

Drainage Reclamations in the Bartholomew-Boeuf-Tensas Basin of Arkansas and Louisiana

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In the Bartholomew-Boeuf-Tensas Basin, as in other parts of the alluvial valley of the Mississippi River, flood control, drainage, and land clearing are essential to land reclamation. In practice, these three activities have not been carried forward uniformly, partly because they have been attacked by groups and organizations with different interests and partly because the difficulties of reclamation are not uniform throughout the valley. This condition has created and perpetuated many problems. Land drainage remains the most serious and vexing of the reclamation problems. In spite of the fact that millions of dollars have been spent to facilitate drainage in the Basin, there are actually very few localized areas where drainage is satisfactory. This publication attempts to make clear why so little has been accomplished. It points out why overall planning and integration of work are necessary if long-sought-for objectives are to be achieved. However, additional and more detailed studies of the engineering and economic aspects of drainage are necessary if past errors are to be avoided.

PHYSIOGRAPHY AND HYDROGRAPHY OF THE BASIN²

The Bartholomew-Boeuf-Tensas Basin is bounded on the north, east, and south by the Arkansas, Mississippi, and Red Rivers, and on the west by the uplands of the Coastal Plains (Fig. 1, cover page). From the standpoint of land development and land settlement, this area is a logical unit, since reclamation activities in one

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² Cf. Fisk, Harold N., "Geological Investigation of the Alluvial Valley of the Lower Mississippi River," Mississippi River Commission, Vicksburg, 1944.

"Depositional Terrace Slopes in Louisiana," *Jour. Geomorph.*, Vol. II, No. 2, 1939, pp. 181-200.

Russell, Richard Joel, "Louisiana Stream Patterns," *Amer. Assoc. Petrol. Geol. Bul.*, Vol. 23, No. 8, 1939, pp. 1199-1227.

part of the area affect the success of drainage works in other parts. It follows that if water control programs are to be efficient and equitable as well as contribute to a maximum development of land, they must be coordinated and integrated for the area as a whole.

The unity and distinctiveness of this area have been enhanced by the extensive levee which has been built along the Arkansas and Mississippi Rivers. A continuous levee now reaches from Pine Bluff, Arkansas, southeastward and southward to Old River, which forms the mouth of the Red River. This levee is designed to exclude Arkansas and Mississippi River flood waters from the major portion of the Bartholomew-Boeuf-Tensas Basin. The interruption of this structure near the mouth of Old River naturally defeats in part the purpose of the levee in that flood waters from the Mississippi River flow through this breach and commingle with the waters of the Red River to flood a considerable section in the lower part of the area with backwater.

The Bartholomew-Boeuf-Tensas Basin is, as the name implies, a multiple basin with a series of troughs, lowlands, marshes, bayous, and streams debouching into the Red River. Although the north and south orientation of basins and major streams is clear and distinct—running parallel to the main axis of the valley—many smaller bayous meander in various directions. Because of the relative evenness of the terrain, catch basins of various streams and bayous are at times indistinct, particularly in the southern part. Near the Red River, water in connecting bayous may flow in either direction, depending on the respective elevation of water in outlet basins and streams.

While the uplands and levee form the most conspicuous framework for most of the area, equally important are the natural levees or high lands along the Arkansas and Mississippi Rivers and Bayou Bartholomew which outline the basin and so give essential unity to the area. These natural levees are the result of stream deposition and they serve to direct local surface waters away from the main streams. The natural levee of Bayou Bartholomew is wide and relatively high and forms a conspicuous western border or rim to the basin.³

³ At present Bayou Bartholomew carries much less water than in former times, a condition well reflected by its wide and prominent natural levee. This levee is comparable in size to that along the Arkansas River and it is fairly well established that the latter river once followed the general course now taken by Bayou Bartholomew.

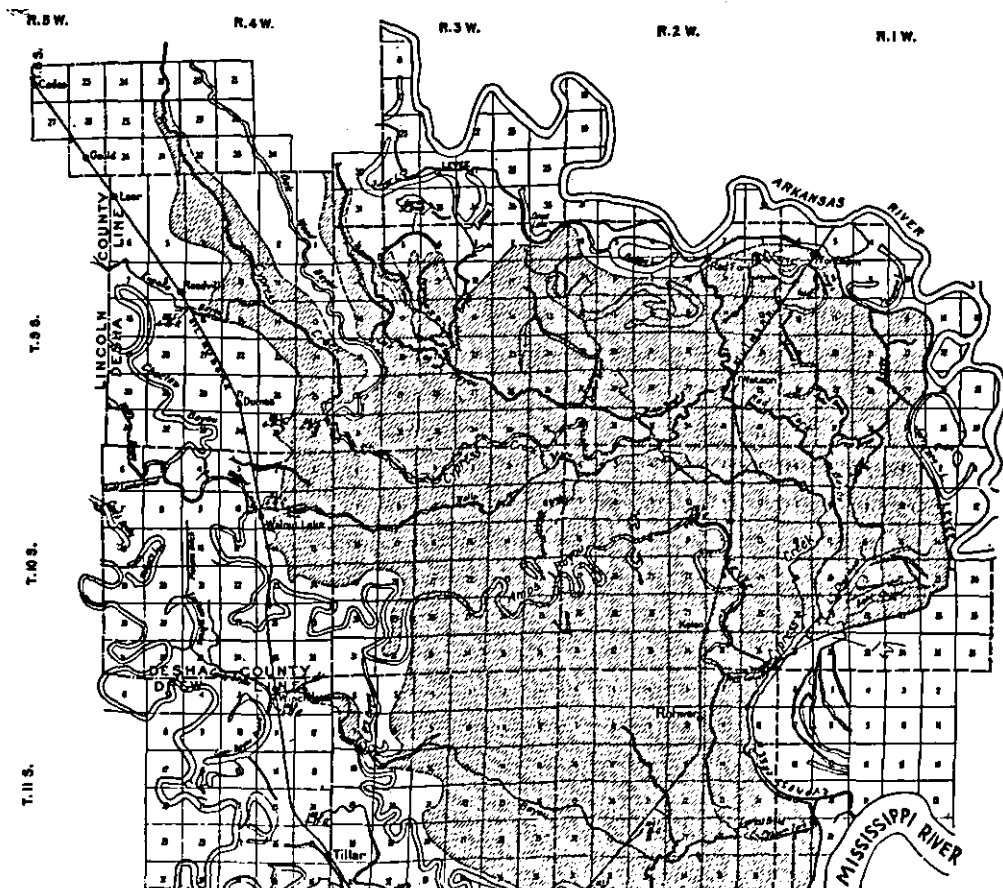


Fig. 2. Areas in the Cypress Creek Basin and adjacent sections which were flooded in 1912.

While the essential unity of the area is established by the flood control levee and natural levees of the major streams, one important discord in this unity should be noted in the one-time largely self-contained Cypress Creek Basin. The Cypress Creek Basin lies between the natural levees of Amos Bayou and the Arkansas River (Fig. 2). Up to 1920 the outlet to Cypress Creek was maintained because the surface waters from this basin ordinarily could not move southward. The creek opened into the Mississippi River a short distance below the mouth of the Arkansas River. However, waters from the Mississippi River at flood stage would enter the Cypress Creek Basin and at times reached such volume as to overcap and breach the natural levee of Amos Bayou and then flowed

southward to occasion floods of various proportions throughout the entire length of the basin. The Cypress Creek gap in the flood control levee and the resultant floods proved annoying and retarded agricultural development. In 1920 the flood control levee was closed, but only after several longitudinal ditches were dug across the natural levees of Amos Bayou by the Cypress Creek Drainage District.⁴ It follows that the Cypress Creek Basin and its drainage pattern is now closely linked with the drainage pattern in the area.

Soil-forming materials of the Bartholomew-Boeuf-Tensas Basin are not wholly composed of recently deposited alluvium. Macon Ridge, an older land form, extends from southeast Arkansas southward and southwestward to Sicily Island, a remnant of the ridge lying in Catahoula Parish, Louisiana. This ridge rises rather precipitously from the valley floor in some places and more gradually in other places. Generally its elevation ranges from a few feet to 20 feet above the bordering alluvial lands. In its southern extension the ridge is broken by some intervening lowlands, while to the north several westward- and southwestward-flowing streams nearly breach it. Caney Bayou, just north of Eudora, in its natural state once nearly breached this ridge. In recent years the upper bed of this bayou was deepened and extended to cut clear across the ridge, thus enabling flood waters to pass through the ridge at this point. This diversion, however, is possible only during periods of high waters.

Numerous elevations in the area could be cited to confirm its multiple basin-like character. High points naturally fall either on the bordering uplands and flood control levees or on the natural levees. Within the basin the highest points naturally occur on Macon Ridge. Centerward lie the longitudinal depressions in the basins which fall below the more elevated natural levees from a few inches to 5, 10, and even more feet. It follows that when the rivers and streams overcap the natural (or artificial) levees, the many depressions fill with water and so create flood conditions.

The multiple basins have a general slope from the northwest to the southeast and thence south, the slope being about one foot per mile in the upper end of the area and a few inches in the lower end. Elevations drop from about 190 feet above sea level in the vicinity of Pine Bluff, Arkansas, to about 35 feet near the Red River in

⁴ See pages 11 to 13 for further details with regard to this development.

Concordia Parish, Louisiana. Because of the greater slope in the northern end, drainage is more efficient in that area or can be made more efficient at relatively lower cost than in the lower end of the area. For this reason, agricultural development is much more widespread near the Arkansas River than it is in the southern part ending at the Red River.

THE SCOPE OF LOCAL DRAINAGE RECLAMATIONS

Important drainage reclamations were begun in the basin about 1907 and were continued until the time of the 1927 flood. Since 1927 only minor reclamations have been initiated which consisted of carrying out works planned but not completed at the time of the flood. During the period 1907 to 1927, 27 drainage districts were organized and actively undertook reclamations. A number of other drainage organizations were formed but they never completed plans for active work.

About 1,091,561 acres are encompassed in the 27 active drainage districts referred to above. Of this total, 853,199 acres are in Arkansas and 238,362 acres are in Louisiana. In the Arkansas part of the basin there is some overlapping of districts. For this reason the total acreage in individual districts is 25,000 to 30,000 acres greater than the figure given above.

Some idea of the magnitude of drainage reclamations and the optimism with which they were undertaken in this area is reflected in figures showing the anticipated benefits which the proposed reclamations would bring to the land, the size of the debt assumed, and the costs of construction. Examination of drainage records shows that over \$25,000,000 in benefits were assessed by drainage districts.⁵ Per acre assessed benefits ranged from a dollar to as much as \$30 or more. Assessed benefits of \$12 to \$15 per acre were common.

Bonds in the amount of \$5,938,650 were issued by drainage districts in the basin, of which four-fifths were in Arkansas. These bonds raised money to build approximately 689 miles of main ditches at a cost of approximately \$5,747,916. Five hundred forty-

⁵ The assessed benefits are available for all districts in Arkansas. Under Louisiana law, assessment of benefits is not made but an approximation of the supposed benefits is possible by capitalizing the tax levy. For the Louisiana districts included here this probably gives a fair estimate of the benefits expected, though this method of estimating assessed benefits cannot be applied indiscriminately.

nine miles of main ditches were dug in Arkansas and 114 miles in Louisiana. That the drainage efforts placed an excessive tax burden on many property owners is well known. The exact proportion of the debt defaulted is not known, but a conservative estimate based on many case studies indicates over-all losses between 40 and 50 percent.

THE FORMATIVE PERIOD OF DRAINAGE RECLAMATION IN THE BASIN, 1850-1900

During the last half of the 19th century about 9 million and 12 millions acres of swamp land were granted to the States of Arkansas and Louisiana, respectively, on the assumption that these lowlands would be sold by the States and the money be used for their reclamation. According to the wording of the Swamp Land Acts, reclamation included both flood control and drainage. However, the complexity and the cost of flood control and drainage in the Lower Mississippi Valley were greatly underrated by both the State and Federal legislators. Receipts from the sale of swamp lands were but a pittance compared to the amount of money required to control floods, with the result that not even a pretense was made of undertaking drainage improvements. Historically, the Swamp Land Acts are important chiefly because of the vast transfer of lands which was made under them, first from the Federal to the State governments and soon thereafter by the State governments to counties and levee boards and, later, to private citizens and corporations.

During the period 1850-1900, disastrous floods occurred frequently. The loss of life and property led the Federal Government to increase expenditures for flood control work each year, largely under the guise of aiding internal navigation and providing for the carrying of mail. In time the flood control improvements became impressive in size, and with their increasing enlargement waves of optimism found expression in new-land development activities. By about 1900, it appeared that reclamation work could soon be enlarged to include land drainage in addition to levee building. Shortly the landscape of much of the area was to be altered through drainage activities initiated and financed through the creation of local drainage districts.

While commercial lumbering activities progressed slowly in the Mississippi River lowlands following the swamp land grants,

it was not until the closing decades of the 19th century that technological improvements and growing markets for hardwood lumber created attractive opportunities for large corporate lumber companies. It became profitable to build numerous short-line railroads into the hardwood forest to transport logs to sawmills or to navigable streams. It should be noted that many of the bayous formerly used for floating logs had been rendered ineffective by the construction of levees. So favorable were the economic conditions during the early years of the 20th century that vast areas were deforested in supplying the building trades with lumber.

Lumber companies soon learned that the cut-over alluvial lands were valuable for agricultural purposes when properly drained. Naturally, the desire to capitalize on this resource was widespread and many lumber companies created real estate departments and land offices for the purpose of disposing of cut-over land to farmers. This combination of lumbering and real estate promotion is still common in the lowlands and is still extensively practiced, particularly in Louisiana.

It is sometimes assumed that land drainage in the Delta was the exclusive idea of agricultural interests, but the records show that the lumber companies' officials were very active promoters of the drainage movement. They desired to remove surface waters so that lumbering could be carried on during more months of the year and to enhance the agricultural potentialities of the land. Naturally much stress was given to the latter, particularly during the promotional period, for it was only by assuming a relatively high agricultural value that sufficient benefits from drainage could be assessed to serve thereafter as a basis for drainage taxation.

As will be shown later, agricultural development of the cut-over lands was frequently retarded, with the result that they were forfeited to the State for general and drainage taxes, leaving the debt-ridden districts to the agricultural interests. In some instances lumber companies apparently promoted drainage in areas which they wished partly drained, though aware that the agricultural interests to follow them would be weak and unable for many years to support elaborate drainage programs.

Joining the lumber companies in the promotion of land drainage were plantation interests, railroad corporations, and land speculators. The established planters frequently had large holdings

extending into the flooded lowlands, which they hoped to drain and convert to farm land. The railroads were interested in colonizing their vast land grants. As usual, the speculator played between the two, and used financial and political means to attract support to drainage efforts which he hoped would stimulate land sales at higher prices per acre.

The State and Federal Governments added assistance to this general upsurge of interests in the drainage of wet land. Numerous State and local as well as some Federal publications proclaimed the value of these lands, and urged that they be brought into cultivation as soon as possible. In 1907, the U. S. Department of Agriculture released Circular 76, which asserted:

"The reclamation of swamp and overflow lands is no longer an experiment. It has become a highly profitable business when based on correct principles," (pp. 10-11) and concluded that, "there is no good reason why this condition [swamp and overflowed land] should longer continue, and it is hoped that the American people will soon take steps to abate the nuisance and make these lands contribute to the support and upbuilding of the nation." (p. 23.)

Two years later, in the 1909 Yearbook of the Department of Agriculture, a report on land drainage to the Secretary declares:

"The Department is actively promoting the drainage of wet land throughout the humid regions of the United States. Examinations of such lands, followed in many cases by the preparation of definite plans for their drainage, have been made in twenty States during the year. Large areas are now being reclaimed in accordance with the Department's plans." (p. 147.)

These Federal publications were accompanied and followed by many State and private reports. The pamphlet "The Dawn of a Greater State: Facts about Drainage—The Awakening of Arkansas" by G. A. Cole (1910) is representative of this literature.

This widespread interest in drainage naturally prompted the States to enact permissive legislation, giving drainage organizations special legal status and in other ways enabling them to initiate and carry out community plans with taxing power and police authority. Arkansas and Louisiana legislatures reworked the old and inadequate drainage laws, dating from 1891 and 1888, respectively, and during the decade 1905-1915 created the major legal framework for local drainage organizations. In Arkansas, however, drainage districts were frequently created by special acts of the legislature, which resulted in many undesirable practices. Thus

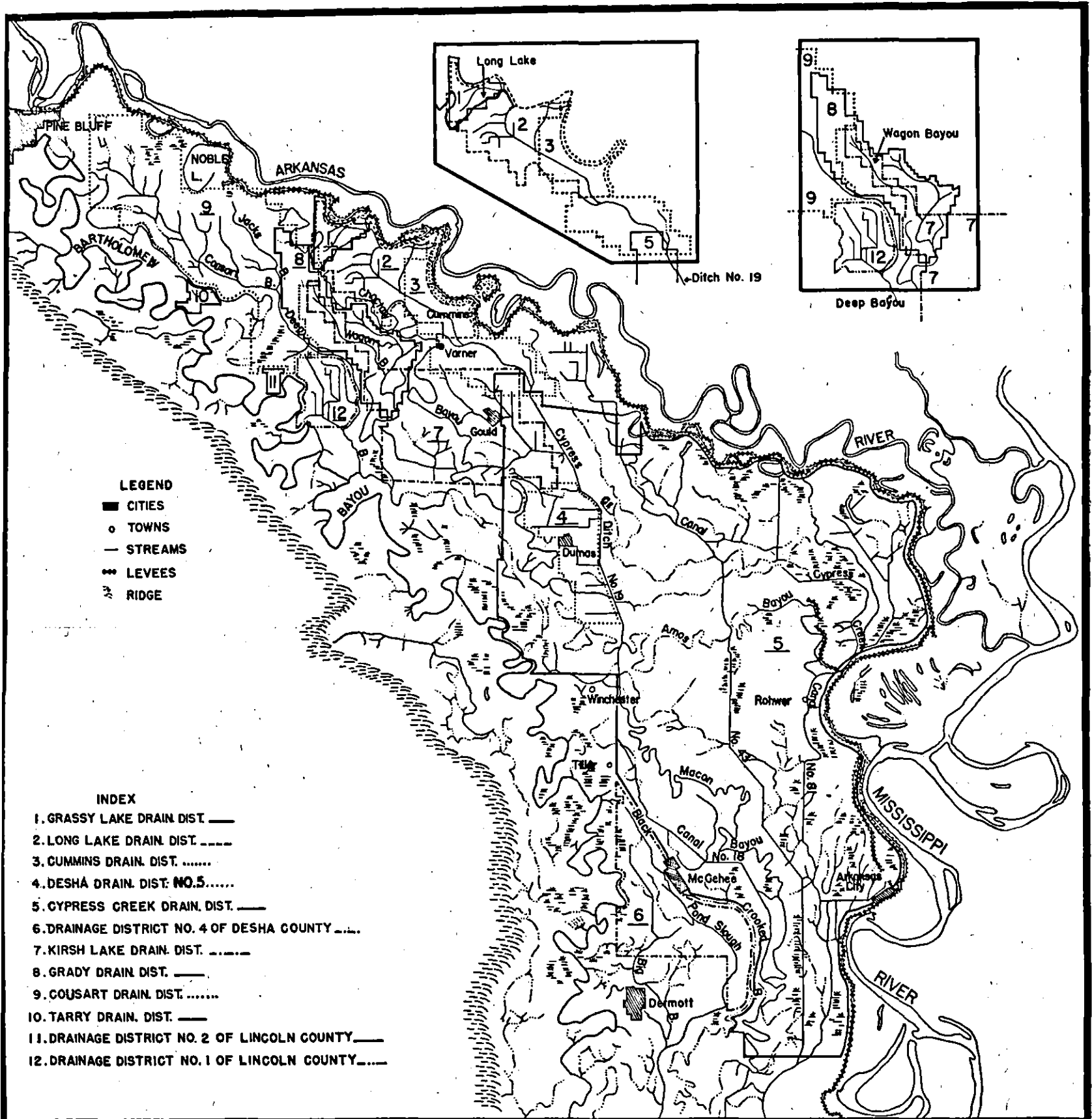


Fig. 3 DRAINAGE DISTRICTS IN THE UPPER PART OF BARTHOLOMEW-BOEUF-TENSAS BASIN, IMMEDIATELY SOUTH OF THE ARKANSAS RIVER (Segment 1)

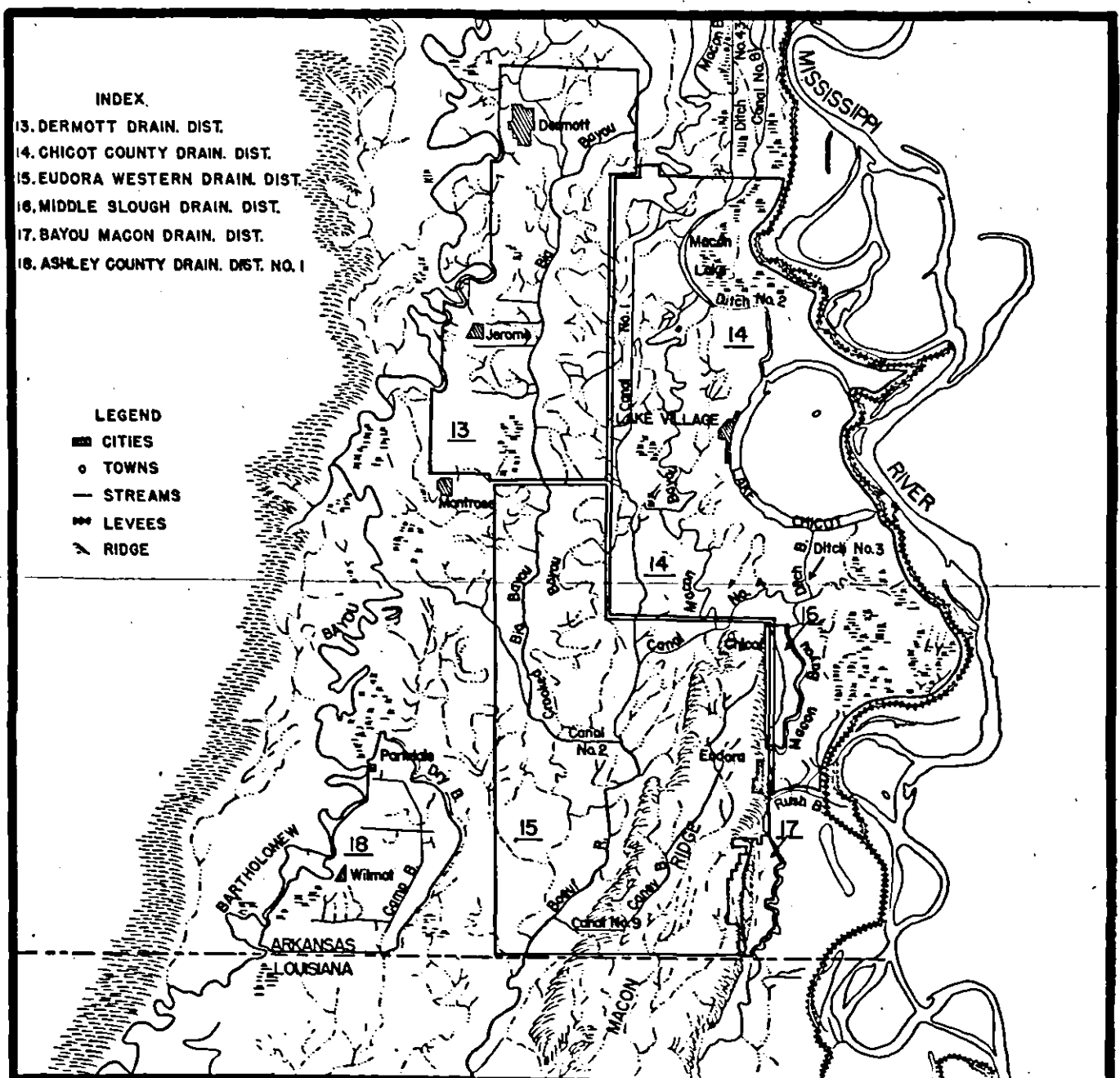
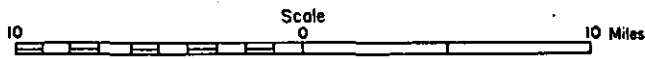
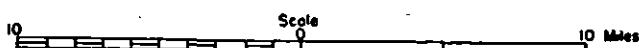


Fig. 4 DRAINAGE DISTRICTS IN THE MIDDLE PART OF BARTHOLOMEW-BOEUF-TENSAS BASIN, IMMEDIATELY NORTH OF ARKANSAS-LOUISIANA STATE LINE (Segment 2)



from 1900 to 1927, the year of the great flood, diverse interests brought their influence and resources to bear on the problem of reclaiming wet land in the Mississippi Alluvial Valley.

INITIAL PLANS FOR RECLAIMING WET LANDS IN THE BASIN

Drainage developments in the Bartholomew-Boeuf-Tensas Basin center to a high degree in the improvements associated with the Cypress Creek Drainage District (Fig. 3). Several districts created above this district are, from the standpoint of hydrology and engineering, an integral part of the drainage system although these organizations are politically distinct, as was their engineering. Similarly, prominent districts below Cypress Creek, namely Eudora Western Drainage District and Chicot County Drainage District, are extensions of the Cypress Creek development, though their proper integration was never effected (Fig. 4). Figures 4 and 6 show the essentially close relationships between the Arkansas drainage districts and the abrupt termination of major development at the Arkansas-Louisiana State line. It can be seen in Figure 7 (p. 46) that most of the drainage district organizations in Louisiana are not in the lowlands of the southerly extending basins in which the Arkansas districts lie, but are largely on the eastern fringe. The Louisiana organizations were more concerned with facilitating the movement of surface waters from the rather extensive natural levees along the present and former channels of the Mississippi River, than with attempts at reclamation of more or less permanently wet and overflowed land lying south of the point where Arkansas drainage ditches ended.

The Cypress Creek Basin forms the only major exception to the north-south drainage pattern, having an east-west axis more or less paralleling the Arkansas River. Closely associated with the Cypress Creek Basin is Amos Bayou which in the natural setting opened into Cypress Creek near the Mississippi River. Flanking this bayou are relatively high natural levees which are generally about 10 feet above the basin lying to the north and south. These levees form a rather effective barrier to north-south drainage except during periods of high floods. Cypress Creek, like most

other lowland bayous, has numerous tortuous meanders, which at times are quite distinct and at other times become wide flats grown up with willows and other vegetation. Moreover, as is characteristic of the small streams connecting with the Mississippi proper, the outlet was constricted, a condition which tended to pond the water upstream. These conditions gave rise to a twofold flood and drainage problem. Headwaters not having a ready outlet tended to spread over the Cypress Creek Basin and to remain in stagnant pools late into the summer season. During the annual rises of the Mississippi River, its waters entered Cypress Creek and greatly increased the volume of impounded waters. Since some of the annual rises assumed proportions of floods, the whole Cypress Creek Basin was frequently filled, overflowing the natural levees of Amos Bayou and then flooding thousands of acres of lowlands lying southward. This condition served in large part to negate the protection otherwise afforded by the extensive flood control levee of the Arkansas and Mississippi Rivers.

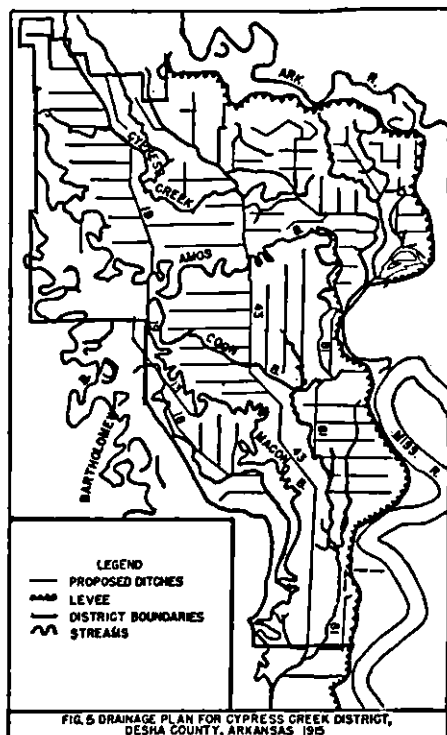
The break in the levee at the Cypress Creek outlet proved increasingly vexing to the Mississippi River Commission and to agricultural and industrial interests lying in the flooded basins. Under its organic act the Mississippi River Commission could take no active interest in agricultural drainage. Its legal duty was to protect existing lines of levees endangered by flood waters flowing and ponded behind them, as well as to improve the navigability of the Mississippi River, which was being somewhat impaired by the debris deposited by Cypress Creek. Local landholders, on the other hand, were interested in a combination of flood control and drainage efforts.

In 1907 the Mississippi River Commission submitted plans for the diversion of Cypress Creek so that the gap in the levee could be closed. This was to be strictly a stream diversion project and envisioned a southward flowing ditch of large proportions with high embankments on each side. This proposal did not contribute to a solution of the local drainage problem south of Amos Bayou and because of this the plan met with strong opposition and was defeated.

Failure to execute the above diversion project naturally served to center increased attention on a combination diversion and drain-

age undertaking. While the Mississippi River Commission was preparing its proposal, local interests were exploring the possibility of combining the needed diversion ditches with a drainage system.

As early as 1906, John T. Stewart, drainage engineer of the Office of Experiment Stations, and an accompanying field party came to Arkansas City and helped lay out a drainage system designed to relieve local drainage problems. These drainage works were later merged with the Cypress Creek Drainage District development. The Department of Agriculture was rapidly expanding its engineering services and was in a position to work on drainage plans as soon as local people organized and requested engineering services. During the formative period between 1908 and 1910, a number of outstanding engineers visited the area and were consulted on over-all engineering problems. These preliminary



efforts culminated in an elaborate diversion and drainage plan prepared by S. H. McCrory, O. G. Baxter, and others, presented in Department of Agriculture Bulletin No. 198 (1915), entitled "Report Upon the Cypress Creek Drainage District, Desha and Chicot Counties, Arkansas." Figure 5 shows the essential features of this plan.

LOCAL DRAINAGE ORGANIZATION IN THE CYPRESS CREEK AREA

At the time the Cypress Creek diversion and drainage program was initiated, the requirements of the U. S. Department of Agriculture were such that local organizations had to be formed which were in a position to reimburse the Federal Government in part for the expenses associated with desired engineering surveys. Partly

to meet this requirement, the 38th General Assembly of the State of Arkansas (1911) created Cypress Creek Drainage District. The resort to a special act in creating this district obviated in part the need for engaging in a major local controversy. The support of many lumber companies, plantation operators, local attorneys, bankers, and large landholders resulted in the passage of the act despite some local opposition by those who feared ruinous taxes.⁶

At the time Cypress Creek Drainage District was created in 1911 only about 10 percent of the land lying within its boundaries was in cultivation. In spite of this undeveloped state, a large reclamation project based on local taxpaying ability was supported by influential citizens and approved by the Legislature. The explanation of this optimism lies in the vision which many local promoters entertained for the area and which they translated into rewards to follow drainage reclamation. These enthusiastic leaders, failing to realize the full magnitude of the engineering problems involved in providing suitable outlets for surplus water, envisioned an almost immediate translation of the swamp and overflowed forest and cut-over lands into an agricultural empire capable not only of self-support but also of producing vast quantities of products for northern markets. Drainage was to be followed by phenomenal rises in land values. These expectations are well reflected in the following statement published in 1915 while the reclamation was in progress:

This is a section [Desha County] that has never known a crop failure, and where the levees have held under the most exceptional strain.

The people of Desha differ from the Dutch boy who believed he could keep the water on the other side of the dyke by plugging the hole with his finger. In that wonderful country they build levees, and build them big, too. Fifty-four miles of protection that the "Father of Waters" can't budge assures the farmer safety. They never think of overflow down there. And the drainage canals! Why, bless you, they are alive in Desha. They realized that the land was valuable, and went to work to reclaim it. They organized the Cypress Creek Drainage District, assessed the property holders for the cost, \$1,400,000; sold the bonds and got busy; 152 miles of drainage canals are under construction, reclaiming 285,000 acres, and doubling the value of land that was once declared worthless.

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⁶ Although Cypress Creek Drainage District was created as early as 1911 by the State Legislature, widespread local interest in the project lagged and did not crystallize until the period of the first World War. By this time proponents and opponents of the program organized their forces and carried the issue of the drainage district to the polls by requiring every county candidate to take a stand either for or against the drainage development.

Desha is a county of large farms and not so very long ago 30,000 acres of timber land lying in one body were purchased by a large company for the purpose of developing it into farms, corn and alfalfa being planted extensively. Another company, from Chicago, has purchased a large tract near Arkansas City and will demonstrate that as much corn can be raised to the acre as will grow anywhere in the country.

Large colonies are coming in regularly from other sections, for the fame of Desha as an agricultural county has gone broadcast.⁷

Subsequent developments have not entirely confirmed the confidence and expectations set forth in the above quotation. Desha County and lowlands lying to the south of it were thoroughly flooded in 1912, 1913, 1916, and 1927. Although considerable new land development took place in the depression years of the 1930's, only about 25 percent of the land in the district was in cultivation by 1945. In all fairness to local judgment it should be pointed out that this low level of agricultural development can be traced in part to the disastrous flood of 1927 and to later flood control plans which designated considerable parts of this area as a flood-way, a condition which prevailed until 1941. The enactment of these flood control plans necessitated the withdrawal of credit extensions (including Federal land bank loans) for the large area affected. Naturally this severely retarded all agricultural progress.

Essentials of the Cypress Creek Drainage District Plan

The Cypress Creek Drainage District plan falls into two major parts: (1) three main longitudinal combination diversion and drainage ditches, and (2) a comprehensive system of lateral drainage ditches (Figs. 3 and 5). The major longitudinal ditches (locally known as ditches number 19, 43, and 81) were designed to divert southward the water from the Cypress Creek Basin and to serve as terminal ditches for the numerous laterals which, according to the original plan, were to follow section lines. Though the U. S. Department of Agriculture engineering party strongly recommended the construction of the entire system as a unit, they recognized the dual purpose of the plan and made separate cost estimates for the main longitudinal ditches and for the laterals. The cost of the former was estimated at about \$1,500,000 and this part of the plan was carried out during the 12 years from 1911 to 1923, being delayed by World War I. The actual cost approximated the

⁷ Keeley, J. Frank, *Arkansas and Her Resources*, Little Rock Publishing Co., 1915, p. 39.

Department's estimate. This diversion made possible the closing of the Cypress Creek gap in the Mississippi River levee, which was completed by the U. S. Army Engineers in 1920.

Complications in Executing Original Plans

Compared with other drainage districts in this area, Cypress Creek District was relatively large and so encompassed a number of local sectional interest groups. Among these groups were the landholders residing in the area lying in Drew County between the Desha County line and the upper end of Crooked Bayou (largely between Winchester and Tillar, Arkansas). This area was to be reclaimed by ditch No. 13 of the Department's plan. The landholders in this area felt that the over-all plan would not benefit them particularly and that the assessed benefits were therefore excessive and unjustified. This attitude prompted them to approach the State Legislature with the request that their land be excluded from the drainage area and that they be left free to form a separate district. Dismemberment followed and this break-up naturally proved disconcerting to the administrators of the district, coming as it did when several hundred thousand dollars were to be raised by floating bonds.

One of the major difficulties confronting the Cypress Creek Drainage District administration was the rather long period which elapsed from the beginning to the end of construction. This protracted period of construction was costly and discouraging to investors and to landholders. Difficulties resulting in serious delays arose from several major floods (in 1912, 1913, and 1916), from the entrance of the United States in World War I, and from controversies with the construction contractors over engineering problems.

Despite the protracted efforts the project was never completed. Most of the proposed laterals were not dug, making the reclamation largely a stream diversion rather than a drainage project. The failure to provide adequate land drainage naturally precluded agricultural developments and discouraged increases in land values, developments needed to support high drainage taxes.

Early in the development of the Cypress Creek project, the administrators of the district decided to finance the work as it proceeded by floating a series of bonds rather than by floating a single issue designed to cover the total cost, estimated at approximately

\$2,200,000. This plan was favored because it offered a substantial saving in interest charges. Floatation of bonds occurred as follows:

July 1, 1911	-----	\$ 300,000
Feb. 1, 1916	-----	700,000
April 1, 1921	-----	500,000
April 1, 1922	-----	300,000
		\$1,800,000

When the program was launched, enthusiasm and support for the work were sufficient to make the sale of bonds easy, with considerable local purchasing. The last installments, however, were issued in the early 1920's when faith in the project had been shaken. The bonds offered in 1922 were very hard to sell and their market value dropped precipitously, many changing hands at 16 cents on the dollar. This was at a time when no lateral drains had been dug and when agricultural prices, especially cotton prices, were dropping to long-time lows. The result was that in the early 1920's the district had a debt approaching \$2,000,000 and a declining income due to delinquent taxes. Moreover, agricultural expansion was not feasible because of the absence of lateral drainage ditches.

When the U. S. Department of Agriculture engineers prepared the original diversion and drainage plans for Cypress Creek Drainage District, their estimates showed that the longitudinal, largely diversion, ditches would approximate two-thirds of the cost, whereas the construction of the smaller laterals would increase the cost by only one-third. Their recommendation that the project be completed as a unit to make possible the immediate and full development of the land, therefore, had much to recommend it. The experiences related above illustrate the disastrous effect of failing to carry out the full project. In this case, the uncompleted part may have been the key part in the reclamation and development program.

The financial status of Cypress Creek Drainage District deteriorated rapidly after 1922 and crumbled after the flood of 1927. Receivers in bankruptcy were appointed on June 15, 1930. The district had, at the time of bankruptcy and refinancing, about \$1,490,000 in principal debt and about \$545,000 in accrued interest, or a total debt of almost \$2,000,000. This debt was not formidable when compared with the original assessed benefits of \$5,927,199 or nearly \$20 per acre. These benefits, of course, envisioned a fully

developed agricultural landscape which, as has been explained, did not materialize. Nevertheless, the unexhausted taxable benefits were made the basis for a Reconstruction Finance Corporation loan which was finally established at \$360,000. This amount, with \$200,000 additional money in district funds, was used to refinance the debt mentioned above. Since refinancing, the district has maintained sound finances with principal and interest payments on a current basis. The tax rate is now (1945) 1 percent of the assessed benefits, one-fourth of this being used for maintenance as required by the Reconstruction Finance Corporation.

Retarded Development Due to Floodways

Field investigators working in the Cypress Creek Drainage District area will discover a widespread local preoccupation with the floodways which were at one time part of the Mississippi Valley Flood Control Program. Many of the shortcomings of the land drainage plan are attributed to these floodways, and thereby responsibility for many local difficulties is shifted to higher authority. While the fuse plug levee at the head of the proposed floodways was an actuality from 1928 to 1941, and undoubtedly severely influenced the economic development of the area,⁸ it cannot be used as a complete explanation for the failures of Cypress Creek Drainage District and other closely related districts. Here, as elsewhere, some of the chief difficulties were inherent in the approach made to a problem which could be handled successfully only as a basin-wide problem.

The Flood Control Act of 1941 abandoned the plan of a floodway in southeast Arkansas and the fuse plug levee near the mouth of the Arkansas River was converted into a standard grade levee. The many drainage problems which the district now faces can in no way be attributed directly to the floodways, but arise from the general approach made to drainage in the area.

Current Problems of the Cypress Creek Drainage District

The report prepared by engineers of the U. S. Department of Agriculture on Cypress Creek Drainage District during the years immediately preceding 1915 (Bulletin No. 198, published in 1915)

⁸ See report of Henry, L. A., *Drainage and Flood Control in Boeuf River-Bayou Macon Drainage Area, Southeast Arkansas*, presented at public hearings held by U. S. Army Engineers, Arkansas City, Ark., Aug. 1944.

stated as a fundamental proposition that "The drainage district should include only such land as would be benefited by the improvement" (p. 13). On the basis of this proposition only minor alterations in the boundary of the district as established by the 38th General Assembly of the State of Arkansas at 298,450 acres or about 466 square miles were recommended. The engineers' report actually recommended a reduction in the area of the district amounting to 3,666 acres, although the report recognized that the watershed area tributary to the district (mainly in the Cypress Creek area) exceeded by about 200 square miles the area of the district. By breaching the natural levees of Amos Bayou and diverting southward the water of the Cypress Creek Basin, Cypress Creek Drainage District is actually interposed between the head-water area and the downstream area of its combined Cypress Creek and Macon Bayou Basins. In this interposed position, any drainage improvements effected would certainly extend up to the head-water area in the Cypress Creek Basin. If this fact was not clear at the time the U. S. Department of Agriculture report was prepared, it has become abundantly clear since the several important diversion ditches have been completed. With the outlet ditches cut through the natural levees of Amos Bayou, it was logical to inaugurate other drainage improvements in the upper Cypress Creek Basin, such as have been made by Long Lake Drainage District and Grassy Lake Drainage District. These districts now direct large volumes of water to the diversion ditches of Cypress Creek Drainage District although they did not contribute money or labor to the ditches' construction. In fact, the volume of water coming from these districts and the Cypress Creek Basin generally greatly exceeds early expectation, and the longitudinal diversion ditches are wholly inadequate to accommodate this water. As a result Cypress Creek Drainage District has not solved the flood problem, but has even made short-time floods more numerous in parts of the district through an inadequate system of diversion ditches which afford considerable relief to nondistrict landholders, but frequently jeopardize lands in the district.⁹

The overtaking of ditches was made even more serious by the diversion to Cypress Creek Drainage District of much of the run-

⁹ See public statements of Dr. Vernon MacCammon, E. B. Warrington, Roy Maxwell, and Dewitt Poe at Arkansas City, Ark., Aug. 17, 1944, which are on file at U. S. District Engineers Office, Vicksburg, Miss.

off from Kirsh Lake District, a district which in turn receives waters from districts to the west and north. As a result, flood waters from as far north as Pine Bluff find their way into the Cypress Creek district, much of it coming from what once appeared to be separate and distinct watersheds. It is an interesting fact that Cypress Creek Drainage District has contributed more to the agricultural development of lands lying to the north and west of its boundary than to certain of its own lands. This is strikingly demonstrated when, in the spring or following flash floods, vast volumes of water converge in the northern end of the district and from there cause flood conditions throughout the entire length of the district and the basin lying to the south of it. The flood waters entering the ditches from the northwest are frequently of such volume that the water covers and obliterates the longitudinal ditches and flows from west to east between the major ditches. To prevent this west-east movement, embankments had originally been placed on the east side of some of the diversion ditches. So desperate have been the owners of flooded land that they have resorted several times to the expediency of dynamiting these embankments, hoping to save themselves but thereby flooding even greater portions of the district to the east and south.

DRAINAGE DEVELOPMENTS WITHIN THE CYPRESS CREEK DRAINAGE DISTRICT

Failure of Cypress Creek Drainage District to carry out a program for developing laterals encouraged the formation of a sub-district called Desha Drainage District No. 5, centering largely around the village of Dumas (Fig. 3). This district was organized in 1917 and constructed about 21 miles of laterals which in general followed the plans laid down in the Cypress Creek survey. Bonds were issued in the amount of \$100,000, against a total assessed benefit of \$188,315. While there was some delinquency in the payment of interest and principal in the early 30's, by 1934 the full debt had been retired. Since that time the district has been dormant, with no provision made for maintenance. At present the ditches are largely filled with sediment and are grown up with willows. Effective drainage would require comprehensive restoration.

Of crucial importance to this subdistrict is the fact that its outlet is ditch No. 19 of Cypress Creek Drainage District. This ditch is seasonally over-burdened with flood waters from districts

lying to the north and west. In fact, the high waters in ditch No. 19 frequently flow into the laterals of Desha Drainage District No. 5 and so defeat the purposes of this development. These experiences naturally irritate the local landholders who criticize severely both the landholders to the north who use the same ditch as an outlet, and the Cypress Creek Drainage District administrators for not enlarging ditch No. 19. Dilemmas such as face this district are common in the Mississippi Valley where no adequate basis for placing riparian responsibility has been developed and where districts frequently attack what is essentially a watershed problem in piecemeal fashion.

While this district is in good financial condition and is rather highly developed agriculturally, it has no specific plans for further drainage development, although annual flooding is serious. Here, as elsewhere, local interests organized on the basis of a small district now feel inadequate to cope with the drainage situation. Cognizant of the failures in the past to realize anticipated drainage benefits and aware of the trend toward Federal aid and Federal projects, the landholders are reluctant to attack the drainage problem again on a local level and are bending their efforts to secure outside help, largely from the Federal Government.

There have been numerous movements to organize other sub-districts within Cypress Creek Drainage District but none has materialized. Failure to organize may be accounted for in part by the floodway plans mentioned above. (Desha Drainage District No. 5 was located outside of these proposed floodways.)

An interesting reclamation within Cypress Creek Drainage District took place in 1942-43 under the auspices of the War Relocation Authority on Government land held by the Farm Security Administration. Near Rohwer, the Farm Security Administration held title to some 10,000 acres of land which they hoped to develop for farming purposes. This development was delayed mainly because of the poor drainage afforded by the Cypress Creek ditches. It was clear that major drainage developments were necessary before land settlement could be undertaken. The problem of obtaining drainage was resolved when the land became the site of a Japanese Relocation Center and it became incumbent on the War Relocation Authority to undertake the digging of numerous laterals to drain the area properly. In all, about 20 miles of ditches were

dug, following in general the plan originally drawn for Cypress Creek Drainage District but, as explained above, never fully carried out. This development of laterals accompanied by considerable clearing of land caused some major irritations to established landholders in the district. Existing ditches were already inadequate to accommodate flood waters and the new ditches increased still further the flood hazards. This experience again demonstrates the significant changes in hydrology which occur following the clearing of land and the development of largely artificial stream patterns in an alluvial valley. In a remarkably short time developments of this kind tend to concentrate great amounts of surface water in available channels, volumes of water which usually can be accommodated only by major engineering works.¹⁰

DRAINAGE DISTRICTS IN THE HEADWATERS OF THE CYPRESS CREEK BASIN THAT COMPLICATE THE CYPRESS CREEK DRAINAGE DEVELOPMENT

In the headwaters area of the Cypress Creek Basin lie the drainage districts known as Grassy Lake, Long Lake, and Cummins. These were organized in the years 1910, 1914, and 1920, respectively. The sequence of this development should be noted, as it represents the usual sequence of drainage development from a headwater area downstream. Each development, piecemeal in itself, made it incumbent upon landholders "down-basin" to initiate drainage improvements to accommodate terminal flood waters as well as to facilitate local run-off.

Grassy Lake Drainage District

Grassy Lake Drainage District (Fig. 3) was the first of the three districts to undertake development. It was organized in 1910, encompassed an area of 3,880 acres, and assessed benefits to a value of \$21,935, or an average of \$5.65 per acre. Improvements were financed with a \$12,000 bond issue which was retired in the early 1930's without serious difficulties.

Only about 5 miles of ditches were dug in the district, leading into Long Lake, an arrangement which improved drainage conditions in the upstream area at the expense of the lake area. This situation, in turn, stimulated the organization of Long Lake Drain-

¹⁰ See public statement of H. H. Hopson, Arkansas City, Ark., Aug. 17, 1944, on file with U. S. District Engineer, Vicksburg, Miss.

age District (1914) which overlaps Grassy Lake Drainage District completely. The larger district then proceeded to dig ditches which facilitated local run-off and dumped the surface and flood waters in an area where Cummins Drainage District later undertook developments (1920) to connect with Cypress Creek Drainage District.

Grassy Lake Drainage District has not done any maintenance work and at present the ditch system is choked with sediment, debris, and vegetation, particularly in the lower part of the district. While administrators of the district are desirous of improving the ditches, they are undecided whether to renew developments on a local basis or to await outside assistance, particularly from the Federal Government.

Long Lake Drainage District

Shortly after development of Grassy Lake Drainage District it became clear that the essential problem had not been solved by running local drainage waters into Long Lake, which is actually a sinuous bayou with little capacity for flood water. As a result, Long Lake Drainage District was organized in 1914 to encompass Grassy Lake Drainage District and a considerable body of land lying between this district and Varner. The area lying north of Varner was largely swamp land which drained into Cypress Creek. The essential purpose of Long Lake Drainage District, therefore, was to define the drainage system in a southward course from Long Lake to the above-mentioned swamp area which in turn drained slowly into Cypress Creek.

Long Lake Drainage District has an area of 17,500 acres of which 15,656 acres bore assessed benefits of \$226,667.50 or an average of \$14.48 per acre. Three issues of bonds were sold totaling \$132,500, creating a debt of about \$8.50 per acre. This debt is now retired and no drainage tax has been levied for several years. Part of the drainage system has been fairly well maintained by convict labor from a State prison farm which lies within the district.

Initial developments in Long Lake District were carried out during the years 1914-16 and included the construction of a main outlet ditch and several laterals. The main ditch was constructed with a bottom width of 30 feet in its upper reaches and 40 feet in its lower, and an average depth of about 9 feet. It was soon be-

lieved that the capacity of the ditch was inadequate and so the upper and lower parts were widened to 40 and 50 feet, respectively. The chief difficulty, however, centered in the outlet, or the swamplands at the head of Cypress Creek, into which the main ditch emptied. This was demonstrated by the stagnant waters that lingered in the lower part of the ditch and the debris that soon began to fill the ditch and prevent drainage. It is interesting that this problem was never attacked by Long Lake Drainage District, but instead another new district was formed, Cummins, joining the major ditch of Long Lake Drainage District with ditch No. 19 of the Cypress Creek development. This merely transferred part of the flood problem downstream, adding new hazards to Cypress Creek Drainage District.

The joining of the main ditches of Long Lake Drainage District with ditch No. 19 of Cypress Creek Drainage District has not given the former district a satisfactory outlet. Relief can come only through enlargement of ditch No. 19, particularly in its upper part. Landowners in Long Lake Drainage District have frequently joined with those in Cummins Drainage District below in petitioning the Cypress Creek district officials to enlarge this ditch. Fulfillment of this hope seems rather remote, for compliance with the request would result only in more rapid concentration of water in Cypress Creek Drainage District which is already incapable of coping with local and terminal drainage. The present strictures in the outlet for Long Lake and Cummins Drainage Districts are, therefore, an aid in retarding flood waters entering the Cypress Creek district.

Cummins Drainage District

Cummins Drainage District has an area of 19,205 acres on which the benefits for drainage were assessed at \$351,259. Bonds were issued in the amount of \$83,500, dated September 1, 1922. The district is now free of debt and levies no drainage taxes.

As was pointed out, the main ditch of Long Lake District emptied for several years into a wide swampy area which in turn ran into Cypress Creek. This swamp area presented a distressing problem to nearby landowners as well as to drainage districts lying to the north, and in a sense to Cypress Creek Drainage District lying below it. As was customary in that period, a new drainage

district, Cummins Drainage District, was organized in 1920 to attack this problem. This district constructed a connecting ditch between the major ditch of Long Lake Drainage District and No. 19 of the Cypress Creek district. Seven miles of lateral ditches were constructed to facilitate local drainage. These laterals were supplemented by a rather extensive network of ditches located on State lands used by a penal institution. Apparently, the largest single beneficiary of this undertaking was the State Penal Farm where drainage made possible the clearing of several thousand acres of land with convict labor. Convict labor was also used to maintain the upper part of the main ditch which adjoins the penitentiary land, with the result that its lands are in a high state of cultivation. This labor has not been available to work on the lower end of the district where the ditches are now greatly deteriorated.

In spite of early financial difficulties, this district is out of debt. With regard to further developments Cummins Drainage District finds itself in the same position as Long Lake and Grassy Lake Drainage Districts, in that all share a common outlet problem, already described, for which no solution has been found.

DRAINAGE DEVELOPMENTS OUTSIDE THE CYPRESS CREEK BASIN THAT COMPLICATE THE CYPRESS CREEK DRAINAGE SYSTEM

As has been mentioned, Cypress Creek Drainage District's problems were not only accentuated by districts lying in its upper watershed (Cypress Creek Basin), but also by districts to the west, situated largely in an adjacent drainage basin. In this manner Kirsh Lake and Grady Drainage Districts influence the development of drainage reclamation in the Cypress Creek area. Accordingly, a discussion of the history and present status of these two districts follows.

Kirsh Lake Drainage District

A combination of district boundary problems and topographic considerations within Kirsh Lake Drainage District (Fig. 3) caused it to divert drainage waters to Cypress Creek Drainage District's ditch No. 19 which, under unmodified conditions, would not have been part of that district's watershed. In a general way, Kirsh Lake Drainage District is interposed between the relatively high

natural levees of Bayou Bartholomew and the western boundary of Cypress Creek Drainage District. Running throughout the length of the district from northwest to southeast is Choctaw Bayou, with relatively high natural levees. In the absence of drainage modifications, surface waters here flow to the southeast, partly in Choctaw Bayou and partly in the lowlands lying to the east and west. The high levees of Choctaw Bayou rendered this stream an unsuitable outlet for drainage ditches. The need, therefore, was to seek outlets either into Bayou Bartholomew or into ditch No. 19 of Cypress Creek Drainage District. Local opposition prevented an outlet into Bayou Bartholomew and so the only outlet effected ran into ditch No. 19 of Cypress Creek Drainage District. A main outlet ditch was cut directly across Choctaw Bayou and its high natural levees, making a diversion that carries surface waters from the basin west of Choctaw Bayou to the basin east of this bayou and into ditch No. 19.

According to the Rotan quadrangle prepared by the Mississippi River Commission, the district planned to drain the basin west of Choctaw Bayou southward into Bayou Bartholomew. Some major longitudinal ditches were dug and a main outlet ditch was carried to the district boundary in section 9, township 9 south, range 5 west. Continuation was prevented by opposition from landowners south of the district as well as by anticipated engineering difficulties associated with carrying the ditch through the high natural levees adjacent to Bayou Bartholomew.

It is difficult to obtain information concerning the organization and administration of Kirsh Lake Drainage District. Although some important boundary changes have been made in the district, its present size is approximately 30,000 acres, which partly overlaps four other drainage districts: Grady, Cypress Creek, Cummins, and Desha No. 5 Drainage Districts. The district assessed benefits of \$286,700.20, averaging \$9.67 per acre. To pay for the fifty-odd miles of drainage ditches constructed by the district, bonds were floated in the amount of \$181,500. In 1945 there was an outstanding debt of approximately \$56,000 in bonds with accumulated interest of some \$90,000, according to the commissioners. This financial situation, as well as the greatly deteriorated condition of drainage reclamation, is the result of a series of controversies between the landowners and the owners of the drainage bonds.

As was pointed out, the most serious problems that confronted the district concerned outlets. This is clearly indicated in the fact that, though the district was organized in 1912, no outlet was secured until about 1920, and that outlet never proved adequate or satisfactory. It extended beyond the borders of the district and cut through what was a part of Cypress Creek Drainage District. At the time this exterior outlet ditch was constructed, it was held that lands lying adjacent to it should be assessed benefits and so an attempt was made to incorporate 6,473 acres in the district and to assess them benefits of \$51,300. This change was resisted, and 12 years later the United States court held that such an arrangement was illegal. In the meantime a more important lawsuit developed.

Financial and legal problems which Kirsh Lake Drainage District faces resulted from a combination of engineering and administrative difficulties. The drainage works installed here served to bring little relief to most landholders from flood waters, with the result that some landholders paid their drainage taxes, whereas many others failed to do so. Moreover, the district encompassed large tracts of undeveloped land, much of which seems poorly suited for agricultural purposes. Owners of this land in many instances permitted their payments to lapse. In 1930 it was found that on many tracts taxes had been levied in amounts which equaled the assessed benefits. The commissioners, therefore, decided to prepare a new tax roll and to levy no further taxes against the property holders who had paid previous tax levies equal to or exceeding assessed benefits. This decision alarmed bondholders who had not received regular principal and interest payments. The matter was taken into the courts where it remained at the time of the field investigation.

The latest decision supports the bondholders in their claims, and orders the commissioners to levy a tax of $6\frac{1}{2}$ percent of assessed benefits on all landholders, regardless of former payments. It is the intention of the court that this tax continue until the bonds and interest are fully paid.

As this account makes clear, drainage efforts in this district have proved futile, although large sums have been spent and many miles of ditches have been dug. Because of the faulty nature of

the outlet into ditch No. 19, flood waters from that ditch back up into Kirsh Lake Drainage District, thus intensifying local drainage problems instead of relieving them. Continued controversy has also caused complete neglect of established ditches, so that they serve little or no drainage function.¹¹

Grady Drainage District

Grady Drainage District (Fig. 3), first organized in 1909 and reorganized in 1917, lies between Choctaw Bayou and Deep Bayou in Lincoln County. The lower part of the district overlaps the upper end of Kirsh Lake Drainage District, so that both districts share the same outlet problem associated with ditch No. 19 of Cypress Creek Drainage District. It is Wagon Bayou, coursing through the center of Grady Drainage District, which below in Kirsh Lake Drainage District is diverted through the natural levees of Choctaw Bayou into ditch No. 19.

Grady Drainage District dug approximately 23 miles of main ditches at a cost of about \$129,000. There are about 17,973 acres in the district, of which 16,239 were assessed benefits totaling \$155,625. In 1928, \$78,799 in additional benefits were added, making a total of \$234,424. The increase in assessed benefits followed a restoration of the original work and the addition of some new ditches. Bonds in the amount of \$123,000 were issued to cover these improvements. In addition, the district borrowed \$60,000 on a pledge. The outstanding debts in 1945 were about \$18,000. Maturing obligations have been paid, although they were delinquent for many years. The district collects an annual tax of 4 percent of the assessed benefits.

The drains of Grady Drainage District are in much better condition than those in Kirsh Lake Drainage District to the south or those in Cousart Drainage District to the north. They were last cleaned in 1943. Though the outlet is not satisfactory, flooding in the lower part of the district damages the Kirsh Lake district more than the Grady district. The most severe water problem in the district comes from the overflowing of Deep Bayou which parallels

¹¹ Readers interested in the litigation surrounding the affairs of Kirsh Lake Drainage District should see the following cases of the Arkansas Superior Court: Case No. 7380, A. S. Johnson et al. vs. Kirsh Lake Drainage District; Case No. 7253, C. H. Holtihoff et al. vs. State Bank & Trust Company of Wellston, Missouri; Case No. 7585, W. H. Fisk et al. vs. Kirsh Lake Drainage District and State Bank & Trust Company, Wellston, Missouri. The transcript in these three cases made 977 typewritten pages and the briefs contained 1,015 printed pages.

the district line on the southwest. This bayou, which runs into Bayou Bartholomew a few miles south of Grady Drainage District, is used as an outlet by Cousart Drainage District. This overflow problem has been serious since 1925 when the Cousart district enlarged Deep Bayou in an attempt to obtain a better outlet for the drainage from some 45,000 acres lying within its boundary. Citizens in Grady Drainage District believe that the solution to the flooding of Deep Bayou lies in the construction of a new outlet by the Cousart district into Bayou Bartholomew.

DRAINAGE DISTRICTS UTILIZING BAYOU BARTHOLOMEW AS AN OUTLET

In the headwaters area of the Bartholomew-Boeuf-Tensas Basin are a number of drainage districts which attempt to use Bayou Bartholomew as a drainage outlet. This high-banked, meandering stream flows at the foot of the uplands that form the western boundary of the basin. The difficulties involved in using such a stream as a drainage outlet, a problem frequently encountered in the alluvial valley of the Lower Mississippi, are admirably illustrated in the history of the four districts next discussed.

Cousart Bayou Drainage District

Cousart Bayou Drainage District (Fig. 3) is the first major district lying to the east and south of Pine Bluff. The district was created by a special act of the State Legislature in 1907 and encompasses an area of about 46,500 acres, of which about 9,500 lie in Lincoln County and 37,000 in Jefferson County. Most of the district lies between the high natural levees of the Arkansas River and of Bayou Bartholomew. It is noteworthy that the district does not adjoin Bayou Bartholomew proper, a fact which has complicated the problem of finding a suitable outlet for surface waters. The natural drainage of the area encompassed in the district was largely provided by Deep Bayou, Cousart Bayou, and Jacks Bayou. The latter two bayous are tributaries to Deep Bayou, which in turn flows into Bayou Bartholomew some 8 miles below the southern boundary of the district. Drainage improvements are mostly centered in these three bayous, and were carried out from the headwaters near Pine Bluff down to the mouth of Deep Bayou.

The history of Cousart Bayou Drainage District illustrates how the State Legislature can become involved in local and district

engineering problems. In 1907 the district was created by a Special Act; in 1909 the Legislature made some changes in the boundary of the district and gave special sanction to an additional bond issue of \$35,000; in 1911 the Legislature authorized the condemnation of some land outside the district for the purpose of obtaining an outlet; in 1923 further changes were made in the boundary and the Legislature made mandatory the digging of an outlet, the location of which is described in detail in the legislative act; in 1925 the Act of 1923 was modified and the digging of an outlet was made optional.¹² Under three of these acts bonds were authorized, totaling \$275,000, and the assessed benefits were established at about \$582,664. Although serious delinquencies occurred at times in the collection of drainage taxes, the bonds were eventually retired. All bonds were retired at face value, but many of them changed hands at figures greatly below par. The payment of drainage bonds in full without refinancing is rather exceptional in the Bartholomew-Boeuf-Tensas Basin and occurred only in districts that were rather highly developed agriculturally when drainage improvements were inaugurated.

From its inception, Cousart Bayou Drainage District has been struggling with an outlet problem. The initial development merely conducted the surface water into the lower portion of Deep Bayou which had only limited capacities to accommodate flood waters. The result was that the lands adjacent to the lower portions of the bayou were frequently flooded. In 1925, when the whole system was rehabilitated, Deep Bayou was also dredged from the lower boundary of the district to its mouth in Bayou Bartholomew.

The continuing and unresolved outlet problem raised a serious controversy which was taken to the Legislature. An Act (677) of the State Legislature in 1923 required the district to effect a drainage outlet into Bayou Bartholomew above the mouth of Deep Bayou. This proposal was resisted by landholders along Bayou Bartholomew. Also, many farmers in the district believed that this outlet might bring in backwaters rather than facilitate drainage. In 1925 another Act (118) of the State Legislature made this cut-off optional and no new outlet has been made. The complexity of this outlet problem is illustrated by the fact that repeated surveys

¹² Readers interested in the detailed history of this district should consult the following Acts of the Arkansas State Legislature: Act 283 of 1907; Act 19, 1909; Act 677, 1923; and Act 118, 1925.

have been made seeking to determine the feasibility of a more northern outlet into Bayou Bartholomew. During the summer of 1945, an engineering party employed by the district was again in the field seeking a solution. This engineering survey was the first step toward plans for rehabilitating the district.

Numerous small farms and homesteads along Deep Bayou and their associated activities and developments illustrate well a special problem which faces drainage engineers as well as drainage district administrators. The bayou is criss-crossed and obstructed to varying degrees by driveways, footbridges, partial dams, and log or board fences. Many of these are in poor repair and others have crumbled completely. Nearly all of them give rise to log jams and the gathering of debris and silt. By neglect and design these obstructions and strictures create a series of duck ponds, fish ponds, and hog wallows, all of them nuisances to effective drainage.

The outlet problem of the drainage district in combination with its deteriorated and clogged ditches gives rise to serious annual flood hazards. Aerial photographs of the district taken in the spring of 1945 reveal the large extent of this flooding, which covered many square miles of cultivated lands.¹⁸ Representatives of the district have expressed a wish to have the system rehabilitated and think that they might levy a maintenance tax at some time in the future.

The desire to have Bayou Bartholomew enlarged and straightened is widespread in this district. The great expense of such an undertaking precludes any local attack on the job, and until recently there has been only a faint hope that the Government would ever undertake such a project. Now that the U. S. Army Engineers are authorized to work on major drainage, local interests intend to press for the clearing of this bayou, so important to Cousart District. However, many landholders southward would resist any efforts to improve Bayou Bartholomew, fearing that this would accentuate their flood problems by facilitating runoff upstream.

Cousart Bayou Drainage District clearly has reached a third stage of the typical life cycle for drainage districts in the alluvial valley. Twenty years after the district was established, the system required complete rehabilitation at an expense somewhat greater

¹⁸ These are private photographs, now in the hands of district officials.

than the initial investment; now, 20 years since the rehabilitation, another major repair is needed that probably will cost as much or more than the former rehabilitation. Throughout this report the reader will observe that drainage districts seem to operate on a 20-year cycle, this being the average life of a drainage ditch in the alluvial valley that receives little or no maintenance.

Drainage District No. 1 of Lincoln County

South of Cousart Bayou Drainage District and lying between Deep Bayou on the east and Bayou Bartholomew on the west is Drainage District No. 1 of Lincoln County (Fig. 3). Organized in 1919 in the County Court of Lincoln County, this district contains about 7,000 acres that have been assessed drainage benefits of \$114,542, or about \$16.40 per acre. Some 14 miles of ditches were dug and several miles of channel improvements were effected. The district obligations have been paid. A considerable number of the bonds were in the hands of district landowners who used them at face value to redeem delinquent taxes.

The drainage improvements of this district were made early in the 1920's. The outlet to the improvements is through an old channel of Deep Bayou. While this channel is fairly well defined, it is a very unsatisfactory outlet, for Deep Bayou is overburdened with water coming from the Cousart system lying to the north. During periods of heavy rainfall, Deep Bayou receives such volumes of water that it spreads over this district, damaging much of the agricultural land. Drainage improvements installed by the district are therefore rendered ineffectual by developments above. The much-talked-of cutoff to Bayou Bartholomew for the Cousart district would relieve many of the problems of this district and of Grady Drainage District lying to the northeast.

About the only lands in the district which can be farmed with any assurance of freedom from floods are those in the western portion on the high banks of Bayou Bartholomew, consisting largely of sandy soils. Low-lying clay and buckshot soils prevail in most of the district, are subject to frequent floods, and are still mainly in forest.

Drainage District No. 2 of Lincoln County

One of the smallest drainage districts in the area is Drainage District No. 2 of Lincoln County, comprising some 680 acres (Fig.

3). It was organized in 1930 and has been financed in an informal manner. Benefits were assessed in the amount of \$3,000 but no bonds were sold. Local parties loaned the district \$650 for digging a ditch about 1 mile long leading into Bayou Bartholomew. The district has taken advantage of rather special relief features in making an outlet into Bayou Bartholomew, a stream ordinarily difficult to enter because of its high natural levees.

Tarry Drainage District

Not all proposed, or even all organized, drainage districts carry out drainage developments. Tarry Drainage District of Lincoln County (Fig. 3) did not. It was organized in the late 1920's, covering an area of 1,400 acres on which benefits were assessed in the amount of \$24,700. Drainage plans were projected but results did not seem promising because of poor prospects for successful outlets, a fact complicated by the frequent overflowing of nearby Deep Bayou; so no improvements were made.

DRAINAGE DISTRICTS IN ARKANSAS BELOW CYPRESS CREEK DRAINAGE DISTRICT

Drainage districts lying below Cypress Creek Drainage District in the State of Arkansas are Chicot County Drainage District, Eudora Western Drainage District, Dermott Drainage District, Bayou Macon Drainage District, and Middle Slough Drainage District (Fig. 4). The first two are outgrowths of Cypress Creek Drainage District since they lie partly in the same watershed, and had as their objective to accommodate the accentuated flood hazards in the northern parts of their districts resulting from upstream drainage developments as well as to improve local drainage for established and anticipated agricultural and industrial developments. Therefore, their problems are in many ways similar to those of Cypress Creek Drainage District, which is distressed by the unmanageable amounts of flood waters dumped into its ditches by districts lying to the north and west. Chicot County Drainage District and Eudora Western Drainage District are discussed first because of their close relationship with the Cypress Creek development.

The combined drainage and diversion improvements effected by Cypress Creek and associated drainage districts lying to the

north and west greatly overburdened Bayou Macon, which served as the main—really the only—outlet stream. This overburdening was particularly evident near the southern border of Cypress Creek Drainage District where ditches Nos. 19, 43, and 81 opened into Bayou Macon and Macon Lake. It followed that if landholders south of this point wished to protect themselves from almost certain and protracted annual overflows, they needed to build terminal drainage facilities. Remedial action seemed to lie either in greatly increasing the capacity of Bayou Macon downstream, a plan that did not seem feasible, or in diverting part of its water to Boeuf River which, when enlarged downstream, seemed to promise not only an adequate outlet but possible drainage of much valuable agricultural land lying to the west of Macon Ridge. This diversion and the accompanying control of water from the Cypress Creek district was the hope of local interests when they formed Chicot County and Eudora Western Drainage Districts. As in the Cypress Creek watershed, developments in these two districts fall into two classes: (1) major terminal drainage improvements and (2) local laterals for draining agricultural land. The first objective was realized in part but the second remains to be accomplished. This partial improvement did relatively little to promote agricultural developments on which the district relied for financial support. Financial failures could only result.

The background for drainage works in these districts paralleled those described for the Cypress Creek area. Here, as elsewhere in the area, the gap in the Cypress Creek levee had caused frequent flooding, with consequent retardation of agriculture. Moreover, large blocks of land were held by lumber interests, who promoted drainage activities as an aid to lumbering operations and to enhance the prospect of agricultural expansion with consequent increases in land values. Reliance on lumber companies to carry a considerable share of the drainage tax burden proved disastrous in that they terminated their lumber operations as rapidly as possible and, finding the land insufficiently drained for farming purposes, abandoned it to the district and the State.

The undertaking of these expensive drainage plans can be explained only by the major wave of optimism concerning expected agricultural activity to follow drainage of delta lands, an optimism that reached a peak in the period from 1915 to 1922. Cypress Creek

Drainage District had just completed plans that were shortly, in local opinion, to make available an empire of new and fertile agricultural land. Naturally, interests lying below the Cypress Creek district were anxious not to be outdone by the show of enterprise to the north and so projected and initiated equally elaborate plans. Combined with the enthusiasm for developments in this lower area was the prospect that, if local drainage patterns were to remain unaltered and therefore inadequate to accommodate the accelerated flow-off from above, local lands would surely be transformed into a vast swamp by such drainage waters.

A study of the drainage efforts along Bayou Macon in Arkansas naturally raises the question as to why these efforts were not integrated in a single district. The explanation for the piecemeal attack lies in the existence of several centers of political, industrial, and agricultural interests in this part of the area. Not only are county seats important centers of administrative interests, but rivalry exists among competing towns in the same county. Local leaders who took the initiative in working for drainage developments wanted to be certain that the plans evolved for their respective areas would be of their own making and subject to their modification and administration. Thus, Arkansas City and Lake Village, important county seat towns, became the centers of major drainage undertakings. Chicot County, it will be noted, has three major centers from which important drainage efforts are administered: Lake Village, Eudora, and Dermott.

Chicot County Drainage District

Chicot County Drainage District (Fig. 4) was organized in 1921 under Special Act 405 of the Extraordinary Session of the Arkansas General Assembly. The district encompasses an area of 148,523 acres of which 147,794 acres were assessed for bond purposes. Assessed benefits were established at \$2,095,533, or an average benefit of about \$14 per acre. Benefits ranged from \$2 to \$20 per acre. Only one bond issue was sold in the amount of \$850,000, dated April 15, 1925. A problem of serious delinquency soon arose.

The drainage plans for Chicot County Drainage District were rather comprehensive and envisioned a diversion of water from Bayou Macon to Boeuf River through two connecting canals, in combination with several control dams for directing the flow of

water. Another important feature of this plan called for using Macon Lake and Lake Chicot as retaining basins for a limited and controlled amount of drainage water. To accomplish this, Bayou Macon was to be dammed near the point where it enters Macon Lake and from about this point a major ditch, No. 1, was dug southward for a distance of about 10 miles where it enters Boeuf River. From this point at Boeuf River the stream was enlarged to the southern boundary of the district, which at this latitude is about 4 miles west of Chicot Village. In addition, it was necessary to relieve Macon Lake of the drainage water received from ditches 43 and 81 of Cypress Creek Drainage District. To accomplish this, ditch No. 2 was dug to connect Macon Lake with Lake Chicot. The augmented waters in Lake Chicot were in turn to be relieved by an enlargement of Ditch Bayou, its outlet to the south (ditch No. 3 of the plan), which entered Macon Bayou near the village of Chicot. Macon Bayou, running to the east of Macon Ridge, was in turn cleaned as far south as the mouth of Rush Bayou, which enters Macon Bayou near the village of Eudora.

The location of Macon Ridge was a crucial factor in the drainage engineering of the Chicot County district. It was essential that Macon Bayou, with its greatly augmented drainage waters from the north, be relieved of as much of this water as possible before it entered the narrow neck of alluvial land between Macon Ridge and the Mississippi River levees. Consequently, another major diversion canal (No. 4) was dug, connecting Bayou Macon and Boeuf River just north of Macon Ridge. Flow through this cutoff and other streams and canals was to be controlled by a series of dams, tubes, and jumps. These major developments were to be paralleled by a comprehensive series of laterals to be built by nine subdistricts.

Work on this development plan was begun in 1922. By 1927 canals Nos. 1, 2, 3, and 4 were dug, Boeuf River was cleaned to the district line, and Bayou Macon was dredged from Ditch Bayou to Rush Bayou. The disastrous flood of 1927 came when the first dam was about half constructed. During the flood the dragline was undermined and lost in a "blue hole." Much other construction equipment was ruined and bankruptcy resulted for the contractor. Prospects for the district were equally dismal. Major obligations had been incurred by local landowners without corre-

sponding benefits. Further, the flood had inflicted heavy loss in private property and had discouraged future agricultural development. These reverses were followed by the floodway plans, authorized by the 1928 and subsequent Federal flood control acts, already discussed. These floodway plans paralyzed the economy of much of the area until the early 1940's.

Failure to build the proposed dams, in combination with alterations effected by the flood of 1927, resulted in a drainage pattern sharply at variance with that originally planned. For example, according to the original plans, most of the flood water originating above Macon Lake was to go to Boeuf River through ditch No. 1. During the flood such alterations occurred that most of the water from Macon Lake drained into Lake Chicot, making the latter a large settling basin for annual flood waters. This is the largest natural lake in the State and is regarded locally as having considerable recreational and scenic value, a function now seriously impaired by the miscarriage of drainage plans.

In recent years another unexpected problem has complicated the drainage problem for Chicot County, Eudora Western, and Dermott Drainage Districts. Here, as elsewhere in the alluvial valley of the Mississippi River, the Farm Security Administration and affiliated land development associations bought large blocks of undeveloped land for the purpose of converting them to agricultural use. A preliminary step was to obtain adequate local drainage. The Farm Security Administration was several times urged to keep its drainage to a minimum by local drainage districts officials, who felt that they could not permit the dumping of additional water into their inadequate systems.¹⁴ This conflict of interest prevailed until the war, despite the fact that the Farm Security Administration (through associated organizations) had constructed a large number of farm units in the Jerome area. When this installation, as well as the Government holding at Rohwer, was leased to the War Relocation Authority, that agency proceeded to install major drainage channels leading into Boeuf River and to Big Bayou. As was anticipated by local interests, the rapid dis-

¹⁴ In one or more instances temporary restraining orders were issued by the local courts. See, for example, the Order of April 15, 1941, issued in the Chancery Court of Drew County restraining Jerome Farms, Incorporated, from emptying drainage into the ditches of Chicot County Drainage District.

charge occasioned by this work caused severe flooding in several parts of the districts.

Chicot County Drainage District now finds itself in somewhat the same situation as Cypress Creek District. It has terminal drainage of rather low efficiency and no adequate farm laterals. The financial history of the district reflects this lack of development. The financial deterioration was hastened by the depression of the 1930's.

Developments in Chicot County Drainage District were begun in 1925 with the proceeds of a bond issue amounting to \$850,000. Tax payments were slow and irregular and some 10 years later the obligations of the district were still more than \$800,000. In 1935 this debt was refinanced through the Reconstruction Finance Corporation with a loan of \$193,500. The refinancing has made possible a substantial lowering of the tax rate which at present is only one-half of 1 percent of the assessed benefits. This low rate is adequate to retire the small remaining debt (about \$20,000 in 1945), and to provide for some maintenance. In the summer of 1945 administrators of the district stated that funds available for maintenance amounted to about \$75,000 and would be spent when materials and labor became available.

While the administrators of the Chicot County Drainage District are prepared to spend considerable money to improve local drainage conditions, they and other landholders realize fully that no major improvements can be effected on the district level. Here, as elsewhere in the alluvial valley, increasing support is given to an expanded program of river and channel improvement financed at least partially with Federal money. A program encompassing drainage as well as flood control was made possible by the Flood Control Act of December 1944 and is shortly to be carried out in northeast Louisiana where the major streams are to be dredged and straightened. An extension of this effort into southeast Arkansas appears feasible. When this work is undertaken, local interests will have only the burden of providing lateral drainage for agricultural lands.

Eudora Western Drainage District

Eudora Western Drainage District (Fig. 4) represents the southernmost extension of the stream diversion program initiated in the Cypress Creek Drainage District. The diversion of water

from Bayou Macon to Boeuf River effected by the Chicot County Drainage District made it rather imperative that the development be extended southward. This would seem to suggest that larger districts be formed. However, here as elsewhere, local interests favored and brought about the establishment of two districts, one centering around Lake Village and one centering around Eudora.

Eudora Western Drainage District undertook to solve two terminal drainage problems, the enlargement of Boeuf River to take care of water from Bayou Macon, and the construction of a short-cut outlet for Big Bayou into Boeuf River. In addition, Caney Bayou extending northeastward into Macon Ridge was straightened and enlarged to bring some relief to the eastern side of the district, where most of the developed land was located.

Eudora Western Drainage District was organized in February 1920 under Special Act 325 of the Extraordinary Session of the Arkansas General Assembly. Bonds were issued in the amount of \$685,000. Assessed benefits were established at \$2,248,116, or an average of \$18.59 per acre. It is worth noting that at this time fully 70 percent of the land was either forested or cut-over. Here, as in the case of several other districts discussed in this bulletin, the original planning assumed that subdistricts would be formed for the purpose of developing lateral drainage and that rapid agricultural expansion would follow. As usual, subdistricts never materialized and agriculture lagged.

This district placed its bonds on the market in 1923 during a serious agricultural depression. They were difficult to sell. That some doubt concerning their value was justified was more than borne out by the fact that of the \$685,000 in bonds issued in 1923 only \$43,000 had been retired by 1929 and actual obligations had increased to \$906,825. Obviously, a drastic program of refinancing was necessary. After prolonged negotiations, the Reconstruction Finance Corporation loaned the district \$211,000 with which to refinance the major part of this debt. It appears that the district will now be able to meet its standing obligations with current tax collections.

The Eudora Western Drainage District provides an almost classic example of the futility of attempting to handle a major terminal drainage and stream diversion problem on a local basis.

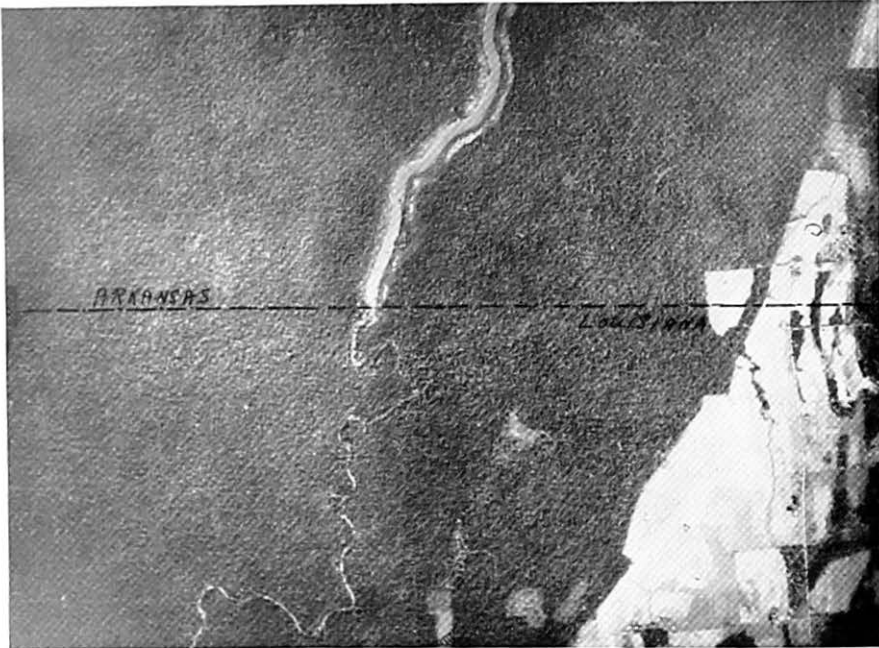


Fig. 6. The development of the Boeuf River ends abruptly at the Arkansas-Louisiana state line. (Photo, courtesy U. S. Dept. of Agriculture.)

Major excavation was done in the Boeuf River channel from the northern to the southern boundary of the district. This excavation was of such proportion that at its southern end Boeuf River was widened to 200 feet. Work was stopped abruptly at the Louisiana State line, below which Boeuf River again becomes a sluggish meandering bayou that floods thousands of acres of district lands as well as north Louisiana lands during the wet winter and spring months (Fig. 6).

Termination of stream enlargement at the Arkansas-Louisiana State line was not contemplated in the original plans. At first it was assumed that interest in Louisiana would somehow carry the development farther down the Boeuf River. When this proved unlikely, the Eudora Western Drainage District planned to carry their efforts as far south in Louisiana as Winfield Lake, about 10 miles below the State line. This plan had the advantage of carrying the water to a point where natural drainage was more completely developed. However, even this plan was not agreed upon and the district stopped the work on the State line with great loss

to both States.¹⁵ The failure to obtain a satisfactory outlet for the enlarged Boeuf River channel has created swamp and overflow areas in the district at the entrance of canals Nos. 2 and 9. The failure of Louisiana people to extend this drainage reclamation will be commented on later.

Dermott Drainage District

Between Bayou Bartholomew and Macon Lake in the vicinity of Dermott are the headwaters of Big Bayou which flows south to the west of and parallel to Boeuf River. Although this was originally a slow and inefficient drainage channel, it has been developed as the major outlet for the Dermott Drainage District (Fig. 4) which was organized in 1915 in the County Court of Chicot County under the general drainage acts. The district encompasses an area of 75,563 acres. At the time of inception about 66 percent of the area was in forests and cut-over land. In all, about 40 miles of main and lateral ditches were dug at a cost of \$167,248. This included the enlargement of Big Bayou, a major feature of the plan. To pay for these constructions a \$190,000 bond issue was floated on a basis of assessed benefits totaling about \$495,356.

Land development here, as in other districts, was not so rapid as anticipated. However, no serious financial delinquencies occurred until the distressing flood of 1927. After this flood, tax delinquency mounted, due to the flood losses, a serious drought in 1930, and the beginning of the general depression. By 1932, 86 percent of the tax assessments were delinquent. The district went into receivership in 1933, although a bondholders' protective association had been organized as early as 1929. While under the jurisdiction of the courts, the debt was materially reduced, and in 1941 it was retired. In 1945 there was no tax levy although delinquent taxes were being collected. The district had about \$15,000 in cash collected from this source. Under present laws and regulations, this money cannot be used for maintenance.

The drainage problems facing the people of this district are still serious, as illustrated by the fact that the village of Dermott experiences almost annual spring floods though it is located on some of the higher land of the district. Three situations contribute materially to this flood hazard: (1) the dumping of water into the

¹⁵ Cf. Sparlin, Estal E., "Special Improvement District Finance in Arkansas," *Ark. Agr. Expt. Sta. Bul.* 424, 1942, p. 46.

northern part of the district by Drainage District No. 4 of Desha County, (2) the almost complete deterioration of earlier improvements, and (3) the absence of an adequate outlet. Some informants also insist that the accelerated run-off following drainage developments at Jerome aggravates local drainage conditions. In the summer of 1945 it was reported that about 25 percent of the cleared land had not been planted to crops that spring because of lingering flood waters. Plans for further development were being held in abeyance pending a solution of outlet problems.

Drainage District No. 4 of Desha County

Drainage District No. 4 of Desha County lies in the southwestern part of Desha County (Fig. 3). In this latitude the basin in which it lies is separated from the Bayou Macon Basin by a relatively high levee of Crooked Bayou. From the standpoint of a coordinated drainage program it might well have been part of the Dermott Drainage District in that the outlets enter the latter district, which has not adequately provided for them.

This district was organized in August 1911 in the County Court of Desha County under the general laws. It has an area of 24,545 acres of which 23,981 acres are assessed for bond purposes. The total assessed benefits were established at \$428,664 or an average of about \$17.88 per acre. Substantial benefits have been assessed against railroads and town lots, thus increasing the average assessed benefits.

Drainage improvements were undertaken in 1914 and 1915 and consisted in the main of enlarging and extending Black Pond (also called canal No. 2) and Big Bayou (ditch No. 1). This work was financed by a \$100,000 bond issue, making an average debt of \$4.17 per acre or 23.32 percent of the assessed benefits.

The flood of 1927 was a serious blow to the economy of the district, and from this time through the depression of the early 1930's the district drainage taxes as well as payments on bonds were delinquent. With the revival of the national economy in the late 1930's, regular payments were resumed and delinquent obligations discharged. Taxes levied in the summer of 1945 amounted to 10 cents per acre on agricultural land and 30 cents on city lots. These revenues are used or are to be used for maintenance.

Even though this district is in a headwater area, it suffers from poor drainage. The ditches were cleaned by Works Progress Administration workers about 10 years ago but nothing has been done toward their maintenance since that time with the exception of some improvements in the city of McGehee. The bayou flowing through the city has been cleaned and partly confined to a concrete flow way in connection with a malaria control program. Local engineers are of the opinion that the ditches constructed by this district were never large enough, nor has the problem of an adequate outlet been solved. Under present conditions, the outlet problem can be solved only by extensive improvements in the Dermott Drainage District.

Middle Slough and Bayou Macon Drainage Districts

Above and below Eudora, in Chicot County, are two separate narrow tracts of alluvial land bounded on the west by Macon Ridge and on the east by Bayou Macon. Each of these tracts has become the site of a miniature drainage district. They are known as Middle Slough Drainage District (north of Eudora) and Bayou Macon Drainage District No. 2 (south of Eudora). Each district has a longitudinal length of only about 6 miles and, in the main, developments have been confined to enlarging small bayous that drain areas formerly rather swampy.

Middle Slough Drainage District (Fig. 4) was organized in June 1924 under the general drainage acts and covers an area of 4,747 acres of which 4,074 are assessed benefits amounting to \$73,260, or an average of \$17.98 per acre. It is overlapped partly by Chicot County Drainage District and partly by Eudora Western Drainage District. Bonds were issued in the amount of \$29,000 which represented a bonded debt of \$7.12 per acre or about 40 percent of the assessed benefits. The district found it necessary to refinance a \$30,000 debt with a Reconstruction Finance Corporation loan of \$19,000. About \$11,000 in refinancing bonds were outstanding in the summer of 1945. These bonds are owned by local people and it appears that they will be retired without any further delinquency. The deterioration of ditches in this district has been rather rapid. Although they were cleaned out in 1942 they are again in need of enlargement.

Bayou Macon Drainage District No. 2 was organized in 1918 and encompasses an area of 6,242 acres (Fig. 4). Some \$60,000 in

bonds were sold on the basis of \$89,385 in assessed benefits. Delinquency developed in the early years of the depression and in 1935 the bondholders agreed on a refinancing program that extended the period of bond maturities. In the summer of 1945 about \$18,500 of these refinancing bonds remained unmatured. Payments were being promptly made.

This district was organized for the purpose of constructing one main ditch to serve as an outlet for a number of tributary sloughs. The outlet of the main ditch lies about one and one-half miles below the Arkansas-Louisiana State line where it enters Bayou Macon. Some cleaning work was done on the main ditch in 1941, but its capacity is again diminished by debris and willows and it is locally hoped that some additional improvements can be made.

Ashley County Drainage District No. 1

Ashley County Drainage District No. 1 is located between Dry Bayou and Bayou Bartholomew in the southeast corner of Ashley County, Arkansas. As Bayou Bartholomew approaches the Arkansas-Louisiana State line, its natural levees become exceedingly wide. These lands, of course, are generally cleared and highly developed agriculturally. In this latitude Bayou Bartholomew becomes almost entirely a terminal stream behind high natural levees and so provides almost no local drainage. Facilitating drainage in the Wilmot area, therefore, required the enlargement of interstream bayous (Camp Bayou and Dry Bayou) and the extension of several laterals westward almost to Bayou Bartholomew. Dry Bayou did not have a satisfactory outlet nor did the improvements provide one. Engineering plans for the district merely contemplated the dumping of water into a swampy lowland below the State line. No coordination of drainage improvements was carried out across the State line.

The district is dormant and no local administrative or court records could be found. According to the best available information gathered from local citizens, the district was organized in 1911 or 1912 and included about 16,500 acres. Only one bond issue of \$60,000 was made. No data could be obtained on the assessed benefits. It appears that the bonds ran for some 20 years and were all retired in full. About the time the bonds were fully paid the ditches had reached the point where a complete cleaning was

needed. Some Works Progress Administration labor was used in doing this work.

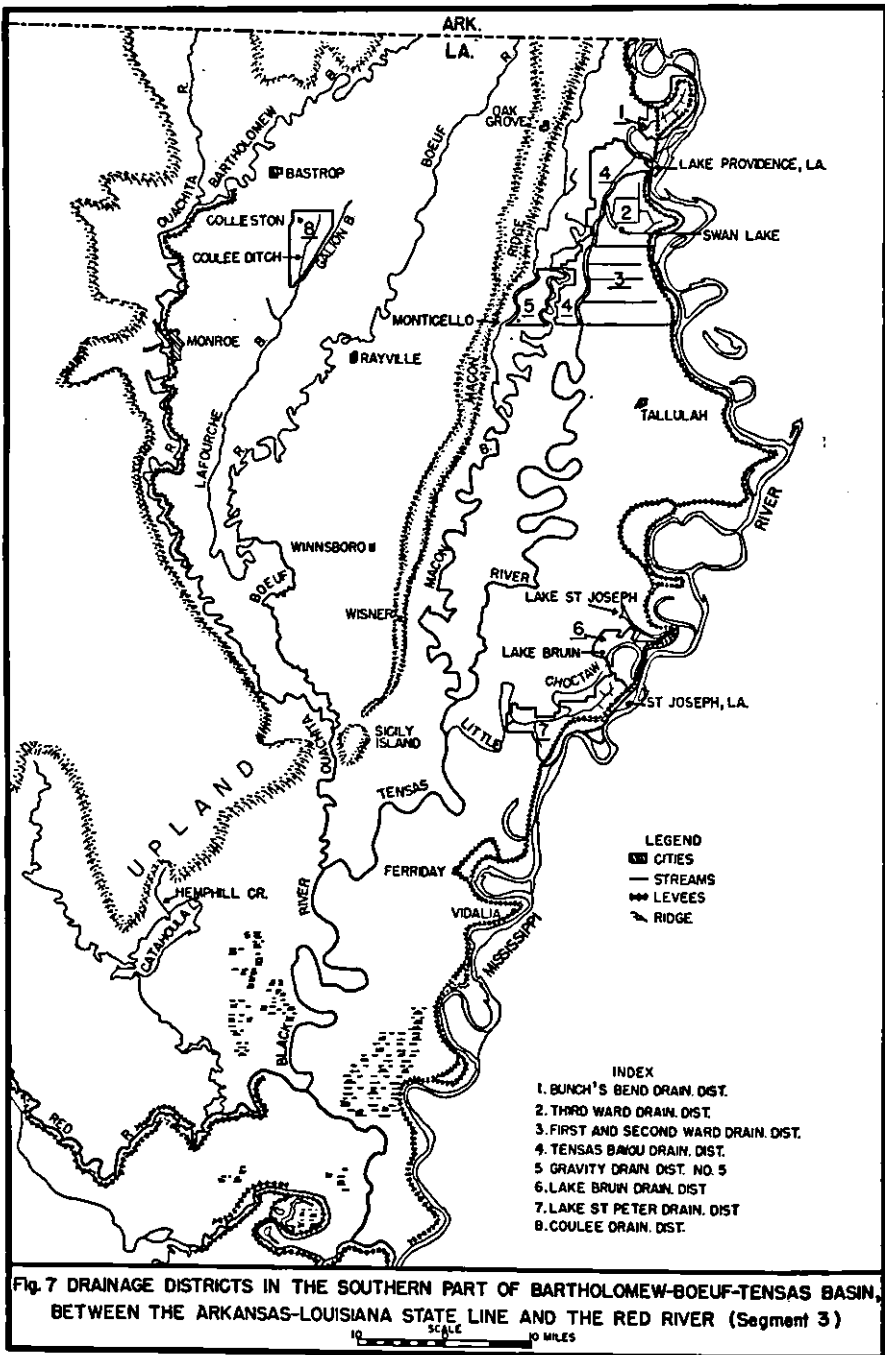
The position taken by local landholders in the district toward drainage improvements in the Bartholomew-Boeuf-Tensas Basin is interesting. They expressed considerable opposition to the cleaning of Bayou Bartholomew north of the district, a program strongly advocated by several districts lying farther north that need better outlets into this stream. On the other hand, they strongly advocate that improvements be initiated below, which would afford a better outlet for their district, though it would greatly increase the flood hazard of lands farther south in Louisiana. These problems have found no positive expression in plans for further drainage developments.

DRAINAGE DISTRICTS IN THE LOUISIANA SECTION OF THE BASIN

Figures 3, 4 and 7 show the sharp contrast in the number and size of drainage districts in the Arkansas and Louisiana sections of the Basin. These unlike levels of drainage activity result from a number of physical, economic, and institutional conditions.

From the Arkansas River southward to the Red River, conditions become increasingly more complex for drainage reclamation, particularly if undertaken by small drainage districts. This increasing complexity from north to south results from (1) decreasing slope, (2) enlargement of stream beds of rivers and bayous, (3) lower ratio of natural levee land to total area of alluvial land, (4) changing nature of alluvium, (5) increased backwater hazards, and (6) distinctive institutional factors. A brief description of each of these changes follows.

1. *Decreasing slope*—The decrease in elevation from north to south in this basin is not uniform. The southward slope is generally about 1 foot per mile in the northern part of the area and only a few inches per mile in the southern part. Translated into drainage improvements, this difference in slope is important, for the more gradual the slope the slower the water velocity and the greater the need for ditches with large capacities. Moreover, with decreased slope, the dumping of flood waters becomes more difficult for, given drainage districts of equal areas but unequal slopes,



the districts with the lower gradients must provide the longer outlet ditches to dispose of surface waters.

2. *Enlargement of stream beds*—Because streams generally flow from north to south in the basin, it is natural that their capacities increase southward. Large streams are more difficult to modify in a drainage program than are small headwater streams. Not only are modifications of large streams more expensive to effect, but if effected locally, they offer little if any prospect of relief from flood hazards. Moreover, in the lower part of the basin major flood hazards threaten from both the north and the south. For example, flood conditions in the Red and Mississippi Rivers may not only retard the southward movement of waters in the lower part of the basin, but may, and frequently do, reverse the direction of water flow. Inundation of much land follows, and local drainage districts can do little to protect themselves from this situation.

3. *Lower ratio of natural levee land to total area of alluvial land*—Natural levees are extremely important phenomena from the standpoint of land development in the alluvial valley of the Lower Mississippi River. Their elevated positions provide a refuge from minor flood. In addition the texture of the soil-forming material in these levees is such that it lends itself well to farming activities. As is well known, early settlers always sought out these prominent formations for settlement and cultivation. From these formations settlements then branched out laterally if conditions proved favorable and some protection against floods could be devised.

In the Bartholomew-Boeuf-Tensas Basin the ratio of natural levee land to total area of alluvial land is greater in the Arkansas than in the Louisiana part. This condition results from: (1) the generally north-south axis of the main streams; (2) the greater width of the valley below the Arkansas-Louisiana State line, (3) general aggradation from north to south, and (4) the important part played by the flood waters of the Arkansas River in building up the flood plain.

4. *Changing nature of the alluvium*—Since aggradation in the basin proceeded mainly from north to south, it is natural that the larger particles of alluvium, including a higher ratio of sand, were deposited in the northern part of the basin and that finer particles

were carried downstream and deposited along the lower courses of the streams. As a result, much of the alluvium in the lower part of the basin is so fine-textured—locally called buckshot land—that it is difficult to farm.

5. *Increased backwater hazards*—A serious backwater problem exists in the lower part of the Bartholomew-Boeuf-Tensas Basin as has already been pointed out. Extensive levee construction, which has moderated flood hazards elsewhere, has served to increase the backwater hazard here and at several other mainstream junctions along the Mississippi River. This hazard, it must be remembered, is not restricted to a small area, but reaches north from Old River for a hundred miles or more. Obviously, the situation as it stands is inimical to any widespread drainage reclamation in the lower part of the basin.

6. *Institutional factors*—In Arkansas certain institutional factors served to encourage the development of a greater number of drainage districts, particularly in largely undeveloped, forested, or cut-over areas. For example, in Arkansas many drainage districts were created by special acts of the Legislature. This method of creating drainage districts often proved expensive in that interpreting the creating act or having it amended, as was often necessary, required considerable legal help.¹⁰ However, it avoided the uncertainties and time-consuming controversies associated with public voting on such improvements. In Louisiana, on the other hand, a vote of persons concerned was required, although on examination it was found that land holdings were largely concentrated in a few hands and that a very small number of citizens had an active voice for or against undertaking drainage developments.

The financing of drainage districts varied greatly between the two States. In Arkansas rather high drainage benefits could be assessed against the land and used as a basis for taxing. In Louisiana, on the other hand, assessed benefits were not established and drainage taxes were not to exceed 50 cents per acre for a 40-year period. Where *ad valorem* taxes were used, returns were even smaller, owing to the low assessed value of the land.

Further, county officials in Arkansas frequently received from landholders property and other taxes without insisting on the pay-

¹⁰ *Ibid.*, p. 8.

ment of drainage taxes. This led to many drainage tax evasions and such practices as tax foreclosures. In Louisiana, drainage taxes were more commonly collected with the general taxes.

Under these statutory limitations no major drainage activities of the magnitude required to drain interstream areas could be undertaken. Thus the districts organized in the Louisiana section of the basin were largely designed to drain the rather wide natural levees adjoining the Mississippi River and other streams and were not major attempts to reclaim lands lying in the lower portion of the basins. Major drainage improvements initiated in Arkansas after the Cypress Creek gap was closed, therefore, found no extension into the State of Louisiana although the drainage waters from Arkansas greatly enhanced the flood hazard to the south.

Bunch's Bend Drainage District

Bunch's Bend Drainage District (Fig. 7) lies several miles north of Lake Providence, Louisiana. It was organized in 1920. It is located very largely on natural levee formations which project peninsular-like into a large meander of the Mississippi River. At its eastern point the district comes close to the channel of the Mississippi River. The interposed levee was threatened repeatedly by the stream during the 1920's and early 1930's. Several set-back levees were constructed and in 1934 a major set-back of the levee was thought imperative though the older levee remained intact. This set-back not only closed the major outlet of the district but also placed most of its land outside the main-line levee and therefore materially reduced the level of flood protection.

This district issued \$100,000 in bonds, based upon a forced contribution of 50 cents per acre to run for 30 years. Some 9 miles of drainage canals were constructed in the old channel of Jack Falls Bayou. This main canal used Lake Providence as an outlet. The drainage system worked very well and much of the land was highly developed agriculturally, being farmed in five or six plantations. When the set-back levee was built in 1934 the economic prospects of the district collapsed almost completely. Serious delinquencies developed in 1935, 1936, and 1937, and a drastic refinancing took place in 1938 when \$71,500 in matured and unmatured bonds were refinanced through an issue of \$15,000 of funding bonds to run from 1938 to 1952. This arrangement made possible a reduc-

tion in the forced contribution from 50 to 35 cents per acre annually.

Bunch's Bend Drainage District now faces two serious problems: (1) a possible break in the old levee on the east side during flood stages on the Mississippi River, and (2) an expanding area of swamp and bog land developing in the center of the district because of the closed outlet. The district lands not cut off by the new levee are in a more favorable position and probably have better drainage now than before the levee was constructed. Moreover, it is likely that the Fifth Louisiana Levee District will see that these lands are kept drained in the interest of levee protection.

Drainage Districts Bordering Upper Tensas Bayou

Tensas Bayou receives its headwaters from Lake Providence through an outlet just west of the city of Lake Providence. About 5 miles southwest of this city the bayou enters Swan Lake, a broad, crescent-shaped marsh area that has a distinct outlet channel to the southwest which again becomes Tensas Bayou. Between Lake Providence and Swan Lake lies the largest block of highly developed land in East Carroll Parish. Southwest of Swan Lake, however, Tensas Bayou meanders through a heavily forested and cut-over area extending to the southern boundary of the parish, and beyond.

The drainage problem faced by landowners along Lake Providence and to the south was largely one of facilitating the flow-off of surface waters from relatively high natural levees. This was undertaken by forming three drainage districts—Tensas Bayou Drainage District, Third Ward Drainage District, and First and Second Ward Drainage District. It is interesting to note the boundary relationships of these districts. Tensas Bayou Drainage District, which drains the land in the Lake Providence area, projects its boundary southward along Tensas Bayou to the parish line. This peculiar boundary structure apparently resulted from a desire to share in the cost of conducting flood waters from the county seat area to the southern boundary of the parish. The cost of enlarging Tensas Bayou was therefore shared by the three districts. It was in the construction of laterals to Tensas Bayou that the districts operated independently.

Tensas Bayou Drainage District

This district (Fig. 7) was organized in 1922, encompassing about 30,000 acres. Bonds were issued in the amount of \$200,000, maturing over a 25-year period. A forced contribution of 50 cents per acre was levied to run for the same number of years. In the summer of 1945 the outstanding debt was reported as \$26,500 and no difficulties were anticipated in meeting current obligations.

As was mentioned, improvements carried out by the Tensas Bayou Drainage District consisted of digging several laterals in the suburbs of Lake Providence and through adjacent plantations, and contributing to the enlargement of Tensas Bayou to the southern boundary of the parish. These improvements now operate at a low level of efficiency, and the enlargements made in Tensas Bayou have long ago been filled in by accumulated debris, log jams, and vegetation.

Third Ward Drainage District

Between Swan Lake in East Carroll Parish and the Mississippi River there is a series of concentric arcs representing natural levee formations built up by old meanders of the Mississippi River. These levees in the main make up the area comprising the Third Ward Drainage District (Fig. 7). The district was formed in May 1921, comprising somewhat over 30,000 acres.¹⁷ Bonds were sold in the amount of \$200,000 for the purpose of contributing to the enlargement of Tensas Bayou and constructing nine major and minor laterals. Construction cost was about \$140,000 and was based upon a forced contribution of 50 cents per acre to run for 25 years. Largely because of the high state of land development in the district this levy was paid regularly and the district bonds were retired as they matured. During the summer of 1945 the unpaid debt of the district amounted to \$13,500 and no difficulty was anticipated in retiring it on schedule.

No systematic or integrated method of maintaining ditches has been carried out. Some ditch improvement was done by Works Progress Administration labor early in 1934, and considerable work has been done by the larger landholders to improve the ditches affecting their holding. The last major cleaning of ditches by

¹⁷ The number of property holders instrumental in creating this district is interesting. Courthouse records show that at the time this district was organized the lands in the district were held by 12 owners, 10 of whom voted, all in favor of the district.

the district was done in 1930. The main difficulties now center around Tensas Bayou and the lower end of the laterals draining into this bayou. Tensas Bayou is a poor stream around which to construct a drainage system, and until its capacity is considerably enlarged locally and downstream, this district cannot undertake major improvements with any promise of success.

First and Second Ward Drainage District

The First and Second Ward Drainage District in East Carroll Parish (Fig. 7) is closely related to the districts above-described. This district made important contributions to the enlargement of Tensas Bayou and dug three major laterals eastward from it to the relatively high natural levees of the Mississippi River. The topography of this district lends itself well to gravity drainage in that surface waters from the natural levees are readily directed to the lowlands along Tensas Bayou.

The First and Second Ward Drainage District was organized in January 1921, with an area of about 52,000 acres. Twenty-five-year bonds were issued for \$350,000, to be met with forced contributions of 50 cents per acre for this period. The ratio of developed to undeveloped lands is not as favorable as in the Third Drainage District. Rather serious delinquencies occurred in meeting principal and interest obligations in the late 1930's. They amounted to \$98,125 in 1943. In recent years considerable progress has been made in collecting delinquent taxes and it was reported in the summer of 1945 that the delinquency had been reduced by about 40 percent, with the bonded indebtedness standing at about \$50,000.

Left to their own devices and resources, Tensas Bayou Drainage District, Third Ward Drainage District, and First and Second Ward Drainage District would face poor prospects of carrying land developments much further. In fact, additional tax levies would have to be made to enlarge Tensas Bayou which is now almost completely clogged with debris and vegetation in its upper end and with a major log jam just below the East Carroll Parish boundary.¹⁸ These heretofore dismal prospects have been vastly

¹⁸ The undeveloped nature of the land along many of the major streams and bayous of this basin with its heavy forest cover and undergrowth makes the inspection and maintenance of drainage canals a very difficult and tedious undertaking. Certain portions of the stream channels are virtually inaccessible to ground crews or inspectors. For example, the log jam in Tensas Bayou, which can be readily seen by aerial flights, is so difficult to reach that it has been viewed and described by only one or two persons who reached the spot by means of carefully planned trips.

altered by the Flood Control Act of December 1944, which specifically authorizes the United States Army Engineers to carry on major channel improvement on Boeuf River, Tensas River, and Bayou Macon. Among other things, the plan provides for channel enlargement in Tensas Bayou lying to the west of First and Second Ward Drainage District, thus providing a good outlet for the three districts here discussed. This work is now in progress. Moreover, the Soil Conservation Service has established a local office in the area (at Tallulah) that will make contributions to local drainage work.

Gravity Drainage District No. 5

This small district (Fig. 7) in the southwestern corner of East Carroll Parish was organized in September 1938 to provide better drainage for the Monticello area and for lands farther south along the natural levee of Bayou Macon. It encompasses 14,115 acres in which 8 to 9 miles of drainage ditches have been dug with an outlet into Bayou Macon. Bonds in the amount of \$15,000 were issued, of which \$3,000 had been paid by the summer of 1945. The entire issue is held by one man who is also a major landholder of the district. The drains have provided relief for the higher natural levees in the district, but much additional work will need to be done if new lands are to be developed. The enlargement of Bayou Macon by the Army Engineers will improve the prospects for this district.

Drainage Districts in Madison Parish

South of East Carroll Parish drainage efforts are localized and uncoordinated and for the most part inactive. In Madison Parish two districts have been formed, Canal Bayou Drainage District and Drainage District No. 2. Both are in a dormant state.

Canal Bayou Drainage District, encompassing an area of 23,000 acres largely to the north of Tallulah, dug about 18 miles of ditches emptying into several sluggish bayous. No records of this district could be located in the parish courthouse, nor was it possible to find informants familiar with the history of the project. No drainage district tax has been levied in recent years but it was said that Works Progress Administration funds were used for cleaning some of the ditches.

Drainage District No. 2 of Madison Parish never attempted the construction of any drains. The limited work done in this district was carried out by the Fifth Louisiana Levee District. Drainage of agricultural lands is said to be no better than when the district was organized.

Lake Bruin Drainage District of Tensas Parish

The Lake Bruin Drainage District (Fig. 7) is small and is developed largely on the natural levees of Lake Bruin and Lake St. Joseph. It was first organized in 1906 when improvements were limited to a few ditches running into Lake Bruin. In 1921 it was reorganized, issuing \$24,000 in bonds and undertaking the rehabilitation of the older system and the enlargement of an outlet from Lake Bruin to Clark Bayou. The remaining debt of the district was reported as \$13,500 in the summer of 1945; it is being retired from the proceeds of a 5-mill tax levy. Since this reclamation is confined to high natural levees, there is little to be learned from it concerning the reclamation of the much more widespread undeveloped, low-lying, alluvial lands in the parish.

Lake St. Peter Drainage District of Tensas Parish

A maze of meandering bayous is found westward and southward of St. Joseph. Some of the bayous are old and have built high natural levees on which intensive agricultural developments have taken place. Between the natural levees are depressions; some of them have few, if any, drainage outlets. Between the levees of the Mississippi River and those of Little Choctaw Bayou is such an area, which has been made the site of a drainage district known as the Lake St. Peter Drainage District. Supporting this district were residents and landholders in and near the city of St. Joseph and the Fifth Louisiana Levee District which desired to protect the main line levees of the Mississippi River against ponded surface waters.

The district (Fig. 7) encompasses 31,175 acres, of which 23,110 acres were taxed for drainage improvements. The original cost of construction amounted to \$169,495, of which the Fifth Louisiana Levee District supplied \$50,000. The balance was raised by an issue of \$84,000 acreage bonds and \$42,000 *ad valorem* bonds. Of the acreage bonds \$23,000 was paid and the remaining obligation

of \$61,000 was refinanced by a \$42,000 refunding bond issue. Of the refunding bonds \$18,200 remained to be paid in 1945. The *ad valorem* bonds had been reduced to \$11,600.

In the main, work of this district consisted of a main drainage canal about 15 miles in length with an outlet in Little Choctaw Bayou. In addition, several channels were dug west of Chamberlee with an outlet in Sandy Bayou, which in turn empties into Little Choctaw Bayou. No comprehensive grid of drainage laterals has been dug for the purpose of extending agricultural land into the lowland beyond the natural levee. In general, the system is in a much deteriorated condition, although in the early 1930's the Louisiana State Board of Engineers spent about \$38,000 to eliminate some drainage problems along State and U. S. highways.

Administrators of the St. Peter Drainage District have no immediate plans for further drainage construction. Here, as elsewhere in the lower part of the area, backwater problems are paramount and much interest is centered on the plans and activities of the Mississippi River Commission and the Army Engineers. It follows that whatever relief is brought here will come mainly from the work of these agencies.

Coulee Drainage District of Morehouse Parish

Coulee Drainage District (Fig. 7) is centered around Colleston, Louisiana, or just to the east of Bastrop Ridge. It was organized in 1906 and covers an area of 18,260 acres. Bonds were issued in the amount of \$26,000. These funds were used to dig 9 miles of main ditch and some lateral ditches, all leading into Bayou Galion. The bonds were retired over a 25-year period from an assessment of 20 cents per acre. No financial difficulties were encountered, largely because of the favorable ratio that existed between developed and undeveloped land.

By the time the Coulee Drainage District had retired its bonds the system had reached a low state of efficiency. The coming of Works Progress Administration found the district in a favorable financial position, however, and with the aid of a grant by the Federal Government the ditches were cleaned. In all, \$9,300 was spent for this purpose, of which the district supplied \$2,300.

This rather recent cleaning by no means solved the drainage problem confronting the district. While the ditches are useful

in facilitating local run-off, they are entirely inadequate during periods of heavy rain when all the lowland streams and ditches are filled with water. A special problem at such times is created by the westward-moving floodwaters of Boeuf River which flood the Lake LaFourche area lying immediately below the district. Flood water then moves up Galion Bayou and the ditches of Coulee Drainage District. Administrators of the district tried to remedy this problem by building a dam designed to hold Boeuf River in its course at the site of the LaFourche cut-off but it merely accentuated flood conditions elsewhere and prompted unfavorably situated groups to blast it. The district considers it futile to try to replace the dam.

Miscellaneous Districts

So far the discussion has been limited to a report on those districts in the Bartholomew-Boeuf-Tensas Basin which had as their purpose the reclamation of alluvial land, and actively undertook engineering toward this end. A considerable number of districts were organized that do not fall in this category. Some were organized but never engaged in any engineering work. For example, court records show that in East Carroll Parish, Louisiana, the following districts were organized early in 1900 but never engaged in active drainage reclamation: Gravity No. 1, Fourth Ward District, East Carroll Parish Drainage District No. 1, Sandy Bayou Drainage District, and Shelburn Drainage District. For the purpose of clearing the records, the court formally dissolved these districts in 1938 and 1939. No explanations could be found in the court records or elsewhere for the failure to engage actively in drainage reclamations. Apparently, a careful search in the county and parish courthouses throughout the basin might bring to light other inactive or dissolved districts.

In some instances villages and cities lying in the alluvial valley found it necessary to organize drainage districts to keep out or remove surplus waters from the corporate limits. A good example of this type of district is Gravity Drainage District No. 1, organized by the city of Monroe, Louisiana. Rayville and Winnsboro have also organized non-agricultural drainage districts, somewhat less elaborate than the district in the city of Monroe.

A number of drainage districts were created on the border of the alluvial lands, lying partly in the uplands and partly in the

lowlands. An example of a district of this kind and the difficulties these border-districts usually faced is the LaSalle Drainage District located north of Catahoula Lake, on Hemphill Creek. This creek had several meanders on its flood plain lying along the lower part of the stream. Cut-offs were made to hasten the removal of water from the flood plain. By straightening the course of the stream, the movement of water in the channel was increased, with the result that the creek first cut a deeper channel and then established a new meander pattern with much undercutting and caving of steep side walls, a process very destructive to good farm land.

A rather unique drainage district was formed in Richland Parish, Louisiana. Here Gravity Drainage District No. 1, organized in 1942, does not propose to engage in any reclamation on its own behalf. Drainage taxes are being collected and held by the Treasurer on the assumption that Federal aid will be forthcoming, and that the limited local funds (about \$8,500 in 1945) can be used to complement Federal grants. These plans are illustrative of a new trend of thinking now widespread in the alluvial valley. It grows out of the realization that major streams must be improved before local developments are initiated and that this task is of such magnitude that only a strong basin-wide organization can undertake it.

SPECIAL FEATURES AND PROBLEMS RELATING TO DRAINAGE DISTRICTS IN THE BASIN

Localization of Effort

Most of the drainage districts in the basin were organized and developed during the first two decades of the present century. That such a problem as drainage, with its rather extensive geographic implications, was attacked with such boldness and confidence on a local level, seems rather extraordinary now. To understand these localized efforts we need only to recall that up to very recent years county seats and county governments were perhaps the most important centers of authority in our society. This fact is made abundantly clear by examining various facets relating to land development in the alluvial valley.

The continuing problem of flood control and the rapidly emerging program of Federal flood control brought little transfer

of knowledge with regard to drainage activities. Flood control, like drainage activities, was first an individual responsibility. In time it became progressively a district, parish or county, and State responsibility. Even this approach was fragmentary, resulting in a patchwork of uneven levees, and so, under the guise of aiding navigation and the carrying of the mails, the Federal Government contributed increasing amounts of money and technical skill to flood control efforts.

Drainage developments in the alluvial valley, to be effective, must be conceived and executed on as large a scale as flood control. This truth has now become clear. The retarded development in drainage must largely be attributed to (1) failure to realize the close relationship that exists between drainage efforts and flood control, (2) retarded recognition of Federal responsibility in this effort, (3) the absence of clearly delegated authority or responsibility under the Federal Constitution permitting the Federal Government to engage in drainage activities, (4) the heretofore relative abundance of farm land, (5) the absence of crisis situations, such as floods, to focus the attention of the Nation on the need for drainage, and (6) the multiplicity of local governmental authorities.

Important milestones in the history of land reclamation in the alluvial valley of the Lower Mississippi River are found in the Federal Swampland Acts of 1849, 1850, and 1851. These acts were passed on the assumption that the receipts from the sale of swamplands would provide for their reclamation, including both flood control and drainage. At first the swampland grants seemed to place full responsibility for land reclamation in the hands of the State governments, with a governor and a legislature responsible for administering the work. Within the States, however, local interests, such as land offices and levee districts, soon demanded positions of dominance in administering these grants. In a few years these interests had become so fixed in their position that they frequently refused to cooperate either among themselves or with the State governments. Such breakdown of authority foreshadowed the piecemeal and ineffective attack that has since been made on what are essentially basin-wide drainage problems.

District land offices, set up to administer the swampland grant, undertook the construction of main river levees, an activity

that appeared paramount in land reclamation. They also planned to drain the protected areas. But the levee program proved to be complex and costly, much more so than many of the administrators of the day realized. Numerous special reports written during the last half of the 19th century confidently predicted the complete mastery of the Mississippi River within a few years. Unfortunately, repeated floods swept away the patchwork of under-sized levees with amazing regularity, so that all means were exhausted in flood control efforts before drainage activities were ever begun. By about 1900 the remaining swamplands were passing into private hands and it was clear that little, if any, revenue would be forthcoming for drainage reclamation. It is significant that at this time the legislation for drainage district organizations was adopted. An examination of drainage experience under this legislation makes it clear that the essential unity of the lowland area from the standpoint of reclamation was not fully recognized.

The unintegrated attacks made on the drainage problem well reflect the importance attached to local rather than regional planning during the early part of the 20th century. At this time the county seats were influential centers of administrative authority. County courts and police juries felt it their right not only to initiate but to carry out all developments affecting local areas. County lines assumed almost the importance of State lines in many public works programs. This condition led to an agricultural leadership closely identified with county affairs that was therefore in a poor position to attack such intercounty problems as drainage. Rivalries between county leaders discouraged the initiation of programs that could not be fully controlled from the local courthouses. Under these circumstances it was only natural that the States delegated authority to local interests to build roads, to initiate and execute drainage developments, and to build and administer schools.

Localisms did not always express themselves on a county basis. Frequently there were several active trade centers in a county, each the domain of local leadership. Situations such as these also needed accommodation in the permissive legislation for improvement districts which in this part of the valley have operated to perpetuate local management and control.

Clearly, excessive localism in the initiation and management of drainage affairs in the Bartholomew-Boeuf-Tensas Basin has more or less run its cycle. Ditches have been dug and become obsolete; debts have been incurred and retired through default, compromise, and payment; yet the drainage problem remains, with the result that more and more attention has been centered upon the Federal and State Governments and upon possible watershed authorities to attack this basin-wide problem as they have already attacked the question of flood control. However, the administrative set-up for effecting drainage remains for the most part on a local district basis. This situation poses the question of how appropriately to integrate drainage district activities in the future in a basin-wide plan. Obviously some stronger agency must be created to integrate drainage efforts properly in each watershed. The way for effecting this integration in Arkansas is not yet clear. Up to this time the State has largely left drainage to local authorities. In Louisiana, on the other hand, two movements have been initiated toward integrating drainage developments. On the State level the Department of Public Works is formulating basin-wide drainage plans to be carried out on a State and parish basis. Moreover, the Federal Government, through the Soil Conservation Service, has gone forward to establish local drainage service in connection with drainage districts or soil conservation districts. Both the Soil Conservation Service and the State Department of Public Works have rather ambitious plans that depend for their success on how much Federal aid can be obtained and how well these programs can be integrated with the drainage work planned by the U. S. Army Engineers.

Even a cursory survey of the districts discussed above will reveal lack of an integrated engineering plan for basin-wide drainage. However, at the time most of the districts were formed no base maps or surveys, such as topographic data, were available for most parts of the alluvial valley. Many drainage plans were formulated on horseback by local engineers who, under such conditions, could hardly be expected to integrate their plans with the natural drainage system or with the drains established by other districts. Not until the 1930's did detailed maps of the alluvial valley become available for use in planning flood control and drainage improvements.¹⁹

¹⁹ Cf. Fisk, Harold N. *Op. cit.*, p. 1.

Use and Importance of Special Improvement Districts in Arkansas

The status and prospect of drainage districts in Arkansas can be better understood by examining briefly the record of special improvement districts and the position these districts and other local organizations have held in the governmental structure. Of special importance in this connection are road improvement and school district activities, though fencing districts and municipal improvement districts are still common in places. At one time all of these distinct activities were financed on the local level, using districts as a method of organization and administration. These several improvement districts in combination with other governmental activities created a paralyzing property-tax burden. With the marked shift that has occurred in the incidence of road and school taxes from a district and county basis to a State and Federal basis, local drainage efforts are now in a much more favorable position to collect drainage levies and in this manner to contribute to an over-all drainage plan, which may be executed by the State and Federal Governments.

State Drainage Statutes

Some of the characteristics of drainage districts, particularly districts in the Arkansas part of the basin, can be understood only in the light of the legislation under which they were created. In Arkansas, drainage districts came into existence through a special act of the Legislature or through the action of a county or district court. Prior to 1926, when the constitution was amended to forbid the use of special acts to create local improvement districts, most of the principal drainage districts were created by the State Legislature. In Louisiana, on the other hand, less resort has been made to special acts, and general drainage laws limited districts to the boundaries of parishes or subdivisions thereof and provided for their organization by police juries.

Special acts used to create drainage districts in Arkansas had both decided advantages and disadvantages. To a degree, the use of special acts avoided the problem of county and district court jurisdictional areas, factors which often tended to limit the size of drainage districts. Since no local elections were required to establish districts organized under special acts, most of the delays and controversies common to such campaigns were avoided. Local

informants also pointed out that districts created under special acts enjoyed greater prestige in the eyes of investors, thus making bonds easier to sell. These features may appear to be desirable but it is clear that special acts frequently served as a handy device in the hands of speculators and promoters to initiate developments that had no widespread local support.

Assessment of Drainage Benefits

One of the major distinctions between Arkansas and Louisiana drainage statutes relates to the basis used for levying taxes. In Arkansas, drainage taxes are based upon assessed benefits assigned to individual tracts by the Drainage District Commissioners, while in Louisiana drainage taxes are either a flat fee per acre (not to exceed 50 cents for 40 years) or are *ad valorem* taxes based upon the assessed value of the land as shown on the general tax books. As a basis for raising funds, particularly in an undeveloped area, the method used in Arkansas has proved to be more flexible and encouraging to sponsors of new districts. It focuses attention, during the crucial period of organization, on the expected benefits to be derived from reclamation and not upon established income-yielding levels, as levies based on assessed values usually do.

Table 1 shows some summary data on assessed benefits in drainage districts located in southeast Arkansas. The assessed benefits range from as low as \$1 per acre for areas in Cousart and Grassy Lake Drainage Districts to as high as \$50 per acre for parts of Eudora-Western District. Because of unusually high assessed values of certain tracts, usually in urban centers, the average per acre figure is more revealing with regard to anticipated agricultural benefits. These average benefits ranged from \$4.69 for Drainage District No. 2 of Lincoln County to as high as \$19.97 in the Cypress Creek Drainage District. For practical purposes these may be considered the values that apply to agricultural land.

In examining Table 1, it should be kept in mind that the average assessed benefits do not reflect the level of agricultural development at the time the districts were created, nor do they reflect present agricultural developments. While the law requires that assessed benefits approximate expected increases in land values due to reclamation, experience has shown that the benefits are usually set at a rather high level because of the desire to have

an adequate base for taxation and because a high assessed benefit figure is necessary to attract prospective bond purchasers who see in this figure a backlog of security for their investments.

Table 1. Assessed Benefits for Drainage Districts in the Arkansas Part of the Basin.

District	Total assessed benefit	Average per acre assessed benefit	Range in per acre assessed benefit
Bayou Macon Drainage District	89,385	15.00	Uniform
Chicot County Drainage District	2,095,533	14.18	2.00-20.00
Cousart Bayou Drainage District	582,664	12.94	Not available
Cummins Drainage District	351,259	18.29	Not available
Cypress Creek Drainage District	5,927,199	19.97	12.00-20.00
Dermott Drainage District	495,356	6.56	Not available
Desha County Drainage District No. 4	428,664	17.88	5.00-15.00
Desha County Drainage District No. 5	188,315	12.76	7.50- 8.25
Eudora Western Drainage District	2,248,116	18.59	5.00-50.00
Grady Drainage District	234,424	14.44	Not available
Grassy Lake Drainage District	21,935	5.65	1.00-16.00
Kirsh Lake Drainage District	286,700	9.67	1.50-15.00
Long Lake Drainage District	226,667	14.48	1.25-25.00
Lincoln County Drainage District No. 1	114,542	16.40	7.00-20.00
Lincoln County Drainage District No. 2	3,000	4.41	4.00-12.00
Middle Slough Drainage District	73,260	17.98	2.25-20.00
Tarry Drainage District of Lincoln County	24,700	17.00	10.00-20.00

The nature and function of assessed benefits are largely unexplored fields and as such are of interest. The established benefits were usually recorded and are frequently available in the county records but very little has been learned of the method used in establishing these benefits. However, the presence of these records in many instances makes it possible to investigate the relationships that exist between assessed benefits and subsequent land development and land values.

Pyramiding of Improvement District Taxes

Widespread establishment of improvement districts in the basin, especially in Arkansas, created exceedingly complex tax structures and heavy tax burdens. In the field of drainage improvements there are numerous instances where properties were encompassed in two, three, or more drainage districts, each with assessed benefits and tax levies. In addition to these overlapping drainage districts, levee districts, road districts, and sometimes fencing districts were superimposed, all with their accompanying taxes. These combined taxes were added to the regular county and State levies, and instances are by no means uncommon where the annual total tax approximated the assessed value

of the land as listed on the tax books. This is particularly true of unimproved lands which, in many parts of the lowlands, comprise the greater part of the area of some counties.

Such pyramiding of taxes resulted in many frustrations and the resort to various devices to avoid their payment. During depressions the defaulting of special improvement taxes was almost universal; it amounted to a virtual revolt. District, as well as county, officials at such times used all manner of devices to encourage at least a partial payment of taxes. One of the most common methods was the forgiveness of several years of unpaid taxes on the condition that current assessments be paid. The abuses that were possible under this practice did much to undermine the morale of local taxpayers, in that it inflicted a penalty on those who paid taxes regularly and promptly. In Arkansas, county officials frequently accepted payment of the general county taxes without insisting on the payment of drainage taxes due at the same time. This naturally led to an accumulation of drainage dues, many of which were never paid. In Louisiana this practice did not gain such wide acceptance.

Capital Losses in Drainage District Financing

Drainage districts conceived and executed in the manner here described naturally encountered many serious financial difficulties, some of which are mentioned briefly in the section describing the individual districts. No detailed reports on the financial history of the districts can be attempted in this study, however, because of the exceedingly complex nature of the financial experiences and the numerous methods used to cope with the relatively heavy debt loads. Such detailed reports must await concentrated investigations dealing with individual districts. Nevertheless, some general over-all observations can be made to show how drainage district administrators have met the problem of retiring maturing obligations.

All the larger drainage districts in the area underwent severe refinancing programs under the guidance of the Reconstruction Finance Corporation in which the stockholders accepted losses, frequently 50 percent or more, of their investments. This experience does not necessarily reflect greater efficiencies on the part of the small drainage districts, but results from the fact that the

large districts attempted reclamations in mainly undeveloped areas and were never able to complete proposed projects. The small districts, on the other hand, usually had a relatively high ratio of developed lands as against undeveloped lands and so were more favorably situated with respect to tax bases. It should also be noted that most of these small districts are in the upper part of the basin where streams are relatively small and have a higher gradient than districts to the south. Even the drainage districts of East Carroll and Madison Parishes, Louisiana, located mostly on natural levees, had much developed land when the drainage improvements were undertaken and slope conditions presented no major problems. Flood waters were merely directed to the nearby swamp and overflow lands.

Failure of most of the small districts to refinance their obligations through the Reconstruction Finance Corporation does not imply that they did not experience financial crises, which brought forth a number of methods for reducing the bonded debts. Some few districts, through persistent tax collection and sale of delinquent lands, met interest and principal obligations more or less currently. More frequently used were (1) the acceptance by the district of bonds at par value in lieu of cash payments for taxes, or (2) the purchase, by agents of the district, of outstanding obligations at prices less than par value. The first method was particularly attractive in cases where large blocks of bonds were owned by landholders in the district or where these landholders could purchase bonds at figures much below par. Obviously, both methods were used at times when the market and par values of the bonds varied widely. In cases where stockholders were not also landholders, and particularly where stockholders were large investment companies, this method was not expedient. In the case of districts that went through formal refinancing, the loss to bondholders resulting from district delinquencies is at least partly established. Less well known are the many losses to private holders who, because of district defaults, sold their bonds at less than par value. During critical times there were large offerings of drainage bonds at a fraction of their par value. Speculators and informed local investors acquired them in large numbers, often reaping substantial profits.

SUMMARY AND CONCLUSIONS

Knowledge of the complex drainage problems that face the people in the Lower Mississippi Valley is best gained by a study of the experience there in reclamation of alluvial land. In the Bartholomew-Boeuf-Tensas Basin intensive drainage reclamations were begun shortly after 1900 and continued on a large scale until the flood of 1927. More than one million acres of the basin were brought into drainage districts, were assessed drainage taxes, and were made the site of drainage constructions, ranging from large stream diversion ditches to simple farm laterals.²⁰ Almost 6 million dollars in bonded debt was assumed by local people through their officially-created districts; and many other obligations, more difficult to measure, were undertaken by individual and informal groups. Since 1927 the attention of local people centered on completing plans in progress at the time of the flood, and on salvaging the established organizations from the financial ruin that followed the flood of 1927 and reached a crisis in the depression of the 1930's.

The history of drainage development in the Mississippi Valley, particularly in Bartholomew-Boeuf-Tensas Basin, has too often been written in terms of these crises—floods and depressions—rather than in terms of the more analytical concepts that embrace and describe the major interests, groups, institutions, and practices which gave form to the drainage movement as it developed and is practiced in this area.

The major causes of defeat in past efforts to achieve adequate drainage in the Bartholomew-Boeuf-Tensas Basin are briefly summarized as follows:

1. Shortage of basic engineering data covering the area which led to improper evaluation of the requirements for a successful gravity drainage system.
2. Inadequacy of district funds for carrying out complete plans, with the result that many projected laterals and some necessary diversion ditches were never constructed.
3. Lack of common interests among many of the groups sponsoring local projects leading in some cases to the construction of terminal drainage satisfying non-agricultural interests but giving

²⁰ Although impressive acreages have been brought into drainage organizations in this basin, there are many thousands of acres potentially suited for drainage but not now in districts. This is particularly true of the Louisiana portion of the basin.