DOCUMENT RESUME

02789 - [A2133233]

Water Resources Planning, Management, and Development: What Are the Nation's Water Supply Problems and Issues? CED-77-100. July 28, 1977. 46 pp. + 3 appendices (6 pp.).

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Issue Area: Water and Water Related Programs (2500).
Contact: Community and Economic Development Div.
Budget Function: Natural Resources, Environment, and Energy: Water Resources and Power (301); Natural Resources, Environment, and Energy: Recreational Resources (303); Natural Resources, Environment, and Energy: Conservation and Land Management (302).
Organization Concerned: Department of Agriculture; Department of the Army; Department of the Army: Corps of Engineers; Department of the Interior; Department of Transportation; Environmental Protection Agency; Office of Management and Budget.
Congressional Relevance: House Committee on Interior and Insular Affairs; Senate Committee on Energy and Natural Resources.
Authority: Water Resources Development Act of 1976 (P.L. 94-587). Reclamation Authorization Act of 1976 (P.L. 94-423). Reclamation Authorization Act of 1975 (P.L. 94-228). Water Resources Planning Act of 1965 (P.L. 89-80). River and Harbor and Flood Control Act of 1970. Safe Drinking Water Act of 1974. National Environmental Policy Act. Federal Water Pollution Control Act Amendments of 1972. Water Supply Act of 1958. Public Works and Economic Development Act. Housing and Community Development Act. Rural Development Act. Consolidated Farm and Rural Development Act. P.L. 94-112. P.L. 94-326. P.L. 94-490.

The development of solutions to the serious water problems facing the United States poses challenges for the establishment of priorities and responsive implementing programs. Issues and concerns related to water and water-related programs which merit attention include: (1) Are existing water resource plans and programs adequate to meet the competing demands for water uses? (2) Do water agencies and industry have effective water conservation and reuse programs which reduce demand and make more efficient use of water supplies? (3) How can the constraints of water laws and rights on meeting water needs be effectively resolved? (4) Do Federal agencies' benefit-cost analyses fully and realistically consider the beneficial and adverse effects of water resource projects? (5) Are water supply and water quality programs being effectively coordinated? (6) Are water research programs making progress in developing technology and in finding new ways to increase the Nation's water supply? (7) Is conjunctive use of surface water with ground and saline water sources adequately considered in

meeting water needs? (8) What are the problems affecting the timely, efficient, and economical construction of water resources projects? and (9) Are cost-sharing requirements of Federal and federally assisted water resources projects and programs viable today: what are the considerations and issues? (SC)

STUDY BY THE STAFF OF THE
UNITED STATES
GENERAL ACCOUNTING OFFICE

Water Resources Planning, Management, and Development: What Are The Nation's Water Supply Problems And Issues?

The drought in the Midwest and Western States with its devastating impacts highlights the seriousness of the water problems facing the United States. Achieving solutions poses challenges for the establishment of priorities and responsive implementing programs.

In this study, GAO identifies existing and emerging water supply difficulties which must be better understood to lead to timely considerations of ways to solve the key water problems.

CED-77-100

JULY 28, 1977

UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

COMMUNITY AND ECONOMIC
DEVELOPMENT DIVISION

FOREWORD

As our Nation seeks solutions to our energy problems, there are increasing signs, such as the current drought in much of the West, that the next great resource crisis--an inadequate water supply--may be rapidly approaching and may be a more difficult problem to solve.

While the United States as a whole has an abundant water supply, the geographical distribution and availability of its water resources often does not match needs and demands. This condition, magnified by the Nation's continuing population growth and industrial development, has led to water shortages and increased competition for the limited supply.

Today the United States is a highly developed, affluent, and urban industrial nation, but new national priorities are emerging. The need to meet energy, food, and fiber demands; changing land use policies; and preservation and enhancement of environmental, aesthetic, and recreational values place new demands on planning for the development of our Nation's water resources. The manner and time within which existing and emerging water problems are resolved can have an enormous impact on the welfare of our country. The challenge is to reshape our water policies and programs to seek solutions that best satisfy our Nation's social, economic, and environmental goals.

In this study we have tried to identify existing and emerging water supply problems. We intend to concentrate our audit and analytical efforts on these matters. We hope that this study will contribute to better understanding and timely consideration of ways to solve the key water problems facing this Nation.

As we were finalizing this study, the President, in his May 23, 1977, environmental message, stated that one of the pressing domestic issues facing his administration and the Congress is the establishment of a national water resources management policy. He therefore directed a 6-month review aimed at achieving comprehensive reform of water resources policy. The review will address several of the issues and concerns discussed in this study.

This study was developed by the Community and Economic Development Division. Questions should be directed to Harold Pichney, Assistant Director, on (202) 275-6075.

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Henry Eschwege
Director

C O N T E N T S

CHAPTER 1

OVERVIEW OF THE WATER AND WATER-RELATED PROGRAMS AREA

DEFINITION AND SCOPE

The focus of the water and water-related programs area is on those programs and activities concerned with water resources planning, management, and development projects designed to provide adequate water supplies to meet present and future demands.

Water resources planning encompasses assessing the quantity and quality of available water supplies, forecasting future water demands, analyzing existing and potential water supply problems, and preparing proposals for resolving such problems.

Management of water resources covers such things as allocating water among competing uses to optimize project benefits, developing technology to augment or make more efficient use of water supplies, and carrying out activities to reduce the demand for and to conserve water supplies.

Development of water resources projects primarily concerns matters relating to project formulation, justification, and construction. Water resources developments may be single-purpose flood control, navigation projects, or multiple-purpose dam and reservoir projects which may provide for hydroelectric power generation, flood control, recreational activities, and water supplies for irrigated agriculture as well as for domestic and industrial uses.

While our concerns will be primarily directed to Federal programs, we will also cover non-Federal activities because the responsibility of planning, managing, and developing water resources is shared among Federal, State, and local governments and private enterprise.

RELATED AREAS

The water area not only affects but is affected by other Federal policies, programs, and national issues. Federal programs on the development and management of water resources are not so clear cut to deal exclusively with water supply but may concern land use, environmental protection, and transportation policy matters. Also, Federal policies and programs on nonwater areas, such as energy development and food production, can impose significant demands for water supplies and therefore

affect development and management of water supplies. Examples of the more important interrelationships follow.

Land is a major element in developing facilities for the storage and conveyance of water. Lands required for such purposes usually have economic and environmental values for other uses. Intensive land use for urban and industrial development often creates water supply problems. However, the development of water resources for irrigation can transform unproductive land to land more productive for food and fiber products. Also, concern for preserving and protecting outdoor recreation, fish and wildlife habitat, and other environmental values, has precluded or materially altered the development of water resources.

Another area affecting water supply is environmental protection programs, particularly those relating to water quality. For example, water pollution resulting from irrigation and municipal and industrial wastes significantly affects the availability and use of our water resources.

Energy and food issues also affect the water area. Water is essential to almost every energy process and is required in tremendous quantities to produce food and fiber products. Federa policies and programs to develop new energy sources, such as synthetic fuels to help solve the energy crisis, as well as those to enhance food production for domestic and foreign markets, will result in severe competition among water uses in the Western States where water supplies do not meet demands. Also, adequate water flows are necessary to maintain our navigable waterways which are an important part of the Nation's commercial transportation network.

Because of the national significance of the areas discussed above, each will be the subject of a separate GAO evaluation.

WATER RESOURCES PERSPECTIVE

In the past, water policies evolved as if water had no cost and no limit on its availability. Water resources developments were essentially justified and accepted on the basis of economic development. However, as with most other critical resources, as the Nation's population and industry grew, water use rapidly increased and its quality seriously deteriorated.

Today the United States is a highly developed, affluent, and urban industrial nation and new national priorities have emerged. Satisfaction of national energy and food and fiber needs; emerging land use policies; and preservation and enhancement of environmental, aesthetic, and recreational values place new demands on planning for the development of our Nation's water resources.

With the existing water shortages and expected future needs, there is accelerating competition and often conflicting demands for water uses. Today's challenge is to reshape our water policies and programs to seek solutions to the existing and emerging problems to best satisfy our Nation's social, economic, and environmental goals.

Water supply and demand

As a whole, the Nation has abundant water resources with average annual precipitation of 30 inches for the conterminous (adjoining) United States, average natural runoff of 1,200 billion gallons per day (bgd), and large reserves of water underground. However, the Nation is less fortunate in the distribution and timing of its water resources. Rainfall varies from the lush abundance of the Pacific Northwest to the scarcity of the parched Southwest. Furthermore, in any one region streamflow can vary widely from season to season and from year to year. Ground water resources are more difficult to assess because in most regions ground and surface waters are not separate sources, and ground water development often results in streamflow decreases.

Some regions of the country have chronic water deficiencies, others have floods and periodic droughts. Most parts of the Nation are not satisfied with their water resources, and poor water quality, usually caused by pollution, is a problem in every region. Florida has a serious emerging water shortage problem because of large increases in population and economic activities; California's water supply problem is one of improper distribution rather than a lack of overall supply; and the Southwest States and most of those in the semi-arid regions west of the Mississippi have the Nation's most severe existing and emerging water shortage problems. Even in the generally humid northeastern part of the Nation, three large metropolitan areas had severe water shortages in the early 1960s because of a drought that lasted several years.

The Water Resources Council's 1975 Water Assessment study (Assessment) now underway states that future rates and patterns of population growth and economic activity are major considerations in estimated future water requirements.

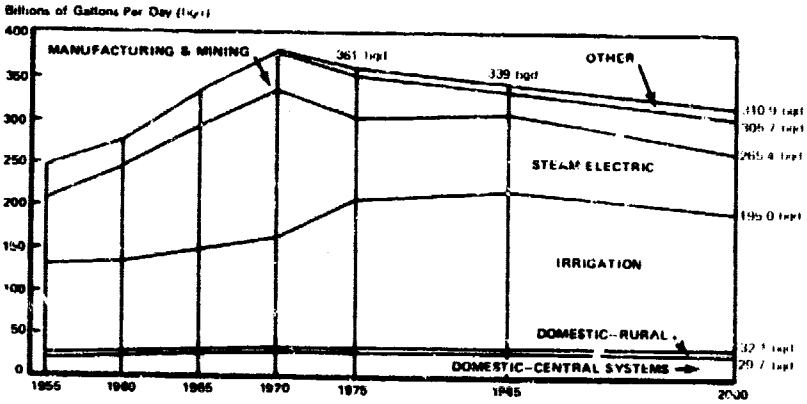
By the year 2000 the U.S. population is expected to increase by 50 million (23 percent) to a total of about 265 million, real gross national product is projected to increase by 135 percent to 2.1 trillion dollars, and real earning from $685 billion in 1975 to $1,657 billion in 2000. This growth will occur primarily in existing metropolitan areas. In absolute terms, the northeastern quadrant of the Nation is expected to receive most of the population increases; however, the great-

est projected percentage of the change is in the Southern and Western States.

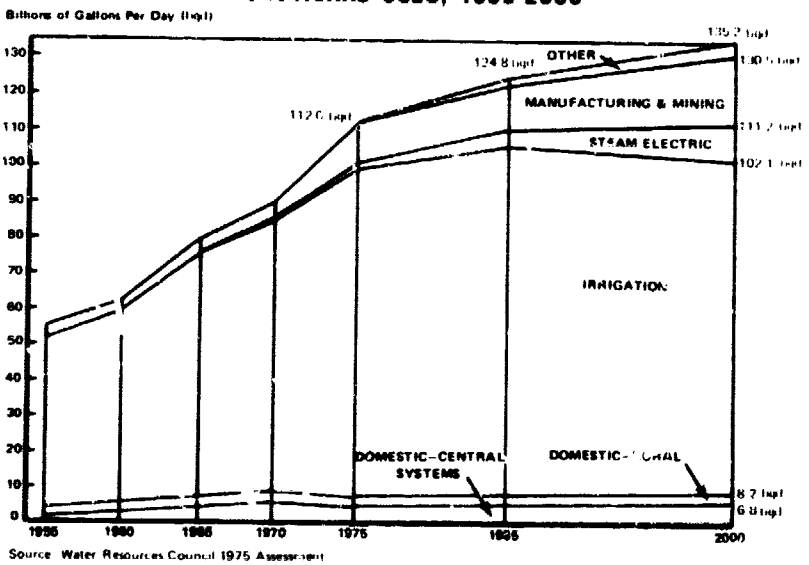
Water uses are generally measured two ways: withdrawal or consumptive uses. Withdrawal uses consume water to varying degrees but may return a considerable quantity to streams or ground water where it may be available for reuse. Water consumption is the more important indicator because it represents water that is consumed; for example, incorporated into a product and, therefore, not available for reuse.

The Assessment shows the historic and projected national totals of withdrawal and consumptive water requirements as follows.

HISTORIC AND PROJECTED WATER WITHDRAWALS FOR MAJOR FUNCTIONAL USES, 1955-2000



HISTORIC AND PROJECTED WATER CONSUMPTION FOR MAJOR FUNCTIONAL USES, 1955-2000



Source: Water Resources Council 1975 Assessment

The graphs show several important trends. The amount of water withdrawn is expected to decrease by 14 percent in the period of 1975-2000. Primarily responsible for the projected decline is the assumption that increasingly stringent water quality laws, particularly the Federal Water Pollution Control Act amendments of 1972 (Public Law 92-500) will have as their byproduct substantial increases in the recycling of intake waters in the manufacturing and electric generation sectors. This assumption seems questionable because the stringent requirements of Public Law 92-500 may be modified, and industry may find it cheaper, particularly for existing facilities, to continue using water on a once-through basis with wastewater treatment before returning it to the stream rather than construct more costly recycling facilities.

On the other hand, water consumption is expected to increase by 19 percent in the 25-year period, which is at a slower rate than in previous periods. The decline in the expected increase stems from the Assessment's assumption that the increase in water use for irrigation will be minor. However, irrigation will show substantial increases in some parts of the country, for example, Souris-Red/Missouri River areas, where agricultural conditions are suitable and water supplies are available. Here again we think the Assessment's assumption that there will be a slower growth in food and fiber requirements and that no new large-scale irrigation projects will be funded seems questionable.

Realistic information on the quantity and quality of water supplies and on future requirements is fundamental to effectively formulate plans and policies for water resources development. The manner in which such data is collected, its reasonableness, and how it is used in planning for selected river basins--especially those which have water shortage problems--are significant concerns which must be addressed.

Problems and trends

In 1975 the United States Water Resources Council sponsored an open forum, representing a broad base of interests and viewpoints, to discuss water-related issues that must be considered and resolved. At the conference Rogers C. B. Morton, Secretary of the Interior and Chairman of the Water Resources Council, pointed out that to free itself from dependence on foreign energy resources, the Nation has turned its attention to the energy resources of the West, and that extraction and conversion of energy minerals would require significant amounts of water. He noted that world hunger was outstripping capacities of many nations to grow enough food, and that demand for the products of our farms and ranches could be expected to rise dramatically in the decade ahead. Secretary Morton

also commented on the need for more water for municipal and industrial growth and clean water requirements for fish and wildlife and water-oriented recreation. He stressed the urgent need to consider the adequacy of present water policy and the appropriate roles of each level of government, as well as the private sector.

Secretary of the Army, Howard H. Callaway, in his address before the Conference, stressed the pressing need to reexamine the state of our water supply, the laws that govern its distribution and its ownership, and the priorities for maintaining future supplies. Former Secretary of Agriculture, Earl L. Butz, stressed the need for more comprehensive water use planning, noting that water rights and water legislation had too often been a temporary truce among special interest groups for today's water with little or no thought or regard about long-range needs or tomorrow's objectives. He also pointed out that as food production increases, the conflict between agricultural and environmental interests could be expected to intensify.

Russell W. Peterson, then Chairman of the Council on Environmental Quality, emphasized that it was imperative to balance equally the planning objectives of national economic development and environmental quality. He noted that water development could create needs as well as satisfy them, and that the Nation was at a point where planners must distinguish between requirement and demand and consider further development in the context of environmental management.

Other issues discussed covered the need for conserving and making more efficient use of water supplies, improving coordination between water supply and quality, reassessing the cost-sharing responsibilities for water resource programs, and resolving the uncertainty in quantity and nature of Federal and Indian reserved water rights. Although opinions varied on how the United States should manage its water supply, the Conference brought into sharper focus many water-related problems and issues.

The Department of the Interior's Westwide Study Report on Critical Water Problems Facing the Eleven Western States, April 1975, representing the view of Government, nongovernmental organizations, and regional and national interests, identified the present and near future critical water resources problems and issues of the West, which, for the most part, suffers the most severe water supply problems in our Nation.

Problems identified as having high priority are those related to the needs for water for energy resources development, municipal and industrial water sources, and water supplies to satisfy the objective of Indian self-determination. Other

important matters concern the role of federally subsidized irrigation projects and the legal and institutional arrangements for water which do not foster efficient and effective use of water supplies.

Many of the water-related problems and issues previously discussed were covered in the National Water Commission's June 1973 report "Water Policies for the Future." The Commission was created by the Congress in 1968 to review national water problems and to identify alternative ways of meeting them. However, very little action was taken in response to the recommendations in the report primarily because the Commission took certain positions, for example, need for full cost sharing by non-Federal beneficiaries of water resources projects, which the members of cognizant congressional committees and representatives of the principal Federal water resource agencies did not find readily acceptable. We note also that effective followup had not been made on the National Water Conference and Westwide reports. Other studies of water-related problems and issues, which were authorized by the Congress, are being made by the responsible Federal agencies and are discussed under the applicable subjects in this study.

Today there are changing trends in water resources planning to address the complex water problems and emerging issues. For example, historically Federal agency planning programs were project oriented with construction of new projects in most cases the ultimate result. Current trends in planning place greater emphasis on much broader objectives; multidisciplinary and multi-interest planning is now the norm rather than the exception, and State, local, and private entities are increasingly participating in the planning process. New techniques in planning are emerging, using computers to simulate physical, economic, and environmental conditions, and to evaluate impacts of alternative decisions and policies. There is a greater awareness that total water management includes such concerns as water reuse and recycling and improvement of water system efficiency.

Also, while there is no clear, integrated national water policy, there are changing directions in Federal water planning policies. The new principles and standards for planning water resources direct planners to treat environmental quality as equally important to economic development and require consideration of alternative plans. Federal policy now requires that nonstructural measures, including restrictions on flood plain development, be considered as alternatives to the construction of flood protection works.

Conclusion

There is no simple, direct, permanent solution to the water resources problems and emerging issues facing the Nation. The manner in which the problems are treated, the time limit within which they are resolved, and the substance of their resolution can have enormous influence on the economic, social, and environmental future of our country. The current drought in the Midwest and Western States with its devastating economic, environmental, and social impacts highlights the seriousness of the water problems facing our Nation, and, hopefully, will create a sense of urgency and provide the impetus for our country to seek timely solutions. However, finding solutions to our water problems requires the establishment of clear priorities and timely and responsive implementing programs.

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The United States Water Resources Council's 1975 National Conference on Water, the Department of the Interior's 1975 Westwide Study Report on the Critical Water Problems Facing the Eleven Western States, and the National Water Commission's 1973 report on Water Policies for the Future provided valuable guidance in preparing this document and are suggested reading for a more comprehensive discussion of the existing and emerging water-related problems of the United States.

THE FEDERAL ROLE

Management of the Nation's available water resources is, to a considerable extent, a State responsibility. State and local governments have an immediate and utilitarian interest in water resources management because their well-being, as that of the Nation as a whole, depends upon the availability of water resources of adequate quality and quantity.

The Water Supply Act of 1958 (Public Law 85-500) declared it to be policy of the Congress to recognize the primary responsibilities of the States and local interests in developing water supplies for domestic and industrial purposes and that the Federal Government should participate and cooperate with State and local interests in developing water supplies in connection with the construction of Federal water resources projects. It is interesting to note that Federal projects for the development and use of water resources are seldom initiated without strong State support and generally are not undertaken in opposition to State desires.

The Federal concerns with our natural resources and the economic and social well-being of our people have led to many acts of the Congress which clearly indicate that the Federal

Government may participate to some degree in all aspects of water resources planning, management, and development. In response to such Federal concerns, the developing body of law has established varying degrees of Federal interest in such areas as hydroelectric power, irrigation, water supply, flood control, navigation, outdoor recreation, and fish and wildlife preservation and enhancement. The degree of Federal participation is generally limited to that required to achieve national objectives in an optimal manner and varies from a maximum participation in planning activities to minimum participation in operation and maintenance activities.

The Federal role in water resources planning basically stems from the Water Resources Planning Act of 1965 (Public Law 8980). The act was designed to encourage conservation, development, and use of the Nation's water and related land resources on a comprehensive and coordinated basis by Federal, State, and local governments and private enterprise. Also, the act established the Water Resources Council, provided for establishment of river basin commissions, and authorized financial assistance to States for comprehensive water and related land resources planning. The river basin commissions were designed to be planning-coordinating entities where representatives of States and Federal agencies could coordinate activities and jointly develop river basin or regional plans for water and related land resources.

With respect to the management and use of the Nation's water resources, the Federal Government, by ownership of much of the land in the West, by its responsibilities over Indian lands, by constructing and operating water resources projects, by its various loan, grant, and technical assistance programs to municipalities, rural communities, and farmers, has both a direct and indirect role in such matters as the allocation of water among competing uses, water laws and rights, conservation and efficient use of water supplies, water quality, as well as water research and technology to increase the useable water supply.

Federal water-related programs are spread through 26 agencies within 8 departments and 10 independent agencies and commissions. The agencies have different missions, and clientele as well as a variety of ways for financing their programs.

The Water Resources Council estimated that in fiscal year 1976 about $4.8 billion would be obligated by Federal agencies for water-related programs, excluding programs for water quality improvement. Federal programs are funded by many different appropriation accounts. For example, the public works appropriations for fiscal year 1977 provided about $2.2 billion to the Corps of Engineers (Civil Functions) and the Bureau of

Reclamation for construction and rehabilitation of water resources projects. Also, the Water Resources Council received about $13 million which included $3 million for grants to States. Agricultural appropriations for fiscal year 1977 included, for example, $146 million for watershed and flood prevention operations, $200 million for rural water and waste disposal grants as well as $600 million for water and sewer facility loans.

The Federal agencies involved in water resources planning, management, and development are listed in appendix I. The activities of the principal agencies are summarized as follows.

DEPARTMENT OF THE ARMY (Corps of Engineers--Civil Functions)

The Corps of Engineers has broad responsibilities for the conservation, development, and management of the Nation's water resources. It carries out programs and constructs projects for flood control, municipal and industrial water supply, irrigation, recreation, hydroelectric power, navigation, fish and wildlife protection, as well as for beaches, shorelines, and hurricane protection. It administers the National Dam Safety Act, carries out flood emergency operations and disaster assistance, conducts research and development programs, such as improving water quality and wastewater management, and has an Urban Studies Program to help metropolitan areas solve urban water and related land problems.

DEPARTMENT OF AGRICULTURE

Responsible for activities which involve watershed protection; flood preven-

DEPARTMENT OF THE INTERIOR

The Department has a broad range of responsibilities for the conservation, development, and management of America's natural resources. The mission of the Bureau of Reclamation, the Department's principal water agency, relates to water activities in the 17 western States. It conducts programs and constructs projects to provide municipal and industrial water supplies, hydroelectric generation, flood control, water for irrigated agriculture, outdoor recreational opportunities, and fish and wildlife enhancement. Also, it conducts mission-oriented research, such as weather modification. The Department's Office of Water Research and Technology's mission is water resources research and development activities, through contracts and grants, to develop new or improved technology and methods for solving water resources problems.

ENVIRONMENTAL PROTECTION AGENCY

Responsible for protecting and enhancing the quality of the Nation's water resources by executing anti-

tion and control; conservation development, utilization, or disposal of waters as they affect farming, ranching, forestry, and rural communities; production, storage, treatment, distribution of water in rural areas. Provides projections of agriculture growth and needs for use in comprehensive studies of water and related land. Has custody of 187 million acres of land. Engages in research on economics, agriculture, erosion control, forestry, watershed management, and in related fields.

pollution policies and carrying out the many functions involved in controlling pollution, such as planning, research, monitoring, standard setting and enforcement.

WATER RESOURCES COUNCIL

Assesses the adequacy of the Nation's water resources; initiates and coordinates regional and river basin plans; suggests changes in Federal policies and programs; assists the States in developing planning capability; develops principles, standards, and procedures for Federal water and related land resource planning; and reviews plans developed by the river basin commissions.

LEGISLATION

Over the years, a great number of Federal laws have been enacted on water and water-related programs. In the past, the national emphasis on economic growth provided the primary basis for development and use of the Nation's water resources. In recent years, however, the national emphasis has been changing, and the significant legislative enactments have been mostly concerned with environmental values and water quality. Such legislation includes, for example, the National Environmental Policy Act, the Federal Water Pollution Control Act amendments, and the Safe Drinking Water Act.

Our audit efforts on implementation of environmental and water quality legislation are not discussed in this study because they are the subject of a separate evaluation. However, the impact of such legislation will be considered when addressing issues relating to water resources planning, management, and development covered under the water and water-related programs area.

Legislation enacted in the 94th Congress relating to matters in this program plan include:

--The Water Resources Development Act of 1976 (Public Law 94-587) which is the biennial authorization of Corps of Engineers' projects and includes other provisions on water resources programs.

--The Reclamation Authorization Acts of 1975 and 1976 (Public Laws 94-228, 423) which authorize Federal reclamation projects.

--Other acts which authorized additional monetary authorizations and appropriations for previously authorized developments and feasibility studies of potential water resource projects.

--Public Law 94-112, which amended the Water Resource Planning Act to include the Secretaries of Commerce, Housing and Urban Development (HUD), and Transportation; the Administrator of the Environmental Protection Agency (EPA); and to delete the Secretary of Health, Education, and Welfare (HEW) from the Water Resources Council.

--Public Law 94-316, which appropriated funds for the saline water conversion program for fiscal year 1977.

--Public Law 490, which authorized and directed the Department of Commerce to develop a national weather modification policy.

Legislative proposals not enacted in the 94th Congress but which may well be considered by the 95th Congress include:

--Establishing a department with responsibilities for natural resources, energy, and the environment.

--Modifying the 160-acre limitation on lands that may receive irrigation water from a Federal water resource project and other related provisions.

--Providing water supplies to the five Central Arizona Indian Tribes and resolving their water rights.

--Placing the Water Resources Council within the Executive Office of the President, establishing an Office of Water Research within the Council, and increasing Federal grants to States for water planning.

--Authorizing the rehabilitation or replacement of locks and dam 26 on the Mississippi River and related user charges.

--Amending section 404 requirements of the Federal Water Pollution Control Act on depositing dredged and fill material in waterways and wetlands.

CONGRESSIONAL COMMITTEES AND SUBCOMMITTEES

There are 63 congressional committees and subcommittees with responsibilities related to water resources planning, management, and development. They are listed in appendix II.

OTHER ORGANIZATIONS

There are a variety of agencies, commissions, trade associations, and public and private organizations concerned with water resources planning, management, and development. Many of these organizations have Washington offices and are suggested as sources of information on the Nation's water problems and issues. Many of these organizations are listed in appendix III.

CHAPTER 2

WATER AND WATER-RELATED PROGRAMS--

ISSUES AND CONCERNS

The following issues and concerns were identified as meriting attention.

1. Are existing water resource plans and programs adequate to meet the competing demands for water uses? 1/

2. Do water agencies and industry have effective water conservation and reuse programs which reduce demand and make more efficient use of water supplies? 1/

3. How can the constraints of water laws and rights on meeting water needs be effectively resolved? 1/

4. Do Federal agencies' benefit-cost analyses fully and realistically consider the beneficial and adverse effects of water resource projects? 1/

5. Are water supply and water quality programs being effectively coordinated?

6. Are water research programs making progress in developing technology and in finding new ways to increase the Nation's water supply?

7. Is conjunctive use of surface water with ground and saline water sources adequately considered in meeting water needs?

8. What are the problems affecting the timely, efficient, and economical construction of water resource projects?

9. Are cost-sharing requirements of Federal and federally assisted water resources projects and programs viable today: What are the considerations and issues?

The issues and concerns were selected on the basis of a consensus on existing and emerging water problems presented in the various reports discussed in the previous chapter, dis-

1/Designated for priority consideration.

cussions with agency officials, congressional interest, and our audit experiences. 1/

We intend to concentrate our water audit resources on these issues and concerns with the expectation that it can provide assistance to the Congress in its consideration of ways to solve the key water problems facing the Nation.

The first four issues have been designated for priority consideration because:

--Water resources planning should provide direction, on a comprehensive and coordinated basis, to all levels of government. In view of the shortages and emerging water problems facing our Nation, such planning should provide a sound basis for rational, well-considered decisions among alternatives or competing uses of our water resources to meet the needs and desires of people. Under this issue, assessments should be made to determine the adequacy of water resources planning and programing to meet competing water needs, to identify the problems impeding effective progress, and to consider whether there is a need for a national water policy and implementing plan.

--As existing water supplies become scarce or too costly to be made available, water conservation becomes increasingly important, particularly when there is considerable potential to reduce demand or make more efficient use of water in irrigation, public, and industrial water systems. Water conservation can be an effective and less costly alternative to constructing new water supply facilities and can lessen the facilities necessary for treating waste and water pollution. Under this issue, matters to be addressed should include Federal, State, local governments and industry's efforts to promote water conservation and identification of the impediments--or consideration of what incentives may be necessary--to achieve more efficient use of the Nation's water resources.

--In the water short regions of the West, the increasing and changing water needs and desires have raised the issue of allocation of available water supplies and transfers of water rights from one use to another. However, such allocations and transfers are affected by

1/The recent May 23-25, 1977, National Conference on Water, representing a broad spectrum of interests, confirmed the current applicability and national significance of the issues and concerns covered in this study.

Federal and State water laws and rights. Of paramount concern is the identification of--and consideration of--proposed solutions to water laws and rights problems which adversely affect meeting priority water needs and achieving efficient use of water supplies.

--Each year the Congress considers appropriation requests for several billions of dollars for the construction of Federal water resource projects. Because of the increasing and competing demands on the Nation's financial and physical resources and concerns for the environmental impacts of such projects, there is a growing and intensifying questioning of proposed projects' economic and environmental need and desirability by Federal and State agencies, the public, and Members of Congress. The economic feasibility (benefit-cost analysis test) of a planned project is a significant factor considered by Federal agencies and the Congress for project decisionmaking. Therefore, it becomes important that the expected beneficial and adverse impacts of projects are fully and realistically determined and documented for consideration by the decisionmakers. Important concerns under this issue are the adequacy of Federal agencies' policies and practices for making benefit-cost analyses, identification of problem areas, and consideration of responsive solutions.

The remainder of this study discusses each of the issues and concerns and presents a detailed statement of the problems and matters which should be addressed.

CHAPTER 3

ISSUES AND CONCERNS FOR PRIORITY CONSIDERATION

ARE EXISTING WATER RESOURCES PLANS AND PROGRAMS ADEQUATE TO MEET THE COMPETING DEMANDS FOR WATER USES?

As the Nation's population and economic activities expand and change, greater demands are made on its available water supply which should be adaptable to these changing conditions. It should be available to best satisfy the needs of the people.

The responsibility for developing and managing the Nation's water resources is shared by Federal, State, and local governments, and private enterprise. The report on the 1975 National Conference on Water, sponsored by the Water Resources Council, points out that water resources planning at all levels needs to be better coordinated because the growing number of water and water-related programs has led to fragmentation and overlapping responsibilities among Federal and State agencies. The report concludes that the proper role of Federal, State, and local levels and private enterprise in water resource planning and management needs reexamination. Our current audit work supports the conclusion that there is a need for improved planning and coordination. Also, it indicates problems in obtaining reliable water supply and demand data under the Water Resources Council 1975 Water Assessment Study.

Water and related land resources are used for many different purposes by numerous competing interests. Most important is the accelerating competition between energy development and agriculture in the arid and semi-arid West where water supplies are not adequate to meet demands. Energy development and production will require significant water use increases. At the same time, increased irrigated agriculture to meet population growth, consumer demands, and especially increasing exports, will require additional water.

Furthermore, the water resources in the Nation's ever-growing metropolitan areas are limited. Major urban areas in the Northeast had severe water shortages in the 1960s and mandatory water use restrictions were imposed; however, no major water supply projects have been built in the most critical areas.

In rural America thousands of small communities have problems of water supply and quality. Indian lands also need adequate water supplies to improve the economic and social standing of the Indians by developing natural resources on reservations.

One of the most significant factors in water resources development is that it generally takes many years to convert a plan to a project. Therefore, the question arises as to whether the Nation can wait until there is a crisis before responding to water shortages, changing water requirements, and emerging water problems. The adequacy of existing water resources planning and programing for meeting the competing demands of water uses needs to be assessed, including considering whether there is a need for a national water policy and an implementing plan.

Following is a discussion of specific areas of water needs and competing demands.

Water for energy development

To help overcome our energy problems and to achieve our national energy policy goals, our Nation must increase development of our energy resources. However, water is essential to almost every energy process. It is needed to extract raw materials from the Earth, process the materials to a useful fuel, generate energy from the fuels, and dispose of water products in an environmentally acceptable manner. Water is also used for hydroelectric power generation and for transportation of fuels and materials. The 1975 Water Assessment estimates that the generation of electricity will increase about 360 percent from 1975 to 2000 with a corresponding increase in associated water consumption.

Water requirements will vary depending on the source of energy, region of development, and extent of environmental control. Substantial deposits of energy resources are located west of the Mississippi River where there is a relative scarcity of water, and about 90 percent of the existing available water is used for agricultural purposes. For example, a recent study states that an estimated 350 billion tons of recoverable coal, comprising over 40 percent of the Nation's total, lies in the Missouri River Basin. The Corps of Engineers has indicated that in this basin proposals for developing coal resources, including coal gasification and coal slurry pipelines, could increase the demand for water to more than 750,000 acre feet annually from storage in the Corps' Missouri River main stem reservoirs alone. According to the Corps, the water stored in the reservoirs is now almost fully used and substantial amounts cannot be diverted for new uses without affecting the purposes now being served.

Water availability will be an important--and often a limiting--factor in the development of energy in the West. The availability of water in an area is governed partly by Federal action and more importantly by physical conditions

and State and local prerogatives. Factors affecting availability are amount of rainfall and runoff; laws, water rights, and other arrangements that govern the allocation of water to users; environmental considerations and requirements; and capital investment and repayment requirements.

Energy industries will have to compete for water with farming, recreation, domestic needs, and industrial activities. In the arid and semi-arid regions, much of the available water is already utilized or legally committed. Major opposition exists to the reallocation of water to energy by irrigation water users and by those who support minimum flow requirements to guarantee a water level sufficient to preserve scenic rivers, fish and wildlife habitat, and recreation.

The areas with the most serious problems are the Missouri and Colorado River Basins. In the Missouri River Basin the significant problems include maldistribution of the available water supply, emerging competition between energy and agricultural development and instream flow needs, and the issue of Indian and Federal water rights. Similar conditions exist in the Colorado River Basins where the high salinity of the river and an inadequate natural water supply to meet expected demands, including water of acceptable quality for Mexico under the Mexican Water Treaty, present the most pressing concerns.

A most significant issue is the appropriate role of Government in the allocation of water among users and uses. In the arid West, the use of water for irrigation is based on water rights, and many feel that reliance on the marketplace for allocation of water among competing uses would result in serious consequences for agriculture and other uses, such as recreation, because the energy industry could afford to pay more for new water sources than the other users. Therefore, the issue arises whether it is necessary for Government to apply allocation criteria, including social and environmental considerations, rather than allow the appropriation and transfer of water rights solely on the basis of the economic factors in the marketplace.

Energy production and use pose hazards of environmental degradation to the Nation's water and related land resources. The principal problems are expected to include sediments associated with mining, thermal wastes, acid mine drainage, and concentration of pollutants due to increased diversions and consumptive use. In addition to water quality problems, the greatly expanded use of water for energy will be accompanied by other water-related environmental problems, which will result from increased consumptive uses and from storage and diversion of waters. Also, water supplies will be needed to

meet the needs of communities established to house those engaged in the development and production of new energy sources.

Water for food and fiber production

Among the elements needed to sustain plant life, water is essential and is required in tremendous quantities. In the arid and semi-arid parts of the Nation, irrigation makes the difference between unproductive range of wastelands and highly productive crop and pasture lands. In humid areas average rainfall may generally be adequate for production of major crops, but supplemental irrigation can prevent crop failures in drought years and increase yields and improve product quality in average years. In the arid West, one acre of irrigated cropland will commonly receive a million gallons or more of water in a season. Water for irrigation is the largest consumptive user of the Nation's water.

Determining the future demands for food and fiber products and, therefore, for irrigation water depends on many varying and interrelated factors. Domestic needs depend to a large extent on population, income levels, and consumption patterns. Foreign demand for agricultural products depends on the purchasing power and policies of foreign countries and U.S. export and food aid programs. Other factors affecting water supply and irrigation development are technology changes which increase productivity, climate, or farm irrigation efficiency and environmental considerations.

Until recently the Nation followed a policy of curbing and containing agricultural production excesses. The long-standing anomaly of spending money to reclaim new lands for agriculture while paying subsidies to keep existing acreage out of production apparently is over. For the foreseeable future, there may be a demand for all arable land that can be productively cultivated.

Land use policy is another factor affecting irrigated agriculture. Rural America is being called upon to increase agricultural production while providing land for living, recreation, and space for the expanding urban population. An estimated 2 million acres of farmland are being lost each year because of urban expansion and other nonagricultural uses with an additional 1 million acres going under water in ponds, lakes, and reservoirs. To replace such land by bringing more marginal land into production will require more irrigation water.

Water for metropolitan areas

Population growth, industrial development, water pollution controls, and water conservation and reuse practices are major factors influencing the water needs of urban and adjacent suburban areas. Seventy-five percent of the Nation's population live in metropolitan areas comprising less than 2 percent of its area. Another 13 percent live in nearby communities. By the year 2000, it is expected that the proportion of the population in metropolitan areas will have grown to 85 percent.

The water resources available to meet future metropolitan area needs are limited. Increasingly, cities like Los Angeles are obligated to go outside their immediate sources of supply, even beyond the river basins in which such cities are located. Also, the costs of providing metropolitan water services are escalating rapidly.

Water, particularly in the East, has been such a readily available resource that it was generally taken for granted. Not until water becomes scarce, or temporarily unavailable, does a person realize how dependent one is on water in everyday life. When water becomes scarce during droughts, people suffer economic losses as well as reductions in standards of living. Solving water problems in large metropolitan areas, however, is difficult where there are numerous organizational authorities involved in competing for the water supply from the same water resources.

The severe drought in the Northeastern United States, beginning in the early 1960s, caused the Congress to direct the Corps of Engineers to work with Federal, State, and local officials to plan steps to insure against future drought-related shortages in the Northeast.

The Corps of Engineers Interim Report on the Northeastern United States Water Supply Study, now underway, is an excellent presentation of the water problems of metropolitan areas. The Interim Report points out that more than 14 million of the 50 million persons living in the Northeast during the 1960s drought were forced to restrict their water use to conserve the dwindling supply. Since the drought ended in the middle 1960s, no major water supply projects have been built in the three most critical areas: Washington, D.C.; New York City; and Eastern Massachusetts/Rhode Island metropolitan areas. Many water supply systems in the three areas find themselves routinely supplying more than they could in a drought. For instance, the New York City system has a safe yield, or drought-time capacity, of 1,312 million gallons per day (mgd). Yet, in 1973, the average consumption was 1,480 mgd. In the Washington, D.C., area in 1974, nearly 448 mgd were used from

the Potomac River while during the summer of 1966, the flow of the River dropped to a rate of 342 mgd.

The Corps of Engineers believes that water shortages will increase in the future during periods of less-than-average rainfall and require immediate action in the three most critical areas in the Northeast because public works projects normally take many years to plan, authorize, design, and build.

Metropolitan communities present in sharp focus the (a) problems of increased demands for water services but limited funds for construction of new sources of supply and (b) controversy of development versus conservation of the urban environment.

Another vexing problem in providing urban water supply is the rigidity of legal or political institutions. Conflicting demands of adjacent States for water flowing in interstate rivers, and the multiplicity of independent governments in metropolitan areas are examples of institutional problems that handicap orderly development of water supplies. Also, other factors affecting effective and efficient water management for metropolitan areas are poor integration of water supply with wastewater treatment and insufficient consideration to recreational and environmental values.

Water for small communities and rural America

The 1975 Water Assessment study points out that central water supply systems provide safe drinking water to most of our Nation's population. However, in all parts of our Nation, in varying degrees, about 31 million Americans reside outside the service areas of central systems and have their own domestic water supplies usually obtained from deep wells. Also, about 6 million persons, primarily residents of remote rural areas and frequently with low incomes, have no running water in their dwellings.

The Farmers Home Administration, which administers a loan and grant program for construction and improvement of rural water systems under the Consolidated Farm and Rural Development Act, identified over 24,000 rural communities with a need for a central water system or an improved one. The Department of Commerce's Economic Development Administration, under the Public Works and Economic Development Act, makes loans and grants to help local communities develop and improve their water supply facilities. Also, the Department of Housing and Urban Development, under the Housing and Community Development Act, provides block grants to local communities which may use them for developing or improving their water supply systems.

The recent Department of the Interior report, "Critical Water Problems Facing the Eleven Western States," points out that at least one-quarter of the 6,500 nonmetropolitan communities in the 11 Western States have water in short supply, water of poor quality, or both. The range of problems includes lack of adequate supplies, mineralized supplies, inadequate storage and treatment facilities, and deteriorating distribution systems. Some of the causes of these physical problems are limited financial base, competing uses by nearby communities, out-migration, and the cost of water. The types of problems and potential solutions often extend far beyond a single community's boundary. For example, upstream waste discharges have caused water quality problems to downstream communities. Lowered aquifer water levels caused by deep well pumping have caused neighboring shallow wells to dry up. One solution may be transporting water over a distance. This method may become practical when several small communities together can achieve economy of scale.

The Department of the Interior report points out that while the national policy enunciated in the Rural Development Act states adequate water supplies should be provided for economically distressed communities to help with efficient and orderly growth and development, many small Western communities are faced with an insufficient quality and/or quantity water supply to maintain or improve the viability of the community.

Water for Indian lands

The Federal commitment and responsibilities to the Indians and the interrelated issues of economic progress, Indian reservation resources development, and Indian water rights pose special and difficult problems. An overall Indian problem is one of a very low standard of living and a very high rate of unemployment. The Nation's stated goal is a standard of living for the Indian comparable to that of other Americans.

A vital key to improving the economic standing of the Indians is the development of the natural resources of the reservations, which include oil, gas, and coal reserves, many acres of potentially productive farmland, and recreational opportunities. Such development would not only be beneficial to the Indians but when viewed in terms of today's problems, such as increasing world shortages of food and the energy crisis, would provide much broader benefits.

As discussed in the Department of the Interior's Westwide Study Report, at virtually all of the 172 Indian reservations in the 11 Western States, the quantity and quality of water readily available determine the degrees to which natural

resources can be developed and utilized. For example, energy development requires water for mining, processing, and production. Also, fishing resources and outdoor recreation cannot be maintained where water supplies are being depleted for off-reservation uses. Water is also needed for grazing lands, and where dryland farming is not adequate the production of food and fiber may be limited by the amount of water available for irrigation.

Obtaining adequate water supplies will be particularly difficult in water-short areas, such as in the Southwest along the lower Colorado River and in the Northern Great Plains, where competing uses have already or are fast approaching the point of oversubscribing existing supplies of water.

At the present time, the Bureau of Indian Affairs is making water studies for Indian lands which include water inventories for the reservations, in terms of quality and quantity, and determinations of present and future Indian water requirements.

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The more important questions which should be considered in addressing this issue include:

1. Is accurate and current information available on the quality and quantity of the basin's or region's water resources? Is accurate and current data available on the basin's or region's present water usage and expected future needs and demands? Such information is vital to realistically establish water priorities and plan Federal water resources developments. What are the problems in developing and using such information and do the Federal agencies and the States effectively coordinate their information-gathering efforts?

2. Do the Federal agencies have current plans for development and use of the basin's or region's water resources and are such plans realistically based on water supply and demand data? How are the water resources allocated among competing needs and expected future demands? Are State and local needs considered and are allocations made on the basis of criteria that puts the water to "best use?" Is there effective consultation and coordination of planning efforts between Federal and State agencies? What are the impediments to effective planning and what actions are necessary to resolve such problems?

3. How are the river basin or regional development plans used by the Federal agencies for seeking authorization and appropriation of funds for individual projects and programs? Is such programing consistent with the plans and responsive to the most pressing needs to make best use of the available water resources? If not, what are the problems and issues and can they be resolved under existing legislation and organizational arrangements, or is there a need for a national water policy and implementing plan?

4. Are the water development agencies coordinating their efforts with the energy and food policymaking agencies so that realistic assessments of future water needs can be made and planned for? If so, are such determinations made for each type of energy development by the various food and fiber products and by regions of the country? If not, what are the problems and issues and what should be addressed to resolve them?

Other matters which should be considered under this issue include evaluation of plans and programs to meet water supply needs of metropolitan and rural areas and Indian lands with water supply problems. The work should cover the activities of the Federal water resources development agencies as well as those that provide loans and grants and technical assistance to the States and local communities.

Recently we issued a report to the Water Resources Council on the results of its review on the adequacy of water data collection activities and related efforts of the agencies participating in the Water Resources Council 1975 Water Assessment study. The Council's study is a 3-1/2-year effort, expected to be completed in December 1977, to identify on a national and regional basis the Nation's severe water and water-related problems.

In addition to the Water Assessment study, the Water Resources Council, with participation of Federal, State, and regional agencies, is in the early stages of making two major water studies authorized by the Congress. The first, called the Section 209, Level B (River Basin) Planning Studies, was authorized by the Federal Water Pollution Control Act Amendments of 1972 and is to be a comprehensive analysis by river basins and subregions for the purpose of resolving the long-range problems identified by earlier studies. The studies will identify and recommend action plans and programs for Federal, State, and local entities. While the completion date is January 1, 1980, progress is slow and it is unlikely that the nationwide studies will be completed by that time. The second study, authorized by the Federal Nonnuclear Energy Research

and Development Act of 1974, provides for assessments of water requirements and water supply availabilities for nonnuclear energy technologies. Legal constraints; water and waste disposal costs; and an analysis of environmental, social, and economic impacts are among the concerns that will be addressed.

OUR REPORTS

Report to the Water Resources Council on Problems Affecting Usefulness of the National Water Assessment (CED-77-50, dated March 23, 1977).

OUR REVIEWS IN PROCESS

Review of the Effectiveness of Water Resources Planning Under the Act of 1965.

Review of Need for a More Effective and Comprehensive Water and Waste Disposal Program in Rural Areas.

The California Drought of 1976-77--Review of its Impact and the Adequacy of the Governmental Response, and Assessment of Conditions to Cope With Foreseeable Water Needs and Drought Periods (congressional request).

Assessment of National Drought Problem and Adequacy of Federal Agency Program Planning and Coordination to Deal with the Drought Problem.

Survey of Plans and Programs to Meeting Competing Water Needs in the Colorado River Basins.

DO WATER AGENCIES AND INDUSTRY HAVE CONSERVATION AND REUSE PROGRAMS THAT REDUCE DEMAND AND MAKE MORE EFFICIENT USE OF WATER SUPPLIES?

As the Nation's waters are more and more committed and used, the potentials of meeting water demands through water conservation and reuse become more and more important. Such programs can be a viable alternative when water supplies become scarce and increasingly costly. Water conservation has wide application and usually can be practical wherever water is used: It could preclude the need for or postpone the development of new water resource projects. It could also result in reducing their size and achieve related economies. The potential adverse effects of water resource developments make conservation a recommended nationwide policy. The reuse of water before it is returned to the stream system is equally important as it reduces the expenditures required for new withdrawal systems and reduces the total pollutants returned to the streams.

One means of making more efficient use of available water supplies is to reduce losses in existing systems. These losses occur from evaporation, leakage in storage and transmission systems, and careless use of water by the ultimate recipients, whether they be farmers, homeowners, or manufacturers. While not all losses can be eliminated and not all those capable of being reduced should be if the cost of saving the water exceeds its value, water conservation practices give promise of significant savings at acceptable costs.

The Federal Government, in carrying out its responsibilities for water resources planning, management, and development has a strong interest in reducing water demand and making more efficient use of existing water supplies. In planning water supply projects, Federal agencies should consider water use efficiency by the potential water users as well as by the recipients of water from existing Federal projects. If effective water conservation practices can be instituted, this should be considered as a viable alternative to new project construction. Also, by requiring conservation policies and practices by the water recipients from a proposed Federal project, the Federal construction agencies could reduce quantities needed and be better able to meet competing demands in the Nation's water-short areas.

Further, agencies that administer the Federal housing, rural, and economic development programs and provide loans, grants, or other financial and technical assistance for the construction and rehabilitation of housing and for the development and improvement of public water systems have a responsibility for promoting water conservation policies and practices. The General Services Administration (GSA), or other major Federal procuring agencies, when establishing specifications for building construction and equipment, should consider water saving devices and practices not only to achieve more efficient water use in Federal activities but also because such specifications can become an industry standard.

Practices that can yield important water savings can be classified into three areas--agricultural, urban, and industrial. A discussion of these areas follow.

Agricultural use

The greatest potential, as well as the greatest need, for water savings is in the irrigated areas of the West. Irrigation of crops accounts for over 80 percent of consumptive uses of water, most of which occur in the arid and semi-arid West.

Some techniques which could lead to "productivity increases," that is, maximizing agricultural output per unit of

water use, are the lining of water conveyance and distribution systems, more exact timing of water deliveries, avoiding over-deliveries, and use of water savings methods, such as drip-irrigation systems. Other measures include suppressing reservoir evaporation, controlling unwanted vegetation which consumes considerable water, and increasing yields without additional water through better crop varieties and fertilizers. Some techniques which could be effective, but are sensitive issues, are water-pricing policies that are a disincentive to excessive use, such as (1) progressively higher rates as greater quantities of water are used and (2) the elimination or reduction of Federal subsidies to recipients of irrigation water from Federal projects.

Recently, the Department of the Interior advised us that it was working with the Department of Agriculture and the Environmental Protection Agency to organize an interagency task force to review the problems of inefficient irrigation in the Western States and to recommend appropriate Federal objectives, policies, actions, and agency roles. We were advised also that ways were being sought to obtain the participation of representatives of State agencies, irrigation associations, and resource conservation districts in the work of the task force.

Urban use

Wise use of urban water supplies not only conserves water for use by more consumers, but it saves the cost of developing and treating new potable (safe for drinking) supplies and reduces the volume of sewage water that must be treated. This is especially important for financially hard-pressed urban areas where many projects are competing for limited funds.

A number of opportunities exist to improve efficiency in urban water use. Municipal water supplies are depleted to some extent by leaks in the distribution systems and by defective connections and fixtures, particularly in older systems. Control programs which detect and correct significant leaks may very well be cost effective. The city of Pittsburgh reduced the amount of water treated by 30 to 50 percent by correcting leaks. Other opportunities are also available with better hardware, toilets, and shower facilities that cut down on the amount of water used. Such water saving devices in the construction of new homes and facilities or for replacement in existing structures, through building code requirements, could be desirable and cost-effective techniques.

Many cities do not meter use by consumers and have no way of measuring water use and charging for the amount consumed. Without such charges, there is no financial incentive for consumers to avoid excessive use. Experience has shown that meter

installations result in reduced water use. While it may not be feasible to install meters in all existing residences and under certain conditions, it would seem advisable for cities not having meters to review the benefits and costs that might be derived from such installations. Also, urban areas could establish pricing policies which would provide incentives for more efficient water use.

Several other measures could be taken to achieve wise use of water resources. For example, States and cities could help direct urban and industrial development to areas where water supply is more readily available. Federal financial and technical assistance programs to urban areas could stress conservation and reuse practices. Such Federal programs include the Department of Commerce's economic development loan and grant program to communities for developing water systems as well as HUD's housing programs. Also, technology is now available to utilize urban wastewaters for such uses as irrigated agriculture, greenbelts, recreation, and open spaces, and the Corps of Engineers is carrying out an urban studies program under which the Corps provides urban areas with planning and technical assistance on wastewater management.

During the drought in the Northeast during the early 1960s, emergency use control reduced per capita water consumption in New York City by about 15 percent and showed that use control during emergencies can and does work if mandatory water use restrictions are applied. However, mandatory permanent or temporary water use control, such as prohibitions of lawn or garden watering and washing of cars and streets, are not popular and, therefore, not reliable over long periods. Cities, by means of public relations and consumer education programs, should encourage their water users to make more efficient use of water and make them aware of the water charges they pay and the costs of developing new supplies and additional sewage treatment facilities.

Industrial use

Water of proper quality in adequate amounts is of great importance for the operation and maintenance of industry. As the total water use increases, the cost of obtaining new supplemental amounts of water increases and, therefore, industry is concerned with making the best use of water.

Most industries that use large quantities of water, such as a million or more gallons a day per plant site, have their own water systems and sources of water. The types of industries that use the largest quantities of water include steam electric powerplants, iron and steel, chemicals, pulp and paper, petroleum refining, and food. These industries account

for more than 60 percent of water used by all manufacturing industries. Other industries use public water supply systems.

Water saving by industry can be categorized into conservation and reuse. Conservation, that is, reduction of water requirements, can result from installation of water usage meters to identify unnecessary and wasteful high usage, by using less water-consuming manufacturing processes, by engineering modifications, and more efficient equipment and plant management practices.

Recovering wastewater for reuse is common and probably offers the most potential for water savings. For example, closed recirculating cooling water systems, with proper treatment, have replaced once through cooling water use in many applications because reusing water is less expensive. In many industrial plants, the water used once in a particular application is still of higher quality than the original raw water. Therefore, it can be reused in another application requiring a lesser quality.

The use of recycled water in industry could be the most cost-effective solution to an industry's or a plant's demands for water in their operations. Such use will probably increase as industries seek to achieve the water quality requirements and goals of the Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500). EPA's programs, to implement Public Law 92-500, should promote industrial recycling and reuse of wastewater. Such programs include (1) the effluent limitation requirements under the national permit system for all point source discharges, (2) pretreatment standards which require industries discharging to municipal systems to reduce or eliminate certain pollutants (incompatible wastes), and (3) the industrial cost-recovery system under which each industrial user of a municipal waste treatment facility must repay a proportion of the Federal grant to the municipality corresponding to its percentage use of the facilities' capacities. This should encourage industry to choose the most cost-effective solution to waste treatment problems.

We note that the National Commission on Water Quality March 1976 report to the Congress recommends that the Congress redefine the goal of the elimination of discharge of pollutants by 1985 to stress conservation and reuse and provide adequate financing to accelerate research directed to the development and demonstration of promising techniques for recycling and reuse.

The rate at which industry will move toward greater recycling and reuse of wastewater depends on advances in tre.t-

ment technology, costs, and the consequences of water pollution controls. Also, water pricing policies of Federal agencies or municipalities that supply water to industries are important factors in motivating industry to use water-saving practices.

Important questions that should be addressed under this issue include:

1. Are the Federal agencies encouraging water conservation and achieving more efficient water use by the recipients of irrigation water from Federal projects? Do the Federal agencies adequately coordinate their efforts and promote the use of new and existing techniques and equipment to save water? What are the impediments to more efficient use of irrigation water and should Federal incentives be considered to promote conservation?

2. What are Federal agencies doing to achieve water conservation by recipients of domestic and industrial water supplies from Federal projects? Do the Federal agencies who provide loans, grants, and other assistance to urban areas and rural communities for housing programs and for developing or improving water supply systems promote more efficient use of their water resources? Are public water systems, on their own initiative, whether receiving Federal assistance or not, carrying out conservation programs? What should be the Federal role in water conservation and should Federal incentives be considered as a means to effect more efficient water use?

3. What is the nature and extent of the efforts of high water-using industries, which provide their own water sources, to recycle, reuse, and make more efficient use of their water supplies? Is Public Law 92-500 effectively promoting industrial recycling and reuse? What are State and local governments doing to encourage industrial water conservation? What is the nature of--and what should be--the role of the Federal Government to achieve water economies by industry?

Other matters which should be considered include (1) do the Federal agencies adequately consider water conservation measures in determining the water needs or evaluating the demands of recipients of water supplies from Federal water resource projects, and should they be required to have conservation programs as a condition to receiving such water, and should such requirements be coupled with Federal incentives and (2) do GSA and other major procuring agencies require

water-saving facilities and equipment when constructing facilities or purchasing equipment?

OUR REPORTS

"Report to the Congress on Better Federal Coordination Needed to Promote More Efficient Farm Irrigation," (RED-76-116, dated June 22, 1976).

OUR REVIEWS IN PROCESS

"Report of Ways to Obtain More Efficient Use of Municipal and Industrial Water Supplies."

"Survey of Federal Efforts to Promote Better Use of Existing Water Supplies by Improving Conveyance Systems Efficiencies of Federal Resources Projects."

HOW CAN THE CONSTRAINTS OF WATER LAWS AND RIGHTS ON MEETING PRIORITY WATER NEEDS BE EFFECTIVELY RESOLVED?

The authority and jurisdiction over water resources are divided between the States and the Federal Government, and much of water law and its related institutional arrangements originated in the 19th century and was fashioned to meet the needs of that era. Many of the laws do not work well in solving the water problems of today and the emerging issues of tomorrow.

In the water-short regions of the West, the increasing and changing water needs and desires have raised the issue of allocation of available water supplies among competing uses and users and transfers of water rights from one use to another. However, such allocations and transfers are significantly affected by Federal and State water laws and rights.

Because this issue is essentially concerned with the allocation of water as a scarce resource, the principal focus should be on water laws and rights in the water-short areas of the West. However, it should be recognized that as water becomes more scarce in the Eastern States, which presently follow the common law doctrine of riparian water rights, problems similar to those in the West may increasingly arise and the Eastern States may also find it difficult to resolve them under their existing legal systems.

Water law of the States is basically of two types: (1) the common law riparian doctrine, usually followed in the Eastern States, where the owners of property adjacent

to a stream or other water source share a right to that water source and (2) the appropriation doctrine, which grew out of the customs of the gold miners of California and adopted by most Western States, by which the first to put the water to beneficial use has the prior right. These two systems vary from State to State and in some States there exists a mixture of riparian and appropriative rights.

The original 13 and other Eastern States and the first tier of States west of the Mississippi River mainly follow the common law of riparian rights. The basic concept that each riparian owner is entitled to share in a common water source, undiminished in quality and quantity, was suitable for a humid area of relatively high precipitation. But the water uses and needs of the arid West were much different from those of the Eastern United States. So the appropriative rights system, which permitted maximum utilization of scarce water, was favored in the arid West.

Each State has its own system of regulation of water rights. Customary in the Western States is a statutory method of adjudication of water rights, usually by a State engineer or another State executive officer charged with the administration of the water laws. Such adjudications serve two purposes: (1) rights are judicially declared and the holders can rely on such declaration and (2) the planners or administrators are informed of the amount of unused or "unappropriated" water remaining for future development.

A riparian right is not created by use nor lost through nonuse. It protects the landowners from withdrawals or uses which unreasonably diminish water quality or quantity. Such rights can be sold and transferred but are subject to the same reasonable use restrictions. An appropriation right can be lost through nonuse or abandonment. It also can be sold or transferred, and the expected impacts of the proposed transfer upon other holders of water rights in the same water supply source are an important consideration.

All Western States permit a change of use of water rights. However, the procedures required and the administrative discretion of the State regulatory agencies inhibit the easy change of use. Some of the States have cumbersome and archaic legal and institutional requirements which hamper the change from one water use to another. Also, the pattern of State water law development was such that adequate consideration was not given to the maintenance of streams for noneconomic and instream uses, such as recreation, fish and wildlife, or scenic beauty. Such uses, in most States, have not been considered beneficial uses of the water and, therefore, have

been subject to appropriation for economic purposes. In the last few years, the public's concern for protection of the environment and desire for recreational opportunities has significantly increased and, therefore, has raised the question of whether State water law should recognize water rights for such values.

Another problem in State water law is the failure of the law to treat ground water and surface water in a manner which recognizes their relationship in nature. For example, the right of a landowner to pump ground water may conflict with the rights of other landowners to pump ground water and with the rights of surface appropriators downstream. Conjunctive use of surface and ground water is not encouraged, resulting in a waste of available surface water at the same time ground water tables are being lowered. Additional problems the law is slow to correct are reductions in quality of ground water and subsidence of the surface as the ground water is mined. If State water law covered ground water in the same manner as surface water, the rapid depletion of ground water in the Western States could perhaps be reduced.

Also, State water law is not designed to encourage conservation by those using it. The greatest potential for water savings is in irrigated areas of the West. Irrigation of crops account for most of the consumptive use in the Nation. However, such use is based mostly on water rights acquired under appropriation law. Water law does not encourage conservation of water because the user who does not efficiently use water is not penalized, and the one who conserves and returns the saved water to the stream is not rewarded for his efforts. Consequently, considerable water is wasted. Another problem is that water of high quality suitable for irrigation or domestic use is used, for example, for purposes such as cooling when low-quality water would be adequate. This raises the question whether legislation is desirable to restrict the use of high-quality water for uses where low-quality water would be satisfactory.

The Federal Government is involved in water law and rights primarily on matters relating to the distribution of water from Federal water resource projects, water quality, and federally reserved water rights on public and Indian lands. In addition, the Federal Government is concerned with the allocation and use of water resources involving international treaties with Canada and Mexico; interstate compacts, approved by the Congress; apportioning the waters of interstate streams; interbasin transfers; and the provision of the individual Federal water project authorization acts.

Federal projects are designed to recognize the water rights of the residents of an affected State. Downstream waters made available by a Federal project are subject to allocation under State laws and parties desiring to use the water impounded by reservoir must have the necessary water rights under the provisions of State laws and regulations. Also, the Congress has established policies which protect and recognize certain State-created rights, such as section 1 of the Flood Control Act of 1944, which subordinates use of water for navigation purposes to beneficial consumptive uses of the streams in the Western States.

The Federal Water Pollution Control Act amendments of 1972 (Public Law 92-500), requiring higher water quality and greater environmental standards, involves maintenance of minimum stream flows for recreation, fish and wildlife habitat, scenic values, and will require greater quantities of water. The energy shortage has raised questions concerning the reallocation of storage rights in Federal reservoirs, interbasin transfers, and the takeover of water emanating from Federal and Indian lands.

If water rights could be readily transferred and reallocated to more pressing needs, it might be possible that adequate water supplies would be available and construction of new Federal water supply projects would not be necessary or could be postponed. Such matters should be considered when evaluating alternatives to proposed projects.

An important problem in the Western States is the uncertainty of the quantity and nature of Federal and Indian reserved water rights. The Congress, by certain legislation, passed control of water on the public lands to the States and invited the public to appropriate and use the water in accordance with State law. At the same time water was being appropriated by the Western settlers, the Federal Government was creating Indian and military reservations and national forests and parks on public lands.

In several court cases, the Supreme Court held that whenever the Federal Government created a reservation for any purpose on public lands, it simultaneously reserved the water within and adjacent to those lands from State appropriations. In other words, when public lands are withdrawn or reserved for authorized purposes requiring the use of water, the right to use a sufficient amount of the related water resources to accomplish such purposes is also reserved. However, the quantity of the Federal and Indian reserved water and the uses to which it can be put, in most cases, is undefined and leaves great uncertainties in the amount of water available for other users. Persons who

believe they have valid water rights under the State law may discover the Federal Government has a prior right.

Until such water rights are inventories and quantified, knowledgeable judgments cannot be made as to their impact on existing water rights based on State law nor can judgments be made as to the extent to which Federal water rights may defer or preclude future private development based on new appropriations under State law. Water that might be used beneficially may not be used or not put to best use because the potential users might be reluctant to invest capital until the uncertain Federal and Indian rights are established. Also, the limits on Federal and Indian use of the reserved water is uncertain; for example, it has not been established whether the water may be used off the Federal or Indian reservations or whether it might be sold to non-Federal interests or to non-Indians, respectively. Another issue, which arises if Indian entitlement to water resources deprives non-Indian users of water obtained in accordance to State laws, is whether the Federal Government should compensate the non-Indian users for the rights given up by them.

With respect to Indian water rights, the Bureau of Indian Affairs has a program under which water studies are being made for the Indian reservations. However, the quantity of water and the pace at which it is made available for Indian use will depend primarily on the speed the Indian water entitlements can be legally established.

It seems clear that the piecemeal legislative and judicial ad hoc approach to water laws and rights has not been adequate to resolve the related water problems and emerging issues. Legislation, probably at both the Federal and State levels, seems necessary to help resolve such problems and to achieve the goals of water conservation, timely transfers of water rights, and appropriate allocation of water resources among competing demands.

The more important questions which should be addressed are:

1. What is the nature and extent of the problems in State water law and its administration? How significant are their adverse impacts on Federal planning and programing to meet priority water needs and to achieve conservation by the recipients of water from Federal projects? Are the States taking actions to resolve the problems and what should be the Federal role in achieving desired reforms? In those States where water law has been

revised, have the revisions been effective and could they be used for designing model State legislation?

2. Are Federal laws, contracts with water users, and federally approved interstate compacts on the allocation and use of water resources effective or are they obstacles to meeting priority water needs and efficient water use? Do Federal water laws and judicial proceedings help solve problems or do they raise water jurisdictional disputes with the States? What is the nature and extent of such problems and what efforts are the Federal agencies making to resolve them?

3. Are the Federal agencies taking effective action to define and quantify Federal and Indian reserved water rights? What is the nature and significance of the problems arising from the failure to take such actions? What legislative proposals have been made or are necessary to resolve the problems and what matters should be considered to avoid disputes or minimize problems when such Federal and Indian rights affect water rights acquired under State law?

Other important matters deserving consideration include the legal aspects and ramifications concerning (1) interbasin transfers of water resources from one watershed to another, (2) the manner in which Federal-reserved water may be used, and (3) repayment responsibilities when water users from Federal projects transfer their water rights to others.

OUR REVIEW IN PROCESS

"Survey of the Constraints of Water Laws and Rights on Allocating Water Supplies Among Competing Needs and Achieving Efficient Use of Water Resources."

DO FEDERAL AGENCIES' BENEFIT-COST ANALYSES FULLY AND REALISTICALLY CONSIDER THE BENEFICIAL AND ADVERSE EFFECTS OF WATER RESOURCE PROJECTS?

The Flood Control Act of 1936, which set a policy that the benefits of Federal projects should exceed costs, led to the development of an evaluation procedure, commonly called benefit-cost analysis. This analysis is intended to provide a rational basis for comparing in monetary terms the estimated benefits of a proposed project with its estimated costs to determine whether the project is economically justified. The

benefit-cost analysis is one of several factors considered by the Federal water resources development agencies and the Congress in determining whether or not to approve a proposed project. It provides a quantified measure of a project's expected worth and thus serves a purpose similar to the estimated return on investment used in private business when expansion of facilities is considered. Water resource projects are seldom authorized or funded by the Congress unless the estimated benefits exceed the estimated costs.

Until fairly recent times, the national emphasis on economic growth provided the primary basis for development of water resources. Water resource planning was directed toward the development of required resources through technically feasible projects which maximized net economic benefits. The plan was thus considered to be the one that provided the most economical way of developing a specific resource.

However, in recent years, the demands of the public and the responding governmental action, in terms of legislative requirements, has led to more emphasis in project formulation and justification on the environmental and social consequences of proposed water resources developments. For example, the National Environmental Policy Act (Public Law 91-190) requires that the short- and long-term environmental consequences of a proposed Federal project must be evaluated and set forth in an environmental impact statement.

Alternatives to the proposed project must be fully considered. Also, the River and Harbor and Flood Control Act of 1970 (Public Law 91-611) states that the objectives of enhancing regional economic development, the quality of the total environment, including its protection and improvement, the well-being of the people, and the national economic development are the objectives to be included in federally financed water resource projects and in the evaluation of the project's benefits and costs. It also stated that due consideration be given to the most feasible alternative means of accomplishing the objectives.

As a result of congressional concern, the Water Resources Council, pursuant to its responsibilities under the Water Resources Planning Act of 1965 and with the approval of the President, issued new principles and standards for water resource project formulation and evaluation. The major significance of the new principles and standards, as compared to prior analytical criteria, is that they place environmental concerns on a basis equal to economic development. Also, they require the consideration of the beneficial and adverse effects on regional development and social well-being and evaluation

of alternative plans. The principles and standards delegate to the water resource agencies the development of the implementing procedures and detailed methods for making benefit-cost determinations.

The construction and operation of water resource projects, many designed for multipurpose functions and often costing hundreds of millions of dollars, have significant and permanent environmental as well as social impacts. For example, one proposed Federal multipurpose project, estimated to cost about $625 million and essentially designed for hydroelectric power benefits, calls for the construction of two dams, powerplant installations, and about 400 miles of overland transmission lines. One dam will be about 2 miles across with a maximum height of 335 feet above the streambed and create a reservoir which will cover about 86,000 acres of timberland and require the relocation of people residing on the lands required for project purposes.

The principles and standards require that the project-planning process include an evaluation of alternative means, both structural and nonstructural measures, to achieve project purposes. The beneficial and adverse effects for each alternative plan are required to be displayed so that the differences among alternatives can be accurately analyzed. Alternatives to be considered when planning a multipurpose dam and reservoir flood and water supply project may, for example, include evaluation of nonstructural measures, such as flood plain zoning and flood insurance with or without single purpose flood control works. Also, water supply needs might be met by reallocation of water supplies from other Federal projects or by use of available ground water resources and, in this way, negate the need for construction of the dam and reservoir.

Because of the increasing and competing demands on the Nation's financial and physical resources and concerns for the environmental and social consequences of water resource developments, there is a growing and intensifying questioning of projects' economic and environmental need and desirability by Federal and State agencies, the public, and Members of Congress. Further, in many cases, project critics have instituted law suits claiming inadequate and inaccurate environmental and economic considerations. Such actions cause delays and escalating construction costs if projects have had funds appropriated for construction or wasted expenditures for planning, design, and engineering if projects are not approved for construction. Consequently, it becomes imperative that a proposed project fully and realistically consider its expected beneficial and adverse impacts so that the Nation can optimize the use of its funds and resources.

More and more Members of Congress, often several members of a State's delegation, have asked for a GAO review of an agency's economic and environmental analysis of a proposed project to help them decide on its merits for authorization and funding. As a result, we have reviewed the economic and environmental issues for individual projects, mostly Corps of Engineers multipurpose reservoir projects. Our reviews consistently disclosed problems concerning the accuracy and reasonableness of the benefit and cost determinations and raised serious questions concerning how realistically the economic and environmental issues were considered. For certain of these projects, totaling hundreds of millions of dollars in costs, the decisionmakers, both at the Federal and State levels, cited our findings as a factor in their decision not to support the projects for construction. As a result, the projects have been shelved or are planned for deauthorization action.

Because the public works appropriations for water resource projects involve billions of dollars and permanent impacts on the Nation's water and related land resources, the Federal water resources development agencies' policies, procedures, and practices for making benefit-cost analyses should be assessed. Such agencies include the Corps of Engineers, Bureau of Reclamation, Tennessee Valley Authority, and the Soil Conservation Service.

The important questions to be addressed under this issue should include:

1. Were the benefits and costs determined in accordance with governing legislation, Water Resources Council principles and standards, and agency policies and procedures, and were the agencies making the determinations in a uniform and consistent manner?

2. Were the adverse environmental and social impacts expected from project construction and operation adequately considered in the analysis? When reasonably measurable, were appropriate adjustments made to the amounts determined for the benefits and costs?

3. Were the potential alternatives to the project for achieving the same objectives realistically considered? Were the expected benefits, costs, and adverse impacts of the alternatives adequately supported and sufficiently displayed so that the trade-offs among the alternatives could be judged?

4. If future evaluations continue to disclose significant deficiencies in the agencies' [illegible]es, should

considerations be given to the need for an independent board of review, as recommended by the National Water Commission, which would evaluate the agencies' water development proposals and analyses?

Other matters of concern include whether (1) the proper interest rate was used to discount future project benefits to present value and to amortize benefits and costs over the project's expected economic life, (2) adequate repayment assurances were received from project beneficiaries of reimbursable project purposes, and (3) the development agency adequately carried out the requirements for consulting with and coordinating its efforts during a project's planning process with other Federal agencies and State and local officials. Also, consideration should be given to the findings and recommendations of the congressionally directed Water Resources Council section 80(c) study on the principles, standards, and interest rate formula (discount rate) to be used in formulating and evaluating water resources projects.

OUR REPORTS

Report addressed to the Congress:

"Improvements Needed in Making Benefit-Cost Analyses for Federal Water Resource Projects," (B-167941, dated September 20, 1974)

Reports addressed to individual Members of Congress on benefit-cost analyses and environmental issues:

Corps of Engineers projects:

William L. Springer Project (RED-75-387, dated April 18, 1975).

Dickey-Lincoln Project (RED-75-387, dated June 19, 1975).

Tomahawk Lake Project (RED-75-382, dated July 2, 1975).

Red River Lake Project (RED-76-9, dated August 15, 1975).

Catherine Creek Lake Project (CED-76-147, dated August 31, 1976).

Extension of the Navigation Season on the Great Lakes and St. Lawrence Seaway (RED-76-76, dated April 20, 1976).

OUR REVIEWS IN PROCESS

Survey of the Corps of Engineers' methodology and procedures for preparing benefit-cost analyses on inland waterway projects.

Assessment of Federal agencies' methodologies and procedures for preparing benefit-cost analyses of water resources projects.

CHAPTER 4

OTHER ISSUES AND CONCERNS

ARE WATER SUPPLY AND WATER QUALITY PROGRAMS BEING EFFECTIVELY COORDINATED?

Water quality is an essential and critical element of water resources planning, development, and management. Water of suitable quality must be available in adequate quantity at the times and places needed for all intended beneficial uses.

In addition to point sources of pollution, the polluting effects of nonpoint sources, such as erosion and sedimentation, are becoming an increasingly serious problem in the Nation's major river systems. Sediments, for example, accumulate in reservoirs decreasing their storage capacity, increase water requirements for irrigation, as well as increase treatment costs for municipal and industrial water supplies.

The Water Resources Council 1975 Water Assessment shows that severe water quality problems occur in most of the Nation. Our audits are being directed to such problems, especially to evaluating the implementation of the Federal Water Pollution Control Act amendments of 1972 and the Safe Drinking Water Act of 1974. Also, the effectiveness of the coordination and integration of water pollution control and water supply planning and programing should be studied, particularly the consideration given to pollution control and water quality improvement programs as elements of--or as viable alternatives to--developing new sources of water supply. Further, consideration should be given to the respective roles of the Federal agencies in water supply and quality programs, particularly whether it might be desirable to consolidate functions spread among the separate agencies.

ARE WATER RESEARCH PROGRAMS MAKING PROGRESS IN DEVELOPING TECHNOLOGY AND IN FINDING NEW WAYS TO INCREASE THE NATION'S WATER SUPPLY?

Water research programs are vital to help solve water shortages and to meet future demands. Solutions to our water problems must consider augmenting the natural runoff; through such measures as precipitation and snow-melt management, water resulting from geothermal extractions, and desalting of brackish and sea water, new techniques for recycling and reuse of water, and by increasing the efficiency of existing water systems. Because of increasing future water demands and the relatively fixed natural supplies of water, it is likely that desalting of sea water and brackish water will play a considerable future role in meeting our Nation's water needs. Until recently it was not technically feasible to convert meaningful

amounts of saline water into fresh water. However, some 20 years of research and development, largely financed by the Federal Government, has changed the picture. Today, the technology for large-scale desalting is at hand. What remains unsolved, in many areas of potential application, is economic feasibility. A major problem is the large quantities of energy required in the desalting technology.

As water demands increase, research and development is needed to provide improved methods for making water supplies available at reasonable costs, for disposing of wastewater in ways that are environmentally and economically acceptable, and to eliminate or lessen the adverse impacts on the natural environment from the development and use of water resources.

The major concerns in evaluating the Federal and federally sponsored research programs should include (1) identifying the problems impeding progress in developing technology and in finding new ways to increase and more efficiently use water supplies and (2) examining the usefulness of research to, and its application by, water resources planners, developers, and managers. Other important considerations are the role of the Federal Government in mobilizing scientific and technological resources as well as its management and oversight of such research programs.

IS CONJUNCTIVE USE OF SURFACE WATER WITH OTHER SOURCES ADEQUATELY CONSIDERED IN MEETING WATER NEEDS?

As surface water supplies become more depleted, conjunctive use of surface and ground water can greatly extend the water supply available for use and can be an effective way of maintaining water service during drought periods. While there are considerable ground water resources in the Nation, there are major gaps in ground water information, such as location of supplies with respect to users, relationship with surface waters, quality, and feasibility of extracting the supplies. The overuse of ground water has led to land subsidence and salt water intrusion problems in some parts of the country. These conditions, as well as the pollution of ground water, are factors to be considered in the use of ground water to supplement surface water supplies.

In addition to surface and ground water, the desalting of sea water and brackish water, which contains much less dissolved solids than sea water, offers considerable potential as additional sources of water supply. Often such sources are found in or near many places where fresh water supplies are limited but in great demand. However, while the technology for desalting is available, the continuing problem

in many areas of potential application is that it often costs more to convert saline water to potable water than to develop new water supplies.

The major concerns under this issue are whether adequate studies are made in water-short areas on ground and saline water supplies and whether such sources are fully considered, including the beneficial as well as the adverse effects of such water uses, in planning and programing for water supplies. Also, it is important to determine whether water agencies are using or have adequately considered utilizing ground water aquifers as storage reservoirs to be recharged when excess surface water is available. Rather than not use the excess surface water, storage in underground reservoirs could permit its use when surface water is in short supply to satisfy the needs of both ground and surface water users.

WHAT ARE THE PROBLEMS AFFECTING THE TIMELY, EFFICIENT, AND ECONOMICAL CONSTRUCTION OF WATER RESOURCE PROJECTS?

The annual budget for construction of Federal water resources development totals several billions of dollars. Also, a most significant factor in meeting water demands is the long time frame to complete a project so that it can provide the benefits for which it was authorized.

For some water agencies' projects, considerable delays and project changes have resulted from environmental and social impact controversies which often lead to time-consuming litigation. Also, there are project design and engineering changes which cause considerable delays in completing projects. Delays often result in substantial increases in projects' final costs.

Under this issue, matters which should be addressed include the effectiveness of the water development agencies' policies, procedures, and practices for selecting construction starts and funding levels as well as identifying and seeking solutions to problems hindering timely and economical completion of projects. Other concerns include whether projects are constructed consistent with their design and the features authorized so that they will provide the benefits intended.

ARE COST-SHARING REQUIREMENTS OF FEDERAL AND FEDERALLY ASSISTED WATER RESOURCES PROJECTS AND PROGRAMS VIABLE TODAY; WHAT ARE THE CONSIDERATIONS AND ISSUES?

Cost-sharing requirements for Federal and federally assisted water resources projects and programs have evolved

over the years as new agencies, programs, and project purposes have been authorized to meet needs. As a result, there are today variations in cost-sharing requirements among agencies and programs with similar purposes and objectives. When Federal water resources developments, such as navigation and irrigation projects, were authorized to provide for transportation and westward expansion and settlement and economic development of the West, the conditions in the Nation were vastly different from those of the highly developed and affluent country we live in today. In many cases the general taxpayer, who may not directly receive benefits, pays all or much of the costs of federally subsidized water resources developments.

The matters for consideration, therefore, are whether the present cost-sharing requirements are fair and equitable among agencies and programs which present alternative means for accomplishing similar purposes and whether identifiable beneficiaries should more fully pay their share of water resource programs from which they receive benefits. Also, in considering the repayment requirements by direct beneficiaries, environmental and social concerns are involved. For example, national interest may require utilization of water resources in a way that does not maximize economic returns but will satisfy natural environmental values or improve an area's persistently depressed economy or enhance incomes of special low-income groups, such as Indians.

Important questions which must be considered include how should water resources programs and projects be financed, who should pay for such projects and programs, and what are the appropriate rates and terms of repayment. Careful consideration should be given to the Water Resources Council section 80(c) study on cost-sharing, as well as the findings and recommendations of the National Water Commission.

APPENDIX I

FEDERAL AGENCIES INVOLVED IN WATER RESOURCES PLANNING, MANAGEMENT, AND DEVELOPMENT

Department of Agriculture:
- Agricultural Research Service
- Agricultural Stabilization and Conservation Service
- Cooperative State Research Service
- Economic Research Service
- Farmers Home Administration
- Forest Service
- Soil Conservation Service

Department of Commerce:
- Economic Development Administration
- National Oceanic and Atmospheric Administration

Department of Housing and Urban Development:
- Community Planning and Development
- Federal Disaster Assistance Administration
- Federal Insurance Administration

Department of the Army:
- Corps of Engineers--Civil Functions

Department of the Interior:
- Bureau of Indian Affairs
- Bureau of Land Management
- Bureau of Outdoor Recreation
- Bureau of Reclamation
- Fish and Wildlife Service
- Geological Survey
- National Park Service
- Office of Water Research and Technology

Department of State:
- International Boundary and Water Commission--United States and Mexico
- International Joint Commission--United States and Canada

Department of Transportation:
- Coast Guard
- Saint Lawrence Seaway Development Corporation

Independent agencies and commissions:
- Delaware River Basin Commission
- Environmental Protection Agency
- Energy Research and Development Administration
- Federal Power Commission
- Susquehanna River Basin Commission
- Tennessee Valley Authority
- Water Resources Council

APPENDIX I

Independent agencies and commissions:
Council on Environmental Quality
Federal Energy Administration
Federal Maritime Commission

Department of Justice:
Land and Natural Resources Division

APPENDIX II

CONGRESSIONAL COMMITTEES AND SUBCOMMITTEES WITH RESPONSIBILITIES FOR MATTERS RELATING TO WATER RESOURCES PLANNING, MANAGEMENT, AND DEVELOPMENT

Senate:

- Committee on Agriculture, Nutrition, and Forestry
  - Subcommittee on Agricultural Research and General Legislation
  - Subcommittee on Environment, Soil Conservation, and Forestry
  - Subcommittee on Rural Development
- Committee on Appropriations
  - Subcommittee on Agriculture and Related Agencies
  - Subcommittee on HUD--Independent Agencies
  - Subcommittee on Interior
  - Subcommittee on Public Works
  - Subcommittee on Transportation
- Committee on Banking, Housing and Urban Affairs
  - Subcommittee on Housing and Urban Affairs
- Committee on Budget
- Committee on Commerce, Science and Transportation
  - Subcommittee on Science and Space
  - Subcommittee on Merchant Marine and Tourism
  - Subcommittee on Surface Transportation
- Committee on Energy and Natural Resources
  - Subcommittee on Energy Research and Development
  - Subcommittee on Energy Production and Supply
  - Subcommittee on Public Lands and Resources
  - Subcommittee on Parks and Recreation
- Committee on Environment and Public Works
  - Subcommittee on Regional and Community Development
  - Subcommittee on Environmental Pollution
  - Subcommittee on Transportation
  - Subcommittee on Water Resources
  - Subcommittee on Resource Protection
- Committee on Governmental Affairs

APPENDIX II

House of Representatives:

- Committee on Agriculture
  - Subcommittee on Conservation and Credit
  - Subcommittee on Family Farms, Rural Development, and Special Studies
- Committee on Appropriations
  - Subcommittee on Agriculture and Related Agencies
  - Subcommittee on HUD--Independent Agencies
  - Subcommittee on Interior
  - Subcommittee on Public Works
  - Subcommittee on Transportation
- Committee on Banking, Finance and Urban Affairs
  - Subcommittee on Housing and Community Development
- Committee on Budget
- Committee on Government Operations
  - Subcommittee on Environment, Energy, and Natural Resources
- Committee on Interior and Insular Affairs
  - Subcommittee on Energy and the Environment
  - Subcommittee on Indian Affairs and Public Lands
  - Subcommittee on National Parks and Insular Affairs
  - Subcommittee on Water and Power Resources
- Committee on Interstate and Foreign Commerce
  - Subcommittee on Energy and Power
  - Subcommittee on Transportation and Commerce
- Committee on Merchant Marines and Fisheries
  - Subcommittee on Fisheries and Wildlife Conservation and the Environment
  - Subcommittee on Oceanography
- Committee on Public Works and Transportation
  - Subcommittee on Economic Development
  - Subcommittee on Investigations and Review
  - Subcommittee on Water Resources
- Committee on Science and Technology
  - Subcommittee on Advanced Energy Technologies and Energy Conservation Research, Development and Demonstration
  - Subcommittee on Environment and the Atmosphere
  - Subcommittee on Fossil and Nuclear Energy Research, Development and Demonstration
  - Subcommittee on Science, Research and Technology

ORGANIZATIONS CONCERNED WITH WATER RESOURCES PLANNING, MANAGEMENT, AND DEVELOPMENT

Agencies and Commissions:
- Congressional Research Service
- Federal Regional Councils
- National Academy of Science
- National Commission on Water Quality
- National Science Foundation
- National Trust for Historic Preservation
- Office of Technology Assessment
- Regional Development Commissions
- River Basin Commissions
  - Great Lakes Basin
  - Missouri
  - New England
  - Ohio
  - Pacific Northwest
  - Upper Mississippi

Trade Associations:
- American Association of Port Authorities
- American Farm Bureau Federation
- American Geophysical Union
- American Institute of Merchant Shipping
- American Society of Civil Engineers
- American Water Resources Association
- American Water Works Association
- American Waterways Operators, Inc.
- International Association of Hydrological Sciences
- International Water Resources Association
- Lake Carriers' Association
- National Water Resources Association
- National Waterways Conference, Inc.
- Transportation Association of America
- Water Resources Congress

Public and Private:
- American Conservation Association
- Chamber of Commerce of the United States
- Coastal Zone Management Institute
- Conservation Foundation
- Council of State Governments
- Environmental Defense Fund, Inc.
- Environmental Law Institute
- Environmental Policy Center
- Friends of the Earth

APPENDIX III

Public and Private:

Interstate Conference on Water Problems
Izaak Walton League of America
League of Women Voters
National Association of Conservation Districts
National Association of Counties
National Audubon Society
National Congress of American Indians
National Governors Conference
National League of Cities
National Parks and Conservation Association
National Planning Association
National Recreation and Parks Association
National Research Council
National Resources Defense Council
National Tribal Chairman's Association
National Wildlife Federation
Nature Conservancy
Resources for the Future, Inc.
Sierra Club
Soil Conservation Society of America
Sport Fishing Institute
Trout Unlimited
Urban Land Institute
Wildlife Management Institute
Wildlife Society