainage law, with a few amendments since added, was passed by the Legislature. The first district organized under the drainage law was the Big Haynes Creek district in Gwinnett and Walton counties. This district has now been in successful operation for three years and as an object lesson has done more than anything else to stimulate drainage in the Piedmont area.

South Georgia, though first to agitate the drainage question, has so far been slow in pushing the work. This is due apparently to the great size of the drainage districts so far formed, which calls for a large outlay of money, together with the price of lands, which are not so high as in the more thickly settled section of the Piedmont Plateau.

A list of the drainage districts so far formed, or in process of formation, is given in the following table:

LIST OF THE DRAINAGE DISTRICTS.

Name	County	Post office	No. of acres reclaimed	Cost per acre[1]	Remarks
Acworth Drainage District	Cobb and Cherokee	Acworth	1,200	$25.00	Work begun.
Alcova Drainage District	Gwinnett and Walton	Monroe	1,873	$20.00	To be completed, Jan. 1918.
Appalachee River Drainage District	Barrow	Winder	1,000	----	District being organized.
Astoria Drainage District	Ware	Waycross	21,925	$3.42	Work not yet begun.
Barber Creek Drainage District	Oconee and Barrow	Statham	1,000	$22.00	Work begun.
Baxley Drainage District	Appling	Baxley	21,514	$3.50	Work not yet begun.
Beaver Dam Drainage District	Clark	Athens	1,480	$23.00	District formed and ready for bids.
Big Clouds Creek Drainage District	Oglethorpe	Crawford	600	$25.00	District being organized.
Big Creek Drainage District	Forsyth	Cummings	----	----	District being organized.
Big Haynes Creek Drainage District	Gwinnett and Walton	Grayson	618	$29.63	Completed in 1913.
Birch Creek Drainage District	Pike	Concord	600	$30.00	District being organized.
Broad River Drainage District	Stevens and Franklin	Lovania	9,000	$23.00 to $38.00	Will be completed, Jan. 1918.
Brushy Creek Drainage District	Madison	Colbert	720	$30.50	District being organized.
Camp Creek Drainage District	Fayette	Fayetteville	3,000	----	Being surveyed.
Cornish Creek Drainage District	Walton and Newton	Jersey	1,402	$21.06	Completed, July 1917.
Fishing Creek Drainage District	Greene and Oglethorpe	Maxeys	1,345	$25.00 to $30.00	District being organized.
Flint River Drainage District	Clayton	Jonesboro	1,795	$27.46	District being surveyed but contract not let.

[1]The cost per acre in many cases is estimated from preliminary surveys.

LIST OF DRAINAGE DISTRICTS—CONTINUED

Name	County	Post office	No. of acres reclaimed	Cost per acre	Remarks
Fork Creek Drainage District	Madison	Carnesville	450	$25.00	District being organized.
Greenbrier Drainage District	Oconee and Greene	Farmington	850	$25.00	District being organized.
Grove Level No. 1 Drainage District	Banks	Maysville	1,076	$25.00	Completed, Sept. 1916.
Grove Level No. 2 Drainage District	Banks	Maysville	800	$25.00	Work to begin, Jan. 1918.
Grove Level No. 3 Drainage District	Banks	Maysville	1,455	----	District being organized.
Hollinshead Levee Drainage District	Baldwin	Milledgeville	1,455	$24.50	District being organized.
Jack Creek Drainage District	Walton	Monroe	870	$22.00	Completed, May 1916.
Little Mulberry Creek Drainage District	Gwinnett and Barrow	Hoschton	500	$26.00	District being organized.
Little River Drainage District	Walton, Newton and Morgan	Social Circle	800	$30.00	District being organized.
Little River and Mill Creek Drainage District	Cherokee	Woodstock	1,870	$37.00	District being organized.
Little Satilla River and Big Red Swamp Drainage District	Glynn and Camden	Brunswick	22,500	$4.87	Work not begun.
Long Creek Drainage District	Oglethorpe	Lexington	1,700	$23.00	District being organized.
Marbury Creek Drainage District	Barrow	Winder	1,000	----	District being organized.
Mulberry Creek Drainage District	Jackson	Brazleton	705	$25.82	Completed, Nov. 1917.
Murder Creek Drainage District	Jasper	Monticello	2,400	$33.00	District being organized.
Olleys Creek Drainage District	Cobb	Marietta	400	$20.00	District being organized.
Pendergrass Drainage District	Jackson	Brazleton	----	----	Surveyed.

LIST OF DRAINAGE DISTRICTS—CONTINUED

Name	County	Post office	No. of acres reclaimed	Cost per acre	Remarks
Powder Springs Drainage District	Cobb	Powder Springs	800	$25.00	District being organized.
Rocky Fork Drainage District	Hancock	Sparta	500	$30.00	District being organized.
Rose Creek Drainage District	Oconee	Watkinsville	600	$25.00	Completed, June 1917.
Shoal Creek Drainage District	Clark	Winterville	600	$28.00	Under construction.
Sugar Creek Drainage District	Morgan	Madison	1,800	$41.00	District being organized.
Sweet Water Drainage District	Gwinnett	Lawrenceville	1,915	$21.00	Under construction.

The above table shows that the total area of the drainage districts so far formed in the State is 114,118 acres, of which 5,271 acres, or approximately one-twentieth of this area, is now in cultivation or will be in cultivation during the coming summer.

There have been planned to date 40 drainage districts, 37 in the Piedmont area, and 3 in the Coastal Plain. The average size of the districts in the Piedmont area is 1,417 acres, while the average size of those in the Coastal Plain is 21,980 acres.

The average drainage cost per acre in the Piedmont section has been estimated at $26.56 per acre and in the Coastal Plain region at $3.93. The small cost per acre in the Coastal Plain is in a large measure accounted for by reason of the large size of the districts.

I would further add that by comparing the acreage above given as now planned for drainage, with the total land area in the State needing drainage, as given on page 108, it will be seen that the ratio is less than 1 to 68, or, in other words, drainage in Georgia has scarcely commenced.

AGRICULTURAL DRAINAGE IN GEORGIA

BY H. H. BARROWS

INTRODUCTION

It is the usual custom, in discussing the drainage situation in a State, to take up separately the lands representative of the various phases of drainage, such as permanent swamp, land subject to stream overflow, tidal marshes, etc. In this paper, however, the two great physiographic divisions of Georgia, namely, the Piedmont Plateau and the Coastal Plain, are treated separately since each, owing to its topographic and soil conditions, presents characteristic drainage problems. At the end of the general discussion of each section are given, in summarized form, two reports on projects typical of that section. These reports were selected from among many that have been made by various representatives of Drainage Investigations, Office of Public Roads and Rural Engineering, U. S. Department of Agriculture, during the several years that the Department has, in a practical way, been endeavoring to promote interest in drainage in the State.

Though the title of this bulletin might lead one to expect the inclusion of the subject of underdrainage, this phase is not taken up; the discussion is restricted to outlet drainage.

Following the general matter on drainage and the reports just referred to, are given in tabular form data recently collected with respect to wet and overflow land in each county.

At the end of the bulletin is given an abstract of the Georgia drainage law. The object in presenting the law in this form is to give, for the benefit of the general reader and in as few words as is practicable, the salient points of the law.

DRAINAGE CHARACTERISTICS OF GEORGIA

PHYSIOGRAPHY

As shown in figure 1, the State of Georgia contains several separate physiographic divisions. Each of these is characterized by distinct topographic and soil features and the boundaries between the different sections are more or less well defined.

The most northerly part of the State is occupied by the Cumberland Plateau, the Appalachian Valley, and the Appalachian Mountains. The first two of these comprise the section of the State generally referred to as the "limestone valleys and uplands." The plateau section is made up of long, narrow, flat-topped mountains which strike northeast and southwest. These table lands are elevated from 700 to 1,400 feet above the valleys, and from 1,500 to 2,300 feet above sea level. The valleys of this section are practically all cleared and under cultivation, although these valleys, being narrow, comprise but a small portion of the whole. The Appalachian Valley district is in many respects similar to the plateau section, but the ridges are not so high (1,000 to 1,800 feet above sea level) and the valleys are wider. These latter are rolling and are nearly all under cultivation. The Appalachian Mountain section ranges from hilly to mountainous, a number of the "balds" having an elevation of more than 4,000 feet above sea level. The valleys are narrow and the streams have deep banks and large fall.

Drainage in this section of Georgia is not so important a problem as in other parts of the State, as owing to the nature of the slopes and to the lack of hillside cultivation there is little soil wash and the streams, having good fall, practically are self-maintaining. Some overflows occur, however, and much of the flat valley land would be improved by underdrainage, but as a whole drainage conditions in the section are quite satisfactory.

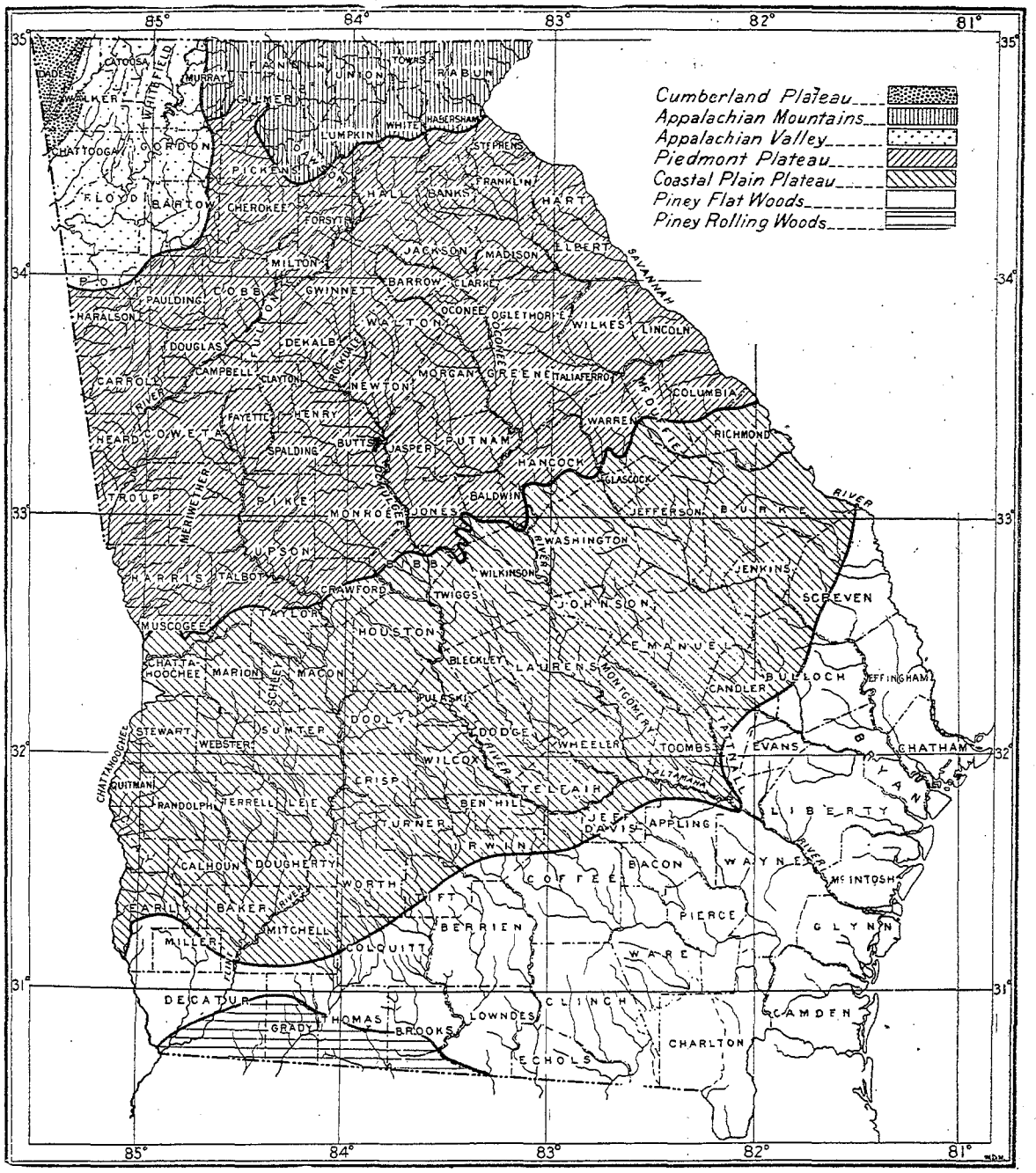


FIG. 1. PHYSIOGRAPHIC MAP OF GEORGIA

That part of the State adjoining on the south the section just described, and extending to the "fall line"—a line described roughly as passing through Augusta, Macon, and Columbus—is known as the Piedmont Plateau. This section varies from rolling to hilly and generally is cleared and cultivated. Its general slope is quite regular from an elevation of about 1,200 feet near the mountains to about 400 feet at the fall line. The most serious drainage problem presented in the Piedmont section is the filling of the stream channels by the products of the erosion of the cultivated slopes. This has in numerous cases progressed to a point where the adjoining rich bottom land is rendered wholly uncultivable. The effectiveness of these streams must be restored and means taken to obviate this action of erosion. Also much of the flat bottom land, having a tight clay soil, must be underdrained before it will attain its maximum productiveness.

At the fall line there occurs a distinct drop, averaging some 60 feet, from the hilly land of the Piedmont Plateau to the gently rolling—or even level—Coastal Plain which includes the remainder of the State to the south. However, from a drainage standpoint, the Coastal Plain may well be considered in two sections, the dividing line being a rather indefinitely defined one passing near Colquitt, Camilla, Tifton, Hazelhurst, Reidsville, Statesboro, and Sylvania (see fig. 1). North and west of this line, and extending up to the fall line, the surface mostly is a gently rolling to level plateau. The section of the State south and east of this line is generally known as the "piney flat woods" and most of it is quite flat with but slight slopes toward the main streams.

DRAINAGE OUTLETS

The principal drainage outlets of Georgia are, the Chattahoochee River which forms the southern half of the western boundary of the State; the Flint River which at the southwest corner of the State unites with the Chattahoochee to form the Apalachicola River; the Altamaha River, formed by the junction of the Ocmulgee and Oconee rivers, and the Savannah River on the eastern boundary of the State.

The upper Chattahoochee drains a narrow belt extending entirely across the northern part of the Piedmont Plateau. Of the area north of this belt a small part drains northward to the Tennessee River and a much larger part westward into Alabama through the Coosa and Tallapoosa rivers. The area bordering the Atlantic Ocean drains directly to the Ocean through numerous small streams, and a considerable area contiguous to the Georgia-Florida line drains through the latter State, by means of several outlets, into the Gulf.

All of the larger streams have their headwaters in the northern part of the Piedmont Plateau and in the southern Appalachian Mountain section, and they flow rapidly to the fall line, below which the velocity of flow is much less.

CLIMATE

From its geographical location it would be inferred that Georgia would have a warm, moist climate. While this is the case with respect to the southern half of the State, the altitudes of the Piedmont Plateau and especially those of the mountain district, have a marked influence upon the temperature and rainfall of those sections. By reason of its latitude Georgia has a long summer and a short winter season, but the mean and extreme temperatures vary greatly as between the northern and southern portions of the State. The variation of mean temperatures is well illustrated in the following table:

TABLE I.

Showing variation of mean monthly temperature in different parts of Georgia.

Place	Elev. above sea level	Mean monthly temperature in degrees (F)												Mean Annual
		Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
	Feet													
Clayton, Rabun Co.	2100	40.2	39.9	50.7	56.0	65.5	71.7	74.4	74.6	68.5	57.0	48.4	40.6	57.2
Athens, Clark Co.	694	42.0	44.1	52.3	60.1	69.8	76.1	78.3	77.2	72.0	61.5	51.2	43.5	60.7
Albany, Dougherty Co.	230	48.9	50 5	60.1	66.7	74.8	81.4	82.9	81.2	77.8	67.5	57.8	51.1	66.8
Quitman, Brooks Co.	173	51.3	53.4	61.4	67.2	74.6	79.9	81.5	80.9	77.6	67.8	59.4	52.2	67.2

It will be noted from Table 1 that the mean annual temperature in the higher portions of the State, in the north, is about 10° lower than that of the southern or low section.

The range of mean annual rainfall in Georgia also is very great. This is due largely to the influence of the mountains in the northern part of the State. The extreme northeastern part of Georgia and an adjoining area in North Carolina have an annual rainfall that is exceeded in the United States only by that of the North Pacific Coast. In 1906 Clayton, in Rabun County, recorded a total rainfall of 91.55 inches, and in 1898, 87.86 inches. The annual rainfall decreases toward the south, but increases again as the coast is approached. The following table shows the mean monthly and annual rainfall at representative points in different parts of the State.

TABLE II.

Mean monthly and annual rainfall in various sections of Georgia.

Place	Elev. above sea level	Mean monthly rainfall in inches												Mean Annual
		Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
	Feet													
Clayton, Rabun Co.	2100	5.51	6.55	6.82	5.68	4.51	5.85	7.39	7.02	5.18	4.47	3.52	6.52	69.02
Athens, Clark Co.	694	4.81	5.25	5.12	3.56	3.63	4.03	4.87	5.15	3.42	2.95	2.85	4.12	49.76
Albany, Dougherty Co.	230	3.96	5.45	4.87	3.63	3.60	4.25	5.71	5.98	3.31	2.70	2.28	3.77	49.51
Quitman, Brooks Co.	173	3.94	4.70	4.11	3.25	3.47	6.43	7.20	6.70	4.41	2.58	1.99	4.47	53.25

The highest monthly rainfall ever recorded in the State of Georgia occurred at Blakely, Early County, in July, 1916. In that month 30.23 inches were recorded. Other stations in that section reported from 23 to 30 inches during that month. In the same month unusually heavy rains occurred in the northeastern part of the State, Clayton, Rabun County, reporting 24.88 inches. More than twenty stations in Georgia received a rainfall of over 15 inches during July, 1916. The average for the State was 14.14 inches. August, 1898, was another excessively wet month in Georgia, when the average for the State was 10.09 inches. In that month the southeastern part of the State was visited by exceptionally heavy rains, monthly totals of from 20 to 28 inches having been recorded. Such periods of prolonged heavy rainfall are infrequent, however, as may be seen by comparison of the figures just given with those of Table II. July and August are the months of heaviest precipitation in all parts of the State, though in the south the period of heavy rainfall is often extended into September. The driest months are October and November.

The rainfall data for short periods, i. e., from 24 to 48 hours, are of greatest interest from a drainage standpoint, since it is such storms that tax the capacity and integrity of drainage structures. Some unusual storms of this kind have occurred in Georgia. Perhaps the most remarkable 24-hour storm that ever occurred in the State was that recorded by the Weather Bureau at St. George, Charlton County, on August 28-29, 1911, when 18 inches fell within a period of about 17 hours. This rainfall occurred in connection with a hurricane which was raging along the coast at that time. These hurricanes, which come in from the Ocean or the Gulf at intervals of several years, are likely to cause excessive 24-hour rainfalls in the southern part of the State. Some of the heaviest rains on record, for 24 and 48-hour periods, occurred in the unusually wet month of July, 1916. At Blakely, Early County, there fell on July 7, 7.35 inches; on July 8, 9.90 inches; on July 9, 2.44 inches; and on July 10, 2.00 inches, a total of 21.69 inches in 4 days. Other stations in the vicinity reported downpours nearly

as great. At Clayton, Rabun County, there fell on July 8, 1916, 3.90 inches; on July 9, 5.25 inches; and on July 10, 2.72 inches, or a total of 11.87 inches in 3 days.

Such excessive storms as those noted above are usually quite limited in extent, and they are likely to occur at a given point only at intervals of a great many years. They cannot economically be provided for in drainage works, such as ditches and improved stream channels, designed to carry the water below the ground surface. However, where levees are to be employed it is not wise to ignore the possibility of the occurrence of such storms.

In all parts of Georgia, one-day rainfalls of 2 inches are to be expected several times each year, and rains of from 3 to 4 inches in 24 hours are not infrequent. It is these heavy storms, occurring at intervals of not more than a few years, that must be provided for in drainage channels that aim to provide economical drainage.

DRAINAGE IN THE PIEDMONT PLATEAU

The characteristic topographic features of the Piedmont Plateau are high hills and narrow winding valleys. The hills range from rolling to steep, and even to precipitous in many places, and often rise to a height of 150 feet or more above the intervening valleys. The valleys generally are crooked and often are contracted to a width of 100 feet or less by the contiguous hills. Through these valleys wind the drainage channels of varying widths according to area drained but usually more or less filled with sand which is the heavier residue of the material washed from hill lands, most of the finer and lighter ingredients such as clay and silt having been carried on down through the channel or else spread over the bottoms during overflows.

NATURAL DRAINAGE

The larger rivers of the State have their headwaters in the Piedmont Plateau and on the southern slopes of the mountains to the north. The Piedmont therefore is well supplied with natural drain-

age channels. The eastern part of the area, amounting to about one-fifth of the total, drains eastward into the Savannah River. The northern and western portions, about one-third of the total, drain westward and southwestward to the Chattahoochee and into Alabama to the Coosa River. The remainder, amounting to something less than one-half of the total and comprising the central and most of the southern portions, drains south or southeast through the Flint, Ocmulgee and Oconee rivers.

The creeks and smaller rivers of the Piedmont Plateau show great variation in fall. Indeed, a single stream may within a few miles have all rates of fall from more than 20 down to 3 feet or less per mile. The variation is nearly always in the nature of a constant decrease of fall from its upper reaches to its outlet. The same condition obtains for the tributary streams, though the fall of the latter is usually greater than that of the main stream at the point of junction.

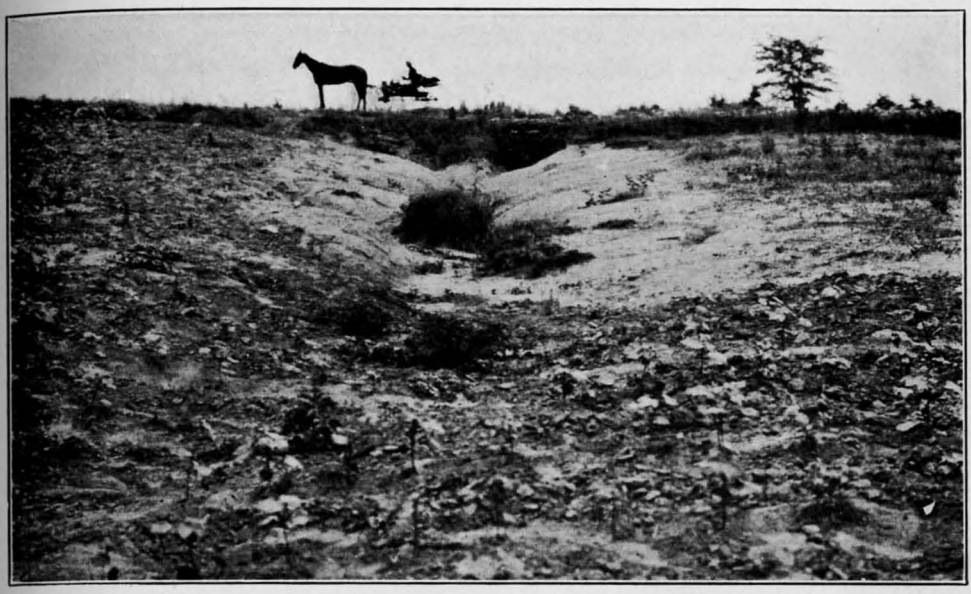
The general testimony of residents is that in former times the Piedmont streams were sufficient for all ordinary demands made upon them, and that overflows were not of common occurrence. Bottom lands now wholly abandoned or cultivated only at great risk formerly were tilled with little expectation of loss by flooding. With the total or partial clearing of the watersheds, and more particularly with the extensive cultivation of the hillsides, drainage conditions were greatly changed. This was due not alone to any increase that, as a result of the clearing, occurred in the percentage of the rainfall that found its way over the surface to the drainage channels, and to the fact that this run-off was more quickly concentrated in the main drainage outlets, but also to marked changes that occurred in the drainage channels themselves as a result of the washing of the soils from the cultivated hillsides into these channels. This latter factor undoubtedly is the most potent cause of the present unsatisfactory drainage conditions in the Piedmont section. There is a difference of opinion among authorities as to whether deforestation aggravates flood conditions by increasing the volume of water to be cared for, but there can be no

doubt that the removal of the natural soil covering and the constant exposure of the surface incident to clean cultivation, facilitates soil erosion, and it is equally true that these products of erosion ultimately will find their way into the main drainage channels.

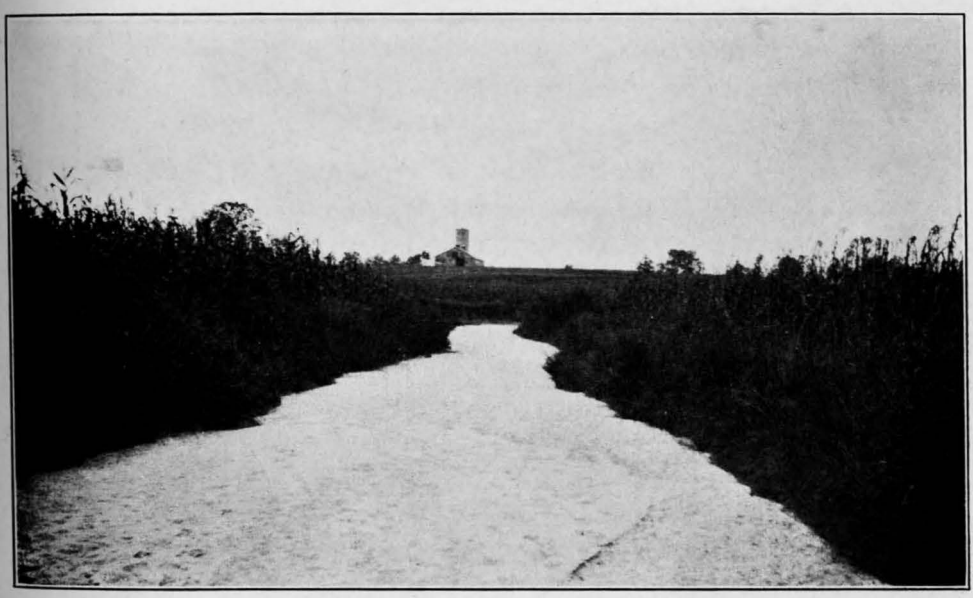
Erosion and its results.—While the principal agency of erosion is flowing water, in north Georgia frost is an important contributory factor. The soil that is loosened in the process of "heaving" by frost is likely to be washed down the slope by the next heavy rain. A covered soil is more or less protected from either agency. The covering not only prevents frequent alternate freezing and thawing of the soil, but reduces the washing by diminishing the velocity of flow of the water and by affording passages along the roots for conducting the water into the soil, and thereby reducing the quantity of water running over the surface.

The weights of bodies that can be transported by water vary as the sixth power of the velocity of flow. It is evident, therefore, that even a slight reduction in the velocity of flow of silt-bearing water must result in the deposition of some of the suspended matter.

When flowing surface water has direct access to soil particles, these are picked up by the water and transported down the slope. In consequence of this action definite channels down the slopes are likely soon to be formed (Plate I, A). If steps are not taken to check this action, these channels constantly enlarge until ultimately they attain the proportions of gullies and during heavy rains carry large volumes of silt-laden water. At the foot of the slope some of this suspended matter may be deposited, but much of it is carried into the smaller watercourses. Here, owing to a reduction in the velocity of flow, a large part of the silt may be deposited for a time, but eventually an unusually heavy rain will cause this material to be carried down into a primary stream. Even if this latter channel be in good condition and free from obstructions, the fact that its slope is less than that of the tributary stream (the usual condition in the Piedmont) will cause a



A. FIELD EROSION IN ITS EARLIER STAGES



B. STREAM PARTLY FILLED WITH SAND WASHED FROM THE HILLSIDES

reduction in the velocity of flow and a consequent deposition of some of the material carried by the water. With each heavy rain there is a repetition of this action with a resulting constant decrease in depth of the main channel. Finally the depth, and consequently the capacity, of the stream are so far reduced that overflow occurs (Plate I, B).

In the channel the water is flowing with a considerable velocity. As it leaves the channel and overflows the banks a marked reduction in velocity takes place and a large part of the sediment, especially the heavier and coarser material, is deposited at once on and near the banks. As the flood water extends back over the bottoms the finer and lighter material is carried with it and finally deposited where the water has little or no velocity. Since the bulk of the suspended matter is deposited near the point of overflow, it is apparent that this land will be built up more rapidly than will that lying further back from the channel. In course of time this building up progresses to such an extent that the land adjoining the channel is appreciably higher than the more remote land, and much of the water that overflows this barrier can not return by the same route and either must remain ponded or flow along the bottoms until it again can reach the channel through a ditch or branch stream.

The foregoing is a superficial account of what has taken place to render the Piedmont streams in the condition we find them today. The extent to which erosion and sedimentation have occurred varies greatly in different localities, but the condition of a creek and its adjoining bottoms, with respect to silting, may be taken as a measure of the erosion that has taken place on the slope of the watershed.

THE GENERAL DRAINAGE PROBLEM

The usual drainage problem of the Piedmont Plateau is that involved in the correction of the wet and overflow conditions of the low lands bordering the creeks and smaller rivers, and their tributaries. In the typical case the main stream has a constantly decreasing rate of

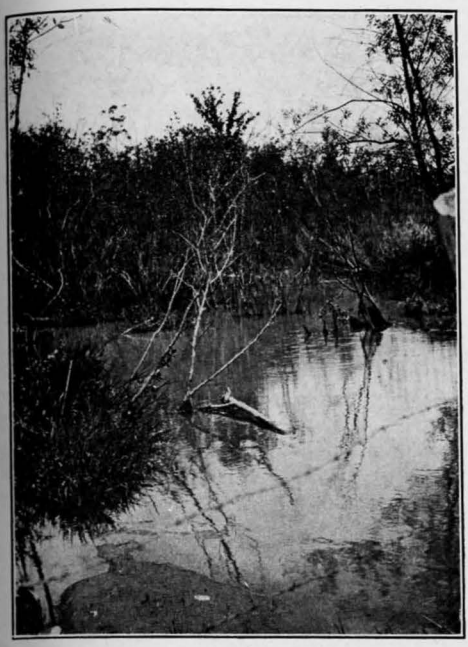
fall from its source to its mouth. A strip along each bank has been built up by deposits due to repeated overflows until it is appreciably higher than the land at the foot of the bluffs. The channel is crooked and has become filled with sand until its bed is approximately at the same level as the back-lying lowlands (Plate V, A). In this sand is buried the logs and other debris that formerly encumbered the channel.

The bottoms are cultivated to but slight extent and are mostly grown up in fair-sized timber and filled with underbrush. The back-lying portions which are permanently wet often contain heavy growths of alder and rushes, while the higher areas near the stream may support growths of cane (Plate II). The bottom lands vary greatly in width, generally being narrowest where the flanking hills are steepest. The larger areas of bottom land occur usually in the form of pockets extending back into the hills. Conditions along the tributary streams are similar to those on the main channels, but the bottoms are not so wide.

Excepting for occasional tracts of woodland nearly all of the hill land is cultivated, almost entirely with clean-cultivated crops. This fact and the fact that much of the cultivation is done on the tenant system—a system which always tends toward deterioration of the land—are in large measure responsible for the present poor drainage conditions along the streams.

PLANNING IMPROVEMENTS

The Survey.—It is not wise to undertake the correction of these conditions without first determining definitely the controlling features by means of a survey. A Piedmont drainage survey is, comparatively speaking, quite simple and inexpensive, but it is none the less important. The improvements required consist usually of a ditch to extend down a portion of the valley of the main stream, and lateral ditches in certain of the tributaries. Owing to the great variation in the natural fall in the valley, there will be a corresponding range in the



A. PERMANENT POND CAUSED BY THE BUILDING UP OF THE LAND NEXT TO THE STREAM, PIEDMONT BOTTOM LAND, GEORGIA

B. CUTTING SURVEY LINE THROUGH GROWTH OF CANE AND UNDERBRUSH IN PIEDMONT BOTTOM LAND, GEORGIA

bottom width of the main ditch, and it is necessary to ascertain at just what points the width should be increased. For this purpose it is essential that a profile of the valley, between the limits of the proposed improvement, be obtained, and that the points of entry of the several tributaries be determined. Lines of levels should be run across the valley, from bluff to bluff, at sufficiently close intervals to establish the best location for the proposed ditch, which location usually has no reference to the location of the existing stream. Where the bottoms are quite narrow these cross lines may be unnecessary as the proper location will be apparent from inspection. It is necessary, also, to define the limits of the land to be affected by the improvements, both on the main stream and on the tributaries, so that the area of such land may be determined accurately. The location of the new ditch usually is first plotted on the map which has been compiled from the data obtained during the survey. The ditch line, however, should be actually located on the ground before the survey party leaves the field. Any necessary minor changes from the plotted line can then be made. In locating the ditch line, stakes should be set every 100 feet and permanent hubs, carefully referenced, established every 500 feet on tangents and at all angles in the line. The surface elevation should be taken at each 100-foot station. When the grade line of the ditch is decided upon, the amount of excavation required can then be determined closely. Where the new ditch line crosses, or follows for a distance, the old channel, data should be taken to enable the computation of the saving in excavation thereby effected. Soil borings to at least the depth of the proposed ditch should be taken along the located line, in order that the character of the excavation may be known.

In order that all the land in a drainage district may be benefited, it not infrequently is necessary to extend the new ditch below the lower limit of the district. The necessity of so doing should be determined and the survey extended as far below the district limit as is required to obtain the necessary data.

Run-off.—The rate of run-off to be adopted as the basis for the design of Piedmont ditches is one to be decided more from economic considerations than by a determination of the maximum rate of flow that may occur. It is quite impracticable to provide for the extreme floods or even for the run-off of such severe storms as are likely to occur only at intervals of 3 or 4 years. The topography is such that rain water is quickly concentrated in the drainage channels, and the percentage of the rainfall that flows off undoubtedly is high although, so far as known, no actual measurements have been made in the Piedmont section of Georgia or the adjoining States to determine just what this percentage is. The streams have large fall and subside quickly after the termination of the storm. Overflows lasting but a few hours do not cause serious damage to crops or land, where no washing occurs and where no considerable amounts of sand are deposited.

It has been found that the owner of Piedmont bottom land can well afford to expend from $20 to $30 per acre for this if he can reasonably be assured of four crops out of five. This expenditure ordinarily covers the cost of outlet ditches of sufficient capacity to handle a run-off of from ¾ inch to 1 inch from the area drained, in 24 hours. The larger figure is applicable to the upper portion of the main ditch and to the branches, and the smaller figure to the lower portion of the main ditch where the latter has a length of more than 10 miles. In special cases it may be advisable to base the improvements on larger rates than those given, but rarely, if ever, smaller. On small streams having unusually wide or valuable bottoms the owner can well afford to seek a greater degree of protection than is obtained by the use of ditches designed to carry 1 inch of run-off, and in watersheds having a topography especially conducive to large run-off it may be desirable to assume as high as 1½ inches for certain portions. However, in the average Piedmont creek the use of a 1-inch coefficient will afford benefits that amply justify the cost of the work.

Design of ditch.—The principal elements of a ditch that determine its capacity are, its fall, its depth, and its width. Within quite

close limits the rates of fall are fixed by the longitudinal slopes of the valley. Any considerable variation from these slopes will result either in shallow or excessive depth. Ordinarily, in the Piedmont section, the grade line must be broken quite frequently, especially in the upper portions, and the changes are nearly always of the nature of repeated decreases in rate of fall from the upper to the lower end. This is an unfortunate requirement as it tends to a reduction in velocity of flow in the lower reaches, and consequent silting; whereas if the fall could increase downstream, or even remain constant, nearly all suspended matter entering the upper end would be carried through to the outlet without being deposited. The fall of many Piedmont streams, especially in their upper reaches, is so great that scouring of the channel may occur. However, the effectiveness of the ditch is not likely to suffer seriously from this cause; any damaging silting that occurs generally can be ascribed to material that has been washed from the clean-cultivated hillsides and carried by the small, steep branches into the main outlet.

Depth is a very necessary requirement of a drainage ditch, the importance of which not always is appreciated. A ditch may have the capacity necessary to prevent all overflow, but the adjoining land may still remain too wet to be cultivated successfully. An effective ditch must, regardless of its width, be of such depth that at low-water flow the water surface will be considerably lower than the level to which the ground water table in the adjoining land must be reduced to permit the best plant growth. In many of the Piedmont valleys underdrainage will be necessary before the full possibilities of the soil can be realized. These drains should be placed about 3 feet deep. Allowance must then be made for fall for the drains to their outlet ditches, and for these latter to the main ditch. The main ditch must then be of such depth that at its normal low-water flow the above described system shall have a free outlet. These conditions ordinarily require that the depth of the main ditch be not less than 7 feet, and a greater depth is desirable. Regardless of whether or not tile drains are installed, deep

ditches mean more effective drainage as the slope of the underground water surface toward the ditch is thereby increased and movement of this water facilitated. Aside from the question of soil drainage, the velocity of flow—and consequently the capacity—in a ditch is increased much more by deepening it a given amount than by widening it the same amount. Therefore economy of excavation is effected in a ditch that is of the maximum depth consistent with its width.

The necessary bottom width of a ditch in general is determined by a consideration of the required capacity, together with the fall and depth previously decided upon. However, certain other considerations affect the bottom width. The slope of the ditch banks is of course one of these. Another is the method of construction to be adopted. If a floating dipper dredge is to be used it is advisable to design the ditch originally with this machine in view. In the average Piedmont project the floating dipper dredge is the most satisfactory means of constructing the main ditch, and often considerable portions of the laterals, as it is better adapted to handling the stumps and sunken logs that will be encountered than is any other device on the market. Not infrequently the width of a long stretch of ditch is determined by the requirements of the machine by which it is to be constructed. In such cases the capacity of the ditch is likely to be considerably greater than is required merely to accommodate the run-off.

Location of ditch.—The location of the ditch is a matter of sufficient importance to justify the most careful study. As has been stated, it usually is advisable, in the Piedmont, to disregard the old channel. Indeed, one may go further and say that often the old channel should deliberately be avoided. Usually it meanders from one side of the bottoms to the other, and contains many short bends. Furthermore, as has been explained, it has so built up the immediately adjoining land that it now occupies the highest land of the valley. Again, the old channel usually is nearly filled with almost pure sand. Consequently pure sand would compose a large part of the material

thrown out by the dredge and the ground occupied by the spoil banks often would be wasted, whereas if the excavated material were clay the banks could be leveled off and cultivated.

There are, it is true, certain advantages to be had in following the old stream bed. One of these is the saving in excavation that may result. In weighing this advantage, however, it must be remembered that the old stream bed probably is nearly filled with sand, and that its present bed is likely to be as high as, and the banks higher than, the lowest parts of the adjoining bottoms; and since it is the low land that is to be drained, the bottom of the ditch must be established with reference to this land and not to the present stream banks. Another difficulty that may arise from avoiding the existing channel is due to the fact that this channel is often the established boundary between adjoining landowners. This is a matter that must be given consideration, but usually the difficulty can be overcome as, owing to the crookedness of the old channel, the new ditch line lies first on one side and then on the other and the land line can be adjusted to the new ditch line without important losses to either party. Ordinarily there need be no loss of land to cultivation by abandoning the present channel, as it is so shallow that with but little labor it can be plowed in and utilized.

With regard to general location, an ideally located ditch would meet the following requirements: (1) It would lie in the lowest parts of the bottoms; (2) it would not depart far from the center line of the bottoms; (3) it would have long tangents; (4) the angles of tangent intersection would be small. In practice the location would be a compromise between these advantages, since all of them could not be attained except in occasional reaches; but the nearer a ditch fulfills these requirements the better will be the drainage results. The general route followed by the bulk of the overflow water is often a reliable guide to the engineer in locating a ditch.

At tangent intersections the change of direction always should be accomplished by curves; the greater the angle the longer should be the

curve. For this purpose it is well to stake out regular railroad curves, setting stakes 50 feet apart. It is advisable that such curves have a radius of not less than 500 feet. If it is not feasible to run regular railroad curves for this purpose, the angle should at least be turned by a series of staked chords, the important thing being not to leave the turning of these angles entirely to the dredge operator.

Outlet.—Owing to the considerable fall usually available on Piedmont streams, the question of outlet for the main ditch is not of such vital importance as it is on improvements in some other parts of the State. As a drainage district often includes only a part of a stream and does not extend to its mouth, it is quite frequently necessary to terminate the new main channel abruptly at the lower line of the district. Where this is done drainage will be more or less interfered with for a distance upstream depending upon the fall of the valley, but in the average Piedmont project this distance is not so great. Such a termination always should be made at some intersection of the old channel, as the latter, however inefficient, is better than no outlet channel. The old stream bed and its banks, for a mile or so below the junction, should then be cleared of all obstructions to flow, such as logs, fallen trees, bushes, and drift. Even where the new ditch is extended to the mouth of the stream to be improved, the outlet channel may be in poor condition and it may be necessary to improve this latter channel for a distance, by removing obstructions to flow. In order that the land in the extreme lower end of the district shall receive full benefit it may even be necessary to carry the ditch excavation some distance below the drainage district boundary.

Not infrequently the limits of a drainage district are, from an economical standpoint, fixed by outlet conditions. It is quite characteristic of Piedmont streams to contain, at intervals of several miles, rock shoals. At such shoals there often is a sudden drop of several feet in the bed of the stream. Such a condition affords a satisfactory lower terminus for the ditch, it being necessary, usually, merely to remove a

small amount of rock at the shoal in order to gain the advantage of the sudden drop of the stream bed, as an outlet. Another such shoal may mark the upper terminus of the improvement, since it would not pay to extend the ditch through this shoal and into the higher level above.

Laterals.—Lateral ditches to be constructed in the branches of the main stream should be designed and located according to the same general principles as obtain for the main ditch. However, as the bottom lands along the laterals are narrower the ditches need not be quite so deep as is necessary to drain the wider bottoms. A branch should enter the main ditch at a slight angle with the latter, in order that the directions of flow in the two streams shall be approximately the same at the junction. This can be accomplished by properly curving the lateral at its lower end.

CONSTRUCTION

As stated before, the floating dipper dredge (Plate III, A) is the most suitable machine for constructing ditches under the conditions ordinarily found in the Piedmont section. Where the upper end of a ditch is near the headwaters of a stream, the question as to how far up the ditch the dredge should be employed usually is decided, not by a consideration of the size of channel necessary to carry the run-off, but rather by a comparison of cost per linear foot between dredge work and that of constructing a sufficient ditch by hand. The cost per cubic yard of material moved is so much less for the dredge than for hand work that often it is cheaper to cut a dredged ditch with a 12-foot bottom and 7-foot depth, than a hand ditch with a 4-foot bottom and 6-foot depth. Nevertheless there are distinct disadvantages in having a ditch that is considerably larger than required. In a flat country, especially, it is not advisable to be governed in this matter by first cost alone, as the small ditch may be distinctly preferable to the dredged ditch owing to the fact that in low-water flow the water in the small ditch would be deeper and have a greater velocity. Such a ditch there-

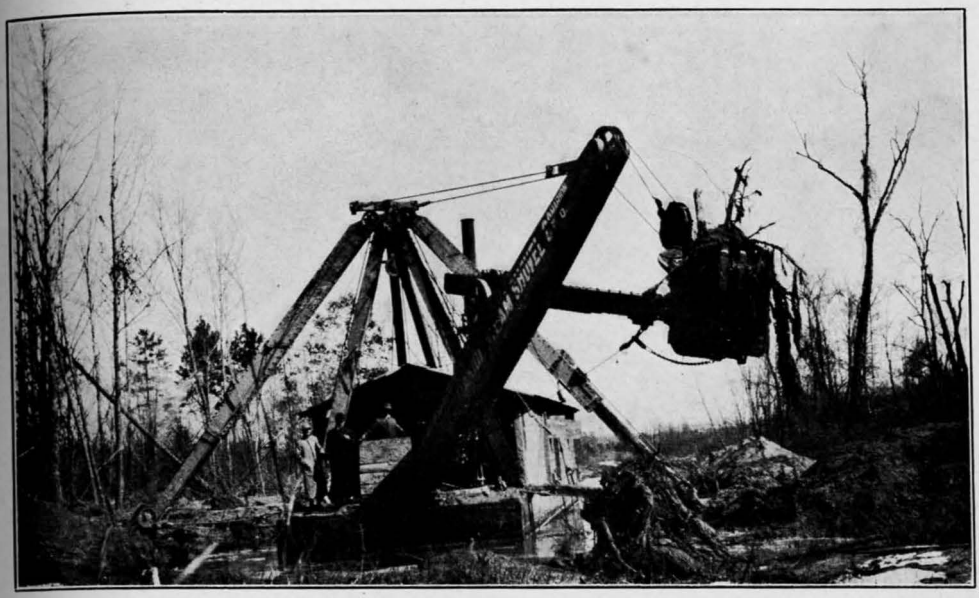
fore would be more nearly self-maintaining than would the dredged ditch which would tend to become filled with vegetation. Moreover, even a minimum-sized dredged ditch, with its berms and spoil banks, will occupy a strip of land 75 or 80 feet wide. This is a feature that cannot well be ignored where the whole object of the work is to reclaim a tract of bottom land that is only a few hundred feet wide.

While the floating dipper dredge probably meets the conditions found in the average Piedmont project better than does any other type of machine, yet under certain circumstances it would seem that another type could be used to great advantage. On projects where the timber is light no reason is apparent why a form of the so-called dry-land dredge (Plate III, B) could not be used. Certain advantages of this latter machine over the floating dredge are worthy of attention.

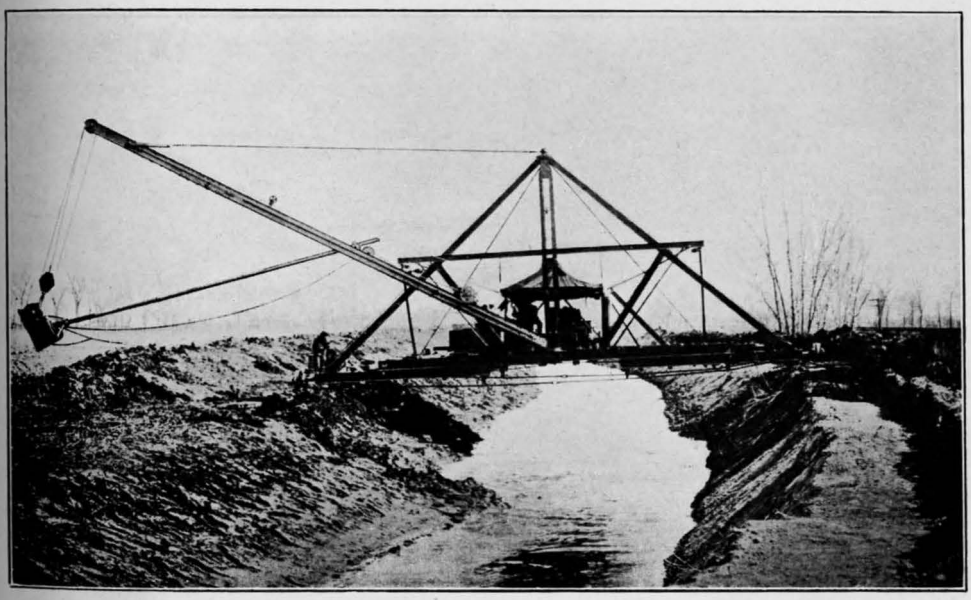
For the floating dredge it of course is necessary to maintain at all times a depth of water sufficient to float the boat. In the Piedmont country this means that the dredge must be built at the head of the ditch and work downstream, since the fall ordinarily is too great to warrant the plan of working upstream by constructing dams behind the dredge. There is a serious disadvantage in working Piedmont ditches downstream, as necessarily there always is a considerable reach of "dead" water behind the dredge boat, and in case of heavy rain in the upper watershed a considerable deposit of sand and silt is to be expected in this reach.

Another advantage of the dry-land type is its lightness and simplicity of construction, making unnecessary the transportation of large quantities of heavy machinery and materials over the rough Piedmont country. This is an important item in projects of such comparatively small yardage as are many of those in the section under consideration. Still another important point in favor of the dry-land dredge is its ability to construct small ditches. The floating dredge must at all times have a channel of sufficient width to float the hull.

So far as known the dry-land dredge never has been tried in the Piedmont, although it has been used with success in the Coastal Plain (Plate IX, A).



A. FLOATING DIPPER DREDGE



B. DRY-LAND DIPPER DREDGE

MAINTENANCE

The maintenance of drainage channels in the Piedmont section consists largely in keeping the channel at an effective depth. This may be done either by periodically removing the deposits by dredging, or by preventing the accumulation of such deposits. The obvious cost of frequently redredging the channel must make it apparent that the problem should, so far as possible, be looked upon as one of prevention rather than of correction.

Preventative measures.—The place to begin maintenance is on the hillsides of the watershed. When these are so handled as to permit of the minimum amount of erosion the problem of maintenance is largely solved. Of the soil particles that still find their way off the land a large part can, by proper measures, be held in the small branches. The quantity that finally reaches the main ditch will then be so small that redredging will be necessary only at intervals of many years, if at all.

Since soil erosion is due to water flowing at considerable velocity over the surface, the two important objects of any preventative measures to be used are, (1) to reduce, so far as possible, the quantity of water running over the surface; (2) of the water that does flow over the surface, to reduce its velocity to such a point that no scouring occurs. These results are to be achieved through various means which may be classified under three general heads, as follows:

(1) Proper utilization of land.

(2) Correct tillage methods.

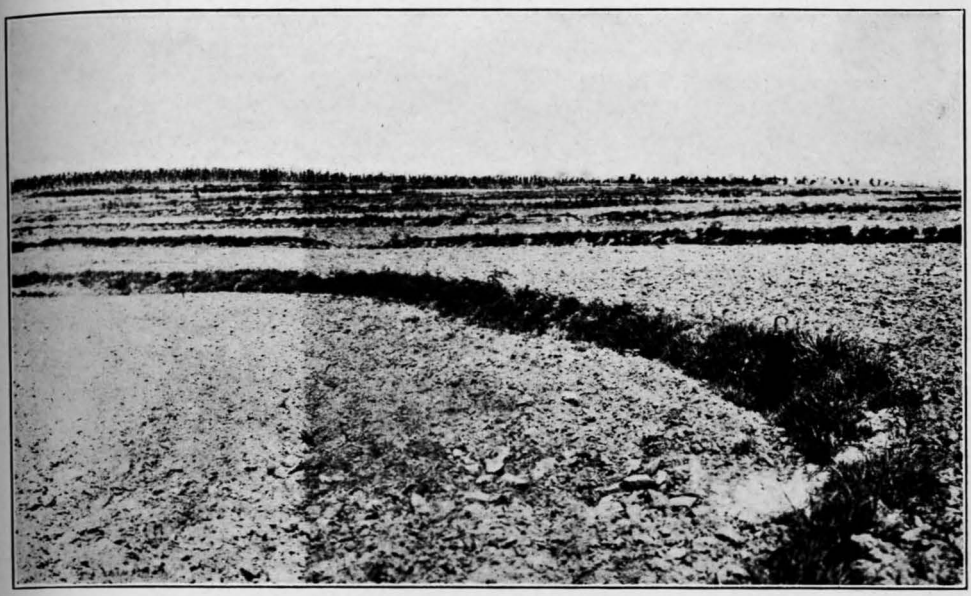
(3) Use of special devices to control surface water.

With reference to the first item, land should not be devoted to purposes for which its slope unfits it. Thus a steep hillside devoted to forest or pasture does not erode and is properly so utilized. If this slope be put under cultivation, especially with clean-cultivated crops, soil wash may begin at once and continue until the productivity of the

field is destroyed. As a rule land having a rise of more than 20 feet per hundred feet can better be devoted to pasture or forest than to crops.

The extent of erosion is greatly affected by methods of tillage employed. Such crops as corn and cotton, where much of the soil surface is exposed to the elements, are much more conducive to erosion on land having any considerable slope than are cover crops such as oats, cowpeas, and clover. These latter are of especial value in protecting land during the winter when otherwise it would be bare and exposed to the full action of the elements. Long-continued shallow plowing has in many places formed a sort of hard pan a few inches under the surface through which water will penetrate but slowly. Deep plowing tends to prevent erosion by increasing the absorptive capacity of the soil. The presence of humus in the soil, obtained by the application of barnyard manure, also is an important factor in the prevention of washing.

A strict following of the correct principles of the utilization and tillage of land will not always prevent soil wash, and these principles are most effective when applied in connection with additional devices to control the flow of water over the surface. By far the most effective of these devices is the terrace. A well designed and constructed terrace in itself fulfills to a high degree the above-mentioned requirements of a preventative of erosion; that is, it holds the water on the land for a time and thus promotes absorption by the soil, and it checks the velocity of the water flowing off to such a degree that erosion is reduced to a minimum. No discussion of the subject of terracing will be attempted here, but it may be said in passing that there are several forms in successful use which are adapted to different types of soil and various land slopes. Terracing is widely practiced in the Piedmont section of Georgia, with more or less success depending upon whether or not the terraces are properly laid out, and well constructed and maintained. Much good land is wasted, however, in permitting the terraces to grow up in grass and weeds, where the use of a cultivable form of terrace would be perfectly feasible. Plate IV, A, shows



A. BENCH TERRACES

B. RIDGE TERRACE UNDER CONSTRUCTION

a field protected from erosion by terraces of the bench type. Plate IV, B, shows a ridge terrace under construction.

Tile drainage is an effective aid in preserving the soil, since by the removal of the soil water space is created for the reception of more water from the surface; furthermore the soil is kept in a condition of porosity that promotes a rapid passage of water through the soil. Nevertheless it is to be doubted whether the cost of installing tile, merely for the prevention of soil wash, is warranted in view of the fact that terraces are cheaper and more effective. The combination of terraces, tile, and correct handling of the soil and selection of crops, affords the ideal plan for preserving the soil on the slopes and maintaining its productivity.

As has already been stated the materials washed from the fields are carried into the smaller water courses and thence ultimately into the main drainage channel. These small feeders usually have considerable fall and the water flows swiftly, carrying with it the suspended soil particles until some obstruction is met which reduces the velocity of flow. With the slowing down of the current soil particles are deposited on the bed of the stream. This action is to be seen on any silt-laden stream, behind drift piles or dams, on the inside of a bend in the channel, and at the point where such a stream enters a larger or more sluggish one. It often is feasible to take advantage of these conditions in preventing the silting of the main ditch. Barriers of brush and logs can be constructed at intervals across the rapidly flowing small feeders and a large amount of suspended matter can be deposited at these points and thus prevented from reaching the main channel. It will of course be necessary to remove the deposits at intervals, or to construct additional barriers as conditions may require. Probably the cleaning could be most cheaply done by teams and scrapers. Another method of arresting the movement of silt in channels has been used with success. This consists in letting the branch discharge on an area set aside as a sedimentation basin and located where the stream debouches from the hills on to bottom land of the main channel. The

silt-laden water on reaching this basin is spread over a considerable area, its velocity of flow is checked and its burden of soil deposited. Such areas, unless quite large, build up rapidly and it ultimately is necessary to clean them or to divert the water to another sedimentation area.

Corrective measures.—Assuming that all possible precautions are taken to prevent the entrance of sand and silt into the main ditch, other maintenance work still will be necessary. It is probable that redredging will be required at intervals of several years, the frequency depending mostly upon the success with which the foregoing preventative measures have been applied. The channel should be kept clear of logs, fallen trees, large rocks, fences, etc., as any such obstruction becomes a nucleus for drift piles and sand bars. Not only should the bed of the stream be kept clear, but bushes and trees should not be permitted to grow upon the banks, as these will obstruct the current at the higher stages of water and trees are likely to topple over into the stream bed. Furthermore, dense vegetation on the banks tends to cause a rapid deposition of silt in case of overflow, and thus build up the ditch banks. Maintenance of this character is far better and more cheaply done if it is carried on systematically and as routine in the administration of the district's affairs. By frequent inspection by some one charged with the responsibility for keeping the channel in condition, and by a comparatively small amount of labor applied at the right time, the problem of maintenance is most effectively and cheaply handled.

TYPICAL PROJECTS IN THE PIEDMONT

To afford a clearer idea of the drainage problem of the Piedmont section of Georgia, and to present in more detail the manner of its handling, there are introduced at this point synopses of reports on two typical projects as prepared by J. V. Phillips and submitted by the U. S. Department of Agriculture to the officers of the respective drainage districts.

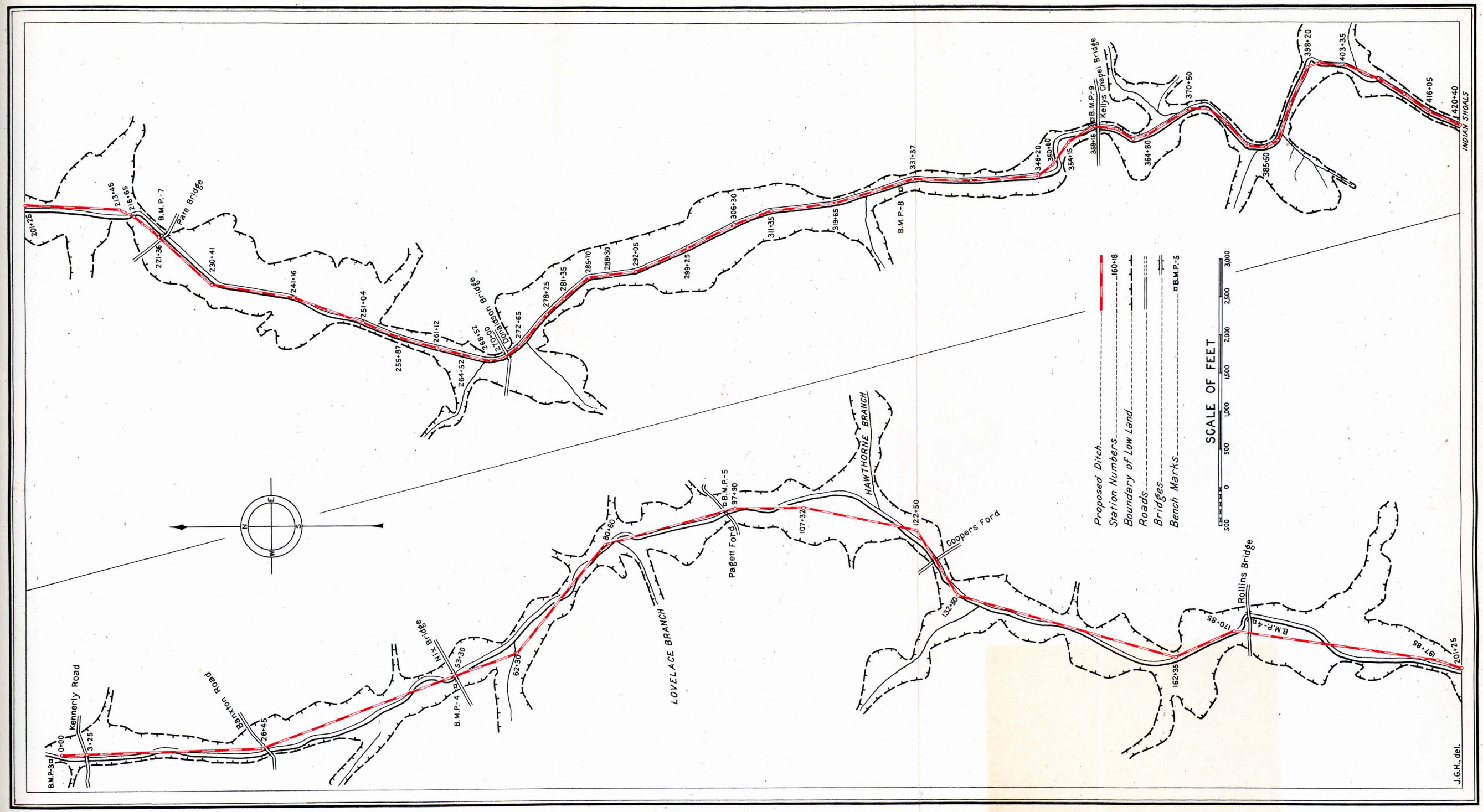
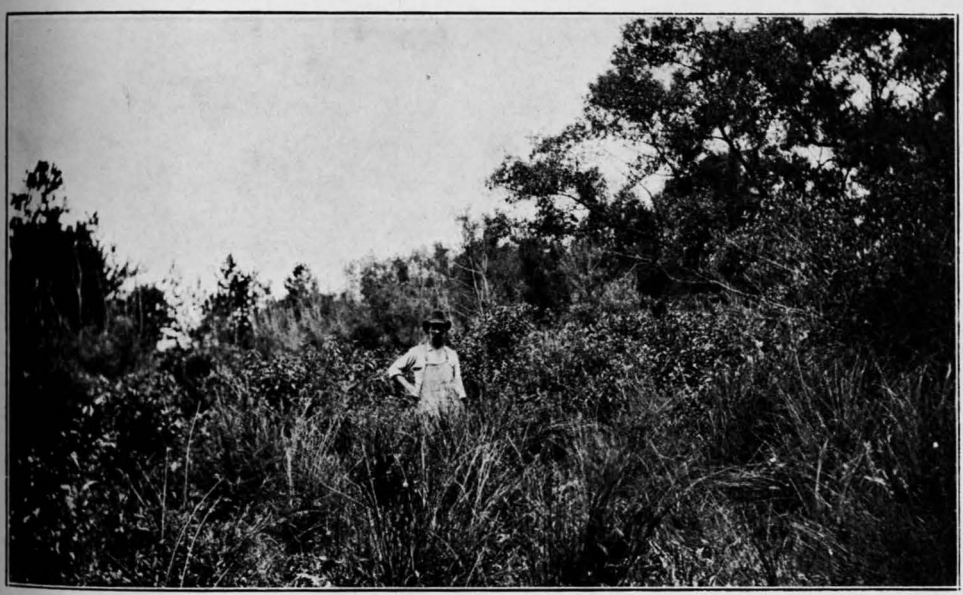


Fig. 2. Big Haynes Creek Drainage District, Gwinnett and Walton Counties, Georgia

A. CREEK CHANNEL BEFORE IMPROVEMENT, BIG HAYNES CREEK, GWINNETT COUNTY, GEORGIA. NOTE EXTENT TO WHICH IT IS FILLED WITH SAND



B. TYPICAL VIEW OF BOTTOM LANDS BEFORE IMPROVEMENT, BIG HAYNES CREEK, GWINNETT COUNTY, GEORGIA

BIG HAYNES CREEK

(Gwinnett and Walton Counties.)

Big Haynes Creek is located in Gwinnett, Walton, and Rockdale counties. It heads just west of the town of Grayson, in Gwinnett County, flows in a general southerly direction through the extreme west corner of Walton County, and thence into Rockdale County, emptying into Yellow River some 8 or 9 miles south of the northeast corner of the latter county. This discussion is concerned only with that section of the creek between the Indian Shoals, located about 1 mile below the mouth of Brushy Fork, and the Kennerly Bridge, which is about 8 miles above the shoals (see figure 2). The watershed contains about 35 square miles, consisting of rolling to precipitous land, ranging in elevation from 800 to 1,000 feet above sea level. The only tributary of importance is Brushy Fork which enters from the east at a point just above the Gwinnett-Walton County line.

Prior to improvement, the section of the creek above Pate Bridge (see figure 2) was narrow and crooked and had a depth not generally exceeding 1 foot. Below Pate Bridge the channel was more efficient; in fact, a portion of it had been improved by the construction of a ditch. According to the testimony of landowners the creek channel, 25 or 30 years ago, was from 4 to 6 feet deep. In recent years, however, the material eroded from the cultivated hillsides had so filled the channel as to render it ineffective (see Plate V, A). As with most of the Piedmont streams there is a marked diminution of fall from the source to the outlet. In this case the fall ranges from about 18 feet per mile near the Kennerly Bridge, to about 8 feet per mile in the vicinity of the mouth of Brushy Fork.

Along the section of the creek under consideration the bottom land is in but few places more than ¼ mile wide. About four-fifths of this bottom land, which was estimated at 618 acres, had at one time been under cultivation; and at the time, above referred to, when the channel still had effective depth, good yields of corn and hay had been produced. After the channel became filled, overflows were frequent and

cultivation of the bottoms practically ceased. The condition of the bottom land is shown in Plate II and in Plate V, B.

Of the 22,000 acres in the watershed, nearly all is rolling land, the soil being, according to the U. S. Soil Survey, a Cecil clay or a Cecil loam. The bottom land is classified as meadow. It is the accumulation of the products of the erosion that has taken place on the higher lands.

The movement looking to the reclamation of the low lands along Big Haynes Creek first took definite form in the spring of 1911 when the assistance of the U. S. Department of Agriculture was requested in determining the feasibility of the project, and later in formulating plans for drainage. A preliminary examination was followed by a complete survey of the creek between Kennerly Bridge and Indian Shoals.

The nature of the improvements required was obvious, namely, a ditch to perform the functions of the creek channel which as before stated had become, in part, so filled with sediment as to be of no value as a drainage outlet. As to the location of the new channel, the results of the survey indicated at once that in the upper half of the district it would be well to disregard entirely the existing creek channel as the latter contained a number of bad bends and repeated overflow had built up the land immediately adjoining the creek until it was distinctly higher than that lying farther back. Moreover, the old creek channel was so shallow that no difficulty would be encountered in cultivating over it. Through a large part of the lower half of the district the abutting landowners had improved the creek channel to such an extent that it was thought advisable to follow the existing ditch line.

The ditch was designed to accommodate a run-off of 1 inch in 24 hours from the contributing watershed. In determining the discharge the watershed was considered in two sections, namely, the area above the mouth of Brushy Fork, and the entire area at Indian Shoals, including that of Brushy Fork. The first or upper section has an area of 13,000 acres and at the assumed rate of run-off would yield a discharge of 550 cubic feet per second. The entire drainage area (22,000 acres) would give a discharge of 925 cubic feet per second.

A. DITCH UNDER CONSTRUCTION, BIG HAYNES CREEK, GWINNETT COUNTY, GEORGIA

B. DITCH COMPLETED AND BOTTOMS UNDER CULTIVATION, BIG HAYNES CREEK, GWINNETT COUNTY, GEORGIA. NOTE THAT SPOIL BANKS HAVE BEEN LEVELED OFF AND LAND IS CULTIVATED UP TO THE DITCH BANKS

It was considered that a minimum depth of 6 feet was essential to give the proper soil drainage. This depth was adopted for the upper end, and increased to 7 feet at the lower end.

The slope of the bottom of the ditch was of course governed largely by the natural fall of the ground down the valley. The slope was adjusted, however, so as to obtain a gradual increase of depth from the upper to the lower end, as noted above.

The following table summarizes the results of the calculations made for ditch sizes:

Data for Big Haynes Creek Ditch.

Station		Length	Average cut	Bottom width	Bottom slope
From	To				
		Feet	Feet	Feet	Feet per mile
0	48	4,800	5.5	16	17.80
48	169	12,100	6.2	16	13.74
169	304	13,500	6.6	16	9.03
304	372	6,800	7.2	16	8.06
372	420+40	11,640	7.0	18	8.06

Disregarding the volume of that part of the existing creek channel which was followed, the excavation involved in the construction of the ditch was estimated at 197,600 cubic yards, including 500 cubic yards of rock. The contents of the portion of the existing ditch which was utilized was estimated at 41,000 cubic yards, leaving 156,600 cubic yards of actual excavation, of which it was expected that 500 cubic yards would be rock.

The total cost of this work, including that of clearing right of way and allowing 10 per cent for contingencies, was estimated at $18,315. On the basis of 618 acres to be benefited, this is equivalent to $29.63 per acre.

Plate VI, A, shows Big Haynes Creek ditch under construction. The ditch was completed in 1913. The results have been highly satisfactory and have been an incentive to the undertaking of other

such projects in the Piedmont. A notable result of the improvement of Big Haynes Creek has been the elimination of the malarial conditions that formerly existed along the creek. Plate VI, B, shows the ditch some time after completion, with the bottoms under cultivation. Particular attention is called to the fact that the spoil banks have been leveled off and the land cultivated up to the break of the ditch banks.

ROSE CREEK

(Oconee County.)

Rising in the central part of Oconee County, Rose Creek flows in a general southeasterly direction for about 12 miles to its outlet into the Oconee River near the intersection of the boundaries of Oconee, Green, and Oglethorpe counties. The watershed is approximately 12 miles long and 2½ miles wide. The part of the creek here considered is between the Elders Road crossing and the Oconee River, a length of about 6¼ miles (see figure 3). The area contributing to the upper end of this section is about 13 square miles, and the total area drained by the lower reaches of the creek is about 30 square miles. The surface topography of the watershed is that typical of the Piedmont section of the State, the general elevation of the hills being from 100 to 150 feet above that of the flat lands along the creek and its principal tributaries. The slopes of the ridges down to the creek bottoms are quite uniform to within 50 to 100 feet of the edges of these bottoms, at which point the fall becomes quite abrupt. Usually the points of these bluffs are rocky, large boulders often protruding into the flat lands.

Rose Creek varies in width from 6 to 20 feet, and in depth from 1 to 3 feet. While its alignment is better than that of most Piedmont streams, some portions are quite crooked, the channel winding from bluff to bluff. As in the case of the Big Haynes Creek, the creek banks have been built up and the bed of the stream elevated by sedimentation until it is even higher, in some places, than the adjoining bottom land.

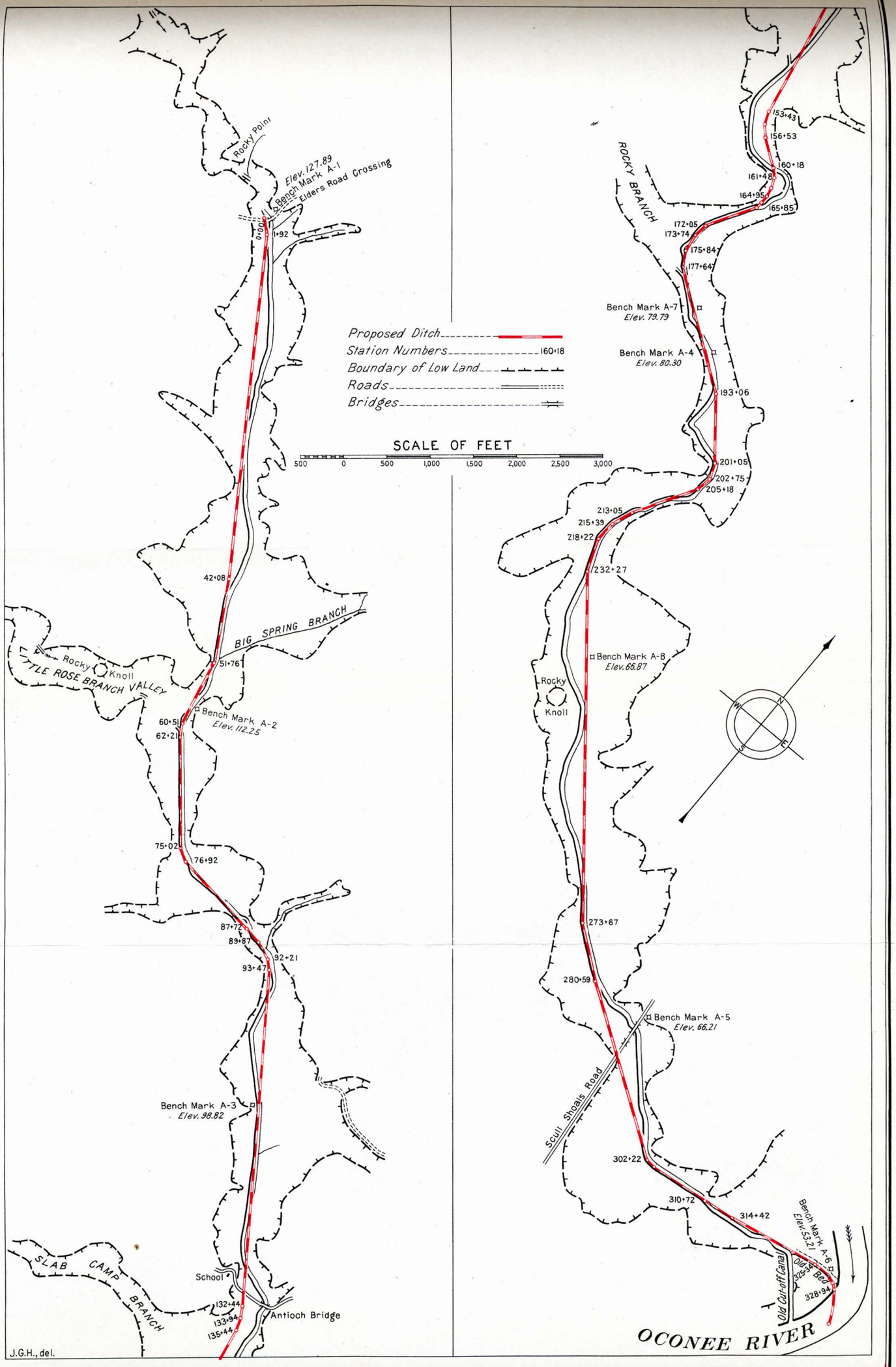


Fig. 3. Rose Creek Drainage District, Oconee County, Georgia

The fall of the creek decreases from about 21 feet per mile, near the Elders Road crossing, to approximately 11 feet per mile near the outlet.

Within the limits of the proposed drainage district it was estimated that the bottoms contained about 645 acres, the width varying from about 200 feet to nearly ½ mile and averaging perhaps 850 feet. The soil of the bottoms, classed by the U. S. Soil Survey as meadow, is a reddish silt loam washed from the hills.

In the summer of 1915 organization was effected with the object of improving the portion of the creek just described. Application was made to the U. S. Department of Agriculture for assistance in planning the improvements, and under an agreement made with the drainage district the Department caused a survey of the creek to be made and plans and estimates prepared.

The drainage problem was found to be the usual one encountered in this section of the State, that of providing an efficient channel to take the place of the natural watercourse which had become filled. The new ditch was located on the most favorable line, regardless of the location of the present channel of the creek.

A run-off of 1 inch in 24 hours from the area drained was used as the basis of ditch design. The depth was so adjusted as to give a depth of flow of 5.5 feet at the upper end and 7 feet at the lower end. A bottom width of 12 feet was adopted for the upper end and the width increased as the contributing area became greater and as the fall of the valley decreased. The following table gives the principal elements of the ditch as designed:

Data for Rose Creek Ditch.

Station		Length	Average cut	Bottom width	Bottom slope
From	To				
		Feet	Feet	Feet	Feet per mile
0	12	1,200	7.0	12	20.70
12	60	4,800	7.4	12	14.20
60	103	4,300	8.5	12	14.20
103	180	7,700	8.2	14	11.33
180	220	4,000	7.5	14	11.33
220	250	3,000	7.9	14	11.33
250	300	5,000	8.1	16	11.33
300	323	2,300	7.7	16	11.33

The amount of excavation as estimated for the ditch on the basis of the above dimensions was 179,000 cubic yards. On the basis of 645 acres of land to be benefited, the cost per acre for these improvements, including 10 per cent for incidental expenses, was $24.45.

At the time of this writing the Rose Creek ditch is under construction, in accordance with the plans here given.

DRAINAGE IN THE COASTAL PLAIN

TOPOGRAPHY

The surface of most of the Coastal Plain varies from gently rolling to level, excepting immediately south of the fall line, where there is a belt of hill land. The elevations range from about 400 or 500 feet at the fall line to zero at the coast. A profile through Macon, Jesup, Everett City, and Brunswick shows three distinct levels or benches. For a distance of 25 miles from the sea the elevations do not exceed 15 feet. At this point a distinct rise occurs, and at Jesup, 45 miles inland, the elevation is 100. Near Jesup another well-defined rise takes place to an elevation of about 150, and from there to the fall line there is a gradual rise to an elevation of about 500 feet above sea level.

The northern portion of the Coastal Plain area, sometimes known as the Costal Plain plateau (see figure 1), is characterized by low, rolling hills and rather narrow, flat, swampy valleys along the small streams, and wider bottoms along the larger streams. The general slope

to the south is gradual, and some of the larger streams are navigable up as far as the fall line, the northern limit of the Coastal Plain plateau.

South and east of the plateau region lies the section known as the "piney flat woods." Most of this section of the State is very flat with slight slopes toward the main streams, though an area in the extreme southwestern part of the State, designated as "piney rolling lands," is rolling to hilly. As a rule, the streams in the flat woods have practically no bottom lands, the banks extending directly up to the general land level.

NATURAL DRAINAGE

None of the larger streams of Georgia originate in the Coastal Plain. The main outlets all rise in the Piedmont and flow in a southerly or southeasterly direction through the Coastal Plain. Most of this latter section is drained by these larger streams and their tributaries, but there is considerable area in the south-central and southern parts that is drained by a number of lesser streams which flow either into the Atlantic Ocean, or through northern Florida into the Gulf of Mexico. Among the most important of these are the Ocklockonee River, the Little River, the Allapaha River, the Suwanee River, and the Satilla River.

The northern or plateau section has fairly well defined streams with good banks, the streams originating in the Piedmont, especially, having cut deep channels. The problem of drainage is not complicated by the action of erosion as is the case in the Piedmont section. The water of the streams that originate in the Coastal Plain is clear and carries little or no suspended matter to be deposited in the channels. The interstream uplands are flat or but slightly rolling. On these often are found bays and disconnected cypress ponds which have no outlets and which tend to keep the adjoining slightly higher land too wet for cultivation. These depressions constitute the principal drainage problem of this section.

In the flat woods section the minor watercourses have poorly de-

fined channels. Whatever drainage outlets are required usually must be constructed practically in entirety. The slope of the land is very slight, and during wet periods water stands over large areas. Numerous ponds and wet depressions are scattered over this area; these contain water during all but the driest periods. In this section lies Okefenokee Swamp, a permanent swamp containing some 700 or 800 square miles and lying at an elevation of from 126 to 112 feet above sea level.

THE DRAINAGE PROBLEM

Unlike the Piedmont Plateau, the Coastal Plain presents no characteristic type of drainage problem. As has been said, the element of sedimentation of channels is not present, owing to the moderate fall in the streams and to the character of the topography and soil. On some of the larger streams levees afford the best means of correcting overflow conditions, and considerable work of this nature has been done. On the lesser streams levees may in certain cases be employed to advantage, but improvement of the stream swamps generally should take the form of enlarged, deepened, and straightened channels. The bottom lands, where such exist, are wider than those ordinarily found in the Piedmont, and the streams have better banks; nevertheless overflow conditions are perhaps as bad as in the Piedmont, owing to the fact that the streams, being fewer in number, drain larger areas. As a result of these overflows large areas of bottom land are kept wet for such long periods that cultivation is rendered impracticable and the bottoms remain as swamps covered with pine, gum, and cypress timber, and often dense undergrowth (see Plate VII, A).

In addition to these stream swamps there is a condition that perhaps is more characteristic of the Coastal Plain Plateau than is any other single drainage feature. This is the occurrence on the uplands of shallow depressions, bays, and cypress ponds. These depressions, of which Plate VII, B, shows a typical example, usually have no effective drainage connection with one another, nor have they efficient outlets from the tableland to the watercourses in the valleys. The re-

A. STREAM AND ADJOINING SWAMP IN COASTAL PLAIN

B. CYPRESS POND ON UPLAND IN COASTAL PLAIN

sult is that during rainy periods they become filled with water. As the water rises over the rims of the depressions it flows from one to another, and this surplus water ultimately finds its way to the lower levels. However, the depressions themselves remain full and the water is removed only by direct evaporation or by being taken up by plant growth. In abnormally wet years they may contain water the year around. In certain parts of the Coastal Plain plateau the depressions themselves, having a clay soil, can be cultivated with profit after having been drained. In other sections their beds are practically a pure sand and they are to be drained, not so much for themselves as for the benefit of the adjoining slightly higher lands which, so long as the depressions contain water, are rendered uncultivable by seepage.

Fortunately, the topographic conditions that accompany the occurrence of these depressions are such that the latter usually can be drained cheaply. While these bays and ponds, as well as the intervening slightly higher lands, are quite flat, as one goes toward the margin of the tableland a distinct fall begins which constantly increases in amount as the rim is approached until it becomes ample for any purpose of drainage. Thus the drainage channels constructed from the interior level areas can be given constantly increasing fall to their outlets. This, it may be noted, is the reverse of the usual situation in the Piedmont where the fall decreases rapidly as one goes downstream.

The method of draining these depressions consists in connecting them by small ditches of sufficient depth, and then providing suitable ditches to carry the water over the rim of the tableland. For this purpose large ditches are not required, although considerable depth may be necessary in order that the more remote depressions in the flat areas may be reached. The proposed Baxley Drainage District, which is hereafter discussed, is an example of this type of reclamation.

Farther south, as tidewater is approached, are found broad, flat areas which have no well-defined outlet streams, but which have slight slopes toward runs which finally, at tidewater, develop into definite channels with good depth. In these areas it is necessary to construct

ditches of good depth, following in general the runs of the swamps. Of this type is the Little Satilla River and Big Red Cap Swamp project which is described hereafter.

Of still another type are the lands drained by tidal streams. Much of the land formerly was utilized in the cultivation of rice. The degree of drainage essential for other crops, and especially for maintaining satisfactory health conditions, requires the construction of deep ditches and the use of tidal gates. Much work of this character has been done in Chatham County (see Plate VIII).

RUN-OFF

Run-off conditions in the Coastal Plain differ decidedly from those of the Piedmont Plateau. The flat topography and sandy soil of the former tend not only to large absorption by the soil but also to slow passage of the excess water over the surface to the drainage outlets. These conditions result in a relatively low rate of run-off. The persistency with which water stands on the surface, over a large part of the Coastal Plain, is in itself evidence that quick concentration in the drainage channels does not occur. However, it should be borne in mind that the run-off from undrained land is no measure of that which is to be expected after the land shall have been provided with the requisite drainage channels and the extensive storage areas done away with.

As regards such drained areas as are included in the average drainage district, no direct measurements of run-off have, so far as known, been made in the Coastal Plain of Georgia. In lieu of such records there are here given the data collected in the Back Swamp and Jacob Swamp Drainage District, in Robeson County, North Carolina, by A. D. Morehouse, Drainage Engineer, Office of Public Roads and Rural Engineering, U. S. Department of Agriculture.

The Back Swamp and Jacob Swamp Drainage District lies in the Coastal Plain of North Carolina. The land is flat, so much so that it is difficult to determine accurately the boundaries of the various com-

ponent small watersheds. The top soil is a sandy loam, the subsoil a sandy clay. An idea of the comparative rainfall of the Coastal Plain sections of Georgia and North Carolina, respectively, may be obtained from the following table:

Table III. Mean Monthly and Annual Rainfall.

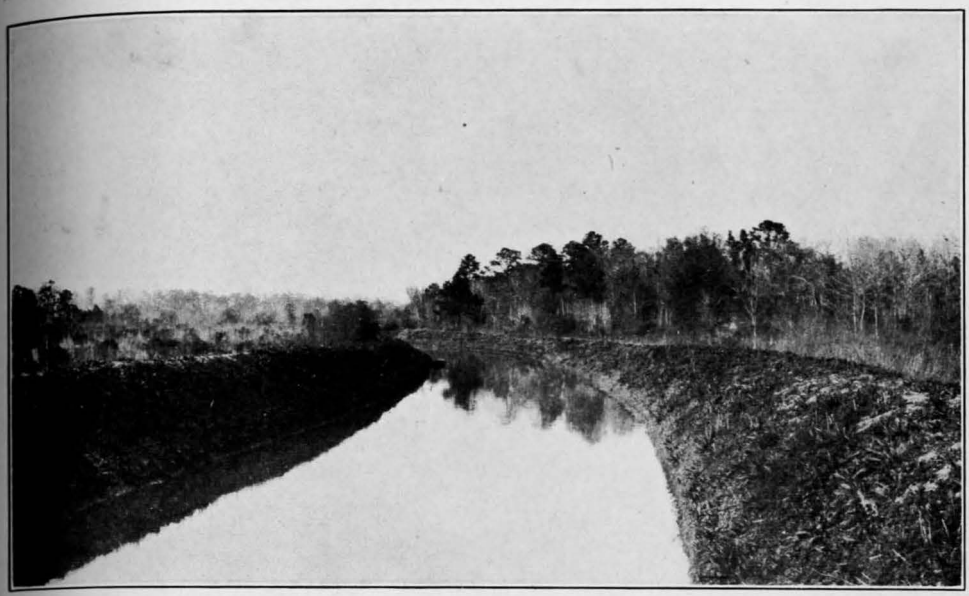
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.	Total
	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
Waycross, Ga.	3.49	4.41	3.59	2.67	3.46	5.67	5.98	6.45	4.28	2.78	2.13	2.62	47.53
Lumberton, N. C.	3.30	4.71	3.84	3.43	3.88	5.52	5.49	6.31	4.25	3.38	2.11	3.21	49.43

From Table III. it is seen that the similarity of topographic, soil, and rainfall conditions is such that run-off data obtained in the Coastal Plain of North Carolina should be quite applicable to the Georgia Coastal Plain, especially the eastern section. These data follow:

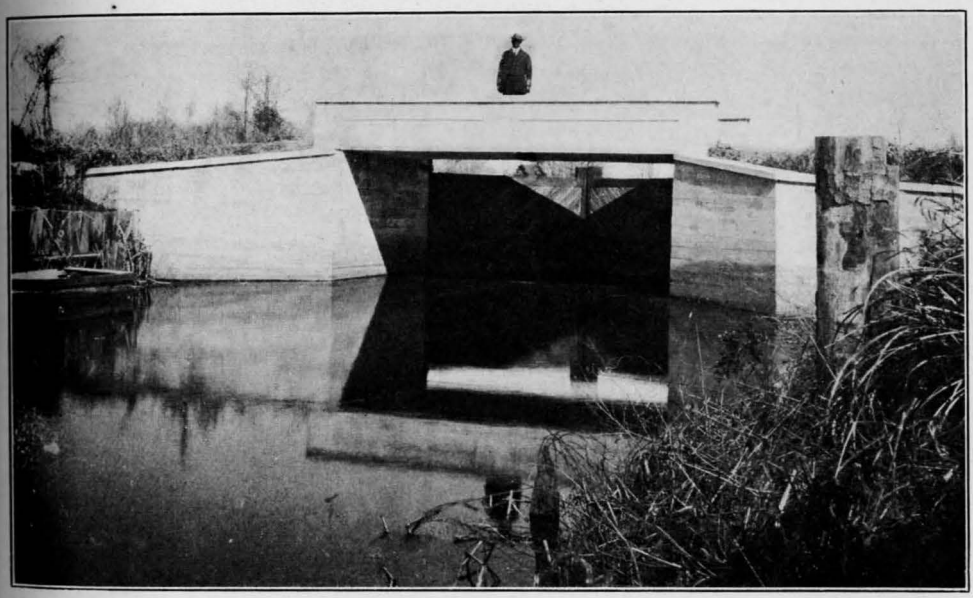
Table IV. Maximum 24-Hour Rainfall and Run-Off, Back Swamp and Jacob Swamp Drainage District, Robeson County, N. C.

Back Swamp

Gage station number	Watershed area	Date of gaging	Maximum 24-hour rainfall	Maximum rate of run-off	
	Acres	1915	Inches	Second-feet	Inches in 24 hours
1	780	January 17	1.59	10.0	0.303
		April 2	1.65	8.0	.242
		May 13	2.25	20.0	.610
		June 1	1.03	4.4	.134
		June 16	1.26	0.9	.027
		June 21	0.98	0.9	.027
2	2400	January 17	1.59	30.0	.300
		April 2	1.65	15.7	.157
		May 13	2.25	21.5	.215
		June 1	1.03	8.5	.085
		June 16	1.26	4.8	.048
		June 21	0.98	4.8	.048
3	12280	January 17	1.59	119.3	.232
		February 1	1.13	78.5	.152
		April 2	1.65	119.3	.232
		May 13	2.25	161.0	.312
		June 1	1.03	57.2	.110
		June 16	1.26	13.4	.026
		June 21	0.98	11.5	.023
4	20780	January 11	1.03	118.5	.136
		January 17	1.52	281.0	.322
		January 23	1.06	271.0	.310
		February 1	1.10	145.2	.166
		April 2	1.62	232.5	.266
		May 13	2.15	291.7	.334
		June 1	1.25	112.0	.128
		June 16	1.41	29.0	.033
		June 21	0.97	23.0	.026



A. MAIN DRAINAGE DITCH, CHATHAM COUNTY, GEORGIA



B. COMBINED TIDE GATE AND HIGHWAY BRIDGE ON A DRAINAGE DITCH, CHATHAM COUNTY, GEORGIA

Jacob Swamp

8	3070	January 11	0.90	16.0	0.124
		January 17	1.26	30.0	.232
		January 23	1.21	33.0	.256
		February 1	1.49	43.8	.340
		May 13	2.15	77.0	.600
		June 1	1.44	26.3	.204
		June 16	1.35	4.3	.033
9	2380	January 11	0.90	10.9	.109
		January 17	1.26	26.3	.263
		January 23	1.21	25.7	.257
		February 1	1.49	40.3	.403
		May 13	2.15	40.1	.401
		June 1	1.44	15.9	.159
		June 16	1.35	3.2	.032
10	6715	January 11	0.90	36.2	.128
		January 17	1.26	78.0	.276
		January 23	1.21	73.5	.260
		February 1	1.49	123.1	.437
		April 2	1.74	94.5	.335
		May 13	2.15	148.4	.530
		June 1	1.44	38.1	.135
		June 16	1.35	6.6	.023

It should be stated that at the time the measurements, given in Table IV, were made, only outlet ditches had been provided. The area was mostly in timber and few field ditches had been constructed. It will be noted that the highest rate of run-off recorded was .6 inch, obtained at stations Nos. 1 and 8. These, however, were small areas. For areas of 20,780 acres and 12,280 acres, respectively, discharges of .33 inch and .31 inch were obtained for a rainfall of about 2.2 inches.

It is recognized that the rates of rainfall given in Table IV are by no means maximum. However, it is believed that for a 24-hour rainfall of 4 inches, Back Swamp (20,780 acres) will be satisfactorily served by the present ditch which is based upon a ½-inch run-off coefficient, and that for Jacob Swamp (12,280 acres) a ¾-inch coefficient is sufficient. It is believed that these figures would apply to similar areas in the Coastal Plain of Georgia.

TYPICAL DRAINAGE PROJECTS IN THE COASTAL PLAIN

Following are synopses of two reports on projected drainage districts in the Coastal Plain section, as prepared by J. V. Phillips and

submitted by the U. S. Department of Agriculture to the officers of the respective drainage districts.

BAXLEY DRAINAGE DISTRICT

(Appling County.)

This project is typical of the flat woods section of the Coastal Plain. The district, covering some 36 square miles, is located in the northwestern part of Appling County, on the flat divide separating the Altamaha River watershed on the north from that of the Satilla River on the south. Ten Mile Creek bounds it on the north, and Blackwater and Sweetwater creeks on the south and west (see fig. 4); the respective portions of the district drain to these streams. The town of Baxley is situated near the center of the district.

The topography of this area can aptly be compared with an inverted saucer, the entire interior portion being flat and the land sloping off at a constantly increasing rate to the natural drainage channels which bound it. The area is covered by a complex system of bays, cypress ponds, and narrow ravines. Conforming to the general topography of the land, the drainage channels usually are flat and ill-defined in the interior, but at the rim of the area become well-defined ravines with considerable fall. The predominating soil is a sand or sandy loam, some sections having a clay subsoil.

Only about 10 per cent of the district had been cleared for cultivation at the time the survey was made (1913). Long-leaf pine is found on the dryer portions, with an undergrowth of wire grass and fan palmetto. In the low places cypress, gum, and bay trees flourish. Little undergrowth occurs in the bays and ponds, but in the ravine-like outlets heavy growths of bay bushes, gallberry, and briers are found.

The drainage problem presented in this project is mainly the establishing of effective connection between the well-defined channels at the rim of the area, and the many detached or poorly-connected bays and ponds on the flat area. These latter are connected only by narrow, flat depressions which act only as overflow channels during unu-

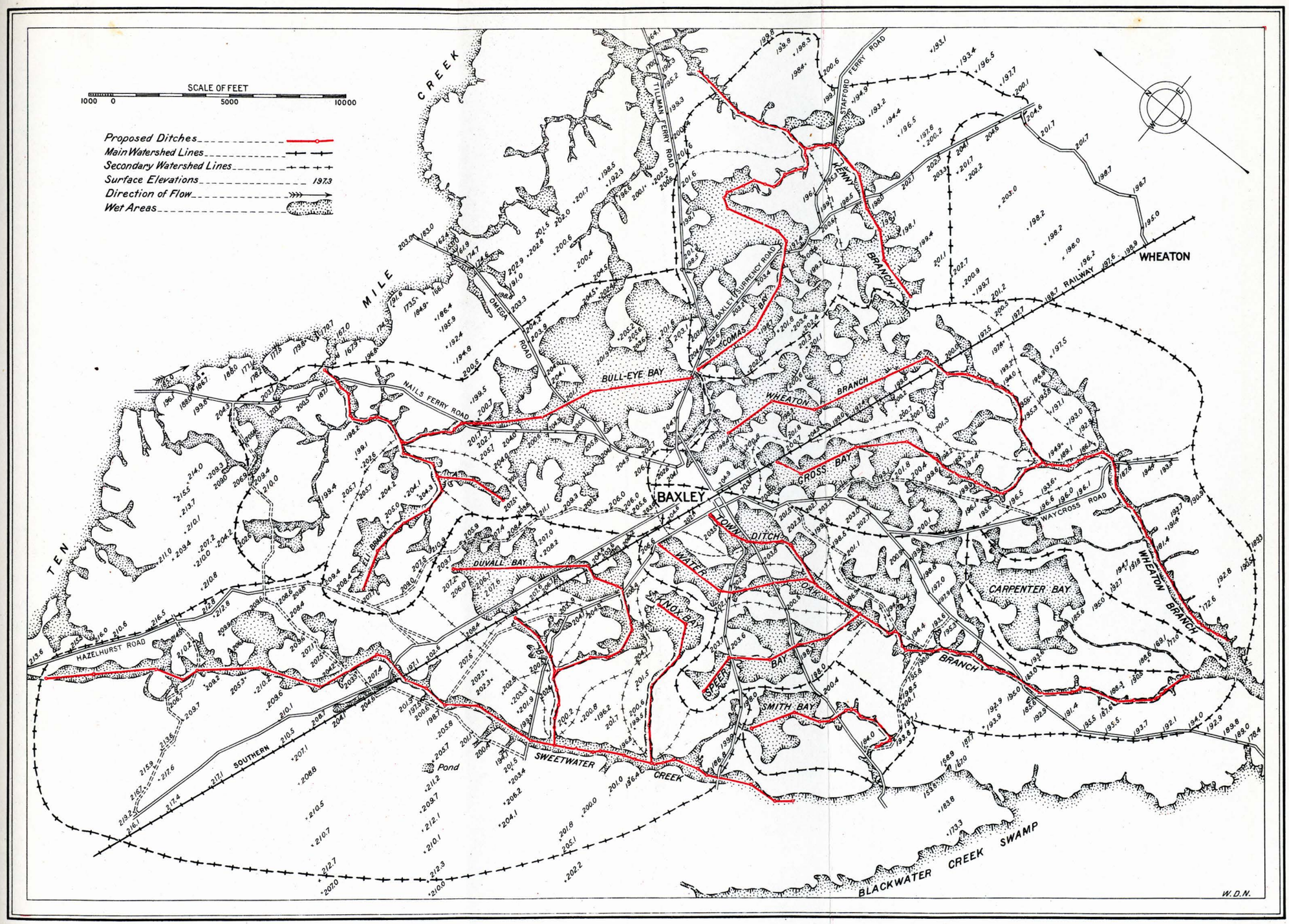


Fig. 4. Baxley Drainage District, Appling County, Georgia

sually wet periods. Under present conditions the greater part of the rainfall must be taken up by plant growth or disappear by direct evaporation. Meantime this water stands in the depressions and by seepage damages seriously the adjoining slightly higher lands. These new channels need not be large, but they must be deep enough to afford proper soil drainage, especially to the higher portions between the bays and ponds.

Under an agreement with the Baxley Drainage District, the U. S. Department of Agriculture, in the fall of 1913 caused a drainage survey to be made of the area under discussion. Plans were worked out for providing drainage on the lines mentioned above. These plans contemplate the collecting of the drainage of the northern part of the district into two main channels, with branches, these to empty into Ten Mile Creek. The drainage to the south is to be collected into four main channels discharging into Blackwater Creek. These proposed ditches are shown in figure 4.

No definite run-off rate was considered in the design of these ditches. After insuring a sufficient depth, the design was governed chiefly by the requirements of construction and economical maintenance. Nevertheless each of the ditches recommended has ample capacity to remove ¾-inch of water from its watershed in 24 hours. It will be noted from the map that the proposed ditches are not continued until they meet well-defined and deep outlets, but that they end abruptly in the low land bordering the respective main outlet streams. Such procedure was permissible in this case as slight overflow at the lower ends of these ditches was not objectionable.

Without detailing the dimensions and other elements of the several ditches, it will be stated that 4-foot bottoms were recommended throughout, except for the lower ends of Sweetwater Creek and Wheaton Branch for which 12 and 8-foot bottoms, respectively, were suggested. A minimum depth of 6 feet was considered necessary in the flat land to give the required degree of drainage. Owing to the flatness of the ground a fall of about 1 foot per mile was the most

that could well be obtained in the upper portions of some of the ditches. On nearly all a fall of at least 10 feet per mile was obtainable for the lower parts.

The total cost of construction, including clearing of right-of-way, bridges, and contingencies, was estimated at $76,357. The area to be benefited was estimated at 21,514 acres, making the cost per acre $3.55.

LITTLE SATILLA RIVER AND BIG RED CAP SWAMP

(Glynn and Camden Counties.)

The Little Satilla River forms the boundary between Glynn and Camden counties. Big Red Cap Swamp is a tributary of the river. It enters the latter near the edge of the salt marsh and extends in a general westerly direction, while the river swamp extends to the northwest. Both swamps originate in the sand-hill region which comprises about one-third of the total watershed area of 32,300 acres. Of this latter Little Satilla River drains 18,800 acres and Big Red Cap Swamp 13,500 acres. The sand hills within the watershed attain an elevation of about 60 feet above sea level. From the foot of these hills the slope is quite steep down to the broad area of flat lands which adjoin the tidal land and which lie at an elevation of from 8 to 20 feet above sea level. The swamps, below the foot of the sand hills, are but slightly above sea level and have very little slope toward tide water.

The drainage channels through all of the large swamps and their tributaries are poorly defined. While each swamp contains a "run," these are of negligible value as watercourses. Clearly-defined channels are found only after tidal waters are reached, near the outlets of the two main swamps. In seasons of flood the entire swamps are covered with water which flows slowly through the thick undergrowth and swamp vegetation to the outlet.

In February, 1912, at the request of landowners in this section, a representative of the U. S. Department of Agriculture made a preliminary drainage examination of the swamps, and later in the same year made a detailed survey of the two swamps and their tributaries. A

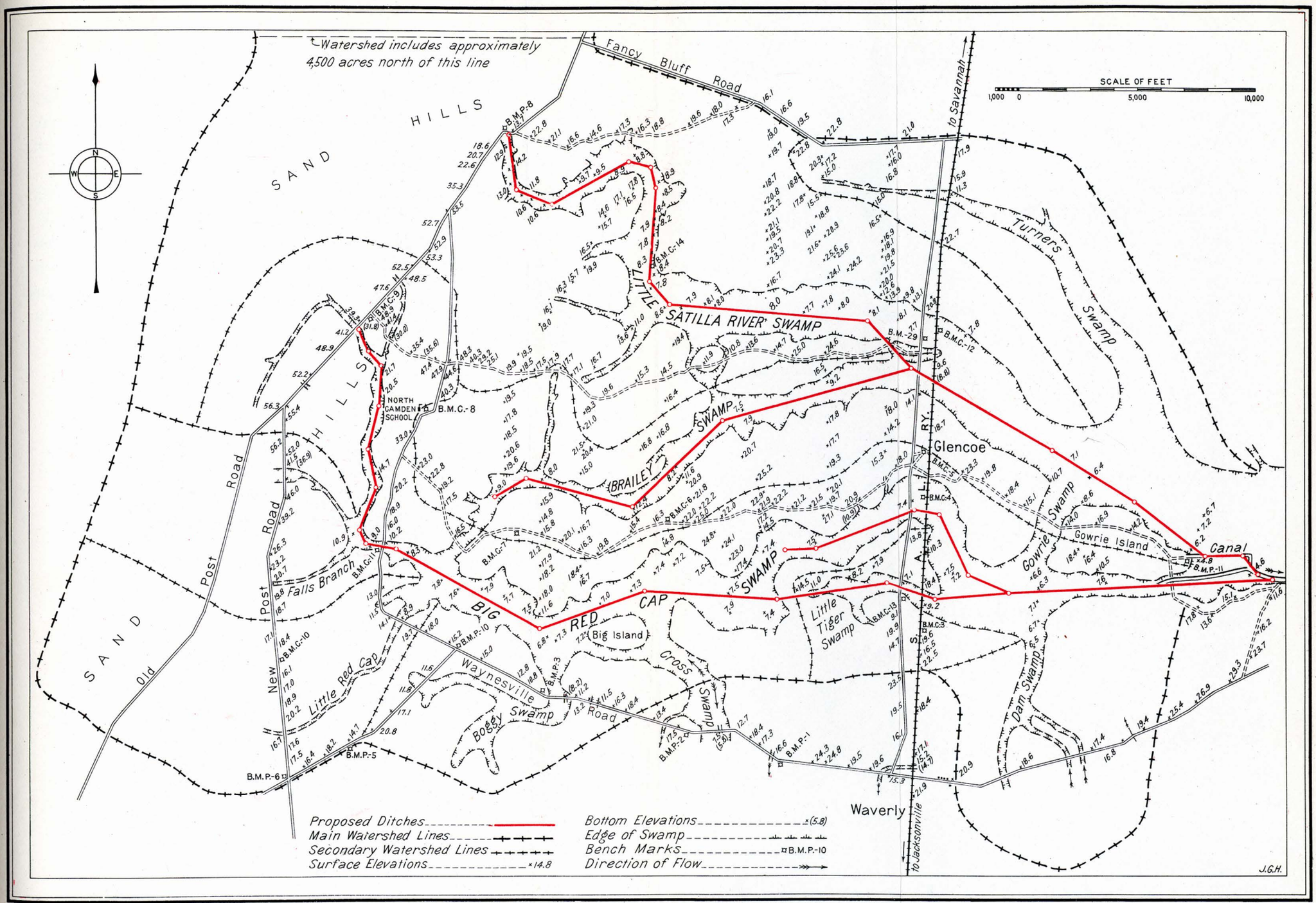


Fig. 5. Big Red Gap, Little Satilla River, and Brailey Swamps, Camden and Glynn Counties, Georgia

drainage channel was planned for each of the two main swamps, one for Brailey Swamp, a connecting area, and one for a short loop in Big Red Cap, near the S. A. L. Ry. These ditches are shown in figure 5.

Of the 8,400 acres of drainage area at the head of the Little Satilla ditch, 7,200 acres consist of sand hills. For this area a run-off rate of ½-inch in 24 hours was considered sufficient as a basis of ditch design. For the remainder of the watershed a run-off rate of ¾-inch was assumed. In establishing the flow line the outlet elevation was assumed at high tide. The elements of the two main ditches are given in the following tables:

Data for Little Satilla Ditch.

Stations		Length	Average cut	Bottom width	Bottom slope
From	To				
		Feet	Feet	Feet	Feet per mile
0	70	7,000	5.2	16	4.52
70	135+70	6,570	5.8	30	0.97
135+70	233+20	9,750	7.2	30	0.97
233+20	260+80	2,760	9.3	30	0.97
260+80	330	6,920	8.9	35	0.97
330	371+40	4,140	9.1	44	0.97
371+40	435+20	6,380	9.0	44	0.97

Data for Big Red Cap Ditch.

Stations		Length	Average cut	Bottom width	Bottom slope
From	To				
		Feet	Feet	Feet	Feet per mile
0	26	2,600	3.6	4	24.08
26	75	4,900	5.0	4	9.13
75	96+30	2,130	5.4	5	9.13
96+30	105	870	5.8	5	9.13
105	135	3,000	5.8	30	0.75
135	190	5,500	5.8	36	0.75
190	265+40	7,540	6.8	40	0.75
265+40	384	11,860	9.1	40	0.75
384	400	1,600	9.0	40	0.75
400	497+20	9,720	8.4	40	0.75

For Brailey Swamp a 16-foot ditch was planned, and for Big Red Cap lateral, 6,300 feet of 4-foot ditch and 5,340 feet of 16-foot ditch.

The total cost of the work, including excavation (1,091,000 cubic yards), clearing right-of-way, bridges, and incidental expenses, was estimated at $109,509. On the basis of 22,500 acres benefited this is equivalent to $4.87 per acre.

WET AND OVERFLOWED LAND IN GEORGIA

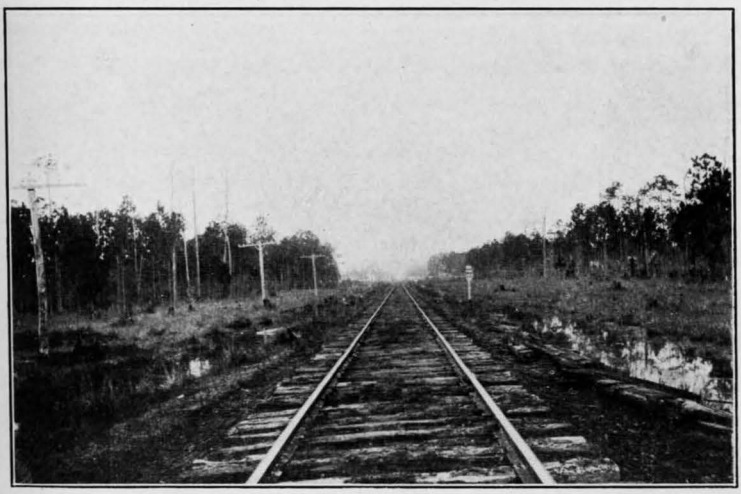
By J. E. Brantley and J. V. Phillips.

INTRODUCTION

The data respecting drainage conditions in each of the counties of Georgia were collected by J. E. Brantley, Assistant State Geologist of Georgia, and J. V. Phillips, who in April and May, 1916, traversed the State by automobile. The information was obtained by making such observations as were practicable from the highways, by discussing the conditions of the stream bottoms and other classes of wet lands with the county officials and other residents who might be familiar with them, and from soil maps published by the United States Bureau of Soils. All but ten of the counties of the State were visited and five of these have been surveyed by the Bureau of Soils from whose maps the desired information was secured. The estimates concerning the remaining five were made by comparison with the contiguous counties.

An attempt was made to classify the different types of land needing drainage and to give the acreage along each stream, if of importance, or the section of the county in which the wet land occurs, if of considerable area. This scheme was followed in the majority of cases, but not invariably. It was rather difficult to get reliable information regarding that class of wet land needing underdrainage, hence it is given in only a few instances which are taken mainly from the soil maps. Finally, the percentage of land in each county needing drainage is given. A summary shows the total area of each type of wet land in the State and the total of all classes.

A. TYPICAL COASTAL PLAIN DRAINAGE DITCH (BUTTS COUNTY). THIS DITCH WAS CONSTRUCTED WITH A DRY-LAND DIPPER DREDGE



B. VIEW IN THE PROPOSED BAXLEY DRAINAGE DISTRICT, APPLING COUNTY, GEORGIA

In different sections of the State there are prevailing types of wet lands contingent upon several conditions among which are topography, geology, agriculture, and the percentage of cleared land. These conditions will be taken up very briefly in the paragraphs to follow.

The Cumberland Plateau and the Appalachian Valley.—The plateau (see figure 1) is made up of narrow, elongated, flat-topped mountains which strike northeast and southwest. These flat, table lands are elevated 700 to 1,400 feet above the narrow valleys between and 1,500 to 2,300 feet above sea level. The ridges have precipitous sides on the east, but more gentle slopes on the west. Sandstones, shale, and limestones are the rocks which make up the mass of the mountains. Owing to the topographic features of this area, a comparatively small percentage of the land is subject to cultivation, though practically all of the land of the valleys is cleared and utilized for agricultural purposes. The percentage of run-off water is comparatively high, and good stream banks and good fall are necessary to carry off the waters without flooding the contiguous land. In the main, these conditions are met very satisfactorily, but there are stream bottoms that are swampy and frequently overflowed because of insufficient channel capacity. Some of the flat land of the district is derivative of limestone and shales which form a close, tight soil. This type of land is frequently in need of underdrainage.

The valley district is similar in many respects to the plateau region. The long narrow ridges are present but are not so high nor so precipitous as farther west, also the valleys between are considerably wider. These valleys are usually rolling and practically all cultivated. The run-off is not so rapid as in the plateau region nor is the fall of the stream beds so steep, which together make the conditions very similar in the two sections, that is, the stream-flooded and swamp lands usually are very narrow or entirely absent. The soil is mainly derivative of limestones and shales which, because of their fineness and compactness, drain poorly when the land is flat. Considerable areas in the valley district are badly in need of underdrainage.

The Appalachian Mountains.—This region is characterized by a mountainous to hilly topography with narrow valleys between. In the more rugged sections the valleys are exceptionally narrow and the streams have deep banks and good fall, thus eliminating the possibility of the bottom land being flooded except in unusual instances. Along the southern border of this district where the country is less rugged and more land under cultivation the stream channels are not in such good condition because of less fall and the fact that most of the stream beds are built up with soil from the drained territory which is cleared and cultivated. On the whole, the bottom land of this section may be said to be in good condition. The soil is derived from a large variety of rocks, but on the whole has a clay base and therefore drains rather poorly in flat places. This type of land would be benefited by underdrainage.

The Piedmont Plateau.—This district is hilly to rolling. A very large percentage of the Piedmont is cleared and cultivated and because of the more or less steep slopes of the hillsides erodes badly when not properly terraced and cultivated. For this reason, the stream beds are filling rapidly or are filled with soil from the contiguous hill slopes. In most cases the stream bottom land is rather narrow and therefore the percentage of swamp and overflowed land in the respective counties is comparatively small. The soil is derived from numerous types of rocks, but on the whole has a clay base which is, however, very permeable. In flat or gently sloping places where there is a tight clay subsoil underdrainage is nearly always needed.

The Coastal Plain.—In the northern or plateau section the streams generally have better banks than in the Piedmont. They have not been filled to the extent of the streams in the more rapidly eroded country, but since the streams are fewer in number in the Coastal Plain and consequently drain a larger proportion of territory the flood conditions are quite as bad. Also, the bottoms are wider in the less rolling country on account of less fall to the stream beds and

the greater ease with which the streams are able to cut into the banks and hillsides, because of the absence of hard or consolidated material. The soil of this section of the State is derived from unconsolidated sands and clays and limestones. The base is generally sand. For this reason the soils are very pulverulent and drain well under ordinary conditions. The value of the creek bottom land for agricultural purposes after being drained is controlled by the contiguous territory from which the soil was derived; thus, in a country where the upland soil is good the bottom land is generally excellent. This is due to the fact that the light, finely divided particles in a soil contain the most of the plant food and are most easily washed into the low places. In a very sandy country the swamp land is usually of poor quality.

A large part of the flat woods section is very flat to slightly sloping towards the main streams. The southern portion of the counties from Echols west to the Flint River is rolling and in some places rather hilly. The streams in this section in the majority of cases have practically no bottom land along their courses, their banks extending directly up to the level of the flat land which is only 10 to 20 feet above the stream beds. There are numerous exceptions to this, especially along the larger streams, but the soil is mostly of rather poor quality because of its sandy nature. The slope to most of the land is so little that during periods of wet weather water will stand in stump holes, wagon ruts, etc., over large areas. This type of land is designated as "Wet Grazing Land" in the following classification. Numerous cypress ponds and wet depressions dot the entire country. These are wet the year around except during very dry seasons. The soil is sandy with frequently a clay sand subsoil. Along the coast there are large areas of tidal marsh, both fresh and salt water. This is an excellent class of soil and yields large crops when properly protected by levees.

CLASSIFICATION OF LANDS NEEDING DRAINAGE, BY COUNTIES

APPLING COUNTY

Area: 583 square miles; 373,120 acres.

Swamp land	10,000 acres
Periodically overflowed or meadow land	25,000 "
Wet grazing land	150,000 "
Total	185,000 acres

Percentage of county needing drainage 49.7%

BACON COUNTY

Included in Appling, Pierce, and Ware counties, from which it was created.

BAKER COUNTY

Area: 386 square miles; 234,240 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Flint River	60	pockets	20,000
Ichawaynochaway Creek	35	300	10,500
Kiokee Creek	15	400	6,000
Coolewakee Creek	12	300	3,600
Other streams	..	...	4,000
Ponds	..	...	4,000
			48,100
Wet grazing land, southern part of county	.....	.....	25,000
Total needing drainage	.....	.....	73,100

Percentage of county needing drainage 31.2%

BALDWIN COUNTY

Area: 307 square miles; 160,000 acres.

Periodically overflowed and permanent swamp land	6,000 acres
Land needing underdrainage	3,000 acres
Total	9,000 acres

Percentage of county needing drainage 5.6%

BANKS COUNTY

Area: 216 square miles; 138,240 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Middle River, lower	2	160	320
Hooper Creek	4	70	280
Tributaries of Middle River	8	50	400
Hudson River, lower	10	125	1,250
Webbs Creek	8	...	300
Grove River	11	90	990
Hickory Level Creek	10	120	1,200
Beaver Dam Creek	5	100	500
Nails Creek	6	80	480
Alston Creek	3	50	150
Caulaus Creek	6	50	300
Other streams	..	...	1,500
Grove Level Drainage District	.....	.....	1,075
Total	.....	.....	8,745

Percentage of county needing drainage 6.3%

BARROW COUNTY

Included in Jackson, Gwinnett, and Walton counties, from which counties it was created.

BARTOW COUNTY

Area: 485 square miles; 310,400 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Boston Creek	5	90	450
Pumpkin Vine Creek	8	100	800
Two Run Creek	8	60	480
Pettit Creek	12	80	960
Total	.....	.....	2,690

Percentage of county needing drainage 0.8%

All other streams in county have good banks and are not subject to overflow.

Considerable acreage in valley land needs underdrainage.

BEN HILL COUNTY

Area: 256 square miles; 163,840 acres.

Swamp land	4,800 acres
Periodically swamp land	42,112 "
Total	46,912 acres

Percentage of county needing drainage 28.6%

BERRIEN COUNTY

Area: 695 square miles; 445,341 acres.

Periodically overflowed and permanent swamp land:

Along streams	10,000 acres
Ponds and bays	25,000 "
Wet grazing land	130,000 "
Total	165,000 acres

Percentage needing drainage 37%

A considerable portion of this wet land is of doubtful value because of the clean sand soil.

BIBB COUNTY

Area: 254 square miles; 162,560 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Rocky Creek	17	100	1,700
Echeconee Creek	17	120	2,040
Tobesofkee Creek	24	300	7,200
Ocmulgee River	24	1,000	24,000
Walnut Creek	3	80	240
Other streams	..	...	1,000
Total	.....	.....	36,180

Percentage of county needing drainage 22%

BLECKLEY COUNTY

Area: 200 square miles; 128,000 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Rocky Creek	5	70	350
Crooked Creek	16	90	1,440
Buckhorn Creek	10	70	700
Green Swamp Creek	14	...	2,240
Ocmulgee River	4½	700	3,150
Limestone Creek	5	70	350
Jordan Creek	12	70	840
Shellstone Creek	7	120	840
South Shellstone Creek	9	110	990
Evergreen Creek	10	70	700
Other streams	..	...	1,000
Total	.....	.....	12,600

Percentage needing drainage 10%

Percentage of county needing underdrainage 6%

Total percentage of county needing drainage 16%

BROOKS COUNTY

Area: 463 square miles; 296,320 acres.

Swamp land	3,000	acres
Periodically overflowed or meadow land	38,000	"
Swampy depressions	30,000	"
Land needing underdrainage	5,000	"
Total	76,000	acres

Percentage of county needing drainage 25%

BRYAN COUNTY

Area: 427 square miles; 273,280 acres.

Swamp land	25,000	acres
Periodically overflowed land	10,000	"
Wet grazing land	20,000	"
Tidal marsh	13,000	"
Total	68,000	acres

Percentage of county needing drainage 25%

BULLOCH COUNTY

Area: 930 square miles; 595,200 acres.

Swamp land	93,504	acres
Periodically overflowed or meadow land	640	"
Periodically swamp land	56,576	"
Wet grazing land	4,864	"
Land needing underdrainage	24,192	"
Total	179,776	acres

Percentage of county needing drainage 30%

BURKE COUNTY

Area: 883 square miles; 565,120 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Savannah River	30	500	15,000
Briar Creek	50	400	20,000
Ogeechee River	13	600	7,800
McBean Creek	20	240	4,800
Boggy Gut Creek	16	160	2,560
Newberry Creek	12	110	1,320
Beaver Dam Creek	7	70	490
Jobley Creek	5	70	350
Sweetwater Creek	10	90	900
Brushy Creek	10	240	2,400
Breman Creek	13	70	910
McIntosh Creek	9	50	450
Tributaries of Briar Creek	40	50	2,000
Ponds, N. E. part of county (5 to 100 acres each)	..	...	3,000
			61,980
Wet grazing land	.....	.....	51,200
Total needing drainage	.....	.....	113,180

Percentage of county needing drainage 20%

BUTTS COUNTY

Area: 179 square miles; 114,560 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Yellow Water Creek	15	100	1,500
Wolf Creek	18	100	1,800
Sandy Creek Little Sandy Creek	23	80	1,840
Cabin Creek	7	80	560
Towaliga River	7	80	560
Rocky Creek	5	80	400
			6,660
Land needing underdrainage	.....	.....	1,500
Total needing drainage	.....	.....	8,160

Percentage of county needing drainage 7%

CALHOUN COUNTY

Area: 276 square miles; 176,640 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Chickasawhatchee Creek	16	240	3,840
Spring Creek	6	240	1,440
Ichawaynochaway Creek	13	480	6,240
Pachitta Creek	20	480	9,600
Boggy Creke	4	70	280
Spring Creek (W. County line)	3	100	300
Other streams	50	70	3,500
Ponds	..	...	2,000
			27,200
Land needing underdrainage	.....	2,000 to	3,000
Total needing drainage	.....	.....	30,200

Percentage of county needing drainage 17%

CAMDEN COUNTY

Area: 718 square miles; 459,520 acres.

Swamp land	52,000 acres
Periodically swampy land	21,000 "
Wet grazing land	90,000 "
Tidal marsh	114,000 "
Total	277,000 acres

Percentage of county needing drainage 60%

CAMPBELL COUNTY

Area: 205 square miles; 131,200 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Camp Creek	8	90	720
Deep Creek	7	70	490
Line Creek	5	80	400
Pea Creek	5	75	375
Bear Creek	9	210	1,890
South Fork Bear Creek	5	60	300
North Fork Bear Creek	3	70	210
Turkey Creek	3	110	330
White Oak Creek	6	160	960
Whitewater Creek	3	70	210
Morning Creek	8	90	720
Lesser streams	..	...	1,000
Total	.....	.....	7,605

Percentage of county needing drainage 5.8%

CANDLER COUNTY

Included in Emanuel and Bulloch counties, from which counties it was created.

CARROLL COUNTY

Area: 486 square miles; 311,040 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Tallapoosa River:			
Upper	25	160	4,000
Lower	20	90	1,800
Big Indian Creek	22	80	1,760
Turkey Creek	15	60	900
Buck Creek	20	125	2,500
Buffalo Creek	17	160	2,720
Yellow Dirt Creek	15	90	1,350
Whooping Creek	16	80	1,280
Snake Creek	30	75	2,250
Wolf Creek	12	45	540
Other streams	..	...	2,000
Total	.....	.....	21,100

Percentage of county needing drainage 6.8%

CATOOSA COUNTY

Area: 171 square miles; 109,440 acres.

No information was gathered in Catoosa County regarding the acreage needing drainage, but since the topography and geology are the same as Walker County, the conditions are probably very near the same, which would give:

Periodically overflowed and meadow land ..... 3,800 acres
Wet grazing land ..... 1,000 "
Total ..... 4,800 acres

Percentage needing drainage 4.3%

CHARLTON COUNTY

Area: 1,063 square miles; 680,320 acres.

Periodically overflowed and permanent swamp land:

Okefenokee and Little Okefenokee swamps	182,810 acres
Cypress ponds	40,000 "
Wet grazing lands	300,000 "
Total	522,810 acres

Percentage of land needing drainage 77%

CHATHAM COUNTY

Area: 427 square miles; 273,280 acres.

Swamp land	39,104 acres
Periodically swamp land	50,669 "
Wet grazing land	7,552 "
Tidal marsh land	79,296 "
Total	176,621 acres

Percentage of county needing drainage 64.6%

CHATTAHOOCHEE COUNTY

Area: 231 square miles; 147,840 acres.

Periodically overflowed and permanent swamp land:

Along streams ..... 7,500 acres

Percentage of county needing drainage 5%

Estimates made from observations and comparison with contiguous counties.

CHATTOOGA COUNTY

Area: 312 square miles; 199,680 acres.

Land needing underdrainage ..... 2,240 acres

Percentage needing drainage 1.1%

CHEROKEE COUNTY

Area: 434 square miles; 277,760 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Etowah River	45	80	3,600
Little River (County line)	38	40	1,520
Blanket Creek	5	40	200
Mill Creek	9	60	540
Town Creek	7	50	350
Shoal Creek	12	50	600
Sharp Mountain Creek	7	50	350
Sitting Down Creek	5	75	375
Noonday Creek	3	75	225
Hickory Log Creek	4	80	320
Total	.....	.....	8,080

Percentage of county needing drainage 2.6%

CLARKE COUNTY

Area: 159 square miles; 101,760 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Shoal Creek	7	86	602
Beaver Dam Creek	2	75	150
Sandy Creek	5	150	750
Oconee River, upper	5	200	1,000
Oconee River, lower	5	40	200
West Oconee River	8	25	200
Long Creek	4	62½	250
McNutts Creek (Co. line)	5	30	150
Total	.....	.....	3,302

Percentage of county needing drainage 3.3%

CLAY COUNTY

Area: 216 square miles; 138,240 acres.

Permanent swamp land	2,600 acres
Periodically overflowed land	12,400 "
Periodically swamp land	5,000 "
Total	20,000 acres

Percentage of county needing drainage 14.5%

CLAYTON COUNTY

Area: 142 square miles; 90,880 acres.

Permanent swamp land	4,500 acres
Periodically overflowed land	3,500 "
Total	8,000 acres

Percentage of county needing drainage 8.9%

CLINCH COUNTY

Area: 1,077 square miles; 689,280 acres.

Permanent swamp land	20,000 acres
Periodically overflowed land	50,000 "
Wet grazing land	445,000 "
Total	515,000 acres

Percentage of county needing drainage 75%

COBB COUNTY

Area: 341 square miles; 218,240 acres.

Periodically overflowed or meadow land ..... 30,280 acres

Percentage of county needing drainage 13.9%

COFFEE COUNTY

Area: 960 square miles; 614,400 acres.

Periodically overflowed and permanent swamp land:

Cypress ponds	30,000 acres
Along streams	10,000 "
Wet grazing land	185,000 "
Total	225,000 acres

Percentage of county needing drainage 37%

COLQUITT COUNTY

Area: 544 square miles; 348,160 acres.

Swamp land	8,256 acres
Periodically overflowed or meadow land	2,240 "
Periodically swamp land	95,808 "
Total needing drainage	106,304 acres

Percentage of county needing drainage 30.5%

COLUMBIA COUNTY

Area: 313 square miles; 200,320 acres.

Swamp land	1,664 acres
Periodically overflowed or meadow land	11,456 "
Total	13,120 acres

Percentage of county needing drainage 6.5%

COWETA COUNTY

Area: 443 square miles; 283,520 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Chattahoochee River	13	80	1,040
Big Skenegoa Creek	6	80	480
Little Skenegoa Creek	3	50	150
Crooked Creek	13	80	1,040
Cedar Creek	12	90	1,080
Line Creek (County line)	22	50	1,100
Shoal Creek	11	70	770
Beaver Dam Creek	4	40	160
Keg Creek	10	55	550
Gardner Creek	3	40	120
Pigeon Creek	7	50	350
White Oak Creek	18	120	2,160
Yellow Jacket Creek	4	70	280
New River	10	40	400
Morgan Creek, lower	4	70	280
Johnson Creek	10	50	500
Reedy Creek	10	50	500
Total	.....	.....	10,960

Percentage of county needing drainage 3.9%

CRAWFORD COUNTY

Area: 334 square miles; 213,760 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Flint River	30	700	21,000
Spring Creek and tributaries	45	300	13,500
Echeconee Creek	25	120	3,000
Little Echeconee Creek	7	140	980
Other streams	..	...	2,000
Total	.....	.....	40,480

Percentage of county needing drainage 19%

Considerable acreage needs underdrainage.

CRISP COUNTY

Area: 285 square miles; 182,400 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Limestone Creek	4	90	360
Gum Creek	18	90	1,620
Cedar Creek	10	90	900
Flint River, upper 5 miles	..	...	1,500
Swamp land northern part of county	..	...	2,500
Other streams	..	...	2,000
Ponds and depressions	..	...	3,000
Total	.....	.....	11,880

Percentage needing drainage 6.5%

There are probably 10,000 acres of wet grazing land and land needing underdrainage, making

Total percentage needing drainage all classes 12%

DADE COUNTY

Area: 188 square miles; 120,320 acres.

No information was gathered in Dade County regarding the acreage needing drainage, but since the topographic and geologic features are similar to those of Walker and Chattooga counties an average of the conditions in these two would give a very close approximation of the area needing drainage in Dade County. The result is:

Periodically overflowed or meadow	3,000 acres
Wet grazing land	1,000 "
Needing underdrainage	1,200 "
Total	5,200 acres
Percentage of county needing drainage	4.3%

DAWSON COUNTY

Area: 209 square miles; 133,760 acres.

Permanent swamp land	1,200 acres
Periodically overflowed land	2,600 "
Total	3,800 acres
Percentage of county needing drainage	3%

DECATUR COUNTY

Area: 766 square miles; 490,240 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Chattahoochee River	40	300(?)	12,000
Flint River (S. of Bainbridge)	28	in pockets	7,500
Spring Creek	30	in pockets	5,000
East of line drawn north and south through Bainbridge	..	...	9,000
Ponds and wet depressions	..	...	10,000
Total	.....	.....	43,500

Wet grazing land:	
West of Flint River	100,000
Area needing underdrainage:	
East of Flint River	25,000
Grand total	168,500
Percentage needing drainage	34.4%

DEKALB COUNTY

Area: 272 square miles; 174,080 acres.

Periodically overflowed or meadow land .....12,224 acres

Percentage needing drainage 7%

DODGE COUNTY

Area: 489 square miles; 313,088 acres.

Periodically overflowed or meadow land .....19,584 acres

Percentage of county needing drainage 6.2%

DOOLY COUNTY

Area: 400 square miles; 256,000 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Flint River	15	600	9,000
Hogcrawl Creek	16	50	800
Turkey Creek	18	100	1,800
Pennehatchee Creek	10	100	1,000
Little Reedy Creek	5	60	300
Ground Creek	10	90	900
Camp Creek	15	100	1,500
South Prong Creek	10	80	800
Cedar Creek	10	90	900
Other streams	..	...	2,000
Ponds	..	...	2,000
Total	.....	.....	21,000

Percentage of county needing drainage 8.2%

DOUGHERTY COUNTY

Area: 343 square miles; 219,520 acres.

Swamp land	20,480 acres
Periodically overflowed or meadow land	2,880 "
Periodically swamp land	31,760 "
Land needing underdrainage	320 "
Total	55,440 acres

Percentage of county needing drainage 25.2%

DOUGLAS COUNTY

Area: 212 square miles; 135,680 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Chattahoochee River	21	40	840
Annawaka Creek	15	55	825
Stoddard Creek	10	55	550
Other streams	..	...	1,000
Total	.....	.....	3,215

Percentage of county needing drainage 2.4%

Most of streams of county are in good condition.

EARLY COUNTY

Area: 503 square miles; 321,920 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Chattahoochee River	34	300	10,200
Sowhatchee Creek	17	70	1,190
Spring Creek	28	200	5,600
Other streams	100	...	5,000
Ponds	..	...	2,000
Wet grazing land:			23,990
26th District	.....	.....	8,000
6th District	.....	.....	6,000
28th District	.....	.....	8,000
Southern part of county	.....	.....	30,000
Total needing drainage	.....	.....	75,990

Percentage of county needing drainage 24%

ECHOLS COUNTY

Area: 365 square miles; 233,600 acres.

Periodically overflowed and permanent swamp land:

Along streams	10,000 acres
Ponds and wet depressions	30,000 "
Wet grazing land	130,000 "
Total	170,000 acres

Percentage of county needing drainage 73%

EFFINGHAM COUNTY

Area: 419 square miles; 268,160 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Ebenezer Creek:			
Above mouth, first	2½	600	1,500
Above mouth, second	2½	300	750
Upper part	27	160	4,320
Cowpen Branch	7	60	420
Turkey Branch	10	60	600
Ogeechee River	31	300	9,300
Savannah River	30	600	18,000
Total	.....	.....	34,890

Wet grazing land 40%

Percentage periodically overflowed and needing drainage 13%

Total percentage needing drainage 53%

ELBERT COUNTY

Area: 364 square miles; 232,960 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Savannah River	27	in pockets	1,350
Pickens Creek	6	50	300
Vans Creek	8	50	400
Falling Creek	16	100	1,600
Dry Fork Creek	6	50	300
Doves Creek	12	55	660
Butler Creek	9	50	450
Other streams	160	30	4,800
Total	.....	.....	9,860

Percentage of county needing drainage 4.2%

EMANUEL COUNTY

Area: 776 square miles; 496,640 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Ogeechee River	6	640	3,840
Daniels Creek	9	90	810
Rocky Creek	9	40	360
Long Creek	12	110	1,320
Deep Creek	9	70	630
Fifteen Mile Creek	16	90	1,440
Sams Creek	5	40	200
Canoochee Creek	30	150	4,500
Little Canoochee Creek	13	60	780
North Prong Little Canoochee Creek	9	60	540
Ohoopee River	28	260	7,280
Little Ohoopee River	20	180	3,600
Yamgrandee Creek	15	70	1,050
Crooked Creek	13	70	910
Pendleton Creek	24	70	1,680
Flat Creek	6	40	240
Mulepen Creek	7	70	490
Sardine Creek	9	70	630
Total	.....	.....	30,300

Percentage of county in swamp land 6.1%

Percentage of county in wet grazing land 30.0%

Total percentage of county needing drainage 36.1%

EVANS COUNTY

Included in Bulloch and Tattnall counties, from which counties it was created.

FANNIN COUNTY

Area: 390 square miles; 249,600 acres.

Practically all bottom land along streams is cultivated and is rarely, if ever, overflowed. Probably 2,500 acres, 1,250 acres underdrainage; 1,250 acres overflowed lands; or 1% of the entire county is in need of drainage or would be benefited thereby.

FAYETTE COUNTY

Area: 215 square miles; 137,600 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Morning Creek	13	100	1,300
Whitewater Creek	21	100	2,100
" " tributaries	15	50	750
Flat Creek	6	60	360
Line Creek	25	100	2,500
Flint River (tributaries of)	6	60	360
Total			7,370
Land needing underdrainage		1,500 to	2,000
Total			9,370

Percentage of county needing drainage 68%

FLOYD COUNTY

Area: 506 square miles; 323,840 acres.

Practically all streams of county are in good condition, rarely overflowing their banks. There are north of Cave Springs about 4,000 acres of flatwoods land needing underdrainage. North and west of Rome there are some 5,500 acres of the same class of land.

Total needing underdrainage .....9,500 acres

Percentage of county needing underdrainage.....3.2%

FORSYTH COUNTY

Area: 252 square miles; 161,280 acres.

Permanent swamp land	3,000 acres
Periodically overflowed land	4,000 "
Total	7,000 acres

Percentage of county needing drainage 4.4%

FRANKLIN COUNTY

Area: 270 square miles; 172,800 acres.

Periodically overflowed or meadow land .....3,576 acres

Percentage of county needing drainage 2.1%

FULTON COUNTY

Area: 174 square miles; 111,360 acres.

Permanent swamp land	1,500 acres
Periodically overflowed land	4,000 "
Total	5,500 acres

Percentage of county needing drainage 5%

GILMER COUNTY

Area: 450 square miles; 288,000 acres.

All streams in county have good banks and narrow bottoms. All are cultivated and rarely overflow.

GLASCOCK COUNTY

Area: 95 square miles; 60,800 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Ogeechee River (Co. line)	14	..	1,500
Rocky Comfort Creek	18	..	1,800
Jones Creek	12	..	1,000
Other streams	..	..	1,800
Total	.....	.....	6,100

Percentage of county needing drainage 10%

Estimates made from observation and comparison with other counties in which the conditions are similar.

GLYNN COUNTY

Area: 468 square miles; 299,520 acres.

Periodically overflowed or meadow land	7,564 acres
Swamp land	33,792 "
Periodically swamp land	96,832 "
Tidal marsh land	68,544 "
Land needing underdrainage	768 "
Land in county needing drainage	207,500 acres

Percentage of county needing drainage 70%

GORDON COUNTY

Area: 372 square miles; 238,080 acres.

Periodically overflowed or meadow land	18,304 acres
Wet grazing land	1,280 "
Land needing underdrainage	13,376 "
Total	32,960 acres

Percentage of county needing drainage 13.8%

GRADY COUNTY

Area: 453 square miles; 289,920 acres.

Periodically swamp and overflowed land	7,744 acres
Periodically overflowed or meadow land	40,356 "
Total land needing drainage	48,100 acres

Percentage of county needing drainage 16.6%

GREENE COUNTY

Area: 400 square miles; 256,000 acres.

Permanent swamp land	3,000 acres
Periodically overflowed land	7,500 "
Total	10,500 acres

Percentage of county needing drainage 4.1%

GWINNETT COUNTY

Area: 510 square miles; 326,400 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Chattahoochee River	24	70	1,680
Alcovy River	13	60	780
Bay Creek	5	40	200
Drowning Creek	4	60	240
Appalachee River	12	130	1,560
Cedar Creek	3	40	120
Total	.....	.....	4,580

Percentage of county needing drainage 1.4%

All other streams in county are either in good condition or are being improved.

HABERSHAM COUNTY

Area: 283 square miles; 181,120 acres.

Periodically overflowed or meadow land .....12,480 acres

Percentage of county needing drainage 6.9%

HALL COUNTY

Area: 449 square miles; 287,360 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Chattahoochee River	35	160	5,600
Little River, lower	4	160	640
Wahoo Creek	6	260	1,560
Dorse Creek	3	60	180
Flat Creek	2	150	300
Flowery Branch	2	160	320
Big Creek	2	160	320
Candler Creek	3	90	270
Oconee River, upper	7	40	280
" " lower	5	320	1,600
" " tributaries of	15	70	1,050
Pond Creek	6	70	420
Allens Creek	9	80	720
Walnut Creek, upper	5	150	750
Mulberry Creek	11	60	660
" " fork of	6	60	360
Other streams	..	...	2,000
Total	.....	.....	17,030

Percentage of county needing drainage 5.9%

HANCOCK COUNTY

Area: 530 square miles; 339,200 acres.

Periodically overflowed or meadow land .....15,104 acres

Percentage of county needing drainage 4.4%

HARALSON COUNTY

Area: 282 square miles; 180,480 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Walker Creek	15	90	1,350
Beech Creek	12	90	1,080
Tallapoosa Creek	18	90	1,620
Other streams	..	...	1,500
Total	.....	.....	5,550

Percentage of county needing drainage 3.1%

Approximately 60% of the bottom land in this county is in good condition and is cultivated.

HARRIS COUNTY

Area: 486 square miles; 311,040 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Shoal Creek	10	60	600
South Shoal Creek	12	50	600
Mountain Creek	24	55	1,320
Hurricane Creek	6	40	240
Mulberry Creek	25	90	2,250
Sandy Creek	9	40	360
East Shoal Creek	13	50	650
Osahatchee Creek	14	80	1,120
Standing Boy Creek	5	75	375
Other streams	..	...	2,000
Total	.....	.....	9,515

Percentage of county needing drainage 3%

HART COUNTY

Area: 257 square miles; 164,480 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Savannah River	13	50	650
Big Shoal Creek	7	110	770
Little Shoal Creek	6	70	420
Mud Creek	7	30	210
Morea Creek	6	70	420
Reed Creek	4	70	280
Big Lightwood Creek	6	70	420
Little Lightwood Creek	5	50	250
Big Cedar Creek	12	100	1,200
Little Cedar Creek	6	100	600
Little Coldwater Creek	8	100	800
Boyds Creek	4	70	280
Big Coldwater Creek	9	70	630
North Beaver Dam Creek	8	100	800
South Beaver Dam Creek	10	100	1,000
Other streams	..	...	1,500
Total	.....	.....	10,230

Percentage of county needing drainage 6.2%

HEARD COUNTY

Area: 313 square miles; 200,320 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Centralhatchee Creek	14	70	980
Hellabahatchee Creek	19	90	1,710
" " (S. prong)	7	70	490
Town Creek	8	80	640
Yellow Dirt Creek	6	70	420
Bushy Creek	8	90	720
Whitewater Creek	7	60	420
Little Wehodkee Creek	7	90	630
Potato Creek	5	70	350
Harris Creek	5	70	350
New River	8	125	1,000
Clear Creek	10	80	800
Red Bud Creek	6	80	480
Other streams	..	...	1,500
Total	.....	.....	10,490

Percentage of county needing drainage 5.2%

HENRY COUNTY

Area: 337 square miles; 215,680 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Ocmulgee River	22	90	1,980
Mountain Branch	2	no bot. lnd	.....
McKnight Creek	3	no bot. lnd	.....
Camp Creek	5	70	350
Cotton Creek (bad condition)	12	75	900
Cotton River " "	15	90	1,350
Reeves Creek	6	75	450
Line Creek	3	60	180
Big Walnut Creek (bad cond.)	22	90	1,980
Little Walnut Creek	7	40	280
Island Shoals Creek	5	70	350
Tushaha Creek	7	90	630
Little Sandy Creek	4	60	240
Big Tushaha	11	90	990
Indian Creek	11	80	880
Sandy Creek	7	75	525
			11,085
Land needing tile drainage	.....	.....	3,000
Total needing drainage	.....	.....	14,085

Percentage of county needing drainage 6.5%

HOUSTON COUNTY

Area: 591 square miles; 378,240 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Ocmulgee River	21	320	6,720
Sandy Run Creek	7	70	490
Beaver Creek	4	70	280
Grassy Creek	4	90	360
Big Indian Creek	28	180	5,040
Mossy Creek	21	70	1,470
Bay Creek	8	70	560
Mill Creek	9	110	990
Dry Creek	4	90	360
Briar Creek	9	90	810
Big Creek	16	80	1,280
Hog Crawl Creek	9	90	810
Echoconee Creek	8	150	1,200
Crooked Creek	8	110	880
Limestone Creek	6	70	420
Other streams	..	...	2,000
Limesinks	..	...	1,000
Total	.....	.....	24,670

Percentage of county needing drainage 6.5%

IRWIN COUNTY

Area: 459 square miles; 293,760 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Allapaha River	27	320	8,640
Brushy Creek	12	110	1,320
Sand Creek	6	110	660
Big Creek	14	110	1,540
Willacoochee River	24	180	4,320
Mill Creek	6	60	360
Satilla River	20	110	2,200
Wiggins Creek	4	60	240
Reedy Creek	20	110	2,200
Other streams	..	...	2,000
Ponds and bays	..	...	10,000
			33,480
Wet grazing land	.....	.....	30,000
Total needing drainage	.....	.....	63,480

Percentage of county needing drainage 21.6%

JACKSON COUNTY

Area: 460 square miles; 294,400 acres.

Periodically overflowed or meadow land .....20,736 acres

Percentage of county needing drainage 7%

JASPER COUNTY

Area: 410 square miles; 262,400 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Ocmulgee River (Co. line)	16	pockets	2,000
Alcovy River (affected by power dam)			
Herd River	10	120	1,200
Smith Ferry Creek	11	80	880
White Creek	3	50	150
Gladeville Creek	10	60	600
Little Falling Creek	3	70	210
Fork of Falling Creek	7	75	525
Cedar Creek	14	160	2,240
South Wolf Creek	4	80	320
North Wolf Creek	10	90	900
Murder Creek	14	320	4,480
Pittman Creek	11	90	990
Tributaries Murder Creek	14	160	2,240
White Oak Creek	5	70	350
Gap Creek	8	60	480
			17,565
Land needing tile drainage	.....	.....	2,500
Total needing drainage	.....	.....	20,065

Percentage of county needing drainage 7.6%

JEFF DAVIS COUNTY

Area: 395 square miles; 252,800 acres.

Periodically overflowed or meadow land .....26,816 acres
Periodically swamp land .....11,392 "
Wet grazing land .....42,176 "

Total.....80,384 acres

Percentage of county needing drainage 31.8%

JEFFERSON COUNTY

Area: 515 square miles; 329,600 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Briar Creek (County line)	11	110	1,210
Reedy Creek	12	70	840
Big Creek	23	70	1,610
Brushy Creek	15	60	900
Rocky Comfort Creek	18	100	1,800
Deeharts Creek	13	40	520
Ogeechee River	30	300	9,000
Rocky Creek (County line)	10	40	400
Williamson Swamp Creek	13	150	1,950
Other streams	75	...	5,000
Ponds	..	...	3,000
			26,230
Wet grazing land, southern part of county	.....	.....	12,000
Total needing drainage	.....	.....	38,230

Percentage of county needing drainage 11.6%

JENKINS COUNTY

Area: 400 square miles; 256,000 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Ogeechee River	21	1,000	21,000
Skull Creek	10	300	3,000
Richardson Prong	9	400	3,600
Bay Branch	8	250	2,000
Buckhead Creeks	22	500	11,000
Mill Creek	9	500	4,500
Beaver Dam Creek	8	400	3,200
Deep Creek	4	400	1,600
Other streams	..	...	6,000
Ponds	..	...	3,000
			60,900
Wet grazing land	..	...	20,000
Total needing drainage	.....	.....	80,900

Percentage of county needing drainage 31.6%

Approximately 25% of creek-bottom land is cultivated, but is subject to overflow during crop season.

JOHNSON COUNTY

Area: 258 square miles; 165,120 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Oconee River	4	160	640
Deep Creek	4	60	240
Buckeye Creek	6	150	900
Fords Creek	4	60	240
Big Creek	3	60	180
Bracken Creek	2	50	100
Big Ohoopee River	27	240	6,480
Cedar Creek	12	110	1,320
Cypress Creek	9	70	630
Dry Creek	7	110	770
Neals Creek	7	60	420
Little Ohoopee River	13	240	3,120
Smith Creek	4	110	440
Swan Creek	5	110	550
McGruder Creek	4	70	280
Battle Ground Creek	10	60	600
Board Tree Creek	4	45	180
Other streams	..	...	1,000
Total	.....	.....	18,090

Percentage of county needing drainage 11%

JONES COUNTY

Area: 401 square miles; 256,640 acres.

Periodically overflowed or meadow land	11,648 acres
Land needing underdrainage	3,840 "
Total	15,488 acres

Percentage of county needing drainage 6%

LAURENS COUNTY

Area: 791 square miles; 506,240 acres.

Permanent swamp land	39,500 acres
Periodically overflowed land	12,000 "
Wet grazing land	47.000 "
Land needing underdrainage	12,200 "
Total	110,700 acres

Percentage of county needing drainage 21.6%

LEE COUNTY

Area: 436 square miles; 279,040 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Kinchafoonee Creek, upper	12	...	5,650
Muckalee Creek	21	...	7,200
Little Muckalee Creek	7	...	1,800
Flint River	3	...	600
	3	...	600
	7½	...	2,000
Chokee Creek	6	...	2,000
Fowltown Creek	7	...	700
Middle Creek	1	...	300
Other streams	..	...	2,000
Total	.....	.....	22,850

Percentage of county needing drainage 8.2%

LIBERTY COUNTY

Area: 976 square miles; 624,640 acres.

Wet grazing land	312,320 acres
Ponds and bays	37,480 "
Marsh land	12,490 "
Total	362,290 acres

Percentage of county needing drainage 58%

Northwestern two-thirds of county has more well-drained land than that nearer the coast.

LINCOLN COUNTY

Area: 290 square miles; 185,600 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Pistol Creek	4	50	200
Fishing Creek	12	125	1,500
Newford Creek	4	80	320
Murray Creek	8	60	480
Soap Creek	22	90	1,980
Little Creek	9	40	360
Grays Creek	14	50	700
Floyds Creek	12	50	600
Savannah River	48	160	7,680
Little River	18	pockets	500
Other streams	..	...	1,500
Total	.....	.....	15,820

Percentage needing drainage 8.5%

LOWNDES COUNTY

Area: 455 square miles; 291,200 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Little Allapaha River	17	160	2,720
Allapaha River	12	160	1,920
Other streams	..	...	2,000
Ponds	..	...	15,000
Total	.....	.....	21,640
Wet grazing land:			
Southern half of county	.....	.....	110,000
Northeastern quarter of county	.....	.....	50,000
Northwestern quarter of county	.....	.....	6,000
Total needing drainage	.....	.....	187,640

Percentage of county needing drainage 64%

LUMPKIN COUNTY

Area: 282 square miles; 180,480 acres.

Permanent swamp land	2,500 acres
Periodically overflowed land	3,500 "
Total	6,000 acres

Percentage of county needing drainage 3.3%

McDUFFIE COUNTY

Area: 258 square miles; 165,120 acres.

Permanent swamp land	3,000 acres
Periodically overflowed land	7,900 "
Total	10,900 acres

Percentage of county needing drainage 6.6%

McINTOSH COUNTY

Area: 429 square miles; 274,560 acres.

Permanent swamp land	6,000 acres
Periodically swamp land	30,000 "
Wet grazing land	90,000 "
Tidal marsh	65,000 "
Total	191,000 acres

Percentage of county needing drainage 70%

MACON COUNTY

Area: 392 square miles; 250,880 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Flint River	25	...	11,110
Beaver Creek	16	...	2,500
Big Whitewater Creek	17	...	3,700
Buck Creek	10	...	1,400
Other streams	40	...	2,000
Total	.....	.....	20,710

Percentage of county needing drainage 8.2%

MADISON COUNTY

Area: 278 square miles; 177,920 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Broad River	17	60	1,020
Mill Shoal Creek	10	60	600
Big Bluestone Creek	10	80	800
Little Bluestone Creek	8	70	560
Scull Shoal Creek	14	80	1,120
Holly Creek	6	60	360
Fork of Holly Creek (Co. line)	16	60	960
South Fork River	12	100	1,200
" " "	18	90	1,620
South Creek (Co. line)	8	60	480
Brush Creek	9	50	450
Little Sandy Creek (Co. line)	7	40	280
Big Black Creek (Co. line)	8	40	320
Hudson River (Co. line)	8	40	320
Sawar Creek	4	100	400
Other streams	75	20	1,500
Total	.....	.....	11,990

Percentage of county needing drainage 6.7%

MARION COUNTY

Area: 344 square miles; 220,160 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Dry Creek	5	80	400
Muckalee Creek	10	80	800
Bridge Creek	6	40	240
Other streams	..	...	1,500
Total	.....	.....	2,940

Percentage of county needing drainage 1.3%

Most of streams in county are in good condition, having deep channels and good fall.

MERIWETHER COUNTY

Area: 544 square miles; 348,160 acres.

Permanent swamp land	5,000 acres
Periodically overflowed land	25,000 "
Periodically swamp land	6,000 "
Land needing underdrainage	600 "
Total	36,600 acres

Percentage of county needing drainage 10.5%

MILLER COUNTY

Area: 275 square miles; 176,000 acres.

Swamp land	6,912 acres
Periodically swamp land	2,560 "
Wet grazing land	20,864 "
Total	30,336 acres

Percentage of county needing drainage 17.2%

MILTON COUNTY

Area: 147 square miles; 94,080 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Big Creek	14	50	700
Chicken Creek	15	50	750
Cooper Sandy Creek	7	50	350
Four Killer Creek	5	40	200
John Creek	6	60	360
Chattahoochee River	17	pockets	300
Little River, Alaculsa Creek	9	75	675
Total			3,335

Percentage of county needing drainage 3.5%

MITCHELL COUNTY

Area: 509 square miles; 325,760 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Along streams	..	...	3,000
Ponds	..	...	5,000
Wet grazing land:			
Eastern half of county	.....	.....	43,000
Western half of county	.....	.....	11,000
Total needing drainage	.....	.....	62,000

Percentage of county needing drainage 19%

MONROE COUNTY

Area: 480 square miles; 307,200 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Buck Creek and tributaries (rough and rocky)..	9	80	720
Towliga River	16	75	1,200
Little Towliga Creek	10	90	900
Rum Creek	25	90	2,250
Little Deer Creek (rough and rocky)	15	66+	1,000
Tobler Creek (rough and rocky)	4	75	300
Tobesofkee Creek (mills on creek)	21	71+	1,500
Echeconee Creek	10	100	1,000
Sandy Creek	8	80	640
Ocmulgee River	12	80	960
			10,470
Land needing tile drainage	.....	.....	4,500
Total needing drainage	.....	.....	14,970

Percentage of county needing drainage 4.5%

MONTGOMERY COUNTY

Area: 642 square miles; 410,880 acres.

Permanent swamp land	20,000 acres
Periodically overflowed land	25,000 "
Periodically swamp land	5,000 "
Wet grazing land	22,000 "
Total	72,000 acres

Percentage of county needing drainage 17.5%

MORGAN COUNTY

Area: 346 square miles; 221,440 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Shoal Creek	4	90	360
Sugar Creek	16	80	1,280
Oconee River (County line)	4	260	1,040
Jacks Creek	8	75	600
Hard Labor Creek	21	110	2,310
Big Sandy Creek	14	90	1,260
Goose Creek	4	40	160
Clarke Creek	8	80	640
Big Indian Creek	18	90	1,620
Little Indian Creek	10	75	750
Little River	17	80	1,360
Gap Creek	4	60	240
Beaver Dam Creek	8	75	600
Total	.....	.....	12,220

Percentage of county needing drainage 4.5%

MURRAY COUNTY

Area: 352 square miles; 225,280 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Holly Creek	24	160	3,840
Buck Creek	4	160	640
Conasauga River	10	300	3,000
" " (Co. line)	40	140	5,600
Sumac Creek	4	160	640
Mill Creek	8	160	1,280
Other streams	..	...	1,500
Total	.....	.....	16,500

Percentage of county needing drainage 7.3%

MUSCOGEE COUNTY

Area: 255 square miles; 163,200 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Upatoi Creek (upper)	15	70	1,050
Tiger Creek	4	75	300
Wolf Creek	5	60	300
Randall Creek (upper)	12	90	1,080
Dozier Creek	6	60	360
Tar River	3	80	240
Other streams	..	...	1,000
Total	.....	.....	4,330

Percentage of county needing drainage 2.7%

The majority of the streams of Muscogee County have good banks and sufficient fall to carry off the water of freshets within their banks.

NEWTON COUNTY[1]

Area: 259 square miles; 165,760 acres.

Periodically overflowed land 17,400

Percentage of county needing drainage 10.5%

OCONEE COUNTY

Area: 184 square miles; 117,760 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Barber Creek (upper)	5	30	150
" " (lower)	5	20	100
Appalachee River	12	pockets	400
Rose Creek	8	100	800
Green Briar Creek (lower)	4	125	500
McRae Creek	5	30	150
Elders Creek	4	25	100
Total			3,700

Percentage of county needing drainage 3.2%

[1]This includes the Covington Area, U. S. Soil Survey.

OGLETHORPE COUNTY

Area: 490 square miles; 313,600 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Broad River (County line)	15	70	1,050
South Broad River (County line)	12	60	720
Beaver Dam Creek	12	50	600
Cloud Creek	18	60	1,080
Hawkes Creek	9	80	720
East Beaver Dam Creek	9	80	720
Grove Creek	12	90	1,080
Millstone Creek	14	90	1,260
Goose Pond Creek	12	90	1,080
Sand Creek (County line)	9	50	450
	20	90	1,800
Dry Fork Creek	12	90	1,080
Buffalo Creek	12	70	840
Little River (Co. line)	4	60	240
North Prong River	7	90	630
South Prong River	7	80	560
Syls Fork	9	50	450
Sandy Creek	6	80	480
Fishing Creek	3	75	225
Falling Creek	10	90	900
Barrow Creek	14	100	1,400
Big Creek	12	80	960
Oconee River (County line)	5	80	400
Other streams	..	...	2,000
Total	.....	.....	20,725

Percentage of county needing drainage 6.3%

PAULDING COUNTY

Area: 329 square miles; 210,560 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Pumpkin Vine Creek	15	200	3,000
Little Pumpkin Vine Creek	12	110	1,320
Rakestraw Creek	6	40	240
Big Sweetwater Creek	15	160	2,400
Little Sweetwater Creek	9	110	990
Grays Mill Creek	9	75	675
Raccoon Creek	10	80	800
Pegamore Creek	3	50	150
Tallapoosa Creek	7	80	560
Powder Springs Creek	5	80	400
Total	.....	.....	10,535

Percentage of county needing drainage 5%

All streams are filling rapidly.

PICKENS COUNTY

Area: 219 square miles; 140,160 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Long Swamp Creek	10	80	800
Big Scarecorn Creek	6	80	480
Little Scarecorn Creek	5	30	150
Stone Creek	5	40	200
Sharp Creek	8	60	480
Other streams	..	...	500
Total	.....	.....	2,610

Percentage of county needing drainage 1.8%

PIERCE COUNTY

Area: 518 square miles; 331,520 acres.

Periodically overflowed and permanent swamp land:

Ponds and swamps	40,000 acres
Wet grazing land:	
Southern half of county	100,000 "
Northern half of county	65,000 "
Total needing drainage	205,000 acres

Percentage of county needing drainage 61.8%

The swamps along streams are usually negligible and are here included in "ponds and swamps."

PIKE COUNTY

Area: 329 square miles; 210,560 acres.

Swamp land	19,328 acres
Periodically overflowed or meadow land	576 "
Land needing underdrainage	2,240 "
Total	22,144 acres

Percentage of county needing drainage 10.5%

POLK COUNTY

Area: 292 square miles; 186,880 acres.

Periodically overflowed land	2,000 acres
Land needing underdrainage	5,000 "
Total	7,000 acres

Percentage of county needing drainage 3.7%

PULASKI COUNTY

Area: 277 square miles; 177,280 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Ocmulgee River	30	250	7,500
Jordan Creek	3½	100	350
Limestone Creek	9	90	810
Mosquite Creek	9	90	810
Crooked Creek	4	70	280
Mossy Creek	2	300	600
Buck Creek	7	90	630
Big Creek	4	140	560
Cedar Creek	9	90	810
Reedy Creek	6	90	540
Bluff Creek	14	110	1,540
Cobb Creek	4	55	220
Town Creek	5	90	450
Other streams	..	...	1,000
Total	.....	.....	16,100

Percentage needing drainage 9.1%

About 25% of this land is under cultivation, but overflows during crop season every 3 or 4 years. Several thousand acres in county in need of underdrainage.

PUTNAM COUNTY

Area: 348 square miles; 222,720 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Sugar Creek	4	90	360
Lick Creek	9	100	900
Crooked Creek	11	60	660
Russ Creek	4	75	300
Turkey Creek	16	100	1,600
Little River	24	50	1,200
Gladey Creek	8	75	600
Indian Creek	6	40	240
Murder Creek	10	60	600
Beaver Dam Creek	4	60	240
Total	.....	.....	6,700

Percentage of county needing drainage 3%

QUITMAN COUNTY

Area: 152 square miles; 97,280 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Chattahoochee River	20	300	6,000
Pataula Creek	12	200	2,400
Hodchodchee Creek	6	...	1,000
Other streams	..	...	1,500
Total	.....	.....	10,900

Percentage of county needing drainage 11%

A considerable portion of the bottom land along the Chattahoochee River is in good condition and cultivated.

RABUN COUNTY

Area: 344 square miles; 220,160 acres.

The majority of the bottom land along the streams of Rabun County is under cultivation and is rarely, if ever, overflowed. Probably 5,000 overflow acres, or 2.2%, in the county is in need of, or would be benefited by, drainage.

RANDOLPH COUNTY

Area: 476 square miles; 304,640 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Ichawaynochaway Creek	13	...	4,500
" " fork of	8	...	2,000
Pachitta Creek	13	...	3,400
West Pachitta Creek	7	...	1,400
Southwest County Creek	3	...	500
Haynes Creek	6	...	1,400
Pataula Creek Pumpkin Creek	15	...	3,000
Other streams	..	...	2,000
Ponds	..	...	1,200
			19,400
Land needing tile drainage	.....	.....	3,000
Total needing drainage	.....	.....	22,400

Percentage needing drainage in county 7.4%

RICHMOND COUNTY

Area: 272 square miles; 174,080 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
McBean Creek	24	100	2,400
Brier Creek	7	160	1,120
Butler Creek	18	40	720
Spirit Creek	40	30	1,200
Savannah River	30	in pockets	3,000
Other streams	..	...	1,200
Total	.....	.....	9,640

Percentage of county needing drainage 5.5%

The majority of the streams of Richmond County have deep channels and good fall.

ROCKDALE COUNTY

Area: 121 square miles; 77,440 acres.

Periodically overflowed and permanent swamp land:

Along streams .....4,640 acres

Percentage of county needing drainage 6%

Estimated from contiguous counties.

SCHLEY COUNTY

Area: 188 square miles; 120,320 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Buck Creek	17	75	1,275
Burke Creek	8	60	480
East Creek	8	40	320
Big Muckalee Creek	13	70	910
Little Muckalee Creek	12	40	480
Other streams	..	...	1,500
Total	.....	.....	4,965

Percentage of county needing drainage 4.1%

SCREVEN COUNTY

Area: 619 square miles; 396,160 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Briar Creek	21	400	8,400
Buck Creek	13	90	1,170
Beaver Dam Creek:			
Lower	8	140	1,120
Middle	7	300	2,100
Upper	2	480	960
Ogeechee River:			
Lower	5	500	2,500
Middle	6	240	1,440
Upper	3	130	390
Evans Branch	2	240	480
Big Horse Creek	12	110	1,320
The Run	6	90	540
Other streams	60	40	2,400
Ponds (northern part of Co.)	...	...	2,000
Savannah River	40	600	24,000
			48,820
Wet grazing land:			
Northeast of Sylvania	.....	.....	22,400
Three miles east of Sylvania	.....	.....	1,920
Southeast corner of county	.....	.....	25,600
Total needing drainage	.....	.....	98,740

Percentage of county needing drainage 24.9%

SPALDING COUNTY

Area: 203 square miles; 129,920 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Towaliga River	7½	75	565
Head Creek	6	108	648
Shoal Creek	5	54	270
Flat Creek	6	36	216
Flint River	12	105	1,260
Line Creek (slightly overflowed)	4	144	576
Cabin Creek and tributaries	20	90	1,800
Buck Creek	7	60	420
Rose Creek	5	60	300
Total	.....	.....	6,055

Percentage of county needing drainage 4.7%

STEPHENS COUNTY

Area: 155 square miles; 99,200 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Tugaloo River	20	100	2,000
Big Tom Creek	4	75	300
North Broad River	6	160	960
Other streams	.....	.....	1,000
Total	.....	.....	4,260

Percentage of county needing drainage 4.3%

STEWART COUNTY

Area: 467 square miles; 298,880 acres.

Swamp land	5,376 acres
Periodically overflowed or meadow land	25,664 "
Periodically swamp land	10,368 "
Total	41,408 acres

Percentage of county needing drainage 13.8%

SUMTER COUNTY

Area: 534 square miles; 341,760 acres.

Swamp land	13,056 acres
Periodically overflowed or meadow land	20,672 "
Total needing drainage	33,728 acres
Percentage of county needing drainage	9.9%

TALBOT COUNTY

Area: 387 square miles; 247,680 acres.

Periodically overflowed or meadow land	27,520 acres
Land needing underdrainage	10,496 "
Total	38,016 acres
Percentage of county needing drainage	15.3%

TALIAFERRO COUNTY

Area: 198 square miles; 126,720 acres.

Periodically overflowed land	4,500 acres
Percentage of county needing drainage	3.5%

TATTNALL COUNTY

Area: 597 square miles; 382,080 acres.

Swamp land	20,288 acres
Periodically overflowed or meadow land	20,708 "
Periodically swamp land	97,664 "
Total	138,660 acres
Percentage of county needing drainage	36.3%

TAYLOR COUNTY

Area: 338 square miles; 216,320 acres.

Periodically overflowed and permanent swamp land:

Bottom land along streams	15,000 acres
Percentage of county needing drainage	7%

No information gathered in county. Estimate made from observation and comparison to contiguous counties.

TELFAIR COUNTY

Area: 412 square miles; 263,680 acres.

Permanent swamp land	28,400 acres
Wet grazing land	30,000 "
Total	58,400 acres

Percentage of county needing drainage 22%

TERRELL COUNTY

Area: 334 square miles; 213,760 acres.

Swamp land	14,400 acres
Periodically overflowed or meadow land	128 "
Periodically swamp land	17,124 "
Total	31,652 acres

Percentage of county needing drainage 14.8%

THOMAS COUNTY

Area: 540 square miles; 345,728 acres.

Swamp land	3,328 acres
Periodically overflowed or meadow land	49,418 "
Periodically swamp land	31,616 "
Total	84,362 acres

Percentage of county needing drainage 24.4%

TIFT COUNTY

Area: 271 square miles; 173,440 acres.

Swamp land	6,976 acres
Wet grazing land	31,616 "
Land needing underdrainage	640 "
Total	39,232 acres

Percentage of county needing drainage 22.6%

TOOMBS COUNTY

Area: 519 square miles; 332,160 acres.

Permanent swamp land	4,000 acres
Periodically overflowed land	5,000 "
Periodically swamp land	1,000 "
Wet grazing land	1,500 "
Total	11,500 acres

Percentage of county needing drainage 3.4%

TOWNS COUNTY

Area: 168 square miles: 107,520 acres.

Practically all of the stream bottom land in Towns County is in good condition and is cultivated. Probably 1,000 acres or 1% of the entire county is in need of, or would be benefited by, drainage. A small underdrainage system has been installed near Blairsville and is giving good results.

TROUP COUNTY

Area: 435 square miles; 278,400 acres.

Periodically overflowed or meadow land	18,432 acres
Periodically swamp land	7,744 "
Total	26,176 acres
Percentage of county needing drainage	9.4%

TURNER COUNTY

Area: 326 square miles; 208,640 acres.

Periodically overflowed land	3,000 acres
Wet grazing land	40,500 "
Land needing underdrainage	5,000 "
Total	48,500 acres
Percentage of county needing drainage	23.2%

TWIGGS COUNTY

Area: 423 square miles; 270,720 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Ocmulgee River	19	1,000	19,000
Flat Creek	14	100	1,400
Savage Creek	11	100	1,100
Shellstone Creek	8	50	400
Rocky Creek	3	120	360
Palmetto Creek	8	120	960
Big Sandy Creek	10	160	1,600
Other streams	..	...	1,500
Total	.....	.....	26,320

Percentage of county needing drainage 9.7%

Several thousand acres of limesink ponds and depressions need underdrainage, making .....4.3%=11,640 acres

Total percentage, all classes, needing drainage, approx. 14%

Total ..... =37,960

UNION COUNTY

Area: 325 square miles; 208,000 acres.

Practically all of the streams in Union County are in good condition and rarely overflow. Probably 2,000 acres, 1,000 over, 1,000 underdrainage, or 1% of the entire county would be benefited by drainage.

UPSON COUNTY

Area: 310 square miles; 198,400 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Flint River	40	50	2,000
Turkey Creek	3½	60	210
Shepard Creek	3½	50	175
Potato Creek	18	70	1,260
Ten Mile Creek	4	60	240
Basin Creek	4	60	240
Womble Creek	8	70	560
Swift Creek	11	60	660
Tobler Creek	18	75 (50% cul.)	1,350
Ocmuchee Creek	15	100 (25% cul.)	1,500
Wolf Creek	4	60	240
Total	.....	.....	8,435

Percentage of county needing drainage 4.3%

WALKER COUNTY

Area: 434 square miles; 277,760 acres.

Periodically overflowed or meadow land	8,640 acres
Wet grazing land	2,624 "
Total	11,264 acres

Percentage of county needing drainage 4.5%

WALTON COUNTY

Area: 366 square miles; 234,240 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Alcovy River	22	pockets	2,000
Big Flat Creek	17	pockets	600
" " " East Fork	7	30	210
Little Haynes Creek	13	40	520
Gum Creek	6	75	450
Appalachee River (Co. line)	21	40	840
Long Creek	11	60	660
Shoal Creek (Co. line)	7	75	525
Beaver Dam Creek	7	75	525
Total	.....	.....	6,330

Percentage of county needing drainage 2.7%

1,000 acres on Jacks Creek has been drained.

WARE COUNTY [1]

Area: 676 square miles; 432,640 acres.

Permanent swamp land	86,000 acres
Periodically overflowed land	10,600 "
Wet grazing land	250,000 "
Total	346,600 acres

Percentage of county needing drainage 80%

[1] This includes the Waycross Area, U. S. Soil Survey.

WARREN COUNTY

Area: 298 square miles; 190,720 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Williams Creek	12	40	480
Little Creek	8	70	560
Carson Creek	4	75	300
Hart Creek	12	40	480
Middle Creek	10	55	550
Big Briar Creek	18	90	1,620
" " " (Co. line)	4	45	180
Little River	2	90	180
" " (Co. line)	8	45	360
Reedy Creek	7	70	490
Rocky Comfort Creek	18	40	720
Whetstone Creek	6	60	360
Long Creek	25	50	1,250
Ogeechee River (Co. line)	18	90	1,620
Red Lick Creek	6	90	540
Wheeler Creek	5	60	300
Other streams	..	...	1,000
Total	.....	.....	10,990

Percentage of county needing drainage 5.7%

WASHINGTON COUNTY

Area: 680 square miles; 435,200 acres.

Permanent swamp land	32,000	acres
Periodically overflowed land	40,000	"
Land needing underdrainage	18,650	"
Total	90,650	acres

Percentage of county needing drainage 20.9%

WAYNE COUNTY

Area: 766 square miles; 490,240 acres.

Permanent swamp land	15,000	acres
Periodically overflowed land	30,000	"
Wet grazing land	210,000	"
Total	255,000	acres

Percentage of county needing drainage 52%

WEBSTER COUNTY

Area: 227 square miles; 145,280 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Kinchafoonee Creek	20	...	7,400
Aeconahachee Creek	7	...	1,600
Sokesohatobee Creek	4½	...	1,200
Lochonee Creek	12	...	4,000
Slaughter Creek	3	...	300
Other streams	30	...	1,500
Total	.....	.....	16,000

Percentage of county needing drainage 11%

WHEELER COUNTY

Included in Montgomery County from which it was created.

WHITE COUNTY

Area: 243 square miles; 155,520 acres.

The majority of the stream bottom land in White County is in good condition and is rarely overflowed. Probably 3,000 acres or 2% of the entire county is in need of, or would be benefited by, surface or underdrainage. Extensive tile drainage systems have been installed by Dr. L. G. Hardman in the Nacoochee Valley.

WHITFIELD COUNTY

Area: 285 square miles; 182,400 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Conasauga River (Co. line)	45	100	4,500
Bear Creek	6	60	360
Swamp Creek	5	80	400
Total			5,260
Land needing underdrainage			5,000
Total			10,260

Percentage of county needing drainage 5.6%

WILCOX COUNTY

Area: 473 square miles; 302,720 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Ocmulgee River	39	600	23,400
Folsoms Creek	20	160	3,200
Gum Swamp Creek	15	160	2,400
House Creek	30	110	3,300
Allapaha River	20	300	6,000
Tributary of Allapaha River	22	160	3,520
Double Run Creek	8	160	1,280
Limesink Creek	6	70	420
Cedar Creek	12	300	3,600
Other streams	..	...	2,000
Total			49,120

Percentage of county needing drainage 16.2%

WILKES COUNTY

Area: 501 square miles; 320,640 acres.

Permanent swamp land ..... 5,000 acres
Periodically overflowed land ..... 15,000 "
Total ..... 20,000 acres

Percentage of county needing drainage 6.2%

WILKINSON COUNTY

Area: 431 square miles; 275,840 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Oconee River	26	700	18,200
Black Creek	30	70	2,100
Commissioners Creek	37	240	8,880
Big Sandy Creek	33	80	2,640
Maiden Creek	15	50	750
Cedar Creek	9	60	540
Palmetto Creek	8	60	480
Other streams	..	...	2,000
Total	.....	.....	35,590

Percentage of county needing drainage 12.9%

WORTH COUNTY

Area: 604 square miles; 386,560 acres.

Periodically overflowed and permanent swamp land:

STREAMS	Length affected miles	Acres per mile	Total acres
Swift Creek	12	70	840
Jones Creek	7	130	910
Abrams Creek	10	130	1,300
Daniels Creek	8	60	480
Warrior Creek	34	160	5,440
Horse Creek	12	80	960
Ty Ty and Little Creeks	21	130	2,730
Mill Creek	8	70	560
Other streams	..	...	2,000
Ponds	..	...	2,000
			17,220
Wet grazing land	.....	.....	40,000
Total needing drainage	.....	.....	57,220

Percentage of county needing drainage 14.8%

SUMMARY FOR STATE

	Acres
Periodically Overflowed and Permanent Swamp Land	3,151,172
Periodically Swamp Land	627,969
Wet Grazing Land	3,591,666
Land Needing Underdrainage	196,332[1]
Tidal Marsh Land	352,330
Total Needing Drainage	7,919,469

ABSTRACT OF DRAINAGE LAW IN GEORGIA[2]

(As passed in Laws of 1911 and amended in Laws of 1913 and 1917.)

BY

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Office of Public Roads and Rural Engineering, U. S. Department of Agriculture.

Section one of the drainage law creates a Court composed of the Clerk of the Superior Court and the Board of Commissioners of Roads and Revenues, or if there be no such Board, then the Ordinary of the county, with authority to establish levee and drainage districts. When the landowners desire to form a levee or drainage district of any particular land a petition, signed either by a majority of the landowners living in the proposed district or by the owners of three-fifths of all the land, is filed with the Clerk of the Superior Court of any county in which part of the land is located. This petition must describe the land to be included in the district in such manner as to give a clear idea of its location. It also must set forth that the land is too wet for cultivation and that the public health and welfare will be promoted by a system of drainage. Accompanying the petition must be a bond acceptable to the Clerk of the Court, to cover all costs in case the request

[1]This figure is not complete as the amount of land needing underdrainage was not estimated for all counties.

[2]Bulletin No. 25—Drainage Investigation in Georgia, issued by the State Geological Survey, contains a copy of the drainage law but not the amendments recently enacted.

of the petitioners is not approved. To the landowners who have not joined in the petition the Clerk of the Court must issue a summons notifying them that the petition has been filed.

On the day when the summons is returned, the Clerk of the Court appoints a Board of Viewers composed of a civil and drainage engineer and two resident owners of real property of the county. It is the duty of this board to examine the lands described in the petition with a view to determining the most practicable route, and to return to the Clerk of the Court within thirty days a written report setting forth:

1. Whether or not the proposed drainage is practicable.
2. Whether it will benefit the public health, or any public highway, or be conducive to the general welfare of the community.
3. Whether the improvement proposed will in fact benefit the lands sought to be benefited.
4. Whether or not all the lands that are benefited are included in the proposed drainage district.

With this report must be filed a map showing the locations of the proposed improvements and the lands that will be affected.

If the findings of the Board of Viewers are not favorable to the formation of the district, and if the Court shall approve such findings, the petition must be dismissed. However, if their findings are favorable and the Court shall agree, then a day for further hearing on the findings of the Board of Viewers is set. Notice of this hearing must be given by publication for two consecutive weeks in a newspaper of general circulation, and by posting a notice at the courthouse and at five conspicuous places in the district. At least fifteen days must intervene between the date of publication and posting of notice, and the date set for the hearing. To landowners not residing in the district, written notice must be sent at least thirty days before the hearing.

At the hearing the Court passes upon any objections that may be offered to the report of the Board of Viewers. If any lands have been included which in the opinion of the Court will not receive benefit from

the proposed improvements, they are excluded; and if any lands which will be benefited are not included the boundaries of the district are extended so as to include them. At the close of the hearing if the Court decides that a drainage district will be to the interest of all affected, it declares a district established and gives it a name or number. Any person who feels that his lands should not be included in the district may appeal to the Superior Court of the county.

After the district is declared established the report of the Board of Viewers is referred back to them with instructions to make a complete survey and plans for the necessary improvements, and report to the Court. For making the survey the Board of Viewers are authorized to employ such assistants as may be necessary.

If lands needed for carrying out the plans can not be secured by purchase or gift, the district has the power to condemn such lands in a manner as is provided in Chapter 9 of the 1910 Code.

It is the duty of the Board of Viewers to determine and assess all damages which may be claimed, and unless such claims are made, no damages will be paid. This board also examines all land in the district and classifies it according to benefit it will receive by the construction of the improvement, consideration being given to the degree of wetness of the land, its proximity to the ditch or natural outlet, and fertility of the soil. The lands receiving the greatest amount of benefit are rated "Class A," the next highest "Class B," the next highest "Class C," the next highest "Class D," and that receiving the least benefit "Class E." The scale of assessment upon the several classes of land is in the ratio of five, four, three, two, and one; that is, as often as five mills per acre are assessed against the land in "Class A," four mills per acre are assessed against "Class B," three mills against "Class C," two mills against "Class D," and one mill against "Class E." Upon completion of the survey and plans and the assessing of benefits and damages, the Board of Viewers files its complete report with the Court which either accepts the report and sets a day for a hearing not less than twenty days thereafter, or refers the report back to the View-

ers with instructions to secure additional information. Notice of this hearing need be given by publications only as heretofore indicated. Notice must be served upon any railroad companies which may be affected. At this hearing any landowner may file objections in writing to the report of the Viewers, and the Court will make such changes as it feels are warranted. If the Court shall find that the cost of constructing the improvements, including damages, exceeds the benefits which will accrue, it dismisses the proceedings at the cost of the petitioners; but if it finds that the cost of construction and damages will not exceed the benefits, it approves the Viewers' report, and appoints a "Board of Drainage Commissioners" composed of three persons who are elected by the landowners within the district. The "Board of Drainage Commissioners" is charged with the administration of the district and becomes a body corporate possessed with powers such as usually are exercised by a corporation. From the findings of the Court, any landowner may appeal within ten days. The right of appeal also extends to railroad companies.

In order that there may be a complete record, the Clerk of the Superior Court is required to keep a "Drainage Record" showing each step in the proceedings.

Upon their organization the Commissioners appoint a competent person as superintendent of construction, who must furnish a ten thousand dollar bond to the Commissioners.

The law provides that the construction of the improvements be by contract, the Commissioners being required to give notice by publication for two consecutive weeks in some newspaper published in the county wherein the improvements are to be constructed and in such other publications as they may deem advisable, of the amount of work to be done and the time and place of letting the work. The work is awarded to the lowest bidder who must enter into a contract with the Commissioners and give a bond equal to 25 per cent of the estimated cost of the work awarded him. The superintendent of construction is required to make monthly estimates of the work performed by the

contractor and to check it against the specifications. If he approve the work the Commissioners direct that an order for 90 per cent of the completed work be drawn in favor of the contractor. Before the work is accepted as complete, it is the duty of the Superintendent to check it carefully to see that it complies with the specifications. If a contractor fail to complete his contract, action may be had against him and his bond to recover such damages as may have been sustained.

When any drains cross public highways, the cost of building all new bridges across such drains must be paid by the county. Any benefits conferred upon such highways are assessed against it. To such assessments the Board of Commissioners of Road and Revenues, or, if there be no such Board, the Ordinary of the county in which the road is located, may file objections the same as landowners. Whenever the drainage improvements will cross the right-of-way of any railroad company, notice must be sent to the company or its agents informing them of a date when officials of the district will meet them at the place where the ditch or drain may cross the right-of-way, for the purpose of agreeing on the place and manner in which such improvements shall cross. In case no agreement can be reached, then the district's officials determine the place and manner of crossing and the damages, if any, which the railroad company may suffer. The cost of building new bridges or of enlarging and strengthening existing bridges and culverts are not to be considered as damages to the railroad companies. Benefits which may accrue to the railroad, by affording better drainage or better outlets, are assessed against the company at a fixed sum. When construction is undertaken the railroad company must be notified of the time the contractor will be ready to construct ditches across the rights-of-way, at which time it must remove its ties, rails and other obstructions, so that the excavation may proceed. Failure on the part of the railroad to remove such obstructions subjects it to a penalty of $25 for each day of delay. For expenses incurred in such removal. the railroad company is entitled to compensation by the district, though it must pay for the cost of excavation.

When the drainage system is completed, it becomes the duty of the Board of Drainage Commissioners to keep it in repair. For this purpose they are authorized to levy additional assessments in the same manner and proportion as the original assessments. However, if any repairs become necessary due to negligence on the part of owners through whose lands the improvements extend, such owners are held liable for the cost of making the required repairs. Any person damaging or obstructing any improvement becomes liable to a fine.

Any person assessed for the cost of construction has the right to use the ditch or drain as an outlet for lateral drains from his land. If his lands are separated from the outlet ditch by the lands of another, he has the right to cross the lands of such other party for the purpose of reaching the outlet ditch.

After the lands are classified according to benefits, as previously provided, and the classification approved by the Court, the Drainage Commissioners prepare an assessment roll, giving a description of all the lands, the names of the owners, and the assessment made against each tract. The total of these assessments represents all costs, including damages awarded, less assessments made against railroads.

If the total cost shall average less than twenty-five cents per acre on all land in the district, the assessment made against each tract is payable in one instalment; but if the assessment exceeds twenty-five cents per acre, the Drainage Commissioners may give notice by publication for three weeks, as heretofore provided, that they intend to issue bonds. Such notice must indicate the amount of bonds, the rate of interest the bonds will bear, and when the same are payable. The interests on bonds will be additional to all other costs and must be borne by the landowners. Those not wishing to pay this interest can escape by paying their assessments in full to the County Treasurer within thirty days after the notice has been published. After the thirty days have expired the Commissioners may sell bonds, for not less than par, to the amount of the unpaid assessments, together with interest thereon, cost of collection and other incidental expenses. These bonds,

which bear six per cent interest payable annually, are paid in ten equal instalments, the first instalment falling due three years after date of issue and one instalment during each of the next nine years. In districts where the total bond issue does not exceed fifty thousand dollars, the Drainage Commissioners may fix the rate of interest at not to exceed eight per cent per annum. After bonds are issued the unpaid assessments become a lien or tax, second only to State and county taxes, upon the lands against which they are assessed. These taxes are collected by the same officers as collect State and county taxes. If they are not paid when due, and if such default continue for six months, the holders of the bonds may bring a suit to enforce their collection. If the officers of the district fail to enforce collection, the bond holders may bring suit against them or their official bond.

In case an assessment approved by the Court is reduced by the Superior Court, the Commissioners have authority to change or modify the original assessments so as to comply with the Court's order. To provide for any deficit which may result, the Commissioners can make another assessment but such relevy must be made on the basis of the original assessments.

The rates of compensation and the fees allowed for services rendered the district are fixed by the law, except in cases of engineer and attorney, where they are fixed by the Commissioners.

Provision is made for co-operation with any departments of the United States Government.

Any person appointed under the law may be removed upon petition to the Court showing corruption, negligence of duties, or other good and satisfactory causes.

APPENDIX

Amendments to the State Drainage Law[1]

The following amendments have been made to the State Drainage Law since its passage by the Legislature in 1911:

AN ACT

To amend an Act providing for a system of drainage and reclaiming the wet, swamp and overflowed lands of the State, approved August 19, 1911, by authorizing a higher rate of interest on bonds in certain cases; authorizing and requiring the validation of bonds, issued under said Act in all cases requiring the cost of building new bridges thereunder to be paid for by the county, and for other purposes.

Section 1. Be it enacted by the General Assembly of the State of Georgia, and it is hereby enacted by authority of the same, That an Act providing a system for draining and reclaiming the wet, swamp and overflowed lands of the State, approved August 19, 1911, be so amended that where bonds heretofore and hereafter issued thereunder do not in any case exceed the sum of twenty thousand dollars, that the rate of interest thereof may be fixed by the Board of Drainage Commission at not more than eight per cent per annum.

Sec. 2. Be it further enacted, That said Act be also amended so that whenever bonds heretofore and hereafter issued thereunder in any case, that the same shall be validated as other bonds are now required to be validated under the provisions of existing laws of this State.

Sec. 3. Be it further enacted, That said Act be also further amended so that the cost of building all new bridges thereunder shall be borne and paid for by the county.

Sec. 4. Be it further enacted, That all laws and parts of laws in conflict with this Act be, and the same are hereby repealed.

Approved, August 16, 1913.

[1]The State Drainage Law passed by the Legislature in 1911, will be found as the Appendix to Bulletin No. 25, Drainage Investigations in Georgia, issued by the State Geological Survey.

AN ACT

To amend an Act approved August 19, 1911, providing for a system of reclaiming the wet, swamp and overflowed lands by providing that the Tax Collector nor County Treasurer, or the equivalent officer, shall receive no commission out of said drainage fund, for performing the duties imposed upon them in said Act, and to amend Section 1, of the amendment to said Act, approved August 16, 1913, authorizing a higher rate of interest on bonds in certain cases; authorizing and requiring the validation of bonds, issued under said Act in all cases requiring the cost of building new bridges thereunder to be paid for by the county by striking the words "Twenty Thousand" and inserting in lieu thereof the words "Fifty Thousand" wherever found in said Section 1, and for other purposes.

Section 1. Be it enacted by the General Assembly of the State of Georgia, and it is hereby enacted by authority of the same, that the Act of 1911 providing a system for the reclaiming of the wet, swamp and overflowed lands of the State, be so amended as to add a new section to the drainage Act as passed in 1911, by adding the following Section 41. That the Tax Collector nor the County Treasurer or the equivalent officer shall receive no commission for handling the Drainage Fund nor for performing any duty imposed upon him in said drainage Act approved August 19, 1911.

Sec. 2. Be it further enacted by the authority aforesaid, that Section 1 (1) of the amendment thereto, approved August 16, 1913, be, and the same hereby is amended by striking therefrom the words "Twenty Thousand" and inserting in lieu thereof the words "Fifty Thousand" wherever found in said Section 1, so that said section, when so amended will read as follows: Section 1. Be it enacted by the General Assembly of the State of Georgia, and it is hereby enacted by the authority of the same: that an Act providing the reclaiming the wet, swamp and overflowed lands of the State approved August 19, 1911, be so amended that where bonds heretofore or hereafter issued

thereunder do not, in any case exceed the sum of Fifty Thousand Dollars, that the rate of interest thereof may be fixed by the Board of Drainage Commission at not more than eight per cent per annum.

Sec. 3. Be it further enacted by authority aforesaid, That all laws and parts of laws in conflict with this Act are hereby repealed.

Approved August 21, 1917.

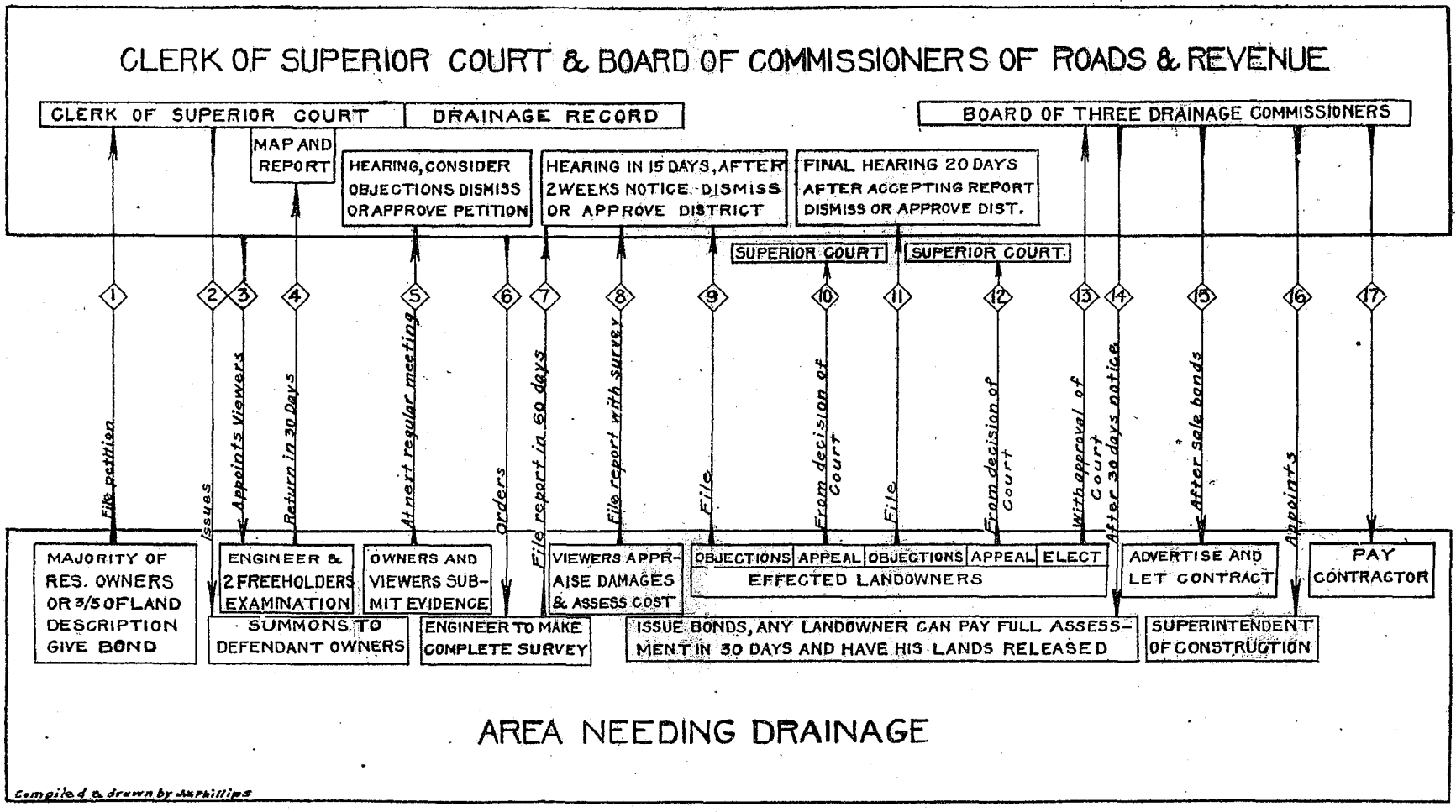

FIG. 6. DIAGRAM SHOWING OPERATION OF STATE DRAINAGE LAW—GEORGIA LAWS 1911, PAGE 108.

INDEX