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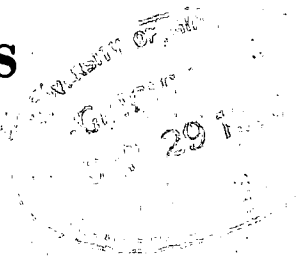

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WATER-RESOURCE DEVELOPMENT IN THE UNITED STATES

THE purpose of this article is to review recent activities in water-resource development in the United States, especially as they relate to economic problems and water policy. Trends in water use, emerging economic problems, progress of water programmes at various levels of government and water-resource policy will be covered. The use of our water resources is so closely related to the use of our land resources and to the distribution of our population that some attention is given in this article to related land-use problems.

Water-resource development activities are an integral part of the general problem of land and water conservation policy. In terms of public-policy considerations, the definition of conservation of land and water may be divided into two parts: (1) the maintenance of the productive potential of land and water resources to meet present requirements; and (2) the increase of the production potential of land and water to meet future requirements arising from population growth and economic development and to maintain a safe contingency reserve.[1]

In maintaining the production potentials of land and water as indicated in the first part of this definition, we attempt to prevent any use of land and water resources that destroys the future productivity or usefulness of the resource. The second part of the definition is a dynamic concept providing for economic growth. It involves an analysis and evaluation of many factors that have changing relations over time. The best possible estimates are needed of trends in such factors as population growth, economic activity, preference in diets, technological change, yields, exports and imports, and competing uses for land and water resources, so that public and private conservation efforts may achieve the maximum return. What is some of the recent thinking regarding these trends in the United States?

Population growth and distribution are major factors in the appraisal of future requirements for land and water resources. The most

[1] Panel discussion on mobilizing research for progress in soil and water conservation, Agricultural Research Institute, National Academy of Sciences, Washington, D.C., 14 October 1958.

recent population projections for the United States indicate that we might expect a population of about 370 millions in the next fifty years. It might be that we should have a low range of something like 300 millions, and some estimates run as high as 440 millions by the year 2010. Although total population is the most important single factor in determining future requirements for land and water resources, other factors enter into the determination. For example, the composition of our diets and the development of substitutes and synthetics would affect total food requirements.

Technological change is one of the chief factors affecting the productivity of the land and water resources. It is also one of the most difficult factors to evaluate and to predict. Changes in technology affect the production, marketing and utilization of agricultural and non-agricultural products. Improved efficiency in any of these steps can change requirements for land and water resources. We have made great progress in technological development in both the agricultural and the non-agricultural parts of our economy. These changes are usually attributed to our private and public investments in research and education.

For example, most of the gain in farm production in recent years has come from greatly increased output per acre, while acreage of cropland in the United States has changed very little. Output per animal has increased also but at a slower rate. When known technology is more widely adopted, and consideration is given to new technology that might become available, much greater increases in yields are anticipated for the future.

Exports and imports must also be considered in appraising our future requirements. Increased imports could be the source of part of our future requirements, thus reducing the need for land and water resources in this country. But increased exports would add to our requirements, thus increasing the need for land and water. In 1957 our exports accounted for the production from about 50 million acres of cropland.

Non-agricultural uses of land and water will become increasingly important as our population increases and our economy becomes more industrialized. Because the *per caput* use of land and water increases as our economy becomes more industrialized, the total water requirements for urban services, industry, transportation and recreation will increase at a faster rate than our anticipated increase in population. Although the acreage of land devoted to non-agricultural use makes

up only about 9 or 10 per cent. of the land area in continental United States, serious conflicts often arise between these uses and agricultural uses in local areas. This has given rise to concern over this problem and to attempts to control changes in land use by zoning and other devices.

While the growth of population and economic expansion is expected to cause serious land-use problems, the more serious impact will be on our water resources. Use of water has increased at a spectacular rate in all parts of the United States and in practically every type of human activity. The United States Department of Commerce has estimated that total water use in the United States (excluding use for hydro-electric power generation) increased from approximately 40 billion[1] gallons per day in 1900 to more than 260 billion gallons per day in 1955.[2] In the latter year, about 120 billion gallons per day were used for irrigation, 17 billion gallons for public water supplies, 120 billion gallons by industries (including steam electric power) from their own supplies and about 5·4 billion by farms and other residences not connected with public water supplies.

With a projected rate of growth that would entail a population of 370 millions by 2010, it is estimated that total water use in the United States would about double by 1975 and would quadruple by 2010. Industrial uses would increase much faster than other uses. In addition to these uses of water, and in some instances conflicting with them, is the use of water resources for recreation. Although this is not a consumptive use, it may not be compatible with some other uses. It is difficult to measure the value of water for this purpose. Again, the projected rate of population growth and distribution indicates a rapid increase in demand for the recreational use of water.

Hydro-electric power generation has played an important role in river-basin development, and revenue from power sales has been the major cash return from many public projects. While power generation may not always be compatible with other purposes, in multi-purpose projects and integrated river-basin development a balance between purposes may be achieved that maximizes the total benefits from all purposes. In addition, there is the problem of integrating the hydro-electric power with fuel-generated power in the same market area. Considerable public effort has been made to promote the wide-

[1] In this article, 1 billion = 1,000 millions.

[2] Walter L. Picton, *Summary Information on Water Use in the United States, 1900–1975*, U.S. Department of Commerce, Business and Defense Administration, Water and Sewerage Industry and Utilities Division, BSB-136, Washington, D.C., January 1956.

spread use of electricity. Along with these problems, the role of public agencies in production and marketing of power is one of the most controversial water-resource policy issues.[1] The increase in demand for water will probably mean that hydro-power will have a less important place in river-basin development. Hydro-power now makes up only a small percentage of total capacity, and fuel generation could be substituted for hydro-generation when desirable. Thus, hydro-power may yield to competing uses of water for which there is no readily available substitute. Hydro-power would still remain as a significant purpose in river-basin development because in many instances it is compatible with the other purposes.

Much of the water used is not consumed. In 1955 it was estimated that 10 per cent. of all water used from public water supplies and from domestic self-supplies was consumed; that 60 per cent. of irrigation water was consumed; but that only about 2 per cent. of the industrial self-supplied water was consumed. Probably these rates of consumptive use will still apply in 2010. Thus, while our total use in the year 2010 would approach the upper limit of water supply as measured by long-term average run-off, the consumptive use would be much less than this.[2] It is possible to re-use water many times for non-consumptive uses, provided that means for purification, waste treatment and re-cycling are available.[3]

However, the supply of water does not coincide geographically with the need for water. The average annual run-off varies from less than one-fourth of an inch in the arid south-west to more than 80 inches along the Pacific Coast. Also, seasonal and annual flows fluctuate more widely than average flows. Some of the flood flow occurs in such a way that it is uneconomic to store it for use in drought periods. Thus, although we now consume only a fraction of the water that flows across the country on its way to the sea, there are many conflicts over its use. A water use may be non-consumptive and still render water unfit for some other use. As the *per caput* and total uses of water increase, the number and intensity of the conflicts between water uses and water users will increase.

In some areas there is now serious conflict between water uses that

[1] Irving K. Fox, *National Water Resource Policy Issues.* Law and Contemporary Problems (Water Resources) 22(3): 472–509, 1957.

[2] The U.S. Geological Survey estimates the long-term average run-off at 1,164 billion gallons per day. Kenneth A. MacKichan, *Estimated Use of Water in the United States, 1955.* U.S. Geol. Surv. Cir. 398, Washington, D.C., 1957.

[3] Gilbert F. White, *A Perspective of River Basin Development.* Law and Contemporary Problems (River Basin Development) 22(2): 156–87, 1957.

compete for a limited supply. Cities are reaching farther out for water. In doing so, they are coming into competition with agricultural uses. Available water supply is becoming a major factor in the location of new industry. There is an increasing investment in irrigation facilities in humid areas with an increased use of water for this purpose, and a demand for water-rights legislation to protect the investment. The changing value of water in different uses may require a change in procedure for allocating water between uses.

With the increased demand for water, conservation of water will become more important. Our system of water rights has sometimes led to misuse. In other instances, current values have not encouraged conservation. If the value of alternative uses of water and the cost of additional supplies increase, there will be more economic incentive to prevent misuse and to encourage conservation and beneficial use.

A major use of rivers in an industrial economy is for the removal of industrial waste. As re-use of river water becomes more important, public demand for pollution control will increase. It was estimated in 1957 that only about 50 per cent. of the municipal pollution and about 50 per cent. of the organic load in industrial wastes are now removed before discharge into streams.[1] Much remains to be done to make water usable down stream for many purposes.

Erosion control and proper watershed management continue to be important in a large part of the country. In many areas flood-water and sediment damages are extensive. There is evidence that we are gaining little ground in our efforts to solve the flood problem.[2] In a recent study the conclusion was reached that the mean annual reported flood losses have increased over the period of record.[3] The flood-damage potential in urban areas is increasing almost as fast as the rate at which engineering protection works are currently reducing losses from flood damage. Programmes to prevent use and occupancy of flood plains in ways that increase the flood-damage potential are needed to complement the protection given by reservoirs, levees, and other flood-control structures.[4]

[1] *State Administration of Water Resources.* The Council of State Governments, Chicago, Ill., 1957.

[2] Brig.-Gen. Herbert D. Vogel, *Flood Problems of Expanding Urban Areas.* Address presented at the National Conference on Flood Plain Regulation and Insurance, Chicago, Ill., 1 December 1958.

[3] Gilbert F. White *et al.*, *Changes in Urban Occupance of Flood Plains in the United States.* University of Chicago, Department of Geography, Research Paper No. 57, Chicago, Ill., November 1958.

[4] Francis C. Murphy, *Regulating Flood-Plain Development.* University of Chicago, Department of Geography, Research Paper No. 56, Chicago, Ill., November 1958.

Research is needed on all these problems, as well as on ways of increasing and conserving usable supplies of water and allocating them to the greatest advantage. Wise planning and institutional adjustments are needed to provide means for orderly solution of these problems of water use and development.

In 1955, the report of the President's Advisory Committee on Water Resources Policy pointed out that to meet future demands for water successfully, we must move toward the goal of making beneficial use of water from the time it falls on the land until it reaches the sea. This task will require the continuing efforts of all levels of government and of the many private interests concerned. There is general agreement as to the basic elements of a sound water policy, as outlined in the 1955 report. This policy would look towards an adequate water supply for our people, prevent waste of water, provide for greater re-use of water, reduce water pollution, provide means for the beneficial use and equitable distribution of available water supplies and take steps to check the destructive forces of water that threaten to injure or destroy land, property and human life.[1]

However, there is some difference of opinion as to the achievement of these goals. The issues have been the subject of several presidential survey commissions, of congressional investigations and discussions, and of recommendations by many private groups.[2]

The main programme-management functions in water-resource development that need to be performed at one or more levels of government include collection of and research on basic data, planning and evaluation of measures, acquisition of property and construction operations, maintenance and operation, resource budgeting, financial management, and co-ordination of related land-resource developments with water-management projects.

The distribution of these functions between the Federal Government and the various State and local governments is one of the basic

[1] Harry A. Steele, *Recent Activities of Water Resource Development in the United States.* Address presented before the Sub-committee on Land and Water Use of the European Committee on Agriculture, Food and Agriculture Organization of the United Nations, Lisbon, Portugal, 21 February 1956.

[2] In addition to the Report of the President's Advisory Committee, the major commission reports are: (1) *A Water Policy for the American People*, vol. 1. The Report of the President's Water Resources Policy Commission, 1950. (2) *Missouri: Land and Water.* The Report of the Missouri Basin Survey Commission, U.S. Government Printing Office, Washington, D.C., 1953. (3) *Water Resources and Power.* Commission on the Organization of the Executive Branch of the Government, 2 volumes, A Report to the Congress, June 1955. (4) A Report to the President for Transmittal to Congress. Commission on Inter-Governmental Relations, June 1955.

considerations in water policy in the United States.[1] Federal powers in the water-resource field derive chiefly from the constitutional authority to regulate inter-state commerce and to spend for public purposes. Powers not delegated to the Federal Government in the Constitution and not implied as 'necessary and proper' are reserved to the States. For example, State laws govern the individual's rights of ownership and tenure of water resources, the taxation of property, and the regulation of use of property. Such local governments as counties and local districts are subdivisions of the State, and the State may delegate its powers to local governments for water-resource development. Many river basins cover two or more States, so special organizations may be needed to handle inter-state and State–Federal relations.[2] Some of the problems and recent developments in water programmes at each of these levels of government are covered in the following pages.

National Planning

Considerable attention has been given to the planning and policy issues that are encountered at the national level. The main issues are (1) achieving co-ordinated water policy and giving positive direction to planning and scheduling of water-development projects; (2) providing independent review of engineering and economic feasibility; (3) scheduling projects in relation to the overall budget and the need for the services of the project; and (4) presenting programmes to Congress so that it may have alternatives to choose from within the general framework of feasible projects.

In the 1930's the National Resources Planning Board worked toward co-ordinated policy and the establishment of standards for planning water projects. The more recent agencies working in this field are the Federal Inter-Agency River Basin Committee and the Bureau of the Budget. The Inter-Agency Committee was established following the dissolution of the National Resources Planning Board. Its monthly meetings are devoted largely to review of reports and consideration of problems presented by several standing sub-committees.

[1] Harry A. Steele and Mark M. Regan, 'Organization and Administrative Arrangements for an Effective Water Policy', *Journal of Farm Economics*, vol. xxxvii, pp. 886–96, December 1955.

[2] There are many international rivers with accompanying international problems of water ownership, control and development. See *Integrated River Basin Development*. Report by a Panel of Experts, Department of Economic and Social Affairs, United Nations, New York, 1958.

A major effort toward achieving uniformity in planning water projects was the preparation by the Inter-Agency Sub-committee on Benefits and Costs of the report *Proposed Practices for Economic Analysis of River Basin Projects*.[1] This report compared evaluation procedures followed by the various agencies, and presented the first reasonably consistent approach for project analysis. The Bureau of the Budget has issued Circular A-47, which prescribes by executive regulation many of the procedures outlined in the sub-committee's report.

In 1954 a new charter was approved for the Inter-Agency Sub-committee and its name was changed to the Inter-Agency Committee on Water Resources. The purpose of the new committee is to provide improved facilities and procedures for co-ordination of the policies, programmes and activities of the Federal departments in the field of water and related land resources.

The member agencies and their functions relating to water and related land resources have been outlined as follows:[2]

Department of Agriculture. Watershed protection and flood-prevention activities; water-facilities loan programme; watershed aspects of the national forests; farm conservation activities; land and water research; and general interest in the Nation's agricultural resources.

Department of the Army (The Corps of Engineers). Flood control, river and harbour development in connexion with navigation, generation of power and water supplies.

Department of the Interior. Collection of basic data such as stream-flow, ground water, topography and geology; soil and moisture conservation on public and Indian lands; irrigation, power and water-supply projects; research and pilot plant on salt-water conversion; fisheries and migratory waterfowl conservation; national parks and recreation interests; mineral investigations; and hydro-electric power marketing activities of several regional power administrations.

Department of Commerce. Collection and analysis of basic weather data; river and flood forecast and warning services; coast and geodetic

[1] *Proposed Practices for Economic Analysis of River Basin Projects.* Report to the Federal Inter-Agency River Basin Committee, prepared by the Sub-committee on Benefits and Costs, Washington, D.C., May 1950.

[2] Adapted from: (1) *Water Resources Policy.* A Report by the Presidential Advisory Committee on Water Resources Policy, December 1955. (2) *Measurement Aspects of Benefit-Cost Practices.* Second Progress Report to the Federal Inter-Agency River Basin Committee, prepared by the Sub-committee on Benefits and Costs, Preliminary Statement, Washington, D.C., November 1948.

surveys; highway re-location and navigational clearances in highway bridges on water-development projects; and general interest in overall transportation policy.

Department of Health, Education and Welfare. Planning for municipal and industrial water supplies and administration of the water-pollution-control Act.

Federal Power Commission. Granting permits on all non-Federal hydro-electric power developments on navigable streams; approval of rates for sale of power from certain Federal projects; and general interest in planning hydro-electric-power development.

In addition to these member agencies, other Federal agencies may participate as their interests are involved. For example, at the time of scheduling construction, the Department of Labour may be concerned with availability and other matters relating to labour. Likewise, the Department of State would be concerned with problems involving international boundary waters. The National Science Foundation has recently been given the responsibility of research on weather modification (Public Law 85–510, s. 86, approved 11 July 1958).

River Basin Organizations

In working together on inter-state problems, Federal and State Governments face difficult policy issues. These include, among others, the division and use of water in inter-state streams, pollution control and joint planning and development of water resources.

Not only must the States co-operate with the Federal Government; they must also co-operate with each other in many ways. Uniform and reciprocal State laws and administrative agreements between States are examples. However, the inter-state compact is the chief device used for co-ordination of water control and development between States. Many inter-state compacts have been used to divide the waters of an inter-state stream or for similar purposes. In some instances, States with common problems have established planning and co-ordinating agencies by inter-state compact.[1]

In the last twenty years the river basin has been accepted by many as the appropriate physiographic unit for planning and developing water resources. The interrelated uses of water and other resources within a river basin result in complex problems that can be solved best

[1] *State Administration of Water Resources.* The Council of State Governments, Chicago, Ill., 1957, p. 19.

by integrated action within its natural boundaries. This principle has been recommended by all major commissions and organizations on water policy. It has been recognized by the Congress in the authorization of interrelated water-control projects for major river basins. Particular segments of river-basin programmes are also required to adhere to this principle. For example, the Secretary of Agriculture is instructed in the Watershed Act and by executive order to submit watershed plans only if 'satisfied that such works constitute needed and harmonious elements in the comprehensive development' of the river basin involved.

Although there appears to be general agreement as to the objective of river-basin development, there is much less agreement as to the kind of organization needed to meet the objectives of basin planning. This issue has been debated for some time and from this debate have come several proposals for river-basin organization.

The Tennessee Valley Authority Act created in 1933 a corporation controlled by the Federal Government to develop water, land and other resources of the Tennessee River Basin. This corporation was given authority to make decisions, and responsibility for developing resources as a unified whole. It was directed by law to work co-operatively with and through local and State agencies. Under this arrangement, a comprehensive programme of water-resource development is being achieved. Similar organizations in other river basins have been proposed from time to time. However, this type of organization has not been adopted in any other river basin in the United States.

Since 1946 Inter-Agency Committees have been created by administrative action in the Missouri, Columbia, Pacific South-West, Arkansas–White–Red, and New York–New England basins. These are committees of interested State and Federal agencies engaged in activities relating to water resources; usually, they operate by mutual agreement; and they achieve a measure of co-ordination by frequent consultation and review. In the Arkansas–White–Red and the New York–New England basins comprehensive reports were prepared by the basin committees. In each basin construction activity on authorized projects is proceeding. In the last few years the charters of the various river-basin inter-agency committees have been reviewed and revised to improve the co-ordinating activities of these committees.

In 1958 the Congress created two new land and water study commissions in an action that may provide a new pattern for river-basin

planning. In setting up the Texas Land and Water Study Commission (Public Law 85–843) and the South-East Land and Water Study Commission (Public Law 85–850), the Congress has provided a new form of organization for the co-ordination of river-basin planning. The objective of these commissions will be to provide for an integrated and co-operative investigation, study and survey in order to formulate a comprehensive and co-ordinated plan that will ensure optimum sustained use of the resources of the region and the nation as a whole. It will be the duty of these commissions to consider carefully the complete range of views and desires of the Federal, State and local governments, as well as private interests. In addition to a chairman, each commission is made up of representatives from the various States or river basins involved and from six Federal agencies. The Federal and State representatives are not to serve as agency representatives but as members of the commission, which is an independent Federal agency whose members are appointed by the President of the United States. They will have national responsibility and will be accountable to the President in performing the duties of the commission. Federal funds are provided for a technical staff. The commission reports to the President through the Special Assistant to the President for Public Works.

State Organizations

The States and their political subdivisions must play an active and responsible role if we are to make the most beneficial use of water in the United States. The extensive powers of States over the use of land and water resources will need to be used more effectively in co-operation with the Federal programme.[1] At present, State water-resource programmes are primarily in the regulatory area, with some research, planning and informational functions and limited development projects.[2]

As water becomes an increasingly critical element in our economic life, the States will need to examine the laws under which it is controlled and used and, in some instances, to devise new State agencies to administer these laws. With the trend toward Federal grants-in-aid for local development, the States will need to make adequate provision

[1] *Missouri: Land and Water.* The Report of the Missouri Basin Survey Commission, U.S. Government Printing Office, Washington, D.C., 1953.

[2] *State Administration of Water Resources.* The Council of State Governments, Chicago, Ill., 1957.

for establishing local districts for resource development and to provide more State guidance and assistance to these subdivisions.

Several States have successful water-resource planning and development agencies. Many States have agencies to administer water laws but there are few with authority to plan and develop resources. Two different patterns of water-right law have developed in the United States. The riparian doctrine based on common law has been followed until recently in all thirty-one Eastern States. The seventeen Western States have adopted the appropriation doctrine, or a combination of the riparian and appropriation doctrines.

A large number of States have recently enacted, or are now considering, legislation dealing with water rights.[1] Laws have been enacted or legislation proposed in sixteen or more States, including California, Oklahoma, Texas, Arkansas, North Carolina, South Carolina, Wisconsin, Iowa, Mississippi, Kentucky, Indiana, Virginia, Florida, Delaware, Maryland, New Jersey, and Hawaii. In addition, Hawaii is considering some form of legal control of ground water.

In addition to these States, legislative, executive or citizens' study committees have been formed in a number of other States to study the problems of water rights in an effort to determine the type of remedial legislation needed.

Several States—including Wisconsin, Minnesota, and North Carolina—have enacted legislation to establish permit systems, and a number of State statutes have been enacted to curb pollution, to maintain lake levels and to protect and regulate navigation, mill dams, public water supplies, fishing and recreation, together with other objectives.

Modifications of the prior appropriation system have been adopted by Mississippi and Iowa. Particularly in Iowa, however, the State can in time recover the rights granted through issuance of permits based on prior appropriation.

Laws to facilitate the storage and use of waters impounded during periods of high stream flows have been enacted by Kentucky, Indiana, Virginia, Arkansas, Florida, Mississippi and Iowa.

State regulation of water use in critical areas has been provided for in New Jersey, Indiana, Arkansas, Florida and North Carolina law. In some instances, however, ground and surface waters are differen-

[1] Data supplied by Wells A. Hutchins and Harold H. Ellis, Farm Economics Research Division, Agricultural Research Service, U.S. Department of Agriculture.

tiated for these regulatory purposes. A move that has considerable promise in providing greater flexibility in meeting local water-administration problems was the transfer by several Eastern States of regulatory power to local water-management districts.

Legislation to establish a prior appropriation system has been proposed in recent years in Arkansas, North Carolina, South Carolina, Michigan and Wisconsin. Legislation to provide for the settlement of inter-sectional disputes over surplus water supplies is being considered in California. Refinements in the legal procedures for adjudication of water rights are being considered by the Texas Legislature. A revision of the water laws of Oklahoma is also under consideration. Hawaii is considering the applicability of both the prior appropriation and permit systems in controlling the use of ground water.

State activity in pollution control has been stimulated under the water-pollution-control Act of 1956, which authorized the Federal Government through the U.S. Public Health Service to co-operate with States on technical assistance and planning and to provide grants for water-pollution-control activities. Grants for construction of State-approved municipal projects may be made when the projects are part of a comprehensive plan.[1]

Local Districts

In recent years there has been a marked increase in local participation and responsibility in the development of land and water resources. States have authorized the creation of local districts of many types to deal with local aspects of these developments. These local districts are a specialized form of government with powers and authorities necessary for the development and management of resources. Single-purpose districts are the oldest and most numerous. In the United States we have about 2,200 drainage districts; about 750 irrigation districts; and 200 flood-control districts. In the last twenty years about 2,700 soil conservation districts have been established as local co-operators in the national soil conservation programme. A limited number of multi-purpose districts have broad powers to deal with several phases of land and water development.

Invested with appropriate powers and a willingness to carry them out, local districts are effective agencies for the development of

[1] *State Administration of Water Resources.* The Council of State Governments, Chicago, Ill., 1957, p. 16.

resources. They may undertake limited developments on their own initiative, or they may take an essential part in co-operative activities with State and Federal Governments.

Among the questions that need to be faced in establishing local districts are appropriate size, scope of function, relationship to local county and city governments, means of co-ordinating operations with neighbouring or overlapping districts, nature and extent of financial authority, and methods of assessing charges.

The passage of the Federal Watershed Protection and Flood Prevention Act in 1954 established a new set of relations between Federal Government and State and local organizations in water-resource development. This act authorizes Federal technical and financial assistance to local organizations for watershed flood prevention, irrigation, and drainage programmes. The local organization must apply for the programme, co-operate in planning, furnish rights of way and any necessary water rights, share in construction costs and provide for operation and maintenance. The Federal Government will provide planning assistance and technical and financial aid in construction of the works of improvement.

In order to take advantage of the programme, local organizations will need adequate financial resources and authority to meet these responsibilities. When the Watershed Act was passed in 1954, a large part of the United States was covered by some type of local district, but many of these districts lacked financial resources or did not have sufficient authority to carry out a watershed programme.[1]

Since 1954 a number of States have passed legislation to further local, State and Federal co-operation under the new Watershed Act. Many States have broadened the authorized functions of soil conservation districts, although few have given the districts power of eminent domain and taxation. A number of States have provided for the formation of sub-districts of soil conservation districts and have given these sub-districts expanded powers. A few States have given more comprehensive charters to drainage districts. Counties in some States already had powers and authority in the field of watershed development, and subsequent legislation has broadened this authority in other States.

Three States have passed new legislation enabling the creation of watershed or conservancy districts and four others have amended

[1] Harry A. Steele and Kirk M. Sandals, 'A Law That Puts Responsibility at Home'. U.S. Department of Agriculture, Water, *Yearbook of Agriculture*, 1955, pp. 165–70.

previously existing watershed district acts. All these multiple-purpose districts have comparatively broad authority and powers.

About one-fourth of the States have enacted legislation providing for varying amounts of State participation in watershed projects. Four States may participate actively in such projects and four others may furnish financial assistance.[1]

In most States, however, there is no one local organization with all the authority and powers necessary for carrying out watershed projects of larger scope. Co-sponsorship with a division of responsibility between two or more agencies—typically a soil conservation district and a county—has been the general rule.[2]

By 1 February 1959, 1,054 applications from local organizations for assistance in watershed programmes had been received. Planning investigations had been authorized for 410 watersheds and 142 had been approved for construction operations.

Another Federal act that is helpful to local organizations in water development is the Small Reclamation Project Act of 1956, which provides for Federal assistance in development of small irrigation projects by State and local governments in the seventeen Western States. Project plans submitted by local organizations must be reviewed and found economically feasible by the State if assistance to the project is to be authorized. The U.S. Bureau of Reclamation may make loans available for the reimbursable portion of the project and, under certain circumstances, it may make grants for non-reimbursable portions. The local organization must finance all costs of acquiring lands, rights of way in land, and water rights. Up to 20 February 1959 there had been about seventeen applications for the loans, and eight projects had been approved by the Secretary of the Interior for Federal participation.

Usually, local governments are required to furnish rights of way, maintenance and sometimes part of the construction costs of such flood-control structures as levees, retaining walls, floodways and other local works. The U.S. Corps of Engineers is responsible for major flood-control and navigation works, and local participation is usually co-operative with this programme. However, if a programme of flood-damage prevention were to be carried out, the local govern-

[1] Kirk M. Sandals and L. M. Adams, *Progress in State Legislation Relating to the Watershed Protection and Flood Prevention Act, 1955–57*. SCS-TP-135, U.S. Department of Agriculture, January 1958.

[2] Robert C. Otte, *Local Resource Protection and Development Districts*. U.S. Dept. Agr., Agr. Res. Serv., ARS 43–48, April 1957.

ments would have a major responsibility in preventing use of the flood plains that would be highly vulnerable to flood damage. Studies of the last twenty years show that we have allowed encroachment on the flood plains so that damage potentials are now higher than when we started our flood-control programme. Most of the population growth of the future will be in urban areas, the size of which will be expanded considerably. Guidance of these developments in a flood-damage-prevention programme will be very important.[1]

Water Resources Policy

In January 1956 the President transmitted to the Congress for its consideration the report of the Advisory Committee on Water Resources Policy. In transmitting the report the President said in part: 'The report is the result of a detailed study of our water problems and of the present powers and activities of the various Federal establishments engaged in water resource development. . . .

'The policies set out in the report embody a framework within which the Federal Government, with State and local governments and other non-Federal interests, may co-operate to develop our water resources. . . .'

The recommendations of the Advisory Committee are summarized as follows:[2]

1. *Basic data.* That the present programme of basic data collection be accelerated, programmed and carried out on a more consistent and definite basis.

2. *Planning.* That planning for water resources and related developments be conducted on a co-operative basis with representatives of all Federal, State and local agencies involved; and that this joint participation be continuous from the beginning in order that plans and projects developed assure the best and most effective use and control of water to meet both the current and long-range needs of the people of a region, State, or locality, and of the nation as a whole.

3. *Organization.* That an organization plan be adopted substantially as follows:

(*a*) The position of Co-ordinator of Water Resources be established to provide Presidential direction to agency co-ordination and to

[1] Francis C. Murphy, *Regulating Flood-Plain Development.* University of Chicago, Department of Geography, Research Paper No. 56, Chicago, Ill., November 1958.

[2] *Water Resources Policy.* A Report by the Presidential Advisory Committee on Water Resources Policy, December 1955.

establish principles, standards and procedures for planning and development of water resources projects.

(*b*) An independent Board of Review be created to analyse the engineering and economic feasibility of projects and report to the President through the Co-ordinator.

(*c*) Regional or river-basin water resources committees be formed with a permanent non-voting chairman appointed by the President and with membership composed of representatives of all Federal departments and States involved.

(*d*) A permanent Federal Inter-Agency Committee on Water Resources, composed of principal policy-making officials of the agencies concerned, advisory in character, be established under the chairmanship of the Co-ordinator.

4. *Water rights.* (*a*) That the principles that recognize water rights as property rights be accepted. That determinations as to disposition of water recognize such rights.

(*b*) That a study be made by the Federal Government in collaboration with State and local entities to determine the relationships between property rights to water and the social and economic development of the nation and the area, and the principles and criteria that should be incorporated into Federal, State and local laws regarding rights to the appropriation and use of water that would assure its best and most effective use and at the same time encourage maximum participation by all parties concerned.

(*c*) That States enact legislation regarding the ownership and right, purpose and place of use of underground water.

(*d*) That where appropriate, formation of inter-state compacts be encouraged.

5. *Priority of use of water.* That no system of relative priorities for use of water be applied uniformly to the entire country.

6. *Evaluation.* That evaluations of water projects by all agencies be on a uniform basis, requiring balanced consideration of all benefits and costs that can reasonably be measured in dollars, as well as consideration of other values not readily expressed in monetary terms.

7. *Authorization.* That each major water resources project be separately authorized by the Congress.

8. *Cost sharing.* (*a*) That, as a general policy, all interests participate in the cost of water resource development projects in accordance with the measure of their benefits; that the Federal Government

assume the cost of that part of projects for which benefits are national and widespread and beneficiaries are not readily identifiable; that power and municipal and industrial water-users pay the full cost of development; that where projects are primarily local and the beneficiaries are clearly identifiable, the Federal Government's contribution be limited, with non-Federal interests bearing a substantial part of the construction costs of the project as well as the replacement, maintenance and operation costs; and that under certain conditions, the Federal Government may bear a higher proportion of the costs.

(*b*) That the Federal Government encourage non-Federal assumption of responsibility for construction of water-resources projects by such means as the payment of costs that would have been non-reimbursable had the projects been Federally constructed, and the making or guaranteeing of loans to non-Federal interests for certain purposes under proper safeguards.

Progress

In the three years since the recommendations of the President's Advisory Committee on Water Resources were made to the Congress, comparatively few specific legislative proposals for carrying out the recommendations have been made. Collection of basic data has increased in selected fields. Progress has been made in research on salt-water conversion and in establishing research on weather modification. The new inter-agency charters offer some improvement in river-basin and national policy and planning co-ordination. Comprehensive water-resource surveys of the Delaware and Potomac river basins are being undertaken by several agencies under the leadership of the Corps of Engineers. The establishment of the Office of Special Assistant to the President for Public Works facilitates co-ordination in the water resources field. The enactment of the South-East and the Texas Land and Water Study Commissions for river basins in these areas is also a step toward carrying out the recommendations of the Advisory Committee.

However, as pointed out by various analysts, little action has been taken on these recommendations for changes in national water policy. One states that 'although there is much agreement, a stable and consistent national water resources policy is far from attainment'.[1] Another analyses the various proposals and concludes that 'no organizational formula has been evolved for drainage basin committees that

[1] Irving K. Fox, *National Water Resources Policy Issues*. Law and Contemporary Problems (Water Resources) 22(3): 472–509, 1957.

will satisfy the area orientation of congressmen, the national orientation of the President, and the functional orientation of the several water resource agencies'. He states that 'Earlier confidence in interagency committees at the national and basin levels has evaporated'. He suggests that 'the bulk of the planning, construction, and operation of water resource programmes and projects should be in a single major national department'.[1]

Another view was expressed by the Committee on Water Resources of the American Association of Land-Grant Colleges and State Universities in 1956 and 1957, when it urged the Association of Land-Grant Colleges to endorse the findings of the President's Advisory Committee and to recommend that the report be implemented as rapidly as possible through appropriate legislative and administrative action. In its 1958 report the Water Resources Committee again considered this subject in a statement as follows:[2]

> Your Committee regrets that it must again report to this Association that during the past year no evident progress has been made in carrying out the recommendations of the Presidential Advisory Committee report. The Committee again suggests that this Association urge the Federal government through appropriate channels to take action promptly through legislation or other means: (1) to establish a position of coordinator of Water Resources to provide Presidential direction to Agency coordination and to establish principles, standards and procedures for planning and development of water resource projects; (2) to create an independent Board of Review to analyze the engineering and economic feasibility of projects and report to the President through the coordinator; (3) to organize river basin water resource committees with a permanent chairman appointed by the President and with membership comprised of representatives of all Federal departments and States concerned; and (4) to establish a permanent Federal Inter-Agency Committee composed of the principal policy-making officials of the departments concerned.

In summary, although substantial advances have been made in the technical solution of water problems, progress in devising and adopting water policies and in adjusting our water resource organizations and laws at the local, State, river basin and national levels has not kept pace with the growing demand on our water resources. The rate at which we are solving these problems indicates that we shall fall further behind in the future unless considerable attention is given to them. Because water is vital to the balanced growth of our economy, accelerated activity at all levels of government will be needed.

[1] James W. Fesler, *National Water Resources Administration.* Law and Contemporary Problems (Water Resources) 22(3): 444–471, 1957.

[2] *Report to the Senate of the Committee on Water Resources.* American Association of Land-Grant Colleges and State Universities, November 1958.