SUMMARY of CONSULTANTS' FINDINGS

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FOR

THE NEW JERSEY STATEWIDE WATER SUPPLY PLAN

STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WATER RESOURCES

JUNE, 1980

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Cover Photograph of Round Valley Reservoir by William Boehle

STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTION
JERRY FITZGERALD ENGLISH, COMMISSIONER
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Dear Citizen:

The Department of Environmental Protection is pleased to share with you this Summary of Consultants' Findings for the Statewide Water Supply Plan.

This Summary presents the conclusions and recommendations made by the consultants and prioritizes them. The document is based on the twelve outputs prepared by the consultants over the course of this planning effort, which seeks to provide a framework for future water supply decision making in New Jersey. The twelve outputs are published in other volumes.

These recommendations, along with input from the public hearing process, will be given considerable weight in determining our state's future water resources actions and policies.

Thank you for your interest in New Jersey's water supply needs.

Sincerely,

Jerry Fitzgerald English

Jerry Fitzgerald English
Commissioner

Attachment

LISTING OF SOURCE MATERIAL DOCUMENTS FOR THE STATEWIDE WATER SUPPLY PLAN

Task 1 represents the consultants' discussion of a data bank necessary for the analysis completion for the water supply plan.

Task 2 represents the consultants' discussion of projected water needs for New Jersey to the year 2020.

Task 3 represents the consultants' efforts to inventory, analyze and recommend water supply development alternatives to meet the State's needs through the year 2020.

Task 4 represents the consultants' evaluation regarding the adequacy of the existing network of interconnected water systems and the actions to be taken in order that all communities have sufficient quantities of water should a crisis situation arise.

Task 5 represents the consultants' disucssion of the abilities of 25 major water purveyors to meet demands during a drought or other water crisis situation.

Task 6 represents the consultants' discussion of water conservation plans and strategies.

Task 7 represents the consultants' recommendations to establish comprehensive strategies for the State's surface and groundwater resources.

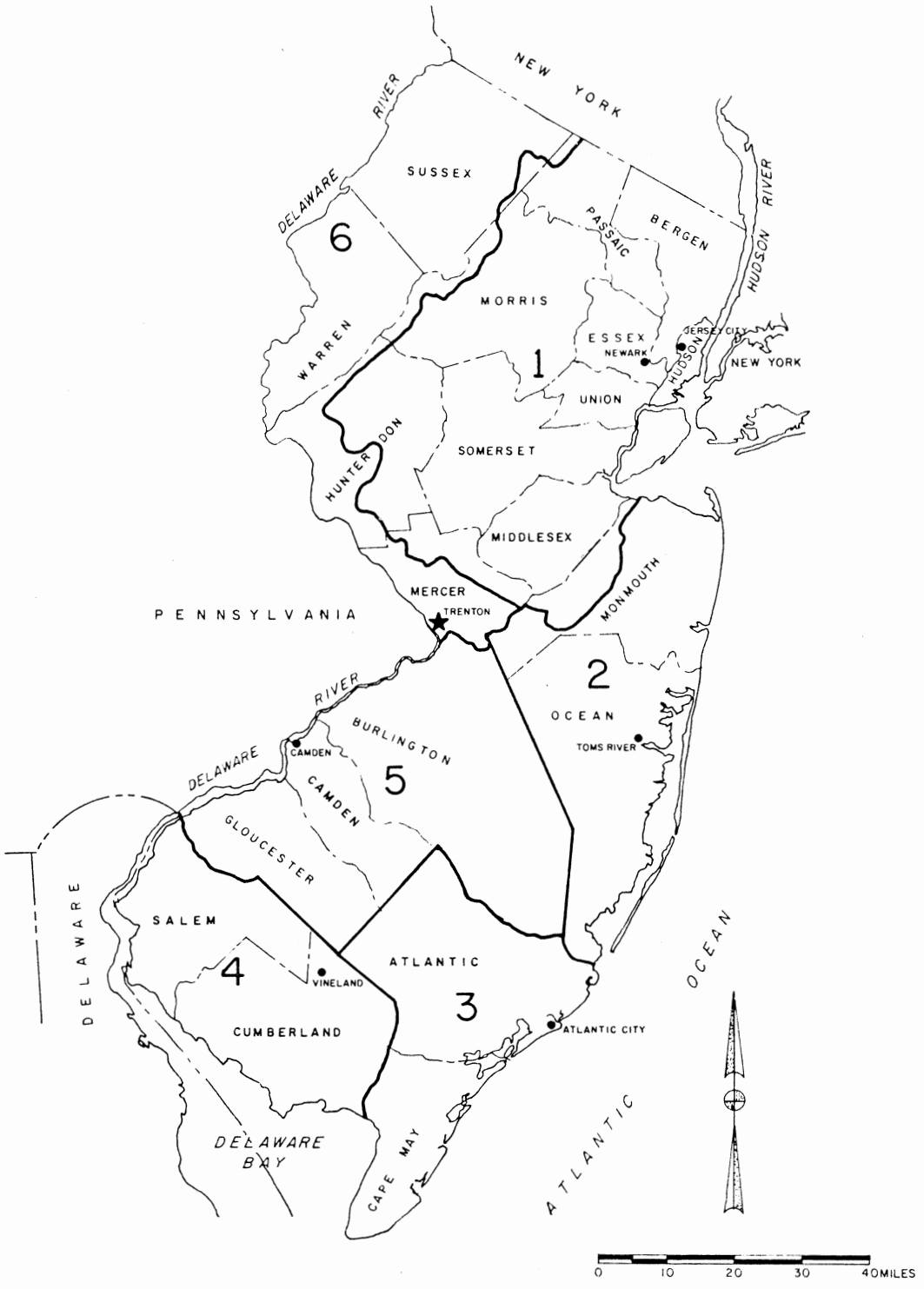
Task 8 represents the consultants' discussion of the regulatory and administrative aspects of water supply.

Task 9 represens the consultants' analysis of state water utility operations and recommends alternative institutional and financing schemes.

Task 10 represents the consultants' discussion of the legal aspects of water supply in New Jersey.

Task A represents the consultants' evaluation of the data management needs of the Division of Water Resources.

Task B represents the consultants' analysis of the capabilities of existing and proposed water supply facilities.



STATE OF NEW JERSEY

WATER SUPPLY PLANNING REGIONS

N. J. STATEWIDE WATER SUPPLY MASTER PLAN

ACKNOWLEDGMENTS

The Association wishes to express its appreciation to the numerous individuals and organizations who assisted in the preparation of the New Jersey Statewide Water Supply Master Plan:

- Commissioner English and former Commissioners O'Hern, Ricci and Bardin for their support and helpful suggestions.
- Dirk Hofman, P.E., Project Director; Dr. Joseph Miri, Deputy Project Director; and their staff (Susan Goetz, Phil Gran, Asghar Hasan, Loretta Nelson, Roy Ross, Josephine Valencia, and Nicholas Valente) for continued cooperation over the three years of the project.
- Professor Abel Wolman, P.E., and General William Whipple, P.E., consultants to the State for this Project, and Donald Kroeck, P.E., of the State Staff, for their invaluable review and comments.
- The Water Purveyors of the State who not only spent many hours completing the questionnaire at the commencement of the Project, but who also gave freely of their time at the many interviews and meetings conducted during the course of the work.
- The many public officials, private citizens, organizations and water users who reviewed the work output and provided constructive suggestions.

NEW JERSEY
STATEWIDE WATER SUPPLY MASTER PLAN

HAVENS AND EMERSON, INC.
PARSONS, BRINCKERHOFF, QUADE & DOUGLAS, INC.
WESTWATER, GASTON & DUNKA
WATER RESOURCES ENGINEERS, INC.
GERAGHTY & MILLER, INC.
— In Association —

Reply to:

Tel.

June 20, 1980

Jerry Fitzgerald English
Commissioner
State of New Jersey
Department of Environmental Protection
P.O. Box 1390
Trenton, NJ 08625

Dear Commissioner:

As the final step in fulfilling our Contract with the State of New Jersey, we are pleased to submit for your consideration this Summary of Findings. After some thirty-six months of study, this submission crystallizes the findings and recommendations of a team of consultants and advisors in cooperation with experienced State staff and extensive public review and comment.

In 1976, the populous northeastern portion of the State experienced water supply deficits totaling 55 million gallons daily (mgd). These deficits have grown to 63 mgd in 1980 and require immediate attention. Statewide water needs over present supply are expected to increase from 90 mgd in 1980 and reach 347 mgd in 2020. These needs exist primarily in the urbanized northeast and generally follow the industrial corridor to Camden.

The water to meet these needs is available in and around New Jersey, although not always in the locations, at the times and in the quality required. The Delaware River, the Hudson River, the intrastate rivers and groundwater are the resources available. Groundwater is a major water resource, but its quality is threatened by chemical pollution and in some areas such as Camden and Sayreville, the source is significantly overstressed.

New Jersey must have a strategy in its approach to water resource planning and development. It is recommended that the State cooperate in the development of interstate resources to maximize, in an equitable manner, its rights to such resources. However, the immediate and near term (1985-2000) needs for water supply and the long lead time of interstate projects make it necessary to conclude that an intrastate development plan is the realistic approach to satisfy New Jersey's priority requirements up to year 2000.

Our findings indicate that immediate action must be taken to implement the following projects by 1985:

Region 1	o Two Bridges/Oradell Project
	o Spruce Run/Round Valley/North Branch Pumping and Pipeline System
	o Delaware and Raritan Canal Improvements
	o Great Notch Interconnection
Region 2	o Manasquan Reservoirs
Region 5	o Delanco Delaware River Intake

Implementation of the Hackettstown Reservoir in Region 6 would augment Delaware River flows and assist development of the Delanco Intake. The decision to implement this project is dependent upon the specific low flow augmentation needs of the Delaware River. Given these needs as they are currently understood, and in conjunction with the Delaware River Basin Commission, a State decision to proceed with the Hackettstown Project appears reasonable. In other regions no particular immediate need exists to justify specific project implementation.

Immediate action is also needed to implement testing of interconnections of the major purveyors in the State. This testing will identify rehabilitation needs and will confirm the reliability of known interconnections such that effective transfers from areas of surplus to areas of deficits can be accomplished with confidence.

As a supplement to interconnection testing and to improve overall management of existing resources, emergency and drought response plans must be developed. Further, successful development of the State's resources will be assisted if conservation is a planning element in purveyor as well as State management programs.

Long range project requirements to be implemented after 1985 include several projects in Region 1 and local developments in other Regions, as described in the Summary of Findings.

The governmental study recommends immediate action on a new water diversion law to confirm existing water rights. Also proposed for immediate attention is a revised administrative process for water allocation decision-making. The existing regulatory review process for water allocation can be frustrating and must be changed. In addition, if the technical plans and projects required to meet New Jersey's pressing water needs are to be implemented in a reasonable time and fashion, there must be greater commitment by the State to provide adequate staff.

Municipal water systems must be managed as self-sustaining utilities over the long run; and small failing private water companies must become the responsibility of the franchising municipalities. State capital in the form of grants applied to this type of problem represents a negative incentive, and such an approach is not recommended. Subsidy programs, comparable to those in the wastewater area are also not recommended as they would lead to artificially low prices for water and would tend to undermine any long range incentive to institute a meaningful conservation program. Instead, actions are recommended where responsibility and accountability are the primary objectives.

State capital can be applied through a program of loans tied to specific pay-back arrangements administered by the Economic Development Authority for investor-owned systems and by the Department of Environmental Protection for the municipal systems. Such loans may be available to any purveyor which accepts the commitment to create a self-sustaining system, backed by technical and financial actions. This approach is consistent with the long range objective of self-sufficiency of all purveyors, without undermining the major investor-owned systems which are the cornerstone of the purveyor network.

In those limited situations where the State must be the sponsor and developer of a water supply project, the Water Facilities Operations Element, with appropriate modifications, is the ideal implementing agent. A State Authority could not advance the front end monies needed at a governmental cost comparable to State General Obligation Bonds. Moreover, even with the creation of an Authority to provide a basis for developing capital, it would be inefficient to create a second statewide water utility operations unit. There is little reason to consider a State Authority for sponsoring and developing water supply projects.

Resources in the form of money and manpower are required if the various roles of State government in overseeing the water supply management system are to be implemented. A system of fees and charges are proposed which require the beneficiaries of the regulations - the users of the water - to pay for the cost of regulation. The resources required to perform regulatory functions are thus internalized by users. Both the "user pays" and the "self-sustaining system" principles are applied to State organization as they are applied to purveyors. While fees are dedicated under this arrangement, normal legislative and executive controls on expenditures would prevail.

The capital to support a municipal loan program and State-sponsored project development could come from bond referenda.

The findings and suggested action programs for immediate implementation and for 1985 to 2020 are described in the Summary of Findings. Detailed discussions and technical analyses are available in each of the Task outputs which support these findings. The results of this work represent a major step forward in water resource planning and management in the State. However, the real benefits of a water plan will be enjoyed only if it is continuously followed and acted upon in cooperation with the legislature, the water industry and the public.

It has been an honor and privilege to serve you and former Commissioners O'Hern, Ricci and Bardin in developing the Plan and we assure you of our continued interest and support.

Respectfully submitted

For the Association,

Glen H. Abplanalp, P.E.
Project Principal

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INTRODUCTION

The severe drought of the 1960's, culminating a long history of water problems, caused a serious crisis in New Jersey and finally focused governmental and public concern on the need for an adequate and reliable water supply. The drought lowered groundwater levels and brought reservoirs throughout the Northeast to critically low levels (exhausting some beyond use), and the State experienced considerable economic and social distress. Public water use was restricted, commerce and industry curtailed operations, businesses were forced to close, and the State's agricultural industry suffered losses. Unfortunately there was no plan of action designed to respond to these conditions. Action was generated by the need of the moment. Although Spruce Run and Round Valley Reservoirs were under construction, it was painfully evident that New Jersey had neither a plan to deal with drought conditions nor a firm basis for comprehensive water resources planning.

The North Atlantic Regional Water Resources Study (NARS) and the Northeastern U.S. Water Supply Study (NEWS) were major planning efforts to address, in part, New Jersey's water supply problems. Both studies were initiated in 1965 as a result of the 1960's drought. These studies identified northern New Jersey as an area in critical need of water supply improvements.

Recognizing New Jersey's plight, the State's County and Municipal Government Study Commission and the Governor's Interdepartmental Commission on Water Supply recommended in 1975 the preparation of a comprehensive Statewide Water Supply Master Plan.

To investigate reasonable solutions to New Jersey's water supply problems, they need to be clearly defined and the issues surrounding them well understood. Actions which benefit New Jersey's water supply situation and which work towards solutions to the State's problems are necessary in planning for the future. The preparation of such a plan was authorized by the Governor in late 1975.

The existing status of the water supply industry in New Jersey can be defined from two basic but interrelated perspectives, categorized here as (1) technical conditions - the physical make-up of the system, including available developed and undeveloped resources, demands for water, transfer networks, emergency and drought response capabilities, water quality, conservation programs, and the collection and utilization of data; and (2) governmental conditions - the management and regulation of the State's water resources, including the roles, responsibilities and processes of government, legislative policy, water rights, availability and management of capital, and the interrelationships among State agencies and public and private purveyors. The State's present water supply condition is described from these perspectives.

The demands of the future will require an increased effort on the part of the public and private sector to address the technical and governmental issues that confront the State in the water supply field. Discussions of the complexity, interrelationships, and dynamic nature of water supply are to be found in the volumes of detailed material on which this summary is based.

EXISTING CONDITIONS

I. EXISTING CONDITIONS

A. EXISTING TECHNICAL CONDITIONS

New Jersey's water supply system is diverse and interrelated. More than 500 purveyors, both public and private, operate within the State. Approximately 75% of the water supplied by these systems is the responsibility of the twenty-five largest purveyors. Additional water is also developed by State agencies and a number of self-supplied users. Both surface water and groundwater resources are used extensively in the State, with groundwater supplies comprising some 40% of the total quantity of water distributed by public purveyors (1975 data).

The sources of water for the various purveyors in the State take many forms: reservoirs, river intakes, well systems, purchases from others, and combinations of these. The southern portion of the State relies predominantly on groundwater, while much of the northern area is dependent upon surface waters. In the densely populated northeast, a complex network of interconnections exists for transfer of supplies. While many of these are used continuously, many others are untested and seldom if ever used.

The technical considerations which define the existing capabilities of the State's water supply systems and which provide a focus for future planning are described below.

REGIONAL WATER SUPPLY, DEMAND AND NEEDS

Demand for purveyor supplied water in 1976 was 1,047 million gallons a day (mgd). Since 1976, new source development has proceeded at a slow space, generally on a local level to replace or augment existing supplies. Demand for water, however, has steadily increased, reaching an estimated 1,080 mgd in 1980.

Although a direct comparison of resources and demands indicates that the State enjoys a moderate surplus of water, further study shows this is misleading. In the coastal communities of central and southern New Jersey, for example, summer vacationers inflate normal populations tenfold in some cases and much of the apparent surplus supplies in those areas is committed to meet these seasonal demands. Some surplus is desirable within a purveyor system as back-up supply in the event of emergency or drought. Committing these supplies to other demand areas could jeopardize response capability.

Some areas are in fact in the enviable position of having sufficient resources both for the present and the near-term future, while other areas are now in or are rapidly approaching critical shortage conditions. The particular status of water supply capabilities in each region is discussed below. For planning purposes, the State has been divided into six regions, generally delineated by major river basin watershed boundaries. As outlined on the frontispiece, these regions encompass the following portions of the State:

Region 1 Northeastern New Jersey

Region 2 Monmouth and Ocean Counties

Region 3 Atlantic and Cape May Counties

Region 4 Cumberland and Salem Counties

Region 5 Burlington, Camden and Gloucester Counties

Region 6 Northwestern New Jersey

Region 1

In 1976, demands in Region 1 totaled 756 mgd. A unique condition exists in this region, since some purveyors are operating with supply surpluses and others are overdrafting their resources well beyond safe levels. In 1976, several water utilities overdrafted their sources to a combined deficit of 55 mgd.

The majority of the surplus water that could be supplied in the region is committed to normal and seasonal peaking conditions, emergency back-up supply, and for meeting future needs. In addition, supplies which are available for export are limited by transfer capabilities among the various purveyors. The existing supply deficits, combined with increases in demands in Region 1, are estimated to total 63 mgd in 1980. This quantity of water represents a critical, immediate need in Region 1 and, since new supply projects will not be operational for several years, the available surplus supplies existing in some purveyor systems must be transferred to those with deficits.

Region 2

Demands in 1976 totaled 79 mgd in this region, and 1980 demands are estimated at 92 mgd. The surpluses which exist are generally committed to peaking conditions, particularly within the coastal communities of Ocean and southern Monmouth Counties. The major portion of the region's surpluses are located in these areas, which are served predominantly by groundwater resources. Surface water supplies and groundwater systems in the area of Monmouth and northern Ocean Counties are experiencing development stresses. There is a need in this area of 12 mgd in 1980. Although supply conditions are not presently at the critical point, potential loss of some existing supplies from saltwater intrusion due to overdrafting would seriously impact the area. The development of at least 12 mgd should be given immediate attention.

Region 3

Demands for water in this region totaled 28 mgd in 1976 and are estimated at 33 mgd in 1980. Seasonal population changes are significant in this region, particularly in the Atlantic City and Cape May areas, and apparent surpluses are to a large degree committed to meet peak demands of the summer populations. While excess capacity is still available on a local basis and the 5 mgd increase in demand from 1976 to 1980 is not considered to require any major project development, the impact of resort-induced growth in the region must be carefully observed.

Region 4

The 1976 demand of 21 mgd in this region has not increased to any appreciable degree in 1980. Sufficient supplies are available to meet all existing 1980 needs. The abundance of groundwater resources, both developed and undeveloped, in the region provides for water supply stability. In some areas, surface water is also a viable resource. There is no immediate concern for additional supply development for Region 4.

Region 5

This region has a complex set of water supply problems requiring a special set of responses. Despite a surplus of supplies in 1976, the groundwater resources available to Camden have in the past few years been subject to contamination from industrial and landfill activities and from salinity intrusion. The latter problem stems from overdrafting which would be aggravated by a drought, causing saline water in the Delaware River to further contaminate the groundwater. Thus, not only are demands increasing, but some existing supplies are being lost and many more are being threatened. Although the degree to which these existing supplies will be lost is not clear, it is estimated that the immediate need for water in the Camden area is on the order of 5 mgd, increasing to 15 mgd by 1990.

Region 6

The 1976 demands in this region totaled 56 mgd, increasing to an estimated 60 mgd in 1980. The purveyors in Region 6 have sufficient resources, either developed or readily accessible, to assimilate the modest additional need of 4 mgd in 1980.

REGIONAL PROJECTED NEEDS

The previous discussions summarize the existing supply and demand status of the various regions of New Jersey. As demands increase in the future, the need to develop additional supplies will intensify. The current estimates of the regional need for water in 1980 and ten-year intervals to 2020 are shown in Table 1.

33% increase

TABLE 1

PROJECTED ADDITIONAL NEEDS BY REGION (mgd)

Region	1976 Demand	Existing and Projected Additional Needs					
		1976	1980	1990	2000	2010	2020
1	756	55	63	107	151	186	203
2	79	0	12	30	38	44	50
3	28	0	5	16	17	20	22
4	21	0	0	2	5	7	9
5	107	0	5	15	26	33	36
6	56	0	4	11	18	23	27
Total	[illegible]	55	89	181	255	313	[illegible]

These additional needs do not include effects of conservation programs, improvements to minimize unaccounted-for water, use of surplus supplies via interconnections or conjunctive use, or other demand reduction or supply augmentation plans. The needs essentially represent the supply requirements anticipated in the future. The major action programs recommended in this study are directed at satisfying these needs.

WATER RESOURCES OF THE STATE

Having discussed the need for additional supplies in the various regions of the State, it is necessary now to review the major resources available for development to satisfy those needs. The major developed and undeveloped sources of water are:

- Interstate rivers: the Hudson River and Delaware River

- Intrastate surface waters, particularly those in the Raritan River and Passaic River Basins

- Groundwater from rock aquifers and glacial valley gravels in the northern part of the State and from unconsolidated aquifers of central and southern New Jersey.

Interstate Rivers

The Hudson River might be used as a source of supply for northeastern New Jersey or to help meet needs in other parts of the State. However, this can not be done merely by relying upon the State's geographic position as a riparian owner since water may only be withdrawn below New Jersey's border on the river and the Hudson River is too saline at this point. The problem is whether the State can obtain Hudson River supply from a diversion within New York State and implement the necessary measures to transport it to New Jersey users. New York statutes require New York's consent before water can be exported.

The Delaware River is in a rather different category. New Jersey is riparian on the Delaware River and a partner in the Delaware River Basin Commission. Provided the rights of other riparians are observed and subject to the requirements of the Delaware River Basin Compact, New Jersey users have rights to take water from the Delaware River for use within the basin. New Jersey's transfer of water outside of the basin, however, is currently limited to 100 mgd by the Supreme Court decree of 1954. The State-owned Delaware and Raritan Canal system presently is used to divert about 75 mgd of the 100 mgd allotment to central and northeast New Jersey. (Rutgers University is completing a study of canal improvements required to allow utilization of all of the 100 mgd.)

Options for the Delaware River include large reservoir projects such as the Tocks Island Lake Project (TILP), providing advantages of economies of scale and the potential for multi-purpose uses, including water supply. Large reservoir projects, however, take a long time to develop in view of tremendous institutional and environmental concerns. For these reasons such projects have been regarded as impractical for the period of this study but appear to be viable and important for the period beyond 2020.

Intrastate Waters

Except for utilization of Delaware River waters along the western border of the State and through the D&R Canal, and use of some New York supplies in the upstream Hackensack River system, intrastate resources, including rivers, natural and man-made reservoirs, and groundwaters have been the principal sources of water supply in New Jersey and will continue to be so for many years. Details of groundwater supplies are discussed below. Dependence upon intrastate surface water supplies is particularly significant in the northern portions of the State, with twelve of the largest purveyors in Region 1 relying almost entirely on these resources, including the Raritan River, the Passaic River, Wanaque Reservoir, Boonton Reservoir, and the Round Valley/Spruce Run Reservoir system. Intrastate surface supplies, particularly in the Passaic River and Raritan River Basins, offer significant potential for further development. It is estimated that the surface supplies available in these basins, with proper development and management, are sufficient to meet needs in Region 1 for the next 40 years.

Groundwater Resources

The State can be divided into three broad geographic areas: the Coastal Plain, the Triassic Lowlands, and the Highlands. It is difficult to determine total groundwater usage in these three areas since current regulations do not require that all pumpage be reported and a great deal of groundwater usage is not metered.* Groundwater diversions approved by the Water Policy and Supply Council (based on a daily average during the maximum month) totaled nearly 980 mgd in 1976, but total reported pumpage was only 500 mgd (based on annual records, exclusive of grandfather claims).

The Coastal Plain physiographic province is the largest area and encompasses more than 5,000 square miles in the southern portion of the State. Five major aquifer systems, consisting of extensive beds of unconsolidated deposits, are capable of yielding large quantities of water. Estimated groundwater pumpage from the Coastal Plain aquifers is over 440 mgd and recharge to the aquifer has been estimated at approximately 5,000 mgd. The physical ability to withdraw groundwater from storage is not a limiting factor, except in areas where pumpage is causing saltwater encroachment, or where it can lower the water levels in the aquifer and reduce streamflow. Only a small portion of the total supply capability of the Coastal Plain aquifer system has been utilized.

In the Triassic Lowlands and the Highlands region, most water-bearing zones are found in sedimentary and crystalline rocks which vary considerably in their ability to yield water to wells. Unconsolidated glacial deposits exist in both regions and represent the most important source of groundwater. Wells in the more permeable glacial deposits can sustain million-gallon per day yields. The areal extent of these glacial aquifers is relatively unknown except in the heavily developed areas of the region. However, in these developed areas, pumpage and consumptive use have overstressed aquifers and limited the availability of new supplies.

PRESENT SYSTEM CAPABILITIES

The existing status of water supply in the State is further defined by such factors as transfer capabilities through interconnections, emergency and drought response capabilities, conservation activities, water quality considerations, yield and low flow determinations, and data handling capabilities. These factors are discussed below.

Interconnections

Approximately 590 individual interconnections have been identified, ranging in size from major 48-inch pipe connections to temporary fire hose hook-ups. About 150 interconnections are in service for normal transfer of water on a regular basis, the remainder being intended for emergency supply transfers. In general, interconnections used for regular water transfer are well maintained, while those reserved for emergencies remain inactive for long periods and are often neglected. Little is known about the actual capacity of the emergency links, or how they would function should an emergency arise. Testing is needed to confirm the conditions and capacities of many interconnections in order to realistically define rehabilitation needs. The importance of interconnections in the overall water supply program is unquestioned. In some cases, these links represent a purveyor's sole source of normal or emergency supply.

Emergency Response

The State of New Jersey presently has an EPA-approved Response Plan for Water Supply Emergencies, developed under requirements of the Safe Drinking Water Act. In

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* Recently modified by Chapter 398, Public Law 1979.

addition, at the State's request, ten major purveyors developed individual emergency response plans for their own utilities. In general terms, the State's responsibility in an emergency is one of providing technical assistance to purveyors, consisting of advisory support, making available equipment and manpower, and overall coordination in the event the purveyor(s) cannot adequately respond. Despite efforts by the State and the purveyors, however, the present overall status of emergency response planning is weak. The large majority of purveyors do not have response plans. There is definite need for purveyors to develop plans, with State guidance, which are specifically responsive to their own system's vulnerabilities and capabilities.

Drought Response

Historically, purveyors and State agencies have reacted to drought emergencies rather than having planned to prevent or minimize their impacts. As drought experience receded into history, the lessons of the drought faded and were lost in the daily activities of business-as-usual. Since the major drought of the 1960's, nature has cooperated with the water supply industry by providing the State with abundant rainfall. The cooperation, however, has again not been mutual. Increased demands and increased reservoir system withdrawals, without parallel development of new resources, have combined to reduce overall drought response capabilities. Drought response planning has been lacking and much of the State is again in the position of having to react to drought, rather than being prepared for and possibly preventing drought impacts. The need for drought response planning is therefore an immediate concern.

Conservation

Water has traditionally been viewed as an inexpensive and unlimited resource -- and conservation efforts were implemented only on the "rare" occasions when water became scarce. However, the specific lessons of recent droughts and a new nationwide awareness of the vulnerability of natural resources have focused more attention on water conservation and wise water use. In New Jersey, for example, the State Uniform Building Code (September 1979) was revised to require water conservation plumbing devices in all new construction. A few municipalities and water purveyors have begun programs to promote conservation, install test water-saving devices, and conduct educational programs. These activities have been sporadic, however, and a great deal more effort is required, not only to encourage conservation, but to further understand its potential water-saving impacts and inspire an efficient use philosophy.

Water Quality

Surface water quality in large rivers has improved in most parts of the State over the past decade, and the new standards of the Federal Safe Drinking Water Act (SDWA) may well cause further improvement in some areas. The position of the State's groundwater resources, however, is less favorable. In many parts of New Jersey the availability of surface water and groundwater resources for public use will be threatened by the impacts of increasing urban development and industrial activity. Much of the contamination is the result of earlier unregulated industrial and municipal waste disposal practices. It follows that the State faces an immense problem in assessing and attempting the after-the-fact control and abatement of water contamination, particularly from non-point source pollution and improper waste disposal practices. Development of plans for the use of either surface or groundwater resources will be impossible unless the water is available in the quality as well as quantity expected.

Yield and Low Flow

Most purveyors assess the yield of their surface water facilities to establish a so-called "dependable yield," the value of which depends on the method and data actually used. Traditionally, the State has relied on the "safe yield" concept based on the worst drought of record. This number changes as the worst drought of record changes. Acceptable, standardized procedures are needed for determining source yield capabilities which include consistent attention to the upstream and downstream inputs and withdrawals. There is also a need for consistent application of the results of yield analyses, particularly as they influence planning and development of facilities and operating strategies.

In assessing the yield of a reservoir, the volume which must be released downstream of the dam, or "the flow-by," is an important consideration. There has been no uniform procedure used for estimating minimum streamflow requirements except to relate releases to the size of the watershed. As water quality downstream becomes a controlling factor, a uniform agreement on the relationships among low flow, yield and priorities is required.

AVAILABLE DATA

There is a wealth of data in the files of the Department of Environmental Protection and other agencies. Unfortunately, it is scattered among many different bureaus and divisions, severely reducing its usefulness. Frequently, the format of this data also limits it to a specific application. Water purveyors often complain of the time spent filling out long forms that may duplicate information already submitted to another bureau or division on a different form. In addition, these forms generally are not uniformly designed for computer use. There is an obvious need for centralization, computerizing and preparation of data in a format suitable for its actual use.

B. EXISTING GOVERNMENTAL CONDITIONS

The State's approaches in regulating and managing its water resources have not evolved at a rate commensurate with the development of problems and issues. The interrelationship among a number of State agencies and more than 500 purveyors requires sharing of responsibility and interdependence, which can be complicated by specific municipal, county, regional, and interstate problems. Recent Federal legislation, such as the Safe Drinking Water Act, is serving to force the State to assume a greater role in regulation and management, or else let these responsibilities pass to the Federal domain by default. Moreover, although responsibility for assuring an adequate and acceptable water supply for the present and foreseeable future rests at present with the purveyor, it is questionable whether all purveyors accept this responsibility.

STATE ROLES AND RESPONSIBILITIES

The State's involvement in the technical aspects of water supply management - protecting the quality and quantity of both raw and delivered water and overseeing the equitable allocation of the resource - occurs primarily through the Department of Environmental Protection (DEP) and its administrative units.

Table 2 provides a brief summary of the DEP units involved in water supply management, the functional areas covered, and the nature of the tasks these units

perform. The table also indicates the other State organizations involved in water supply management from a pricing and financial perspective. Some of these primary units and selected major problems in water supply management are identified below.

The Division of Water Resources and its Bureaus within the DEP have overall responsibility for ongoing water supply activities including planning and analysis, potable water quality regulation, and provision of staff services to the Water Policy and Supply Council (WPSC).

The vulnerability of the groundwater resources - both quality and quantity - challenge the Bureau of Potable Water (BPW) and the Groundwater Management Unit to simultaneously solve today's problems while anticipating the discovery and resolution of tomorrow's new problems. The Federal and State Safe Drinking Water Acts have placed great pressure on both the BPW and the purveyors in the potable water area.

The quasi-judicial process for water allocation decision-making is overseen by a lay board, the Water Policy and Supply Council, which is severely pressed to review and decide upon complex technical matters in a timely manner, with understood procedures and processes. With an understood planning framework within which to consider an application, with adequate staff to review applications, with experienced hearing officers, and with revised procedures which emphasize timely decision-making, water allocations will respond to future needs.

A three-member Board of Public Utilities (BPU), supported by staff, regulates water utilities with respect to the services they provide and the rates they may charge. Basically, the BPU is responsible for the regulation of rates and quality of consumer services as well as financial control of investor-owned water utilities and municipally owned systems selling water outside their own service area. The Department of Community Affairs (DCA) plays a less visible but equally important role in annually reviewing all municipally operated utility financial statements and publishing them in an annual report.

The interrelationships and potential interactions among these regulatory agencies are important. While the BPU has jurisdiction over rates, quality of service and financial matters, the DEP exercises jurisdiction over public health and safety matters. Engineering considerations and approvals for projects and improvements are under DEP, but all economic justification is with BPU, and financial review of municipally operated systems is with the DCA. The Water Policy and Supply Council holds hearings and approves new or additional supplies. Other matters affecting the quality of the raw water source are referred to the DEP Commissioner or Division Director for final decision.

Each of these agencies has partial and sometimes overlapping obligation and responsibility for water supply management. The need for coordination and communication among them is obvious, particularly as they oversee New Jersey's diverse purveyor network.

TABLE 2

STATE ADMINISTRATIVE UNITS INVOLVED IN WATER SUPPLY MANAGEMENT

Administrative Unit	Functional Areas	Nature of Tasks Performed: Administration	Regulation	Planning
DEPARTMENT OF ENVIRONMENTAL PROTECTION				
Bureau of Potable Water	potable water quality and service	X	X	
Water Policy & Supply Council	overall supervision of State's water resources	X	X	X
Water Allocation Unit	staff support to WP&SC; issuance of well drilling permits; record keeping	X	X	
Bureau of Water Supply Planning & Management	water project development; long range planning; staff support to WP&SC	X		X
Groundwater Management Unit	G.W. pollution studies; staff support to WP&SC	X	X	
Executive Staff and Element Managers	administration	X	X	X
BOARD OF PUBLIC UTILITIES				
	rate and financial regulation of investor-owned and certain other purveyors	X	X	
DEPARTMENT OF COMMUNITY AFFAIRS				
	receive and review financial information from municipally operated utilities	X		

THE PURVEYOR NETWORK

New Jersey's water supply system is essentially composed of five major organizational types or classes of purveyors: the municipally operated system, the investor-owned system, the water commission, the authority, and the State-operated utility. Numerically, and in terms of the amount of water delivered to the users, the municipally operated and the investor-owned entities are the most significant.

Of the municipally owned utilities, nearly all take advantage of existing legislation which permits a municipality to separate self-liquidating water utility obligations from its debt statement. This does not mean that municipal water utilities can operate with the same degree of management independence enjoyed by the investor-owned systems. With most major cities under financial stress, other municipal responsibilities frequently influence water utility decisions and expenditures.

Investor-owned utilities fall into two groups: one representing the larger, established, well-managed and well-financed utilities; and the other representing the small utilities, many of which are under-managed, under-operated and under-financed. The larger investor-owned utility represents a major contribution to good water service in New Jersey. These utilities are among the best operated and maintained in the State.

Small investor-owned utilities, however, are a serious concern in many rural and suburban communities. Most of the small investor-owned utilities are a fall-out of land development where franchises were granted by a community and the system recognized by the State. Without borrowing capacity for improvements, or the organization and funds to cope with the rate-making process, these small systems have been a trial for regulatory agencies and a frustration to their customers and local governments.

State-owned water supply operations include the Delaware and Raritan Canal and the Spruce Run/Round Valley Reservoirs. Operations fall generally to the Water Supply Facilities Operations Element, but without the degree of independent operation and decision-making responsibility experienced in investor-owned systems. In recent years the State water utility has not been financially self-sustaining based upon revenues from users. An important aspect of State-owned supply operations is that, in general, any actions by the State serve as examples for other organizational systems.

Significantly, the five different types of purveyor organizations are subject to different financial requirements, which in turn provide them with different degrees of latitude in approaching their financial and pricing responsibilities. This observation is potentially one of the most crucial variables in analyzing the principles by which major purveyor pricing and financing is accomplished. By knowing which type of organization is being reviewed, a great deal is known about the principles and guidelines by which that purveyor pursues the pricing of water. Unfortunately, the standards utilized are not uniform by any means. This difference creates serious limitations on the operations of some water purveyors as utilities. It also threatens their ability to be self-sustaining, and it seriously weakens the stability of the overall water supply system.

WATER LAW

Water law represents another basis for viewing the State's water resources. Like other states in the East, New Jersey's water law tradition is based on the riparian doctrine. However, as a practical matter riparian rights have been so modified by statute in New Jersey that they are shadows of their former common law status.

By a series of legislative actions prior to 1907 the State made allocations of certain water resources to various parties. Legislation between 1907 and 1964 did not always require provisions for revocation or termination (except by abandonment, condemnation, sale or gift) and frequently resulted in grandfather entitlements to water. In almost all instances these allocations have not been incorporated into the Water Resources Management process. Consequently, there is significant uncertainty over people's rights to use water and in the duration and nature of many water uses. These uncertainties create serious problems in managing and allocating the remaining uncommitted resource. In fact, without better control and knowledge, today's decisions will create tomorrow's problems.

C. CONCLUSIONS

Technical and governmental plans of action are needed to address the major problems identified above in Sections A and B. In the next section of this report, the Summary of Findings will present a series of technical and governmental recommendations to address these fundamental needs. The common goal is to provide an adequate and good quality water supply for the present and foreseeable future through efficient use of existing systems, clear delineation of management responsibilities, self-sufficiency and financial accountability at all levels, and intelligent preparation for the future.

SUMMARY OF RECOMMENDATIONS

II. SUMMARY OF RECOMMENDATIONS

A. THE BASIS FOR ACTION: A STRATEGY FOR THE 1980s

A strategy for water supply management in the 1980s creates a framework from which to review complex technical, institutional and financial issues. Eight premises of the strategy, presented below, suggest the broad bounds within which water supply should be managed in the future.

PREMISE NO. 1

> Accountability and responsibility must be identified and exercised at all levels of water supply management, within an understood, updated governmental system.

No system is capable of sustaining itself if major participants do not accept their share of responsibilities. Limitations on State government's future role in water supply management are directly dependent upon accountable, responsible actions by other major participants. Self-sufficient, businesslike utility operation by all purveyors is the cornerstone of an understood, updated governmental system which practices responsibility at all levels of water supply management.

PREMISE NO. 2

> There must be an effective, responsive adminstrative structure for the resolution of water supply issues and problems.

The administrative structure should not impede the development of water supplies and the supportive actions of suppliers. The seventy-year-old allocation system should be modernized to address the complex issues by which projects must be analyzed. In the process, roles and duties must be clarified among component regulatory programs, and a new diversion law enacted to unify the basis for regulation.

PREMISE NO. 3

> Responsibility for the development of water resources and the operation of water supply systems should be commensurate with the lowest level of government capable of being financially responsible for the particular water supply project.

With so many involved activities to be performed, there is a temptation to assign most of the responsibility to upper levels of government, particularly State government. In formulating a program for water supply management, each participant must play a maximum role within the framework of its operations. Local development of resources and water system operations, through to the consumer, are purveyor responsibilities. Small water companies, created with municipal approval, are municipal responsibilities. Major developments should be purveyor responsibilities when there is an available sponsor. The State role, then, is limited to doing those things purveyors cannot do in addition to overall regulation and management.

PREMISE NO. 4

> Decisions to utilize State capital for water resources projects must be subject to criteria that serve to promote self-sufficiency of all purveyors without undermining the most stable parts of the purveyor network.

Sufficient funds are not available to provide for complete assumption of the water supply function by State government. It must be presumed that existing purveyors will continue to carry the responsibility of water supply operations in New Jersey. To discharge their utility functions, purveyors must be financially self-sufficient based upon revenues from their customers. The mix of public and investor-owned purveyors makes the establishment of an extensive grant program inherently unfair to users of investor-owned systems unless the grants are available to all purveyors. The goal is not cheap water. The goal is an adequate supply at a price which reflects the real cost of water including the difficulty in developing new supplies.

PREMISE NO. 5

> The commitments of the State's resources - human and financial - to water supply management must be based on a greater recognition and perspective of areas outside the more populous northeast.

A Statewide program of water supply management must address the accumulation of issues faced by people from High Point to Cape May City at the same time the concerns of northeastern New Jersey are addressed. The growing recognition of groundwater resources vulnerability throughout New Jersey represents a potential understanding of the Statewide responsibility and benefits of a water supply program.

PREMISE NO. 6

> Intrastate water resources must be developed to meet existing needs, while development of interstate sources should be maintained as an overall, long-range objective.

New Jersey has immediate water supply needs which must be addressed. In this respect New Jersey should cooperate in the development of interstate resources to maximize, in an equitable manner, its rights to such resources. Development of interstate waters of the Delaware River and Hudson River will require an extended time frame, beyond the year 2000. Although interstate development should take precedence over intrastate development, present conditions seriously limit its immediate potential. Therefore it is recommended that while interstate water development be maintained as a strong objective, planning for intrastate supplies to meet existing needs must proceed without delay.

PREMISE NO. 7

> The development and management of water resources must include consistent procedures to determine supply capabilities and provide plans to respond to stress conditions.

Evaluation of resource capabilities must take into consideration the backup source capabilities of interconnections, the management of resources in times of drought, and emergency response plans. No one backup is unique and all work together to provide a better perspective of additional development needs.

PREMISE NO. 8

A conservation ethic must be established.

In this study, conservation is defined as the wise and efficient use of water resources without adversely affecting lifestyles or industrial development. Conservation plans are applicable in all areas and at all times, as distinguished from contingency plans which focus on the relatively short term demands of a drought or water supply emergency. Since considerable time and effort are required to develop, implement, and realize the benefits of conservation programs, conservation cannot deal with current water supply deficits. The goal should be to create a conservation ethic and to implement test programs to better understand the potential impacts of conservation. The effectiveness of many conservation devices and practices have yet to be well documented and definitive studies are necessary.

* * * * *

When viewed in the aggregate, the eight premises form a strategic framework within which to present the technical findings and governmental recommendations. If the findings and recommendations are implemented as proposed in the remainder of this section, the intended result will be the development of a balanced water management and governmental process that:

- o is based on understood responsibility;
- o institutes an effective administrative structure;
- o makes maximum use of existing systems;
- o promotes self-sufficiency and financial accountability at all levels;
- o recognizes the foremost purpose of protecting and managing resources and furnishing an adequate supply of readily available, safe drinking water for the health and economic well-being of the State's citizens, communities and industry.

B. TECHNICAL RECOMMENDATIONS

The Existing Conditions section outlined the present status of water supply in the State of New Jersey and indicated a number of problems which must be addressed immediately and some which require ongoing attention. For example, the resource capabilities of many of the purveyors in Region 1 have been stretched to such an extent that several key purveyors cannot meet 1980 demands reliably.

Supply capabilities have previously been estimated using a variety of procedures, which make comparisons and management decisions on a region-wide basis impractical. Further, it is evident that the potential response of purveyors to emergency and drought conditions is hampered by lack of specific knowledge of the conditions of their interconnections and their access to support resources.

It is clear that actions of an immediate and coordinated nature are needed to solve these problems. They must include implementation of specific projects to meet present deficits.

At the same time, actions are needed to confirm the condition and reliability of known interconnections such that surpluses can be effectively transferred to areas of need during emergency or drought situations. This action is justified for two reasons:

- Sound water management requires available backup capabilities to meet emergency situations.
- Certain purveyors have chosen to overuse their resources, thus endangering public health, safety and welfare.

As a supplement to interconnection testing and to improve overall management of existing resources, emergency and drought response plans must be developed. Emergency plans should be designed to meet unforeseen events while drought response plans are necessary to meet long term, relatively predictable events. The specific policies and criteria upon which these plans should be based are detailed in Task 4E and Task 5C.

Finally, capabilities to successfully manage the development of the State's resources in the long term will be enhanced if conservation and judicious use of water are planning elements in purveyor as well as State management programs. Conservation in the form of wise water use, however, cannot solve the State's immediate water supply problems.

The technical recommendations are presented below, separated into two action periods:

- actions in 1980 - 1985
- actions in 1985 - 2020

ACTIONS IN 1980 - 1985

Immediate action is required to assure that surface water supply development projects in Regions 1 and 2 and the related development in Regions 5 and 6 are implemented and operational by 1985. Immediate needs in all other regions can be met by development of local groundwater supplies. In-depth evaluations of preferred projects are presented in the individual (Task 3) study outputs, as is the project selection methodology.

Specific management action, including the initiation of an interconnection testing program, development of drought and emergency response plans, and implementing studies of conservation practices in all regions, will improve management of available water supplies and are recommended. The details of these recommendations are presented below, by region.

Regional Actions

It is emphasized that the regional technical programs described, particularly in regard to new projects, are primarily concerned with matching water resources to needs. Implementation and specific questions of sponsorship, funding, and other institutional factors are addressed only where known to be presently committed. Overall recommendations relating to many of these issues are discussed under "Governmental Recommendations."

Region 1.

Current water supply needs in Region 1 are only being met when above average rainfall is experienced. If the 1960s drought had recurred in 1976, several major

purveyors in this region would have experienced a combined supply deficit of 55 mgd. In 1980 there is a need for 63 mgd in Region 1, expected to increase to 107 mgd by 1990. This deficit will increase over time unless immediate action is taken.

The distribution of needs in Region 1 can best be understood by dividing the region into three geographical areas: north, south and west, as shown in Figure 1. The counties which comprise these areas are:

- North - Bergen, Passaic, Essex, Hudson and the northern half of Union County
- West - Morris, the northern half of Somerset, and those portions of Sussex and Hunterdon Counties in the region
- South - Middlesex, the southern halves of Union and Somerset, and those portions of Monmouth and Mercer Counties within the region.

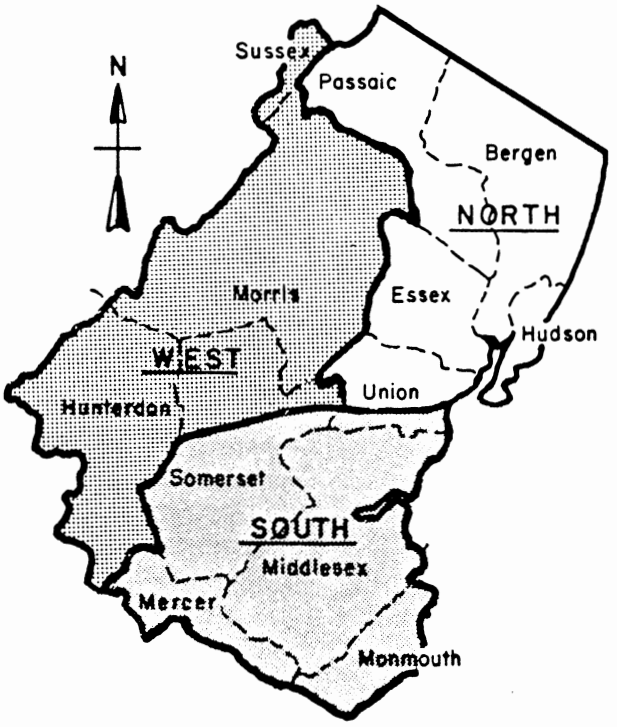
To meet immediate needs, the following projects should be operating in each area by 1985:

- North Area - Two Bridges Project including Ramapo Diversion and Wanaque-Oradell Pipeline
- West Area - Spruce Run/Round Valley/North Branch pumping and pipeline system
- South Area - Delaware and Raritan Canal Improvements.

The Two Bridges/Oradell project, shown in Figure 2, consists of an intake and pumping station at the Passaic River - Pompton River confluences, a force main to the NJDWSC Wanaque Reservoir, and a pumping station and pipeline to the Oradell Reservoir of the Hackensack Water Company. The project provides 79 mgd about half of which would be used by NJDWSC participants and half by the Hackensack Water Company system. This supply would meet the needs of the area to 1995. The capital cost of construction is estimated in 1980 at $66.1 million. This project must be implemented by the end of 1980 to be operational by 1985.

The Spruce Run/Round Valley/North Branch pumping and pipeline system shown on Figure 3 will have an initial capacity of 17 mgd for meeting the immediate needs of the West area. The intake and pumping station will be constructed at or near the confluence of the Lamington River and the North Branch of the Raritan River. This station will utilize releases from the Round Valley Reservoir outlet pipe at Whitehouse Station, and runoff from the Lamington and North Branch drainage areas upstream of the pumping station. A force main will convey the water to the existing Ravine Lake impoundment on the North Branch near Peapack-Gladstone. From there another pumping station and force main will boost the water to the Mendham area at the ridgeline of the Raritan and Passaic River basins where an initial 5 mg of terminal storage will be provided. The water will be treated by receiving water utilities. The total estimated construction cost of the project facilities is $14.4 million.

The Delaware and Raritan Canal Improvements include dredging the canal and removing vegetation to improve its capacity from 75 mgd to 100 mgd. Rehabilitation of control gates and structures is also included in this project. The 1980 cost of these improvements is estimated at $3.7 million. Further details of the projects described above may be found in the extensive analyses of Task 3.



REGION 1

ADDITIONAL WATER NEEDS (MGD)

YEAR	NORTH	WEST	SOUTH	TOTAL
1980	55	3	5	63
1985	63	7	15	85
1990	70	12	25	107

FIGURE 1

REGION 1
SUB-AREAS AND NEEDS

N.J. STATEWIDE WATER SUPPLY MASTER PLAN

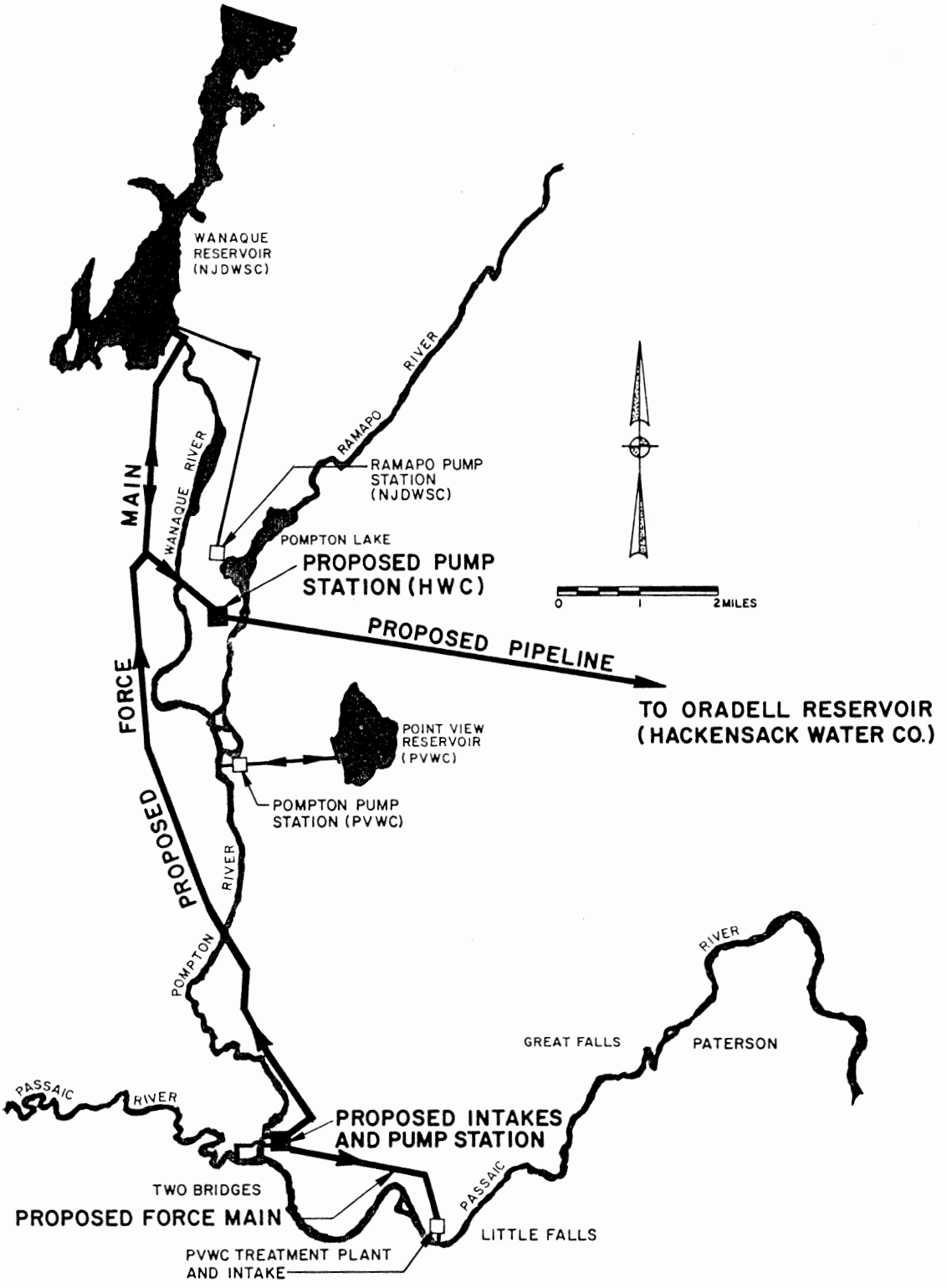


FIGURE 2

TWO BRIDGES - RAMAPO DIVERSION AND WANAQUE-ORADELL PIPELINE

N. J. STATEWIDE WATER SUPPLY MASTER PLAN

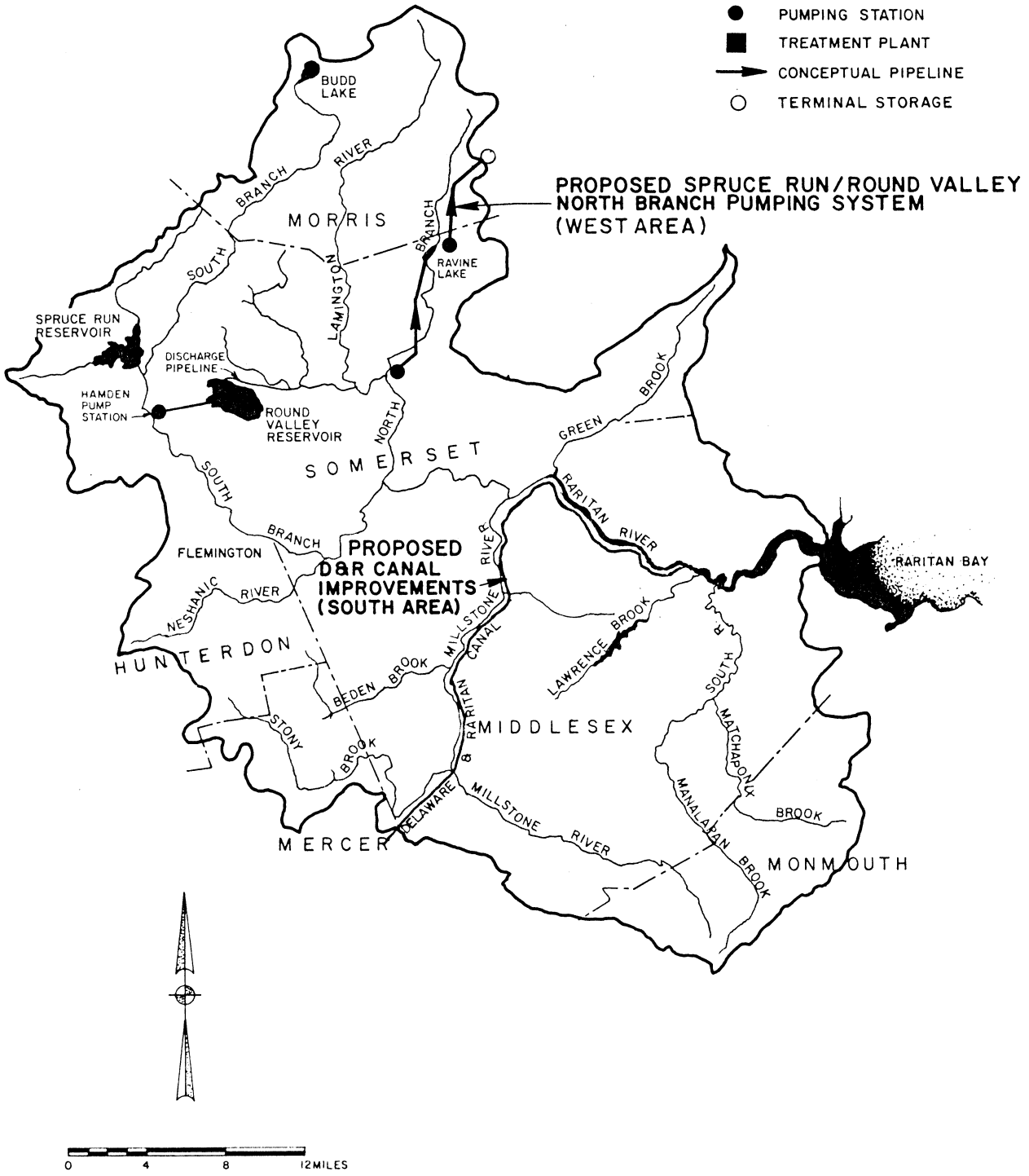


FIGURE 3

RECOMMENDED DEVELOPMENT
RARITAN RIVER & D&R CANAL
FOR IMMEDIATE NEEDS 1980-1985

N. J. STATEWIDE WATER SUPPLY MASTER PLAN

Interconnections will also play a crucial role particularly over the next five years in the complex purveyor networks in Region 1, until the projects noted above become operational. Regional deficits totaling 63 mgd in 1980 are projected to reach 107 mgd in 1990. Purveyors will be hard pressed to avoid adverse impacts of a major drought or other emergency without adequate capacity to transfer surplus supplies.

Unfortunately, in many cases the condition and carrying capacity of many of the emergency links in the State are unknown, and a program to test interconnections should be initiated immediately. Such a program would be of the greatest benefit by focusing on the interconnections of the Hackensack Water Company, Jersey City Water Department and Newark Water Department. A testing program to verify the condition and flow capacities of the interconnections of these major purveyors would greatly assist their ability to meet future demands.

Flexibility for water transfers among purveyors allows for improved response to variable stress conditions. A multiple exchange facility at Great Notch among NJDWSC, Newark, PVWC and Jersey City should be built to provide for coordinated transfers of supply during emergencies (options are also available for continuous service). This facility would consist of piping work with pumping and storage.

Region 2.

Water supply needs in Region 2 are expected to increase from 12 mgd in 1980 to 30 mgd by 1990. Groundwater supplies in the northern area of the region are at present experiencing problems from overdrafting and potential salt water intrusion. It is suggested that needs can best be met with development of surface waters. We recommend the Manasquan project, which consists of an upper and lower reservoir as shown on Figure 4. The lower reservoir is an on-stream storage reservoir and will yield 10 mgd. The upper reservoir is located off-stream and receives flows from a pumped diversion on the Manasquan River. This reservoir, with a capacity of 5 billion gallons, can provide a yield of 25 mgd. The estimated 1980 cost for these facilities is $33.5 million.

The immediate construction of both reservoirs will provide 35 mgd by 1985, when needs are expected to be about 20 mgd. The region is impacted to a large extent by summer residents and provisions now of additional supply will improve water management capabilities in the region. Several purveyors will benefit from this project, which should satsify needs in most of Monmouth and northen Ocean counties.

Regions 3 and 4.

While no major projects are recommended, the proposed, expanded Statewide groundwater monitoring effort is of vital importance to these regions since they rely totally on groundwater supplies and the threat of contamination by indiscriminate dumping is ever present.

Region 5.

The needs in this region are expected to increase from about 5 mgd in 1980 to 15 mgd in 1990. Although local groundwater sources may be able to meet these needs, their quality is in serious doubt. The contamination of some wells and the general salinity problem require that substitute supplies be developed in the Camden area. The use of substitute supplies will directly benefit the over pumped aquifers. The construction of a Delaware River intake at Delanco will provide a substitute supply and can be used for some seven months of the year without impacting critical low flows in the river. Should the intake be operated on a continuous basis, compensating flows to the river must be

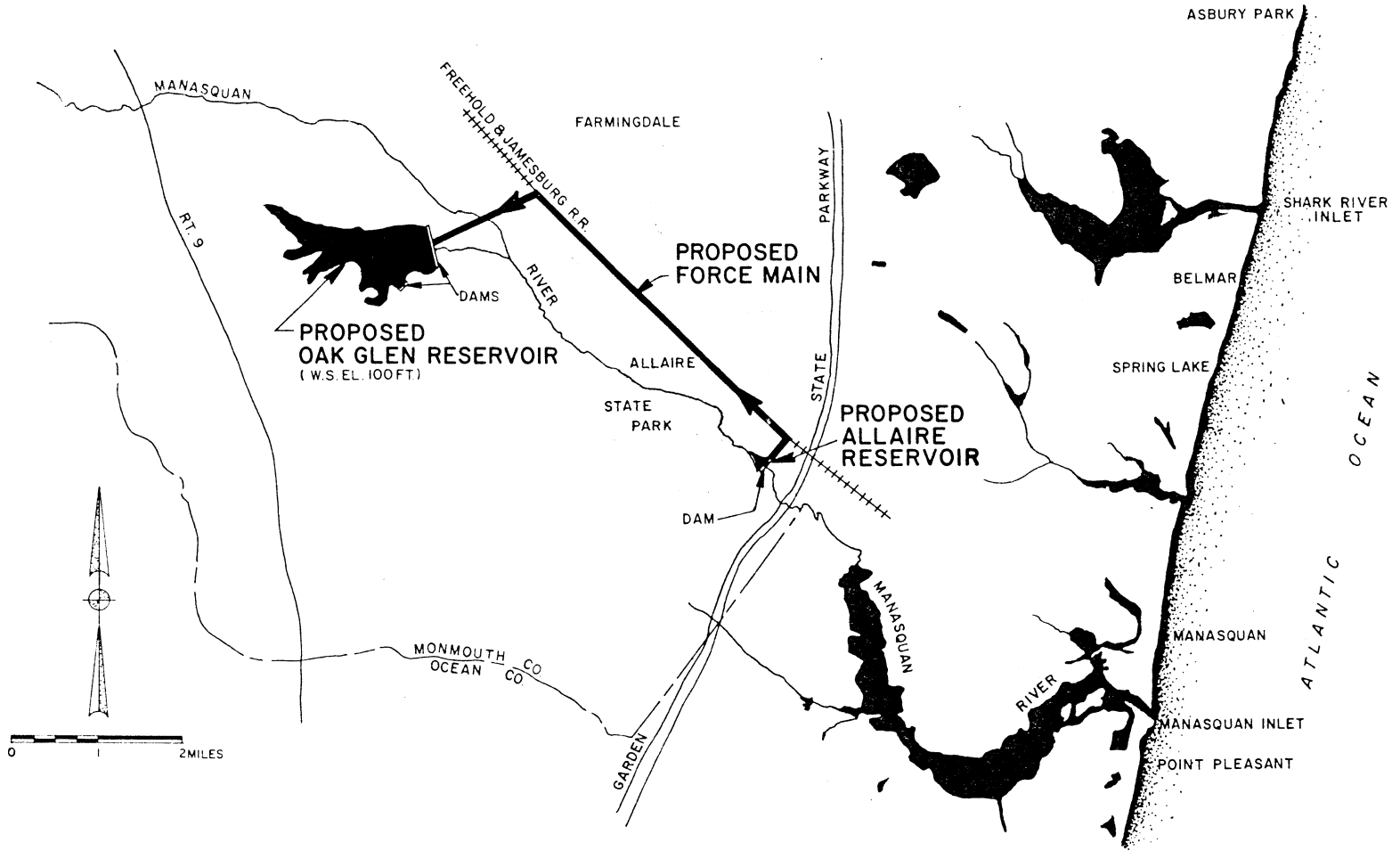


FIGURE 4

MANASQUAN RESERVOIR PROJECT

N.J. STATEWIDE WATER SUPPLY MASTER PLAN

provided. The salinity problem is being studied by the DRBC and the Corps of Engineers. The results of this study may affect the Delanco project.

Low flow augmentation of the Delaware River has been suggested as a critical need which would respond to both quality and quantity problems. Additional flow in the river could provide natural recharge to the Camden area well system as a substitute for or in conjunction with the Delanco Intake. The Tocks Island Lake Project is viewed as the best source of flow augmentation for this purpose; however, the environmental impacts and the present status of this project do not make it suitable as a response to the immediate or near-term needs of the area. The Hackettstown Reservoir Project appears to be the most viable project for the purpose. Other potential reservoir sites in New Jersey for this purpose are more costly and energy intensive.

The Pine Barrens region of the State also offers a potentially significant source of substitute supplies for the Camden area. However, the transmission and treatment costs of the estimated 25 mgd required are substantially greater than the Delaware River intake alternative. The recently enacted Pinelands Protection Act mandates the development of a Pinelands Plan which is now in the final stages of preparation. Use of water resources in this region must take such planning efforts into consideration.

In view of the urgent nature of the problem, it is believed that both immediate and future needs can be met by constructing the Delaware River Intake at Delanco, shown in Figure 5, such that it is operational by 1985. The estimated 1980 project cost is $23.6 million. The project is located at Delanco about 10 miles northeast of Camden and will deliver water through a transmission pipeline to the City's well field and distribution system and to other nearby communities. It will yield 25 mgd. Planning should proceed pending completion of the current salinity study.

Region 6.

The needs in this region are expected to increase from about 4 mgd in 1980 to about 11 mgd by 1990. Sufficient supply can be diverted from the run-of-the-Musconetcong River, the Delaware River, and local surface and groundwater resources to meet year 2020 demands without recourse to a reservoir project.

Although major water supply projects are not needed in Region 6 for the foreseeable future, any New Jersey requirements for augmenting flows in the Delaware River would have to be met by a project situated in the higher elevations of the State. In view of the deferred status of TILP, the Hackettstown Reservoir has been considered for development by the State and has been listed as a feasible flow augmentation alternative in DRBC's level B Study (draft). The reservoir, shown in Figure 6 and located in Allamuchy State Park on the Musconetcong River about 3 miles upstream of Hackettstown, could provide based on DRBC's Level B Study 130 c.f.s. to the Delaware River for 120 days during the critical low flow period.

A study of the effectiveness of various low flow augmentation reservoirs in New York, Pennsylvania and New Jersey is currently in preparation. Subject to the findings of this study, it is expected the Hackettstown Project could aid in preventing saline water in Delaware Bay from traveling upstream to Camden where groundwater quality is largely dependent upon the river's quality. In coordination with the Delanco Project in Region 5, the Hackettstown Reservoir can provide required releases to the Delaware River to mitigate that project's impact on low flows. The reservoir would also provide important recreational opportunities.

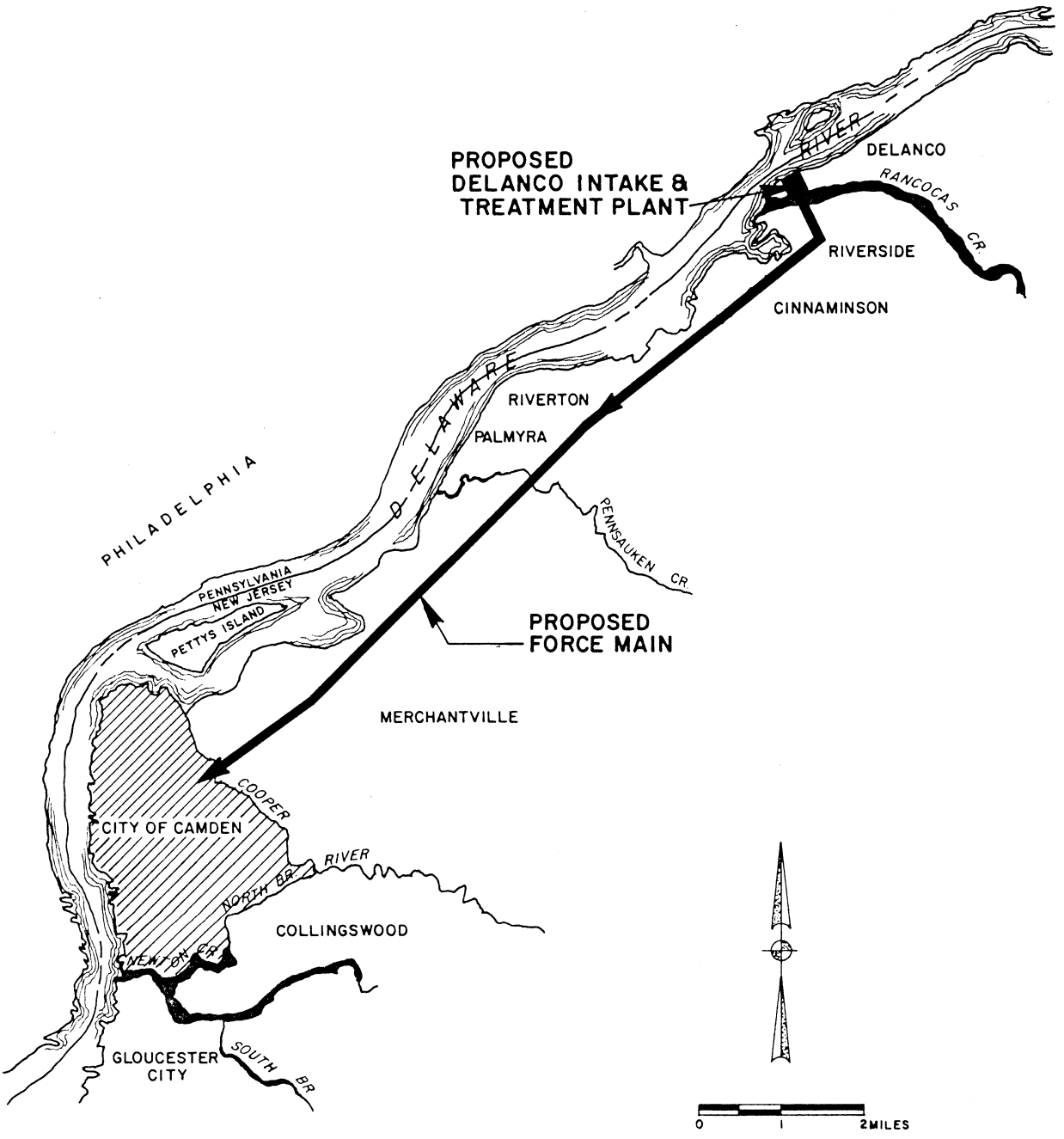


FIGURE 5

DELANCO INTAKE PROJECT

N. J. STATEWIDE WATER SUPPLY MASTER PLAN

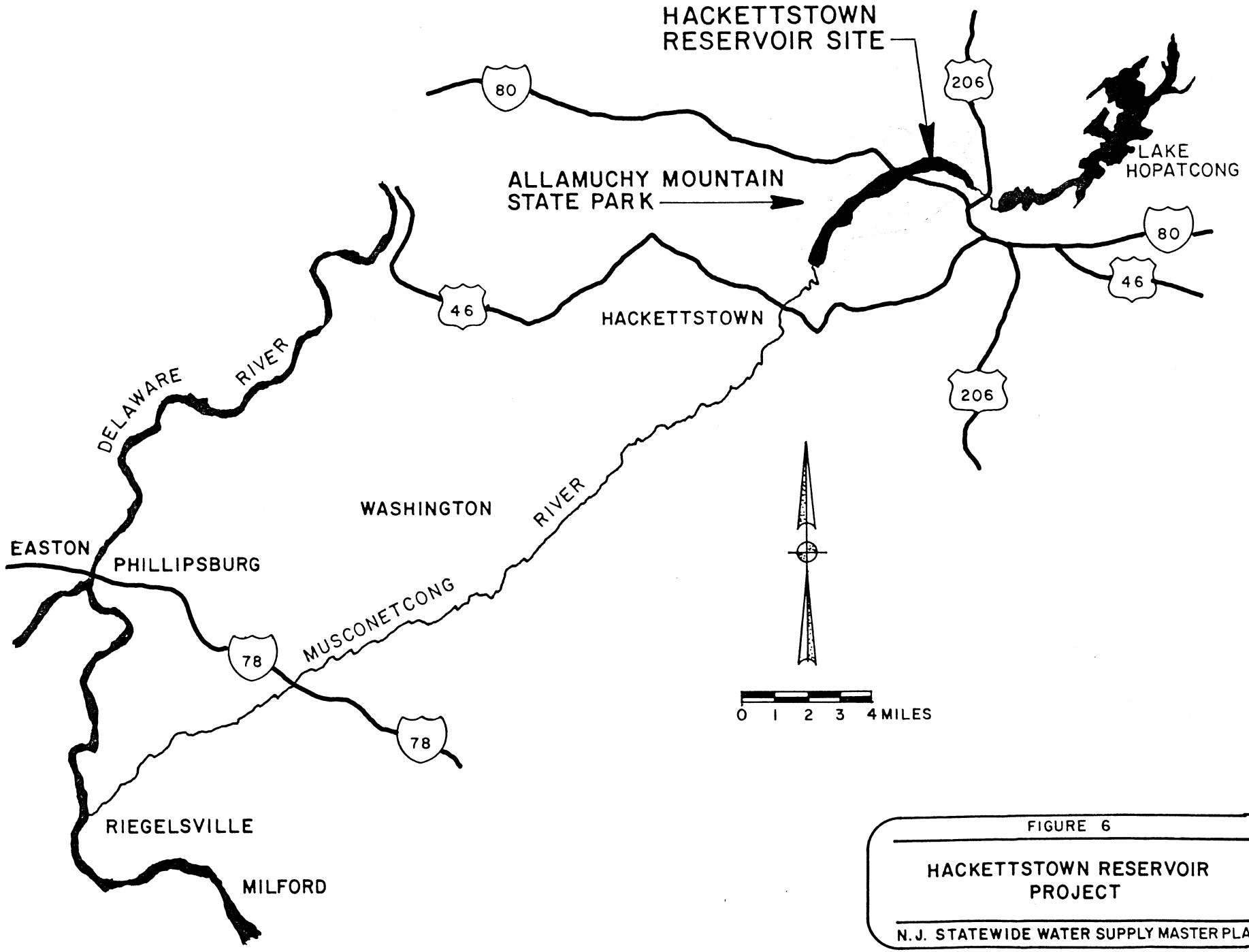


FIGURE 6

HACKETTSTOWN RESERVOIR PROJECT

N.J. STATEWIDE WATER SUPPLY MASTER PLAN

Although construction of TILP would eliminate the current need for Hackettstown Reservoir, the Tocks Island area of the Delaware River is presently designated as a "Wild and Scenic River," thus deferring consideration of this Project. Therefore, assuming the above investigations confirm the Hackettstown Reservoir's effectiveness in alleviating the salinity problem, a State decision to proceed with the Hackettstown Project appears reasonable. The estimated 1980 cost of the project is $55.0 million.

The total estimated 1980 cost of the Immediate Action Program (1980-1985) is $202.3 million as shown in Table 3.

TABLE 3

IMMEDIATE ACTION PROGRAM (1980-1985)

Project	Estimated Construction Cost* ($ Million)
Two Bridges/Oradell	$ 66.1**
Spruce Run/Round Valley/North Branch Pumping System	14.4
Delaware and Raritan Canal Improvements	3.7
Manasquan Reservoirs	33.5
Delanco Intake	23.6
Hackettstown Reservoir (low flow augmentation)	55.0
Subtotal	$196.3
Interconnection testing and improvements, various purveyor systems and the Great Notch area	6.0
Total	$202.3

* Includes construction contracts, land acquisition, engineering, contingencies, financial, legal and administrative costs.

** Based on private financing estimates.

Action in All Regions

In addition to the specific project developments described above, the State and purveyors must address a number of issues of a management and operational nature. These include:

- Interconnections
- Drought Response Plans
- Emergency Response Plans
- Conservation Programs
- Source Protection
- Yield and Low Flow Analyses
- Planning Information Storage and Update

Interconnections.

Interconnections are critical components of the overall water supply planning strategy in the State for both the immediate and long term periods. In some cases, interconnections are the sole sources of water for large centers of use or the only source of emergency supplies.

A statewide program to test and analyze existing interconnections is essential and, in the management of this program, purveyors should be assisted by the State. Needs for rehabilitation of existing interconnections and for construction of new ones can then be evaluated, followed by an action program to implement the necessary work.

Final planning, design and acquisition for the major water exchange facility at Great Notch are estimated to have a 1980 cost of $4.2 million. It is estimated that some $1.8 million will be required for initial interconnection improvements and construction.

Drought Response.

The overall ability of the State to withstand the adverse impacts of a major drought is dependent on two critical factors: (1) having sufficient supplies available to meet needs during the stress period and (2) managing those supplies in an efficient and timely manner. Implementation of the projects described earlier will serve an important role in providing additional yield both for normal and drought conditions. Ensuring that these and existing supplies are available where and when needed requires that each purveyor should prepare a drought response plan outlining anticipated requirements for water and the measures that must be taken to comply with the objective of a safe and adequate water supply during drought. Detailed discussion of the components of such drought response plans appears in Task 5C.

Experience has shown that the public will cooperate in a plan that is properly articulated, uniformly followed, and fairly enforced. Plans formulated quickly during the time of drought crisis are frequently subject to public suspicion and question.

Since the ability of an individual purveyor to respond to a drought is a function of the reliability of its own resources, the availability of interconnected back-up supplies, and the particular internal capabilities of the system, the measures to be implemented in a drought will vary from purveyor to purveyor.

Drought measures fall into two categories: those which increase supply and those which reduce demand. Development of new supplies, transfers through interconnections, curtailment of letdown requirements and use of reserves fall in the first category; restrictions on use fall in the second. Preparation of a multi-stage drought response plan is essential and will inform the public in advance of the measures to be taken during various levels of the drought. The plans should include rigorous but equitable restrictions and actions, specific to each purveyor, such as restrictions on outdoor water use, requests for prudent indoor use, arrangements for emergency supplies and rationing schedules. Use restrictions and other drought response activities would increase in severity as the drought intensifies. A four-phase alert program should be adopted well in advance of a drought; this will also facilitate early identification of an impending drought. The four phases are:

- Stage 1 Alert Warning - a drought may be developing. Purveyor notifies State.

- o Yellow Alert - drought established. Customers are requested to exercise voluntary use reduction to minimize consumption.

- o Orange Alert - drought worsens. State of emergency declared and mandatory restrictions enacted. Emergency rate escalations are imposed.

- o Red Alert - water shortages imminent. Severe use restrictions are imposed, including rationing, to counter threats to health and welfare. Further rate escalations imposed.

It is emphasized that these restrictions and curtailments would be based on prearranged priority lists established by the purveyors in coordination with the State to minimize their social, environmental and economic impacts.

Emergency Response Plans.

Unlike a drought, a crisis or emergency is a relatively sudden event requiring immediate and rapid response. Power failures, source contamination, floods, main breaks, equipment failures and a wide range of other factors could result in a system's inability to supply water. Timely and efficient management of back-up resources requires a plan of action based on preparation and coordination.

The State should require each purveyor to develop an initial emergency response plan to outline the actions necessary during a crisis. Each plan should identify relevant backup supplies and interconnectons to be used. Since the reliabilities of many of the interconnections are as yet unconfirmed during the 1980-1985 period, the plans must be regarded as interim to be updated after the interconnection testing program is complete.

The plans will include provisions for annual update and must nominate an emergency response organization team of managerial, technical, operations and public information personnel. Although their size and composition will vary from purveyor to purveyor, all teams will need sufficient expertise and decision-making authority to respond quickly and intelligently to emergencies.

The specific elements and guidance criteria necessary for emergency response plans are detailed in Task 4E.

Conservation.

Water is a renewable resource. Water that is available in a system is wasted rather than conserved if it does not become available for another use that is beneficial. On the other hand, reduction in water use that extends the useful life of a water supply system and postpones the addition of costly supply increments is conservation since it reduces monetary, environmental and socio-economic costs. Water use reduction can be achieved in four ways:

1. By changes in lifestyles, such as reduced emphasis on watering of lawns and plantings, reduction in home labor-saving devices or changes in our attitude towards living habits.

2. By substitution of other resources for some water uses such as incinerator toilets or compressed air waste evacuation.

3. By increased efficiency in water use, and efficiency achieved without change of the basic function of the water supply, such as leakage control, faucet aerators, water-saving washing machines and other conserving devices.

4. By instituting strong voluntary or enforced use reductions as needed.

The first way is not considered applicable or acceptable in the study. Neither is the second one, since detailed benefit/cost analysis might in some cases make this approach not acceptable in design studies. The fourth method as a drought response measure is discussed in Task 5C.

It is the third way that was considered here and is detailed in Task 6. This task concluded that a conservation program consisting of education, loss reduction, use of low water using fixtures in new construction and industry response to the needs for water use due to waste treatment costs may produce an ultimate saving of up to 12% of the demand that can be anticipated in the year 2000 to 2020 period. But even the best intended conservation program must be evaluated in relation to the public welfare benefit it produces. Therefore, the State should sponsor studies of industrial water use and studies of the potential for direct reuse of wastewaters to better predict the opportunities for saving in these areas. It is recommended that the purveyors also perform studies aimed at reducing system losses.

Further, the State should sponsor testing of the use of home plumbing conservation devices to better understand their effectiveness under retrofit conditions. These steps should complement action already taken by the Department of Community Affairs, which revised the State uniform construction code to require as of September 1979 the use of conservation plumbing fixtures on new home construction.

While conservation is defined as wise use and an important part of prudent water supply management, it cannot replace presently needed additional supplies nor remove the need for future development. However, the timing of the need for these projects may be affected.

Source Protection.

Known sources of existing and potential water supply need protection from pollution that may be generated by future development, improper waste disposal practices, etc. Effective monitoring of groundwater is one procedure that will provide a basis for the control and protection of these resources.

There are four basic categories of groundwater monitoring to which the NJDEP should direct its attention. In order of priority they are: (1) Quality Assurance, (2) Source, (3) Regional, and (4) Research Monitoring. Quality Assurance involves protecting the consumer against contaminated water supplies and in the future, surveillance of community wells should include a broad band of metals and organic chemicals.

Monitoring the tens of thousands of individual potential sources of groundwater contamination is not feasible. Industrial wastewater impoundments and municipal landfills should be given prime consideration with each location given priority according to hydrologic criteria.

Regional monitoring is required to provide background data for inventories of groundwater resources, and input in construction of hydrologic models. Such monitoring

activities should initially be devoted to development of long term yield estimates for groundwater basins in northern New Jersey and as an aid in modeling Coastal Plain aquifers.

Research monitoring will answer specific questions that affect groundwater management decisions, such as allowable septic tank densities. Priority questions to be answered include the effects of various land uses on groundwater quality and the acceptability of land application of industrial and municipal sludges. Finally, to enable the State's existing groundwater monitoring program to meet these needs, all water quality and water level monitoring activities should be centralized within DEP's Division of Water Resources with adequate staff (Task 7C).

Surface water can be protected by the procedures noted above, by reservation of specific sites and watershed areas and by an improved DWR program for surface water quality monitoring. Reservation of specific sites is dependent upon purveyor oriented development. The sites for projects identified in the immediate action program should be reserved as soon as the specific area requirements are known.

Yield and Low Flow Analysis.

The yield of any project development depends upon the inflow to and constraints on the watershed system. These are influenced by upstream and downstream uses, the hydrologic period selected for analysis and the pattern of supply and use. For surface water development projects, it is recommended that the project yield be analyzed in terms of statistical reliability, using the full record of available hydrologic data as the period for analysis.

The methods used are reported in the Appendix and explained in Task 5A and Task B.

The selection of the yield of a surface water development must consider a number of factors in determining the minimum recommended reliability. It should be recognized that not only the rate of failure to meet stated demands is important but that the sequence of failures and the magnitude of the shortage involved must be considered seriously in the final decision.

Two general situations prevail which should be treated somewhat differently. In the first case, when other backup resources are readily available, a lower reliability can be accepted than when no other supplies are available. As a rule of thumb, we recommend a reliability of ninety-five to ninety-eight percent when backup resources are present, and a reliability greater than ninety-eight percent and perhaps approaching one hundred percent when the system must stand on its own resources.

We emphasize the need to examine each system on a case-by-case basis and the inappropriateness of setting a definitive number for the allowable minimum reliability, particularly in the framework of a planning level study. For example, if all of the shortages noted occur within one year or in consecutive months the impact upon purveyors and users would be especially severe. If the magnitude of the shortages is small, however, the impacts may be negligible and easily borne by the elasticity of the demand. Very large shortages occurring in even isolated, nonrepetitive periods can result in severe impacts and may require the use of backup supplies or use restriction.

The final selection of the storage size and reliability must consider both the character of the shortage and purveyor connections to other purveyors with surpluses, availability and reliability of supplemental ground or surface water, and the willingness of

users to accept periods of reduced demand. The methodology used in this study relies on the computer simulation model HEC-5C and provides the tool for continued study of supply systems in the detail necessary to develop further planning guidelines and detailed operational constraints and procedures, including the ability to maintain flexibility to meet peaks and unanticipated demands. For example, all of the HEC-5C runs made in the current study used monthly hydrology. This was appropriate in view of the planning level nature of the study. However, the computer code permits the user to choose his time step and the State may select weekly or daily hydrology in operational level studies where the circumstances warrant this detail.

The yield of a system is influenced by upstream and downstream uses including those uses which enhance environmental values, such as low flows. The low flow quantity used to assist in evaluating system performance should be estimated using existing requirements published by the State and from data included in 201 and 208 plans.* Where previous estimates are lacking, or where specific State requirements have not been established, it is nevertheless essential that a minimum flow be maintained. This flow, which perhaps could more accurately be termed an "environmental low flow," might logically equal the natural $7Q_{10}$** of the stream at the point of diversion.

Where specific available data support the use of environmental low flow values other than $7Q_{10}$, an analysis of yield should be made using, first, the selected low flow constraints and variations of this constraint, such as multiples of $7Q_{10}$. The impacts on yield and facility size can then be estimated and a decision on specific low flow can be made.

Yields selected for groundwater developments should approximate the long-time mean supply as determined from pumping tests and other hydrogeological information with a sufficiently long record of water table elevation and quality changes. In the absence of such specific information and until adequate groundwater investigations are performed, interim use should be made of the best available regional hydrogeological evaluations of groundwater potential of aquifers, as available from the State, U.S. Geological Survey and other agencies.

Planning Information Storage and Update.

Planning future resource development is significantly dependent upon today's actions, especially with regard to record keeping and data use and storage. Because of the data's regional nature and the storage capabilities of the government computer facilities, the State should take the lead in this activity.

A bank of relevant information should be established and maintained by the Division of Water Resources for the combined use of all divisions of DEP, other interested departments and agencies and the public. The data bank should be well organized and contain all relevant existing and new information in computerized and traditional library form as appropriate to the specific type of information; be regularly up-dated; and be

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* Section 201 Facilities Planning and Section 208 Water Quality Management Planning under Public Law 92-500.

** The minimum consecutive seven day flow which would occur with a probability of once in ten years.

readily accessible to users. Specifics on data storage and update appear in the Appendix and are detailed in Task 1.

Actions Between 1985-2020

Once the immediate action program is underway, the State and purveyors will be in a better position to consider and respond to needs that will develop after 1985. State water needs over and above existing supplies are expected to grow by some 258 mgd between 1980 and 2020, as shown in Table 1. The effective utilization of available resources within this time frame and thereafter will be enhanced by the management issues adopted in the immediate action program.

Development of new sources of supply will remain the principal means of satisfying needs in the 1985-2020 period. It is not anticipated that these future needs will be seriously affected by conservation programs, programs to minimize distribution system losses, or other demand reduction schemes, although these should be monitored closely for their potential impact on local needs and project construction schedules.

For regional surface water development projects to be operational by 1995, construction must begin in 1990 and planning, study and design must begin immediately.

The recommendations for project development are presented by Region and build upon the recommendations presented for the immediate action program.

Region 1.

Projects - Additional water needs in Region 1, within the North, West, and South areas, previously defined, are expected to grow as follows:

	Region 1 - Needs (MGD)		
Year	North	West	South
1990	70	12	25
2000	89	21	41
2010	109	27	50
2020	118	31	54

The source developments required to meet these needs are:

- North Area - Spruce Run/Round Valley - New pipeline and pump station to the Newark Area.
- West Area - Spruce Run/Round Valley - Expand capacity of pump station.
- South Area - Spruce Run/Round Valley - Pumping station near Manville and force main to Delaware and Raritan Canal and Six Mile Run Reservoir, pumping station and force main.

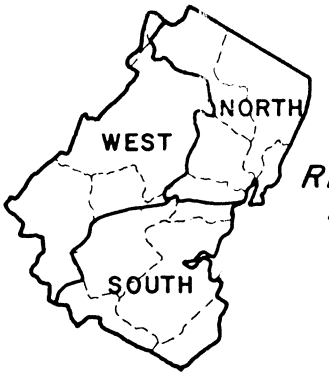
The recommended sequence of development for each area, which builds upon the project developments in the immediate action program, is shown in Figure 7. The estimated construction cost for this development program is shown in Table 4.

TABLE 4

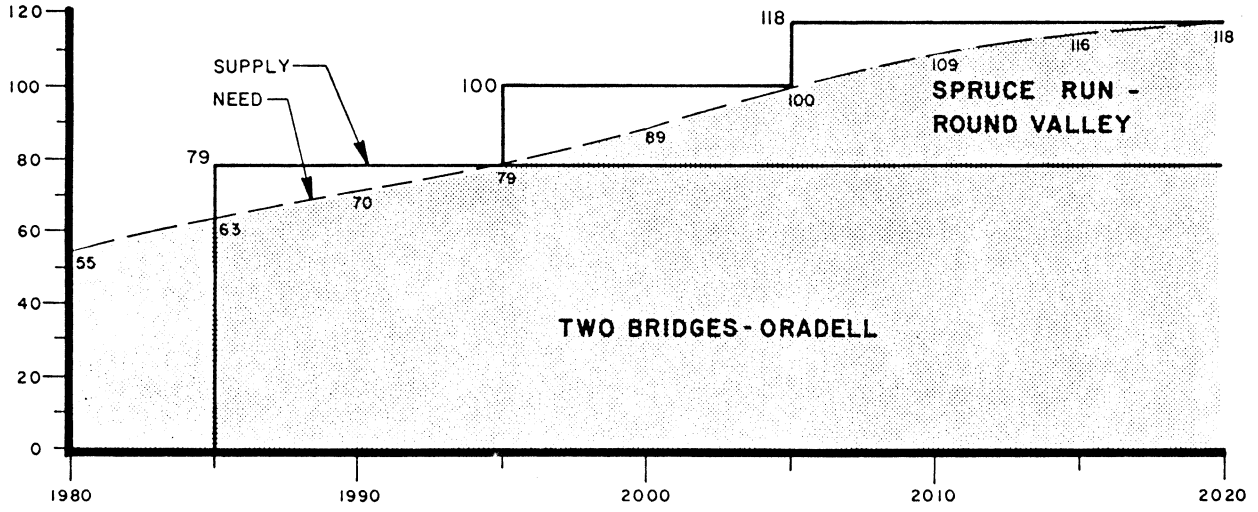
REGION 1 - RECOMMENDED SOURCE DEVELOPMENT PROGRAM (1985-2020)

Project	Estimated Construction Cost (1980 $Millions)
North Area:	
Spruce Run/Round Valley Pipeline from Bound Brook to Newark Area	
Initial Operation (1995)	$35.1
Expand Pumping and Treatment Capacity (2005)	12.7
West Area:	
Spruce Run/Round Valley/North Branch Pumping	
Expand Pumping Stations (1995)	1.3
Expand Pumping Stations and Terminal Storage (2005)	2.4
South Area:	
Spruce Run/Round Valley/Raritan Pumping Station	
Initial Operation (1990)	1.1
Expand Pumping Station (2000)	1.1
Six Mile Run Reservoir Pumping Station and Force Main	
Initial Operation (2010)	27.1
Total	$80.8

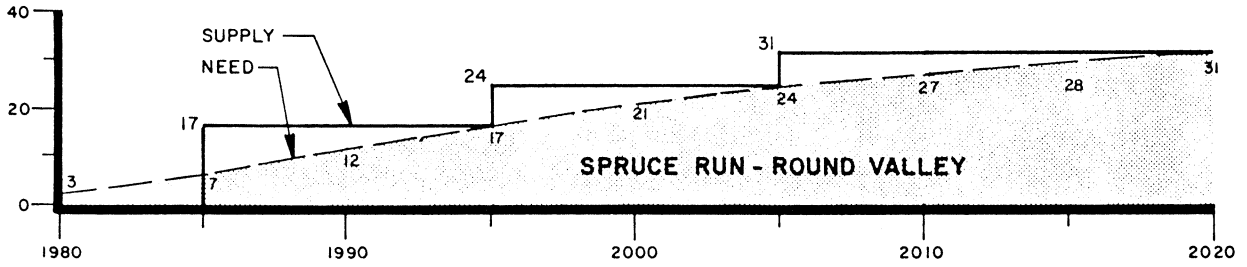
North Area. The Spruce Run/Round Valley Pipeline project from Bound Brook to the Newark area is planned to start operation in 1995 to add 20 mgd to supplement the North Area supply provided earlier by the Two Bridges - Oradell Project. The water supply will be from surplus Raritan River water available from the existing Spruce Run/Round Valley system. An intake and pumping station will be provided at or near the existing Raritan-Millstone Filter Plant of the Elizabethtown Water Company. Water will be pumped through a pipeline to the Newark area with water supply connections en route and from the Newark area to other "northeastern" communities.



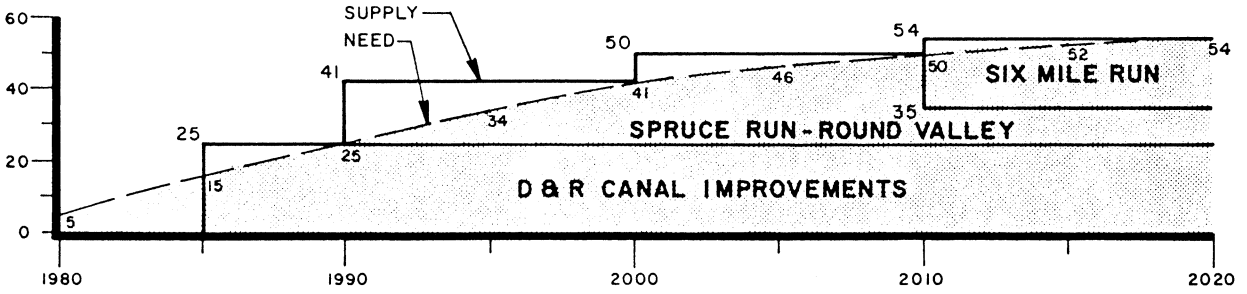
REGION 1
AREAS



NORTH AREA



WEST AREA



SOUTH AREA

LEGEND

ESTIMATED NEED

DEFICIT 1980-1985

FIGURE 7

REGION I
RECOMMENDED
SOURCE DEVELOPMENT PROGRAM

N. J. STATEWIDE WATER SUPPLY MASTER PLAN

The estimated 1980 construction cost of this project is $22.1 million. This will provide capacity for supplying an average annual 20 mgd to the North Area. In year 2005, a $2.1 million expansion of the pumping station capacity will add another 20 mgd capacity to the system.

West Area. The Spruce Run/Round Valley/North Branch pumping system implemented in the immediate action program will require about 7 mgd of additional pumping capacity by 1995. This addition is estimated to cost about $1.3 million. By 2005, pump station capacity should be increased by 7 mgd and a ground storage tank added at the pipeline terminus. This additional construction is estimated in 1980 to cost about $2.4 million.

South Area. The South Area would supplement its supply by about 1990 from Round Valley/Spruce Run/Raritan River water by constructing a pumping station near Manville with discharge to the Delaware and Raritan Canal (see Figure 8). The initial pumping capacity will be about 18 mgd with expansion to a total 25 mgd capacity by the year 2000. The total estimated construction cost of the pumping system is $2.2 million.

The Six Mile Run Project will be needed to supplement South Area supplies by about 2010 when all but 10 mgd of the available Spruce Run/Round Valley water will be in the North and West areas as shown on Figure 7. The project location is shown in Figure 8.

The project includes a dam on the Six Mile Run in Franklin Township with the reservoir extending into North Brunswick Township. A pumping station will be constructed downstream at the Delaware and Raritan Canal with a force main to be built between the Canal and Reservoir. High-water flow from the Canal will be pumped into the reservoir for storage and controlled releases back to the Canal. This pumped storage system has a maximum potential yield of about 28 mgd. The Six Mile Run drainage area at the dam has a yield of about 10 mgd; therefore, the total potential yield of the project is 38 mgd. The estimated 1980 construction cost of the Six Mile Run project is $27.1 million.

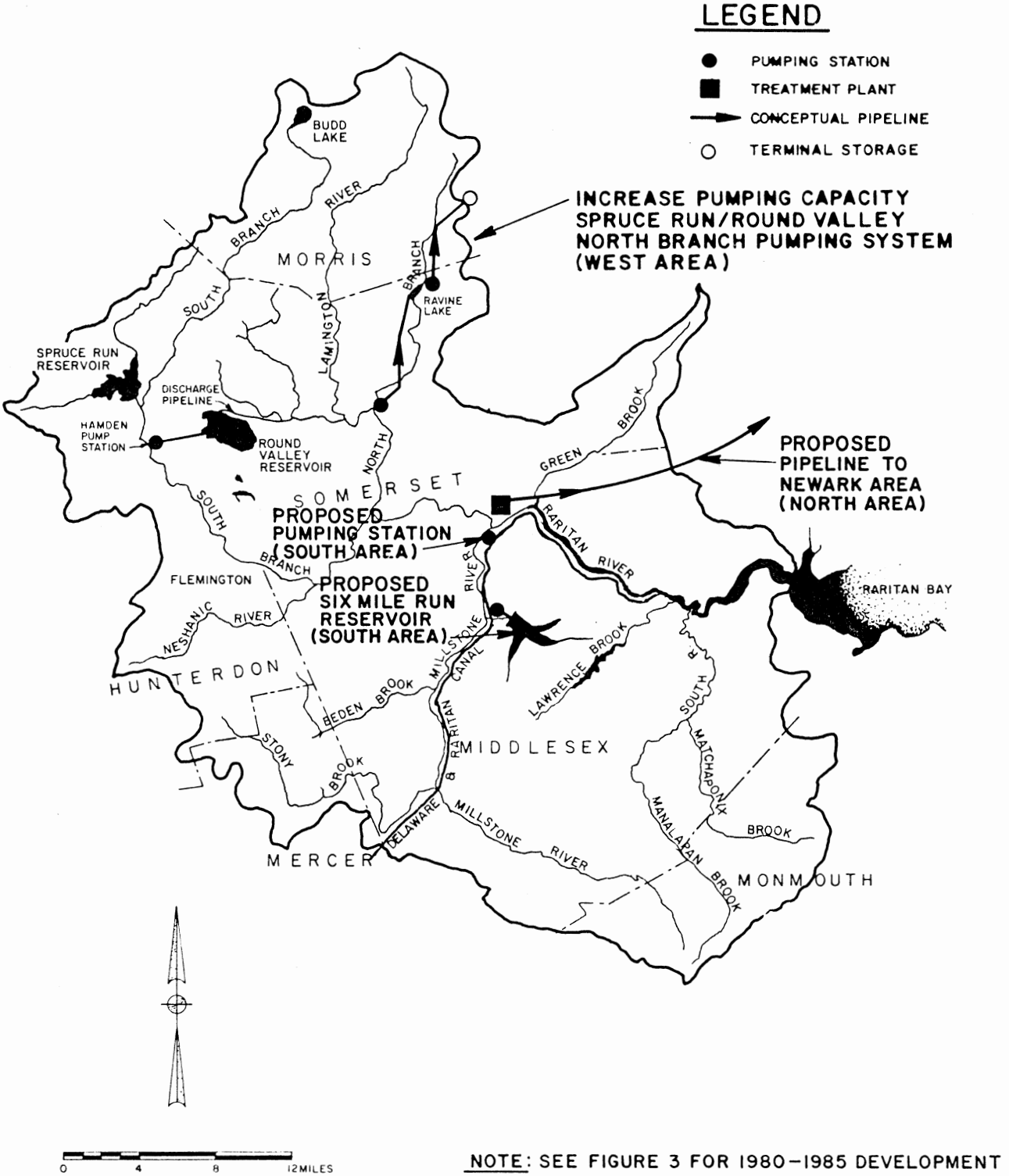
Construction of the source development program recommended for Region 1 (including the immediate action plan) would cost an estimated $114 million at 1980 levels. About $84 million of this would be invested by 1985 for the immediate projects.

Costs include project developments, conveyance to connections with water supply systems near major demand centers, land acquisition, 25 percent for engineering and contingencies, and 10 percent for financial, legal and administrative costs. They do not include the costs to purveyors of adequate interconnections, storage and water mains, or improved and extended distribution systems.

Region Two.

The needs in this region are expected to increase from 30 mgd in 1990, to 38 mgd in 2000, and 50 mgd by the year 2020. These needs are impacted by seasonal demands created by the large influx of people to the seashore in the summer. Implementation of the Manasquan project, both lower and upper reservoirs, in the immediate action program will provide a total of 35 mgd which should meet needs to year 2000.

Development of local groundwater supplies will be needed by year 2000 to supplement the supply of the Manasquan project. Further, by year 2020, some 15 mgd will have to be developed from groundwater sources located in central and southern Ocean County.



NOTE: SEE FIGURE 3 FOR 1980–1985 DEVELOPMENT

FIGURE 8

RECOMMENDED DEVELOPMENT
RARITAN RIVER & D&R CANAL
1985 TO 2020 NEEDS

N. J. STATEWIDE WATER SUPPLY MASTER PLAN

Region Three.

The needs in this region are expected to increase from 16 mgd in 1990 to 22 mgd by 2020. This increase reflects anticipated impacts of casino and shore recreation developments.

As noted under the immediate action plan, local groundwater sources can already meet 1980 needs. In fact, if present growth projections are accurate, these sources already have the potential to meet Region 3 needs through to the year 2020. Therefore, large well field projects and surface water developments are not recommended for the region over the next 40 years. However, if existing threats to groundwater quality are not controlled, such as from landfills near the Atlantic City mainland well fields, new source developments involving costly transmission pipelines may be required.

As detailed in Task 3D, several other realistic projects are available to satisfy the long-term regional needs. These include the South River (Atlantic County) Reservoir Project Pumped Storage, development of the Wharton Tract, and the Burlington County Well Fields.

As noted, the groundwater resources are sufficient to meet all regional needs to year 2020. The South River project should be used to supplement groundwater sources if monitoring indicates wells are not capable of supplying all future needs.

Region Four.

The needs in this region are modest and are expected to increase from about 2 mgd in 1990 to about 9 mgd by the year 2020. Self-supplied water development in the region is extensive, primarily from the Delaware River in the Tidewater area and from groundwater sources at inland areas.

The widely distributed needs of the region can be met by groundwater development in appropriate locations if the self-supplied and purveyor-supplied groundwaters are carefully monitored and protected from contamination and new well developments are planned and operated to avoid adverse impacts on the ground and surface waters. The region's groundwater situation and potential is discussed in detail in Subtask 7C.

An examination of the Maurice River basin prepared under Task 7B indicated that 6 mgd could be developed by stream diversion without the need for a storage reservoir. This surface water development would cost about $374,000 (1980).

The Task 7B study also estimated that a 6 mgd well field development, with 1 mgd per well, would cost about $900,000 (1980); more than twice the cost of the surface water development. Groundwater development possesses significant advantages, however, when demand centers are as widely distributed as in this region.

Region Five.

The needs in this region are expected to increase from 15 mgd in 1990 to 26 mgd in 2000, and 36 mgd in 2020. As noted in the immediate action program, the 1980 needs of 5 mgd and the protection of well supplies and water quality near Camden can be achieved by implementing the Delanco Intake project which provides 25 mgd.

The Delanco Intake Project will satisfy needs in Region 5 to the year 2000. Local groundwater development can meet the increased needs between 2000 and 2020.

The watershed resource management study of Subtask 7B included analyses of the Crosswicks Creek and Rancocas Creek, both of which discharge to the Delaware River. These watersheds have adequate resource capability to meet their additional water needs for at least the next 40 years by either surface water diversions, without the need for storage dams, or well field developments.

Based on a weighted scoring evaluation of water supply, quality, environmental and other issues, there is no clear choice evident for deciding whether surface or groundwater development would be preferable in the two watersheds. Either can be developed to meet future needs.

Region Six.

The needs in this region are expected to increase to about 11 mgd by 1990 and 27 mgd by the year 2020. These needs are relatively modest in comparison to the extensive surface water resource capabilities of Sussex and Warren Counties.

As noted in the immediate action program, the Hackettstown Reservoir on the Musconetcong River will provide releases for flow augmentation of the Delaware River and for assistance to the Delanco Intake. Its water supply capability can also satisfy some local needs. These needs within the Musconetcong River Basin can be met by direct run-of-the-river diversion.

Supplies in the Wallkill River Basin were investigated in the watershed management program analysis of Task 7B and it was determined that a reservoir such as the Beaver Run site may be required to meet local needs expected to reach 5 mgd by 2020.

C. GOVERNMENTAL RECOMMENDATIONS

The implementation of the technical findings requires a series of modifications to the existing governmental system for managing water supply. These major recommendations, which require immediate action, are derived from the Task 8, 9 and 10 reports which comprised the governmental studies portion of the Master Plan.

The recommendations are based upon the problems and issues presented earlier in the Existing Conditions section, subject to the framework provided in the Basis for Action - A Strategy for the 1980's, and serve to respond to the technical considerations discussed. For the most part, the recommendations address identified issues, assign responsibility, permit the existing system to function at maximum capability and promote self-sufficiency and financial accountability at all levels.

If implemented, the several governmental recommendations should permit individual purveyors to assume a maximum role in running their respective systems under a regulatory and managerial umbrella overseen by State government. In the process, the types of financial assistance that complement the attainment of a strong, interdependent system will be discussed.

The result is a series of proposed alterations which respond to past problems, which anticipate the challenges of the future, and which will establish some meaningful dimensions and principles for the use of State capital in the 1980's.

PROPOSED NEW DIVERSION LAW: SYSTEMATIC RECORDING OF ALL WATER RIGHTS

There is an absence of certainty over people's rights to use water and a lack of knowledge of the quantity of water that can be used. As a result of allocations emanating from special legislation, from grandfather considerations, and from permits and approvals, there is a basic difficulty in managing water resources in New Jersey. The conditions of the allocations are not always readily determinable.

For these reasons, a new diversion law has been proposed in Task 10B. This Model Diversion Law proceeds on the principle that a right to use water may be limited in the public interest, provided that the regulation is reasonable and that it is applied equitably.

A primary function of the law is to precipitate the declaration and confirmation of all existing water allocations. There would be a statutory mandate directing everyone to have validated and recorded the claimed water rights. An objective of the law is the orderly and complete recording of water allocations, so that all may know the nature and extent of outstanding rights to withdraw or divert water. Where a claim is controverted, the State would be required to determine the existence and extent of the right. Judicial review would be available for claimants who are not satisfied with the administrative findings.

It is the intent of the proposed law to establish a confirmed and systematic recording of all water allocations and to formulate the legal underpinning of an administrative water resources management system.

REVISED ADMINISTRATIVE REVIEW PROCESS: TIMELY AND DECISIVE DECISION-MAKING

Although an overwhelming number of water supply allocation applications have been handled in a timely and objective manner, in exceptionally critical and complicated hearings and cases, the decision-making process has not functioned smoothly.

In these cases, the difficulties with the existing regulatory system as well as the limited planning perspectives have slowed the implementation of needed major projects. Recommendations have therefore been advanced in Tasks 8B-D to alter the organizational structure for the water supply hearing process, with particular emphasis on preferred alternatives IV and V.

An approach which utilizes elements from both preferred alternatives is currently being considered by the State. This approach would result in a review process similar to the one used by other Divisions within the DEP. Preapplication discussions and evaluations would precede formal review. Applications would be received by the Division of Water Resources and they would be completed within 90 days.

Applications requiring a hearing would be presented to a hearing officer, and the appropriate findings of fact and law would be considered by the Water Policy and Supply Council as a basis for its decision-making. An administrative veto would reside with the DEP Commissioner.

In addition, the development of a planning base for the State review of applications has also been anticipated in the Task 8B-D recommendations. The DEP staff, under the direction of the Division Director, should provide an important resource for the technical review of water resource allocation requests. Also, it should provide a most suitable basis

for integrating various planning efforts and implementing State policy. The responsibility for allocating management resources within the appropriate existing policy framework would be with the Division of Water Resources.

ALL PURVEYOR SYSTEMS: TO BE OPERATED AS UTILITIES

The future of the State's water system has been premised on the ability of the water purveyors to finance, construct, and operate their own system, and to fulfill their responsibilities. To accomplish this objective, as Tasks 8H-I indicate, it is necessary that all purveyor systems - both public and private - are operated in a sound financial and businesslike manner. Public purveyors in particular must function on a self-liquidating basis. State statutes and procedures should be changed to mandate compliance by public and private utility systems to commit the necessary resources to maintain and improve their systems.

The accounting and administrative review processes and procedures are already in existence and requiring adherence to a self-sustaining principle should not require manpower changes. Under the statutes, all municipally operated water utility financial information must be identified in a separate division of accounts. The municipally operated water utility must comply with the State's regular audit procedures and have such audits prepared by a registered municipal accountant. Similar requirements are mandated for private water companies which are required to submit annual financial reports to the State.

It is incumbent upon the private and municipal systems to follow the long standing rate-making principles of the American Water Works Association or the Joint Committee in developing rates for self-sustaining operations. Equally, it is incumbent upon the State through the BPU, the DEP, and the DCA, to oversee the performance of the purveyors, to make sure that these principles are applied. DEP must assist by verifying that utility systems are committing the necessary resources to maintain and improve their systems including, for example, developing or arranging for sufficient supplies for normal operations and emergencies; testing interconnections to verify condition and flow capacity; maintenance and improvements to distribution systems; maintaining current emergency and drought response plans. Unless the State is able to oversee adherences to sound principles and practices, there is little to be gained from proposals for State financial assistance except more requests for money.

STATE WATER UTILITY OPERATIONS: ON A SELF-SUSTAINING UTILITY BASIS

State government should serve as an exemplary model for all utilities, in particular the public purveyors. As such, it is imperative that the State-owned water operations be based on self-sustaining utility management principles.

It has been recommended in Tasks 9E-F that the statutes be changed so that the financial management of the Water Facilities Operation Element (WFOE) be as close as possible to that of a commercially operated water utility.

Under this proposal, revenues from the water operation of the Delaware and Raritan Canal as well as those from the Spruce Run/Round Valley Reservoir Complex would be utilized by WFOE. These revenues would be paid towards all operating and maintenance expenses of its facilities, as well as bond retirement and interest on bonds outstanding. Approved rates should be set at levels sufficient to cover all costs and leave adequate reserves, except for the cost of drought storage. Consequently, it would not be necessary for the State to make budget appropriations from the General State Fund to cover

operating and maintenance costs. The State, however, should pay the bond indebtedness of the water stored for drought emergency. As these drought reserves are committed, the financial responsibilities would shift to the users. Moreover, dedicating certain revenues to specific purposes, such as those pursued by the WFOE, is both legally permissible and in full conformance with the practices of the Legislature and the State Treasury.

This approach would serve to mitigate DEP's inherent conflict of multi-roles: as allocator and regulator of public waters, as operator of State-owned facilities, and as the State agency empowered to sell such water on just, reasonable, and equitable terms.

THE SMALL WATER COMPANIES: THE COMPANIES AND MUNICIPALITIES MUST MEET THEIR RESPONSIBILITIES

Just as the State and the purveyors must assume responsibility for their programs and operations, so also must local governments meet their responsibility and recognize their paramount decision-making role in franchising small water companies. Before any efforts to render financial assistance to small water companies are instituted on a Statewide basis, it is first necessary to clearly assign responsibility and to mitigate the recurrence of this problem.

In reviewing the experiences of the small water companies, the trend has been that in the early stages of its development, the community does not deem it in its interest to assume responsibility for the provision of water, and it grants its consent to permit private water companies, frequently incorporated by developers or builders to provide the service. As time goes by, problems with the reliability of the service and management are encountered.

In determining whether to grant a franchise to a water company, the municipality's consent is the primary determinant. The Court has held that the State Board of Public Utilities lacks the power to dispense with local consent, and that the State agency cannot override a municipal refusal to grant a franchise to a water company.

Small water companies are primarily a local problem, and it should be addressed by those entities which have primary responsibility for approving the systems. Local government must fulfill those responsibilities that are based on the success of home rule. Also, it should be understood that sufficiently financed, managed, and equipped small private water companies, where appropriate, should not be discouraged. The small water company has an extremely important role to perform and where properly constituted can be very successful. However, if the small water company is unable to fulfill its responsibilities, the municipality that approved the franchise must be prepared with an alternate plan and approach to assure safe, adequate water for its residents.

THE LARGE INVESTOR-OWNED SYSTEMS: THEIR ROLE MUST BE MAINTAINED AND STRENGTHENED

The competitive posture of the large investor-owned water utilities must be maintained and strengthened because of their unique role in New Jersey. Tasks 8 and 9 have indicated that the major investor-owned water systems constitute the backbone of the State's system, have a strong record of reliability and public responsibility, and are willing to reinvest in their systems.

It is proposed the State support only those financial measures that will strengthen the ability of all water utilities to be self-sustained businesslike operations. One such measure is for the State to institute a Pool Fund Concept to provide money for financing

improvements by the large investor-owned systems and selected small private water companies worthy of assistance.

The advantages of pursuing the Pool Fund Concept approach for private water purveyors in New Jersey could be extremely significant. By discussing those advantages, which are of a policy, financial and governmental-administrative nature, the Pool Fund Concept will be explained.

Of a policy nature, the Pool Fund Concept would be an excellent opportunity to formulate State strategy at a broad level and to integrate the primary State Departments and agencies in the decision-making process. Under the proposal the Department of Environmental Protection (DEP) would exercise responsibility for identifying and evaluating the technical and capital needs of the purveyors in accordance with sound water quantity and quality considerations; the Economic Development Authority (EDA) would exercise responsibility for developing and implementing a financial revenue program that is responsive to the needs of the identified purveyors and to the concerns of the financial community; and the Board of Public Utilities (BPU) would exercise responsibility for monitoring and strengthening the revenue-tariff (rate) relationship in an expedited and understood manner that would address the needs of the purveyors and their customers.

Of a financial nature, the Pool Fund Concept would enable the State to package the large "A" rated companies and the nonrated companies in a manner that would meet the financial needs of both the large and the small purveyors concurrently. The small private purveyors who are not capable of financing major capital improvements on their own credit and who could not obtain low interest, long-term financing on their own would be the direct benefactors. Most significantly, the Pool Fund Concept would maximize the opportunities of the private sector money market and would not impair the full faith and credit of the State.

Of a governmental and administrative nature, there would be maximum utilization of the resources and talents of existing State agencies. There would be no need to create another State agency or unit of government to monitor the Pool Fund Concept.

Under the proposal the active participation of the private sector should serve to institute a "businesslike review" and promote a proper complementary mix of the private and public sector values. Also, all the private purveyors would be able to participate in the program, and the revolving nature of the issues and the experience and capabilties of EDA would minimize uncertainty and costly processing time.

STATE ROLES IN WATER SUPPLY: TO MAKE SURE WHAT SHOULD BE DONE IS ACCOMPLISHED

A thorough and well balanced program of water management and development throughout the State is essential to assure readiness and to obtain and utilize water efficiently, and to see that distribution and entitlement to use are equitably provided. It is incumbent upon State government to make sure that such a program is instituted and maintained. It is also appropriate for the State to make sure that public and private purveyors promote the use of available resources to meet the legitimate needs of all users.

Although there are many roles that the State can and should play in the water supply management field, it is important that the State limit its direct participation in areas where, more appropriately, purveyors and municipalities should fulfill the responsibility.

Basically, it is the primary responsibility of the purveyor and municipality to provide an adequate supply of potable water and it is the State's responsibility to see to it that this is attained in a coordinated and planned manner.

The State's responsibilities and roles in the water supply area may be viewed from many perspectives. However, fundamentally there are seven significant areas — policy, trustee, guardian, economic welfare, management, overseer, and utility operator. The nature of those roles is identified as follows:

- The State's policy responsibility to establish the overall water supply management framework and statutory basis, to institute the technical standards and enforcement procedures, and to sustain the required monitoring, research, laboratory and training efforts and programs;

- The State's trustee responsibility to regulate and to allocate the use of water resources in an equitable manner, and to determine the water resources that are needed and that are available for use;

- The State's guardian responsibility to assure potable water quality, and to conserve the judicious use of the water resources, and to establish uniform action plans for droughts and emergencies, including safeguarding environmental low flows;

- The State's economic welfare responsibility to promote and to develop the welfare of its citizens and its industries and to see that their legitimate social and economic water needs are realized by purveyors and municipalities;

- The State's management responsibility to establish a sound institutional and financial water supply system, to ensure the continued primacy of the private purveyors, and to direct its programs on a self-supporting basis;

- The State's overseer responsibility to support the planning, coordination and public participation required for the protection and maintenance of its intrastate and interstate water resources; and

- The State's utility operator responsibility to conduct its activities as a wholesaler of water in an exemplary fashion, and to operate the State facilities on a self-sustaining criterion.

In summary, the State must make sure that the purveyors and municipalities furnish an adequate supply of readily available, safe drinking water for the health and economic well-being of its citizens, communities, commerce, and industries.

STATE WATER SUPPLY PROGRAMS: ON A SELF-SUSTAINING BASIS

The State's administrative, management, regulatory and planning operations should be based on a self-sustaining approach. The development of revenue sources to cover the variety of prudent and necessary functions performed by the State DEP in the water supply field should lead to the establishment of a self-sufficient water supply management system.

The principle of water fees to cover the costs of the administrative, management, regulatory, and planning programs is not new to the water supply program in New Jersey. The 1907 enabling legislation for State responsibility in the area of water supply included two fee provisions which were intended to make the program of a self-liquidating nature.

However, since that time, the needs of the State, the demands for regulation, and the conditions of the economy have changed dramatically without a commensurate alteration in the amounts of revenue which the fees generate. As a result, the water supply program has relied upon the State and Federal tax revenues to a greater degree as the program has expanded over the intervening seven decades.

The discussions presented in Tasks 8H and 8I are designed to promote a strategy for administering charges which would balance evolving program costs with revenue from administrative fees and diversion fees. This effort to make water supply administration and programs self-sustaining is based upon a long standing principle in water utility economics and regulation. Moreover, alternatives to general revenue funding sources must be developed and instituted if required water programs are to meet a specific array of water needs.

Tasks 8H-I indicate that a key element in developing a self-sustaining flow of revenue for water supply management is a general diversion fee. This fee should provide sufficient revenues, along with Federal funds and administrative fees, to balance the budget for water supply management.

Presently, funds collected through water fees are not available to the water supply management budget. Also, on a daily basis, better than one billion gallons of water is used in New Jersey. Of this, all groundwater users and 40% of the surface water users are excluded from the State's water diversion fee, which is about two dollars per million gallons (MG).

The clearest approach to developing a flow of revenues to support the revitalized regulatory program is to institute statutory changes for an upgraded system of general diversion fees incorporating certain free allowances and exemptions and a parallel set of administrative service fees. The costs of the water supply program are proposed to be absorbed directly by the users and the beneficiaries of the program, thus decreasing the burden on the State General Fund.

BUILDING A WORKING PARTNERSHIP: GOVERNMENT MUST INCREASE PRODUCTIVITY FROM EXISTING RESOURCES AND MOVE TOWARDS ADMINISTRATIVE COORDINATION

Government's resources are limited. There is a strong competition occurring among the State, county and municipal programs for those limited resources, and resources have not and will not grow at a rate commensurate with the expansion of government's regulatory responsibilities. Consequently, a far greater return and increased productivity will have to be gained from existing resources.

There are innumerable examples in Tasks 8, 9 and 10 of the Master Plan where there is a necessity for greater administrative coordination and the need for government to increase productivity from existing resources. To demonstrate the importance of this need the following illustrative examples are cited.

As indicated in Task 8F the State is now responsible for carrying out the Safe Drinking Water Act activities, and seeing to it that all available resources are drawn upon

to accomplish the purpose of this Federal Act. In recognition of resource limitations, the working partnership approach, which utilizes county and local resources, appears to be the only way in which the potable water quality program can be applied on a widespread and relatively uniform basis. Experience indicates that potable water quality regulation can be carried out most effectively by those close to the regulated water suppliers, and this is the principle that should be employed within New Jersey.

The working partnership will have to utilize the existing resources of other governmental units, particularly those of county governments. Implementing the County Environmental Health Act would serve to reforge an old alliance and establish a much needed localized action aim for potable water quality regulations.

Moreover, the working partnership concept must also be selectively applied to the groundwater quality management program, field activities of a laboratory, monitoring and surveillance nature, and technical assistance and planning type activities.

As noted in Tasks 8A and 8C the working partnership approach should also be utilized between agencies. At the inter-agency level it is extremely important that the working partnership concept is formalized between the DEP's Division of Water Resources (DWR) and the Board of Public Utilities (BPU). There must be improved orchestration between the DWR and the BPU on rate cases and water supply issues. Opinions expressed during interviews and the public participation process were that the DWR should not assume the power to determine water rates. The formulation of an inter-agency (DWR-BPU) policy agreement, and continuous and ongoing staff coordination on service, engineering, financial, and inspection matters should result in an expedited, less costly, more effective process.

The working partnership approach and administrative coordination should also be instituted: 1) between DEP and EDA on financing the needs of the private sector (Tasks 9B-D); 2) between DEP and DCA in assuring that the municipal purveyors are committing the appropriate financial resources to maintain their systems in a utility operations manner (Tasks 8H-I); and 3) between DEP (as the State representative) and the Delaware River Basin Commission and the States of New York, Pennsylvania and Delaware in developing the necessary strategies and programs to ensure the maximum use of the inter-state waters.

Clearly, the primary role of State government - namely, to make sure what should be done is accomplished - emerges from this emphasis on administrative coordination and making greater use of existing resources.

THE ROLE OF STATE CAPITAL: A PRUDENT ALLOCATION OF LOANS AND STATE FINANCING

The utility concept, as applied to a water supply, should not be eroded, either consciously or unconsciously. Unfortunately, Federal and State grants have a tendency to create a dependency relationship, and such an arrangement is not beneficial to the long-term interests of the purveyors and their customers. Furthermore, Federal and State grants in a utility area only serve to disguise the cost of service, diminish local responsibility to be self-sustaining and develop inequitable rates. When public purveyors receive grants, another public purveyor (or more importantly a private purveyor which may not qualify for the grant) will have commensurately higher charges. As a matter of policy, the financial opportunities that are available to the public purveyor must not undermine self-reliance, or the eventual repayment by user charges, or the public-private balance in the State.

Governmental grants to aid purveyors in the construction of necessary facilities --- examples: new systems, interconnections, rehabilitation of present systems, transmission facilities, and internal improvements --- are not recommended as the mechanism and means to develop and maintain financial and management independence for self-sustaining public utilities. However, it is realized that in certain situations --- examples: extraordinary requirements of the Safe Drinking Water Act or the need to institute major capital programs --- could place difficult-to-manage burdens on a purveyor. In such circumstances, low interest State government loans, with repayment schedules, and phased rate increases are recommended, especially if such a program were available to both public and private purveyors.

It is imperative that both the public and private sectors are able to benefit from such a State loan program. If the proposed EDA approach is instituted for the private sector, the Legislature should formulate a comparable loan program for the public sector as part of its proposed 1980 Environmental Bond Issue. The engineering estimates for a five year program of mandatory interconnections indicates a need of some $6 million. Comparable estimates should be made for similar mandatory needs in the areas of treatment facilities, rehabilitation, transmission lines, internal improvements, and necessary physical improvements for consolidating small systems. These estimates should be made on both region and purveyor bases with a relative sense of priorities.

STATE-SPONSORED PROJECTS

Conversely, it is recognized that the State has basic responsibilities in the water supply field and that there are appropriate occasions when it is incumbent upon the State to use its financial resources for the best interests of its citizens and for the health, welfare, and economy of the State.

The existing Spruce Run/Round Valley project is an example of such an occasion. Another example may be the proposed Hackettstown Reservoir in Region 6. The reservoir is also expected to address recreational concerns, flow maintenance considerations for the Delaware Basin in addition to meeting the water supply needs of the area, and the Reservoir is expected to be an integral element in the State's interstate program under the DRBC agreement.

In these instances, the State should assume the initial capital financing responsibility, or it should have that obligation fulfilled by some other comparable body. For example, it might wish to have the Hackettstown project financed by the DRBC, utilizing the bonding powers of the Commission. Obviously, the capital financing arrangements are independent of the need to develop a series of accounts for repayment. By applying the utility operations and user pays concept, the costs of the water used by the communities in the region could be separated from the recreation costs and the costs to maintain required stream flows in the Delaware.

Understandably, there should be compelling reasons for the use of State capital. The reasons should reflect the considerations that have been identified: multiple use projects of a regional nature; projects where it is not possible for private capital or localized public capital to be raised to meet the intended objectives; and the projects which, if not fulfilled, society as a whole will suffer negative repercussions. Obviously, decisions for State financing should be made based on the individual merits of the project.

Those facilities infrequently financially supported as a matter of State policy, as a form of protection for the benefit of the State or a region, or to provide for long range future needs or for drought reserves, should be treated as trust assets. The State would

initially fund the requirements and when demand for the water increases to the point where the facilities in the trust category are required to provide water to meet the demand, the costs of such facilities would be transferred to regular operating accounts.

There is at present no substantial incentive by law or regulation for purveyors to protect the minimum streamflows required for environmental purposes. Some mechanism should be provided to render it financially less profitable for purveyors to disregard such minimums.

In conclusion, the future of public water supply in New Jersey is directly tied to placing purveyors in a position to meet their responsibilities as utility operators. The primary criterion is self-sufficiency, achieved through the imposition of rates to system users, whether they be wholesale or retail.

The major governmental findings indicate that a new water supply management institution is not needed to implement key provisions of the Plan. By reaffirming the role of purveyors, by recasting the financing and accounting of the State Water Facilities Operation Element, and by utilizing the existing powers of the Economic Development Authority, adequate major institutions are available to implement projects.

The capital to support a municipal loan program and State sponsored project development should come from a bond referendum. The dimensions of any such proposed referendum should be based upon estimates supported by technical analyses, subject to a reasonable plan for implementation.

SOURCE DATA

SOURCE DATA

This document has presented a summary of the major findings and recommendations of the study. The background data from which the findings emerged are recorded in the outputs of a series of tasks prepared as the Source Data over a period of three and a half years and reviewed by the public at a series of open meetings. These documents, listed below, are available from the State upon request and should be reviewed to examine detailed analyses, conclusions and recommendations. An asterisk indicates that certain subtask outputs were bound and published together for the convenience of the reader.

LIST OF TASK AND SUBTASK TITLES

TASK 1 - DATA BASE OF WATER SUPPLY SYSTEMS AND USE

- *1A Collection of Data
- *1B Analyze Purveyor Systems
- *1C Ranking and Checking of Data
- *1D Compile and Present Data
- 1E1 Analyze and Define Drought, Withdrawal Limits, Stream Flows
- 1E2 Update Interconnection and Transmission Facilities Maps
- 1E3 Document and Project Purveyor Deficits
- 1E4 Identify Self-Supplied Users
- 1E5 Capital Needs Survey
- 1F Evaluate Existing Information System

TASK 2 - NEEDS ASSESSMENT

- 2A Trends and Patterns of Populations and Water Use
- *2B Problem Summaries for Each Water Supply Region
- *2C Analyze Implications of Needs
- 2D Recommend a Projections Approach

TASK 3 - WATER SUPPLY DEVELOPMENT STUDIES

- *3A List Available Supply Projects
- *3B List Additional Projects
- *3C Data Bank to Analyze Alternative Projects
- 3D Analyze and Evaluate Alternative Projects
- *3E Combine Projects into Programs of Developments
- *3F Presentation of Results
- 3G Develop Selection Methodology

TASK 4 - AN INTERCONNECTIONS PROGRAM

- *4A Safety and Stability of Supply Systems
- *4B Backup Capabilities
- *4C Regional Interconnection Needs
- 4D Interconnection/Transmission Recommendations
- 4E Emergency Response Plan Recommendations

TASK 5 - CONTINGENCY PLANS

- ✓5A Purveyors' Drought Capacity
- *5B Regional Drought Capacity
- *5C Formulate a Program to Address Drought Situations

TASK 6 - CONSERVATION PLANS

- 6A Formulate Conservation Policies and Programs
- *6B Evaluate Significance of Policies and Programs
- *6C Develop Conservation Plans

TASK 7 - WATERSHED RESOURCE MANAGEMENT ACTIVITIES

- 7A Contents and Methodology for Watershed Resource Management
- ✓7B Prepare Watershed Resource Management Plans for Five Basins
- ✓7C Prepare Groundwater Management Program

TASK 8 - REGULATORY SYSTEM MANAGEMENT AND ADMINISTRATIVE ACTIVITIES

- ✓8A Accounting of WP & SC Functions
- *8B Regulations Governing WP & SC
- *8D Procedures for Review, Adoption and Updating of Plans
- ✓8C Relationship of PUC and DWR
- ✓8E Develop a Small Water Company Program
- ✓8F Analyze Potable Water Program
- 8G Procedure to Cause Water Treatment Facilities to be Built
- ✓8H Principles of Major Purveyor Pricing Systems
- ✓8I Recommend Water-related Fee System

TASK 9 - STATE UTILITY OPERATIONS AND ACTIVITIES

- ✓9A Compare Institutional Schemes
- ✓*9B Analyses of Institutional Schemes
- ✓*9D Capital Finance Recommendations
- ✓9C Analyses of Alternative Financing Schemes
- 9E Pricing Schemes for Future Water Supplies
- 9F Recommend Finance Schemes for Existing Water Supplies

TASK 10 - LEGAL STUDIES ACTIVITIES

- ✓10A Analyze "Grandfather" Diversions or Grants
- 10B Identify a Comprehensive Diversion Rights Law
- 10C Possibility of Reserving Diversion Rights for Future
- ✓*10D Legal Access to Delaware Basin
- ✓*10E Legal Access to Hudson Basin

✓Amendment No. 1 - Task B - Use of Computer Simulation Model
✓ Task A - Data Base of Water Supply Systems & Use

METHODOLOGY FOR THE PLAN

APPENDIX

METHODOLOGY FOR THE PLAN

The methods and procedures used in this study have been detailed in the various outputs and form an important part of the work. It was the intent of the State that these procedures - the "Methodology" - would be recorded if this work is to be the basis of an ongoing guide to water resource management. This section presents, in brief, some of the methods used to analyze major elements of the study ranging from the data base to public participation. Consistent use of the methods and the regular updating of data at no greater than five-year intervals will greatly assist future decision-making.

A Data Base was developed in the study from four primary sources: diversion records; diversion approvals; purveyor questionnaires; and Bureau of Potable Water inspection reports. A computer data base was created and State personnel have been trained in its use. Available programs can utilize these data in projecting future water needs at regular intervals, five years being suggested.

The data suitable for storage include: comprehensive water resources inventory of all water sources and major facilities; water demand usage and projections; historical and projected population and employment; compilation of water supply allocations; water rights and diversions; compilation of potential water resource developments including the Water Resources Bank projects; water supply regulatory and administrative requirements; compilation of existing and potential water supply programs together with their location; water supply emergency response plans; water conservation programs and results; and other information deemed necessary.

Additions and corrections will be made annually and a comprehensive review and update should be performed every five years. Population estimates should also be reviewed every five years and new water demands projected using the updated data. The population and employment estimates should be based upon official State projections.

Water use data should be examined and revised every two years in order to reflect changing conditions that may result from water conservation practices, water reuse, increased use of domestic appliances and requirements of new industry and commerce.

Population/Employment and Water Use changes are key factors in any projections. Population forecasts prepared by the Department of Labor and Industry, Office of Business and Economics (OBE) were used for statewide water use projections. The medium range OBE forecast was used which assumes continuation of current trends as the set of future events most likely to occur. These estimates should be updated every five years.

Employment Projections for the study period were not available and were developed independently, based on national forecasts of industrial activity and recent trends in State and County employment for twenty-three industrial sectors. Three series were developed to provide a range of estimates corresponding to the population forecasts. These employment forecasts are based on a modified shift-share projection using the mid-range forecast and a computer program was prepared to handle this data. This program was provided to the State as part of the study.

Water Use per person was related to regional activity levels and was projected for a variety of user categories applied to present and future levels of population and employment on a county by county basis. This is the most sophisticated approach available for water use projections.

Trendbreakers are significant events which have a direct and important impact on such factors as regional population, industrial activity and water demands. Current projections are founded on the continuation of present trends, but it follows that the occurrence of an event having a direct and important impact on regional populations and water demands will interrupt present trends and require new forecasts. Examples of such trendbreakers are the Hackensack Meadowlands Development, oil exploration on the Outer Continental Shelf, Coastal Area Facility Act, Wild and Scenic Rivers Act, resort-induced growth in the Atlantic City area, and future preservation of the Pine Barrens. Continuous monitoring of the impacts of potential trendbreakers is suggested.

Available Resources and their Dependable Yield includes the methods to quantify existing and potential water supply source capabilities.

These estimates can be prepared by stream system analysis using one or any combination of three available methods. These include: traditional approaches such as the Rippl method of reservoir analysis for small systems and preliminary survey analyses, the daily flow simulation models developed by the State and the monthly flow simulation models such as the Corps of Engineers' HEC-5C computer program, "The Simulation of Flood Control and Conservation Systems." The HEC-5C basin model as applied in the study can be used to develop statistical information on frequencies of shortages over a selected simulation period, as explained in Task 5A and Task B, and is based on reliability of supply, replacing the traditional design drought safe yield concept. The HEC-5C computer simulation program can establish the interrelationship among demand, storage capacity and failure probability.

Groundwater Resources represent a major part of the State's water supply and, in the past, provided an uninterrupted supply during the worst droughts. Unregulated use of groundwater, overpumping and chemical and heavy metals pollution have placed a number of these supplies in jeopardy. The objectives are to assist recovery of polluted aquifers over an extended period, relieve overstressed areas and maintain the integrity of existing aquifers. The methods used to achieve these objectives include providing adequate control over and regulation of all groundwater, an extensive but carefully designed groundwater surveillance system and development of plans to relieve existing overstressed aquifers.

Project Analysis - all possible supply projects available to meet present and projected demand are inventoried. Those projects having the best characteristics are screened using a general matrix evaluation based on technical, economic, and environmental feasibility. The realistic projects are then evaluated using a detailed matrix based on criteria such as technical soundness, monetary cost, environmental and socio-economic impacts, implementation issues and needs.

Projects are judged primarily in terms of their water supply benefits. Projects not selected may be viable for other primary uses, however, such as recreation, low flow augmentation, flood control, etc.

A periodic review and update of the matrix every 5 years is necessary since times will change and such things as needs, economics, environmental policies and philosophies, institutional factors, social issues, and political directions are not static and unchanging.

Projects deemed realistic and viable but not selected for implementation form an essential reserve pool of "deferred" projects available to meet new or changing water supply problems and needs in the future.

Emergencies managed and planned for are not emergencies as such, but events in the life of any purveyor. Short-term disaster conditions, generally of a localized nature, require emergency response planning. The continued reduction of water supply due to drought, on the other hand, calls for a carefully planned and generally understood drought response program.

Emergency response planning in the State must be based on individual purveyor plans which are specifically responsive to the vulnerabilities and capabilities of each purveyor's own system with emphasis placed on interconnections. Each purveyor must have provisions for updating its plan on an annual basis. The plan must be filed with the State, which is responsible for technical assistance and advice in maintaining a safe and adequate water supply.

The Drought Response Program is directed towards individual purveyors, with State agencies contributing overall planning and response activity. The key to success is the early identification of an impending drought with all parties (the State, the purveyors and the public) knowledgeable concerning the steps to be taken.

Conservation is the serious concern of every conscientious citizen. Conservation is a consistent practice, a way of life which conserves a resource and minimizes waste. Since experience has shown the effectiveness of education in promoting conservation, this subject should be part of the school curriculum throughout the State.

In no sense does conservation create water resources other than a one-time possible delay in the date when new resources are required. Prudent water resource planning recognizes conservation as a factor which may prolong the useful life of a given supply. Conservation programs, as recommended in the summary, and their success should be reviewed at regular intervals every year.

Public Participation was an important part of the process in developing the New Jersey Water Plan. A comprehensive public participation program involving committees located throughout the State arranged for each of the interim outputs of the Plan to be reviewed by various members of the public having a special interest. It would be regrettable that such a highly organized network of committees should cease with the completion of this study and, accordingly, it is proposed that a Public Advisory Committee and the Water Purveyor's Committee of the public participation network be perpetuated.

NOTES