

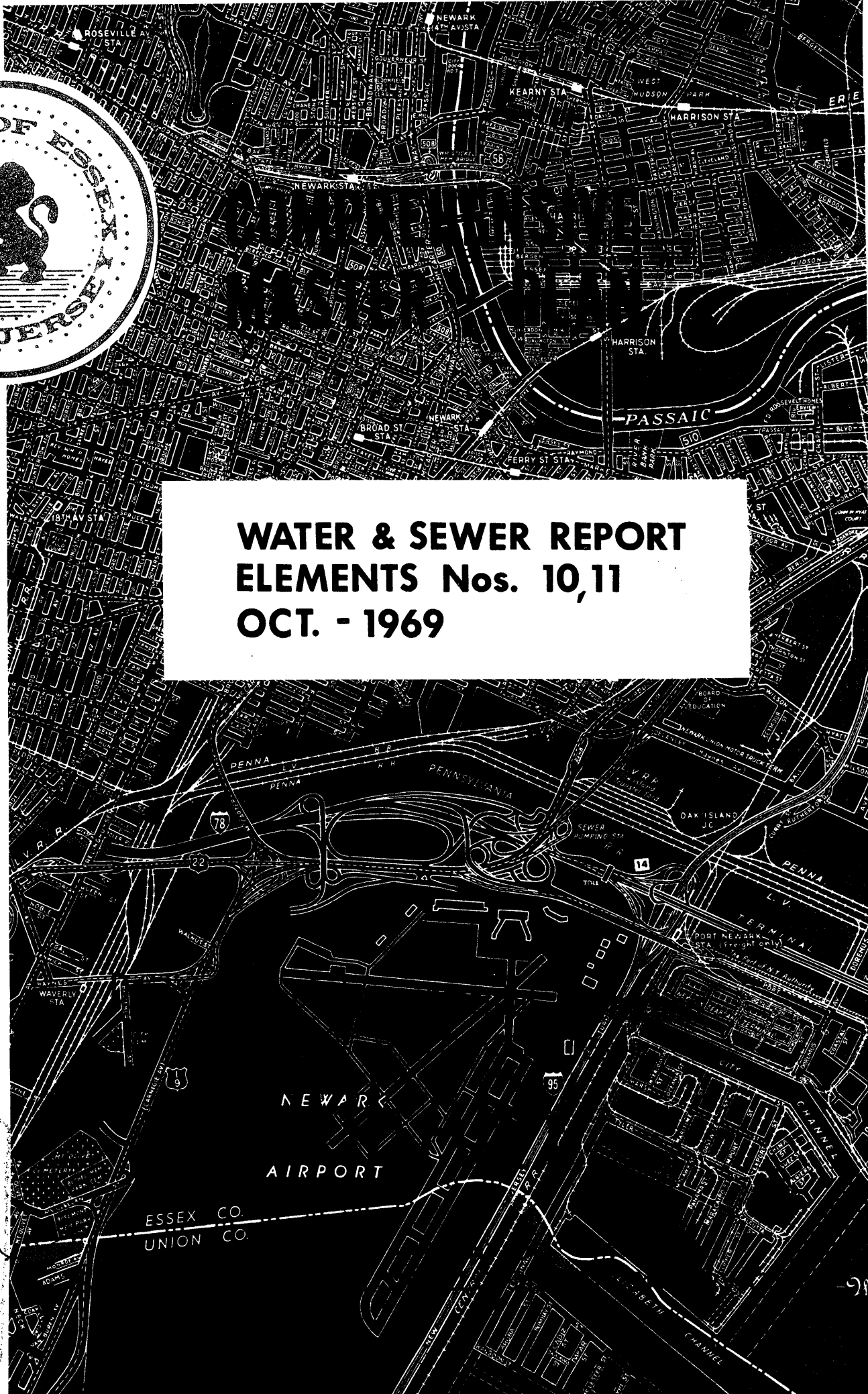


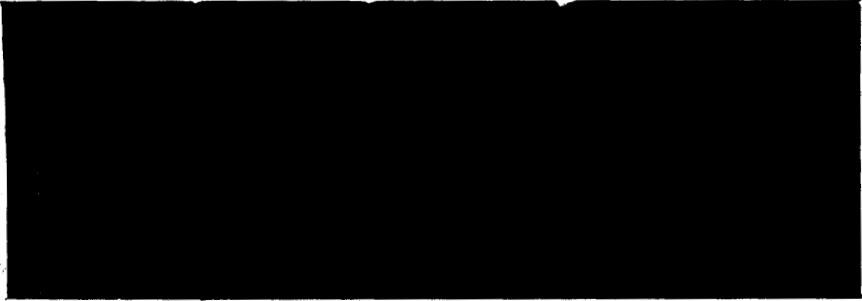
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COMPREHENSIVE WATER AND SEWER PLAN  
FOR  
ESSEX COUNTY, NEW JERSEY

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Prepared for the:  
ESSEX COUNTY PLANNING BOARD

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Prepared By:

PLANNERS ASSOCIATES, INC.  
60 Park Place  
Newark, New Jersey 07102

December, 1969

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ABSTRACT

TITLE: Comprehensive Water and Sewer Plan for  
Essex County, New Jersey

PREPARED BY: Planners Associates, Inc.  
60 Park Place  
Newark, New Jersey 07102

SUBJECT: Water and Sewer Plan for Essex County,  
New Jersey

DATE: December, 1969

PLANNING AGENCY: Essex County Planning Board

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Essex County Planning Board

HUD PROJECT  
NUMBER: New Jersey P-111

SERIES NUMBER: N.A.

NUMBER OF PAGES: 129

ABSTRACT: This report inventories all public and  
private water and sewer systems in Essex  
County and the 22 municipalities therein.  
It then forecasts the 1990 demand for  
water and sewer services and formulates  
a plan meeting these demands. The costs  
for implementing all elements of the  
recommended plan are included in the  
capital improvements program.

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I

BACKGROUND

## I. BACKGROUND

### A. ESSEX COUNTY'S REGIONAL SETTING

Essex County encompasses 127 square miles and is located in the northeastern portion of the State of New Jersey. Although one of New Jersey's smallest counties in area, Essex is the State's largest from the standpoint of population and economic activity. The County has been growing at a modest rate, having a 1960 population of 923,545 and an estimated 1967 population of about one million. According to a recent report by the County's Department of Planning, Economic Development and Conservation, it is expected that this will increase to 1.15 million in 1975 and 1.36 million persons by 1990.\*

Bounded by Hudson, Bergen, Passaic, Morris and Union Counties, Essex forms the hub for the industrial and financial activities in the northeastern portion of the State. (Maps No. 1 and 2 show the County's location within the eastern seaboard and New Jersey respectively.) The County contains 22 separate municipalities, including Newark, a city of approximately 400,000 people, which is also the core city for the SMSA consisting of Morris, Union and Essex Counties.

---

\*"Community Shelter Plan, Essex County, New Jersey"; Department of Planning, Economic Development and Conservation; January, 1969.

The County's landform has greatly influenced the character of its development. It consists of a coastal marsh in the eastern portion bordering the Passaic River and Newark Bay. The terrain gradually rises in a westerly direction in a line through Newark and the Oranges. In the western portion of the Oranges, the Watchung Mountains bisect the County, running in a north-south direction, and form a strong demarcation line. The central portion of the County, along the Watchung Range, is characterized by large park and recreation open space areas. Crossing the mountains, the western slope gradually descends to the Passaic River, which forms the County's western boundary. This part of the County is not as yet completely developed because of its distance and relative lack of accessibility to the urbanized eastern hub.

The new Interstate routes under construction, 280 and 78, will dramatically affect the movement of people in the County, as both expressways cross the State and County in an east-west direction. (See Map No. 3.) Existing roads must currently absorb the 350,000 automobile commuters in the County.\* Maintaining the flow from eastern to western points are State and Federal route numbers 46, 80, 10, 24 and 22, and from northern to southern points are route numbers 1, 9, 17, 3, 21, 23, 95 (New Jersey Turnpike) and the Garden State Parkway, providing convenient access to other parts of Metropolitan New York.

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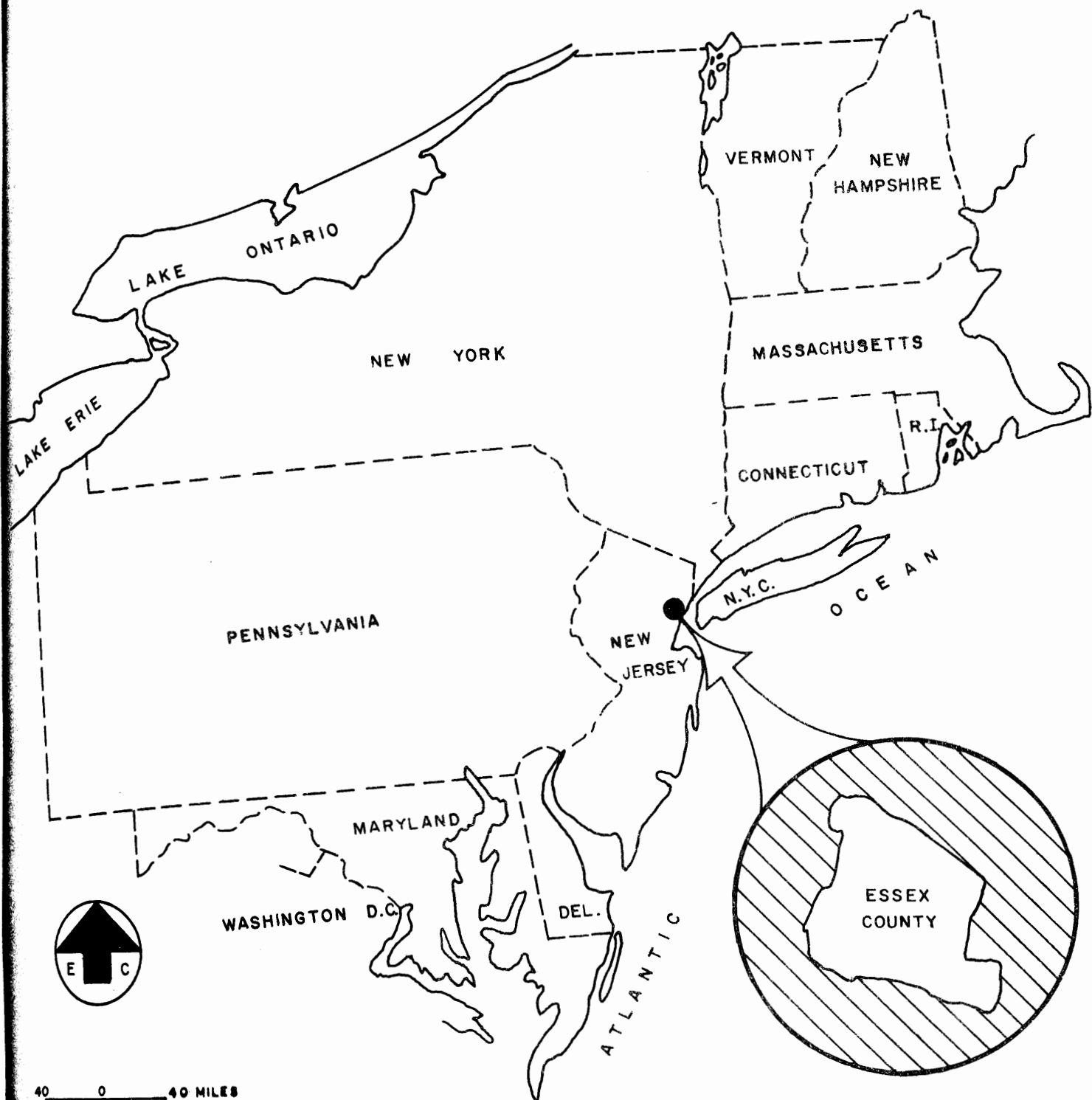
\*Based on the Tri-State Transportation Committee report, "Journey to Work in the Tri-State Region", June, 1964.



In addition to these major highways, Essex presently has three railroads (the Erie-Lackawanna, Pennsylvania and the New Jersey Central) providing service to downtown Newark. Local and rapid transit are available to most of the residents of the area as well.

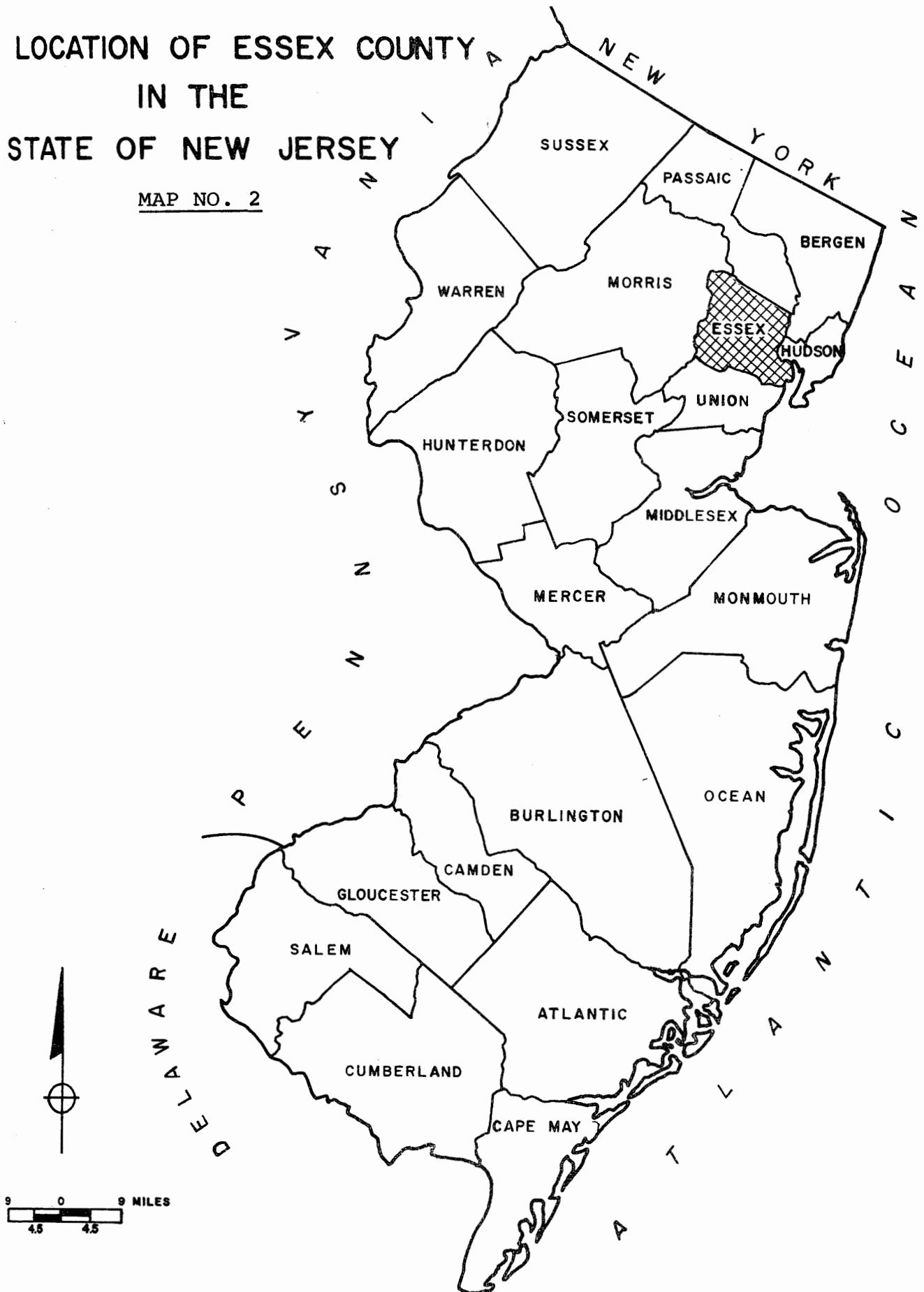
# REGIONAL LOCATION MAP ESSEX COUNTY

MAP NO. 1



# THE LOCATION OF ESSEX COUNTY IN THE STATE OF NEW JERSEY

MAP NO. 2








ESSEX COUNTY, NEW JERSEY

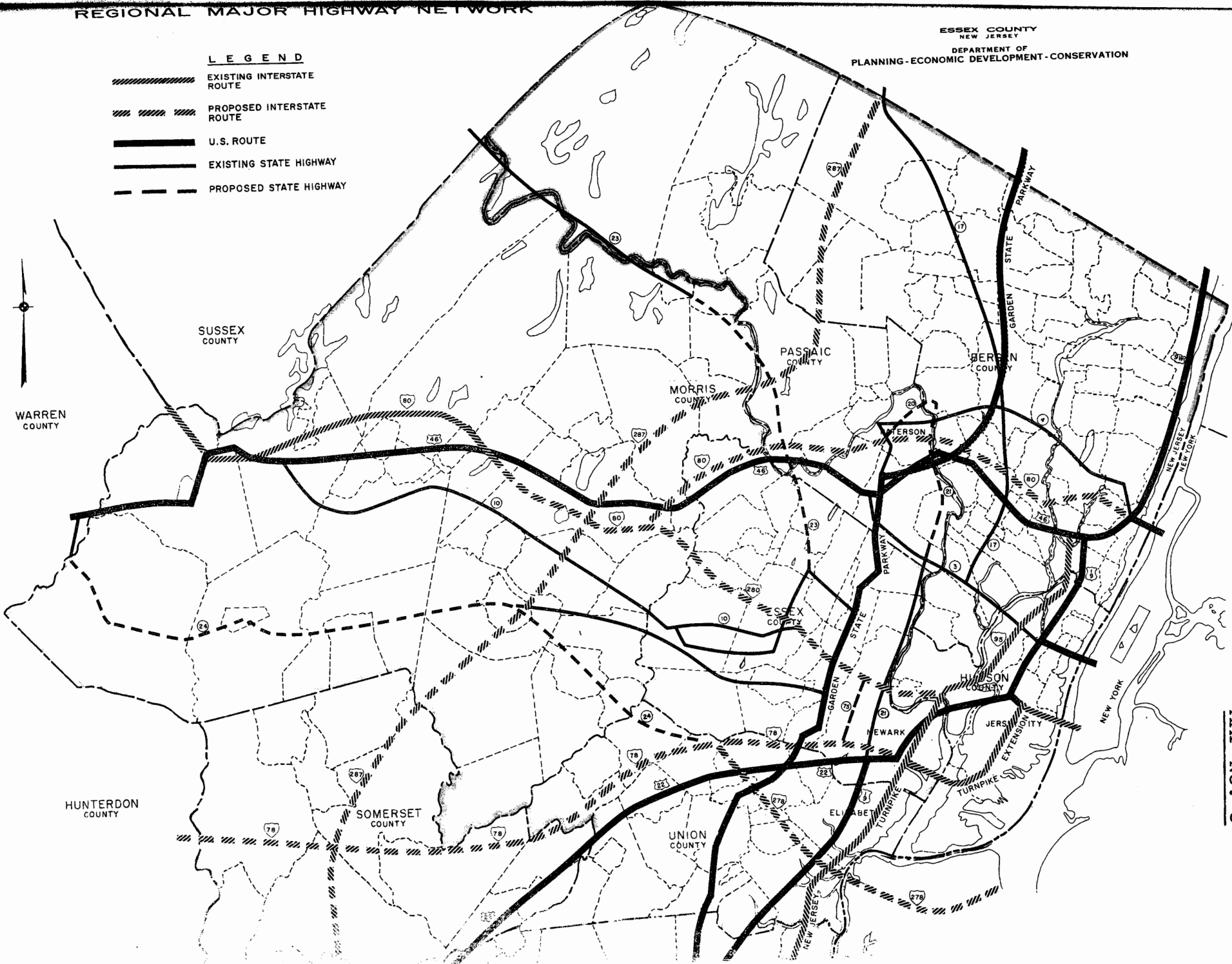
DEPARTMENT OF PLANNING - ECONOMIC DEVELOPMENT - CONSERVATION

# REGIONAL MAJOR HIGHWAY NETWORK

## LEGEND

-  EXISTING INTERSTATE ROUTE
-  PROPOSED INTERSTATE ROUTE
-  U.S. ROUTE
-  EXISTING STATE HIGHWAY
-  PROPOSED STATE HIGHWAY

ESSEX COUNTY  
NEW JERSEY  
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MAP NO. 3

## B. INTRODUCTION TO WATER AND SEWER PLAN

The problems of water management in urban areas have become enormous in the recent past. All levels of government are realizing the importance of preventing the deterioration of our natural environment, while at the same time meeting the range of human needs, including water needs. Water management problems have affected Essex County in a number of ways. The safe supply of an adequate amount of water, the quality of water in the rivers within and adjacent to the County, the adequacy of sewerage treatment facilities, and the containment of surface runoff are some of the current critical subject areas within which there are problems facing the County.

The solutions to the above questions, and specifically to the problems of water supply and sewerage treatment to which this report will address itself, are currently being sought by municipalities and industries within the County and by the agencies -- public, quasi-public, and private -- that provide these services to users in Essex County. Water supply for the majority of the people in the County is controlled by either the North Jersey District Water Supply Commission, the Commonwealth Water Company, or the Newark Water Authority. The major sewerage systems are under the

authority of the Passaic Valley Sewerage Commission and the Elizabeth Joint Meeting. Government at all levels must address itself to the operation of these regional agencies, commissions and authorities which cross municipal and, indeed, county boundaries.

At the County level, it is essential that a plan be developed for these functional areas, which will analyze and evaluate existing systems, review current and forecast future needs, and develop an overall plan for meeting those needs. As integral components of the ongoing Comprehensive Plan process for the County, the Water and Sewer Plans will play an important role. It should be stressed at the outset that, in water and sewer planning, the County is clearly not an isolated entity and cannot plan in a vacuum. However, a plan of action for the County as a whole, to which all the municipalities can relate, is necessary for the orderly expansion of facilities in the larger planning areas under the jurisdiction of the relevant multi-county bodies. The plan for the County must be consistent with any plans developed for the North Jersey multi-county area, which must coordinate the operating practices of the commissions controlling water supply and sewage treatment.

Having predicated that the County plan be consistent with those at the multi-county level, it is necessary that there

be an acceptable plan for internal County guidance and reference. The report that follows concerning the Water and Sewer Plan consists of an inventory of the existing facilities, an analysis of the demand for expanded or new facilities, and an interim plan formulated to meet this demand, consistent with the objectives defined in the Comprehensive Plan for the County.

A final note on the consistency of these plans with the County Master Plan in general: At present, the Comprehensive Plan for Essex County is under preparation and several of the studies are not yet completed. Since the Plan is in varying stages of completion and contains information relevant to this report, reference to the various studies will be included wherever possible. Other County-wide studies, such as the Community Shelter Program, in which future population levels and land-use alternatives are examined and projected on the basis of certain criteria (defined later), will also be used where appropriate. The Plan prepared will be based upon certain development assumptions consistent with those developed in other portions of the Comprehensive Plan. The relationship to the Comprehensive Plan will be considered more specifically in the following section. The assumption made in these studies must, of course, be placed before the

County Planning Board for consideration and for change if  
deemed necessary by them..



C. RELATIONSHIP OF THE WATER AND SEWER PLAN TO THE  
COMPREHENSIVE PLANNING PROCESS

As mentioned above, the Essex County Planning Board and the Department of Planning, Economic Development and Conservation are currently preparing a Comprehensive Plan for the County. This multi-year effort has been financed in part through the "701" Comprehensive Planning Assistance Program of the Department of Housing and Urban Development. The first year of this planning program, now approaching the publication stage, consists of a broad range of inventory work elements, preliminary analyses, and a broad-brush sketch plan for the County.

This Water and Sewer Plan reflects, or is compatible with, the data collected during the past year's inventory and the preliminary analyses based on that data; the concepts developed in the sketch plan now being prepared for publication; and the preliminary proposed policies for the County which, in turn, reflect preliminary goals and objectives previously postulated.

Moreover, this Water and Sewer Plan is designed for compatibility with relevant published reports of the Tri-State Transportation Commission and the State of New Jersey. Lastly, mechanisms exist for ensuring the proper coordinated

implementation of this Plan. These mechanisms include, among others, the Joint Council of Municipal Planning Boards of Essex County and the Essex County Board of Chosen Freeholders.

While compatible with planning data collected as part of the County's planning process, this Plan has also utilized as basic source material recent plans prepared by the Regional Plan Association for Northeastern New Jersey. As the Tri-State Transportation Commission develops and publishes regional water and sewer studies, and as the Essex County planning process moves from its current preliminary stage toward completion of its Comprehensive Plan, this Water and Sewer Plan can be adjusted if and as indicated.

II

WATER PLAN

## A. OVERVIEW OF ESSEX COUNTY WATER SUPPLY AND DEMAND

### 1. Summary of Problem and Regional Relationships

The 22 municipalities in Essex County are served almost entirely by water sources within the Passaic River Basin, which extends over a large portion of northern New Jersey and on into New York State. The majority of this water is impounded as surface water in the Wanaque and Pequannock watersheds. (See Map No. 4 for location of these watersheds.) Some municipalities in the central and western areas of the County rely on ground water from wells as their source of water. Both surface and ground water thus combine to form the available water in the Basin which is used to supply Essex County. The counties of Somerset, Morris, Union, Passaic, Bergen and Hudson also derive part or all of their water from this Basin.

The total water production of a river basin such as the Passaic has a maximum limit determined by rainfall over the basin and the available ground water flow into the basin. This flow, however, in the Passaic River Basin is of small consequence. The yield or water crop is determined largely by rainfall and by the amount of water available for use that is stored on the surface and in the ground throughout

the Basin. The yield will vary with rainfall and the existing water storage. The yield from the Passaic River Basin is approaching its upper limits at present, and the expected increased demand for water will severely tax present facilities in the near future. The Pequannock and Wanaque, the major suppliers, are watersheds which are now faced with the greatest demand in relation to their yield grants.

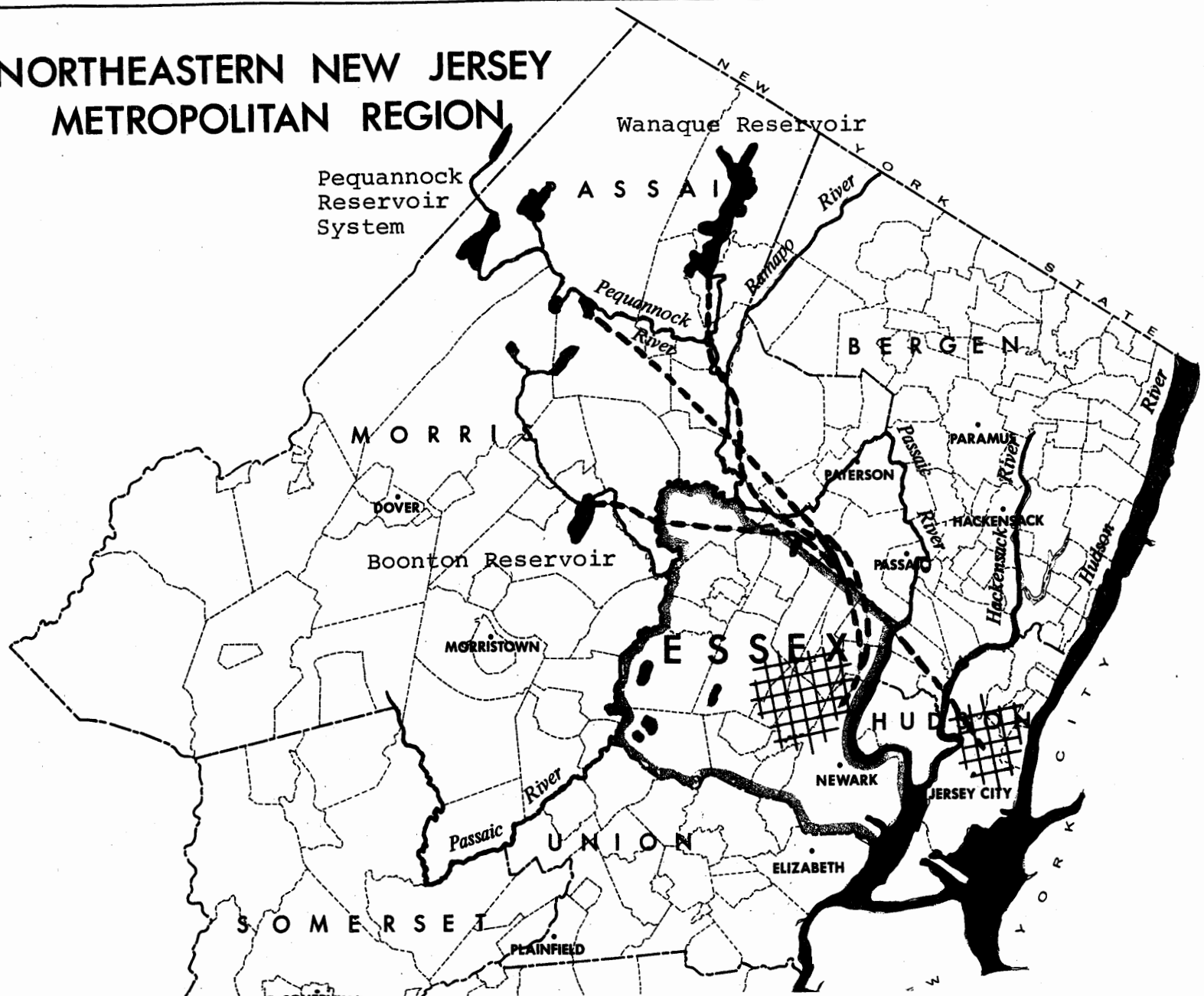
Any expansion of storage within the Passaic River Basin is only a temporary solution toward meeting projected water demand for Essex County and its environs. Tapping other watersheds must be the final solution toward meeting Essex County's future water demand. Possibilities in this area will be discussed later in this report.

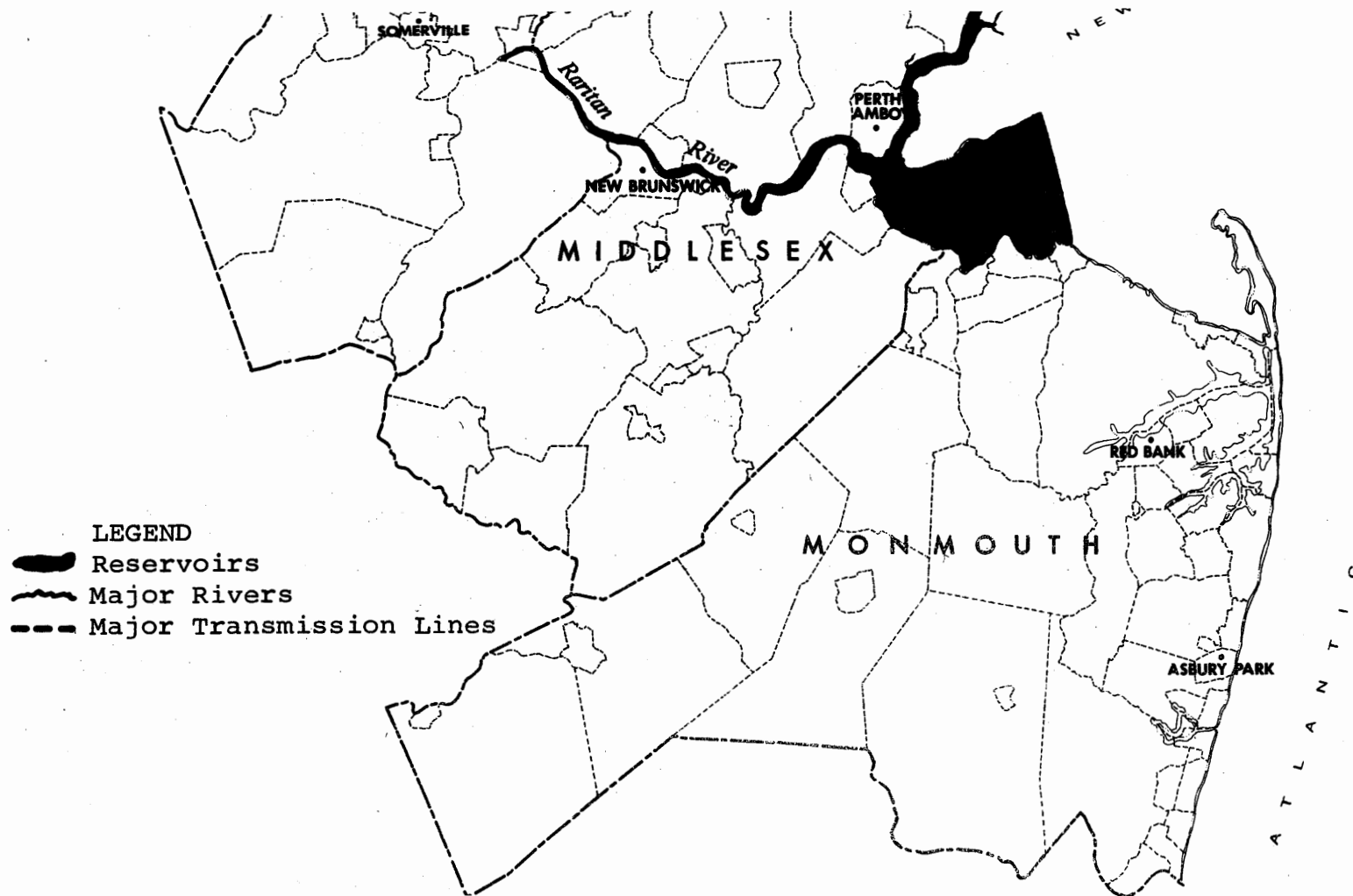
From this introduction to Essex County's water supply problem, the point made in the above Background statement should become abundantly clear: that planning for the County's water supply is fundamentally a multi-county, regional problem. The vast bulk of the County's current supply sources lie outside of Essex in Passaic, Morris and Sussex and, to a degree, in New York State. Potential future sources lie to the west in Hunterdon County. At the risk of repetition, it should be emphasized that water resources planning for Essex County must recognize its regional interdependence with the balance of northern New Jersey.

## 2. Study Organization

This Water Plan report is divided into four basic sections. First, existing water supply sources and facilities are inventoried, which includes a description both of reservoir systems and watershed sources and of the major distribution systems. Secondly, there is a brief review of existing demands placed on the systems. Third, a methodology is developed for forecasting future water demand; and fourthly, proposals are advanced for improvements to the systems which can meet future demand. The proposals outlined within this report are referred to as a "sketch plan" for water supply, and should be viewed as interim suggestions pending completion of other parts of the County's Comprehensive Plan.

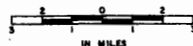
# NORTHEASTERN NEW JERSEY METROPOLITAN REGION





# LEGEND

- Reservoirs
- Major Rivers
- Major Transmission Lines



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## MAP NO. 4 ESSEX COUNTY WATER SYSTEM LOCATION OF RESERVOIRS AND MAJOR TRANSMISSION LINES

ESSEX COUNTY NEW JERSEY	
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## B. INVENTORY OF EXISTING WATER SUPPLY SOURCES AND FACILITIES

### 1. General Description of Entire System

#### a) Areas Generally Served With Water:

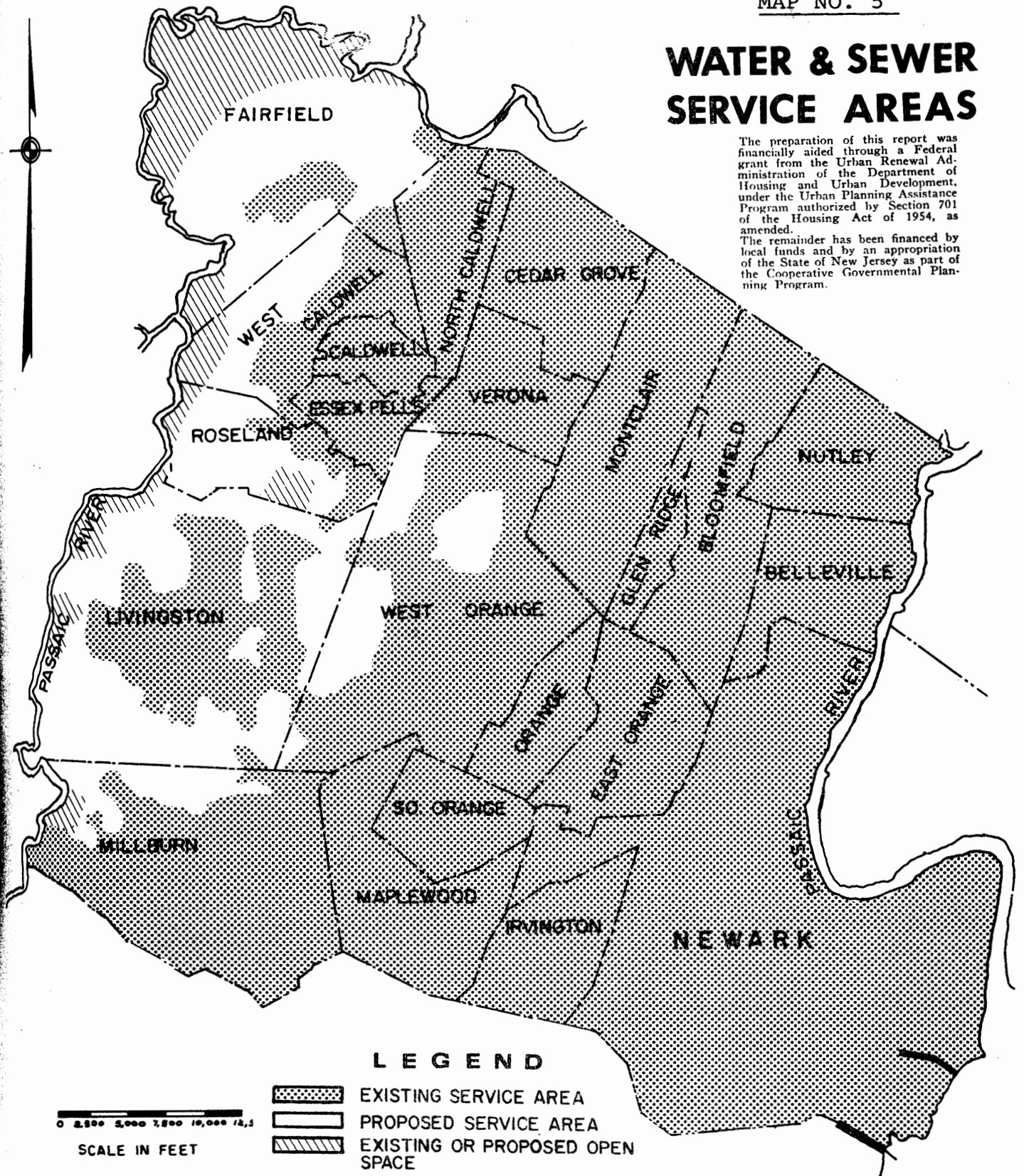
As indicated on the Water and Sewer Service Areas Map, (Map No. 5), most of Essex County is already served with water. New service areas are proposed in the western portion of West Orange and in portions of Livingston, Millburn, Roseland, West Caldwell, Fairfield, North Caldwell and Cedar Grove. Certain portions of Essex County along the Passaic River are either existing or proposed open space, and will require minimal water service in their future development. Water treatment plant and transmission facility improvements, either in the form of new facilities or expansion of existing facilities, have been scheduled for Belleville, Bloomfield, Cedar Grove, Glen Ridge, Livingston, Newark, South Orange and Verona.

#### b) Summary of Areas Served by Major Systems:

In 1969 there were twelve different source systems supplying water to the municipalities in Essex County. The largest sources were the Wanaque-Ramapo and Pequannock systems of the North Jersey District Water Supply Commission and the Newark Water Authority respectively. Water from the reservoirs in these systems supply the majority of the water

# WATER & SEWER SERVICE AREAS

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ESSEX COUNTY  
NEW JERSEY

to the population concentrations of eastern Essex. These large water systems are controlled by managing authorities which distribute water within each municipality or sell water wholesale to municipalities. (The responsibilities of the managing authorities, the characteristics of each system and the areas served by them are described below.)

Nine municipalities in central and western Essex (Orange, East Orange, South Orange, Livingston, Fairfield and four municipalities under the Essex Fells Water Department) are served by wells. The wells are owned by the municipalities and the storage and distribution managed locally. In the Essex Fells system, the municipality of Essex Fells owns the wells and sells to four customers (Caldwell, North Caldwell, Roseland and Essex Fells).

Four municipalities in the southern part of the County (West Orange, Maplewood, Millburn and Irvington) are supplied by the Commonwealth Water Company, which is a private firm in the water business. This company also serves some municipalities in neighboring Union County. The Passaic Valley Water Commission supplies the municipalities of Nutley and Verona, plus municipalities in Bergen and Passaic counties, while the Jersey City Water Department supplies West Caldwell.

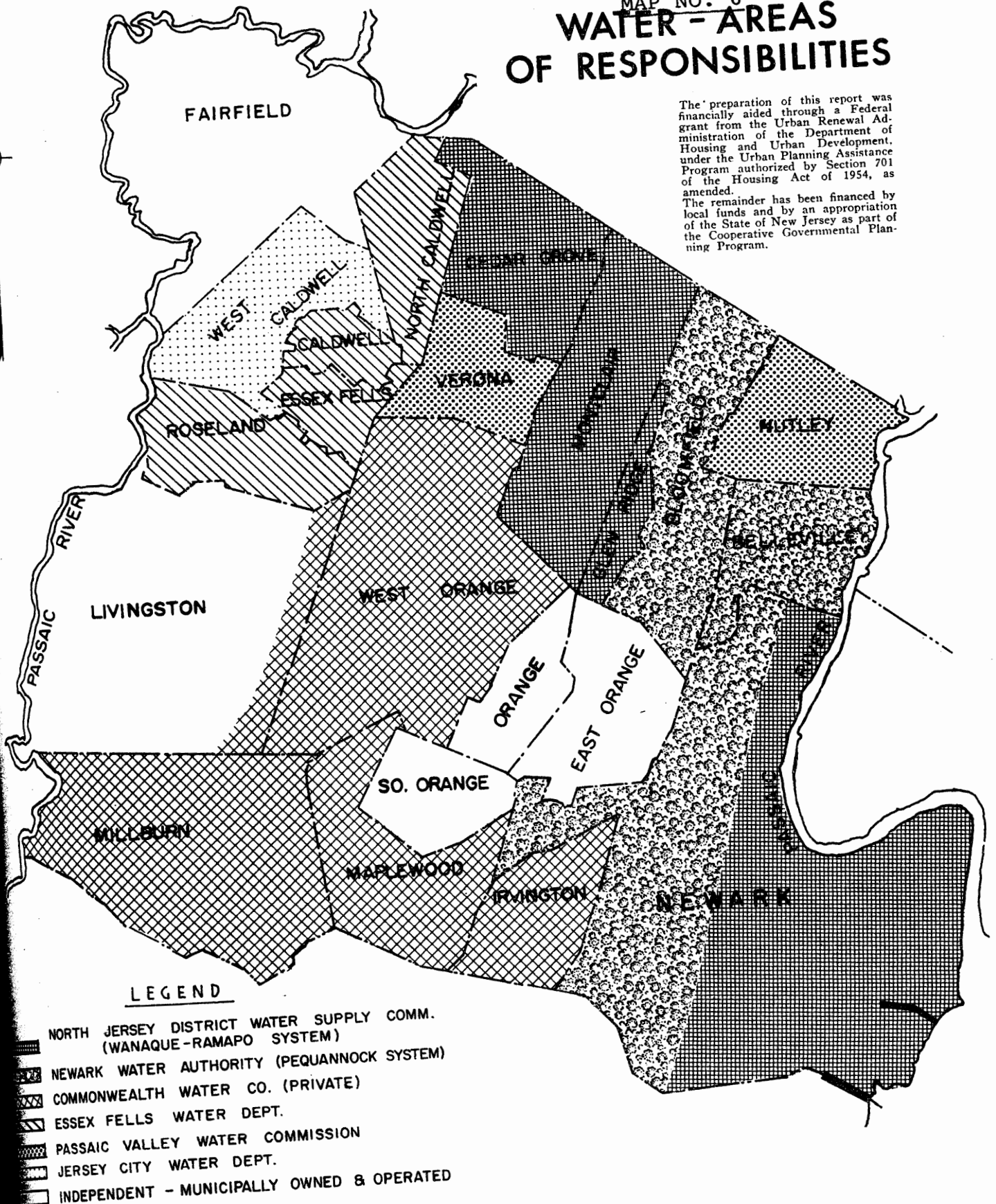
The Elizabethtown Water Company supplies water to the Newark system through a transmission line from Bound Brook on the Raritan River.

Map No. 6 shows these areas of responsibility by graphically representing the service areas of the County's major water systems. In an attempt to simplify the situation, it should be stated that generalizations have been made due to the fact that several service areas do not coincide with present municipal boundaries. These factors were considered and the map represents the service areas of the major purveyors by municipality. If a municipality is served by more than one purveyor, the major purveyor is shown as the sole supplier. In most cases this is a reasonable depiction of the situation, for there is in each municipality a major purveyor and a single or several additional small purveyors.

Table 1, taken from a 1962 publication by the State Division of Water Policy and Supply, lists the local distributors of water for each municipality in Essex County. This study is County-wide and, thus, emphasis is directed toward the water supply problem from a larger-than-municipality point of view. Although an analysis of water demand in this report is carried out at the municipal level, it should be borne in mind that the municipal boundaries are

MAP NO. 6  
**WATER - AREAS  
 OF RESPONSIBILITIES**

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**ESSEX COUNTY  
 NEW JERSEY**

**DEPARTMENT OF PLANNING-ECONOMIC DEVELOPMENT-CONSERVATION**

used for convenience of analysis, and serve as areas for approximate estimates of the use and demand for water.

The next section contains a more specific description of water supply sources and of water distribution systems presently serving the County.

TABLE 1

ESSEX COUNTY MUNICIPAL WATER PURVEYORS

<u>Municipality</u>	<u>Served in Part or in Whole by</u>
1. Belleville	Belleville Water Department Newark Water Department Passaic Valley Water Comm.
2. Bloomfield	Bloomfield Water Department Newark Water Department Montclair Water Department
3. Caldwell	Caldwell Boro Water Department
4. Fairfield	Fairfield Water Department Jersey City Water Department
5. Cedar Grove	Jersey City Water Department Cedar Grove Water Department Verona Water Department New Jersey Water Service Co.
6. East Orange	East Orange City Water Department Newark Water Department
7. Essex Fells	Essex Fells Water Department
8. Glen Ridge	Glen Ridge Water Department Passaic Valley Water Comm.
9. Irvington	Newark Water Department Commonwealth Water Company
10. Livingston	Livingston Water Department Commonwealth Water Company
11. Maplewood	East Orange City Water Department Commonwealth Water Company
12. Millburn	Orange City Water Department Commonwealth Water Company

ESSEX COUNTY MUNICIPAL WATER PURVEYORS

(cont'd)

- |     |                |   |
|-----|----------------|---|
| 13. | Montclair      | Newark Water Department<br>Montclair Water Department   |
| 14. | Newark         | Newark Water Department   |
| 15. | North Caldwell | North Caldwell Water Department<br>Essex Fells Water Department<br>West Caldwell Water Department<br>New Jersey Water Service Co. |
| 16. | Nutley         | Nutley Water Department<br>Jersey City Water Department<br>Passaic Valley Water Comm.   |
| 17. | Orange         | Orange City Water Department<br>Montclair Water Department<br>Commonwealth Water Company  |
| 18. | Roseland       | Roseland Water Company<br>Essex Fells Water Department  |
| 19. | South Orange   | Orange City Water Department<br>South Orange Water Department<br>Commonwealth Water Company                                       |
| 20. | Verona         | Verona Water Department<br>Montclair Water Department<br>Cedar Grove Water Department<br>Passaic Valley Water Comm.               |
| 21. | West Caldwell  | West Caldwell Water Company<br>Caldwell Boro Water Company<br>North Caldwell Water Department<br>Essex Fells Water Department     |
| 22. | West Orange    | Orange City Water Department<br>Montclair Water Department<br>Commonwealth Water Company  |

Source: State Division of Water Policy and Supply, January, 1962.



## 2. Specific Description of Each Major System

In Essex County, many factors must be considered in describing the transmission of water from the reservoirs or wells to the eventual consumer. The purpose of this section is to describe each water system which supplies water to the County and distributes it to municipalities purchasing water for their residents and various economic and municipal activities. Thorough descriptions of each major system are provided.

It should be realized at the outset that water distribution lines often do not stop at municipal or county boundaries. Also, transmission lines are interconnected, so that sources from one reservoir can be diverted into the usual transmission lines of another system. It is obvious that the tracing of water from source to consumer could be complicated by this interconnection of mains.

The descriptions below are divided into two sections: Firstly, a review of the major reservoir/collection systems; and, secondly, a description of the major wholesaling/distribution systems which transmit water to what can be termed the retailers -- in most instances the municipal water departments. In some cases (e.g., Jersey City Water Department), the agency does not fall neatly into one of these categories

and may, in fact, be a reservoir system, wholesaler and retailer simultaneously, but this distinction is a useful way of describing most of the system.

a) Major Reservoir/Collection Systems:

(1) North Jersey District Water Supply Commission

(Wanaque-Ramapo System):

Ownership - The Wanaque-Ramapo System is administered by the North Jersey District Water Supply Commission (NJDWSC) for its owner cities. This Commission is composed of five water commissioners appointed by the Governor of New Jersey. All financing of the Wanaque-Ramapo System is borne by the participating communities, in accordance with each participant's proportionate ownership in the System. The ownership of the System is as follows:

40.50%	- City of Newark
37.75	- Passaic Valley Water Commission
	(composed of the cities of Clifton, Passaic,
	and Paterson)
5.00	- Montclair
4.00	- Bloomfield
0.75	- Glen Ridge
12.00	- Kearny
<u>100.00%</u>	

Areas Served - The areas in Essex County served by Wanaque water are Cedar Grove, through the Montclair system; Verona, from the Passaic Valley Water Commission, through

lines connected to Little Falls; Glen Ridge, through the Montclair system; Montclair, by a connection with the Wanaque Aqueduct at the Grove St. pumping station; Nutley, part from the Passaic Valley Water Commission and part from the Newark Water System; Bloomfield, from the Newark Water System; Belleville, from the Newark Water System; and Newark from the Newark Water System.

Source of Supply - The source of water in this System is the Wanaque River's 94.4 square mile watershed and in addition excess water from the Ramapo River. The maximum safe yield from the system is 104.0 million gallons per day (hereinafter referred to as MGD.)

The System's single storage unit, Wanaque Reservoir, has an area of 2,300 acres at a flow elevation of 300.3 feet. The available storage capacity below this elevation is 27.6 billion gallons. This reservoir, the largest in New Jersey, has enough capacity to store all the water which might fall upon the watershed during a period of three or four days of above average rainfall. Consequently, during critically dry periods, the reservoir would be only partly full for several days. The reservoir is formed by a main dam and seven smaller dams.

The State of New Jersey permits a daily average of 25 MGD to be pumped from the Ramapo River at Pompton Lakes into

the Wanaque Reservoir subject to the following restrictions:

(1) only water in excess of 40 MGD river flow can be pumped from the river to the reservoir; and (2) water from the river cannot be removed between June 1 and October 1 of any year.

Treatment - The capacity of the treatment plant located in Wanaque is 146 MGD. Prechlorination and pH adjustment, with lime, are the specific types of treatment applied.

(2) The Newark Water Authority (Pegquannock System):

Ownership - The Pegquannock Water System is owned and operated by the City of Newark. It is proposed that control of the system be transferred to the newly created Newark Water Authority.

Area Served - The areas served in Essex County are Newark, Belleville, and parts of Bloomfield, Nutley, East Orange and Irvington.

Sources of Supply - There are five storage reservoirs and one intake reservoir in the Pegquannock System. The characteristics of each reservoir are listed below:

1. Canister Reservoir

Capacity - 2,407 million gallons (MG)

Spillway Elevation - 1,086'

Reservoir Area - 350 acres

2. Charlotteburg Reservoir

Capacity - 2,964 MG

Spillway Elevation - 725'

Reservoir Area - 300 acres (approximately)

3. Clinton Reservoir  
Capacity - 3,518 MG  
Spillway Elevation - 992'  
Reservoir Area - 423 acres

4. Echo Lake Reservoir  
Capacity - 1,678 MG  
Spillway Elevation - 894'  
Reservoir Area - 300 acres

5. Oak Ridge Reservoir  
Capacity - 3,895 MG  
Spillway Elevation - 846'  
Reservoir Area - 482 acres

6. Macopin Reservoir  
Capacity - 32 MG  
Spillway Elevation - 583'  
Reservoir Area - 12.1 acres

The Pequannock Watershed is 63.7 square miles in area and the total capacity of the reservoirs within the system is 14.0 billion gallons. The maximum safe yield from the system is 58.0 MGD.

Treatment - Water from the Pequannock reservoirs is treated at the Charlotteburg plant. The rated capacity of this plant is 150 MGD. Prechlorination, screening, aeration, and adjustment of pH with lime and soda ash are the treatments usually given.

(3) Commonwealth Water Company:

Ownership - The Commonwealth Water Company is privately owned. As with any public utility, its rates are regulated by the New Jersey State Public Utility Commission.

Area Served - Irvington, Maplewood, Millburn and West Orange are the Essex County municipalities almost entirely served by the Commonwealth Water Company. Small portions of Livingston, Orange and South Orange are also serviced by this system; and nine municipalities in Union County are served entirely or in part by the Company as well. The Bernards Water Company and the Elizabethtown Water Company have connecting lines to the system and, when necessary, purchase water from Commonwealth.

Source of Supply - The water from 33 wells and diversion from the Passaic River provide the chief sources of water for the Commonwealth Water Company. Purchase of water from the Elizabethtown Water Company is an additional source of supply, obtained through existing interconnections between the systems.

The capacity of the storage facilities is 1,370 MG. The Canoe Brook reservoirs (#1 and #2) in Millburn and a reservoir near Walnut Street in Livingston are the impoundment sites.

Treatment - All water entering the system is chlorinated at the Canoe Brook Treatment Plant located in Millburn.

b) Major Wholesaling/Distribution Systems:

It is clear that the majority of water supplied to Essex County is from the two larger reservoir systems, Wanaque-Ramapo and Pequannock, described in the preceeding pages of

this report. The reservoirs have a combined maximum yield of 162 MGD. This entire quantity is not used in Essex County, for about 50% of the water from the Wanaque System is used in Passaic, Bergen and Hudson counties. Approximately 100 MGD are supplied to Essex County from these two reservoir systems. Currently, Essex County is supplied approximately 150 MGD of public water from all sources.

The Newark Water System and the Passaic Valley Water Commission are the major distributors or wholesalers of reservoir water in Essex County. The distribution of the water, and its interchangeability between distribution systems after leaving the reservoir through interconnections, will be described to realize the flexibility of the present water system.

(1) Newark Water System:

The Newark Water System draws most of its water from the two major reservoir systems; about 50% from the Pequannock and 40% from the Wanaque. An additional 10 MGD, or approximately 10% of the system's supply, comes from a pipeline connection with the Elizabethtown Water Company. The Wanaque water is delivered by twin 74-inch transmission lines from the reservoir to a balancing reservoir in Clifton, and then by a single 74-inch transmission main to the Belleville Reservoir, a total distance of 20.6 miles. There are inter-

connections along the way to the Pequannock Aqueduct, the Little Falls pumping station of the Passaic Valley Water Commission, the Jersey City Aqueduct, the Grove Street pumping station of Montclair, and to Bloomfield. (See Table 2 for list of interconnections on the major systems.)

Supply from the Pequannock reservoir system is delivered by 48- and 42-inch transmission lines and extends 21.2 miles from the Macopin Intake Reservoir to the Belleville Reservoir, with a by-pass arrangement at the Cedar Grove reservoir.

Water from the Elizabethtown Water Company is delivered via a connection on the Raritan River at Bound Brook. This water enters the Newark system from the south, while the water from the other sources is supplied to the system by way of the Cedar Grove and Belleville reservoirs to the north and west.

Water from the Wanaque and Pequannock transmission lines can be supplied to the Cedar Grove and the Belleville reservoirs. In times of heavy draft, water from the Pequannock Reservoir is supplied directly to the Belleville Reservoir, bypassing the Cedar Grove distributing reservoirs. In normal operation, this water flows by gravity into the reservoir and does not pass it. The Wanaque water, when needed in the Cedar Grove Reservoir, must be pumped because it is at a



TABLE 2

NORTHERN NEW JERSEY REGIONAL MAJOR WATER SYSTEMS,  
INTERCONNECTIONS AND OTHER PERTINENT DATA

<u>Interconnections</u>	<u>Transfer Capacity</u>	<u>Pipe Diameter (In Inches)</u>	<u>Available Direction of Flow</u>	<u>Pumping</u>	
				<u>Yes or No</u>	<u>Direction</u>
Wanaque (West) Pequannock #2 (Wayne)	15.0	12&16	Last to first	No	--
Wanaque - Jersey City (Little Falls) 95%	25.0	24	Both	Yes	Last to first
Wanaque (East) Pequannock #1 (Wayne)	25.0	24	First to last	To be installed	Only emergency First to last
Pequannock - Jersey City (Chittenden)	25.0	24	First to last	To be installed	Last to first
Pequannock - Passaic Valley Water Co. (Great Notch)	12.0	24	First to last	To be installed	Last to first
Passaic Valley Water Co. Hackensack (Lodi)	6.0	20	First to last	Yes	First to last

Source: "Status of Water Supply, Sewage and Flood Control in the North Jersey Region, 1949",  
Appendix No. 6, Samuel Emanuel, Regional Plan Association.

lower elevation than is the reservoir. (There is additional chlorination after water leaves the Cedar Grove Reservoir.)

(2) Passaic Valley Water Commission:

Water from the Wanaque Reservoir (53%), and diversions from the Passaic River (47%), are the sources of supply for this water distribution system. The State has granted diversion rights from the Passaic River of 75 MGD when the river flow permits. Cedar Grove, Verona and Nutley receive water from this system. The total water used by these municipalities is small compared to the amount supplied to other customers (Paterson, Passaic, Clifton) in the Passaic Valley System.

The sources of water for both the Newark System and the Passaic Valley System are from the Passaic River Basin. Thus, if and when the expected demands for water increase, deficits would likely occur in both systems.

The Little Falls supply of the Passaic Valley Water Commission has a large watershed but no reservoir storage. The Commission has the right to take 75 MGD from the river at Little Falls. There are, however, two factors which have tended to reduce past safe yield estimates for the supply below 75 MGD. First, existing pump and filter capacity is somewhat less than that necessary to permit utilization of

this quantity of water. Secondly, there are days during the year when the flow in the river at Little Falls was less than 75 MGD. The minimum flow on record is 28 MGD. It is from the low flow period during which the minimum occurred, considered in conjunction with the storage available in the distribution reservoirs, that the safe yield of this supply was fixed by the State Water Policy Commission at 35 MGD.

If, on the days when the flow of the Passaic River at Little Falls was below 75 MGD, the flow could be increased to 75 MGD from water stored somewhere on the watershed, and if additional pump and filter capacity is installed, then a supply of 75 MGD could be pumped continuously from this source.

(3) Jersey City Water Department:

The Boonton Reservoir of the City of Jersey City on the Rockaway River Watershed has relatively small capacity; consequently, it is full and overflowing for several months in even the driest years. Much water goes to waste because it cannot be stored in the reservoir. This overflow does not occur at times when the Passaic River at Little Falls is very low and so cannot help directly in this situation. The Boonton supply, however, does have an aqueduct of greater capacity than is needed for Jersey City's ordinary present needs, so that some of the water wasted from time to time at Boonton

could be brought through the aqueduct for the use of supplies other than Jersey City.

(4) Six Municipal Supply Systems:

The above inventory covers all of the water supply (reservoir/collection and distribution) systems serving Essex County, with the exception of the six municipally-owned systems supplied by wells. These are the Essex Fells system, which also serves the towns of Caldwell, North Caldwell and Roseland; and the systems of East Orange, Orange, South Orange, Livingston and Fairfield. Table 3 indicates the water supply wells in Essex County and summarizes some of the characteristics of these systems.

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In concluding the inventory of Essex County's water supply system, Table 4 summarizes selected characteristics of each of the major collections and distribution components of the system, showing present consumption, safe maximum yield, supply sources, storage facilities, etc.

Tables 5 and 6 then summarize the system by municipality, whose water departments can generally be referred to as the retailers of water, selling it directly to the customer. Map

TABLE 3WATER SUPPLY WELLS IN ESSEX COUNTY AS OF 1966

<u>Owner</u>	<u>No. of Wells</u>	<u>Dry Season Yield (MGD)</u>	<u>Storage</u>		<u>Estimated Plant Capacity (MGD)</u>
			<u>Number</u>	<u>Capacity (MG)</u>	
Essex Fells	17	3.8	6	4.5	5.0
East Orange	22	20.7	1	5.0	20.7
South Orange	13	1.3	2	2.0	4.0
Orange	5	5.5	1	6.0	N.A.
Livingston	8	2.8	N.A.	12.5	N.A.
Fairfield	4	N.A.	3	1.2	0.5
Montclair	1	N.A.	2	4.0	1.3
Commonwealth	33	18.5	2	1371.0*	20.7

N.A. - Not Available

\* - Surface Reservoirs

Source: State of New Jersey, Department of Conservation and Economic Development,  
Division of Water Policy and Supply, August, 1968.

SUMMARY OF ESSEX COUNTY WATER SUPPLY SYSTEMS

<u>System</u>	<u>Approximate Present Consumption (in MGD)</u>	<u>Safe Maximum Yield (in MGD)</u>	<u>Sources of Supply</u> <u>Type</u> <sup>1</sup>	<u>Capacity (in billion gallons)</u>	<u>Pumping Facilities (MGD)</u>	<u>Storage Facilities (million gallons)</u>
Pequannock	54.6	58.0	5R	14	Gravity Fed	--
Wanaque Watershed	108.0	104.0	1R	28 <sup>2</sup>	--	--
Commonwealth Water Company	26.4	34.6	33W	--	10.00 (2 stations)	1371.0
Passaic Valley Water Comm.	3.4	3.0	Passaic River <sup>3</sup>	--	--	89.40
Essex Fells	1.8	4.0	17W	--	3.48 (5 stations)	6.00
West Caldwell (from Jersey City Water Department)	1.6	4.0	Jersey City Water System		2.82 (4 stations)	3.50
Total system:	65.0	65.0				
East Orange	9.4	20.7	22W	--	25.5 (2 stations)	5.00
South Orange	1.9	3.0	13W <sup>4</sup>	--	--	3.70
Orange	5.2	5.5	5W	--	Gravity Fed	6.00
Livingston	4.2	4.5	8W <sup>5</sup>	--	--	12.60
Fairfield	0.2	N.A.	4W <sup>6</sup>	--	1.44 (3 stations)	1.23

Notes: <sup>1</sup>R=Reservoir

<sup>2</sup>W=Well

<sup>3</sup>Ramapo River when flow in excess of 40 MGD.

<sup>4</sup>Wanaque Reservoir flow in excess of 75 MGD in Passaic River.

<sup>5</sup>Purchased from Commonwealth and East Orange when needed.

<sup>6</sup>Purchased from Commonwealth when needed.

<sup>7</sup>Many private wells supply additional water.

Source: Essex County water purveyors; and Planners Associates, Inc.

TABLE 5

INVENTORY OF WATER UTILITIES BY MUNICIPALITY IN ESSEX COUNTY

<u>Municipality</u>	<u>Source</u>	<u>Treatment</u>	<u>Approximate Consumption 1967 (MGD)</u>	<u>Storage Capacity (MG)</u>
Belleville Water System	Newark	None*	3.8	None
Bloomfield Water Dept.	Newark	None	6.0	None
Caldwell Water Dept.	Essex Fells	None	0.6	None
Overbrook Hospital	3 Wells, Newark	Chlorination	0.7	1.3
Cedar Grove Twp. Water Dept.	Montclair, Verona, N.J. Water Service	None	1.2	0.5
East Orange Water Dept.	22 municipally owned wells	Chlorination	7.5	5.0
Essex Fells Mun. Water Fac.	17 municipally owned wells	Chlorination	2.0	2.0
Fairfield Water Dept.	4 municipally owned wells	Chlorination	0.2	1.5
Glen Ridge Water Dept.	Montclair	None	0.7	None
Irvington** (Incl. Maplewood, Millburn, West Orange)	Commonwealth Water Co.	Chlorination	16.1	1371.0

\*"NONE" for treatment means that the specific utility does not treat the water. All water in Essex County is chlorinated primarily by the largest purveyors (wholesalers).

\*\*The information on areas served by the Commonwealth Water Co. could not be broken down into four municipalities and the data are presented under one municipality.

INVENTORY OF WATER UTILITIES BY MUNICIPALITY IN ESSEX COUNTY  
(cont'd)

<u>Municipality</u>	<u>Source</u>	<u>Treatment</u>	<u>Approximate Consumption 1967 (MGD)</u>	<u>Storage Capacity (MG)</u>
Livingston Div. of Water	8 municipally owned wells	Chlorination	2.3	4.3
Maplewood	Commonwealth	(See Irvington)		
Millburn	Commonwealth	(See Irvington)		
Montclair Water Bureau	N.J.D.W.S.C. Wanaque - Pequanmock	None	4.7	4.0
Newark Board of Public Works	Wanaque- Pequanmock, Elizabethtown	Diverse*	40.0 50.0 10.0	700.0
North Caldwell Water Dept.	Essex Fells	None	0.3	1.29
Nutley Water Dept.	Passaic Valley Water Commis- sion (PVWC) Newark	None	2.1	None
Orange Water Dept.	5 wells; muni- cipally owned reservoir	Diverse	3.4	258.0
Roseland Water Dept.	Essex Fells	None	0.9	None

\*"Diverse" treatment may involve a variety of processes, including prechlorination, screening or aeration, and pH adjustment with lime and/or soda ash.



INVENTORY OF WATER UTILITIES BY MUNICIPALITY IN ESSEX COUNTY  
(cont'd)

<u>Municipality</u>	<u>Source</u>	<u>Treatment</u>	<u>Approximate Consumption 1967 (MGD)</u>	<u>Storage Capacity (MG)</u>
South Orange Water Dept.	13 municipally owned wells	Chlorination	1.8	3.7
Verona Water Dept.	PVWC	None	1.4	3.0
West Caldwell Water Dept.	Jersey City System	Chlorination	0.8	3.5
West Orange	Commonwealth	(See <u>Irvington</u> on this table)		
TOTAL			156.5	

Source: Planners Associates, Inc.

TABLE 6

ESSEX COUNTY WATER INTERCONNECTIONS AND SERVICE AREAS  
(SHOWN BY MUNICIPALITY)

<u>Municipality</u>	<u>Estimated Population Served</u>	<u>Date of Data</u>
Belleville	38,620	12/66
Bloomfield	54,780	12/66
Caldwell	9,840	8/67
Overbrook Hosp.	6,000	8/67
Cedar Grove	17,870	12/67
East Orange	78,290	12/67
Essex Fells	2,470	12/67
Fairfield	6,420	3/68
Glen Ridge	8,810	1/67
Irvington	64,100	1/67
Livingston	29,000	4/65
Maplewood	25,110	
Millburn	21,580	
Montclair	44,540	8/67
Newark	399,500	10/68
North Caldwell	5,310	1/67
Nutley	32,480	1/67
Orange	35,080	1/67
Roseland	3,840	1/67
South Orange	17,590	3/68
Verona	15,640	5/67
West Caldwell	11,650	
West Orange	44,090	

Source: 1968 population estimates and application data from the New Jersey Department of Conservation and Economic Development; tabulations by Planners Associates, Inc.

ESSEX COUNTY WATER INTERCONNECTIONS AND SERVICE AREAS  
 (SHOWN BY MUNICIPALITY)  
 (cont'd)

Service Areas Served

County Hospital, Jail,  
 Auditorium, Public Works  
 Building  
 Caldwell, Roseland,  
 Caldwell  
 Supplier to Maplewood,  
 Burn and West Orange  
 Irvington)  
 Irvington)  
 Suppliers to Clifton,  
 Little Falls and Cedar  
 Grove  
 Belleville, Bloomfield,  
 Elizabeth, Pequannock Twp.,  
 the Twp., Nutley, Essex  
 County Hospital, N. J.  
 School  
 Irvington)

Interconnections

Two with Nutley  
 East Orange, Nutley  
 P.V.W.C.  
 Three with Essex Fells  
 Verona, Cedar Grove,  
 Caldwell  
 Overbrook  
 Orange, Newark, Bloom-  
 field, Glen Ridge  
 None  
 None  
 East Orange  
 Elizabethtown and  
 Newark  
 Commonwealth  
 Commonwealth, Passaic  
 Valley W. C., Newark  
 Jersey City, Butler,  
 Commonwealth, PVWC,  
 Elizabethtown Water  
 Company  
 West Caldwell  
 Belleville  
 Commonwealth, East  
 Orange  
 Essex Fells  
 Commonwealth, East  
 Orange  
 PVWC, Essex Fells  
 North Caldwell

# ESSEX COUNTY WATER INTERCONNECTIONS AND SERVICE AREAS

(SHOWN BY MUNICIPALITY)

(cont'd)

### Other Areas Served

## Interconnections

County Hospital, Jail,  
atorium, Public Works  
ilding  
orth Caldwell, Roseland,  
ldwell  
upplier to Maplewood,  
ilburn and West Orange  
ee Irvington)  
ee Irvington)  
lk suppliers to Clifton,  
ttle Falls and Cedar  
rove  
elleville, Bloomfield,  
Elizabeth, Pequannock Twp.,  
ayne Twp., Nutley, Essex  
ounty Hospital, N. J.  
chool  
(See Irvington)

Two with Nutley  
East Orange, Nutley  
P.V.W.C.  
Three with Essex Fells  
Verona, Cedar Grove,  
Caldwell  
Overbrook  
Orange, Newark, Bloom-  
field, Glen Ridge  
None  
None  
East Orange  
Elizabethtown and  
Newark  
Commonwealth  
Commonwealth, Passaic  
Valley W. C., Newark  
Jersey City, Butler,  
Commonwealth, PVWC,  
Elizabethtown Water  
Company  
West Caldwell  
Belleville  
Commonwealth, East  
Orange  
Essex Fells  
Commonwealth, East  
Orange  
PVWC, Essex Fells  
North Caldwell

No. 7 shows the major trunk and transmission lines of the system, indicating the basic connectors which come into the County from the reservoir systems to the northwest. Tables 7 and 8 show residential water rates and water service costs respectively by municipality. The County's water supply system is an extremely complex one, and it should be emphasized that any description such as the one offered here involves some over-simplification in the interests of clarity.

MAP NO. 7

# ESSEX COUNTY WATER SYSTEM MAJOR TRUNK & TRANSMISSION LINES

To Pequannock System

To Wanaque System

Rockaway System

River





Passaic

Passaic River

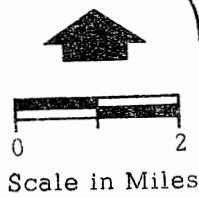
River

Hackensack

## Legend

-  Bays & Rivers
-  Water Impoundments
-  Major Trunk Lines
-  Major Transmission Lines

The preparation of this report was financially aided through a Federal grant from the Urban Renewal Administration of the Department of Housing and Urban Development, under the Urban Planning Assistance Program authorized by Section 701 of the Housing Act of 1954, as amended.  
The remainder has been financed by local funds and by an appropriation of the State of New Jersey as part of the Cooperative Governmental Planning Program.



Newark Bay

TABLE 7

RESIDENTIAL WATER RATES IN ESSEX COUNTY

<u>Municipalities</u>	<u>Length of Billing Per. In Months</u>	<u>Minimum Chg. for Service per Billing Period (\$)</u>	<u>Gallons of Water Available with Min. Charge</u>	<u>Cost (\$) per 1,000 Gal. of Water Ini- tially Supplied</u>	<u>Cost of Additional Water</u>	
					<u>Rate Per 1,000 Gals. (\$)</u>	<u>Range in Gallons</u>
Belleville	3	5.15	7,500	0.69	0.69 0.60	7,500-247,500 over-247,500
Bloomfield	3	3.90	8,250	0.47	0.47 0.39 0.31 0.23	0-75,000 75,000-143,000 143,000-675,000 over-675,000
Caldwell Boro	6	6.50	10,000	0.65	0.65	None
Cedar Grove	3	4.80	8,000	0.60	0.60 0.45 0.35	0-50,000 50,000-450,000 over-450,000
East Orange	3	3.25	1,000	3.25	0.43 0.40	0-375,000 over-375,000
Essex Fells	3	3.50	1,000	3.50	0.60	None
Fairfield	3	10.00	20,000	0.50	0.50 0.40 0.30 0.25	0-20,000 20,000-40,000 40,000-60,000 over-60,000
Glen Ridge	3	4.50	7,500	0.60	0.60 0.40	0-225,000 over-225,000
Irvington	3	2.41	1,500	1.60	0.63 0.48 0.37	0-75,000 75,000-750,000 750,000-7,500,000

RESIDENTIAL WATER RATES IN ESSEX COUNTY  
(cont'd)

<u>Municipalities</u>	<u>Length of Billing Per. In Months</u>	<u>Minimum Chg. for Service per Billing Period (\$)</u>	<u>Gallons of Water Available with Min. Charge</u>	<u>Cost (\$) per 1,000 Gal. of Water Ini- tially Supplied</u>	<u>Cost of Additional Water</u>	
					<u>Rate Per 1,000 Gals. (\$)</u>	<u>Range in Gallons</u>
Livingston	3	6.70	7,500	0.89	0.52	0-75,000
					0.47	75,000-150,000
					0.40	150,000-225,000
					0.33	over-225,000
Maplewood	3	2.41	1,500	1.60	0.63	0-75,000
					0.48	75,000-750,000
					0.37	750,000-7,500,000
					0.25	over-7,500,000
Millburn	3	2.41	1,500	1.60	0.63	0-75,000
					0.48	75,000-750,000
					0.37	750,000-7,500,000
					0.25	over-7,500,000
Montclair	3	3.30	7,500	0.44	0.44	7,500-75,000
					0.38	75,000-750,000
					0.29	750,000-7,500,000
Newark	3	3.50	3,750	0.93	0.93	0-3,750
					0.30	3,750-75,000
					0.27	75,000-750,000
					0.23	750,000-3,750,000
					0.20	over-3,750,000
North Caldwell	3	4.50	7,500	0.60	0.60	None
Nutley	3	3.25	1,000	3.25	0.43	None



RESIDENTIAL WATER RATES IN ESSEX COUNTY  
(cont'd)

<u>Municipalities</u>	<u>Length of Billing Per. In Months</u>	<u>Minimum Chg. for Service per Billing Period (\$)</u>	<u>Gallons of Water Available with Min. Charge</u>	<u>Cost (\$) per 1,000 Gal. of Water Ini- tially Supplied</u>	<u>Cost of Additional Water</u>	
					<u>Rate Per 1,000 Gals. (\$)</u>	<u>Range in Gallons</u>
Orange	3	4.00	1,200	3.30	0.54	0-9,000
					0.44	9,000-375,000
					0.39	375,000-1,875,000
					0.20	over-1,875,000
Roseland	3	4.25	760	5.60	0.75	None
South Orange	6	7.80	6,750	1.15	0.54	None
Verona	3	3.00	4,000	0.75	0.75	None
West Caldwell	3	3.50	4,000	0.87	0.65	None
West Orange	3	2.60	1,500	1.70	0.74	0-75,000
					0.60	75,000-750,000
					0.48	750,000-7,500,000
					0.37	over-7,500,000

Source: Responses from individual municipal water departments collected by Planners Associates, Inc., in September, 1969.

TABLE 8

WATER SERVICE COSTS IN ESSEX COUNTY  
(By Municipality)

<u>Municipalities</u>	<u>Residential Floor/Land Area Ratio</u>	<u>Water Demand Rate (Gals/ Cap/Day)</u>	<u>Gals/1000 Sq. Ft. Land Area</u>	<u>Cost/ Initial 1000 Gal.</u>	<u>Cost/ 13,500 Gal.</u>	<u>Cost/ 28,000 Gal.</u>
Belleville	0.237	75	32	\$0.69	\$ 8.60	\$19.64
Bloomfield	0.217	75	30	0.47	6.72	13.30
Caldwell	0.122	75	35	0.65	9.10	15.60
Cedar Grove	0.078	80	48	0.60	7.80	17.40
East Orange	0.438	70	29	3.25	8.84	14.86
Essex Fells	0.034	80	30	3.50	11.30	19.70
Fairfield	0.045	80	38	0.50	10.00	13.60
Glen Ridge	0.091	80	48	0.60	7.50	17.70
Irvington	0.493	70	27	1.60	9.97	20.05
Livingston	0.059	80	43	0.83	6.24	18.10
Maplewood	0.131	75	40	1.60	9.97	20.05
Millburn	0.056	80	42	1.60	9.97	20.05
Montclair	0.111	75	41	0.44	5.50	12.98
Newark	0.742	65	30	0.93	6.50	11.00
North Caldwell	-	80	54	0.60	7.50	17.70
Nutley	0.146	75	34	3.25	8.84	15.29
Orange	0.328	75	40	3.30	10.18	19.12
Roseland	-	80	45	5.60	14.00	26.00
South Orange	0.084	80	55	1.15	7.68	17.94
Verona	0.098	80	44	0.75	10.50	21.75
West Caldwell	0.065	80	44	0.87	10.00	19.75
West Orange	0.115	75	34	1.70	11.48	23.32

Sources: Tri-State Transportation Commission, May, 1968; Essex County Water Purveyors.  
calculations and tabulations by Planners Associates, Inc.

## C. REVIEW OF EXISTING WATER DEMAND

### 1. General Statement on Demand

Demand for water within an urbanized community is dependent on many factors. Among these are climate (which affects water demand for such purposes as air conditioning and lawn sprinkling); type of service (meter or flat-rate) and related cost; standard of living; pressure and quality of water; size of urban area and density patterns; and the area of land devoted to different land uses (industry, commerce, residence, etc.). All of these factors relate to the population level within a given area.

In analyzing water demand in Essex County, the factors considered most important are land use, or major use category; density, as measured by floor to land area ratio; and population size. As will be discussed, this report's basic demand projections are based on a factor which relates consumption levels to floor space areas for each land use.

First, some definitions of demand components: Public water consumption accounts for the largest use of water. The entire supply system described under this report's inventory of water supply sources and facilities is for public use. Public water use can, in turn, be broken down by major land uses (residential, industrial, commercial, etc.). In

addition, some water is supplied outside the public system for private industrial use. In these instances, industries may have their own wells or other supply sources which may meet all or a portion of their demand. A third major component of overall demand is for irrigation. In the discussion that follows, some of the data is given for these three broad demand components, while most information relates to the specific land use categories into which public consumption can be divided.

The categories of public water consumption can be classified as residential or domestic; industrial; commercial, public (more explicit definition used here); waste and miscellaneous; and are characterized as follows:

a) Domestic or residential use consists of water furnished to houses, apartments, motels and hotels for drinking, bathing, washing, sanitary, culinary, and lawn-sprinkling purposes. Domestic use accounts for between 30 and 60% of total water consumption in an average city, and between 50 and 90 gallons per capita per day (hereinafter referred to as gpcd). Using the gpcd measure, it was found that Essex County residential or domestic water consumption was about 70 gpcd.

b) Industrial uses of water are diverse. No direct relationship exists between the amount of industrial water used and the population of the community; but 20 to 50% of the total quantity of water used in gpcd is normally charged to industrial usage. Usually the large-sized cities, such as Newark, have a greater degree of industrialization and, hence, industrial usage accounts for a correspondingly greater percentage of total consumption. Essex County was found to fall within the 20 to 50% range, as slightly less than 50% of all water used in the county was for industrial use from both public and self-supplied sources.

c) Commercial water is classified as that which is used in stores and office buildings for sanitary, janitorial and air conditioning purposes. Commercial use of water amounts to about 10-30% of total consumption.

d) Public use of water for parks, public buildings and street washing contributes to the total amount of water consumed per capita, and accounts for about 5-10% of total usage. Fire fighting demands are usually included in this class of water use as well. The total quantity of water used for fire fighting may not be large, but, because of the high rate at which it is required over short spans, it may have considerable impact on the design of delivery facilities.

e) Waste and Miscellaneous uses of water include that lost because of leakage in mains, meter malfunctions, reservoir evaporation, and unauthorized uses. About 10-15% of total consumption may be charged to waste and miscellaneous uses.

## 2. Existing Demand by Category

In 1960, the total amount of water consumed in the nine northeastern New Jersey counties\* was 806 MGD, according to a report prepared by the New Jersey Division of Water Policy and Supply. Of this amount, 489 MGD were used by public sources, 288 MGD by private industrial systems and 29 MGD by irrigation. It has been estimated that approximately 1/3 of the water used by industry in the nine-county area is supplied by public sources, which amounted to 144 MGD. The remaining 345 MGD were used for residential, commercial and public activities. Commercial activities use approximately 20% of the total public supplied water, or about 96 MGD. Residential use in the area was about 239 MGD, or 60 gallons per capita per day (gpcd). Public use was estimated at about 10 MGD.

As shown on Table 9, comparable 1960 demand for Essex County amounted to approximately 140 MGD, of which 120 MGD

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\*Bergen, Morris, Hunterdon, Middlesex, Hudson, Somerset, Essex, Passaic and Union counties.

TABLE 9

WATER DEMAND IN NINE NORTHERN NEW JERSEY COUNTIES  
AND ESSEX COUNTY -- 1960  
(Million Gallons Per Day -- MGD)

<u>Broad Demand Components</u>	<u>Nine Counties</u>	<u>Essex County</u>
Public	489	120
Industrial	288	19
Irrigation	<u>29</u>	<u>1</u>
Total	806	140
 <u>Land Use Categories (Public Demand)</u>		
Residential	239	63
Industrial	144	29
Commercial	96	24
Public Use	<u>10</u>	<u>4</u>
Total	489	120

Source: "Water Resources Management in New Jersey", November, 1967, page 29.

were from public sources; 19 MGD from private industry and only one MGD from irrigation. The public supply breaks down as follows for the major use categories: 63 MGD for residential; 29 for industrial; 24 for commercial; and four for public uses. Following is a discussion of demand in Essex County by each major public water consumption category:

a) Residential Water Demand:

In Essex County, as elsewhere, the rate of residential water use in a given area or municipality is dependent particularly on the following factors: population distribution and density; income levels; the method of waste water removal; and amount of lawn area. The national average for residential water use is 80 gpcd.\* However, Essex County, with an estimated 1967 population of 966,610 persons\*\*, consumed approximately 70 MGD solely for residential or domestic purposes -- or an average of only about 70 gpcd. This demand estimate also corroborates the 1970 use rate applying the computer method developed for future projections (as described herein).

It is logical that the national average would be higher, for in the County there are disproportionately more people

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\*From "A Study of Residential Water Use", Department of Housing and Urban Development, 1967.

\*\*Estimate by New Jersey State Department of Conservation and Economic Development.



living in apartments and high-density low-income areas than in the Nation as a whole. These characteristics tend to lower water consumption. Conversely, high-income areas, with large lawns and lot sizes, increase the water demand rate. Table 11 estimates the water demand by municipality for 1967. It is based on State population estimates for that year, and on the Tri-State Transportation Commission's 1963 floor space and land area estimates. Weighted factors were developed taking into consideration derived floor-to-land ratios, and estimated gallons per capita per day for residential water use in Essex County. The following table illustrates varying consumption of water for residential use, according to the criteria that residential water usage increases per capita as the floor to land area ratio decreases:

TABLE 10  
WEIGHTED RESIDENTIAL WATER CONSUMPTION  
FOR ESSEX COUNTY

<u>Floor to Land Ratio</u>	<u>Gallons/Capita/Day</u>
0.0 - 0.099	80
0.1 - 0.399	75
0.4 - 0.699	70
0.7 - 0.999	65

The national average water demand rate of 80 gpcd was assumed to be characteristic of an average residential floor

to land area ratio. Utilizing the average floor to land ratio of 0.170 for the study area, Essex County would demand water at the national average rate. Municipalities above and below this average will demand water at a lesser or greater rate. Downward adjustments were made in those few areas that are still served by septic tanks. Similar adjusted increments were made in the estimates of municipal water use based on the 70 gpcd nine-county average. As Table 11 indicates, the total residential water demand in Essex County in 1967 was estimated to be approximately 71.7 MGD.

b) Industrial Water Demand:

Total industrial water consumed in Essex County was compared with industrial usage rates per industry group (SIC Code) in a study done for industries in California for the period between 1957-1959. The underlying assumption was that industrial water use in California may be assumed to be comparable with that of Essex County. Moreover, the assumption was made that the proportionate use of water for both "light" and "heavy" industrial categories remained constant during the ten-year interval from 1959 to the present.\* Using these

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\*Heavy industry includes the food, paper, chemical and petroleum categories; while light industry includes the textile; apparel; lumber; furniture; printing and publishing; rubber; leather; stone, clay and glass; primary metals; fabricated metals; machinery; transportation equipment; instruments; and miscellaneous durables categories. This classification is defined in the Standard Industrial Classification Manual, published by the U. S. Government. In this context, the classification is based on water use by actual industries within each category located in Essex County.

TABLE 11

## TOTAL ESTIMATED RESIDENTIAL WATER DEMAND RATES IN ESSEX COUNTY -- 1967

Municipalities	1968 Population Estimates	Residential Floor to Land Ratio	Tri-State 1963 Resi- dential Floor Area (000's sq. ft.)	Tri-State Residential Land Area (000's sq. ft.)	Water De- mand Rate (Gal/Cap- ita/Day)	1967 Water De- mand (000's Gal/Day)	Water De- mand Rate (Gal/1000 sq. ft. of Residential Floor Area/ Day)
Belleville	38,620	0.237	87,050	367,514	75	2,897	32
Bloomfield	54,780	0.217	132,650	610,813	75	4,109	30
Caldwell	9,840	0.122	18,630	152,886	75	738	35
Cedar Grove	17,870	0.078	29,860	383,436	80	1,430	48
E. Orange	78,290	0.438	188,980	431,895	70	5,480	29
Essex Fells	2,470	0.034	7,020	205,557	80	197	30
Fairfield	6,420	0.045	12,140	272,746	80	513	38
Glen Ridge	8,810	0.091	18,190	199,215	80	704	48
Irvington	64,100	0.493	158,510	321,387	70	4,487	27
Livingston	29,000	0.059	58,910	1,004,857	80	2,320	43
Maplewood	25,110	0.131	58,280	445,241	75	1,883	40
Millburn	21,580	0.056	49,770	887,234	80	1,726	42
Montclair	44,540	0.111	89,490	802,803	75	13,340	41
Newark	399,500	0.742	888,480	1,197,128	65	25,967	30
N. Caldwell	5,310	0.039	9,410	238,606	80	424	54
Nutley	32,480	0.146	73,930	506,050	75	2,436	34
Orange	35,080	0.328	64,440	196,577	75	2,631	40
Roseland	3,840	0.040	7,710	191,754	80	2,806	45
S. Orange	17,590	0.084	31,970	381,972	80	1,407	55
Verona	15,640	0.098	29,950	305,683	80	1,251	44
W. Caldwell	11,650	0.065	21,970	336,761	80	932	44
W. Orange	44,090	0.115	102,860	890,877	75	3,307	34
Totals	966,610		2,140,200	10,330,992		70,985	

Sources: "A Study of Residential Water Use" by HUD, 1967; Tri-State Transportation Commission, May, 1968. 1968 population estimates by Essex County Water Purveyors; Jersey Department of Conservation and Economic Development. calculations and tabulations by Planners Associates, Inc.

criteria, it was found that heavy industry uses four to five times as much water per day as does light industry.

Weighted industrial water use factors were programmed for the computer to compare with information available on industrial floor space and land area from the Tri-State Transportation Commission in order to calculate industrial water use in Essex County. Following this methodology, it was determined that industrial water use was some 72.8 MGD in 1963.

According to the State, only about one-third of the water used by industry is supplied by public sources in the nine-county northern New Jersey area of which Essex County is a part. However, this figure will likely be as high as 40-50% in Essex County, as Table 9 would indicate. In 1967, roughly 30-35 MGD of the estimated 70+ MGD of water used by industry was publicly supplied, with the remainder being supplied by private sources or reuse of the water previously supplied through public and self-supplied sources.

c) Water Demand for Other Uses:

The residential and industrial use categories make up about 75% of total public water demand, and well over 80% of all demand components. However, at least two other categories should be briefly discussed here -- that for commercial use and that for various public uses.

Table 9 indicates that commercial use makes up about 20% of total public water consumption in both the nine-county area and Essex County. For Essex County, this came to approximately 24 MGD in 1960. Based on the same source, an additional 4 MGD were demanded for public use. A somewhat lower demand quantity for these uses was derived by applying commercial and related use factors to the Tri-State information of land area and floor space for commercial and public uses. According to this method, it was determined that combined commercial, public and quasi-public demand was only 19.6 MGD in 1963.

## D. FORECAST OF FUTURE WATER DEMAND

### 1. Future Demand for State and Region

#### a) Statewide Demand:

It is expected that the demand for water throughout the State and region will increase in the future at a substantial rate. The total State demand in 1960 was 685 MGD for public uses, 576 MGD for industrial use, and 239 MGD for irrigation or agricultural uses. The New Jersey Division of Water Policy and Supply has projected that, by 1990, these usages will increase to 1,801 MGD for public uses, 1,113 MGD for industrial uses, and 355 MGD for irrigation uses.

#### b) Regional Demand:

In the nine-county region of northern New Jersey, the public demand for water is, likewise, expected to increase by almost 200% from 489 MGD in 1960 to 1,227 MGD in 1990. Similarly, industrial use is projected to increase from 288 MGD to 497 MGD, and agricultural use from 29 MGD to 66 MGD between 1960 and 1990.

TABLE 12

PAST AND PROJECTED WATER DEMAND IN NINE NORTHERN  
NEW JERSEY COUNTIES (Million Gallons Per Day - MGD)

<u>Demand</u>	<u>1940</u>	<u>1950</u>	<u>1960</u>	<u>1970</u>	<u>1980</u>	<u>1990</u>
Industrial	N.A.	285	288	345	409	447
Public	268	381	489	667	907	1227
Irrigation	N.A.	N.A.	29	44	54	66
Total	268	666	806	1056	1370	1790

Source: "Water Resources Management in New Jersey", November, 1967, page 29.

It is apparent that shortages of water will begin to appear in the future unless steps are taken to manage this resource more carefully. The above demands can be met within the natural water supplies of the State if there is adequate planning for the needed supply and distribution systems. If the 1990 projections are correct, more than 50% of the State demand of 3,270 MGD will be needed in the nine-county northern New Jersey area. This water will have to come from new sources of water supply both from outside and from within the region.

## 2. Future Demand For Essex County: Computer Model Application Methodology

Computer derived totals for water demand, based on floor space areas for each land use activity, were calculated and compared with actual past recorded consumption in order to establish a mathematical model which may be used to simulate future demands whenever future land use space requirements have been fully determined. For this processing, the basic data were contained on the Tri-State Transportation Commission's tape, supplying information on land use, land area and floor area. By manipulating the available data in combination with various factors, three sets of calculations were quantified to develop: (1) floor to land area ratios which

were expressed in three-digit decimal form; (2) land areas which were previously tabulated in square feet and converted to acres; and (3) water demand expressed in gallons per day. In developing the calculations, nationally-derived standards of water used per 1,000 square feet of floor space were multiplied by the total floor space for that particular land use. Special water usage standards were developed for Essex County based on land use intensity, employment and population distribution and density. Four such categories were tabulated as indicated:

- a - Manufacturing
- b - Commercial, Public and Quasi-Public
- c - Residential
- d - Other

The totals of each of the three sets of calculations mentioned above were developed for eight subcategories of land use. These include:

- a - Manufacturing
- b - Commercial, Public and Quasi-Public
- c - Residential
- d - Streets and Highways
- e - Open Space and Vacant
- f - Mining
- g - Water, Swamps, Reservoirs and Watersheds
- h - Other

Grand totals in the above three sets of calculations were prepared for each of the eight categories of land use and for three geographical units: (1) 1/4 square mile grids; (2) municipality; and (3) county.



Using the computer method described herein, the 1963 water demand in the entire County, for all purposes, amounted to some 158.7 MGD. This compares favorably with the average total daily water demand range of some 140 MGD to 170 MGD estimated for 1960 and 1970 respectively by the State, as shown in Table 13.

The computer and State water demand totals for Essex County are higher than those supplied by public and private purveyors. This was probably due to the fact that much water used by industry is self-supplied or reused water. Moreover, leakages and other unreported water usage simply go unestimated in available records. As an example, public demand for water in Essex County in 1966 from all purveyors amounted to only 134.7 MGD -- considerably less than the above-cited overall projected consumption forecasts made either by the State or by the computer method already described.

TABLE 13

PAST AND PROJECTED PUBLIC, INDUSTRIAL AND  
AGRICULTURAL WATER DEMANDS IN ESSEX COUNTY

1940 - 1990  
 (Million Gallons Per Day - MGD)

<u>Demand</u>	<u>1940</u>	<u>1950</u>	<u>1960</u>	<u>1970</u>	<u>1980</u>	<u>1990</u>
Public	73	98	120	151	188	231
Industrial	N.A.	18	19	20	21	22
Irrigation	N.A.	N.A.	1	3	4	5
Total	73	116	140	174	213	258

Source: Adapted and modified from "Water Resources in New Jersey", November, 1967.

In conclusion, it appears to be possible to determine future water demands to the year 1990 using computer calculations based on land use floor area space allocations. Since the mathematical model has been developed, with proven results approximating actual existing water demands, then it is logical to assume that future demands for water may also be projected in a similar fashion.

### 3. Demand Forecasts

#### a) By Use Category:

Table 14 estimates water demand by municipality for 1963, based on the computer model application method developed for this report and described in the preceeding section. The

TABLE 14

WATER DEMAND BY MUNICIPALITY -- 1963  
(Gallons per Day)

	<u>Manufacturing</u>	<u>Commercial, Public &amp; Quasi-Public</u>	<u>Residential</u>	<u>Other</u>	<u>Total</u>
Belleville	5,328,901	487,728	2,304,900	1,973	8,123,503
Bloomfield	3,747,504	757,417	3,818,925	8,934	8,332,781
Caldwell	38,013	209,155	594,675	2	841,846
Fairfield	1,729,875	105,880	310,050	4,411	2,150,208
Cedar Grove	470,780	195,250	766,800	8,127	1,440,958
East Orange	1,862,976	1,351,120	6,206,625	1,865	9,422,587
Essex Fells	17,761	18,373	158,850	1,836	196,821
Glen Ridge	38,229	107,905	493,875	7,556	647,567
Irvington	2,255,130	759,456	4,705,200	9,311	7,729,097
Livingston	734,490	274,333	1,569,825	16,775	2,595,424
Maplewood	635,829	313,335	1,637,775	14,637	2,601,576
Millburn	179,019	431,433	1,378,575	16,290	2,005,318
Montclair	287,861	741,757	2,888,100	8,522	3,926,240
Newark	48,592,477	11,616,898	28,890,225	93,123	89,192,724
North Caldwell	16,678	103,585	365,400	25,656	511,320
Nutley	2,984,748	298,876	1,946,700	973	5,231,297
Orange	1,513,817	640,858	2,439,000	6,258	4,599,934
Roseland	351,000	52,555	191,250	2,719	597,525
South Orange	130,393	394,929	1,065,825	1,868	1,593,016
Verona	186,059	216,351	897,525	64	1,300,000
West Caldwell	202,304	97,348	641,025	16,286	956,963
West Orange	<u>1,480,677</u>	<u>465,601</u>	<u>2,753,100</u>	<u>39,606</u>	<u>4,738,985</u>
Total	72,784,531	19,640,151	66,024,225	286,803	158,735,710

Source: Tri-State Transportation Commission Land Area and Floor Space Inventory, 1963; and Planners Associates, Inc.

data on this table reflects demand from all sources, both from the public systems as well as private, industrial and agricultural systems. The table shows that manufacturing had the greatest demand, at 72.8 MGD, although this use had only one-seventh as much land area and one-fourth as much floor space as the residential category. Residential demand ranked second, at 66.0 MGD; while commercial, public and quasi-public uses combined ranked a distant third, at 19.6 MGD. The remaining miscellaneous uses, classified as "Other", amounted to 0.3 MGD.

As future land use space requirements are projected with greater precision, it will be possible to forecast demand in greater detail by use category and by municipality utilizing this same methodology. The State has forecast on Table 13 the projected future consumption levels in Essex County by major demand components. It shows, in general, that public suppliers will account for approximately 90% of the water demand from 1970 to 1990, while private industrial and agricultural suppliers will constitute only 10% of total demand. Because Essex County is largely built up, and is not expected to have a substantial population increase to 1990, the rate of increase in demand between 1960 and 1990 is not as great as that forecast for the State or region. As shown on the table, public demand is projected to increase from 120 MGD

in 1960 to an estimated 231 MGD in 1990, or nearly a 100% increase. Note that demand for private use is projected to increase only slightly during the same period, from 20 MGD to 27 MGD.

b) By Municipality:

In 1963, nearly 60% of the estimated total demand of 158.7 MGD was within the City of Newark, primarily because of the concentration of industries there which are supplied not only through the public system but from private sources. If only public water consumption is taken, Newark's demand would, thus, be proportionately less. Exact future demand forecasts by municipality must await the development of land use and floor space projections. Hence, no precise forecasts shown at this point.

c) By Major Water Purveyor:

In Table 15, and on the graphs that follow, the State Division of Water Management and Policy has projected future water demand to 1990 for each of the major purveyors which serve Essex County. The information is basically self-explanatory.

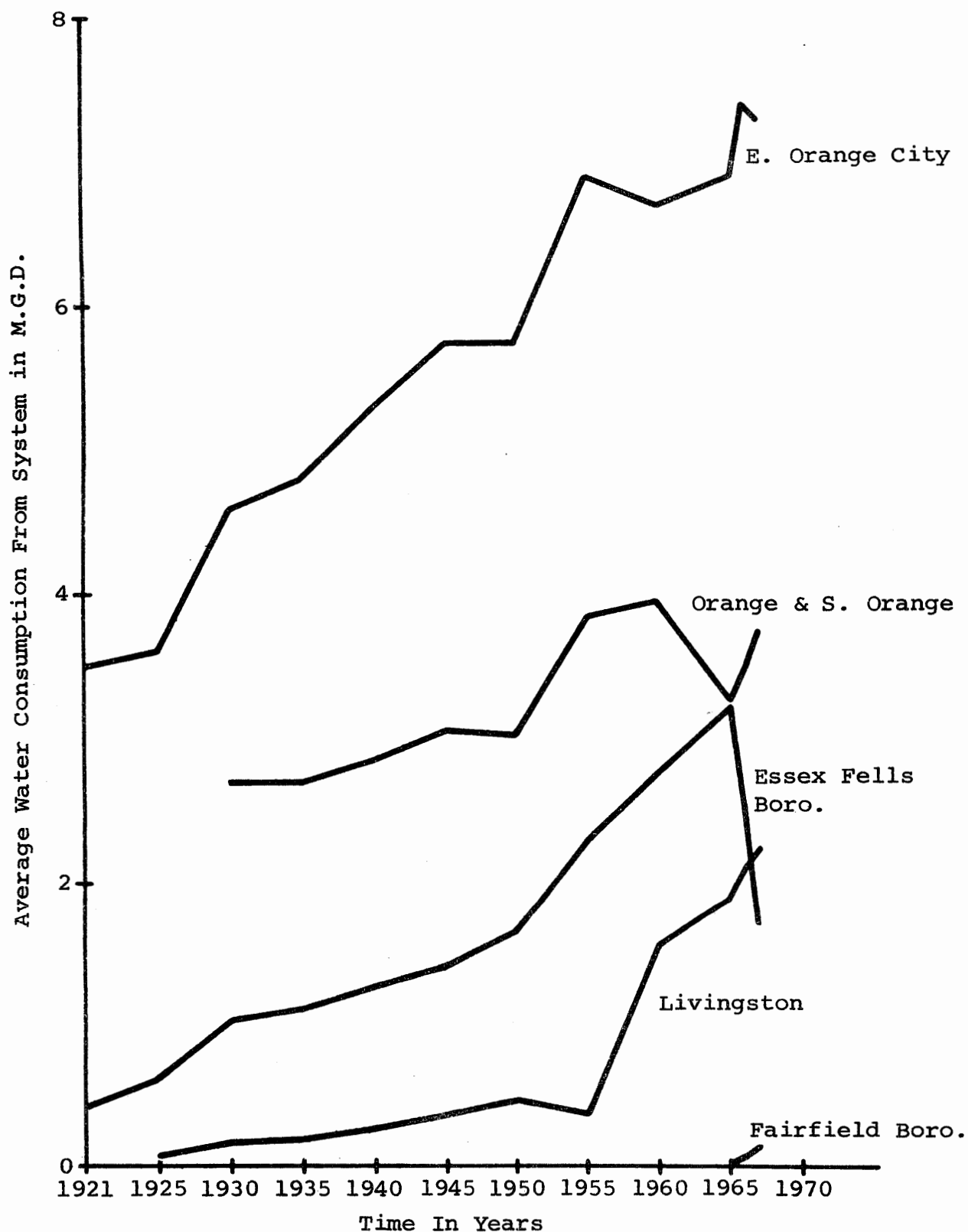
TABLE 15

WATER CONSUMPTION FOR MAJOR PURVEYORS SERVING NORTHERN NEW JERSEY  
AND PREDICTED FUTURE WATER DEMANDS (Million Gallons Per Day)

<u>Purveyor In</u> <u>Essex County</u>	<u>Yield</u> <u>Grants</u>	<u>1950</u>	<u>1955</u>	<u>1960</u>	<u>1962</u>	<u>1970</u>	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>
Commonwealth Water Co.	25	13.55	16.16	18.83	19.68	24.6	28.2	32.4	37.4	42.7
Elizabethtown Water Co.	112	29.44	41.11	52.68	60.75	90.0	115.0	147.0	188.0	240.0
Pequannock (Newark)	50	57.22	54.82	55.28	54.24	55.0	55.5	56.0	56.5	57.0
Passaic Valley	75	35.95	35.26	32.75	36.53	41.0	44.0	47.2	50.6	54.3
Wanaque (North Jersey District Water Supply Comm.)	94	82.86	92.43	102.34	106.89	123.0	135.0	147.0	161.0	177.0
Boonton (Jersey City)	65	61.63	62.72	58.09	56.94	54.9	53.7	52.5	51.3	50.1
<u>Purveyor Not In</u> <u>Essex County</u>										
Hackensack	90	43.53	52.53	64.41	66.02	84.0	97.0	112.0	130.0	150.0
Middlesex	38	11.06	13.07	16.05	17.66	25.7	32.5	41.1	52.0	65.7
New Brunswick	16	10.42	11.33	12.33	12.50	14.4	15.7	17.2	18.8	20.5
Perth Amboy	10	9.01	9.39	10.00	9.63	9.9	10.1	10.3	10.5	10.7
29 Smaller Purveyors	90.5	38.82	45.39	51.36	54.58	72.3	86.5	104.8	126.3	154.0

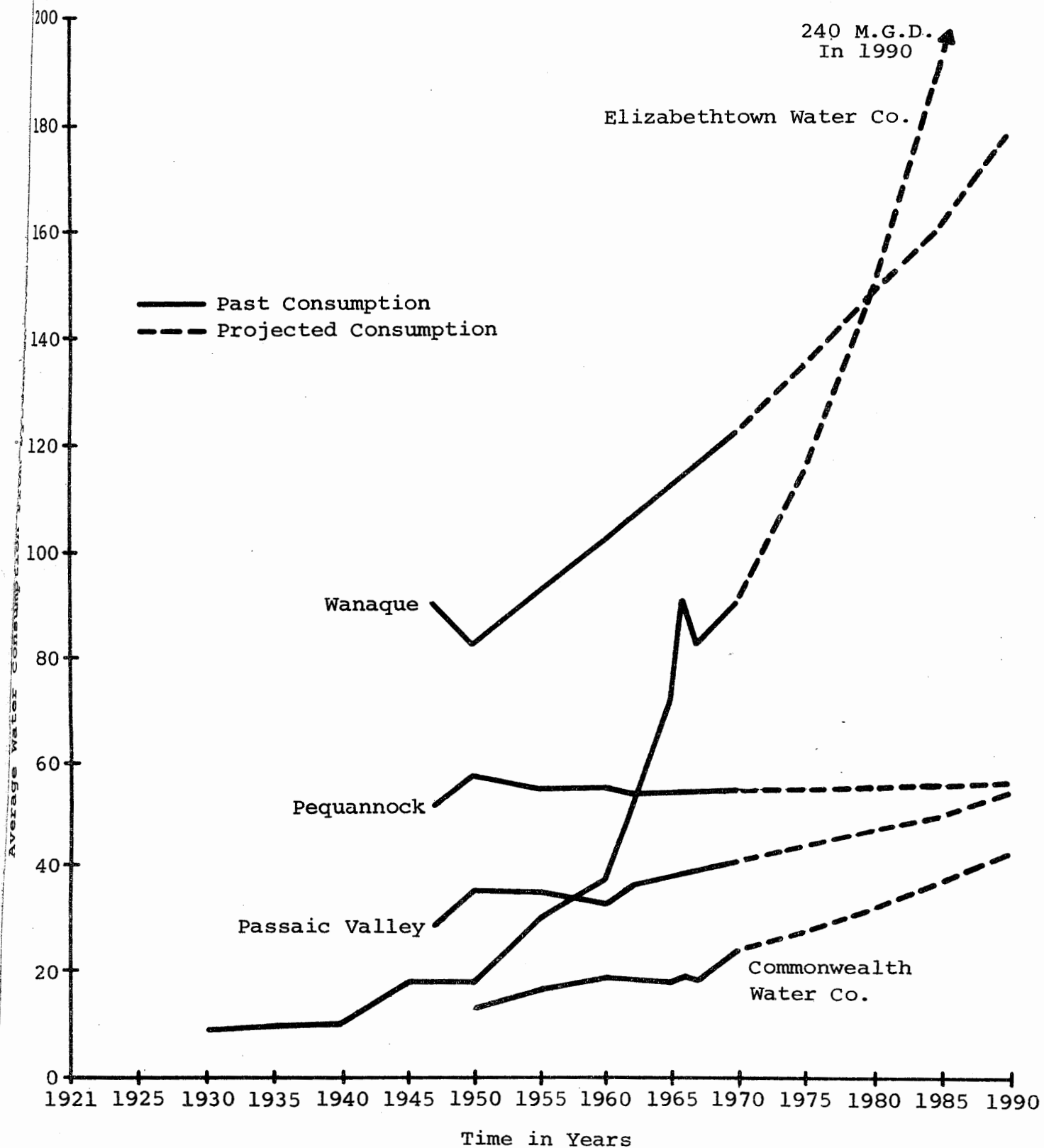
Source: "Water Resources Management in New Jersey", November, 1967, page 34.

PAST AND PROJECTED DEMAND BY MAJOR PURVEYORS  
SMALLER WATER SYSTEMS OF ESSEX COUNTY



Note: Verona and W. Caldwell Left Essex Fells System After 1965  
Source: State Division of Water Management and Policy

PAST AND PROJECTED DEMAND BY MAJOR PURVEYORS  
LARGER WATER SYSTEMS OF ESSEX COUNTY



Source: State Division of Water Management and Policy



E. SKETCH PLAN: PROPOSALS FOR MEETING FUTURE DEMAND

1. Summary of Water Deficit and General Recommendations

a) Summary of Future Water Demand/Supply Deficit:

As has been indicated in the preceeding section, it is anticipated that there will be a three per cent annual growth in public water demand for Essex County over the three decades from 1960 to 1990 -- from 120 MGD to 231 MGD. On the other hand, total capacity of the facilities currently supplying water to the County is limited to 176 MGD, as is shown on Table 16. Capacity assigned to Essex County on the right-hand column of this table is based on the current percentage of each system's total consumption in Essex County which, in some instances, may increase, but it is a realistic estimate of current capacity.

As the graph that follows indicates, Essex County thus continues to have a slight excess of capacity over demand, but by 1980 this picture is expected to have changed. It is estimated that there will be a deficit of 22 MGD by that date, which could increase to 55 MGD by 1990 if supply facilities are not increased accordingly.

Table 16 also points up an important basic fact regarding the County's water supply -- namely that safe maximum yields from the Pequannock and Wanaque systems, currently the main sources for Essex County water, have been exceeded.

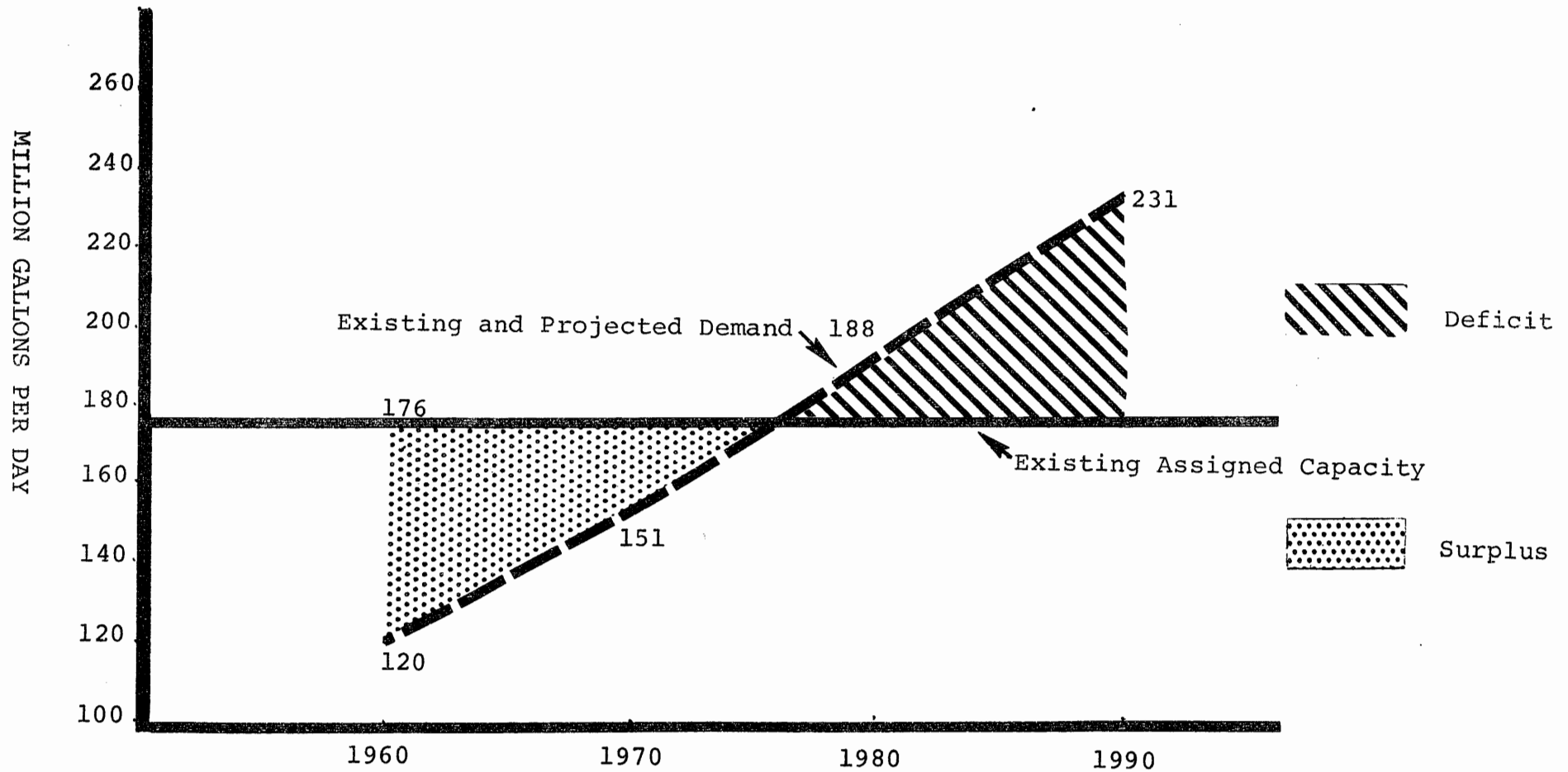
TABLE 16

SUMMARY OF CURRENT CONSUMPTION AND CAPACITY ASSIGNED TO ESSEX COUNTY  
FOR EACH WATER SYSTEM, 1966 (Million Gallons Per Day -- MGD)

<u>Water System</u>	<u>Safe Max. Yield</u>	<u>Present Consumption</u>	<u>% of Consump. In Essex County</u>	<u>Essex County Consump.</u>	<u>Essex County Assigned Capacity</u>
Pequannock	58.0	54.6	100.0%	54.6	58.0
Wanaque	104.0	108.0	50.0	54.0	52.0
Passaic Valley Water Comm.	3.0	3.4	100.0	3.4	3.0
Jersey City Water Department	65.0	65.0	2.5	1.5	4.0
Commonwealth Water Company	34.6	26.4	60.0	15.8	20.8
Essex Fells	4.0	4.8	100.0	1.8	4.0
East Orange	20.7	9.4	100.0	9.4	20.7
Orange	5.5	5.2	100.0	5.2	5.5
South Orange	3.0	1.9	100.0	1.9	3.0
Livingston	4.5	4.2	100.0	4.2	4.5
Fairfield	<u>0.5</u>	<u>0.2</u>	<u>100.0</u>	<u>0.2</u>	<u>0.5</u>
Total	302.8	270.1	56.0	152.0	176.0

Source: Projections from "Water Resources in New Jersey", November, 1967; and Planners Associates, Inc.

ESSEX COUNTY  
SUMMARY OF PROJECTED PUBLIC WATER DEMAND/SUPPLY DEFICIT



Source: Projections from "Water Resources in New Jersey", November, 1967, and Consultant.

Although steps can be taken to increase the capacity of these two systems, and they are so recommended below, it should be emphasized that long-range solutions toward meeting the County's future deficit involve tapping watersheds in addition to the Passaic River Basin.

b) General Recommendations:

Before advancing specific physical proposals for increasing water supply facilities available to Essex County, two general recommendations would be in order:

(1) Suffice it to say that the County should be planning now, and should encourage implementation of capital proposals as soon as possible, well before the time when demand exceeds the capacity of systems supplying this area. There is still sufficient time to plan for and build the needed facilities, but this time is rapidly running out. The County should play a role in ensuring that coordinated plans are developed by the suppliers. Among other objectives, these plans must determine to what extent new facilities to better tap existing sources or entirely new sources of water will be needed to meet the future demands of the County's communities.

(2) Planning for Essex County's future water supply must be closely coordinated with State-wide and regional plans. A single county cannot effectively plan for its future water

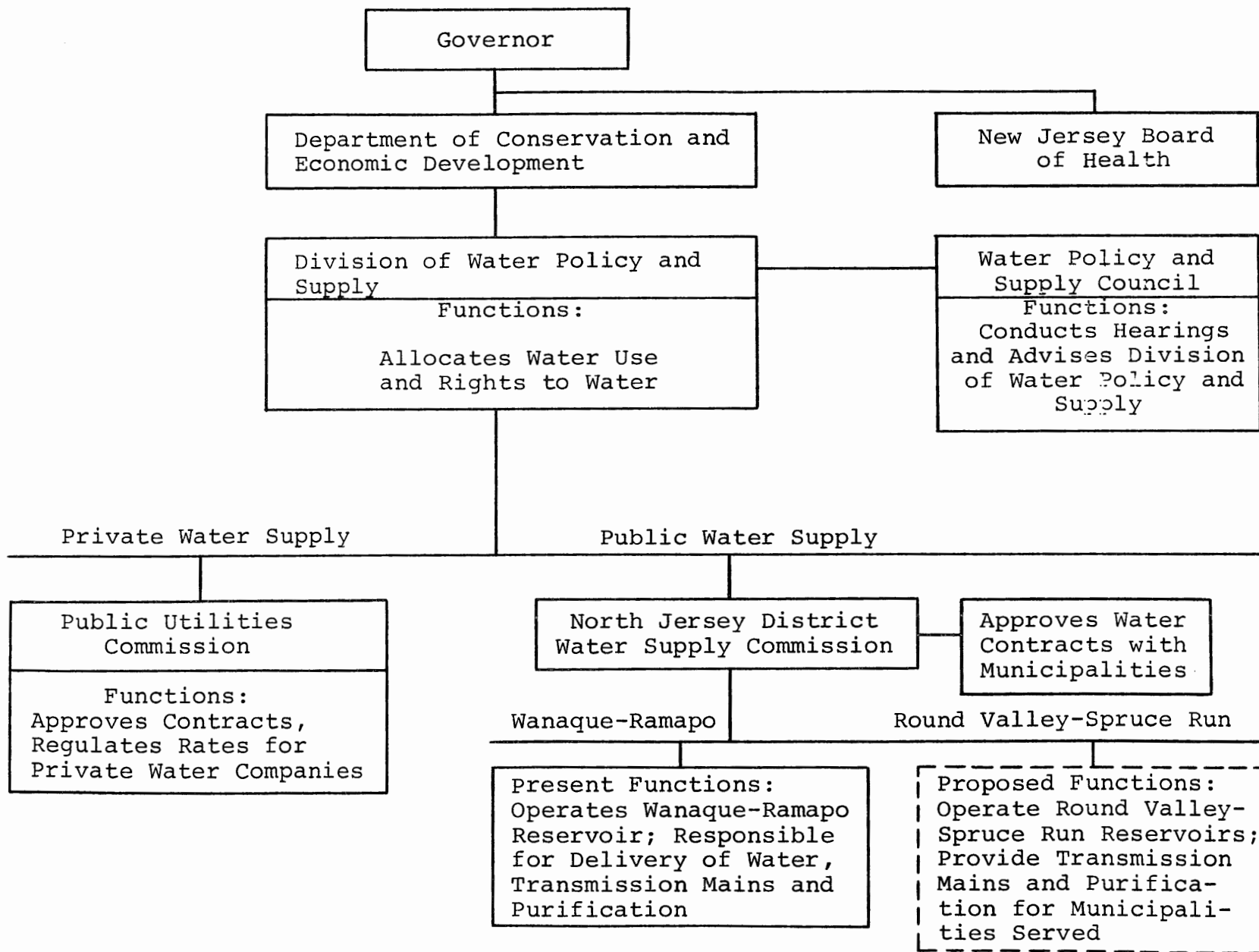
supply without such coordination because its sources lie increasingly beyond its boundaries and because every municipality in the region is faced with the same spectre of future water shortages.

Looking at the functional diagram of water supply administration (see chart), it seems obvious that the resolution of problems in the supply of water is dependent upon the cooperation of State and district authorities. There is some overlapping of responsibilities, and some areas where responsibilities are not covered at all. Of particular concern to the greater Newark area is that no central responsibility has been brought to bear on the problems of obtaining the cooperation of various municipalities. This cooperation will be required in order to request and sign contracts with the North Jersey District Water Supply Commission to provide transmission pipelines.

What is needed is a responsive body empowered to plan, construct, finance and operate water facilities from the source to the user municipalities. In addition, some means of coordination should be created so that compatible planning between sewer and water authorities becomes feasible and is facilitated.

(3) Although no attempt has been made to quantify the magnitude of this problem, river pollution places a constraint

# FUNCTIONAL DIAGRAM OF WATER SUPPLY ADMINISTRATION



on the permissible safe yields from given river supply sources. The elimination of water pollution would guarantee additional safe water supply.

## 2. Specific Proposals Toward Eliminating Deficit

### a) Proposals for More Complete Utilization of Passaic River Basin:

(1) As mentioned in the description of the Jersey City system in Section B, the Boonton Reservoir has a relatively small capacity and is overflowing for several months during the year, thus wasting considerable water. It is proposed that water from this source be brought through the Jersey City aqueduct to the limit of its capacity for the use of consumers in the Wanaque System. This will, thereby, lessen the use of water from the Wanaque Reservoir by a corresponding amount and thus permit Wanaque to gain that additional amount of water in storage. Such a measure would increase the overall effective yield or utilization of the two interconnected systems.

(2) Whenever Macopin Intake Reservoir is overflowing, the Pequannock aqueducts should be used to the limit of their capacity to supply Newark and its Pequannock customers and Wanaque Reservoir would thereby gain additional water as in (1). The utilized flow yield of the Pequannock Supply would

be increased by the amount of Macopin overflow delivered to Wanaque users.

(3) The additional water stored in Wanaque Reservoir by the above described operation could be utilized as far as it may be necessary to supplement the dry weather flow of the Passaic River at Little Falls and permit continued pumping at the rate of 75 MGD therefrom. As was mentioned in the discussion of the Little Falls facility (within the Passaic Valley Water Commission in Section B), it would also be necessary to install additional pump and filter capacity in that processing facility in order to achieve this rate.

(4) When the Boonton and Pequannock reservoirs are not overflowing, additional water stored in the Wanaque system as a result of the above described operations could serve to permit greater rates of draft from Wanaque, thereby resulting in an increased overall yield from the combined supplies.

b) Proposal to Tap the Round Valley/Spruce Run Reservoir System:

The above proposals for increased utilization of water within the Passaic River Basin could increase Essex County's effective supply by a substantial amount, estimated at perhaps 20-30 MGD, thus postponing until after 1980 the time



when other major sources must be developed for the County. If, on the other hand, there is another prolonged drought similar to the one that occurred during the early sixties, a major crisis could still take place before the end of the seventies. However, it will definitely be necessary to tap other supply sources prior to 1990, and those that appear to be the most logical are the Spruce Run and Round Valley reservoirs operated by the State in Hunterdon County within the Raritan River watershed. This system has substantial excess capacity, but additional transmission and purification facilities must be constructed before it can be utilized to meet Essex County deficits. However, the allocation of available water resources and the building of essential facilities have not been a completely rational or orderly process.

A recent article in the Newark Evening News, entitled "Raritan River Water Tap Plea Concluded" (June 30, 1969, page 21), gave credence to this point in a discussion of the much delayed pipeline project to bring water from the State's Spruce Run and Round Valley reservoirs to municipalities in northeastern New Jersey. The Round Valley/Spruce Run Reservoir System can supply water to any water purveyor willing to provide the necessary facilities, including purification and transmission pipelines. The Elizabethtown Water Company

presently owns facilities for purification and delivery of additional water. Moreover, funds are available for expansion of existing facilities.

The North Jersey District Water Supply Commission has no facilities available to deliver water from the Round Valley/Spruce Run Water Supply Project, and the funds necessary for additional facilities must be provided by the member municipalities. The North Jersey District Water Supply Commission must substantiate its application to the State for water diversion rights by showing the State Water Policy and Supply Council the necessity for taking 90 million gallons of water daily from the Raritan River watershed. Opposition to the North Jersey proposal is expressed by the Elizabethtown Water Company, which claims the ability to sell water at a rate of \$100 per million gallons less than the current rate charged by North Jersey. A number of municipalities are seeking to cancel contracts to buy water from North Jersey and switch to Elizabethtown. Although present contracts between the North Jersey District Water Supply Commission and the municipalities have been upheld in several court tests, discussion continues regarding the strain that necessary new improvements will impose on local budgets.

It is clear that the uncertainty of "who is to serve who" is not conducive to the sound scheduling of water facilities and provision of service. In the light of the general recom-

mendations spelled out above, the means must be found to implement this project as rapidly as possible. There should be an objective analysis of the alternative means available, both technically and administratively, and the selection of that scheme which will most equitably distribute the benefits and costs to the consumers of Essex County and surrounding areas.

III

SEWER PLAN

## A. OVERVIEW OF ESSEX COUNTY SEWER PLAN

### 1. Summary of Problem and Its Regional Implications

A reconnaissance of sanitary sewerage facilities serving the 22 municipalities in Essex County indicated, in general, that adequate facilities exist in most municipalities within the County for collection and primary treatment of sewage, but that facilities are not adequate in some areas for more intensive treatment. Sanitary sewerage facilities are now generally available to most municipalities, and those areas which are not completely sewered are now either planning or constructing sanitary sewerage systems.

The New Jersey State Department of Health has stressed that septic tank systems should be prohibited in the urban areas of the State. Septic tanks are found only in very limited areas in the western portion of Essex County, and may in the foreseeable future be entirely eliminated as a result of the construction of new sewerage facilities together with the extension of existing systems. Most of the sanitary sewerage facilities which presently serve the eastern portion of the County are very old, and some systems are heavily surcharged during periods of high rainfall runoffs.

As will be described in the following section, much of the County is already served by "regional" (multi-municipal)

sewerage facilities, and there is no immediate necessity for eliminating "individual" municipal sewage treatment plants and package plants in favor of regional area or central treatment plants, where they are not overloaded and are providing adequate treatment. The regionalization plan developed by the State may not become a reality for many years. Of primary concern in the area of treatment is the degree of treatment given the sewage by existing facilities. In the western part of the County, where municipal and private systems discharge into the upstream reaches of the Passaic River, secondary treatment is provided. This is largely due to the fact that the Passaic River is a major source of potable water supply.

In the regionalized systems serving the heavily populated eastern portion of Essex County, however, only primary treatment is provided. Because of the fact that the treated primary effluents from the eastern portion of the County are eventually discharged into interstate waters and, further, because the volume of waste discharged is encroaching upon the available dissolved oxygen in these waters, there is mounting pressure by State, interstate and Federal agencies to provide higher degrees of treatment to alleviate pollution.

## 2. Study Organization

The outline for this Sewer Plan parallels that followed for the Water Plan dealt with previously. After this introductory "overview" section, the body of the study will begin with an inventory of existing sanitary sewerage facilities in the County and a review of key questions. Next, the report will deal with an analysis of existing sewage flow and the complex task of forecasting future volumes of sewage for which adequate facilities must be designed. Regional and local sewerage system plans are then considered, and the study concludes with a summary of some of the basic issues and recommendations that have been advanced.

B. INVENTORY OF EXISTING SANITARY SEWERAGE FACILITIES AND

REVIEW OF KEY PROBLEMS

1. Description of the System

a) Areas Generally Served By Sanitary Sewerage Facilities:

Map No. 5, showing Water and Sewer Service Areas, and described in Section B-1a) of the Water Plan, indicates that most of Essex County is already served by public sanitary sewerage facilities. With few exceptions, the areas served by water coincide with the areas served by public sewerage facilities. Those portions of the eight municipalities in western Essex County which do not yet have these facilities are now either building or planning them.

b) Summary of Areas Served by Each System:

Essentially, sanitary sewerage services in Essex County are provided by two large regional systems, one smaller regional system, and several independent, municipally-owned systems. The large regional systems are (1) the Passaic Valley Sewerage Commission, serving all or parts of eight municipalities in eastern Essex, and (2) the Elizabeth Joint Meeting System, which serves all or parts of seven municipalities in the central and southern portion of the County. The smaller regional system is operated by the Caldwell Sewerage



Department and serves five municipalities in that vicinity. The remaining systems are independent and municipally owned, and have facilities in Cedar Grove, Fairfield, Livingston, Millburn, Verona and West Orange. (Map No. 8 shows the areas of responsibility for each of these systems.)

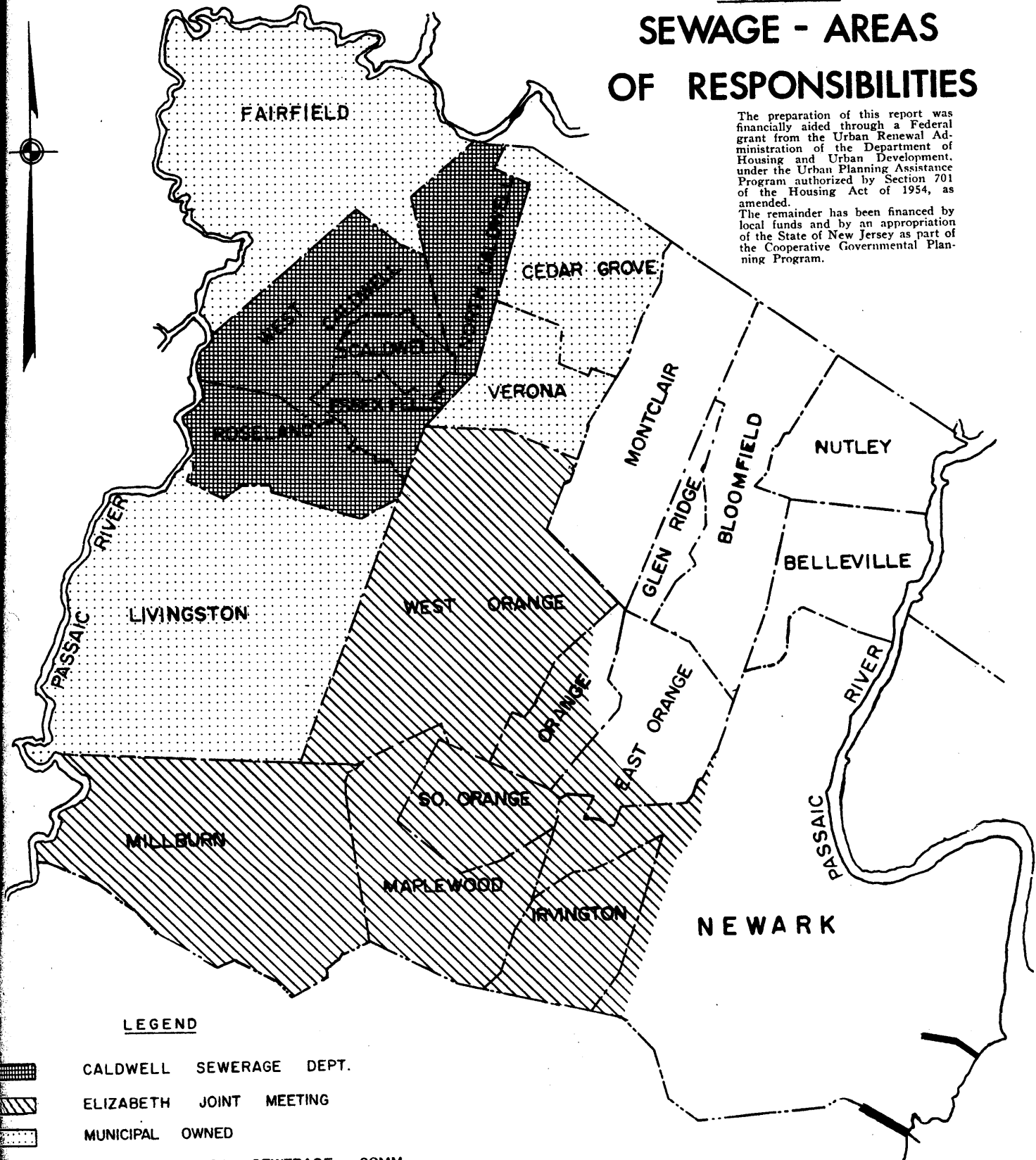
c) Summary of Basic Sewerage Facilities:

Map No. 9 is a geographic depiction of the main and secondary trunk lines which collect sewage from the local areas and deliver it to the treatment plants. On Map No. 10, the general locations of pumping stations, and of the local and the two regional treatment plants (in Newark and Elizabeth), are shown. Taken together, these two maps locate those facilities which in toto comprise the County's sanitary sewerage system. Table 17 provides an inventory by municipality of the system's existing sewage treatment plants and of some of their basic characteristics (design capacity, type of treatment and collection, receiving waters, etc.).

The total design capacities of all these systems combined is estimated to be nearly 260 million gallons per day (MGD). When compared with the measured sewage flow of 155 MGD in 1964, this combined design capacity appears to be more than adequate. However, some of these systems also serve areas located outside Essex County, so that the excess between

# SEWAGE - AREAS OF RESPONSIBILITIES

The preparation of this report was financially aided through a Federal grant from the Urban Renewal Administration of the Department of Housing and Urban Development, under the Urban Planning Assistance Program authorized by Section 701 of the Housing Act of 1954, as amended.  
The remainder has been financed by local funds and by an appropriation of the State of New Jersey as part of the Cooperative Governmental Planning Program.



## LEGEND

CALDWELL SEWERAGE DEPT.  
 ELIZABETH JOINT MEETING  
 MUNICIPAL OWNED  
 PASSAIC VALLEY SEWERAGE COMM.

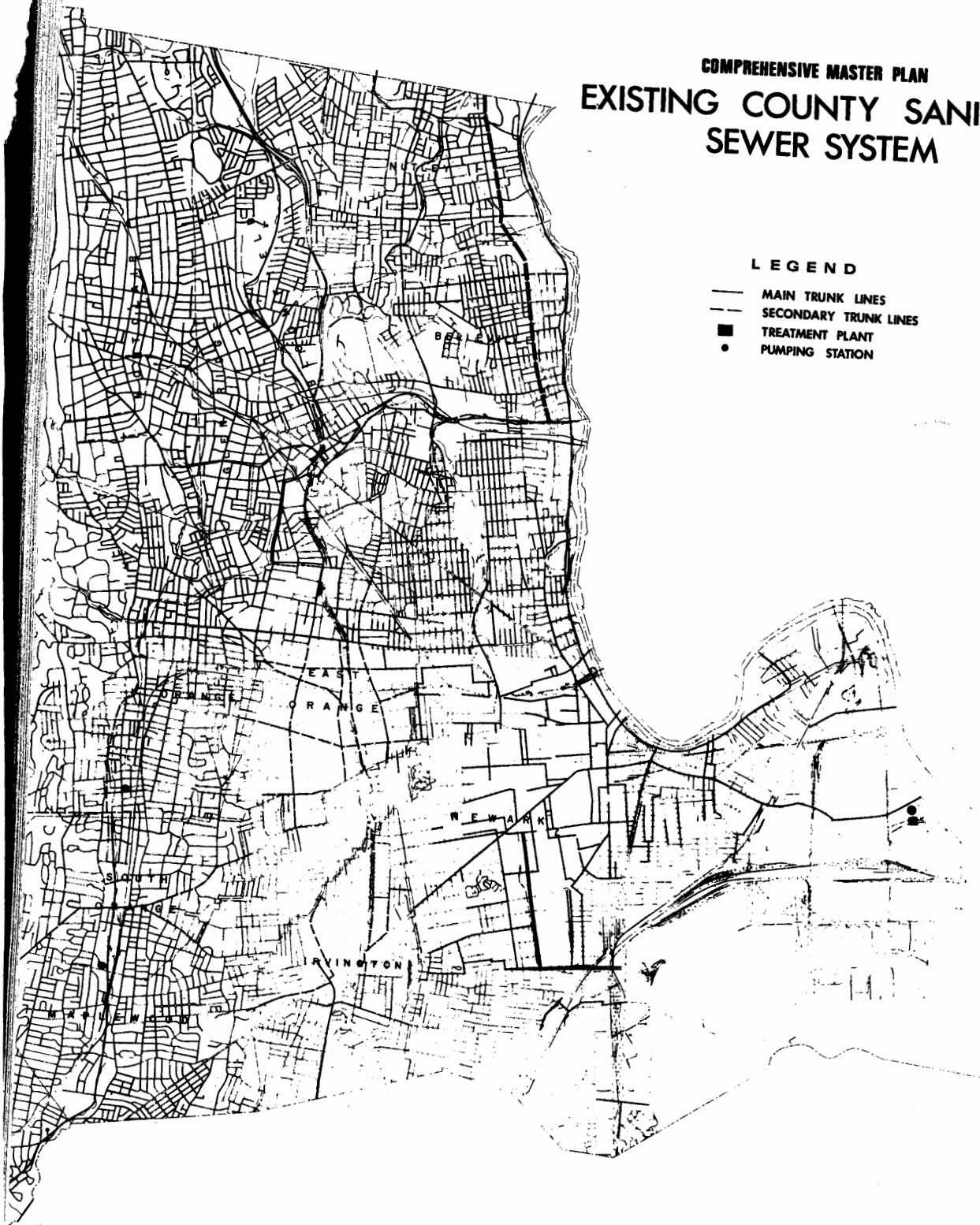
ESSEX COUNTY  
NEW JERSEY

DEPARTMENT OF PLANNING-ECONOMIC DEVELOPMENT-CONSERVATION

COMPREHENSIVE MASTER PLAN  
EXISTING COUNTY SANITARY  
SEWER SYSTEM

LEGEND

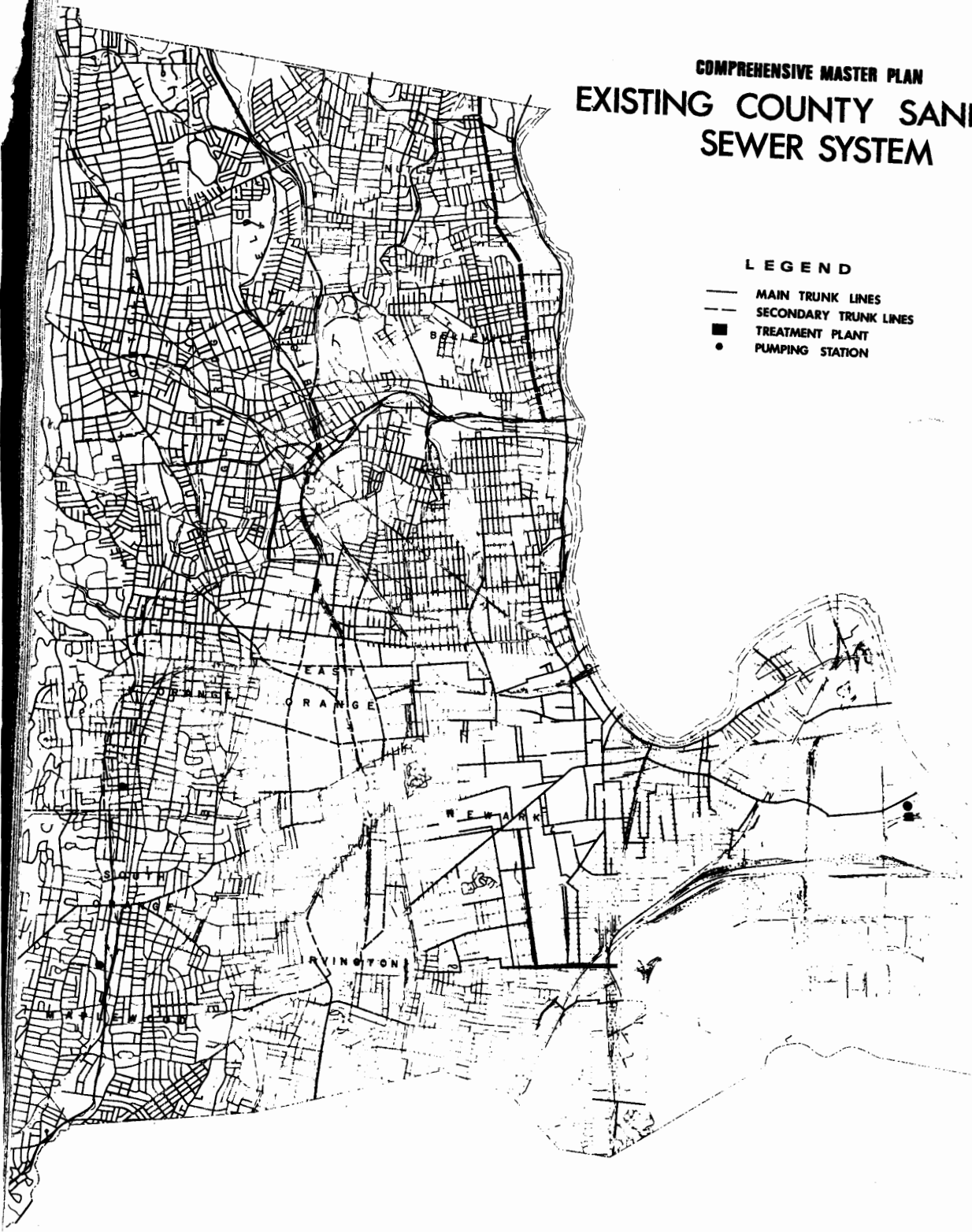
- MAIN TRUNK LINES
- - - SECONDARY TRUNK LINES
- TREATMENT PLANT
- PUMPING STATION



COMPREHENSIVE MASTER PLAN  
EXISTING COUNTY SANITARY  
SEWER SYSTEM

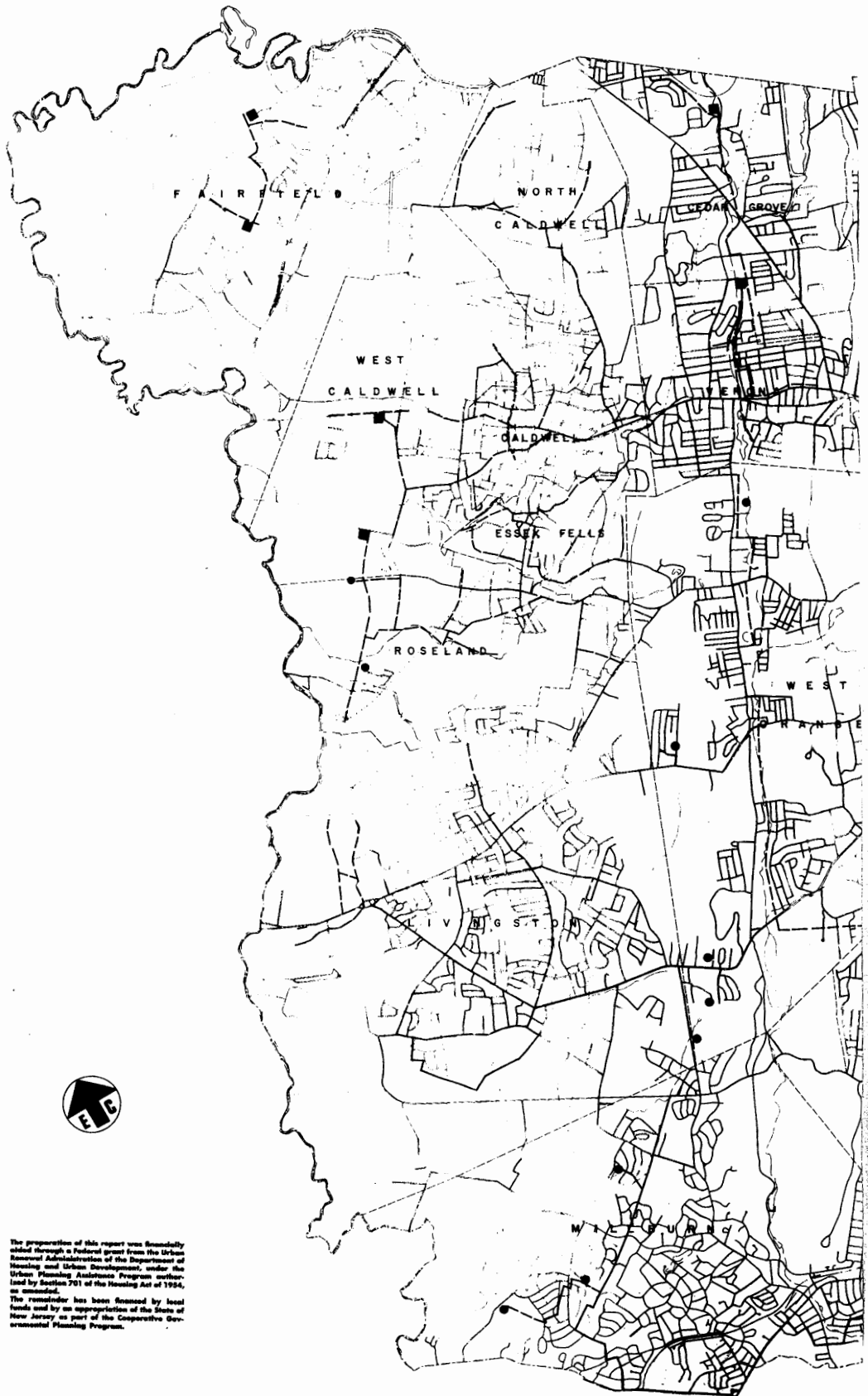
LEGEND

- MAIN TRUNK LINES
- - - SECONDARY TRUNK LINES
- TREATMENT PLANT
- PUMPING STATION



ESSEX COUNTY, NEW JERSEY  
DEPARTMENT OF  
ECONOMIC DEVELOPMENT-CONSERVATION



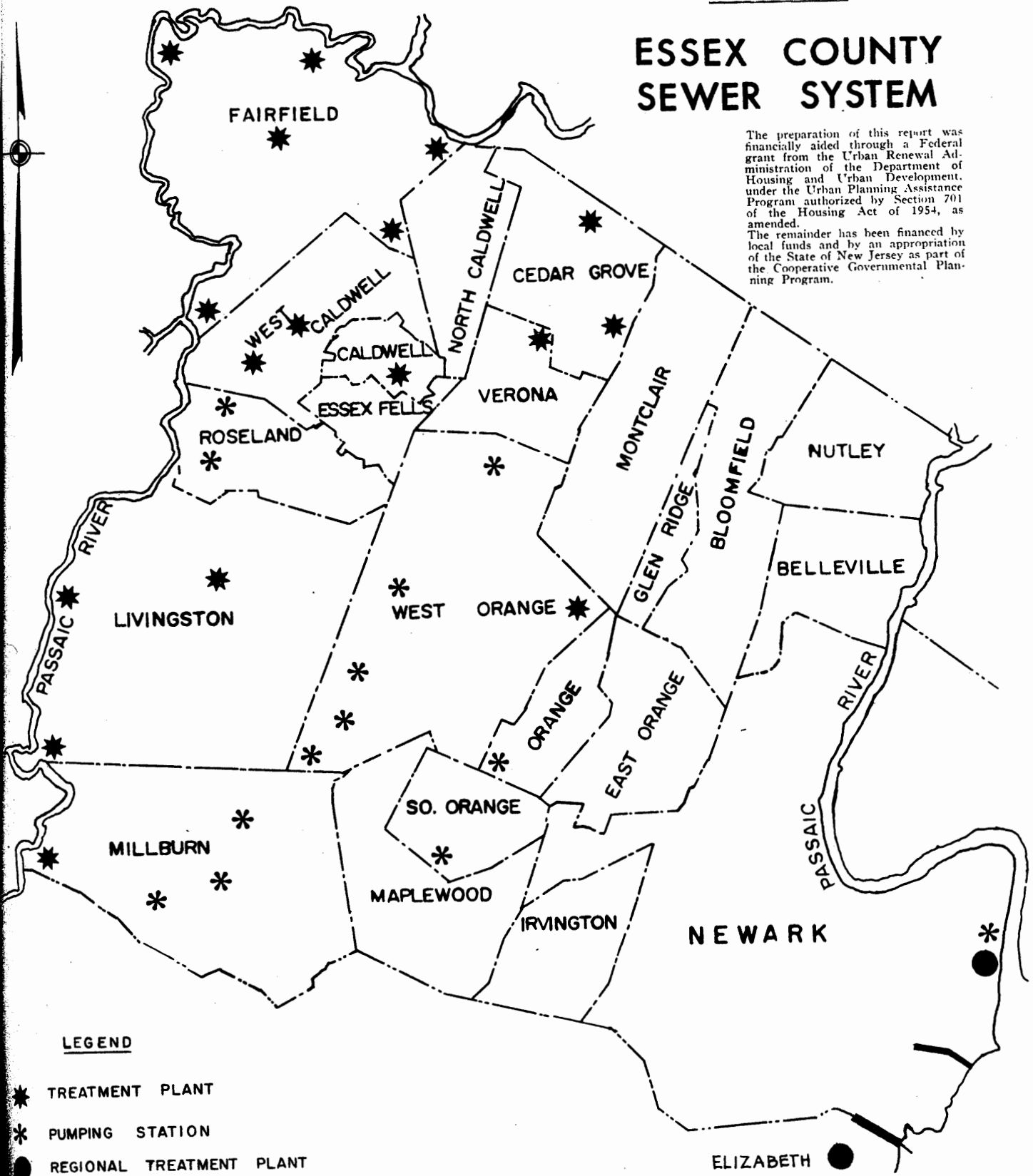


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# ESSEX COUNTY SEWER SYSTEM

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## LEGEND

- ★ TREATMENT PLANT
- \* PUMPING STATION
- REGIONAL TREATMENT PLANT

ESSEX COUNTY  
NEW JERSEY

DEPARTMENT OF PLANNING-ECONOMIC DEVELOPMENT-CONSERVATION

TABLE 17

INVENTORY OF EXISTING SEWAGE TREATMENT PLANTS SERVING ESSEX COUNTY

<u>Municipality</u>	<u>Owner</u>	<u>Design Capacity (MGD)</u>	<u>Type of Effluent</u>	<u>Type of Treatment &amp; Collection</u>	<u>Receiving Waters</u>
Caldwell	Municipal	0.4000	D <sup>1</sup>	Preparation, settling, standard rate, sprinkling filter, chlorination, digestion, sludge drying beds, sand filters and separate collection.	Tributary to Passaic River
Cedar Grove	1. Board of Chosen Freeholders (Overbrook Hospital, Essex County)	0.9000	D	Primary settling, high rate trickling filter, digestion, chlorination, sludge dewatering, secondary setting. Separate collection.	Peckman River to Passaic River
	2. Municipal	1,7500	D	Settling, high rate filter, secondary settling, chlorination, and sludge drying beds. Separate collection.	Peckman River to Passaic River
Fairfield	1. Municipal (Twin Pines)	0.1800	D	Temporary plant, septic tank, sand filters, chlorination. Separate collection.	Tributary to Passaic River
	2. Curtis-Wright (Caldwell Airport)	N.A.	I <sup>2</sup>	Cyanide oxidation.	Passaic River
	3. Deer Park	N.A.	I	Septic tank, sand filters, chlorination.	Passaic River

INVENTORY OF EXISTING SEWAGE TREATMENT PLANTS SERVING ESSEX COUNTY  
(cont'd)

<u>Municipality</u>	<u>Owner</u>	<u>Design Capacity (MGD)</u>	<u>Type of Effluent</u>	<u>Type of Treatment &amp; Collection</u>	<u>Receiving Waters</u>
Fairfield (cont'd)	4. Curtis-Wright (Dutch Land)	N.A.	I	Imhoff tanks, standard rate filters, sand filter, chlorination.	Passaic River
	5. Curtis-Wright	N.A.	I	Oil skimmers	Passaic River
	6. Municipal	0.5000	D	Contact stabilization, digestion & chlorination. Separate collection.	Tributary to Passaic River
Elizabeth <sup>3</sup> (Serves 8 municipalities in Essex County)	Elizabeth Joint Meeting	50.0000	D	Settling, sludge holding (barged to sea). Separate collection.	Arthur Kill
Livingston	1. El Dorado Swim Club, Inc.	0.0050	D	Septic tank, intermittent sand filter and chlorination.	Bear Brook to Canoe Brook to Passaic River
	2. Leemac Construction Co. (Shadybrook Swim Club)	0.0100	D	Settling tanks, sand filters and chlorination	Slough Brook, tributary to Passaic River
	3. Municipal	2.2500	D	Step aeration settling, chlorination, digestion, sludge dewatering. Separate collection.	Passaic River
Millburn	Commonwealth Water Company	0.0015	D	Settling tanks, sand filters and chlorination.	Canoe Brook tributary to Passaic River



INVENTORY OF EXISTING SEWAGE TREATMENT PLANTS SERVING ESSEX COUNTY  
(cont'd)

<u>Municipality</u>	<u>Owner</u>	<u>Design Capacity (MGD)</u>	<u>Type of Effluent</u>	<u>Type of Treatment &amp; Collection</u>	<u>Receiving Waters</u>
Newark (plus 7 municipalities)	Passaic Valley Sewerage Commission	200.0000	D	Primary settling (sludge barged to sea). Combined & separate collection in Newark; the remaining facilities are separate.	New York Bay at Robbins Reef
Verona	Municipal	4.0000	D & I	Primary settling, high rate trickling filters, chlorination, digestion & sludge drying beds, final settling. Separate collection.	Peckman River to Passaic River
West Orange	Nursing Home	0.0300	D	Clarigester, high rate trickling filter, chlorination.	Cub Brook to Passaic River

1 = Domestic      2 = Industrial      3 = Joint meeting treatment plant is located in the City of Elizabeth, Union County.

Source: New Jersey Department of Health, August, 1968.

capacity and existing utilization is not this great. Table 18 indicates average daily flow for all municipalities within each system and summarizes the capacity of the systems.

## 2. Regional, State and Federal Controls on the System

The Passaic Valley Sewerage Commission has jurisdiction over the methods of pollution abatement and sewage treatment in an area described and defined by Statute. This area generally embraces those municipalities which are now served by the Passaic Valley Sewerage Commission as described above. All of the municipalities in Essex County served by the Passaic Valley system are essentially completely sewered. The treated effluent from the Passaic Valley outfall system is discharged into Lower New York Bay at a point designated as Robbins Reef.

Those municipalities in Essex County served by the Joint Meeting System have their treated wastes discharged into the Arthur Kill through the System's regional sewage treatment plant located in the City of Elizabeth. Those communities in the western part of the County, which are presently served by local municipal and area treatment plants, have their wastes discharged, after treatment, into the Passaic River. The abatement of pollution from sewage effluent, and the requirements to be met for discharge of wastes into streams

TABLE 18

ESSEX COUNTY SEWAGE SYSTEMS FLOW AND DESIGN CAPACITIES

<u>System</u>	<u>Service Areas</u>	<u>1967 Average Daily Flow (MGD)</u>	<u>1964 Average Daily Flow (MGD)</u>	<u>Net Change (MGD)</u>	<u>Number of Plants</u>	<u>Capacity of Treatment Facilities (MGD)</u>
Passaic Valley Sewerage Commission	Belleville	1.76	1.49	0.27		
	Bloomfield	5.88	5.90	0.02		
	E. Orange (Part)	N.A.	1.00	N.A.		
	Glen Ridge	0.91	0.85	0.06		
	Montclair	4.92	4.47	0.45		
	Orange (Part)	6.01	5.76	0.25		
	Newark (Part)	N.A.	97.63	N.A.	1	200.00
	Nutley	N.A.	5.59	N.A.		
	Total	N.A.	121.69	N.A.	1 (In Newark)	
Elizabeth Joint Meeting	E. Orange (Part)	2.40	2.15	0.25	1	50.00*
	Irvington	5.95	5.79	0.16		
	Maplewood	4.20	3.54	0.66		
	Millburn	2.36	2.36	0.00		
	Newark (Part)	5.65	5.38	0.27		
	S. Orange (Part)	3.47	2.50	0.97		
	W. Orange	5.16	4.28	0.88		
	Total	29.19	26.00	3.19	1 (In Elizabeth)	
Borough of Caldwell	Caldwell,	N.A.	2.00	N.A.	1	0.40
	W. Caldwell,					
	N. Caldwell,					
	Essex Fells, Roseland					
	Total	N.A.	2.00	N.A.	1 (In Caldwell)	

\*Located in Elizabeth and capacity is increased to 175.5 MGD when Union County facilities are included.

ESSEX COUNTY SEWAGE SYSTEMS FLOW AND DESIGN CAPACITIES  
(cont'd)

<u>System</u>	<u>Service Areas</u>	<u>1967 Average Daily Flow (MGD)</u>	<u>1964 Average Daily Flow (MGD)</u>	<u>Net Change (MGD)</u>	<u>Number of Plants</u>	<u>Capacity of Treatment Facilities (MGD)</u>
Independent	Cedar Grove	N.A.	1.20	N.A.	2	2.6500
Independent	Fairfield	N.A.	N.A.	N.A.	6	0.0680
Independent	Livingston	N.A.	2.80	N.A.	3	2.2650
Commonwealth Water Co.	Millburn	N.A.	N.A.	N.A.	1	0.0015
Independent	Verona	N.A.	1.40	N.A.	1	4.0000
Independent (Nursing Home)	W. Orange	N.A.	N.A.	N.A.	1	0.0300
Grand Totals		N.A.		N.A.	17	9.0145

Sources: New Jersey State Department of Health, August, 1969; and Planners Associates, Inc. estimates.

for receiving waters by all treatment plants in the State, other than those directly controlled by the Passaic Valley Sewerage Commission, is under the jurisdiction of the New Jersey State Department of Health. That is, all other communities in Essex County, with the exception of those served by the Passaic Valley system, come directly under the jurisdiction of the New Jersey State Department of Health.

The Interstate Sanitation Commission has a voice in the type of treatment and the quality of effluent discharged into interstate waters. The U. S. Army Corps of Engineers and other Federal and State agencies, likewise, have an interest in the overall efficiency of treatment, and have studied and investigated the flow and quality of waters in the waterways into which the wastes from the eastern part of Essex County are discharged.

Presently, no catastrophic health hazards appear to exist as a result of inadequate sewage treatment in the County, and this analysis includes areas served by septic tank systems as well. As a result of stronger enforcement and some litigation by the controlling authorities in recent years, there has been some improvement in the quality of effluent discharged into the rivers. But, because of the use of the Passaic River as a potable water supply source, it is essential to

be continually concerned about the adequacy of present-day effluent treatment and its discharge into the Passaic River Basin.

### 3. Problem Areas in Essex County

There are instances in some municipalities where heavily surcharged sewer systems, during periods of extensive rainfall or peak flow periods, result in overflow into local streams which from time to time create nuisance conditions and potential health hazards. Some municipalities may have to study their internal collection systems and eliminate (or control) such overflows through treatment or the construction of relief sanitary sewers.

Some of the larger cities in the eastern part of the County have combined sewers (sewers which carry both storm water and sanitary wastes). Ordinarily, these wastes are conveyed to the treatment plant for disposal but, during periods of rainfall, overflows of combined storm water and untreated sewage are discharged directly into the Passaic River. Separation of storm water from domestic and industrial wastes would be most difficult and costly, and the absolute necessity for complete separation of these wastes for treatment and disposal has not yet been clearly demonstrated, locally or nationally. In many areas in the County,

chlorination is provided for storm water overflows, which is a consideration for a short range future possibility or necessity in reducing health hazards due to overflows, particularly along the Passaic River where the problem is concentrated.

In most of the interior communities of Essex County, the sanitary sewerage collection systems are "separate" and the storm water problem does not arise, except for the aforementioned surcharged conditions created by infiltration due to leaky sewers. Such discharges into streams are inadvertent, infrequent and not intentional (as in the case with the larger combined systems which are found in the older cities). For example, it was estimated that in 1964 some 25 MGD of raw, untreated sewage was discharged into Newark Bay by the City of Newark alone. This particular problem has since been partially corrected with completion of the South Side interceptor in 1966.

## C. FORECASTING FUTURE SEWAGE FLOW

It has been estimated that the total 1964 estimated average sewage flow in Essex County for all systems exceeded 153 million gallons per day (MGD). The 1964 sewage flow estimates were included in a report prepared by the Newark Area Community Health Study, published in 1965.

### 1. Sewage Flow Based on Water Demand

Several methods may be used for estimating and forecasting sewage flows, among which are estimates based on water usage, in that general experience shows that 80-90% of all water used may be considered to be used for sewage waste disposal. Based upon this assumption, we can estimate total sewage flows for Essex County based on the total water consumption shown in the water study portion of this report. In the water study section, one method used in determining Essex County's water demand to 1990 was a forecast based on that used by the State for the northern nine-county area of New Jersey. Assuming that the State water forecasts are correct, and assuming that water and sewage rates will continue to increase proportionately to 1990, we may expect the sewage flow for Essex County to be approximated in the following table:



TABLE 19

FORECAST OF SEWAGE FLOW IN ESSEX COUNTY, 1960-1990  
BASED ON WATER DEMAND (Million Gallons Per Day)

<u>Demand</u>	<u>1960</u>	<u>1970</u>	<u>1980</u>	<u>1990</u>
Public	82	85	102	124
Industrial	65	76	90	108
Totals	147	161	192	232

2. Sewage Flow Based on Computer Model Application

Computer derived totals for sewage flow based on floor space for each land use activity was calculated and compared with actual recorded flows to establish a mathematical model which may be used to simulate future effluent, when future land use space requirements have been fully determined. The base file for the computer operations, performed in relation to this study, was the 1963 Tri-State Transportation Commission's tape. This file basically contained areas of water and swamp, vacant, street, residential and non-residential land uses and, in addition, residential and non-residential floor space area. These data were manipulated to develop (1) floor to land ratios (in three digit decimal form); (2) the area in acres; and (3) the effluent in gallons per day for seven categories of land use. These categories included: residential; manufacturing; commercial; public and quasi-

public; streets and highways; open space (and vacant); mining; and water, swamps, reservoirs and watersheds. As in the case of the water model developed earlier in this report, totals were obtained for three geographical units: (1) 1/4 square mile grids; (2) municipality; and (3) county.

In order to determine the effluent rate, it was assumed that 80-90% of all water demand required sewage disposal. Based on this assumption, factors were derived from nationally-recognized "water for sewage use" standards which could be used to translate floor areas into expected sewage flows. This method made use of information on the average waste water usage per thousand square feet of floor space for various land uses, and the average amount of effluent per gallon of water used for these same activities. This information was reworked to provide weighted factors suitable for Essex County which, when computed in combination with the square footage of land space, resulted in an approximation of the number of gallons of sewage per day for each of the seven land uses. The actual 1963 total sewage flow for the entire County amounted to some 159.5 million gallons per day (MGD) using the computer method. This compares favorably with the estimated average daily flow of 155.2 MGD recorded in 1964. The 155.2 MGD sewage flow tends to be a conservative estimate, as not all of the systems in

the County reported actual measured flows. Moreover, leakages and overflows plus septic tank systems could account for additional flows which were not recorded.

Although residential floor space and land area were greater by far than any other category, this land use ranked second in generation of sewage flow per day. Manufacturing, with 1/7 as much land area and 1/4 as much area devoted to floor space (showing a greater intensity of usage), was responsible for nearly 1/2 of all liquid wastes currently using the County and regional sewerage systems. This emphasizes the fact that in the areas where manufacturing land use is concentrated there will be a requirement for higher capacity sanitary sewerage systems. Such information must be examined in conjunction with future land use space requirements in order to more accurately plan for future sewerage needs. Detailed engineering studies will be required to determine exact design requirements of each system in question.

In conclusion, it appears to be possible to determine future sewerage facility needs to the year 1990 using the computer calculations based on floor space allocations. Since the mathematic model has been developed with results approximating actual recorded flows, then it would be logical to assume that future flows may also be determined in a similar fashion.

B. REGIONAL AND LOCAL SEWERAGE TREATMENT PLANT PLANS

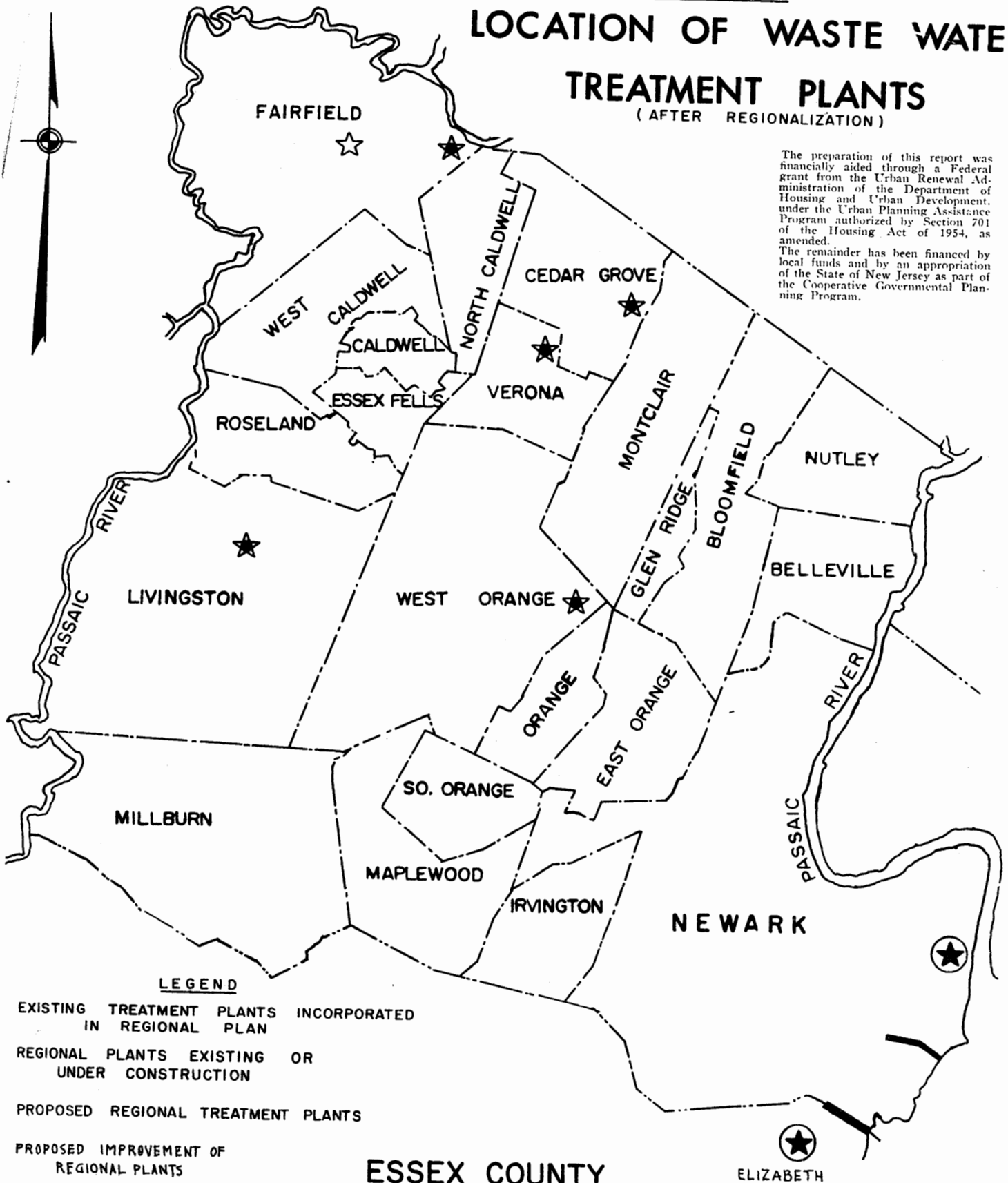
1. The Regional Plan

The State of New Jersey's Department of Health, in its report entitled "Anticipated Capital Needs for Sewerage Facilities in New Jersey", dated February 3, 1969, proposed a regional treatment plant to be located in Fairfield. Moreover, the State recommended that a number of existing treatment plants be incorporated in the regional plan. The regional plan, of course, would include the present Passaic Valley Sewerage Commission's plant at Newark. Existing treatment plants located in Essex County which have been proposed by the State to be included as part of the regional plan are located in Livingston, Fairfield, West Orange, Verona and Cedar Grove (see Map No. 11).

Presumably, all listed facilities in the State regional plan may have the benefit of additional financial assistance under the State's Public Sanitary Sewerage Facilities Assistance Act of 1965. The Essex County municipalities of Newark, Irvington, South Orange, East Orange, Orange, Maplewood, Millburn and West Orange will benefit from the construction of new regional secondary sewage treatment plant facilities to be constructed at Elizabeth (Union County) under the management of the Joint Meeting. Costs of this new construction

# LOCATION OF WASTE WATER TREATMENT PLANTS ( AFTER REGIONALIZATION )

The preparation of this report was financially aided through a Federal grant from the Urban Renewal Administration of the Department of Housing and Urban Development, under the Urban Planning Assistance Program authorized by Section 701 of the Housing Act of 1954, as amended.  
The remainder has been financed by local funds and by an appropriation of the State of New Jersey as part of the Cooperative Governmental Planning Program.



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will be partially shared by the Essex County municipalities served by the Joint Meeting.

## 2. Local Plans

Treatment plant improvements, either in the form of new plant facilities or expansion of existing facilities, will be made in Caldwell, Fairfield, Cedar Grove and Livingston.

Other sewerage collection system improvements are slated for Bloomfield, Verona and East Orange.

Storm sewer improvements have been scheduled for Belleville, Bloomfield, East Orange, Livingston, South Orange and Verona. All these communities have separated storm and sanitary sewer collection systems.

All of the system improvements are listed under the Improvement Program which is outlined at the end of this report.

## B. SUMMARY AND CONCLUSIONS

### 1. Summary

As previously indicated, all of the municipalities within the study area are now served at least in part by sanitary sewers. Limited areas of some of the municipalities are still served by septic tanks, and these areas are in the western portion of the County. In general, the need for construction of sewerage pipeline facilities in this highly developed industrial and suburban County is not the most critical problem.

However, the provision of improved and new treatment plant facilities is already a major problem for the communities in the eastern portion of the County. The installation of secondary treatment facilities is now being considered by the Elizabeth Joint Meeting, and pilot plan studies have been prepared to determine the most economical methods of treatment. The Passaic Valley Sewerage Commission is presently confronted with recommendations from the Federal and State governments to improve or increase the degree of treatment provided. If such improvements are implemented, the contributing communities will be confronted with a very substantial increase in the cost of operation, as compared to their present relatively low costs. This is particularly true for the

Elizabeth Joint Meeting. As a result, it will be necessary for these communities to alter their priorities and curtail expenditures in other areas, or alternatively to pass these increased costs onto the user. (See Table 20 which shows sewer rates.)

No rigorous attempt has been made to accurately determine the annual increase in treatment costs for the municipalities now served by the Elizabeth Joint Meeting or the Passaic Valley Sewerage Commission because of higher treatment requirements, but an estimate of from two to three times present costs is considered to be conservative. The Passaic Valley Sewerage Commission has estimated that the rate per million gallons of sewage flow will soon go up to \$62.94 for each participating municipality, as opposed to the present rate of \$46.90 per million gallons. This is an increase of \$16.04, or 34% over the present rate. This is largely due to the fact that cost estimates for the Passaic Valley Sewerage Commission's proposed secondary treatment plant to be located in Newark, go as high as \$200 million. Current estimates for the proposed Elizabeth Joint Meeting secondary treatment plant are \$30 million. Federal and State government authorities are requesting 90% BOD removal of effluents. However, local officials would like to limit waste removal



TABLE 20

ANNUAL MINIMUM SEWAGE RATES IN ESSEX COUNTY -- 1968 to 1969Key for rate basis

1. Rate per million gallons (both sewage and water).
2. Rate per single household connection.
3. Rate and range per \$1,000 gallons water used.
4. Rate and range per 1,000 cubic feet water used.
5. Cost included in tax fee and the amount dependent on balance of operating costs to revenues.
6. Cost computed on a quarterly basis.
7. Tax included in tax fee.

<u>System</u>	<u>Municipality</u>	<u>Rate Base</u>	<u>Rate</u>
Passaic Valley Sewerage Commission			
	Montclair	1	\$65.00
	Bloomfield	1	65.00
	Nutley	1	65.00
	Newark	1	65.00
	Glen Ridge	1	65.00
	Belleville	1	65.00
	East Orange	1	65.00
Joint Meeting Sewage Commission (Elizabeth)			
	West Orange	1	\$19.66
	East Orange	1	19.66
	Orange	1	19.66
	South Orange	1	19.66
	Newark	1	19.66
	Irvington	1	19.66
	Maplewood	1	19.66
	Millburn	1	19.66
Borough of Caldwell			
	Caldwell	5	(no charge)
	Essex Fells	2	\$25.00
	West Caldwell	2	22.00
	North Caldwell	2	22.00
	Roseland	1	183.00

ANNUAL MINIMUM SEWAGE. RATES IN ESSEX COUNTY -- 1968 to 1969  
(cont'd)

<u>System</u>	<u>Municipality</u>	<u>Rate Base</u>	<u>Rate</u>
Fairfield	Fairfield	1	\$48.00
Cedar Grove	Cedar Grove	3, 6	28.00 = up to 20,000 1.08 = 21,000 - 50,000
Verona	Verona	7	(no charge)
Livingston	Livingston	4	2.50 = up to 1,000 1.00 = 1,001 - 10,000 0.90 = 10,001 - 50,000 0.80 = 50,001 - 100,000 0.70 = 100,001 and over

Note: Includes cost of sewage and waste plant treatment.

Source: Data collected by Essex County local governments and sewerage authorities.  
calculations and tabulations by Planners Associates, Inc.

to 60% initially, with the remaining 30% to be eliminated when resources become available.

The municipalities in the western part of the County, which drain into the Passaic River and operate their own plants, now provide secondary treatment. Most of these plants are in relatively good operating condition. Livingston has increased and enlarged its plant facilities, and the Borough of Caldwell has applied for Federal matching funds for another enlargement project following one which was completed several years ago. The additional enlargements at Cedar Grove, Fairfield, Livingston and Caldwell (the latter serving neighboring communities as indicated on Map No. 8) are primarily to provide greater capacity to serve additional residential areas.

Essex County is well ahead of other counties in New Jersey, in that regional sewerage treatment plans developed by the two major authorities handling sewage treatment for the eastern and central portions of the County already exist. There has been a regional plant recommended for Fairfield by the State Department of Health, which will serve most of western Essex County by supplementing present municipally-owned and operated sewage treatment plants. As the area in the western portions of the County develops, this proposed regional facility will become more important in maintaining river quality and general health standards.

Of primary interest in the County is the degree of treatment provided, and it is possible that in the future tertiary treatment may be required for all effluents discharged into the Passaic River. If such a level of treatment does become necessary, local governments will again be faced with an appreciable increase in annual expenditure for sewage treatment service. The cost of treatment per household is much greater in the smaller communities in the western part of the County than in the areas served by the Joint Meeting and the Passaic Valley Sewerage Commission systems. Economies of scale make it more economical to establish regionalized systems for waste treatment, particularly when the requirements for secondary and tertiary treatment are considered. Moreover, regionalized systems have the advantage of better utilization and management of unified drainage basins for water pollution control and abatement programs.

Some municipalities have difficulties with surcharged sewers during periods of excessive runoff. Some overflow of sanitary sewage spills into storm sewers or streams, particularly in Newark where portions of the system are still combined, and may create some problems of nuisance and potential health hazards.

## 2. Conclusions

The Essex County sewerage authorities must consider a joint approach to the problems of sewage collection, treatment and disposal. First, members of each participating municipal or regional sewerage authority must organize and participate in the overall planning process now being undertaken by the County. Capital programming priorities must be re-evaluated annually, and included in each year's water and sewer capital improvement program prepared by the Essex County Department of Planning, Economic Development and Conservation. This procedure will enable each local government, or regional authority, to continue to be eligible for both Federal and State grant-in-aid programs for sewer improvements. It is strongly urged that all new private housing developments provide sanitary sewer service from the outset. From time to time, the older sewerage facilities in eastern Essex County will have to be replaced or upgraded, particularly sewerage conduits in certain sections of Newark. The fact that most of the County has sanitary sewer collection systems available does not mean that present facilities are sufficient to meet future needs, nor will they necessarily meet the standards established by the controlling State, interstate and Federal agencies.

#### IV

#### IMPROVEMENT PROGRAM

Development plans have been prepared indicating the type of facilities required to provide water and sewer services to Essex County. Specific recommendations will be made in this final section of the report as to the manner and sequence in which the projects might be implemented.

A. IMPROVEMENT PROGRAM CRITERIA AND FINANCING

1. Criteria for Improvement Programming

The specific suggestions and recommendations were made after making evaluations based on the following criteria:

1. Projected future growth
  - (a) Population growth
  - (b) Suitable land availability
  - (c) Projected future land use plan(s)
2. Meeting present needs
3. Meeting future needs
  - (a) 5-10 year program
  - (b) 10-20 year program
4. Geographic location
  - (a) Regional location
  - (b) Soils, geology and topography (slope)
  - (c) Watershed basins
5. Stated County-wide goals and objectives

Water and sewer facilities constructed before 1967 served an estimated 966,610 residents. The 5-10 year water and sewer facilities program is expected to serve an estimated additional 140,000 to 190,000 persons, while the long-range program of 20 years or more will serve upwards of 1.36 million persons, according to estimates developed by the County Department of Planning, Economic Development and Conservation.



## 2. Financial Bases for Improvement Programming

### a) Approach to Financing:

The basis for determining additional requirements for water and sewer facilities in Essex County has been established in the initial portions of this water and sewer plan report. Financial breakdowns for each given project can only be done on an individual basis. The areal or geographic service area of some of the proposed facilities will, no doubt, result in costs which will be prohibitive for funding of the project by assessing wholly against direct users. For this reason, it is expected that many improvements, such as trunklines, mains and treatment plants, etc., can only be constructed by utilizing Federal and State matching grants and loans. As each individual project is considered, a preliminary engineering report should be prepared in advance, depicting what portion of the improvements can reasonably be borne by the local and regional governmental water and sewer agencies.

The recommendations for financing are as follows:

1. Determine what proportionate share of the project can be funded with monies from:
  - (a) Direct loan funds -- funds to be provided in the form of loans from public agencies.

(b) Insured loan funds -- funds to be secured from private investors with repayment guaranteed by public agencies.

(c) Revenue bonds -- joint financing with bonds and loans.

(d) General obligation bonds.

2. Determine what portion of the funds will be required to finance the balance of the project (which sometimes may be obtained from outright grants from public agencies).

b) Sources for Financial Assistance:

Financial assistance for water and sewer project proposals may be sought from one or more governmental agencies.

Programs administered by these agencies are outlined as follows:

(1) U. S. Department of Housing and Urban Development (HUD)

(a) Advances for Public Works Planning.

Purpose -- planning for specific projects or areawide long-range projects.

Use -- all types of public works (except housing) are eligible, including, of course, water and sewer systems.

(b) Grant Assistance for Water and Sewer Systems

Use -- to help finance water systems to store, supply, treat or purify, and transmit water; sewer facilities, including sanitary sewer systems that collect, transmit, or discharge liquid wastes. Grant funds cannot cover the cost of installing water or sewer lines connecting to houses or other buildings, or local collection

or distribution laterals, or sewage treatment works which are covered under other Federal programs. Maximum grants may not exceed 50% of the project's eligible cost, except under special circumstances.

- (c) Public Facility Loans -- Maximum term is 40 years. Virtually all public works projects are eligible (except schools). Information regarding interest rates is available at HUD Regional Office.

(2) Federal Water Pollution Control Administration  
(FWPCA) - U. S. Department of Interior

- (a) Grant assistance is available for up to 30% of the eligible cost (or \$600,000., whichever is smaller) of the project. A grant may be increased by 10% if the planning is certified by the planning agency having jurisdiction as being part of an overall comprehensive plan. In the case of joint projects serving more than one municipality, this limitation will apply to each participating community's share of the project cost, up to a maximum Federal grant of \$2.4 million for the overall project. (An applicant receiving a 25% state construction grant is automatically eligible to receive a 55% Federal construction grant, providing the state has water quality standards approved by the Federal government, and the proposed facilities are of a regional nature. These two requirements are met in New Jersey.)

- (b) Grant funds may be used for sewage treatment plants, including the various devices used in the treatment of liquid sewage or industrial wastes which includes the necessary interceptor sewers, outfall sewers, pumping, power, and other equipment, and their appurtenances.

(3) Economic Development Administration (EDA) - U. S.  
Department of Commerce

- (a) Grant assistance is available for up to 50% of the total project cost for public works, including water and sewage systems, where such public

works would be located in Federally designated redevelopment areas.

(b) Proposed projects must contribute to long-term employment opportunities and economic growth.

(4) Division of Clean Air and Water, New Jersey Department of Health

(a) Grant assistance is available for feasibility studies.

(b) Loans funds may be used to cover actual engineering design. The loans are interest free if repaid within three years after construction is funded.

(c) Use of grants and loans include assistance for the design and construction of new sewerage collection and treatment facilities.

(d) Under the terms of the Federal statute of the Federal Water Pollution Control Act (FWPCA), local government is eligible for 30% of the cost of construction of sewage treatment plants and trunklines. This eligibility can be increased to 55% overall if the state provides the legal authority and the money to fund 25% of the cost of all such projects. The State of New Jersey does have enabling legislation in the "State Public Sanitary Sewerage Facilities Assistance Act of 1965".

## B. SUMMARY OF IMPROVEMENT PROGRAM

### 1. Basic Recommendations and Priorities

Currently there are about 12 different public and private water supply systems in Essex County which have constructed water collection and/or distribution facilities. Sanitary sewerage systems in the County are largely under the jurisdiction of two major systems: the Passaic Valley Sewerage Commission (PVSC) and the Joint Meeting (at Elizabeth), with the Borough of Caldwell and independent municipal systems comprising lesser systems. Basically, the major need for improvements in these systems consists of the installation of additional sanitary sewers and treatment plants and the expansion and extension of water service.

It is recommended that each municipality, as a part of its capital budget and capital improvement programming, annually update its programs to include the water and sewer facility needs. Some municipalities in the County prepare an annual capital budget program while others do not.

Logically, it would be the function of each water and sewer agency to internally develop a system which will provide a program for the improvement of water and sewer services, and submit reports periodically to the County Planning Board.

Pending the establishment of such a program, it is recommended that the following priorities be observed, as shown on Tables 21 and 22, subject to the approval of the local authorities involved. Since most of the programs are to be implemented in the next five to ten years, it was decided not to assign consecutive numerical priorities in this initial County-wide water and sewer planning program. However, the estimated year of need for each project was assigned on the attached capital improvement schedule.

## 2. Summary of Program Cost

Water improvement programs within Essex County for fiscal years 1969-1975 will cost \$6,020,500. The basis for this figure is the estimated development cost submitted to Planners Associates, Inc. by the municipalities of Belleville, Bloomfield, Cedar Grove, Glen Ridge, Livingston, Newark, South Orange and Verona.

Expenditures for sanitary sewer improvement programs in the period 1969-1975 are expected to total \$44,890,500. This figure was obtained by an analysis of the capital budgets for the following municipalities or authorities: Bloomfield, Caldwell, Cedar Grove, East Orange, Fairfield, Elizabeth Joint Meeting Sewerage Commission, Livingston, Newark, Passaic Valley Sewerage Commission, South Orange and Verona. This

TABLE 21

WATER IMPROVEMENT PROGRAMS (CHRONOLOGICAL ORDER)

<u>Municipality or Authority</u>	<u>Estimated Total Cost</u>	<u>Federal Grant in Aid</u>	<u>Federal Funding Agency</u>	<u>Project Type</u>	<u>Project Descriptions and Comments</u>	<u>Date Certified By State</u>	<u>Year(s) of Need</u>
Bloomfield	110,000	Not known	TBD**	Water	Improvements for Water System	--	1969
Belleville	213,500	Not known	TBD	Water	Water Mains and Laterals	--	1969-1970
Newark	3,096,000	Not known	TBD	Water	Water Supply	--	1969-1973
Livingston	1,111,000	Not known	TBD	Water	Improvements for water storage, supply transmis- sion & other un- specified improve- ments.	--	1969-1975
South Orange	55,000	Not known	TBD	Water	Round Valley Interconnection.	--	1970
South Orange	15,000	Not known	TBD	Water	To Water Capi- tal Improvement Fund Reserve.	--	1970
Glen Ridge	50,000	Not known	TBD	Water	Water Distri- bution System.	--	1970
Verona	240,000	Not known	TBD	Water	Construction of Water Tank & High Service Water System.	--	1970
Cedar Grove	1,130,000	Not known	TBD	Water	Improvements for Water System (Phase II, III & IV-Phase I al- ready begun).	--	1971-1974

TABLE 22

SANITARY SEWER IMPROVEMENT PROGRAMS (CHRONOLOGICAL ORDER)

<u>Municipality or Authority</u>	<u>Estimated Total Cost</u>	<u>Federal Grant in Aid</u>	<u>Federal Funding Agency</u>	<u>Project Type</u>	<u>Project Descriptions and Comments</u>	<u>Date Certified By State</u>	<u>Year(s) of Need</u>
Bloomfield	500,000	250,000	HUD	Sewer	Sewerage collection Systems Improvements (Proj.-WS-NJ-220).	4/28/69	1969
Bloomfield	15,000	7,500	HUD	Sewer	Preliminary Sewer Advance Planning (Proj. WS-NJ-218).	5/12/69	1969
South Orange	22,000	Not known	TBD**	Sewer	Share of Purchase of site-new secondary treatment plant. (Total cost of Elizabeth Joint Meeting Plant - \$30 million.)	--	1969
Fairfield	1,808,000	702,500	HUD	Sewer	Construction of partial Sanitary Sewerage System.	3/ 5/69	1969-1970
Caldwell	204,000	102,370	FWPCA	Sewer	Additional Alteration to existing waste treatment plant.	8/25/69	1969-1970
Fairfield	250,000	116,820	FWPCA	Sewer	Alteration to existing water pollution control plant.	7/15/68	1969-1970

\*\*TBD -- To be determined.



SANITARY SEWER IMPROVEMENT PROGRAMS (CHRONOLOGICAL ORDER)  
(cont'd)

<u>Municipality or Authority</u>	<u>Estimated Total Cost</u>	<u>Federal Grant in Aid</u>	<u>Federal Funding Agency</u>	<u>Project Type</u>	<u>Project Descriptions and Comments</u>	<u>Date Certified By State</u>	<u>Year (s) of Need</u>
Cedar Grove	300,000	Not known	TBD	Sewer	Sewerage treatment plant expansion.	--	1969-1970
Livingston	2,259,000	Not known	TBD	Sewer	Sanitary Sewers & Sewerage treatment plant improvements.	--	1969-1970
Newark	8,492,000	Not known	TBD	Sewer	Sewers	--	1969-1973***
Joint Meeting	30,000,000	15,000,000	FWPCA	Sewer	Construction of a secondary sewerage treatment plant in Elizabeth, costs will be shared in Essex Co. by municipalities of Newark, Irvington, S. Orange, E. Orange, Orange, Maplewood, Millburn & W. Orange.	--	1970
Verona	7,500	Not known	TBD	Sewer	Sanitary Sewer.	--	1970
East Orange	783,000	Not known	TBD	Sewer	Sanitary Sewer Improvements.	--	1970-1975
Nutley	250,000	Not known	TBD	Sewer	Trunk Sewer Improvement and/or modification.	--	1970-1975

\*\*\*Includes both Sanitary and Storm Sewers.

summary figure does not include the cost of the Passaic Valley Sewerage Commission's proposed secondary treatment plant which would be located in Newark.

TABLE 23

SUMMARY OF COST FIGURES FOR IMPROVEMENT PROGRAMS

<u>Type of Improvement</u>	<u>Total Estimated Cost</u>
Water	\$ 6,020,500
Sanitary Sewer	44,890,500

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ESSEX COUNTY, NEW JERSEY

DEPARTMENT OF PLANNING, ECONOMIC DEVELOPMENT AND CONSERVATION

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ESSEX COUNTY, NEW JERSEY

DEPARTMENT OF PLANNING, ECONOMIC DEVELOPMENT AND CONSERVATION

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