

REPORT  
OF THE  
**FLOOD CONTROL**  
AND  
WATER CONSERVATION  
COMMITTEE



TO THE  
GOVERNOR OF THE STATE OF KANSAS  
December 27, 1928

PRINTED BY KANSAS STATE PRINTING PLANT  
B. P. WALKER, STATE PRINTER  
TOPEKA 1929  
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LETTER OF TRANSMITTAL

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TOPEKA, KAN., December 31, 1928.

*To the Honorable Ben S. Paulen, Governor of Kansas:*

SIR—Submitted herewith is the report of the Flood Control and Water Conservation Committee appointed by you.

The problem of the control of floods and the storage and conservation of water has been studied as thoroughly as possible in the time available, and it is believed that the conclusions and recommendations which follow deserve careful consideration. It is the hope of the committee that you may have this report printed and pass it on to the legislature with your recommendations.

Respectfully submitted,

H. W. AVERY.

H. H. WOODRING.

J. A. McDERMOTT.

L. O. RIPLEY.

JEAN A. MCKONE.

H. F. WALTER.

GEO. S. KNAPP.

## REPORT OF THE COMMITTEE

### INTRODUCTORY STATEMENT.

Kansas has suffered repeatedly from destructive floods. A complete record of these floods cannot be obtained, but below, separated as to the watersheds on which they occurred, is as complete a list of flood years as information at hand will permit. These records have been obtained from the United States Weather Bureau and other sources.

Years in which Kansas floods are known to have occurred:\*

KANSAS: 1844,† 1858, 1892, 1896, 1897, 1902, 1903,† 1904, 1908, 1909, 1915, 1923.  
BLUE: 1844,† 1903,† 1904, 1908, 1909, 1910, 1912, 1915, 1916, 1923, 1927.  
REPUBLICAN: 1844, 1903, 1904, 1905, 1908, 1915,‡ 1923.  
SOLOMON: 1844, 1903, 1904, 1905, 1906, 1908, 1909, 1914, 1915, 1919, 1923, 1928.  
SMOKY HILL: 1844, 1903, 1904, 1905, 1908, 1915, 1916, 1919, 1923, 1927, 1928.  
ARKANSAS:‡ . . . 1922, 1923,† 1924, 1927, 1928.  
NEOSHO: 1844, 1885,† 1896, 1898, 1899, 1900, 1902, 1903, 1904,† 1905, 1907, 1908, 1909, 1911, 1912, 1915, 1916, 1919, 1920, 1921, 1923, 1926, 1927,‡ 1928.  
VERDIGRIS: 1889, 1895, 1896, 1899, 1901, 1902, 1903, 1904, 1906, 1907, 1908, 1910, . . . , 1922, 1923, 1926, 1927, 1928.  
MARAIS DES CYGNES: 1844, 1894, 1895, 1898, 1904, 1909,† . . . , 1922, 1923, 1927, 1928.†

Except that 57 lives were lost in the Kansas river flood of 1903, and the loss has been estimated by the Corps of Engineers, U. S. Army, to be \$22,000,000, little or nothing is known of the destruction caused by floods prior to that of 1926-1927.

An investigation was made by Gov. Ben S. Paulen and Geo. S. Knapp, chief engineer of the Division of Water Resources, State Board of Agriculture, of the loss caused by a series of floods beginning in September, 1926, and continuing to October, 1927. Five sets of questionnaires, covering, in addition to questions of public health, losses sustained by farm lands, highways, cities, industries and railroads, were sent to farmers, bankers, city and county officials and officials of companies competent to supply the information desired from their particular fields. From this information a thorough analysis of flood losses was made.

The reported loss obtained in this survey reached a total in ex-

\* Records have not been kept continuously. Floods probably have occurred on other years of which there is no known record.

† Greatest floods.

‡ No records available prior to 1922.

cess of \$15,466,000, which figure takes no account of loss of life, sickness as a result of the floods, nor losses caused by the suspension of business. The following is a brief summary of these losses, separated as to the principal river system of the state:

RIVER AND TRIBUTARIES.	Aeres of overflowed land.	Loss to farms.	Loss to county roads and bridges.	Loss to cities.	Loss to railroads.	Total.
Kansas.....	83,740	\$1,308,300	\$134,290	\$263,100	\$87,490	\$1,883,090
Marais des Cygnes.....	68,500	672,300	143,600	119,300	64,850	1,090,050
Neosho.....	152,100	5,039,000	563,200	851,800	114,810	6,568,810
Verdigris.....	157,000	2,968,500	446,700	222,000	122,500	3,759,700
Arkansas.....	96,000	1,329,800	567,500	295,700	61,660	2,254,660
Totals.....	557,340	\$11,107,900	\$1,855,200	\$1,751,900	\$451,310	\$15,466,310

Floods occurred again during the spring and summer of 1928 on the Smoky Hill, Solomon, Arkansas, Neosho, Verdigris and Marais des Cygnes rivers, and in November a flood of unusual magnitude occurred in all streams in the southeast part of the state, causing the loss of a number of lives and the destruction of a great deal of property.

The stream systems sustaining the violence of this flood were the Marais des Cygnes, the Neosho, the Verdigris and the Walnut, a tributary of the Arkansas. On two of these streams, the Marais des Cygnes and the Walnut, the flood rose to heights exceeding those of any other floods of record. In the Marais des Cygnes valley, the crest of the flood was about 20 inches higher at Ottawa and 30 inches higher at Trading Post than that of July, 1909, which was the previous largest flood. A large part of the city of Ottawa, both business and residential districts, was overflowed, with great damage to property and the loss of a number of lives.

On the Walnut, at Winfield, the flood rose about 17 inches above the previous highest water mark, that of 1923, and because of the breaking of a levee along the north side of the city it was especially destructive, the flood water flowing across the city through the center of the business district. The cities of Augusta and El Dorado, farther up on this stream, also suffered severely from this flood.

At Iola the Neosho lacked nearly three feet of reaching former high water marks, but east of Parsons it reached height as great as former floods, with the possible exception of that of July, 1904.

While the flood on the Verdigris was also very destructive, the stage of 34.93 feet registered at Independence was exceeded by both the floods of 1904 and 1927. On all four stream systems the volume of flood water was sufficient to cover the entire valleys and overflow all the land in their flood plains.

A survey is now under way to ascertain if possible the loss caused by this most recent flood, but the preparation of this report cannot be delayed until the results are known. It is apparent, however, that the flood loss in Kansas runs into many millions each year.

The frequency with which floods have occurred, the poor progress made in their control, and the fact that floods from year to year become more destructive of life and property as population and property values increase, serves to emphasize the necessity of taking steps to bring about a greater measure of flood control. To determine what should be done, Governor Paulen, assisted by the Division of Water Resources, called a flood control and water conservation conference, which met in Topeka on December 7, 1927. After two days of discussion, participated in by people from all parts of the state as well as by prominent engineers from other states, the conference at its close adopted resolutions, relating to both state and national flood control, which included the following:

"WHEREAS, The state of Kansas has suffered great loss both from floods in some portion and from a deficient water supply in other portions, and the problem of water conservation and flood prevention is a serious one now confronting the people of our state;

"Be it resolved, That we respectfully request the governor to appoint a commission of citizens representative of all sections of and all interests of the state, whose duty it shall be to study flood control, water conservation, and the laws pertaining thereto, and to present a comprehensive plan and needed legislation that will attain these objectives."

Acting upon this resolution the governor appointed a committee composed of the following men:

H. W. Avery, Wakefield, Clay county farmer, member State Board of Agriculture and former state senator.

J. A. McDermott, Winfield, lawyer, and former member of state legislature.

L. O. Ripley, Wichita, engineer, and vice president and general manager Kansas Gas and Electric Company.

H. H. Woodring, Neodesha, banker and director Southeast Kansas, Inc., representing agriculture.

Jean A. McKone, Tonganoxie, farmer, and member of legislature.

H. E. Walter, Syracuse, lawyer, former member of legislature, and now judge thirty-second judicial district.

Geo. S. Knapp, chief engineer Division of Water Resources, Kansas State Board of Agriculture.

#### ORGANIZATION AND PLAN OF WORK.

When the committee met on February 28, to start its work, it effected its organization by electing Mr. H. W. Avery president, Mr. Geo. S. Knapp vice president, and Mr. H. W. Woodring secretary.

With its instructions directing it to study many phases of the control and use of water, ranging from the prevention of overflow to the conservation of water in those portions of the state normally deficient in rainfall, the committee deemed it wise to take up one feature of the problem at a time, reserving the formation of its conclusions until the entire study was completed. The work was therefore divided into the following four general divisions.

1. The control of floods by drainage and levee districts.
2. The reduction of floods through a general program of stream cleaning and maintenance.
3. The necessity for stream flow equalization.
4. The conservation of water by the building of dams.

Inasmuch as the constitution prohibits the state from engaging in works of internal improvement, except the building of roads, the creation of drainage and levee districts, which in effect are local benefit districts, offers the only opportunity which localities have of draining their lands or protecting themselves against overflow. The December conference brought out that satisfactory progress in the control of floods has not been made under the laws now on the statute books. Several speakers held that these laws were inadequate and should be revised.

In view of this situation, it seemed wise to make a thorough study of drainage and levee districts and the laws pertaining thereto. For that purpose the committee decided to hold a public hearing to which all interested parties should be invited. This hearing was set for March 27 and 28, and notices were sent to drainage and levee district officials throughout the state, county commissioners, lawyers and consulting engineers known to be interested in the matter, and

to many others, informing them of the hearing and inviting them to attend.

From many sources the committee had brought to its attention the fact that the river and stream systems of the state are so badly clogged with trees, brush and other obstructions that their capacity to carry water is greatly reduced, and that as a result such streams overflow with much greater frequency than they would if they were properly cleaned and maintained. In order to study the situation closely the committee planned a trip along some of the principal streams to personally examine the condition of them. This trip was made on April 30, May 1, 2 and 3.

While the matter is not strictly within the field of flood control, since sanitation and municipal water supply is also involved, the committee deemed it advisable, in connection with its study of flood control, to consider problems incident to low-water flow on Kansas streams. For this reason it decided to arrange for a conference with those who were interested in maintaining satisfactory conditions on Kansas streams through periods of dry weather. This conference was held in Topeka on May 21.

The matter of water conservation was studied on a trip through the western part of the state during the week of August 13 to 18. For this trip the committee arranged conferences at points on their route to enable them to discuss matters of local importance with the residents of various communities.

#### FINDINGS OF THE COMMITTEE.

##### DRAINAGE AND LEVEE DISTRICT LAWS.

Briefly stated, while the hearing on drainage and levee-district laws brought out many shortcomings and inconsistencies in the present laws, the practical effect, so far as the operation of the acts is concerned, is that (1) districts are often too small to cope with the problems with which they are confronted; (2) boundaries are not always located with due regard to such physical conditions on the stream as should properly determine the boundaries of such districts; and (3) there is often lack of necessary coöperation between adjacent districts.

With regard to the first, Mr. Fred G. Laptad, of Lawrence, the secretary of three drainage districts in the Kaw valley, said that while those districts were satisfactory for the purposes for which

they were created, they were too small to deal with the problem which now confronts them—the removal of obstructions from the Kaw river and the prevention of flood overflow from that stream.

Mr. H. L. Hannon, of Burlington, a man who is familiar with flood problems on the Neosho, and who was a legal adviser for the new drainage district there, discussed at some length the effect of present and proposed drainage districts on the Neosho. He said in part:

"Now if that drainage proposition is carried out it will straighten the river for 17 miles; it will shorten the river 17 miles, a distance by road of only about 20 miles. I do not know the length of the river—35 or 40 miles. If that proposition is carried on it will mean overflowing the bottoms in Hartford, in Coffey county. That means there will have to be a drainage district in Coffey county. It ought to be organized on the same lines. If there is a drainage district organized in Lyon county under a board of directors, etc., and a district organized below that under a different system, it means confusion, and will not work properly. The works will not have the uniformity that ought to be if you want a good, comprehensive drainage system. It seems to me that what we need is some legislation that would make provision for a general drainage system all the way down these streams, under one head and one supervision. I do not know just how it could be worked out, but possibly under state supervision, so that there would be one head to the entire system. There is no question but what the time is coming when we must take care of these streams or they will take care of us."

The fact that small districts were inadequate for works of flood control was also emphasized by Mr. J. T. Davis, of Liberty, representing drainage district No. 3 in Montgomery county. In the course of his remarks, he said:

"Another thing, little local districts cannot do the work. You have got to take care of this water from end to end of the river."

Later on, in reply to the question—

"In your judgment would you make better progress with flood control if the districts were much larger, if, for example, an entire watershed could be brought into one district?"

he replied:

"My judgment is that that is the only scheme that would work."

Mr. J. W. Reamer, of North Topeka, representing the Kaw Drainage District, told of the difficulties they had in their small district. To quote:

"I can say one thing, we are up against a pretty hard proposition up there. Our district is small and our expense is quite a bit too, and—

"Mr. McDermott: How much area in your district?"

"MR. REAMER: I don't know exactly. Somewhere around 5,000 acres—12 square miles. Probably you know of the 1903 and 1908 floods. They did quite a lot of damage to us. The river there has a short bend. We built our dike on the river, but the bank keeps cutting away and the dike goes into the river. I don't know whether we will rebuild the dike or not, on account of the expense in a small district."

The drainage district laws of Kansas were discussed at some length at the December, 1927, flood control conference, by Mr. Clark E. Jacoby, a drainage engineer of many years' experience. With reference to the 1905 drainage act, he said:

"This is the best drainage law that Kansas has upon its statute books today. The best features of this law are that the board of directors have power to proceed in a practical way to accomplish results. The powers conferred upon the drainage district and the board of directors are potent, far-reaching and sufficient to accomplish results. The provisions of this article carry with them the power to levy annually an *ad valorem* tax on all the property in the district, based upon the assessed valuation, to create a general fund. The limitations of this law that tend to make it impracticable are:

"1. The fact that the district must be located wholly within the boundaries of one county, and the jurisdiction of the county commissioners in one county incorporating a district under this article cannot extend to any territory beyond the limits of the county within which such commissioners have jurisdiction. Therefore, the law is unworkable and impracticable so far as the organization of a territory which may be located in two or more counties, for the reason that it is almost impossible to get the county commissioners of two or more counties to proceed with the organization work in the various counties at the same time, and properly coordinate the progress of the projects.

"2. There are many special provisions in this article, which are made applicable only to certain counties having certain population. If the law is a good law, it should be a good law for every county in the state."

While reference was not as frequently made to improperly located drainage-district boundaries, the instances brought to the attention of the committee were sufficient to show a very unsatisfactory condition. Two of these are particularly to the point.

Mr. O. P. May, a lawyer of Atchison, representing the Missouri Pacific Railway, in discussing difficulties of the Delaware drainage district said:

"The main trouble with that drainage district is that they are right there in the middle of it. Mr. Thompson's district stops down there at the Union Pacific railroad, and where it needs straightening the worst is below the railroad. There is less fall there and it is more crooked. These drainage districts can't accomplish much by working piecemeal. They ought to begin at the mouth and go up, or at least take in the whole drainage system. . . . A large part of the failure of those things is that they work piecemeal and do

not take in an entire drainage system. My father's farms were over on Stonchouse creek. Thirty years ago I straightened the streams on his farm. It doesn't do much good because it is stopped up with trees below. If the Stonchouse were straightened clear to the river, the work that the individual farmers have done would be of some benefit, because the water would shoot clear on through."

That districts can be, and have been, organized under present laws without due regard for those natural physical conditions which properly should serve to fix the boundaries of such districts is shown by the following, taken from the remarks of Mr. O. L. Isaacs, attorney for Lyon county drainage district No. 1:

"MR. KNAPP: What fixed the boundaries of that district in the first place—physical conditions or the desires of the persons circulating the petition?"

"MR. ISAACS: You have asked me a question, Mr. Knapp, that I hesitate to answer, but to this extent: I'll tell you the circumstances and you can draw your own conclusions. One man was the promoter of this proposed drainage district. Several years before some sort of a drainage project had been contemplated. The man who started out with his petition owned a given body of land. Now, he secured a man in Emporia who was an abstractor and had a good knowledge of the lay of the land, to draw this petition of incorporation. This man who was employed went out and rode up and down the valley on a horse and said, 'You ought to go up to here and down to there,' and so on, and the boundary that was first outlined that way was the boundary, substantially, of the district.

"MR. KNAPP: My reason was this, that there seemed to be no physical reasons for fixing the boundaries of that district where they were fixed in two instances, and the question was raised in my mind as to whether a law is good if it permits fixing boundaries in other than their proper locations. Obviously, the boundary of the west end of that district was not determined by any physical condition in the valley.

"MR. ISAACS: I think you are absolutely right, Mr. Knapp."

The Lyon county district not only failed to adopt the plan prepared on the basis of the boundaries fixed in the manner noted above, but the majority became so thoroughly dissatisfied that they decided to disorganize. They then found that while the district had incurred expenses totaling more than \$20,000 for organizing and plans, under the provisions of the law they could raise no money to pay such costs unless they adopted a plan. As in other instances brought to the attention of the committee, it will require, it seems, a special act of the legislature to help them out of their difficulties.

Lack of coöperation between adjoining districts seems to be one of the principal reasons why the works built by many districts are not as successful as they might otherwise be expected to be. Numerous instances of such lack of coöperation, ranging all the way from

the failure of adjacent districts to properly coördinate their works for their mutual benefit, to actual competition or rivalry between them, were brought to the attention of the committee. One witness actually stated that the district which he represented "was organized for the express purpose of heading off" another district.

Mr. W. W. Brown, of Parsons, in discussing the lack of progress in flood control on the Neosho says:

"It occurs to me that something ought to be done to coördinate the various interests along each river or each stream, and to bring about progress in this matter."

Information brought to the attention of the committee showed very strikingly the effect of the lack of coöperation in the planning and construction of the levees on the Neosho river. These levees were built by a great many small districts. As a rule the length of river banks controlled by each district is small, usually no more than from one to five miles, and, so far as the committee could determine, a district controlled one side of the river only. Because the landowners desire to save as much land as possible, the levees are built close to the river bank regardless of the amount of waterway which should be left to carry the flow of the stream at flood time, and since it is outside of their district no money is spent on cleaning the stream, maintaining it or removing obvious obstructions from it. Later a district is formed on the opposite side of the river. The same plan is followed. The levee is put close to the bank, and no money is spent for channel improvement. If anything, this latter levee is built a little higher than the one on the opposite side, so that when a flood occurs theirs will not be the first to be overtopped. The net result of this practice is that the river is in effect a "no man's land," and adjacent districts, instead of coöperating for their mutual benefit, find themselves competing with one another, each in the attempt to build the highest levee. Thus the river, left to itself, becomes clogged with trees and brush, and with inadequate flood way between them, the levees are overtopped and fail whenever a flood of considerable magnitude occurs.

Practically the entire system of levees on the Neosho broke in the flood of the fall of 1926, many of them failed during the floods of 1927, and almost every one of them broke again in the flood of November, 1928.

Mr. Brown, who says he happens "to be the unfortunate possessor of a farm in the Neosho valley," discussed this situation at some length.

When asked what might be a remedy for the situation he replied:

"The remedy, it seems to me, is that every levee placed on a stream, especially where it goes through more than one county, should have the approval of a state board. Take our road proposition. Our road proposition went from the local approval, to where the structure has to have the approval of the state engineer. It has had a very wholesome effect on the road system of the country. It seems to me that every structure that is designed to take care of waters like the Neosho river should have the approval of the state engineer before it is put into effect. Now, a controlling clause of that sort would get good results. The farmers, when they are in the mood of paying \$10 per acre for a structure, are pretty much in the mood of paying \$15 per acre if it is necessary. But after the structure is once put in, and it has been torn down, the people are in such a mind that it is hard to get relief work constructed after that. I am in hopes that the state will rewrite our drainage laws from one end to the other; first, so that drainage districts can be initiated or started easier; and second, to have the work under the supervision of the state engineer, who will insure some good protection and some good work."

Many other witnesses expressed the opinion that flood-control projects should embrace entire watersheds, or conform to a general plan for an entire watershed.

When asked to suggest a remedy for the unsatisfactory conditions which prevail, the answer usually was, a rewriting of the laws, and state control over the construction and maintenance of flood-control works. On no other one thing did persons at the hearing put greater emphasis than on the necessity for state control. Here are some of the statements made:

"MR. L. H. HANSON: I do not know just how it could be worked out, but possibly under state supervision, so there would be one head to the entire system."

"MR. W. W. BROWN: The control of those matters ought to be in larger hands; it seems to me it ought to be in the state."

"MR. J. T. DAVIS: I think the state ought to have control."

"MR. KNAPP: You mean that there should be some state supervision over it, and require that the plans be checked and approved by the state?"

"MR. C. H. THOMPSON: Absolutely."

"MR. H. W. OXNARD: When an improvement is likely to result in a high discharge, it seems to me the legislature should take that into consideration in the protection of the people below, by requiring state supervision to approve the plans."

"MR. O. P. MAY: I think there ought to be a system of state control. This thing can't be done piecemeal."

"MR. P. T. SIMONS: During the day, here is one proposition I jotted down that seems to be important, that state supervision is needed to coordinate drainage and flood-control interests on streams, and it is also needed to coordinate other interest in the water resources."

Mr. H. A. Rice, professor of civil engineering at the University of Kansas, and for a number of years a member of the Kansas Water Commission, believes that the state should develop general plans for each watershed and require that works, when built, should conform to such plans. He said:

"In addition to that, I would give the state organization, the State Board of Agriculture as it is now, sufficient money so that they can make a survey of all the watersheds of the state. Then I would have them make a layout, perhaps, of a system of controlling the streams, such as has been made on certain rivers, the Neosho for instance. Then when the local drainage districts put in their works, they should conform to the plans recommended by this state organization. Some sort of coordination of our districts along the rivers is needed, so that when they are through they will be built according to some plan. As it is now, there is no plan, no scheme. Everybody builds to suit himself, as cheap as possible, and there is nobody to keep them from doing it. If a state board had control of this, and we had some sort of conservancy-district act so that if desirable we could take charge of a whole stream, from one end to the other, then I think we could accomplish something. But under the present laws it is a rather poor mess."

Many speakers expressed the opinion that new laws were needed to permit satisfactory progress to be made with flood control. A number of persons told of the difficulty of proceeding under present laws, and others suggested changes which should be made. In two instances brought to the attention of the committee it was necessary for communities to secure the passage of special acts before they proceeded with their drainage projects.

The city of Burlington for years sustained great damage due to the flooding of Rock creek which flows through the business district. Various attempts were made to organize a drainage district there, but without success. In 1927 Burlington secured the passage of an act under which they later constructed the works necessary to protect the city from overflow.

The North Wichita drainage project was organized under article 7 of the drainage district laws, and proceeded under that act until the report of the directors and engineer had been filed. It was then found that when assessments were made they would be due and payable within the year in which such assessments were made. Because paying the entire cost of that project in one year would have worked a hardship on the property owners, the directors advised the property owners that they would not make such a levy, and in 1925 the legislature passed an act which provided that after a district had proceeded, under the provisions of article 7, up to the point of filing the report, and it is found that the cost cannot be

paid within one year, bonds may be issued. The North Wichita Drainage District is now proceeding under this latter act.

Many bills have been passed by the legislature amending the drainage district acts to make them apply in a peculiar manner to certain communities, or to permit districts to proceed in a manner different than the law provided, after they found themselves in difficulties; and the committee is advised that a special act will be required to get Lyon County Drainage District No. 1 out of the difficulties under which they now find themselves. They are organized under the 1911 act. These conditions and the statements of a number of persons who furnished information to the committee suggest the need of a general drainage act which corrects the defects in the present acts.

Mr. Clark E. Jacoby, who discussed the present drainage district acts, concluded his remarks with the following statement:

"Kansas is very much in need of the enactment of a new law which we may term a conservancy act, patterned after the Ohio and Texas conservancy acts. The Ohio conservancy act should be carefully studied by constitutional lawyers of the state of Kansas, and in that respect so amended that the law, when enacted, will conform with the constitution of the state of Kansas. From the standpoint of being a practicable, workable and feasible law, there can be no special criticism directed against the Ohio conservancy act, for it has been carefully tested and has been found to be sufficiently flexible so as to give results in actual practice. Briefly explained, a conservancy act should provide ways and means to effectively and easily organize all of the lands which may be benefited lying within a constituted area of overflow lands within one watershed system in the state of Kansas. The initial cost of organization is minimized by organizing the larger area. The cost of preliminary studies and plans is minimized and the scope of the investigation is greatly enlarged, therefore making any plans adopted more feasible and practicable. The cost of construction work per acre is greatly reduced and the benefits as a whole to the district are greatly increased. Thus, such watersheds as the Neosho, Verdigris, Arkansas, Kaw, etc., may be treated separately as one problem and a comprehensive study made and plans evolved for the reclamation and drainage of the wet and overflow lands in each of these drainage systems.

"I have pointed out briefly some of the defects of the Kansas drainage laws; and now I wish to enumerate briefly, in a general way, essential provisions of drainage laws which are so many times omitted, not only from Kansas drainage laws but other state drainage laws. In order that a drainage and flood-control law be applicable and practicable, I wish to call attention to the following points that should be given due consideration in formulating a drainage law:

"1. The method of organization of the project should be made plain and the law should state specifically just what the petition should contain, and

specifically on what manner the petition should be heard by the court or commission organizing the district.

"2. Provision should be made for the maintenance of any improvements that are constructed under the provisions of the law. Many drainage laws have no provision whatever for any method of maintenance. No provision is made for any maintenance tax nor for the upkeep of the improvements constructed. We can readily see how important this is when we stop to consider the result if the state or railroad companies should construct a railroad system without any provision for upkeep or maintenance.

"3. Proper provision should be made in the law for extending or changing the plans at any time both before and after the improvements have been constructed. Many of the drainage laws simply provide for the laying out of a plan on the basis of which taxes can be levied, but after the plans have been in operation five, six, ten or twelve years, if it is deemed necessary to extend the plans or change them in any way, there is absolutely no provision for such amendments in many of the drainage laws.

"Proper provision should be made for the extension of the boundary lines of the district at any time it may be deemed proper.

"5. The general powers of the district and the directors of the district should be broad enough to cover any possible contingency which might arise in connection with the laying out of plans and execution and maintenance of the same for the best interests of the district. Often the powers and duties of the executors are so limited that it is impossible for the district to properly function and to construct and maintain improvements that should be constructed and maintained in order to economically benefit the lands in the district.

"6. Proper provision should be made for the condemnation of rights of way both inside and outside the district.

"7. Proper provision should be made for refinancing the district, or for the refunding of indebtedness if necessary, and for the extension of the corporate existence of the district. Many districts have been incorporated for only a period of 25 years. They have issued bonds for say 20 years, and on account of adverse economical conditions they find it is impossible for them to pay out the indebtedness within the 25-year time. The law under which they are organized perhaps does not provide for a refinancing scheme or the extension of the life of the district.

"8. Provision should be made so that from year to year the board of directors of the district may have the power to condemn land and use certain sections of the district, as need be, for sedimentation or silting basins, and as one area becomes silted in so that it cannot be used any longer as a sedimentation basin, that other areas may be used, thus saving the rich soil that washes down from the hills and at the same time control flood waters so as not to damage adjacent property.

"10. Drainage districts should have the authority and power to cooperate with other drainage districts, and with the United States government and with the state in which the district is organized, and also with other states.

"11. Drainage districts should have the authority also to lease land for temporary uses.

"12. Proper provision should be made for the disincorporation of a drainage

district at any time. One of the main requisites required before a drainage district be allowed to dissolve, would be that all of its indebtedness should be paid.

"13. In this day and time, when much is being said and written about flood control, I would offer by way of suggestion in concluding my remarks, that the first and most important step that Kansas can take toward the reclamation of its overflowed areas is to enact remedial legislation whereby drainage and flood-control projects may be organized and operated in a practicable, feasible way. The various communities in the state will then be in a position, if at any time federal assistance is offered, to take advantage of such offers and thereby reduce the cost of the improvements to the landowners. Primarily and constitutionally, referring both to the constitution of the federal government, and the constitution of the state of Kansas, drainage and flood-control work must pay its own way; and this fact should be borne in mind by all those who expect the Federal government to pour out revenues for the reclamation of overflowed lands. Knowledge of this fact makes it all the more important that the various states in the Union early enact adequate drainage and flood-control laws."

As expressing the opinion of a man who has had many years of experience in the planning of flood-control projects in many parts of the world, the views of Mr. Arthur E. Morgan carry great weight, and are a fitting finale to this résumé of the information on drainage and levee-district laws which the committee had before it. Mr. Morgan is president of the Dayton Morgan Engineering Company, of Dayton, Ohio. He is one of the authors of Ohio conservancy act, and it was under his direction that the Miami conservancy district, one of the most notable flood control projects in the United States, was planned and the works built. He came to Kansas at the earnest request of both the governor and the chief engineer of the Division of Water Resources to address the December, 1927, conference. He said in part:

"I believe that it will scarcely be possible for work to be done economically and effectively until you have a changed or an entirely new legal code under which to work. If there is hesitancy in letting go of the present code, it is perfectly feasible to set up an alternative code. As soon as a good sound statute is provided the others will no longer be used.

"There are three ways in which I think the Kansas drainage law is susceptible of improvement. First, in its general thoroughness and orderliness. The Kansas drainage law was built when many of the legal codes in this country were not well developed. A well-designed water-control code should be built out of experience that includes all kinds of contingencies. When we built the Ohio conservancy law we studied practically every water-control code of Europe and America. We codified and listed every way in which every law provided for everything. For instance, there were provisions for condemnation of right of way. We compiled a history of the methods of carry-

ing through that process, and similarly as to assessments of benefits and damages, and we did the same thing as to administrative methods. In each case we endeavored to select the method, or policy, which had been most generally fair and effective. Then we integrated these into an organic procedure. We needed to see that that procedure did not do violence to the constitution of the state, so we had lawyers go over every provision with that in view. It was possible to find an effective, fair and constitutional way of doing everything that was necessary to an orderly program. We made the same careful study from the standpoint of everyday administration. If a landowner comes into the courthouse to pay his assessments for water control, we want him to be able to do so in his habitual manner. So we went over the draft of the bill with experienced county officers, to see that step by step, in the way of giving notices, etc., the law would make the least possible disturbance in the habitual way of doing customary things.

"If you will read twenty or a hundred water-control laws, you will find things that are generally haphazard affairs built around some particular experience. Taken altogether the water-control laws of the country constitute a record of most every difficulty that people have encountered in controlling water. Our attorneys made light of my elaborate provisions for moving cemeteries. 'Just leave that provision there, we might need it,' I told them. Before we were done we had to move one or two cemeteries in the particular project for which that law was enacted. Without ability to move them we might have been blocked. The codes that have been passed are in some respects the best history of the difficulties people have met and the methods they have used to overcome this. The drainage and reclamation laws of many states are a hodgepodge of expedients, with no evidence that the problems have been thought out. Only when given thorough study can there be achieved the smooth, fine, fair working of a perfect instrument. When you do get such an instrument, there is pleasure in working with it, and the results are admirable."

#### STREAM FLOW EQUALIZATION.

The conditions existing on Kansas streams, during dry weather when the flow of such streams is low, are well described in the following brief extracts taken from the paper, "Sanitary Conservation of Water Resources," read by Mr. Earnest Boyce, chief engineer of the State Board of Health, at the December, 1927, flood control conference.

"There are two conditions under which the flow of water in a stream becomes a problem. One is when the flow exceeds the capacity of the channel and the other when the quantity flowing is less than is necessary to meet the needs of those who have use for it. Both problems would be solved if the maximum flow could be reduced to the carrying capacity of the channel and the minimum flow increased to meet the maximum demand for water.

"We have suggested some of the problems of flood control and some of the methods proposed for their solution. We still must consider the problems of minimum flow, and we want to suggest that suitable flood-water control may

at the same time increase the amount of dry-weather flow and help solve the other problem proposed in the beginning. Just so much rain falls on a given area, and the more that leaves as flood flow the less there will be remaining to maintain dry-weather flow.

"At present, at least two streams in southeast Kansas have dry-weather flows of less than one-half of the amount of water required by the population dependent on these streams for water for domestic use. In other words, were we to add together the daily water consumption of the cities along these rivers during period of low flow, it would total more than twice the flow past a given point.

"If water supply were the only thing to consider during low flow, it would be possible to continue the present practice of impounding in the channel without difficulty. Unfortunately, these streams must carry not only the natural storm and dry-weather flow, but they form the natural drainage of the valleys through which they pass, and must of necessity carry the liquid wastes that result from the habitation and development of the valley.

"The desire to have modern houses with the conveniences afforded by water under pressure, has given rise to the modern system of sanitary sewerage. By the flow of the water, the sewage wastes are flushed continuously from a city into some receiving stream. This is convenient, and as modern cities are now constructed, an absolute necessity to the health of the city. However, one should not forget that in handling the wastes incident to human habitation in this manner, there is still the problem of the ultimate disposal of these wastes. It has been repeatedly shown that a stream can receive and purify a certain amount of liquid waste, but that the capacity for so doing is limited. When there is ample flow in the stream these problems are not acute. It is the period of minimum flow that gives rise to the critical situation, when the load of domestic and industrial waste exceeds the capacity of the stream to absorb it and to render it harmless by natural purifying processes. At such times two things are possible. First, a purification of the liquid wastes, and second, an increase in flow. Thus far most of our attention has been directed to the problem of the purification of the wastes, but it may be that in the ultimate solution of the problem some means of increasing the dry-weather flow will be helpful, especially if it can be considered, if you please, as a sort of by-product of the solution of the flood-control problem.

"The use of modern systems of sewerage has increased very rapidly during the past ten or twenty years, until now approximately 41 per cent of the entire population of the state are served by this modern convenience. Four out of every ten inhabitants of the state are contributing to this problem.

"While it is possible to destroy organic wastes in treatment plants and render the effluent harmless and not objectionable, it is possible to change only the organic wastes. Wastes of mineral nature do not change as a rule except in intensity by dilution. The liquid wastes of mineral character have their source mainly as the result of the mining and oil industries, and while it is possible to overcome their objectionable characteristics by adequate dilution,

there must be water available for dilution or the concentration can easily become great enough to destroy the usefulness of the stream for other purposes. There must be adequate flow in the streams at all times to dilute wastes that cannot be changed by treatment to a point where they will not be objectionable. There are two ways of doing this: First, by holding the wastes in reservoirs until the natural flow of the stream will give adequate dilution; and second, increase the dry-weather flow of the streams by a controlled discharge of water impounded above the source of these mineral wastes. While in the past more thought has been given to the discharge of mineral wastes during flood stages in the receiving stream, it is possible that in the solution of flood problems some of the water presenting a problem at one time can by storage be made to serve a need at another time.

"The amount of chloride calculated as sodium chloride or common salt carried in the Neosho river at times will serve to show the magnitude of the problem. In the fall of 1923, with a flow of only 160 second-feet, there was approximately 772,500 pounds, or over 360 tons, of salt being carried down the river every day, and in the spring of 1924, with a flow of 260 second-feet, over one-half million pounds of salt were carried every day by this river. It is also of interest to note that half of these amounts could have been carried without cause of complaint from other riparian users of the stream. This could have been accomplished by impounding half of the salt water that was being produced or by releasing impounded fresh water to double the flow."

Information reaching the committee indicated that in some respects the problems brought about as conditions of minimum flow occur are as acute and their solution as urgent as the problems which exist when the flow of the stream exceeds the capacity of the channel.

What the committee desired especially to investigate was the extent to which it would be possible to find common solution of these two perplexing problems, more specifically the extent to which reservoirs built for flood control might also serve to build up low-water flow. Bearing in mind the often repeated assertion that reservoirs for flood control are not feasible, the committee wanted to find whether such reservoirs might not be feasible if they could be made to serve also to bring low flow up to a satisfactory minimum, and cost distributed equitably among those who would benefit.

A project of this kind has been developed and is functioning successfully on the Beaver river in the state of Pennsylvania. Nearly twenty years ago the dry-weather flow of that stream was no longer sufficient to meet the demands made on it by increasing population and growing industry. Development was checked because of limited water supply. The stream was also subject to destructive floods. As a result of studies made by the state, reservoirs were built to conserve part of the flood waters, and supplement dry-weather flow.

The effect of these reservoirs has been to increase the former low-water flow of 20 cubic feet per second to a minimum of 400 cubic feet per second (an amount sufficient for the needs of the people and industries), and to decrease flood heights 3.9 feet, or the volume of flood flow from 25,200 cubic feet per second to 17,000 cubic feet per second. This suggests the advisability of at least giving the matter consideration in connection with the problems on Kansas streams before a conclusion is reached.

In order to secure what information it could, the committee called a conference, which was held in Topeka on May 21. To this conference were invited the chief engineer of the Board of Health, representatives of the cities and industries along Kansas streams, and others who might be interested in the problem. While the information obtained from this conference was not sufficient to justify a conclusion, it did indicate that both problems should be thoroughly studied, as plans for the control and use of water are being developed for each stream.

#### STREAM CLEANING AND MAINTENANCE.

The clogged condition of many Kansas streams has been held to be at least partly responsible for the frequency and severity of overflow in recent years. As noted in the introductory part of this report, the committee made a trip to personally examine a number of the principal streams. On this trip a great deal of interesting and valuable information was obtained. Briefly, the committee found all of the streams visited, with the exception of the Kaw, clogged, some of them to an astonishing degree, with trees, brush and slides.

On the trip a number of pictures were taken. A few of them are included in this report to illustrate some of the conditions found.

Slides of the character of those shown in figure 4 are of frequent occurrence during flood periods, not only on the Marais des Cygnes, Neosho and Verdigris, but on many other Kansas streams having high banks which are covered with trees. On nearly all of these slides are found large growing trees. The weight of these trees, and especially the enormous leverage exerted by the large trunks, due to their swaying under the action of flowing water and wind, are undoubtedly among the chief causes of the occurrence of these slides, this swaying having the effect of loosening and shaking up large masses of earth already water soaked. In this connection it is of interest to note that there were no slides along the city parks

at Independence and Neodesha where the banks have been kept clear of undergrowth and such trees as were not suitable for shade, nor were any slides found at other places along these streams where the banks were kept free from overhanging trees and undergrowth which obstructed the flow of water. The numerous slides observed



FIG. 1. The Neosho river about 200 feet down stream from the bridge on highway U. S. 50-S, a few miles east of Emporia. A mud bar or low bottom is covered with down timber, as well as brush and undergrowth. This picture illustrates very well the condition of the Neosho river through the eastern part of Lyon county.



FIG. 2. The Verdigris at Independence. Although the banks here are nearly 30 feet high, trees are growing right down to the water's edge. These serve to break the velocity of the water and thus make a considerable portion of the channel ineffective for the discharge of flood waters.



FIG. 3. The Verdigris near Independence. Large trees have slid down both sides into the bed of the stream and are firmly imbedded in mud bars which have formed about them.



FIG. 4. Slides on the Verdigris. The picture shows two slides in which great sections of the bank have slid into the stream, causing serious obstructions in the channel.

were all associated with the presence of a heavy growth of trees and brush on the banks.

The committee is convinced that the clogged and obstructed condition of Kansas streams is in a large measure responsible for the frequency of overflow, and that the proper cleaning and maintenance of these streams should be undertaken at once. It has been estimated

by experienced engineers, for example, that clearing the channel of the Marais des Cygnes would increase its capacity 30 per cent, and measurements made by the Division of Water Resources justify the opinion that the capacity of many other streams would be increased from 25 to 30 per cent. If such is the case, then we can conclude that with properly cleaned streams what are now small floods would be carried with no overflow, and the heights of large floods would be materially reduced, thus reducing also the area of land flooded.



FIG. 5. A section of Fall river near Neodesha. The bank has been cleared by the owners, the Standard Oil Company.



FIG. 6. Looking downstream from the same point from which figure 5 was taken, and showing how the same stream looks uncleaned.

In looking for a way in which to remedy this condition, the committee was confronted with the remarkable situation that, while the streams of the state perform very important public functions as carriers of flood water, and while public convenience and safety depend in a large degree on the condition in which such streams are kept, the public has no means by which it can enforce its interests in these streams to the extent of seeing that they are kept in a proper condition to perform the service required of them.

Undoubtedly the ownership of unnavigable streams should remain as it now is, in the riparian landowner, and he should be allowed to enjoy whatever benefits accrue to him from his position on the stream, but the cleaning and maintenance of the stream should be a matter of public concern and responsibility; should be under public control and direction, and should be done in a systematic and well coördinated manner throughout the entire length of each stream.

On state streams, where the state is now receiving revenue from the sale of mineral products from the bed of such streams, a portion of the cost of maintenance should properly be borne by the state. The justice of this is especially apparent on the lower Arkansas, where the works constructed for the removal of such minerals are themselves seriously obstructing the flood way of the stream and have created an additional flood hazard for the people in the valley.

The statutes now contain a provision (R. S. 19-238 to 19-240) permitting the counties to do a certain amount of stream cleaning, but the act appears to be inoperative, and it is doubtful if a workable instrument can be developed without a completely new act.

The committee is convinced that not only does stream cleaning hold a promise of greater benefit for the amount of money expended than any other form of flood-control works, but it offers the only prospect of early relief from the situation which now exists.

#### WATER CONSERVATION.

The necessity for water storage and conservation was stressed by almost everyone from the western part of the state who attended the state-wide meeting of December, 1927. As one proceeds westward across the state the problem becomes less and less one of flood control, and becomes increasingly one of saving and retaining for use the meager run-off from that part of the state. Unlike the arid western states, the greatest precipitation in Kansas does not occur in those regions having greatest altitude, and it is therefore im-

possible to store any of the abundant run-off of eastern Kansas and transport it to the western part where it could well be used. The problem with which we are confronted is to store as much as possible of the moisture which falls so that it can be used for domestic and municipal water supplies, for irrigation, or in some instances left to seep into the ground to supplement ground-water supplies. The situation during periods of dry weather becomes such that both private and municipal wells fail, and at times it has been necessary to sell thousands of head of stock because farmers were without water for them. This situation can be met only by building ponds and reservoirs on individual farms, along highways and on draws and streams to store the water as nearly as possible where it falls. That means the building of great numbers of small dams.

There are in the statutes a number of laws calculated to encourage the storage of water. One of these laws (R. S. 42-201, 42-609) is intended to compensate landowners who construct dams across dry draws or watercourses by allowing a reduction in the assessed valuation of their land. This reduction in valuation, ranging from \$100 to \$300 according to the type of construction in the dam, not only has not been sufficient to bring about the desired storage of water, but it is so insignificant that people who have built dams have not taken the steps necessary to claim it.

Another act (R. S. 68-901 to 68-908) provides for the storage of water along highways by the construction of dams as a part of the highway grade where the highway crosses creeks, draws and ravines. This law appears to be good, and should be used to a greater extent than it now is. Undoubtedly the cheapest storage which it is possible to secure can be obtained in that manner, since much of the fill which would be necessary for the dam is required also for the highway grade. County authorities with whom the committee talked generally feel that this law has considerable merit, but they are reluctant to incur a higher cost per mile for road construction as long as their funds are insufficient for the construction of the large mileage of still unimproved county roads.

On its trip through the western part of the state, the committee visited a number of dams constructed by landowners for the storage of water, and was pleased to observe the large number of such dams, but notes with regret that a great many of them were so poorly constructed that they must soon fail. Not only has sound engineering been disregarded in the construction of the embankment, but no consideration seems to have been given to the amount of spillway

required to safely pass surplus flood waters around the dam. The result is that many of these dams will be overtopped and destroyed when the first heavy rain occurs.

Concerning dams of this kind, Mr. W. V. Jackson, speaking at the December, 1927, conference, made this rather significant remark:

"I have seen hundreds of these little dams put in by cattle men for water supply and for irrigation propositions, and I venture to say that 95 out of every hundred of them go out, because they do not have sufficient information as to the amount of water that will flow down and must pass over a spillway."

Undoubtedly, as far as purely private dams are concerned, nothing but a campaign of education will improve the situation. The committee believes, however, that the law relating to compensation for the impounding of water should be rewritten, not only to provide a greater reduction in assessed valuation of land on which such dam is built, but to make the reduction directly proportional to the amount of water which it is possible for the project to store, and that into the law should be written a provision requiring that the plans for such dams be made by a competent engineer, be approved by the Division of Water Resources, and the satisfactory completion of the works in accordance with such plans certified before such compensation can be claimed.

#### CONCLUSIONS AND RECOMMENDATIONS.

The committee is of the opinion that there is great need for a state policy and plan for the control and use of the water resources of the state. In its absence, development, whether for the use of water or the control of floods, cannot be expected to proceed along those orderly and well coördinated lines which will ultimately bring about the most effective control and greatest use of this most important natural resource.

The purpose of such a policy and plan should be to lay the foundation for the systematic control and development of our streams in order that the greatest ultimate benefit may be obtained from them. These matters cannot wisely be left to individuals, private corporations or governmental subdivisions if coördinated development and control is to prevail. Various phases of our water problems have in the past been studied independently instead of collectively, and their relationships have not always been properly recognized.

Probably no other one of the natural resources of the state is related so intimately to all of the others as is water, and it is becoming increasingly important to the life and comfort of man. It is important, therefore, that each entire stream be studied in all of its aspects before works are built which will permanently change its channel or its discharge.

The need of a definite program was recognized to some extent in 1917 when the Kansas Water Commission act was passed. The Water Commission in that act was instructed to "work out a systematic general plan for the complete development of each watershed in the state in order to secure the most advantageous adjustment of the interests involved in matters of floods, drainage, irrigation, water power and navigation." However, sufficient appropriations were not made to enable the Commission to do more than carry on stream gaging. It was abolished in 1927, and its duties transferred to a Division of Water Resources in the State Board of Agriculture. The authority of law now exists for the adoption of such policy.

An adequate policy and plan for the control and development of the waters of the state can be formulated only in so far as present and probable future conditions are known and understood. Even then a plan will not be perfected all at once, but in many respects it must be a matter of growth and development. However, the time is here when the state should undertake a program the object of which is to formulate such a policy and plan. For this purpose it is necessary, first, to have a thorough knowledge of the streams of the state, so that the problems of use and control may be known; second, general plans for solving these problems; and, third, an orderly legal code should be enacted which will insure proper supervision and control.

In order to lay a sound foundation the Division of Water Resources should study the character and extent of each drainage area, the conditions of rainfall and run-off, the extent to which floods menace life, destroy property and restrict growth; the extent to which the streams are and may be called upon in the future for water supplies for domestic and industrial use; the effect which reservoirs which may be constructed primarily to equalize stream flow or store water for domestic or industrial use or for irrigation, will have upon flood conditions on the stream, and the possibilities of water power. This will require:

1. The continuation of stream gauging to determine conditions of river flow at all stages.

2. Profiles of all the principal streams. These should show, besides the slope of the stream, the location of all dams and bridges, the area of bridge openings, and high-water lines wherever they can be obtained.

3. Complete topographic maps. Regular United States topographic maps now cover all but a few quadrangles in the western part of the state. Besides the completion of these maps, topographic surveys not greater than two-foot contour intervals should be made of the flood plains of our streams. These are necessary, among other things, for a study of the quantity of water which goes into temporary storage in the valley when overflow occurs in order to determine how much permanent storage will be required to take its place when overflow is prevented, or if not replaced, how high the flow line of the stream will be raised when works are built to confine flow to the channel of the stream. This temporary storage has a material effect on flood stages.

4. An examination of possible reservoir sites. This should include a study of the extent to which such reservoirs might be used to control floods or conserve water for subsequent use.

With this information at hand, tentative general plans should be made for the control, use and development of each stream, to the end that a general policy may be followed without conflict or lack of coördination. This work should result in foreseeing water-control problems which may arise; should determine the best methods for solving these problems, and should outline the units in which the work can best be handled.

Many of our Kansas streams require flood control, and at the same time there are demands upon them for domestic and industrial water supply which greatly exceed the present dry-weather flow. It may be found that reservoirs for domestic water supply and also for industrial water supply are feasible, and that by combining the two functions large economies in cost may be secured. It may be found, further, that flood control by reservoirs is feasible, but that, if reservoir capacity is secured for water supply, flood prevention must be secured by other means, as by channel improvement and the establishment of permanent shore lines. It should be the duty of the Division of Water Resources to weigh the comparative needs and values of the available storage capacity, to decide what use

should be made of this capacity, and to plan other methods to solve the remaining problems.

Such a course will tend to insure the orderly and systematic development and control of the water resources of the stream, and will tend to prevent future developments from becoming a confusion of conflicting interests. Millions of dollars have been wasted in flood-control work in the Middle Western states through the lack of comprehensive plans for development.

The Division of Water Resources should be a clearing house of general information for the public in reference to problems of public water control—not in the sense of being consulting engineers, but by outlining policies and by furnishing information which only a public institution can collect.

As water-control projects are initiated from time to time in various parts of the state, the Division of Water Resources should furnish advice as to the general methods which may be used in approaching the problems, and should have regulatory powers over such undertakings. This advice and direction should indicate whether the community or corporation in question can best work out its problems alone, or in coöperation with other communities, and whether a single object, such as water supply, can best be secured alone, or whether more than one object, such as water supply and flood prevention, or water supply and power development, should be provided for by the same improvement. Such supervision will reduce waste of public and private funds in ill-advised or impracticable projects, and would aim to secure the safest and most beneficial use of the waters of the state.

The plans for water control and utilization on each river system should be developed to such a point that when any community or corporation desires to undertake the construction of works for either flood prevention, water supply or water power, the following information can be furnished:

With reference to flood-control problems:

- (a) The extent of the menace.
- (b) The most promising methods of control.
- (c) Whether the community or company in question can best handle its problem alone, or in coöperation with other communities or interests. This would include the outlining of the territory which ought to be included in the unit for development.
- (d) Whether flood control should be undertaken without

reference to other problems, or whether it should be combined with water supply or water power.

(e) Whether, in case conditions are not ripe for undertaking a comprehensive improvement, partial, local, or temporary improvement could be secured without interfering with future possibilities.

(f) Whether limitations should be imposed upon the community or corporation in question in order to protect other communities or interests. This would include the outlining of the territory which ought to be included in the unit for development.

(g) How to initiate and organize public undertakings.

As plans for the improvement would be developed by the engineers employed by the local communities or interests, these engineers would have access to the information in the hands of the Division of Water Resources, and the completed plans would be examined by that department to insure their adequacy for the protection of the public, when measured by state standards.

The function of the state should be educational, advisory and regulatory. Many communities cannot determine or do not appreciate their own needs. Frequently it is impossible for them to maintain suitable engineering organizations, or to spend the time and money in collecting information necessary to see a situation in its broader aspects. They tend to view their problems locally, and to work them out without regard to the interests of other communities. The proper work of the state is to furnish to each community such information and direction as commonly only the state can give; to make clear to the community what are its needs and duties in the matter of flood control, how it can meet them, and how they are related to other problems; and to indicate what are the natural units in which to work. As this service of education, regulation and advice would be furnished alike to all communities, it is a state function to be paid for by the state.

The committee recommends:

1. (a) The enactment of a conservancy-district law patterned after the Ohio act, the provisions of which will extend with equal fairness and effect to districts created for stream-flow equalization as well as to drainage, levee and irrigation districts.

(b) That hereafter the plans for all drainage, levee and irrigation districts must be approved by the chief engineer of the Division of Water Resources before such works can be built or rebuilt.

(c) That the present drainage and levee-district laws should remain on the statute books, but that the irrigation district act (R. S. 42-357 to 42-388) should be repealed.

2. The adoption of a system of maintenance for the streams of the state and their tributaries, up to that point where the drainage area above, on each, does not exceed 200 square miles, with the following provisions:

(a) The work to be done under the direction of the board of county commissioners in the same manner as county road work.

(b) One-half of the funds to be raised from a levy on the entire county, and the balance from an additional levy on property in the flood plain of the valley.

(c) One-half of the proceeds of the sale of products taken from the bed of any river which is the property of the state of Kansas to be returned to the counties through which such river flows in proportion to the mileage in each; such fund to be used only for actually cleaning and maintenance of such state streams.

(d) The Division of Water Resources to make surveys to establish the bank lines to which all streams must be maintained throughout the length.

(e) The act should further provide that no obstructions could extend into the stream beyond these established bank lines without the consent of the chief engineer of the Division of Water Resources.

(f) This act not to apply to those portions of any stream lying wholly within the boundaries of any organized drainage or levee district, provided that that portion of such stream is actually improved and maintained by and as a part of the work of such district.

3. (a) The amendment of the present act (R. S. 42-601 to 42-609), allowing compensation for reservoirs constructed to conserve water, to provide greater compensation, the compensation to bear a direct relation to the capacity of such reservoirs.

(b) That in order to claim such compensation, plans for such dams must be approved by the chief engineer of the Division

of Water Resources, and the dams constructed in accordance with such plans.

4. The repeal of present act (R. S. 42-333 to 42-337) which requires an engineer designing a dam to give bond for its safety, and the requirement that hereafter the plans of all dams constructed to a height greater than ten feet, or impounding more than 15 acre-feet of water, must be approved by the chief engineer of the Division of Water Resources before such works may be built.

