STATE OF TENNESSEE
STATE GEOLOGICAL SURVEY
GEO. H. ASHLEY, STATE GEOLOGIST

BULLETIN 3

DRAINAGE RECLAMATION IN TENNESSEE

FIRST PAPERS

DRAINAGE PEOBLEMS IN TENNESSEE.
By Geo. H. Ashley.

PRELIMINARY REPORT UPON THE LANDS OVERFLOWED BY THE NORTH AND MIDDLE FORKS OF FORKED DEER RIVER AND RUTHERFORD FORK OF THE OBION RIVER IN GIBSON COUNTY, TENNESSEE.
By A. E. Morgan and S. H. McCrory.

THE DRAINAGE LAW OF TENNESSEE.

NASHVILLE, TENNESSEE
1910

Folk - Keelin
Printing . Co.

Nashville
Tenn.

State Geological Commission

MALCOLM R. PATTERSON, *Chairman,*
Governor of Tennessee.

JOHN THOMPSON,
State Commissioner of Agriculture.

R. A. SHIFLETT,
Chief Mine Inspector.

BROWN AYRES,
President, University of Tennessee.

J. H. KIRKLAND,
Chancellor of Vanderbilt University.

WM. B. HALL,
Vice-Chancellor, University of the South.

GEORGE H. ASHLEY,
State Geologist.

3-A

STATE OF TENNESSEE
STATE GEOLOGICAL SURVEY
GEO. H. ASHLEY, STATE GEOLOGIST

Drainage Problems in Tennessee

BY GEO. H. ASHLEY

EXTRACT (A) FROM BULLETIN No. 3, DRAINAGE RECLAMATION IN TENNESSEE, 1910.

NASHVILLE, TENNESSEE
1910

CONTENTS

Value of alluvial lands 7
Need of their protection 7
Reclamation of glaciated areas 7
Financial return for reclamation 8
How funds are obtained 8
General conditions in West Tennessee 8
Physical condition of drainage in West Tennessee 10
Width of bottom lands 11
Gradient of streams 11
Growth of flood conditions 12
Reclamation problems 12
Stages of reclamation 13
Causes of reclamation values 13
Preliminary data to be collected 13
Planning construction 13
Tennessee Drainage law, passage of 14
State Geological Survey and drainage work 14
Peculiar province of Geological Survey in drainage work 14
Final results 15

DRAINAGE PROBLEMS IN TENNESSEE

BY GEORGE H. ASHLEY.

Value of Alluvial Lands.

In all places, and at all times, it has been true that the alluvial lands excel all others in fertility and durability. The valley of the Nile, long known as the grainery of the world, is but one example out of thousands. The soil of the bottom lands of the rivers is made up of a mixture of all of the materials derived from the various rocks exposed to weathering in the valley above. At the same time with every flood large quantities of leaves and other vegetation is washed over the flooded lands and deposited with the sand, clay, silt, or other material. These deposits are built up with every flood, gaining in depth from year to year.

Need of Their Protection.

But it has also been true in most places that the same floods that build up and render these bottom lands fertile have prevented their use for agriculture to a greater or less degree. Where the overflow is not excessive and does not come when crops are growing, it may be possible to carry on a precarious form of agriculture, the fat years making up for the lean years when crops are ruined by overflow. But in most countries, both ancient and modern, these rich bottom lands have been cultivated only after they have been protected from the ravages of floods, either by digging drainage channels or ditches, or by raising levees, or both. The valleys of the Nile, Tigris, Euphrates and Kiang rivers, the English "Fens," and the coastal lands of Holland, are well known examples of such protected or reclaimed lands.

Reclamation of Glaciated Area.

The northern United States within the area covered by the great glaciers of the ice age is full of marshy areas formed by irregular dumping of the dirt pushed or carried by the glaciers. In the early times these places were avoided by the settlers as the breeding places for malaria, as valueless for agriculture, as places in which to lose cattle, fit only to harbor wild animals. But during the last few decades, especially, there has come a realization of the agricultural possibilities of these lands, and everywhere they are being drained with most satis-

factory results. Lands which before were only a menace to health and life become the richest lands of the region, and people who were eking out a precarious existence on the adjoining hills found the worthless swamps the highway to wealth and prosperity.

FINANCIAL RETURN FOR RECLAMATION.

In the reclamation of these lands it has commonly been found true that the income from one or two crops will pay the cost of the improvements necessary to secure immunity from the floods. On the other hand, the loss of a single crop through inadequate protection has often meant several times as much loss as the additional cost of adequate protection would have been. To be feasible, any land so reclaimed must be worth more than its value before reclamation, plus the cost of reclaiming. Where land worth $10 to $20 an acre can be reclaimed for $10 to $15 an acre, and then be worth $50 to $75 an acre, there can be no doubt as to the feasibility or desirability of its reclamation.

HOW FUNDS ARE OBTAINED.

One of the chief difficulties in the past has been that too often the unreclaimed land has not sufficient value to serve as security for financing the necessary engineering construction. Such reclamation only becomes possible, therefore, when the land owners have other funds or property, or the funds are advanced from some outside source. It is to meet these needs that in recent years most of the States have passed laws enabling counties in which drainage work is needed to advance the necessary money to be paid back in installments after the land comes into production. In that way the land in a few years pays for its own improvement.

GENERAL CONDITIONS IN WEST TENNESSEE.

This general subject has a very live interest for the citizens of Tennessee, because of the large areas, particularly in West Tennessee, that are subject to overflow, and that may be profitably reclaimed. While the larger streams all through the State have more or less bottom lands along their courses, in Middle and East Tennessee these form but a small percentage of the several drainage basins. In some cases, as in Stewart county, the area is quite large, as it is estimated that nearly or quite 50,000 acres of that county are included in the bottoms of the Tennessee and Cumberland rivers and their tributaries. But this is rather exceptional, and in a large number of cases these lands are not

so subject to frequent and destructive floods but that they prove valuable for agriculture. But in West Tennessee the bottom lands subject to overflow often form from ten to twenty-five per cent of their respective drainage basins. Thus it has been estimated that in Obion county, 80,000 acres, or about one-fourth of the county, is subject to overflow. In Gibson county a more careful estimate gives the overflow lands an area of about ten per cent. of the total surface. All told, it has been estimated that there are about 1,000,000 acres of land in West Tennessee subject to overflow. Supposing that the reclamation of that land cost $10 an acre, it will call for a total expenditure of $10,000,000. At first sight, that seems like a very large undertaking, but if it be recalled that with the expenditure of such a sum it is almost certain to increase the value of the lands so reclaimed by $50,000,000, and may increase the State's output by $10,000,000 a year, it would seem to be well worth while. The result of such expenditure is well seen in any part of the United States where wise drainage laws have been in effect for some time. Perhaps I can do no better than to quote from a recent report (Illinois State Geological Survey, Bulletin No. 8, pages 56-7.) a description of some of the changes that have been wrought in that State.

"If one examine the accounts of the early exploration of Illinois he will be constantly impressed with the large amount of swamp land traversed. The impression gained in reading of the winter journey of Colonel Clarke from the Mississippi to the Wabash, at the time he surprised and captured Vincennes, is that the soldiers waded in swamps from one river to the other. Yet, if one traverse the same route now, he will find, in the main, a slightly rolling upland well drained and cultivated, with so little water present that ponds must be made to furnish the boilers of the mills and factories scattered through our areas of cheap coal.

"If, again, one examines the maps of the early land surveys, he sees acres and square miles of our Central Illinois corn belt set aside as swamp lands. The contrast between the territory as it now is, is so great as to have created the suspicion of fraud in the early surveys. Indeed, a few years since the United States land office sent special agents into the State to investigate matters and set at rest, if possible, these suspicions. These agens drove over miles of territory, the original maps in hand, and where swamps were marked by the surveyors, found only well drained, highly productive fields, beautiful groves, substantial barns and handsome houses. They were puzzled and suspicious, but, in the end, after thorough investigation, reported no fraud. The explanation after all is simple.

"Many years ago, some thousands in fact, the great glaciers came down from the north and spread over nearly all of what is now Illinois. In their coming they scraped and shoved along the rocks and soils of the territory invaded, and, when the warm sun melted the ice away, dumped their load in a vast irregular mantle over our older landscape. Our old Illinois is, therefore,

buried 20 to 200 feet deep beneath a mass of rocks, bowlder clay, silt, and soil brought down from the north. The heritage of Canada, the soil patiently prepared by wind, water and sun acting through years on the rough rocks, has been spread out here with lavish generosity and now forms our great fertile prairies. The glacier, however, worked irregularly, and, in dumping its load, paid little attention to existing streamways. It filled up some, diverted others, and created shallow ponds and deep 'kettle holes' over the whole of a formerly well-drained territory. Long as has been the period since the ice melted, it has not been long enough for the slow-eroding rivers to eat their way backward and to drain all these ponds and flat uplands. Only the early stages of river work have been accomplished. They have cut their deep narrow gorges, canyon-like in places, but have not developed the tributaries.

"Such a landscape affords the maximum favorable conditions for artificial drainage, and the people of Illinois were quick to see and to seize their opportunity. By the enactment of wise and far-seeing laws—laws which have been a model to many other States, and which may well serve as a model to more yet—it was made possible for the people of individual areas, large or small, to organize drainage districts and to tax themselves for the reclamation of their land. In a way, the great Sanitary District, with its deep waterway, is only a large drainage tract, and is only doing what many a modest farming community in many parts of the State has already done.

"The drainage districts are permitted to organize, cut ditches, dig canals, build levees where necessary, and, in short, to aid nature in the extension of her streams, so as to carry off the surplus water and convert the swamps and ponds into cornfields and orchards. Above the open ditches the farmers bury long rows of tile, made at some nearby factory, and in a few years the increased yield of crops pays off the bonds, leaving a permanent benefit free of cost. In this way has been accomplished the miracle which puzzled the land inspectors, and in this way has been added millions of dollars to the permanent taxable wealth of the State."

The lands needing reclamation in Tennessee differ from those described, but when reclaimed there will be the same transformation from the present timber-covered bottom lands, with brush-choked streams, muddy roads, sloughs filled with standing water to breed malaria-bearing mosquitoes, suitable only for the ranging of cattle—to valleys and fine farms, "highly productive fields, beautiful groves, substantial barns and handsome houses."

PHYSICAL CONDITION OF DRAINAGE IN WEST TENNESSEE.

West Tennessee has an area of about 10,000 square miles, of which about 1,150 drain to the Tennessee River, and the remaining 8,850 square miles, forming the "Plateau of West Tennessee," drain to the Mississippi. The divide between the two drainage systems is much nearer the Tennessee River, the relative width of the two drainage belts ranging from one to six to one to four. In consequence, the streams

flowing to the Tennessee are fairly rapid, while those flowing to the Mississippi have very meandering courses flowing in fairly straight, regular valleys. In most cases it is probably true that the meandering courses of the streams are fully twice as long as the valleys in which they flow. The main streams from north to south are: Obion River, with its North, Middle, South and Rutherford forks, and Reelfoot Creek; the Forked Deer River, with its North, Middle and South forks, emptying into the Obion River near its mouth; Big Hatchie River, of which the principal tributaries are: Rose, Piney, Spring, Clover, and Big Muddy Creeks; Loosahatchie River, receiving the waters of Beaver Dam, Cypress and Big Creeks; and Wolf River; the last named two rivers emptying into the Mississippi at Memphis.

WIDTH OF BOTTOM LANDS.

The valleys of these streams, including only the portion that is subject to flooding, will range from one-fourth of a mile to four miles in width. The Obion and Big Hatchie have bottoms three to four miles wide. The South fork of the Forked Deer has bottoms of about three miles wide; the Middle fork about two miles wide, and the North fork will probably average less than a mile.

GRADIENT OF STREAMS.

There is, as yet, but little data on the grade of these valleys. A line of levels down the North fork of the Forked Deer showed a grade of over four feet to the mile at the head and about one and one-fourth feet per mile where it joins the Middle fork. By taking known elevations of the Mississippi at the mouths of the streams, and of some towns on railroads up the rivers, it may be possible to make an approximation of their grade. From these facts it seems probable that the lower courses of these rivers have a fall of little, if any, above one foot to the mile. This will rise to two feet in the middle courses of the rivers, and to three or four feet per mile in the upper courses. Thus, low water in the Mississippi at the mouth of Obion River is about 225 above tide. The Illinois Central Railroad track at Obion is 289 feet above tide. The difference is 64 feet. Making allowance for the elevation of railroad track at Obion above the level of Obion River at that point, it is evident that the fall is less than one and one-half feet per mile. Hico, on the South fork of the Obion River, has an elevation of 389 feet above tide, which gives a fall of less than two feet to the mile to the mouth of the river. On the North fork of the Forked

Deer River, Trenton has an elevation of 315 feet above tide at the station. Allowing for the elevation at the station above the stream, and assuming the river level at the mouth as 225 feet above tide, and the distance as forty miles, this gives a grade of less than two feet to the mile. Vildo, on the Big Hatchie, has an elevation of 328 feet above tide. Mean low water at the mouth of the river is about 215 feet. Vildo is about fifty-two miles by valley from the mouth, giving, again, a grade of probably a little under two feet per mile. The Loosahatchie and Wolf Rivers again are shorter and have a higher gradient, of probably over three feet per mile.

GROWTH OF FLOOD CONDITIONS.

The flooding of the stream bottoms of West Tennessee is a matter of fairly recent growth. It tends to become worse rather than better. Before this region was deforested, these rivers and streams flowed with good depth all the year round. The rains then were held by the leaves and humus, and found their way to the stream through perennial springs and brooks. There are still living men who can tell of boating on these rivers, and of the time when it was difficult to find fords. As the country has been cleared up and put under cultivation, the rain waters have tended more and more to run quickly and directly to the streams, carrying sand and silt with them. Thus resulted a temporary increase in the water delivered to the stream channels, and at the same time, a decrease in the carrying capacity of the channels through its filling with sand. At the same time the streams have been allowed to become choked up with fallen timber and brush. This tendency toward rapid run-off has continued until today it does not require more than from three to twelve hours after a storm until the waters reach the bottoms. The general result has been that instead of the former fairly uniform flow throughout the year, there is a series of floods following each storm or series of storms, and a practical drying up of the streams in late summer, or during the dry season. The introduction of tile drainage is going to make matters worse, for it will hasten the removal of the water that soaks into the ground.

RECLAMATION PROBLEMS.

The problems of the reclamation of the bottom lands of West Tennessee, therefore, involves four factors: 1. Retardation of the run-off; 2. Preparation of an adequate channel for the greatest present and future run-off; 3. The prevention of the filling of the channels by sand or other material; 4. The clearing and secondary drainage and preparation of the bottoms reclaimed.

STAGES OF RECLAMATION.

The reclamation work itself will involve four stages: (1) The collection of data on which to base plans for the work; (2) the planning and the location of the work on the ground; (3) the construction of the work; and (4) the financing of the work.

CAUSES OF RECLAMATION FAILURES.

In the past large amounts of money have been wasted through not securing sufficient data before beginning work, or through poorly conceived plans. Nearly every State where reclamation projects have been under way for a long time can point to numerous exeamples of drainage construction that have had to be reconstructed, with too often the entire loss of the cost of the first construction. Sometimes the levees are not high enough or far enough apart; sometimes they are built of silt of a form suitable for clay, and they wash away; sometimes stumps or logs have been left in the foundation, or the muck ditch was omitted; sometimes a layer of water bearing sand ran under the levee and ultimately undermined it; sometimes the hill wash came down and filled the channels, or the "hill water" proved to be more than could be disposed of, or it may have been one of a hundred other causes.

PRELIMINARY DATA TO BE COLLECTED.

The data first to be collected includes: the rainfall, both general and special; the area drained by each stream, the run-off, the slopes of the surface, the character of the soil, sand contained in the run-off, the capacity and shape of the present channel, the detailed topography of the valley bottoms (for the planning of the new channels, levees, the drainage of the lands back of the levees, etc.).

PLANNING CONSTRUCTION.

With this data in hand, it may be found that all that is necessary is the clearing of the channel of the stream of all obstructions, including the growth on its banks; or it may be necessary to straighten the channel as well, so as to increase its grade and rate of run-off; it may be necessary to enlarge, as well as straighten the channel; or still further it may be necessary to construct an outer channel by raising levees either side of the channel and at some distance back. In most cases in West Tennessee it is probable that the last plan may have to be adopted. Just how high the levees should be, and how far back, is a

matter of calculation from the data collected, using known formulæ of stream flow. It is here that the data collected becomes of value; for if the levees are not high enough or far enough apart, they would be of little or no value. On the other hand, if they are made larger than necessary, money is wasted in their construction. A knowledge of the behavior of various materials is necessary in planning the levees, for a levee built of sand or silt has to be of different construction from one of clay.

TENNESSEE DRAINAGE LAW, PASSAGE OF.

In Tennessee, drainage work has been made possible through the passage of a drainage law by the Legislature of 1909. This law provides for the formation of drainage districts, and all of the necessary machinery for legalizing the necessary condemnations and assessments, for supplying the funds through the county and for the refunding of such moneys by districts benefited, and for the necessary surveying and engineering control, and all other details. This law is published separately in another part of this bulletin.

STATE GEOLOGICAL SURVEY AND DRAINAGE WORK.

At the same time the organic law of the State Geological Survey provided as one of its objects and duties "a study of the swamps and other non-tillable lands of the State, with reference to their reclamation for agricultural purposes." In pursuance of this provision of the law, and in recognition of the need and the great benefit to the State, as well as to the people locally of the reclamation work, the State Geological Survey has, from the first, entered heartily into coöperation in such work, and has devoted a large share of its funds to such coöperation. It has felt that its share in the work should be in the making of the necessary preliminary studies and surveys, in coördinating the work between the several districts, so that plans and constructions carried out in one district would be in harmony with those of another district, and in securing such coöperation from the Federal Bureaus as it could.

PECULIAR PROVINCE OF GEOLOGICAL SURVEY IN DRAINAGE WORK.

Where, as is often the case, there are two or more drainage districts on the same stream, it is of vital importance that the work in these several districts be coördinated in order that construction in one district shall not produce conditions in the other districts detrimental to those districts, either by constricting the channel between the levees so

as to back water up on a district above, or by hastening the on-flow of waters through one district, to add to the flooded conditions of the next district below. The Geological Survey had felt it to be peculiarly its province to assist in securing such coördination. Again, many of the studies, as of rainfall and run-off, are general in their nature, and data secured in one district is of value in all the districts. It is hoped by coöperation with the Drainage Investigations Division of the U. S. Department of Agriculture, to secure much data of this kind that will be necessary in making plans for the drainage construction in the several districts, and so prevent the necessity of each district securing this data for itself.

FINAL RESULTS.

As for final results, perhaps no better statement can be made than that given by Judge John S. Cooper in an address published in 1908:

"West Tennessee is already the most densely populated grand division of the State, and taken as a whole, is now the most desirable portion of the State for agriculture. With these bottoms made susceptible of safe cultivation, and the health of the region, which is already good, made much better by such drainage, with an inexhaustible supply of the finest drinking water in the world now obtained from the deep wells of the plateau region, with excellent facilities for transportation already, and with some of these rivers further utilized for navigation, and even for irrigating many portions of their flood-plains, prophecies for the future of this region could, perhaps, hardly be too sanguine."

3-B

STATE OF TENNESSEE
STATE GEOLOGICAL SURVEY
G. H. ASHLEY,
State Geologist

U. S. DEPT. of AGRICULTURE
OFFICE OF EXPERIMENT STATIONS,
DRAINAGE INVESTIGATIONS,
C. G. ELLIOTT, Chief.

PRELIMINARY REPORT

UPON THE

DRAINAGE OF THE LANDS OVERFLOWED

BY THE

North and Middle Forks of the Forked Deer River

AND THE

Rutherford Fork of the Obion River

IN

Gibson County, Tennessee

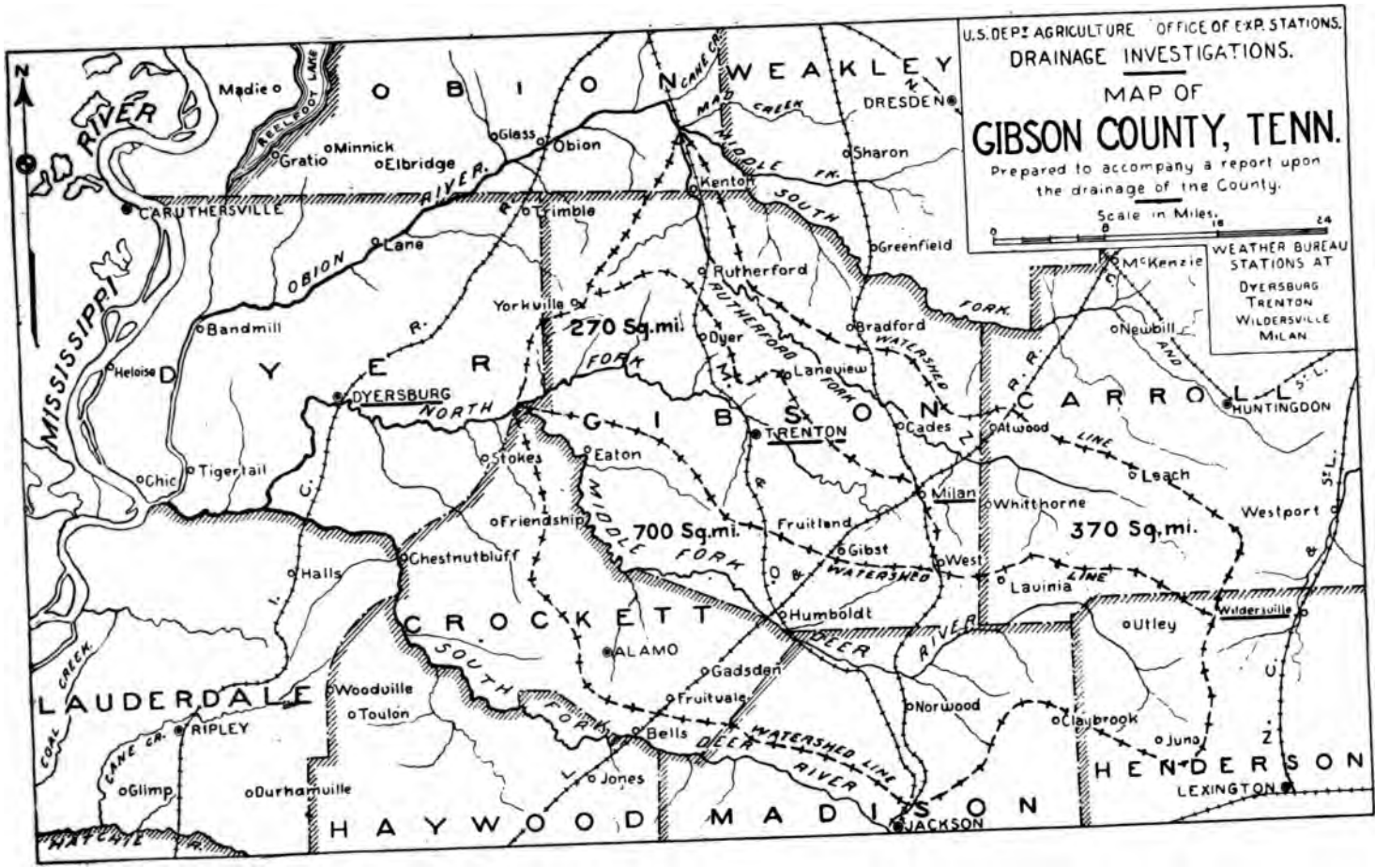
BY

A. E. MORGAN and S. H. McCRORY
Drainage Engineers, U. S. Department of Agriculture

NASHVILLE, TENNESSEE
1910

CONTENTS

Introduction 21
Description of territory 21
Run-off 22
Units of measurement 22
Rain fall 22
Discussion of run-off 30
Description of streams 32
Rutherford Fork of the Obion River 32
Drainage condition 32
North fork of the Forked Deer River 32
Middle fork of the Forked Deer River 33
Drainage conditions 34
Soil erosion and silting of channels 35
Control of soil erosion and deposits 35
Control by collecting ditches 36
Collecting basins 37
Prevention of erosion 37
Enlarging of channels by erosion 38
What constitutes reclamation 38
Plan of improvement 40
Benefits 41
Survey 41
Recommendations 42


U.S. DEPT. AGRICULTURE OFFICE OF EXP. STATIONS.
DRAINAGE INVESTIGATIONS.
MAP OF
GIBSON COUNTY, TENN.
Prepared to accompany a report upon the drainage of the County.
Scale in Miles.
0 8 16 24
WEATHER BUREAU STATIONS AT
DYERSBURG
TRENTON
WILDERSVILLE
MILAN
N
OBION
WEAKLEY
DYER
GIBSON
CARROLL
CROCKETT
LAUDERDALE
HAYWOOD
MADISON
HENDERSON
MISSISSIPPI RIVER
REELFOOT LAKE
Madie
Gratio
Minnick
Elbridge
Glass
Obion
Kenton
Trimble
Lane
CARUTHERSVILLE
DRESDEN
Sharon
Greenfield
McKenzie
Newbill
Rutherford
Yorkville
270 Sq.mi.
Bandmill
Heloise
DYERSBURG
Dyer
Laneview
Bradford
TRENTON
Cades
Atwood
HUNTINGDON
Stokes
Eaton
Chic
Tiger Tail
Milan
Leach
Whitthorne
Westport
Friendship
700 Sq.mi.
Fruitland
370 Sq.mi.
Gibst
West
Chestnutbluff
Halls
Lavinia
Humboldt
Wildersville
Utley
ALAMO
Gadsden
Woodville
Toulon
Fruitvale
Norwood
Claybrook
RIPLEY
Bells
Juno
Glimp
Durhamville
Jones
LEXINGTON
JACKSON
HATCHIE R.
COAL CREEK
CANE CR.
WATERSHED LINE
DEER RIVER
SOUTH FORK
NORTH FORK
MIDDLE FORK
RUTHERFORD FORK
MAD CREEK
CANE CR.

PRELIMINARY REPORT

Drainage of Lands Overflowed in Gibson County

By A. E. MORGAN and S. H. McCRORY

INTRODUCTION.

In May, 1910, a coöperative agreement was made between C. G. Elliott, Chief of Drainage Investigations of the Office of Experiment Stations, U. S. Department of Agriculture, and Geo. H. Ashley, State Geologist of Tennessee, under the terms of which Drainage Investigations agreed to make an examination of the Rutherford Fork of the Obion River and the North and Middle Forks of the Forked Deer River; and to suggest a plan for draining the overflowed lands along these streams. A. E. Morgan and S. H. McCrory, drainage engineers of the Office of Experiment Stations, were detailed for the work, and before entering upon their duties attended a meeting of the committee having charge of the drainage work in Gibson county, Tenn., held at Trenton on May 13th, 1910, which meeting was also attended by Mr. Ashley.

The following report contains suggestions based upon information obtained by personal examination of the streams and their watersheds, and represents the judgment of the engineers as to their respective drainage capacities and requirements. The data relating to the fall on the North Fork of the Forked Deer River was obtained from surveys made by H. P. Farrar for the Drainage District that has been formed for the improvement of this stream.

This report presents the drainage problems as they exist in the territory examined, and submits a review of the estimated cost of draining the flooded land along the North Fork. It discusses the necessity of adequate preliminary surveys and of careful stream investigations.

DESCRIPTION OF TERRITORY.

The territory considered in this report includes the watersheds of the Rutherford Fork of the Obion River and of the North and Middle Forks of the Forked Deer River. Rutherford Fork drains approximately 370 square miles, North Fork 270 square miles, and Middle Fork 700 square miles. The principal towns in the area examined are Rutherford, Trenton, Humboldt, Dyer, Milan, and Eaton. The Mobile and Ohio R. R. crosses the territory from north to south, and the Illinois Central and Louisville and Nashville Railroads cross the head waters of the streams. The staple crops of the region are corn, cotton,

wheat, and hay; and in parts of the country small fruits and vegetables. The soil along the streams is a silt loam, generally a dark brown color. The soil on the uplands is loam or silt loam, varying in the different parts of the territory. Nearly all the well drained land is cultivated or used for pasture. Only a small part of the river bottoms is cultivated, the remainder being used for pasture.

RUN-OFF.

Of all the water that falls upon a given area as rain or snow, a part is returned to the air by evaporation, part sinks deep into the ground, and the remainder flows over or through the ground to the streams, and through them passes out of the country as run-off.

UNITS OF MEASUREMENT.

In discussing run-off in its relation to rainfall it is usual to express the rate in inches of depth in 24 hours over the entire watershed, or in cubic feet per second per square mile for the watershed area.

RAINFALL.

Rainfall is the most important element to be considered in the estimation of the run-off. The streams examined are in a region of abundant rainfall, the average precipitation being about 50 inches in a year. The maximum annual rainfall of which we have a record is 72.56 inches at Trenton, Tenn., in 1884, and the minimum is 38.64 inches at Kenton, Tenn., in 1904.

The heaviest rains occur in the Winter or early Spring, while the driest season is in September and October. The heaviest month's rain of which we have a record occurred during January, 1898, when an average of 13.78 inches fell over the entire area drained by the three streams. There are several months for which no precipitation is recorded at any station.

Tables 1 to 4 were compiled by the Weather Bureau and show the monthly, annual and average rainfall at four stations in the watersheds of the streams examined.

TABLE NO. 1.

Showing Monthly, Annual and Average Precipitation (in inches and hundredths) at Dyersburg, Dyer County, Tenn. Elevation 310 feet.

YEAR	January	February	March	April	May	June	July	August	September	October	November	December	Annual
1883	------	------	------	------	3.26	4.76	6.45	4.00	0.63	5.22	1.99	2.48	------
1884	2.60	8.69	3.48	3.94	4.06	4.09	6.12	2.41	3.27	2.02	2.13	8.85	51.66
1885	5.59	1.55	1.67	6.15	3.25	6.98	4.59	1.04	2.94	1.74	------	------	------
1886	------	------	------	------	5.41	5.06	1.76	3.31	2.51	0.92	------	------	------
1887	------	------	------	------	2.06	2.44	2.92	2.70	4.59	0.68	------	------	------
1888	------	------	------	1.60	3.77	3.08	1.38	11.75	0.92	2.72	------	------	------
1889	------	------	------	------	2.36	8.16	5.92	1.42	6.64	0.94	8.71	0.60	------
1890	7.07	8.05	5.28	5.04	3.96	2.06	2.13	3.84	5.54	2.68	4.47	------	------
1891	------	------	------	------	1.59	9.13	4.03	1.42	1.69	1.61	11.45	5.05	------
1892	1.68	3.44	2.67	10.45	6.62	4.18	5.68	4.12	0.94	0.33	4.87	------	------
1893	------	------	------	------	7.63	1.84	2.17	0.07	6.64	2.74	4.36	------	------
1894	------	------	------	------	3.73	0.76	5.62	2.56	1.50	0.27	0.00	------	------
1895	------	------	------	------	2.78	0.73	4.77	1.99	1.06	1.01	7.66	3.76	------
1896	3.16	1.93	6.07	4.03	4.92	5.29	3.57	1.75	3.54	2.53	5.66	------	------
1897	------	3.13	10.75	6.43	1.32	2.54	2.11	0.63	0.00	0.75	3.67	------	------
1898	13.93	1.88	3.49	4.91	4.42	3.34	3.49	3.44	4.35	4.02	------	------	------
1899	------	------	------	------	4.48	2.90	3.58	3.00	1.10	2.47	3.23	------	------
1900	------	------	------	------	2.12	11.19	4.04	0.87	7.33	7.49	------	------	------
1901	------	------	------	7.37	3.60	0.21	1.15	4.40	2.72	3.55	------	------	------
1902	------	------	------	------	2.06	3.97	0.25	4.92	1.74	2.70	------	------	------
1903	------	------	------	------	2.50	0.58	1.41	0.48	0.53	0.72	------	------	------
1904	------	2.32	5.70	3.75	3.36	2.73	4.03	2.38	4.96	1.00	0.59	5.75	------
1905	1.92	1.66	3.17	3.50	9.84	6.21	4.20	4.81	1.60	5.35	3.45	4.75	50.46
1906	5.40	1.62	8.08	2.77	4.11	2.47	4.88	5.79	6.21	1.76	12.63	8.08	63.80
1907	5.90	5.08	3.13	7.54	10.43	3.58	2.69	2.69	1.80	4.20	5.00	3.36	55.40
1908	1.70	7.60	4.05	6.40	3.59	5.75	1.54	5.35	1.32	T	7.30	1.45	46.05
Months	**4.94**	**3.91**	**4.80**	**5.28**	**4.12**	**4.00**	**3.48**	**3.12**	**2.93**	**2.29**	**5.13**	**4.41**	**48.41**

TABLE NO. 2.

Showing Monthly, Annual and Average Precipitation (in inches and hundredths) at Kenton, Obion County, Tenn. Elevation 360 feet.

YEAR	January	February	March	April	May	June	July	August	September	October	November	December	Annual
1902	------	------	------	2.58	2.57	2.58	T	4.76	3.20	3.51	4.79	10.53	------
1903	2.69	8.34	5.45	3.32	4.67	1.87	3.00	1.44	0.75	0.77	3.29	4.71	40.30
1904	4.72	2.53	5.06	4.03	2.32	2.74	3.10	2.15	2.92	0.94	0.70	7.43	38.64
1905	3.00	2.17	3.33	4.56	4.34	4.28	8.26	3.32	2.45	4.38	3.23	4.48	47.80
1906	5.15	1.39	7.53	2.48	3.52	1.99	4.73	4.25	5.20	1.78	13.09	7.81	58.92
1907	5.41	5.68	4.46	6.25	10.19	4.87	6.32	2.65	1.85	3.87	4.15	3.67	59.37
1908	2.71	4.89	4.24	8.25	4.37	7.31	1.73	3.34	0.41	T	8.12	1.65	47.02
Months	3.95	4.17	5.01	4.50	4.57	3.66	3.88	3.13	2.40	2.18	5.34	5.75	48.54

TABLE NO. 3.

Showing Monthly, Annual and Average Precipitation (in inches and hundredths) at Trenton, Gibson County, Tenn. Elevation 345 feet.

YEAR	January	February	March	April	May	June	July	August	September	October	November	December	Annual
1869	------	3.15	5.93	9.00	3.30	3.80	7.00	5.70	1.30	2.60	5.50	5.30	------
1870	5.58	4.41	4.32	2.90	4.70	5.60	1.80	3.40	1.70	2.90	------	------	------
1871	4.05	3.00	8.20	7.75	3.60	2.80	3.20	2.60	1.70	4.20	1.22	2.50	44.82
1872	1.44	3.30	1.80	7.60	3.00	5.00	4.30	------	3.65	1.60	1.70	1.87	------
1873	3.66	------	------	------	------	------	------	------	------	------	------	------	------
1883	------	------	------	------	------	------	------	4.57	0.96	12.83	5.80	7.74	------
1884	7.36	10.71	7.75	8.77	8.64	3.77	5.93	2.55	5.91	2.17	1.95	7.14	72.65
1885	6.98	1.96	2.46	3.84	4.50	6.78	4.43	1.26	3.49	2.26	2.52	3.18	43.66
1886	6.16	6.74	3.74	5.06	4.37	4.14	1.28	2.92	4.19	0.86	7.73	2.36	49.55
1887	4.97	8.23	2.86	1.68	3.17	2.21	2.73	2.83	3.50	1.99	2.77	4.01	40.95
1888	4.73	2.14	5.72	1.63	4.19	3.89	1.18	8.62	1.94	2.85	5.16	2.15	44.20
1889	5.25	1.74	3.32	1.51	3.74	8.33	2.69	1.02	6.43	1.15	9.83	0.93	45.81
1890	7.70	8.50	8.31	4.48	3.11	4.85	0.50	8.58	4.90	2.48	5.49	5.09	63.99
1891	7.77	5.40	7.70	4.36	1.24	8.06	6.74	2.44	1.39	0.80	7.60	6.50	60.00
1892	------	------	------	------	------	------	------	------	------	------	------	------	------
1893	------	------	------	------	------	3.06	2.42	T	6.98	2.32	4.90	4.50	------
1894	3.99	8.90	6.57	6.74	3.49	1.17	4.11	2.58	2.00	0.47	0.46	------	------
1895	------	------	6.36	0.91	1.83	1.81	4.59	0.03	1.62	0.77	7.23	3.95	------
1896	2.26	3.81	6.94	2.66	5.95	4.92	3.87	4.24	2.77	1.77	8.37	1.11	48.67
1897	4.67	4.13	7.70	6.10	0.98	2.58	1.56	1.62	T	1.95	4.32	4.17	39.78
1898	14.86	1.99	6.74	4.59	3.92	3.73	4.67	2.07	5.04	6.50	3.20	3.80	61.11
1899	6.60	3.64	4.77	2.57	4.47	2.11	4.04	0.79	0.47	2.71	2.91	4.00	39.08
1900	------	------	1.83	2.99	2.12	12.05	1.96	1.24	4.71	4.01	7.40	------	------
1901	------	------	------	------	------	------	------	10.52	2.05	2.23	1.99	4.74	------
1902	6.92	3.70	5.84	2.28	------	------	------	------	3.01	3.10	4.20	10.19	------
1903	3.16	8.76	5.05	3.95	5.54	3.34	4.44	1.33	0.55	1.57	3.10	5.45	46.24
1904	5.05	1.36	5.70	5.17	3.17	1.87	3.39	1.99	4.50	1.26	1.21	7.57	42.24
1905	4.58	2.75	4.21	4.27	5.23	5.94	4.61	1.94	1.90	5.18	5.47	3.82	49.90
1906	3.76	1.46	5.81	3.72	1.28	1.98	1.71	4.08	5.08	1.90	13.79	7.59	52.16
1907	4.55	5.74	3.60	5.90	7.79	1.97	1.29	1.30	3.47	4.26	4.68	3.86	48.41
1908	3.13	4.34	4.88	6.11	4.15	6.10	2.18	3.43	0.49	T	7.24	1.81	43.86
Months	5.38	4.58	5.31	4.48	3.90	4.30	3.33	3.10	2.96	2.71	4.92	4.44	49.41

TABLE NO. 4.

Showing Monthly, Annual and Average Precipitation (in inches and hundredths) at Wildersville, Henderson County, Tenn. Elevation 400 feet.

YEAR	January	February	March	April	May	June	July	August	September	October	November	December	Annual
1885	------	------	------	------	------	------	------	------	------	2.10	3.08	1.75	------
1886	6.17	5.95	2.95	------	------	------	------	------	------	------	------	------	------
1897	------	------	------	------	------	------	------	------	------	0.96	4.22	6.08	------
1898	12.55	1.48	5.60	4.25	4.42	3.56	5.15	2.34	3.27	2.71	3.66	2.92	51.91
1899	7.95	6.36	6.96	5.25	5.37	4.65	4.00	2.70	0.38	3.01	3.52	5.22	55.37
1900	2.56	6.39	3.16	3.67	3.93	15.85	2.33	4.51	4.78	6.50	7.48	2.98	64.14
1901	4.28	2.32	3.40	3.44	3.74	1.93	1.63	9.08	2.60	1.75	2.05	5.38	41.60
1902	5.21	1.68	9.42	4.73	4.59	3.36	2.65	8.25	2.69	1.58	4.25	9.64	58.05
1903	2.59	7.39	4.67	2.56	6.05	2.39	6.37	------	0.30	1.18	3.58	4.95	------
1904	4.70	0.95	5.70	3.75	3.57	3.87	5.82	3.77	3.15	2.90	1.15	8.60	47.93
1905	3.02	1.25	4.34	3.08	7.21	5.93	4.98	4.01	2.29	6.21	2.09	4.49	48.90
1906	4.85	0.76	3.62	2.88	------	2.60	3.64	4.37	5.38	3.30	12.18	6.93	------
1907	4.29	4.20	4.86	5.62	9.91	1.08	2.85	2.58	2.87	4.53	4.18	------	------
1908	------	------	------	3.94	3.65	4.49	1.81	4.21	0.77	0.00	4.09	1.95	------
Months	5.29	3.52	4.97	3.92	5.24	4.52	3.75	4.58	2.59	2.83	4.27	5.07	50.55

As the record at Milan is incomplete, no table was compiled for this Station.

TABLE NO. 5.

Storm periods for the years 1897 to 1909, inclusive, as shown by the records of the U. S. Weather Bureau Stations at Dyersburg, Milan, Trenton and Wildersville, Tenn.

1897

	April				September	December					
	1	2	3	4	For Month	17	18	19	20	21	22
*r*Dyersburg	.60	----	.49	1.51	None	----	----	----	----	----	----
*r*Milan	.98	----	*s*	2.05	Trace	----	----	----	----	----	----
Trenton	.55	----	.80	1.02	Trace	.28	.03	.05	2.23	.25	.02
Wildersville	----	----	----	----	----	.43	.06	.25	2.08	.50	.25

r December missing. *s* Missing.

1898

	January														
	5	6	8	9	10	11	12	14	15	19	20	22	25	30	31
Dyersburg	.06	.36	----	----	.09	2.54	.80	2.30	.24	2.60	.95	2.80	1.09	.10	----
*r*Milan	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Trenton	T	.61	.05	.01	.62	1.85	.90	2.18	.78	2.42	1.25	3.36	.76	.07	----
Wildersville	T	.62	.02	----	.06	2.00	.80	2.04	.87	1.65	.75	2.93	.53	.07	.01

r January missing.

	March							May			September			
	12	13	14	15	16	17	18	20	21	22	21	22	29	30
Dyersburg	----	.37	----	.48	----	.72	.12	1.03	.30	1.52	.69	1.33	----	1.10
*r*Milan	----	----	----	----	----	----	----	1.07	.01	1.65	.35	1.30	----	.80
Trenton	T	.76	----	3.44	----	.16	.02	1.02	.09	1.68	.43	1.27	.26	1.59
Wildersville	T	1.00	T	.94	.39	----	----	1.63	----	1.94	.35	.23	.17	1.87

r March missing.

1899

	January						Feb.		May				July					
	9	10	11	12	13	14	25	26	10	11	12	13	21	22	23	24	25	26
*r*Dyersburg	----	----	----	----	----	----	----	----	.43	*s*	.90	.40	.47	.09	1.21	.73	----	.27
*r*Milan	----	----	----	----	----	----	----	----	.35	.69	.20	.65	.90	.10	2.50	.20	.55	.52
Trenton	.05	.73	.34	.10	1.50	.49	1.38	----	.13	.20	.42	T	1.36	1.69	.28	T	.25	----
Wildersville	T	----	1.10	T	1.54	.53	.30	2.05	T	.68	2.00	----	.75	.28	2.43	.22	T	----

r January and February missing. *s* Missing.

(Table No. 5 Continued)

1900

	February					May			June									
	7	8	20	21	22	29	30	31	1	2	3	4	5	6	7	8	13	14
*r*Dyersburg	----	----	----	----	----	----	.30	.67	1.18	----	----	.40	.13	.32	----	.14	----	.80
*r*Milan	----	----	----	----	----	T	.50	.23	1.18	T	.56	.25	.43	.80	.03	1.50	----	1.43
*r*Trenton	----	----	----	----	----	.02	.10	.38	.38	----	.34	.12	.04	.20	.05	1.13	----	1.15
Wildersville	.70	2.05	.08	1.80	.06	.50	.35	.82	.38	1.60	.08	.18	.20	.45	.82	----	T	2.80

r February missing.

	June																Total Month
	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
Dyersburg	3.20	----	----	----	.22	----	----	----	.68	.58	.03	2.20	1.31	----	----	----	11.19
Milan	2.35	.07	.03	2.47	T	----	.24	----	.97	.27	.87	.55	.43	----	----	----	16.38
Trenton	2.03	T	.05	1.56	.18	.04	----	T	.64	.25	1.83	1.61	.45	T	T	----	12.05
Wildersville	.16	.88	----	.72	----	----	.02	2.33	----	1.76	.22	2.60	.04	.55	----	.06	15.85

	August			September							
	29	30	31	1	2	3	20	21	22	23	24
Dyersburg	----	.27	.15	.17	----	.43	1.25	2.15	----	1.50	1.75
Milan	----	.30	.27	2.00	.55	.10	1.60	.65	.05	1.30	----
Trenton	T	.03	.35	.43	----	T	.20	.23	1.49	----	----
Wildersville	.60	----	2.30	1.70	----	----	.74	.08	1.52	.07	----

	October				November					
	6	7	8	22	19	20	21	23	24	25
*r*Dyersburg	.39	M	1.64	2.18	----	----	----	----	----	----
*r*Milan	.02	1.25	.40	2.00	----	----	----	----	----	----
Trenton	T	.30	.80	1.75	1.47	3.49	----	.75	1.37	.20
Wildersville	----	.66	3.00	1.20	.36	2.86	1.98	.94	.72	.62

r November missing.

1901

	April		August									
	17	18	12	13	14	15	16	17	18	19	20	21
Dyersburg	----	2.52	----	----	.25	.50	----	1.75	.15	.60	----	.05
Milan	.10	1.00	1.52	----	.50	1.20	.15	1.78	.90	.50	.52	1.60
*r*Trenton	----	----	.60	T	2.75	1.25	----	.65	----	1.69	2.05	----
Wildersville	.60	.30	T	.56	1.70	----	1.80	.54	.76	.65	1.53	----

r April missing.

	September				October			December			
	13	14	15	17	11	12	13	8	9	13	14
*r*Dyersburg	----	1.50	.05	1.17	----	2.15	1.25	----	----	----	----
*r*Milan	----	2.20	.50	.12	----	.40	.90	----	----	----	----
Trenton	2.05	----	T	----	1.89	T	----	.46	1.88	----	2.00
Wildersville	----	2.56	.04	----	----	1.70	----	.86	1.14	.40	.60

r December missing.

(Table No. 5 Continued)

1902

	March					August			Oct.	
	26	27	28	29	30	26	27	28	3	4
*r*Dyersburg	----	----	----	----	----	----	.95	1.25	1.20	1.35
Kenton	1.01	----	2.31	.03	.24	.20	2.02	.02	3.10	.20
*r*Milan	----	----	----	----	----	----	.59	1.05	.55	1.50
*s*Trenton	1.31	----	2.23	.05	.24	----	----	----	2.50	T
Wildersville	1.25	T	4.05	----	----	.05	2.05	.65	.38	----

r March missing. *s* August missing.

	November				December					
	24	25	26	27	11	12	13	14	15	
*r*Dyersburg	----	----	----	----	----	----	----	----	----	Followed by four days without rain.
Kenton	1.16	1.10	.12	.04	.04	.65	.07	1.40	6.03	
*r*Milan	----	----	----	----	----	----	----	----	----	
Trenton	1.26	1.06	.18	.02	T	1.10	.08	1.36	4.90	
Wildersville	1.50	1.15	----	T	T	.30	----	1.50	3.94	

r November and December missing.

1903

	February			March						July		Dec.	
	14	15	16	5	6	7	8	9	10	30	31	19	20
*r*Dyersburg	----	----	----	----	----	----	----	----	----	.10	1.25	----	----
Kenton	1.15	2.30	.60	.70	2.00	.17	1.00	----	.69	.02	.96	2.43	.52
*r*Milan	----	----	----	----	----	----	----	----	----	.22	2.25	----	----
Trenton	.72	2.44	1.02	.28	2.00	.47	.75	.04	.82	.27	2.00	2.50	.65
Wildersville	.31	.98	1.00	.65	.78	.10	.60	----	2.16	.14	3.30	1.75	1.00

r February, March and December missing.

1904

	Sept.		December			
	3	4	24	25	26	27
Dyersburg	.31	.95	.75	.50	.50	3.10
Kenton	1.00	----	.77	----	*s*	5.38
*r*Milan	2.10	.20	----	----	----	----
Trenton	2.20	----	.95	----	2.50	2.60
Wildersville	2.30	----	1.90	----	2.30	2.60

r December missing. *s* Missing.

1905

	May					Aug.		October			Nov.		Dec.	
	19	20	21	22	23	9	10	18	19	20	28	29	1	2
Dyersburg	.50	.05	T	----	3.64	----	2.30	----	.98	1.57	----	2.40	T	2.35
Kenton	.19	----	----	1.27	.28	----	1.40	.91	1.64	.03	.15	2.09	.20	2.25
Milan	.36	.03	.04	.06	2.45	.00	0.06	----	1.80	.92	T	3.90	T	1.58
Trenton	.50	----	1.20	.30	----	----	----	1.00	----	1.10	----	4.70	.16	1.67
Wildersville	.55	T	T	.40	1.65	----	.36	.72	2.20	.27	T	1.00	T	1.00

(Table No. 5 Continued)

7.00—24 HOUR MAXIMUM.

1906

	JAN.		SEPTEMBER						OCTOBER					
	21	22	25	26	27	28	29	30	1	2	3	4	5	6
Dyersburg	T	3.90	T	1.60	.44	1.54	1.35	.13	.47	T	.89	----	T	.20
Kenton	1.23	2.18	1.19	.44	.35	1.34	.29	.23	.13	.70	.34	----	.21	.04
rMilan	----	----	T	.42	.56	1.20	.45	.05	2.52	.05	1.28	.86	.03	.36
Trenton	.45	1.88	.63	.56	.11	1.24	.28	1.34	.54	.95	.15	----	.26	----
Wildersville	1.00	1.80	T	1.80	.10	1.40	T	.98	.20	1.30	1.12	----	.40	.20

r January missing.

	NOVEMBER					DECEMBER		
	17	18	19	20	21	15	16	17
Dyersburg	2.00	4.50	.20	1.50	3.00	1.50	1.35	.80
Kenton	4.42	2.03	.88	2.00	2.24	1.78	1.52	.53
Milan	2.11	4.90	.30	1.50	2.55	1.05	1.60	.97
Trenton	6.47	T	2.28	1.45	2.25	1.43	1.05	.64
Wildersville	7.00	.50	.40	2.50	.60	.40	2.40	.31

1907

	JANUARY			APRIL					MAY					
	2	3	4	26	27	28	29	30	6	7	8	9	10	11
Dyersburg	1.17	1.88	1.00	.15	.20	.15	T	2.80	3.35	1.60	1.00	.80	.15	.65
Kenton	.60	2.28	.08	.11	T	.45	----	2.49	3.80	.77	1.48	.06	1.10	.02
rMilan	----	----	----	.14	.10	1.07	.25	1.49	3.12	1.58	.78	.33	----	.27
Trenton	.27	1.47	.07	.27	----	.48	----	1.73	3.00	.74	.95	.05	.58	----
Wildersville	.62	.25	1.50	.20	----	.76	----	1.80	4.00	.35	1.30	----	.30	----

r January missing.

1908

	JUNE		AUGUST			NOVEMBER							
	29	30	18	19	20	23	24	25	26	27	28	29	30
Dyersburg	T	.40	----	.50	2.00	----	2.20	----	.60	----	.40	.65	.90
Kenton	2.42	.23	.94	.02	.26	.78	.52	T	----	----	----	2.88	.54
Milan	----	.64	----	T	.12	----	.53	.02	.81	----	.05	1.66	.10
Trenton	.58	.53	----	----	.08	.19	----	.93	----	1.73	.51	1.08	----
Wildersville	.25	.54	.85	.02	----	T	.27	----	.61	----	.82	.18	.40

1909

	FEBRUARY						APRIL			MAY	
	11	12	13	14	15	16	6	7	13	19	20
Dyersburg	----	.20	.10	1.10	.80	T	----	1.67	2.70	----	2.00
Kenton	T	.41	.01	----	1.92	.05	1.61	.07	2.76	----	2.92
Milan	----	.08	.37	2.00	1.05	.12	.02	3.05	2.43	----	2.19
Trenton	----	.21	----	2.20	1.14	T	1.72	.30	2.40	1.12	1.29
Wildersville	1.10	.80	1.36	.85	.40	----	1.03	2.22	1.75	2.23	.58

	JULY			NOVEMBER			
	7	8	9	14	15	16	17
Dyersburg	----	4.05	.65	T	2.00	1.20	.70
Kenton	3.38	----	----	.40	3.19	.60	----
Milan	.37	.81	1.11	.05	.70	.75	.55
Trenton	1.04	----	.36	.33	2.12	.93	----
Wildersville	1.10	1.02	----	.05	----	.70	----

(Table No. 5 Continued)

1910

	January			Feb.	
	4	5	6	27	28
Dyersburg	----	1.20	1.40	2.88	.21
Kenton	----	1.05	1.15	3.70	.05
Milan	.05	.50	1.15	1.73	.35
Trenton	----	1.98	1.00	3.55	----
Wildersville	2.40	----	----	.80	----

The heaviest storm during the time covered by the tables occurred from November 17th to 21st, 1906. The distribution was as follows:

TABLE NO. 6.

November	17	18	19	20	21
Dyersburg	2.00	4.50	.20	1.50	3.00
Kenton	4.42	2.03	.88	2.00	2.24
Milan	2.11	4.90	.30	1.50	2.55
Trenton	6.47	T	2.28	1.45	2.25
Wildersville	7.00	.50	.40	2.50	.60
Average	4.40	2.39	.81	1.79	1.53

Another very heavy rain occurred in December, 1902. The records from only three stations are available and are given below:

TABLE NO. 7.

December	14	15
Kenton	1.40	6.03
Trenton	1.36	4.90
Wildersville	1.50	4.96
Average	1.42	4.96

These two storms are the only ones in which 6 inches of rainfall in 48 hours was exceeded during the period for which we have records.

In the 12 years from 1897 to 1910 there have been 21 storms, during which an average rain of 2 inches or more fell in 24 hours, and three during which 4 inches or more fell in 48 hours, over the entire drainage area.

TABLE NO. 8.

The maximum 24-hour rainfalls recorded at the several Stations:

Dyersburg, November 18, 1906.....4.50 inches
Kenton, December 15, 1902 .....6.03 inches
Milan, November 18, 1906.....4.90 inches
Trenton, November 17, 1906.....6.47 inches
Wildersville, November 17, 1906.....7.00 inches

A table (No. 9) was compiled showing the number of rains of 2 inches or more in 24 hours that have occurred at Trenton, Tenn.:

TABLE NO. 9.

Excessive precipitation of 2 inches or more in 24 hours at Trenton, Tenn.:

1897—December 20 .....2.23	1903—March 6 .....2.00
1898—January 14 .....2.18	1903—July 31 .....2.00
1898—January 19 .....2.42	1903—December 19 .....2.50
1898—January 22 .....3.36	1904—September 3 .....2.20
1898—March 15 .....3.44	1904—December 26 .....2.50
1900—June 15 .....2.03	1904—December 27 .....2.60
1900—November 20 .....2.86	1905—November 29 .....4.70
1901—August 14 .....2.75	1906—November 17 .....6.47
1901—August 20 .....2.05	1906—November 19 .....2.28
1901—September 13 .....2.05	1906—November 21 .....2.25
1901—December 14 .....2.00	1907—May 6 .....3.00
1902—March 28 .....2.23	1909—February 14 .....2.20
1902—October 5 .....2.50	1909—April 13 .....2.40
1902—December 15 .....4.90	1909—November 15 .....2.12
1903—February 15 .....2.44	

Two inches or more fell on 29 days, 3 inches or more on 5 days, 4 inches or more on 3 days, and on one day 6.47 inches fell at Trenton.

DISCUSSION OF RUN-OFF.

On the North Fork of the Forked Deer and on the Rutherford Fork of the Obion River practically all of the run-off from heavy storms reaches the river bottoms within three to six hours after a rain. On the Middle Fork of the Forked Deer River, a somewhat longer time may be required in case of the larger branches. No gaugings of these streams have been made during flood flow, so that this class of data does not exist as a basis for making estimates. The best obtainable results may be secured by comparing these areas with others on which definite estimates of run-off have been made by assuming that a given percentage of the rainfall of heavy storms will pass off to the streams, and by estimating the amount of water stored in the bottoms after storms. On the bottoms of the North Fork, flood water gathers

to a depth of three feet after exceptionally heavy rains. As the area of the bottoms is about 10 per cent. of the area of the entire watershed, it appears that 3 1-2 inches from the entire watershed has entered the bottoms, in addition to that which has flowed off through the channel This would indicate a run-off greater than any considered in this report. Before definite plans for the work are completed, careful gaugings of the various channels should be made to determine the rate of run-off.

Over a considerable part of the areas under consideration light rains falling on well-drained soil produce almost no run-off, all the water passing at once into the ground. The run-off during the winter will be greater than during the summer months, and more water will enter the bottoms after a storm which follows a season of wet weather than when such a storm occurs after a drouth. On the whole, however, it is probable that during rainfalls of two inches or more during twenty-four hours, from half to two-thirds of the total precipitation will pass into the streams within a few hours after it falls as rain. As a general precipitation of two inches or more over the entire area of the three streams occurs on the average twice each year, it appears from the above statements that to provide for a run-off of less than one inch in twenty-four hours in the outlet channels would not make the valley secure from overflow. As but fifteen hours will be required for the water to traverse the entire length of a channel provided for the valley of the North Fork, it is seen that the rate can not safely be reduced to any great extent for the entire area of a watershed of this size. More probably it should be raised for smaller areas within which more precipitous local storms may occur. To provide for less run-off would furnish some relief from the present overflowed conditions of the bottoms and would make possible the production of late corn and peas. It is doubtful, however, whether any less effective protection would represent as good an investment. It nearly always occurs that where a drainage project has been undertaken and the plans have been found to furnish insufficient relief, the people will make further investment to save that which was made in the first instance. However, if the work is not to be done thoroughly at first, the plans should be so prepared that further work can be done without losing the value of the first investment. It commonly occurs that where work must be reconstructed a considerable part of the original investment is wasted, so far as its value in lessening the cost of reconstruction is concerned.

DESCRIPTION OF STREAMS.

RUTHERFORD FORK OF THE OBION RIVER.

The Rutherford Fork of the Obion River rises in Carroll county and flows in a northwesterly direction across Gibson county to its junction with the Obion River about three miles north of Kenton. The watershed of the stream is approximately fifty miles long and from four to twelve miles wide, and has an area of about 370 square miles. The M. & O. R. R. follows the valley from Rutherford to its lower end. The L. & N. and I. C. Railroads cross the stream near Milan.

The watershed varies from gently rolling to hilly land. As a rule, the territory on the north side of the river is rougher than that on the south side. The river flows through a broad flat flood plain varying in width from 1-4 to 1 1-2 miles and averaging about one mile wide, the greater part being in timber and used for pasture. Sloughs occur on both sides of the river.

The lateral drainage is received through many small tributaries, the largest of these being near the upper end. Wolf Creek and Johns Creek are the most important tributaries.

From a point about four miles up stream from Rutherford nearly all the larger tributaries that enter from the north carry considerable sand, and as the river flows quite near the north edge of the valley the sand from many of these has reached the main channel and is filling it. The streams entering from the rolling country on the south carry but little sand.

Drainage Condition.

The channel of Rutherford Fork is very crooked, and, like the two others, is obstructed by logs, drift, and trees. As the river was in flood when the examination was made, a close inspection of the channel was not possible. It has a top width of 50 to 70 feet at the lower end, and is said to be 7 to 10 feet deep. The river overflows its banks and floods the bottoms after every hard rain. These floods frequently last several days and at times much longer. In its present condition the river is totally inadequate to remove the flood water.

NORTH FORK OF FORKED DEER RIVER.

The North Fork of the Forked Deer River rises in the southeastern part of Gibson county, Tennessee, near Sitka Station, and flows in a

general northwesterly direction to a point on the west line of Gibson county, where it unites with the Middle Fork. The watershed of the stream is approximately 30 miles long, from 5 to 8 miles wide, and covers about 270 square miles. The L. & N. and I. C. Railroads cross the headwaters, and the M. & O. R. R. traverses the valley at Trenton. There are approximately 18,000 acres of overflowed land in the valley.

The watershed varies from rolling to very hilly land. The river flows through a broad level flood plain approximately 3-8 of a mile wide at the L. & N. R. R., widening to about 1 1-4 miles at the mouth. It is said to have an average width of one mile between these two points. The valley has a varying grade, falling about 1 1-2 feet per mile at the lower end and about 4 feet per mile at the upper end. The channel has a top width through the lower half of its course of 60 to 70 feet and an average depth of not more than 5 feet.

The greater part of the flood plain is timber land, though in a few places the bottoms are being cultivated. There are numerous depressions and secondary channels through the length of the valley. The lateral drainage is received through small tributaries or branches that enter the valley at frequent intervals. Many of these do not reach the river, but disappear when they reach the bottoms, becoming sloughs and ponds. A number of them carry considerable sand, but in most cases this is deposited before it reaches the rivers. The greater part of the streams that carry sand enter the bottoms above Trenton. The floods of this stream are similar to those on the Rutherford Fork. During extreme storm periods water stands over the bottoms three feet deep or more, requiring weeks to pass off.

THE MIDDLE FORK OF THE FORKED DEER RIVER.

The Middle Fork of the Forked Deer River rises in Henderson County and flows westerly to the west lines of Gibson County, where it unites with the North Fork. The drainage basin is about 55 miles long, 10 to 16 miles wide, and has an area of about 700 square miles. It is crossed by three railroads; the M. & O., the I. C., and the L. & N. The headwaters of the stream flow through very hilly country, but toward the west the land is more rolling and the hills have steeper slopes. Except at the upper end, the flat river bottom averages about two miles wide. A number of the larger tributaries also have broad flat bottoms, the largest about a mile wide, which will require drainage for their reclamation. Only a few of the branches seem to carry sand in large quantities. Apparently the control of sand deposits will not be a matter of so serious concern on this stream as on the other two. There is

much erosion in the hills, but this occurs mostly in a fine silt loam, which will probably remain in suspension in the water until it reaches the outlet.

The channel of the Middle Fork is similar to the other streams in being crooked and obstructed by debris, and in being wholly inadequate for the drainage of the watershed. During flood flow several times as much water passes through the river bottom outside of the channel as is carried within its banks.

If the improvement of the Middle Fork were to be secured by carrying the flood waters in a large channel below the ground surface, it would represent a slightly better prospect for drainage than the other two streams; for while there is approximately twice as much land to be redeemed on the Middle Fork as on the North Fork, the drainage area is more than two and a half times as great, and therefore much larger channels would be required. However, if a combined system of ditches and floodway is used the cost of sonstruction will not increase in proportion to the amount of water to be carried, and the improvement of this stream can be carried out at a smaller cost per acre to the benefited land than that on either of the other streams. An estimate of this cost would not be justified without a survey to determine the fall obtainable throughout the river bottom, and other conditions affecting the plan.

DRAINAGE CONDITIONS.

The channels in their present condition will carry but a small part of the water which reaches them during floods. They are very crooked, and in bad order—full of trees, logs, stumps, and drifts that extend entirely across the channel. In times of flood a large part of the water flows over the river bottom outside the channel. The rivers overflow their banks in this manner during every heavy rain, these floods being generally of short duration; but there are occasional periods when the lowlands are covered for a week or more at a time. The overflows occur most often during the Winter and Spring. The frequent floods prevent the land from being cultivated and greatly reduce its value for pasture. Some of the larger tributaries frequently flood their valleys and do serious damage, but it would seem probable that the construction of a main channel would materially lessen the damage on these streams. The rivers flow through broad flat bottoms from less than half a mile to more than two miles wide. These are so flat that the overflow water of heavy rains extends entirely across the valley. The river channels meander back and forth across these flat valleys on their courses toward the West.

SOIL EROSION AND THE SILTING OF CHANNELS.

The erosion of soils on hillsides, while of frequent occurrence in the watershed of these streams, is not so serious a menace there as on streams farther south and east. In the west half of the proposed district the hills are low, and there is little evidence of extensive soil wash. Probably the most serious situation is along the creeks at the east ends of the valleys. Here roadside ditches have washed out, forming gullies perhaps 20 feet deep, which carry sand and silt from the hillsides and from the sides of the gulley, depositing it on the bottom lands below. Some of these bottoms have been filled in this manner to a depth of five feet during recent years.

Hillside washing is taking place to a serious extent at several points, with a consequent deposition of sand and silt on the lower land. The cutting consists of the erosion of abandoned fields, or the formation of large gullies where roadside ditches once were located. The deposits of sand and silt have as yet reached the river channel in but few places. Where erosion takes place in abandoned fields, the material usually remains in the bottoms of wooded gullies or channels, frequently filling them entirely. Where roadside ditches have enlarged into gullies the sand is commonly laid down on the bottom lands adjoining. In the few cases where sand has been carried into the river channel usually it has been dropped very near the point where it entered the channel, partly filling it and forming a sand bar. A large part of the silt held in suspension in the water either passes through the entire length of the channel or is deposited on the bottom lands from the overflow water. The danger of sand deposits is most serious on the Rutherford Fork and is least on the Middle Fork of the Forked Deer River. On the latter stream there are but few tributaries which carry sand to the main channel; for while hillside washing is more serious here than on the North Fork, the soil contains very little sand.

THE CONTROL OF SOIL EROSION AND DEPOSITS.

The problem of controlling soil erosion is not a very difficult one on these, as compared with many streams, but the success of a drainage system depends to a considerable extent upon this question being properly worked out. It is safe to assume that while a large amount of silt and clay may enter the channel, be carried through its entire course, and be discharged at its lower end, any sand which enters the upper half of the canals will remain and tend to fill them up. At present but little sand reaches the main channels of any of these streams. It is stated to

be the intention of the landowners, however, upon construction of the main canals, to dig lateral ditches into them for the purpose of carrying away the sand which now is deposited upon the surface of the farm lands. This intention is based upon the supposition that the water in the canals would have sufficient velocity to carry to the outlet any sand which would reach them. It is probable that a limited amount of sand would be rolled along the bottom of the ditches until finally it would reach the outlets, but in the meantime parts of the ditches above might become almost entirely filled. In some instances in Mississippi where similar conditions prevailed, except that the erosion was greater, channels constructed in this manner not only have been entirely filled, but the water loaded with sand flowing between the waste banks of the ditches has built up the ditch beds to a higher elevation than the surrounding land.

For the successful operation of this drainage system all large deposits of sand must be prevented from reaching the channels and provisions to secure this result should be essential parts of the drainage plan. Fortunately there are but a limited number of points where serious erosion occurs in soil containing a large proportion of sand, and these can be controlled without adding very greatly to the cost of the system. In the greater number of these places, while the deposits are gradually extending across the river bottoms, they have not yet reached the location of the main channel. In these cases there is no iminent need for protection, except to establish the policy that no ditching shall be done which will result in depositing sand in the channel. As lateral drainage will be necessary to complete the reclamation begun by the main canal, it will soon be necessary to find some other means of control. The following methods are suggested as offering some advantages. A complete drainage plan should include methods of control in each case where the conditions require attention.

Control by Collecting Ditches.

In many cases where sand deposits have not yet extended very far into the bottom, one of the simplest methods of control would be to allow the sand-bearing hill stream to spread out over the bottom as at present until the sand is deposited, and then to pick up the water in a collecting ditch located around the margin of the overflowed tract, carrying it from thence into the main channel. This would prevent the overflow of any land except that necessary for receiving sand deposits. If too much sand was being deposited on one piece of land for

farming purposes, the hill stream could be led from one part of the field to another, still being controlled in the same manner.

Collecting Basins.

It is wholly practicable to construct a levee around a tract of land at the outlet of a hill stream, forming a settling basin in which the water of the hill stream will deposit its sand and much of its silt. The water may then be let off through a wooden or concrete flume and carried to the main channel. This method has been practiced successfully in Illinois, and its use on a large scale is being planned in Missouri and Mississippi. In the case in question enough silt would be deposited with the sand to make a good farming soil, and frequently it will be possible to use as a settling basin a slough or tract of lowland which will be benefited by sand deposits.

THE PREVENTION OF EROSION.

The remedies suggested above, while perhaps sufficient for years to come, are at best but temporary expedients, and the final solution of the problem must lie in preventing erosion in the hills. In many of the localities this proposition would truly be a formidable one, but here, where hillside washing is already to a considerable extent under control, the prevention of further erosion is entirely practicable, and can be attained at an expense small in comparison with the benefits to be received. Such preventive work would consist in stopping the formation of deep gullies, especially along roadsides, and in preventing the further erosion of abandoned fields. A large part of the sand now being carried onto bottom lands is washed from large gullies which have formed along roadsides. Further washing could be prevented in most instances by placing properly constructed brush dams at frequent intervals along the gullies; checking the velocity of storm water, and causing the gullies to fill to a higher level; thus covering some of the sand strata which erode most easily. In some places more substantial timber dams may be necessary to supplant those built of brush. In constructing future road ditches they should be carried down the hillsides by gentle slopes to prevent further soil erosion. If necessary, the laws should be amended so as to give the road authorities the right to pass over private holdings in constructing ditches of this character. Doubtless in the present instance landowners would willingly allow such constructions on their lands. It is probable that the most satisfactory results from such ditches will be secured only when locations are made after suitable surveys.

The control of erosion in fields is reaching such a point that if fields now washing badly are prevented from further deterioration, those which have not begun to erode will be prevented by the landowners from doing so, and trouble from this source will be ended. In many instances further washing can be prevented by digging hillside ditches above the eroded areas, leading the water away by gentle slopes, so that no further cutting will take place. In other instances gullies may be filled by brush dams. A general practice should be adopted of plowing furrows along the hillsides rather than up and down the slopes; and hillside ditches should be dug in a similar manner to catch rain water before it has gained sufficient volume to form gullies, leading it along the slopes of the hills to the points of outlet. In many places where fields are now washing badly the sand is lodging in wooded gullies further down, and at its present rate of progress will not reach the main stream channels for several years.

In short, the problem of hillside erosion and of sand deposits, while demanding careful and effective handling in the preparation of a drainage plan, does not constitute a serious menace to the success of the district.

THE ENLARGING OF CHANNELS BY EROSION.

It has been assumed in some instances that small channels constructed through these bottoms would quickly enlarge by erosion until they would be of sufficient size to accommodate the water of extreme floods. This opinion is based to a considerable extent upon observation of the erosion which frequently takes place in short cut-offs, or in ditches entering the river bottoms with a heavier fall than exists through the bottoms. In the case of cut-offs there is usually a drop-off curve at the lower end, where the water flows very swiftly as compared with the main channel. The channel enlarges along the line of this drop-off curve, which works back up the channel to the upper end of the cut-off. To expect that a long straight channel of uniform cross section and velocity will enlarge in a similar manner in the course of a few years is not justified by any information we have on the subject. In fact it is more probable that the channel will fail to maintain itself, and will tend to fill with sand, unless precautions are taken to prevent this.

WHAT CONSTITUTES RECLAMATION.

The reclamation of these river bottoms may be more or less complete, depending upon the amount of money invested in the work. With a sufficient investment the bottom lands may be completely protected

from all overflow, even in case of the most severe storm; while with a smaller expenditure the relief will be proportionately less. In order to get the largest return for the money invested, it is necessary to use good judgment in deciding what degree of reclamation shall be undertaken. Under the present conditions of development in this region it would probably be unwise to plan drainage which would protect the land from those rare storms which occur not oftener than once in ten years, and doubtless many of the landowners would prefer to risk the loss of a crop once in three to five years rather than to increase largely the cost of the improvement for the purpose of insuring against such loss. However, land on which a crop would be lost oftener than once in three to five years, or on which but a limited variety of crops could be raised, can not be said to be effectively reclaimed, and would not be profitable for farming purposes. If the bottoms should be overflowed nearly every winter, the production of wheat, oats, and clover would be impossible, and if overflows are common in May the raising of cotton would be uncertain. The remaining crops of corn, peas, and pasturage would furnish an income from the land, but its being limited to these crops would largely reduce its practical value. Moreover, if large areas are overflowed in May, it will frequently be impossible to put the land in cultivation in time to produce a corn crop where one farm has a large area of this class of land. Where the bottom is in pasture, and is overflowed by the muddy waters, it becomes useless for this purpose for some weeks, or until the next heavy rain. Hay meadows are likewise seriously injured by overflows during the growing season. It seems, therefore, that a profitable degree of reclamation would be that which would secure freedom from overflow during years of ordinarily heavy rainfall, so that crops would be lost, or serious damage sustained, not oftener than about once in three to five years. As the loss of a single crop would amount to more than the cost of the reclamation, it would seem that any protection less than this would be poor economy. Even this class of improvement should be planned so that it may be enlarged at any time in the future.

If an improvement were planned to be sufficient for about four years out of five, it might occur that there would be no overflows for ten years or more, or overflows might occur for two or three years in succession; because a number of unusually wet years or a number of unusually dry years may follow each other in succession. Only the general tendency can be determined beforehand. In suggesting plans for the work, the degree of reclamation outlined above has been followed, except where noted otherwise.

PLAN OF IMPROVEMENT.

A plan for the improvement of the North Fork of the Forked Deer River already has been presented. It provides for a channel extending through the river bottom for a distance of about 27 miles. This proposed channel, which would remove about one-fourth of an inch of water from the entire watershed in 24 hours, would have about one-third or one-fourth the capacity necessary to furnish relief from overflow in years of ordinary rainfall. The expectation that it would enlarge by erosion probably would not be fulfilled to any important degree. As the new channel is planned to cross the old one in various places, the latter would fill with silt at each of these crossings, soon becoming useless for carrying water. If the landowners should carry out their present intention of ditching sand-bearing tributaries into the main channel, it would tend to fill with sand, as but a small part of that which would enter it would reach the outlet.

Unless careful stream gauging extending over periods of heavy rainfall should indicate otherwise, it appears that a channel for the relief of the North Fork should have sufficient capacity for removing three-fourths to one inch in depth of water from the entire drainage area in 24 hours in order to secure freedom from ordinary overflows. It does not necessarily follow that reasonable protection will cost three or four times as much as the work which has been proposed. A larger capacity may be secured at relatively less expense, if a single large channel is constructed, while it is very probable that on the lower part of the North Fork a large portion of the flood water can be carried on the surface of the ground, confined between levees perhaps 400 feet apart. The levees would be formed by the waste banks of smaller ditches which would carry the local drainage water outside the floodway and below the surface of the ground. A small dredge ditch would be required within the floodway to carry the low water flow. The use of such a floodway through the lower valley of the North Fork would probably result in considerable saving over the cost of a very large channel.

Where a floodway is to be used, its capacity may be greatly increased by leaving a wider space between the controlling levees, the cost of purchasing and clearing the additional land being the only additional expense required for such an enlargement. In designing this method of improvement, therefore, it would be desirable to plan a floodway in the first instance to have sufficient capacity for the complete reclamation of land tributary to it.

An estimate of the cost of reclaiming the bottom lands of the North Fork should be based upon a careful survey, such as is outlined else-

where in this report. It seems probable, however, that reasonably complete reclamation, such as would prevent overflows oftener than once in three to five years may be secured for $10 to $15 per acre. It would be a mistake to plan an improvement so completely inadequate that but little benefit would result from its construction.

BENEFITS.

The land which it is proposed to reclaim is useless for cultivation in its present condition, and has but a limited value as meadow and pasture land. The soil is very fertile, and if properly drained and protected from overflow would be the most valuable in this territory for raising corn, cotton, wheat, and grass. The construction of drainage improvements costing from $10 to $18 per acre would make land which now sells for $10 to $20 worth $50 to $75 per acre, and would give it a rental value of not less than $5 per acre. The increased rental value of the land would pay the cost of the improvement, including interest, in five years or less. In addition to increasing the value of the land, the drainage improvement would benefit the health of the community by removing the breeding places of the mosquito, and would probably result in completely eliminating malaria from this region. There is sufficient timber on most of the bottom land to pay for clearing it and putting it into cultivation.

It is fully believed that while complete drainage may cost somewhat more than has been anticipated, it will be a most profitable investment. Where it is considered that the loss of a single crop due to overflow would amount to more than the whole cost of the improvement, it is seen that there is small economy in constructing an inadequate system.

SURVEY.

A survey of the North Fork of the Forked Deer River has been made by H. P. Farrar, C. E., from the L. & N. bridge to its mouth. This survey gives much valuable data. The map shows the location of the channel and of many of the tributaries, and has in addition elevations marked on it at various points. Before it is decided to construct the improved channel, further surveys of this and other streams should be made as follows:

A survey to determine the boundaries of the watersheds may be necessary. A compass and stadia traverse line will be sufficient for this work, as the traverse can be tied to the main traverse of the river at intervals of 5 or 6 miles.

A hydrographic survey of the streams should be made, and as much data as possible obtained as to the amount of run-off and the duration of floods. There seem to be few desirable places to make flood gaugings, as nearly all the grades or levees across the river bottom are overtopped during the floods. It probably will be best to select several small tributaries with good channels, and to make gaugings on these. There are several streams suitable for this purpose. The areas of their watersheds could be determined readily, and with the rate of run-off from them worked out, that from the entire watershed could be estimated quite closely.

A stadia traverse should be made on both sides of the valleys to determine the areas of the flooded lands. Levels should be run on this line at the same time, and probably it would be best to carry three or four two-foot contours along each side. This would accurately indicate the amount of land benefiited and the location of the bottom lands. This survey should also locate all property lines on the bottoms and all natural channels not located on the existing maps. The survey should be referenced by means of permanent points. Permanent bench marks should also be set at suitable intervals.

Sufficient topography should be secured to enable a map of the valley to be made, and to determine the best location for the ditches. This should include the locations, dimensions, and condition of all tributaries to the river, and should be sufficient for locating the improved channel and the necessary settling basins for sand and silt. Lines of cross levels should be run across the valley at approximate half-mile intervals. These, with the hydrographic survey, will give all the topographic data which will be of value for drainage purposes. Five-foot contours would be practically useless, as there is seldom a difference of elevation of five feet in the entire width of the valley.

Careful studies should be made of erosion and silting of streams, and soil borings should be made along the lines of the canals to determine the presence of sand strata which would effect construction and maintenance. As the improvements must be paid for by assessments on the land benefited, the boundaries of the various tracts should be located. The final location of the main channels should be made after the maps are completed which show the topographic and other features.

RECOMMENDATIONS.

The object of this investigation was to determine the drainage conditions on the three streams discussed in this report, and to recommend

means for reclaiming the adjoining bottom lands. The following conclusions were reached as a result of the examination:

The overflowed lands along these streams are susceptible of complete reclamation at a cost which is reasonable in comparison with the results which will be received. The Rutherford Fork of the Obion River offers the least favorable prospects, while the Middle Fork of the Forked Deer River can be reclaimed for the least expenditure per acre.

It would be a mistake to construct a wholly inadequate system of drainage in the hope that the channels will enlarge themselves by erosion.

By the use of floodways carrying the greater part of the water through the valleys above the surface of the ground and between levees, the cost of reclamation on the Middle Fork, and perhaps on the other streams, can probably be much reduced over the cost of canals large enough to serve the purpose.

If sand from the hills is allowed to enter the drainage channels they will deterioate rapidly, and a large expense for re-dredging may be frequently necessary. With proper care and good planning the sand can be prevented from reaching the main channels.

Until reliable observations of run-off are secured, the planning of the drainage canals will be attended by much uncertainty.

A careful drainage survey should precede construction on all of the streams.

It would be desirable to have the State Drainage Law examined by an attorney who is an authority on bond issues, to determine whether the law as it stands will be effective for carrying out the improvement.

3-C

STATE OF TENNESSEE

STATE GEOLOGICAL SURVEY

GEO. H. ASHLEY, STATE GEOLOGIST

Drainage Law of Tennessee

(Senate Bill No. 229)

EXTRACT FROM ACTS OF TENNESSEE, 1909,
CHAPTER 185

EXTRACT (C) FROM BULLETIN No. 3, DRAINAGE
RECLAMATION OF TENNESSEE, 1910.

NASHVILLE, TENNESSEE

1910

CONTENTS

SECTION 1.	To provide for establishment of levee and drainage districts..	49
SECTION 2.	Petition and bond required	49
SECTION 3.	Engineer to be appointed	50
	Report to be made	50
	Engineer may be recalled	51
	Location of drains and ditches	51
	Crossing railroads	51
	Help may be employed	51
SECTION 4.	County Court may approve or reject plans	51
	Writs to be served on owners not petitioners	52
	Publication—when required	52
	Hearing may be postponed	53
SECTION 5.	Claims for damages	53
SECTION 6.	Jurisdiction of the County Court	53
	Jury of view	54
SECTION 7.	To file reports with clerk	54
SECTION 8.	Decision of County Court	54
	Appeals	55
	Circuit Court proceedings	55
	May prorate costs	56
SECTION 9.	Damages—by whom to be paid	56
	Power of condemnation	56
SECTION 10.	May require new survey and estimates of cost	56
SECTION 11.	Commissioners and qualifications	57
	Duties	57
	Apportionment of cost of construction	57
	Basis of assessment	58
	Notice of assessments	58
	Additional assessment may be made	59
	New report may be ordered	59
SECTION 12.	Assessments—how collected	59
SECTION 13.	Appeals	59
SECTION 14.	Counsel may be employed	59
SECTION 15.	Drainage record	59
SECTION 16.	Fees	60
SECTION 17.	New apportionment made—when	60
SECTION 18.	Directors—qualifications and terms	60
	Board of Directors	60
	Vacancies and removals for cause	60
	Organization	61
	Bond of treasurer	61
SECTION 19.	Contract may be made—when	61
	Notice for four weeks	61
	Deposits from bidder	52
	Bond of contractor	62

SECTION 20.	Engineer to be employed	62
	Removal for cause	62
	Monthly estimates of work done	62
	Warrants—how paid	63
SECTION 21.	Assessments against railroads	63
	How enforced	63
SECTION 22.	Bridges	63
SECTION 23.	Rights of landowners assessed	64
SECTION 24.	Assessments—how collected	64
SECTION 25.	Character of work—how determined	64
SECTION 26.	Sub-districts may be established	64
SECTION 27.	Drainage bonds may be issued	65
	Proceeds of issue	65
	New apportionment and additional bonds may be issued	65
	Duties of Clerk and Trustee	65
	Terms of bonds	66
	How signed	66
	For what district issued	66
	How payable	66
	Denominations	66
SECTION 28.	Warrants may be issued—when	66
SECTION 29.	When district is in more than one county	67
	Duplicate reports of engineers	67
	Proceedings	67
	Viewers	67
SECTION 30.	Commissioners	68
SECTION 31.	Board of Directors	68
	Organization	69
	Bond of treasurer	69
SECTION 32.	Drainage assessment book	69
SECTION 33.	Assessments become liens upon lands	70
	Delinquent lists	70
	Prima facie evidence	70
	Assessment liens—how enforced	70
	Sale of lands may be ordered	70
	Writ of possession may be given purchaser	71
	Time and terms of redemption	71
	Attorney's fees	71
	Decree of redemption may be had	71
	Exceptions	71
SECTION 34.	Distress warrants may be issued	71
SECTION 35.	Petitions may be signed by attorney or agent of petitioner	72
SECTION 36.	Salaries and expenses	72
	Compensation of trustees and clerks	72
	Expenses of directors	72
SECTION 37.	Contractors to forfeit deposits—when	73
SECTION 38.	Mutual agreement districts may be established	73
SECTION 39.	*Preliminary expenses—how paid*	73
SECTION 40.	*This act not to apply to Reelfoot Lake*	74

DRAINAGE LAW OF TENNESSEE

CHAPTER 185.

(Acts of Tennessee, 1909.)

SENATE BILL NO. 229. BY MESSRS. SENTER AND WARD.

AN ACT to provide for the establishment of levee and drainage districts for the purpose of the draining and reclamation of the wet and swamp lands and lands subject to overflow in the State, and prescribing the method for so doing, and providing for the assessment and collection of the costs and expenses of such improvements, and the manner of obtaining the means or funds therefor.

To provide for establishment of levee and drainage districts.

SECTION 1. *Be it enacted by the General Assembly of the State of Tennessee,* That the County Court of any county in this State is hereby vested with the jurisdiction, power, and authority at any regular, special, or adjourned session to establish a drainage district or districts, and to locate and establish levees, and cause to be constructed, as hereinafter provided, any levee, ditch, drain, or water course, or to straighten, widen, deepen, or change any natural water course in such county, or provide for the same being done whenever the same will be of public utility or conducive to the public health or welfare, and as hereby provided. The court here vested with this jurisdiction and authority is the County Court held and presided over by the County Judge or Chairman, and not the Quarterly County Court, and all references in this Act to the County Court is to the court so held by the County Judge or Chairman, unless otherwise stated.

Petition and bond required.

SEC. 2. *Be it further enacted,* That before any County Court shall establish a drainage or levee district, or any levee, ditch, drain, or water-course improvement, as provided for in this Act, a petition, signed by one or more persons owning land that will be affected by or liable to be assessed for the expenses of the proposed improvement, shall be filed in the office of the County Court Clerk of the county in which the improvement is expected to be made, setting forth that any body or district of land in such county, described by metes and bounds or otherwise, so as to convey

an intelligible description of such lands, is subject to overflow, or too wet for profitable cultivation, and that the public health or welfare will be promoted by draining, ditching, or leveeing the same, or by changing a natural water course, or by in part changing such water course by cutting across bends of the same and shortening its length, or by cleaning out its natural bed or deepening or enlarging such bed, or by giving such water course a new outlet, or any or all of these and similar things pertaining to the proposed improvement, and setting forth in said petition as near as may be the starting point, route, and terminus, and lateral branches, if with proper prayer for purpose desired; and there shall be filed with said petition a bond, with good security, in such penal sum as the County Clerk may deem adequate, to be approved by him, and conditioned for the payment of all preliminary expenses till refunded, and of all costs and expenses incurred in the proceedings in case the County Court does not grant the prayer of the petition, or the petition is dismissed for any cause. The County Court may at any time deemed proper order said bonds increased in penalty or in sufficiency, and make all necessary orders to this end.

Engineer to be appointed.

SEC. 3. *Be it further enacted,* That after such petition has been so filed and bond taken and approved, the County Court shall, at the first session thereafter, regular, special, or adjourned (and may at a later session), appoint a disinterested and competent engineer and have placed in his hands a copy of said petition, and he shall proceed to examine the lands described in said petition, and any other lands that would be benefited by said improvement, or necessary in carrying out such improvement, and survey and locate such drain or drains, ditch or ditches, levee or levees, improvement or improvements, as may be practicable to carry out the purposes of the petition, and which will be of public benefit or utility or conducive to the public health or welfare. He shall make return of and file his proceedings with the County Clerk, which returns shall set forth the starting point, the route, the terminus or termini of the ditch or ditches, drain or drains, levee or levees, or other improvements, such as the straightening or shortening of water courses, cleaning out the beds thereof, etc., together with a plat and profile showing the ditches, drains, or other im-

Report to be made.

provements, and the course and length of the same, approximately, through each tract of land as far as may be practicable, and the total length and the course and the elevation, as near as may be, of all lakes, ponds, and deep depressions in said district, and the fall obtainable across said district, and the boundary of the proposed district, and the description of each tract of land therein, as shown by the tax books, and the names of the owners thereof, as shown by the tax books, together with the probable cost of the improvement, and such other facts and recommendations as he may deem material.

Engineer may be recalled.

The court may at any time recall the appointment of any engineer made under the provisions of this Act, if deemed advisable to do so, and appoint another to act in his place.

Location of drains and ditches.

That the ditches and drains herein provided for shall be surveyed and located along the general course of the natural streams and water courses, or in the general course of the natural drainage of the lands of said district, unless there should be some special and good reason why the natural course should be departed from to secure a new and better outlet, or for any other good reason, and having due regard to the straightening and shortening of such natural streams, water courses, and course of natural drainage.

Crossing Railroads.

Whenever such ditch or drain crosses any railroad track or right of way, it shall be located at the place of the natural waterway across said right of way, unless said railroad company should have provided another place in the construction of its roadbed for flow of the water, or unless another place for so crossing its right of way shall be agreed upon by said railroad company; and if located at the place provided by or agreed upon by the railroad company, such company shall be estopped from afterwards objecting to such location on the ground that it is not the place of the natural waterway.

Help may be employed.

The engineer may employ necessary help—such as axmen, rodmen, etc.—returning an itemized expense account.

County Court may approve or reject plans.

SEC. 4. *Be it further enacted,* That upon the filing of the return of the engineer, the County Court shall examine the return; and if the plan seems to be expedient, and meets the approval of the court, it shall order the County Clerk to cause notice to be given, as hereinafter provided; but if it

does not appear to be expedient, and is not approved, the court is hereby authorized to direct said engineer, or another engineer selected by it, to prepare another plan. If the court should deem the proposed improvement inexpedient or inadvisable, after an examination of the return of the engineer, or after a second or further return, it may dismiss the petition and proceedings, and, in that event, it shall adjudge all costs and expenses incurred against the petitioners and the sureties on said bond. When the plan, if any, shall have finally met the approval of the court, it shall order the County Clerk to issue a summons, or writ, to the Sheriff of the proper county, said writs to run in the name of the State, commanding the Sheriff to summons the persons named in said writ to appear before the court on the day set by it for the hearing of said petition. Said writ or summons shall name therein to be served the owners of all the tracts or lots of land not petitioners, within the proposed levee, improvement, or drainage district, as shown by the tax books of the county, or by affidavit filed, and upon the persons in actual occupancy of the lands or lots, and also upon any lien holder or incumbrances of any land in the proposed district, as shown by the county records, and shall notify them of pendency of said petition and the prayer thereof; but no copy of the petition shall accompany the writ.

Writs to be served on owners not petitioners.

Said writ shall be served at least twenty days before the time set for the hearing of the matter of said petition; but said writ shall not be issued for or served upon any of the persons hereinbefore described who shall file with the Clerk a statement in writing, signed by said party, entering his appearance at said hearing and waiving any additional notice, or the service of the writ may be acknowledged. In case any such owner, lien holder, or incumbrancer is a nonresident of the State, or his name or residence can not be ascertained after diligent inquiry, and these facts are made to appear by affidavit filed, then publication shall be made for such party for two consecutive weeks in some newspaper of the county where the proceeding is pending notifying such party or parties of the pendency and prayer of said petition, and to appear at the time set for the hearing thereof, the last publication to be at least twenty days before the time set for such hearing. Proof of such publication may be made

Publication—when required.

as now provided by law in Chancery cases, and who are actual owners, or such lien holder or incumbrancer, may be made to appear to the Clerk by the affidavit of any person acquainted with the facts or by the averments of the petition if sworn to.

Hearing may be postponed.

If at the time set for the hearing it shall appear to the court that any person entitled to notice as herein provided has not had such notice, the hearing shall be adjourned till such person can be given the required notice, and the court shall not lose jurisdiction of the subject-matter, or of the person already properly notified, by such adjournment or postponement. The persons concerned may appear and be heard without formally answering such petition in writing.

Claims for damages.

SEC. 5. *Be it further enacted,* That any person claiming damages as compensation for or on account of the construction of such improvement shall file such claim in the office of the County Clerk at least five days prior to the day on which the petition has been set for hearing, and on failure to file such claim at the time specified shall be held to have waived his rights thereto; *provided,* if such person be an infant or a *non compos mentis,* and without regular guardian, or such guardian has not been notified of the proceeding as herein provided for notice, and the facts are made to appear by affidavit, the court shall appoint a guardian ad litem for such person, who may file such claim for damages, if deemed proper for the person so under disability, within the time above allowed or within five days after so appointed.

Jurisdiction of the County Court.

SEC. 6. *Be it further enacted,* That the County Court, upon the hearing of said petition at the time set for hearing, or at the time to which the matter has been adjourned, or continued, shall proceed to determine the sufficiency of the petition in form and manner, which petition may be amended at any time, as to form and substance, before final action thereon; and if the court should find that such levee or drainage or improvement district would not be for the public benefit or utility, or conducive to the public health or welfare, it shall dismiss the proceedings; but if the court should find such improvement conducive to the public health or welfare, or to the public benefit or utility, it shall determine and adjudge the necessity therefor of such levee or drainage district; and if no claim for damages has been filed, as provided

in Section 5 of this Act, the court may, if deemed advisable, locate and establish said district, or may refuse to establish the same, as the court may deem best; and at such hearing the court may order said engineer, or a new engineer appointed by it, if deemed advisable, to make further examination and report to the court as to said improvement, in which event the hearing shall be continued till the filing of such further report. If any claims for damages have been filed, as provided in Section 5 of this Act, the court shall not establish such district till viewers have been appointed and have reported, and the court shall proceed to appoint three viewers to assess such damages, who shall be disinterested freeholders of the county, and not related to any party interested in the proposed improvement, nor themselves interested in a like improvement, and the engineer appointed by the County Court as aforesaid shall accompany said viewers and furnish such information as may be called for by them concerning the survey of said improvement.

Jury of view.

To file reports with Clerk.

SEC. 7. *Be it further enacted,* That the viewers appointed to assess damages, after being duly sworn to act impartially and faithfully to the best of their ability, shall proceed to view the premises and determine and fix the amount of damages to which each claimant is entitled, and file reports in writing with the County Clerk showing the amount of damages each claimant would be entitled to because of the establishment of the proposed improvement. The report of the viewers shall be filed as soon as practicable; and if any of them fails or refuses to act, for any reason, or they do not proceed to act with promptness, the court may appoint others as viewers in the place of any or all of them. In estimating the damages, the viewers shall give the value of the land proposed to be taken without deduction, but incidental benefits which may result to the owner by reason of the proposed improvement may be taken into consideration in estimating the incidental damages.

Decision of County Court.

SEC. 8. *Be it further enacted,* That after the filing of the reports of the viewers, the court shall consider the amount of damages awarded in deciding whether such levee or drainage district should be established; and if in its judgment the probable cost of construction is not a greater burden than should be properly borne by the land benefited

by the improvement, and the improvement is conducive to the public health or welfare, or to the public benefit or utility, then the court shall locate and establish such drainage or levee district by proper order or judgment to be entered of record, and the court shall thereupon proceed to determine the amount of damages sustained by each claimant, and may hear evidence in respect thereto, and may increase or diminish the amount awarded by the viewers, as may seem just and right. Any party aggrieved may appeal from the decision of the court in establishing, or refusing to establish, the improvement district, or its decision in the allowance of damages, such appeal being to the Circuit Court, and any party so desiring to appeal shall have the right to have the benefit of such appeal at any time within ten days after such decision is made, without formally praying an appeal, by filing with the Clerk of the County Court a notice of such appeal, at the same time filing with him a bond, to be approved by said Clerk in such sum as he may deem adequate, and conditioned to pay all costs and expenses of the appeal, unless the finding of the Circuit Court shall be more favorable to the appellant or appellants than the finding or decision of the County Court.

Appeals.

The Circuit Court shall hear any such appeal *de novo;* and if the appeal be from the amount of damages allowed by the County Court, the amount ascertained and fixed by the Circuit Court shall be entered of record, but no judgment shall be entered therefor. The amount thus ascertained shall be certified by the Clerk of the Circuit Court to the County Court, which court shall thereafter proceed as if such amount had been by it allowed the claimant as damages. If the appeal is from the action of the County Court in establishing, or refusing to establish, the drainage or levee district, the Circuit Court shall enter such order as it may deem just and proper in the premises, and the Clerk of said court shall certify the same to the County Court, which shall proceed thereafter in the matter in accordance with the order of the Circuit Court. In the Circuit Court in such cases the cases shall be docketed with the appellant or appellants as plaintiffs and the adversary parties as defendants, and where there are several appellants on questions of damages, the Circuit Court may consolidate the causes and hear or try them together, if

Circuit Court proceedings.

practicable, making proper findings or orders as to each; and in such appeals from orders of the County Court made at the same session where there are several appellants, at their request only one transcript shall be made out by the County Court Clerk.

May pro rate costs.

On such appeals it shall rest in the discretion of the Circuit Court how the costs shall be adjudged and distributed among the litigants; and the trial in that court shall be with or without a jury, as the court may deem the right of the parties to be under the particular issues to be tried, the right to a jury being accorded wherever the parties have such right under the law of the land.

Damages—by whom to be paid.

SEC. 9. *Be it further enacted,* That after the amount of damages due any claimant or claimants shall have been finally ascertained and fixed by the County Court, the amount of all such damages shall by said court be required to be paid, in the first instance, by the parties benefited by said levee or drainage district, or be secured, to be paid upon such terms and conditions as the County Court may deem just and proper; and after said damages have been paid, or secured, as aforesaid, the County Court shall enter a proper order of condemnation showing all such lands are appropriated and belong to such drainage or levee district for all its necessary purposes. In establishing any such levee or drainage district, all necessary lands may be appropriated as herein provided, and a right of way as much as two hundred (200) feet wide may be so appropriated, if deemed necessary, for the situs and location of any ditch or drain, or for the location of a new route or channel for any natural water course for the whole way or parts of the way of its course; and the natural bed of any water course in such district may, in so far as the same may be utilized and necessary, be so appropriated, to the end that such bed or channel may be cleaned out, deepened, or widened; but the provision in this section as to the width of such right of way shall not prevent the County Court from ordering appropriated such other lands as may be deemed necessary for the purposes of such improvement district under the provisions of this Act.

Power of condemnation.

May require new survey and est'mats of cost,

SEC. 10. *Be it further enacted,* That after such levee or drainage district is so established by the County Court, and all damages paid or secured, if the County Court is of

opinion that the report of the engineer already made is not sufficiently full or definite to enable the proper letting of contracts for the construction of the improvements, or, for other reasons, is not as full and definite as it should be, the court shall direct said engineer, or another appointed by the court for the purpose, to make a further and more complete survey and estimates of such district and cost of proposed improvements, and report to the court as to the same, giving all necessary and required information; how much of said improvement will be upon each tract of land, as nearly as practicable, giving definite estimates as to cost and character of work, and dividing the work into convenient sections for making contracts, etc., and giving such other particulars as the court may see fit to direct, and such report of such engineer shall be made and filed with the County Clerk without unreasonable delay; and if such engineer fails to act with reasonable promptness, the court may remove him and appoint another in his stead.

Commiss'nrs and Qualifications.

SEC. 11. *Be it further enacted,* That when the drainage or levee district, or other improvement herein provided for, shall have been located and established as provided for in this Act, the County Court shall appoint three Commissioners, one of whom shall be a competent civil engineer, and two of whom shall be freeholders of the county, not living within the levee or drainage district, and not interested therein, or in a like question, nor related to any party whose land is affected thereby; and they shall, as soon as practicable after their appointment, and after being duly sworn to perform their duty faithfully and impartially to the best of their ability, inspect and classify all the lands benefited by the location and construction of such drainage or levee district in a graduated scale of benefits, naming the tract or tracts of each owner and so classifying the same, each tract to be numbered according to the benefit received, as below provided, by the proposed improvement; and they shall make an equitable apportionment and assessment of the costs, expenses, cost of construction, fees and damages assessed for the construction of any such improvement, and make report in writing thereof to the County Court. In making said estimate and apportionment, the lands receiving the greatest benefit shall be marked on scale of one hundred, and those benefited in a less

Duties.

Apportionment of cost of construction.

Basis of assessment.

degree shall be marked with such percentage of one hundred as the benefit received bears in proportion thereto. This classification, when finally established, shall remain as a basis for all future assessments connected with the objects of said drainage or levee district, unless the County Court, for good cause, shall authorize a revision thereof. In making such classification, said Commissioners are authorized to divide the land of one owner lying in one body into more than one tract, and classify each subdivision thereof, if they are of opinion that portions of such entire tract will be more benefited than other portions, and especially when such entire tract is a large one, and that it will be more equitable and just to so classify it in subdivisions.

Notice of assessments.

In the report of such Commissioners they shall specify each tract of land by reasonable description and the ownership thereof as the same appears on the tax books of the county or as the same has been previously adjudged in the proceeding, and the court shall cause notice to be served upon each person whose name appears as the owner, and upon any person in actual occupancy of the land, which notice shall state the amount of special assessments apportioned to each owner on each tract or lot, the day set for hearing the same before the court, that all objections thereto must be made in writing and filed with the County Clerk on or before noon of the day set for hearing; and said notices shall be signed by the County Clerk and served at least five days before the time set for the hearing. If any such owner be a nonresident of the State, or his name or residence is unknown and can not be ascertained after diligent inquiry, then service of such notice upon the resident agent or attorney of such person shall be sufficient; if there be no such resident agent or attorney of such person, then the assessment may be made without notice, just as taxes are assessed without notice in such cases. When the day set for hearing has arrived, and the hearing is not continued by the court for good reason, as it may be, and when the hearing is had, the County Court shall proceed to hear and determine all objections made and filed to said report, and may increase, diminish, annul, or affirm the apportionment and assessments made in such report, or in any parts thereof, as may appear *to the court to* be just and equitable; but in no case shall it

be competent to show that the lands assessed would not be benefited by the improvement; and when such hearing shall have been had, the County Court shall assess such apportionment so fixed by it upon the lands within such levee or drainage district. If the first assessment made by the court for the original cost of any improvement as provided in this Act is insufficient, the court may make an additional assessment in the same ratio as the first.

Additional assessment may be made.

If for any reason the court annuls in toto, or sets aside such report of the Commissioners, it shall order them to make a new report, or shall remove them and appoint new Commissioners to act as in the first instance, if desired by the parties concerned.

New report may be ordered.

SEC. 12. *Be it further enacted,* That the assessments shall be levied upon the lands of the owners so benefited in the ratio aforesaid, and shall be collected in the same manner as taxes for county purposes, except as herein specially provided, and the funds so collected shall be kept as a separate fund, and shall be paid out only for purposes properly connected with such improvement, and on the order or warrant of the Judge or Chairman of the County Court.

Assessm'ts—how collected.

SEC. 13. *Be it enacted,* That an appeal may be taken to the Circuit Court of the county from the order of the County Court fixing the assessment of benefits upon the lands in the same manner and time as herein provided for appeals from the assessment of damages, including the provisions as to consolidating cases, making transcript, etc., and certifying to the County Court the action and doings of the Circuit Court.

Appeals.

SEC. 14. *Be it further enacted,* That when any appeal is taken from any order of the County Court made in any proceedings before it under this Act, the County Court may employ counsel to represent the interests of the levee or drainage district affected by such appeal, on the trial thereof in the appellate courts, and the expenses of such counsel shall be paid out of the drainage fund of such district.

Counsel may be employed.

SEC. 15. *Be it further enacted,* That in any county where a levee or drainage district is sought to be establish the County Court Clerk of such county shall provide a book to be known as the "Drainage Record," and to be paid for by

Drainage record.

the county, and said Clerk shall keep therein a full and complete record of all proceedings in each case arising under this Act, including all orders made by the County Court, and certified from the Circuit Court, and a copy of the original petition shall be enrolled in said Drainage Record, and all bonds required to be given.

Fees.

SEC. 16. *Be it further enacted,* That the fees of the County Clerk in proceedings under this Act shall be the same as for similar services now allowed by law, and in such case the County Court may allow said Clerk an additional sum for extra services, or services not covered by existing fee bills, or statutes, to be fixed by the court, and paid as other costs and expenses in the case or proceeding.

New apportionment made—when.

SEC. 17. *Be it further enacted,* That where any assessments made and levied under this Act can not for any reason be enforced, and part of the work has been done, the County Court shall proceed as to any or all lands benefited by said improvement in the same manner as if the appraisement and apportionment of benefits had never been made, in which event any payments already made shall be duly credited to those who have paid the same.

Directors—qualifications and terms.

SEC. 18. *Be it further enacted,* That after a drainage or levee district has been located and established as provided for by this Act, the County Court shall appoint two Directors of such district, said Directors to be owners of lands, or interested in lands, in such district, and at least one of those first appointed to be one of the petitioners for the establishment of said district, or his successor in estate or interest, said Directors to hold their offices for two years from the date of appointment, and these two thus appointed and their successors, together with the Judge or Chairman of the County Court, shall constitute the Directors, or Board of Directors, of such district, and as such Directors they shall have the general control and management of the business affairs of such district and supervision of the same, and be vested with power and authority to make contracts, as provided by this Act, for all improvement to be done in said district.

Board of Directors.

Vacancies and removals for cause.

If there should be a vacancy in the office of the Director appointed as aforesaid, because of death, resignation, or other reason, the County Court shall appoint another Di-

rector of like qualifications to fill such vacancy till the end of the two years' term, and for sufficient reason the County Court may remove a Director so apponited, but not till such Director has had at least five days' notice of the time of the hearing, and of the grounds on which he should be removed, as alleged, and he shall thus be entitled to be heard and to introduce proof upon the issue as to whether he should be so removed as a Director; and if, on the hearing, the decision of the County Court is that he be removed, he may appeal therefrom, on giving proper cost bond, to the Circuit Court of the county, where the matter shall be heard anew and sucn judgment given as that court deems just and proper. If a Director is removed, the County Court shall appoint another to serve the remainder of the two years' term, having like qualifications as to ownership of lands, etc., as herein provided.

At the end of each two years' term the office of the two appointed Directors shall be again filled by appointment by the County Court from among those owning or interested in lands in such district. The Judge or Chairman of the County Court shall be Chairman of said Board of Directors, and said Board shall elect one of the other Directors Secretary and Treasurer of the Board, and as such Treasurer he shall give bond in the sum of twenty-five thousand dollars to faithfully account for all money coming into his hands as such Treasurer, said bond to be approved by the County Court and payable to the county or State, for the use of such district, and shall be recorded in the Drainage Record.

Organization.

Bond of Treasurer.

SEC. 19. *Be it further enacted,* That no contracts for improvements to be done in such drainage or levee district shall be made until after the Commissioners provided for by this Act have made their inspection, classification, and apportionment as directed in Section 11 hereof, nor until said question of classification and apportionment and assessment of benefits has been determined and settled by the court; but after the said Commissioners and the court have so acted then such contracts may be made by the Board of Directors of the district. Before entering into any contract for improvements, the Board of Directors of the improvement district shall cause notice to be given once a week for four consecutive weeks *in some* newspaper published in the county

Contracts may be made—when.

Notice for four weeks.

wherein such improvement is located, and such additional publication elsewhere as they may direct, of the time and place of letting the work of construction of said improvement, and in such notice they shall specify the approximate amount of work to be done in each section, and the time fixed for the commencement and completion thereof, and they shall award contract or contracts for each section of the work to the lowest responsible bidder or bidders therefor, or they may award the contract as a whole to the lowest responsible bidder, exercising their own discretion as to letting said work as a whole or in sections, and reserving the right to reject any and all bids, and re-advertise the letting of the work.

Deposits from bidder.

Each person bidding for such work shall deposit with the Treasurer of the Board of Directors in cash or certified check a sum equal to ten per centum of the amount of the bid, not in any event, however, to exceed ten thousand dollars, said deposit to be returned to him if his bid is not successful; and, if successful, to be retained as a guarantee only of his good faith in entering on said contract.

Bond of contractor.

The successful bidder shall be required to execute a bond, with sufficient sureties, payable to the county for the use and benefit of the drainage or levee district, in an amount equal to twenty-five per centum of the estimated cost of the work so let, or he may deposit such amount in cash with the Treasurer of the Board of Directors as security for the performance of his contract, and upon the execution of such bond or the making of such deposit, the deposit originally made with his bid shall be returned to him.

Engineer to be employed.

SEC. 20. *Be it enacted,* That the said Board of Directors shall employ a competent engineer to take charge and supervision of the construction of such improvement work, contracting with him for compensation for his services in such sum or at such rate as may be agreed upon, and to be paid as other expenses of such district. The Directors may remove such engineer and contract with another, if they see fit for any reason.

Removal for cause.

Monthly estimates of work done.

The engineer in charge of the construction shall furnish the contractor monthly estimates of the amount of work done on each section, and upon filing the same with the County *Court Clerk,* the Judge or Chairman of the County Court

shall draw a warrant in favor of such contractor for eighty per centum of the value of the work done according to the estimate; and when said work is completed to the satisfaction of the Board of Directors and said engineer, and so certified by him and said Board, and such certificate is filed with the County Clerk, then the Judge or Chairman shall draw a warrant in favor of the contractor for the balance due. All such warrants shall be drawn upon the County Trustee or Treasurer as ordinary county warrants are drawn, but shall be payable only out of the fund provided for such drainage or levee district, and shall so state upon their face. The Board of Directors shall require such engineer to give bond in such sum as they may deem proper for the faithful performance of his duties, such bond to be payable to the county or State, for the use of such improvement district, and filed with the County Clerk and recorded in the Drainage Record.

Warrants—how paid.

SEC. 21. *Be it further enacted,* That whenever any railroad or public highway will be benficially affected by the construction of any improvement or improvements in such district established hereunder, it shall be the duty of the Commissioners appointed to classify and assess benefits to determine and return in their report the amount of the benefit to such railroad or highway, and notice shall be served as to such railroad upon its nearest station agent, as provided in case of an individual property owner; and as to such highway, notice shall be served upon the Judge or Chairman of the County Court, as in case of an individual property owner; and when such special assessments have been approved and fixed by the County Court, as hereinbefore provided, as to such railroad, it shall be a debt due personally from the railroad company, and, unless the same is paid by the railroad company as special assessment, it may be collected in the name of the county in any court having jurisdiction; and as to a highway, such assessment shall be paid by the county out of the general county fund or highway tax fund, such assessments to be paid into the fund of such drainage, levee, or improvement district.

Assessments against railroads.

How enforced.

SEC. 22. *Be it further enacted,* That whenever the making of such improvement across a public highway necessitates the building of a bridge over the same, the county shall

Bridges.

build and construct the same and pay all cost thereof out of the county bridge fund, if such fund be provided, and, if not, out of the general county fund.

Rights of land-owners assessed.

SEC. 23. *Be it further enacted,* That the owner of any land or lot that has been assessed for the payment of the cost of the location and construction of any ditch, drain, or water course, as hereinbefore provided, shall have the right to use the ditch, drain, or water course as an outlet for lateral drains from said land or lot.

Assessment—how collected.

SEC. 24. *Be it further enacted,* That the assessments as provided for by this Act shall be collected by the County Trustee, as county taxes are collected, except as herein provided, and the funds so collected shall be kept as a separate fund, and shall be paid out only for purposes properly connected with such improvement on the order or warrant of the County Judge or Chairman; but such assessments may be collected by bill filed in Chancery, as herein below provided, and no personal property of the owner of land so assessed shall be liable or distrained upon for such assessment, but the land so assessed only shall be liable for such assessment.

Character of work—how determined.

SEC. 25. *Be it further enacted,* That the improvement in the drainage districts herein provided for may consist solely, if so desired by those concerned, in the changing in whole or in part of the course or channel of a natural water course, or in straightening, as far as practicable, such water course, and cleaning out so much of its natural channel as it is desired to utilize; or the improvement in such drainage district may, in addition to the main ditch, or drain, or channel, include such other lateral and other ditches and levees as may be deemed proper or necessary.

Subdistricts may be established.

SEC. 26. *Be it further enacted,* That any person owning lands within any drainage district who desires to establish a subdistrict within the limits of the original district for the purpose of securing more complete drainage, may file his petition with the County Clerk, asking the County Court to establish such subdistrict, and describing the lands to be affected thereby so as to convey an intelligible description of such lands; and the bond and all other proceedings shall be the same as herein provided for the establishment, formation, and construtcion of original districts and improve-

ments thereof, including the assessment of damages and assessment of benefits; and when established and constructed, it shall be and become a part of the drainage system of such drainage district, and be under the control and supervision of the Board of Directors of such drainage district; *provided, however,* such subdistrict shall only be established when conducive to the public health or welfare, or to the public benefit or utility; and *provided further,* that any special assessments made for the benefit of such subdistrict shall be secondary in lien and in right to the assessments for the benefit of the original district.

Drainage bonds may be issued.

SEC. 27. *Be it further enacted,* That if the County Court shall determine that the estimated cost of reclamation and improvement of such district of land or levee or drainage district is greater than should be levied in a single year upon the lands benefited, the court may fix the amount that shall be levied and collected each year, and may issue drainage bonds of the county, bearing not more than six per centum annual interest, said interest payable annually, and may devote such bonds at par, with accrued interest, to the payment of the expenses and work as it progresses, or may sell the same at not less than par with accrued interest, and devote the proceeds to such payment; and if, in the sale of said bonds, a premium is received, such premium shall be credited to the drainage fund; and should the cost of such work exceed the estimate, a new apportionment of the assessment may be made and levied and other bonds issued and sold in like manner; but in no case shall the bonds run longer than twenty years. Any property owner may pay the full amount of the benefit assessed against his property before such bonds are issued and receive a receipt in full therefor. Such payment shall be made to the County Trustee, and it shall be the duty of the County Clerk to certify to the Trustee the amount of any such assessment when requested to do so, and the Trustee shall enter the same upon the assessment lists in his hands in a separate place provided therefor, and shall furnish the County Clerk with duplicate receipts given for all assesments so paid in full, one of which the Clerk shall deliver to the Judge or Chairman of the County Court, and the Trustee shall also give a receipt to the property owner so paying in full.

Proceeds of issue.

New apportionm't and additional bonds may be issued.

Duties of Clerk and Trustee.

Terms of bonds.

The terms and times of payment of the bonds so issued shall be fixed by the Board of Directors of the improvement district, and such bonds shall be signed by the Judge or Chairman of the County Court and countersigned by the Clerk of the County Court, each of said officers signing his name officially, and shall be verified either by the county seal or seal of the County Court Clerk. Said bonds shall be issued for the benefit of the district numbered thereon, and each district shall be numbered by the County Court and recorded by the County Clerk in the Drainage Record, said record showing specifically the lands embraced in said district and upon which the assessment has not been previously paid in full.

How signed.

For what district issued.

How payable.

Each bond shall show expressly upon its face that it is to be paid only by assessments levied and collected on the lands within the district so designated and numbered, and for the benefit of which district such bond is issued; nor shall any assessment be levied or collected for the payment of said bond or bonds, or the interest thereon, on any property, real or personal, outside the district so numbered, designated, and benefited. Such bonds shall be in denominations of not less than fifty dollars; and when such district lies in more than one county, the County Court of each county shall so determine whether bonds shall be issued to meet the expenses, etc., of the improvement so far as the lands of the district lie in that county; and if so issued, the bonds shall be signed by the Judge or Chairman of the County Court of such county, and countersigned by the County Court Clerk, and verified by the county seal or seal of the County Clerk, and shall be payable only out of the assessments levied for such improvement on the lands in such county, as provided hereby when such district is wholly in one county.

Denominations.

Warrants may be issued—when.

SEC. 28. *Be it further enacted,* That if the Board of Directors of any improvement district provided for by this Act deems best instead of issuing bonds, they may direct that warrants shall be issued or drawn on such district, or on the County Trustee, by the Judge or Chairman of the County Court, to be paid out of the funds of such district only, and at such times as the assessments may be due, or as may be deemed best, the time of the ma-

turity of assessments as fixed being considered, such warrants to be issued or drawn for all lawful demands on such district, and to bear interest at not more than six per centum per annum.

When district is in more than one county.

SEC. 29. *Be it further enacted,* That where a proposed or desired improvement will require a location in more than one county, applications by petition shall be made to the County Court of each of said counties, as provided by this Act, for applications where the improvement to be made lies wholly in one county, and signed by one or more persons owning lands lying in each county to be affected, or assessed for the proposed improvement; and when such petitions have been filed, the County Court of the county in which the larger or largest per centum of the lands to be affected by such improvement lies, shall appoint a competent engineer to make survey, etc., of such proposed improvement district in the same manner as when the proposed improvement lies wholly in one county, and such engineer shall proceed in the same manner as when the improvement lies wholly in one county, and said engineer shall make out duplicate reports of his survey and work and file one with each of the County Court Clerks in the counties where the petitions for such improvement is filed; and after such reports of the engineer are so filed, the County Court of each of said counties shall proceed as herein provided for improvement districts located wholly in one county till the point in the proceeding is reached when viewers are to be appointed to assess damages, as provided by this Act; and as to such viewers, the County Court of the county in which the larger or largest per centum of the lands to be affected or assessed on account of such improvement is located, or lies, shall appoint two viewers, and one of such viewers shall be appointed by the County Court of each of the other counties concerned, if more than one other county; and if only one other, by the County Court of such county, said viewers to have the same qualifications, etc., as hereinbefore provided for viewers. When so appointed, the viewers shall meet as soon as practicable at some convenient point to be designated by the Clerk of the County Court of the county, the court of which appoints two of the viewers, and shall then proceed to assess damages, etc., as hereinbefore provided for dis-

Duplicate reports of engineer.

Proceedings.

Viewers.

tricts lying in one county only, said engineer rendering them like assistance, as hereinbefore provided; and when their work is completed, the viewers shall make out one copy of their report for each of said counties, signing same, and shall file a copy of such report with each of the County Court Clerks of the counties where such petitions have been filed for the establishment of such improvement or district.

SEC. 30. *Be it further enacted,*. That when the viewers have so reported, each of said County Courts shall proceed as herein provided in other cases till the point is reached to appoint Commissioners to make assessments and apportion the same as to the lands affected, when the County Court of the county in which the larger or largest per centum of the land lies to be assessed or affected, shall appoint two of said Commissioners, one of these appointees to be a competent engineer, and the other County Court, or Courts, shall appoint one of said Commissioners each, the Commissioners so appointed to have the same qualifications as hereinbefore provided; and when so appointed, they shall, as soon as practicable, meet at some convenient place to be desgnated by the County Court Clerk of the county, the court of which has appointed two of the Commissioners, one being an engineer, and shall then proceed to assess the lands in such district, and apportion the assessments in the same manner as herein provided where such district lies wholly in one county, and shall report in like manner, and shall file a copy of their report with the Clerks of the County Courts in each county having lands within such improvement district; and when such Commissioners have so reported, each of said County Courts shall proceed as to said reports, and in levying assessments, etc., as provided by this Act, in cases of districts lying in one county only.

Commissioners.

Board of Directors.

SEC. 31. *Be it further enacted,* That in cases of levee or drainage districts so lying in more than one county, the Board of Directors of such districts shall consist of one member from each county, to be appointed by the County Court of such county, and the Judge or Chairman of the County Courts of each of said counties shall be members of such Board of Directors, and the qualifications, powers, and duties of such Board of Directors shall be the same as *provided by* this Act for Boards of Directors and members

thereof in improvement districts lying entirely in one county. The County Courts of the respective counties shall have the same right to remove the viewers, Commissioners, and Directors appointed by such court, and to appoint others in their stead, and to fill vacancies that the County Courts have, as provided by this Act, where such improvement district lies wholly in one county. The Judge or Chairman of the County Court of the county in which the larger or largest per centum of the lands of such improvement district lies shall be Chairman of such Board of Directors, with authority to call meetings of the Board; and said Board shall elect one of the appointed Directors Secretary and Treasurer of the Board of Directors, and such Treasurer shall give bond, etc., as provided by this Act, such bond or a duplicate of same to be filed with the County Clerk in each of the counties and recorded in the Drainage Record, said bond to be taken before and approved by the County Court of the county in which the larger or largest per centum of the lands of the district lies.

Organization.

Bond of Treasurer

SEC. 32. *Be it further enacted,* That the assessments provided for by this Act, and to be collected for the purposes herein provided, shall be entered upon a book to be provided by the County Court Clerk, at the expense of the county, for this purpose, in a similar manner to that in which taxes are entered upon the tax books, such books showing the tracts of lands, amounts of assessments, etc., and such book, when so made out, shall be furnished to the County Trustee for collection of assessments so levied. Said book shall be called "Drainage Assessment Book," and shall be made out by the County Court Clerk of the county in which the particular assessment is levied, and said book may be made out but once, if practicable, for the entire assessment for the particular improvement project; but if not practicable, then a new drainage assessment book may be made out for a shorter period, or for each year, and furnished the County Trustee; and the assessments levied under the provisions of this Act shall become due and payable and delinquent at the same time State and county taxes become due and delinquent, and such assessments shall bear interest at the legal rate after they become delinquent.

Drainage assessment book.

Assessments become liens upon lands.

SEC. 33. *Be it further enacted,* That the assessments provided for by this Act, when made and levied, shall be and become valid liens upon such lands so assessed just as State and county taxes are liens upon lands; and when such assessments have been due and delinquent for sixty days, bills may be filed in the Chancery Court of the county, or Chancery District, in which the lands lie, upon which such assessments are due and delinquent, for the collection thereof out of such lands by a sale thereof in all cases, except in cases where the assessment is made against a railroad company or a public highway, as herein provided for. Such bills in Chancery shall be filed in the name of the county in which the lands are situated for the use of the improvement district for the benefit of which the assessments were made, and against the owners, if known, and, if unknown, against them as such; and the owners of all lands upon which such assessments are delinquent may be made defendants to the same bill as parties thereto. When it is desired by the Board of Directors, or other interested party entitled to sue, to file such bill, the County Trustee, upon request shall make out a statement or list, showing all the lands upon which such assessments are so delinquent, and the names of the owners thereof, as appears upon the Drainage Assessment Book, or showing any tract or tracts assessed to unknown owners, if such be the case, and certify as Trustee to the correctness of such statement or list as the same appears upon said book, and in such Chancery suit such certified statement or list shall be prima facie proof of the facts so certified to, and that such assessments are delinquent, and sufficient proof to authorize a decree of sale in the absence of rebutting proof of the facts shown by such certified statement. Such suits in Chancery shall be proceeded with as other suits are in said court, except that the court may hear the case as to any one or more of the defendants, whether ready to be heard as to other defendants or not, and so proceed to sale and final decree as to any one or more of the defendants, though the case be not disposed of, as to other defendants. When a sale is ordered in such suits, and is made and reported, the Clerk and Master of such court so making the sale shall report what public taxes are a lien upon any tract so sold in favor of the State, county, or any municipality, and the

Delinquent lists.

Prima facie evidence.

Assessment liens—how enforced.

Sale of lands may be ordered.

court shall see that this is done, and any such taxes, if the sale be confirmed, shall be first paid out of the proceeds of such sale before such delinquent assessments are paid. Upon confirmation of such sale by the Chancery Court, it shall divest title out of the owner and vest it in the purchaser, and award a writ of possession if asked for; but where title is so vested in a purchaser the land so purchased shall still be subject, in the hands of the purchaser, his heirs, or assigns, to any other assessments not yet due, or unpaid, that may have been made and fixed or levied upon it at the time of such confirmation of sale, for the benefit of the improvement district on account of which sale has been made. When any such sale is made by decree of the Chancery Court, it shall be made for cash, and the owners of lands so sold shall have two years from the date of the confirmation of such sale in which to redeem the same by paying to the Clerk and Master of such court making the sale the amount paid by the purchaser for said lands, with legal interest thereon, to the date of redemption, and also a further sum equal to ten per centum of the amount so paid by the purchaser for said land. In such proceedings in Chancery Court, the court shall enter a decree in the cause, tending to the suit shall be allowed as a fee ten per centum of the amount found due as an assessment or assessments on each tract of land decreed sold, the same to be charged up in the decree as part of the judgment for which the land is to be sold; and when such lands are redeemed, as herein provided, and this fact is made satisfactorily to appear to the Chancery Court, the court shall enter a decree in the cause, adjudging the land so redeemed and declaring it to be the property of the owner so redeeming, or his heirs or assigns, if redeemed by his heirs or assigns; and if necessary may award a writ of possession to put the person so redeeming in possession of the land.

Writ of possession may be given purchaser.

Time and terms of redemption.

Attorney's fees.

Decree of redemption may be had.

Provided, however, that infants, and persons who are lunatics or of unsound mind, shall have the further period of one year after the removal of such disability in which to redeem their lands sold under the provisions of this section and this Act, under like terms as to amounts to be paid, in redemption, as above provided.

Exceptions.

SEC. 34. *Be it further enacted,* That the assessments

Distress warrants may be issued.

provided for by this Act shall, if not paid by the owners of the land assessed, be collected only out of the land so assessed for improvement purposes, and shall not be collected, by distress warrant or otherwise, out of any other property, real or personal, of the owners of the land so assessed under the provisions of this Act.

Petitions may be signed by attorney or agent of petitioner.

SEC. 35. *Be it further enacted,* That it shall be a sufficient signing, in the sense of this Act, of the names of petitioners to the petitions herein provided for, if their names are signed by their attorney at law or by an agent authorized so to do.

Salaries and expenses,

SEC. 36. *Be it further enacted,* That engineers employed by Boards of Directors of improvement districts to supervise the work, etc., shall be paid for their services such salary or sums as may be agreed upon between them and such Board of Directors; that engineers appointed hereunder by the County Courts shall be paid for their services at such rates as the courts appointing them may fix, and, if not so fixed, at the rate of five dollars per day while engaged in the work, and, in addition, all actual traveling expenses, an itemized account of such expenses to be kept by them and reported and sworn to; that the viewers and Commissioners provided for by this Act shall be paid at the rate of three dollars per day while engaged in the work, and, in addition, all actual expenses, including board paid for, itemized accounts for the same being reported and sworn to; and that other necessary help aiding the engineers, viewers, or Commissioners—such as chain carriers, axmen, etc.—shall be paid not more than two dollars per day.

Compensation of Trustee and Clerks.

For collecting and paying out assessments under this Act, the County Trustee shall receive the same compensation he receives for collecting public taxes; and for any certified statements furnished by him, the same fees per one hundred words as are allowed Clerks of courts for certified copies of records; and if there be any services required of any person under the provisions of this Act, and the rate of pay therefor is not provided for hereby, then the County Courts shall fix the amount, or rate, of pay in such cases; *provided, however,* that the members of the Boards of Directors shall not be entitled to receive any pay for their services, but only be reimbursed or paid their actual expenses incurred on ac-

Expenses of Directors.

count of attending to their duties as Directors, an account of the same to be kept, made out, and sworn to by each.

SEC. 37. *Be it further enacted,* That if any person to whom the work, or any portion of the work, in such improvement district has been let shall fail to perform the same according to the terms specified in his contract, then the cash deposited by him shall be forfeited for the benefit of such district and be paid into its fund; or if bond has been given by such contracting party so failing, then recovery of the damages sustained may be had by suit in the name of the payee in such bond for the use of such district, and such damage on judgment therefor collected and paid into the fund of such district.

Contractors to forfeit deposits—when.

SEC. 38. *Be it further enacted,* That the owners of land which require combined drainage may provide for the establishment of a drainage district, or location and construction of drains, ditches, and water courses upon their own lands by mutual agreement in writing, duly signed, acknowledged, and filed with the County Clerk. Such agreement may include the location, the character of work to be done, the adjustment of the damages, the classification of the lands to be benefited thereby, the amount of special assessments to be levied, when the same shall be levied, or so many of these or other provisions as may be agreed upon, and to such extent shall be as valid and binding as though performed in the mode and manner provided for in this Act. Upon the filing of the agreement with the County Court Clerk, the County Court shall establish such drainage district and locate the ditch, drain, or water course provided for in said mutual agreement according to the terms thereof and shall thereafter have full and complete jurisdiction of the parties and subject-matter, and order such procedure under the provisions of this Act as may be required or necessary to carry out the object, purpose, and intent of such agreement, and to complete and construct the desired improvement, and shall retain jurisdiction of the same as fully as in other cases made and provided for in this Act.

Mutual agreement dist'cts may be established.

SEC. 39. *Be it further enacted,* That the preliminary expenses of such levee or drainage district, ditch, drain, or water-course improvement provided for by this Act (not including contracts for construction) may be paid by order

Preliminary expenses—how paid.

of the Quarterly County Court of the county in which the lands lie of such improvement district out of the general county fund, the same, if so paid, to be refunded to the county out of assessments collected from the lands of such improvement district when so collected; and if not so repaid, for any reason, then to be adjudged against and collected out of the bond of the petitioners required by this Act, and thus repaid to the county. If the Quarterly County Court should not see fit to order such preliminary expenses so paid, and the parties to whom such expenses may be owing are not willing to agree to wait till a fund for their payment can be provided by special assessments upon such district, then the County Court by proper order shall require the petitioner or petitioners to pay to the County Court Clerk a fund sufficient to pay such preliminary expenses, and the bond required of petitioners by this Act shall be liable for such preliminary expenses, and judgment thereon may be rendered at any time by the County Court to the end that such fund for expenses be provided, just as courts render judgments on cost bonds, and one such judgment shall not prevent other judgments on the same bond, so the sum of the judgments does not exceed the penalty of the bond; *provided, however,* such fund for expenses may be paid in from time to time, under the orders of the court, as the same may be needed; and *provided further,* that all sums so paid by the petitioners or their sureties on their bonds shall be refunded and repaid to the person or persons so paying the same out of the funds of such improvement district when such funds have been realized under the provisions of this Act.

This act not to apply to Reelfoot Lake.

SEC. 40. *Be it further enacted,* That this Act is not intended to apply to Reelfoot Lake and the waters thereof, or to authorize the draining of same, and this Act shall not be construed to in any way authorize the drainage of said lake.

SEC. 41. *Be it further enacted,* That this Act take effect from and after its passage, the public welfare requiring it.

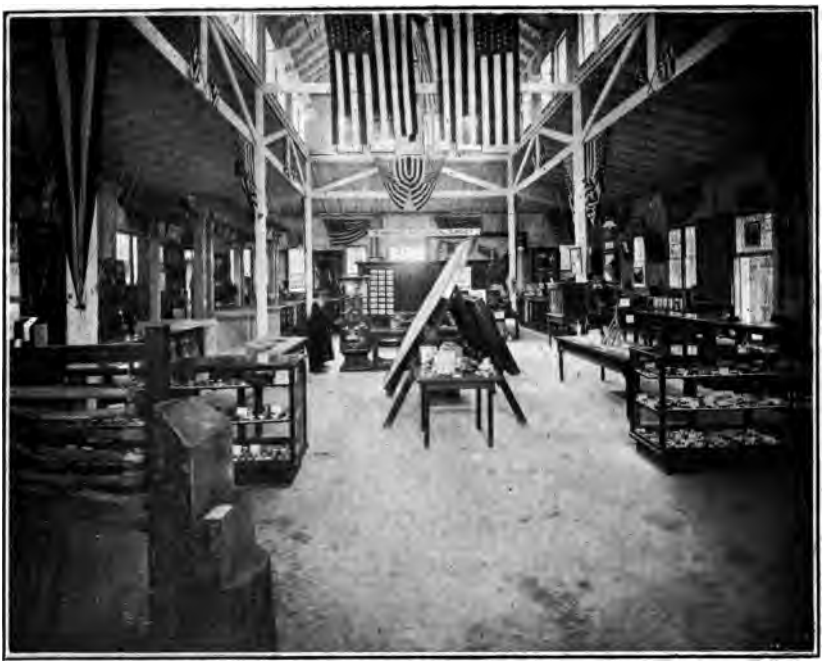
Passed February 25, 1909.

WILLIAM KINNEY,
Speaker of the Senate.

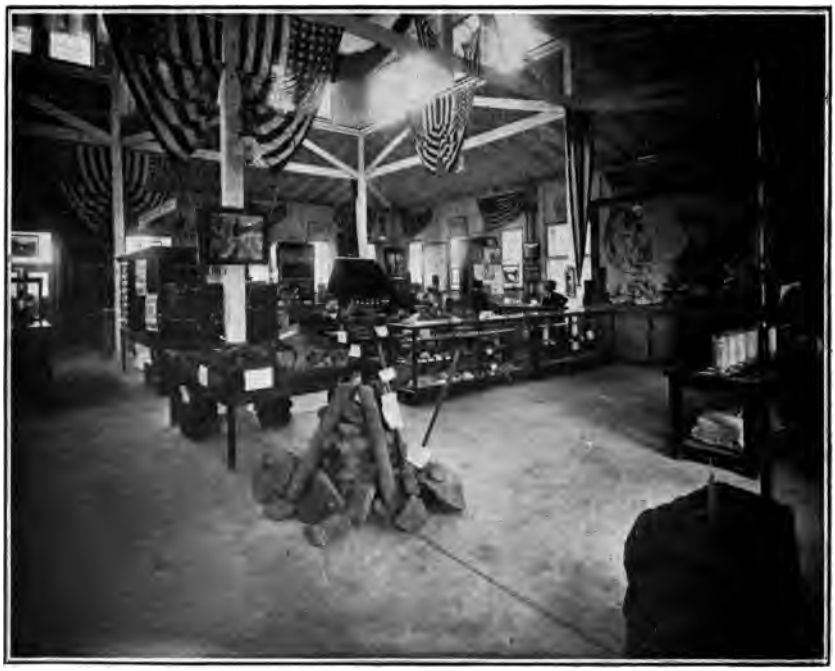
M. HILLSMAN TAYLOR,
Speaker of the House of Representatives.

Approved April 20, 1909.

MALCOLM R. PATTTERSON,
Governor.



VIEW OF EXHIBIT FROM NORTH END.



VIEW OF EXHIBIT FROM WEST SIDE.

Views of the Mines and Minerals Exhibit at the Appalachian Ex-*position, Knoxville,* Tenn., made by the Tennessee Geological Survey.