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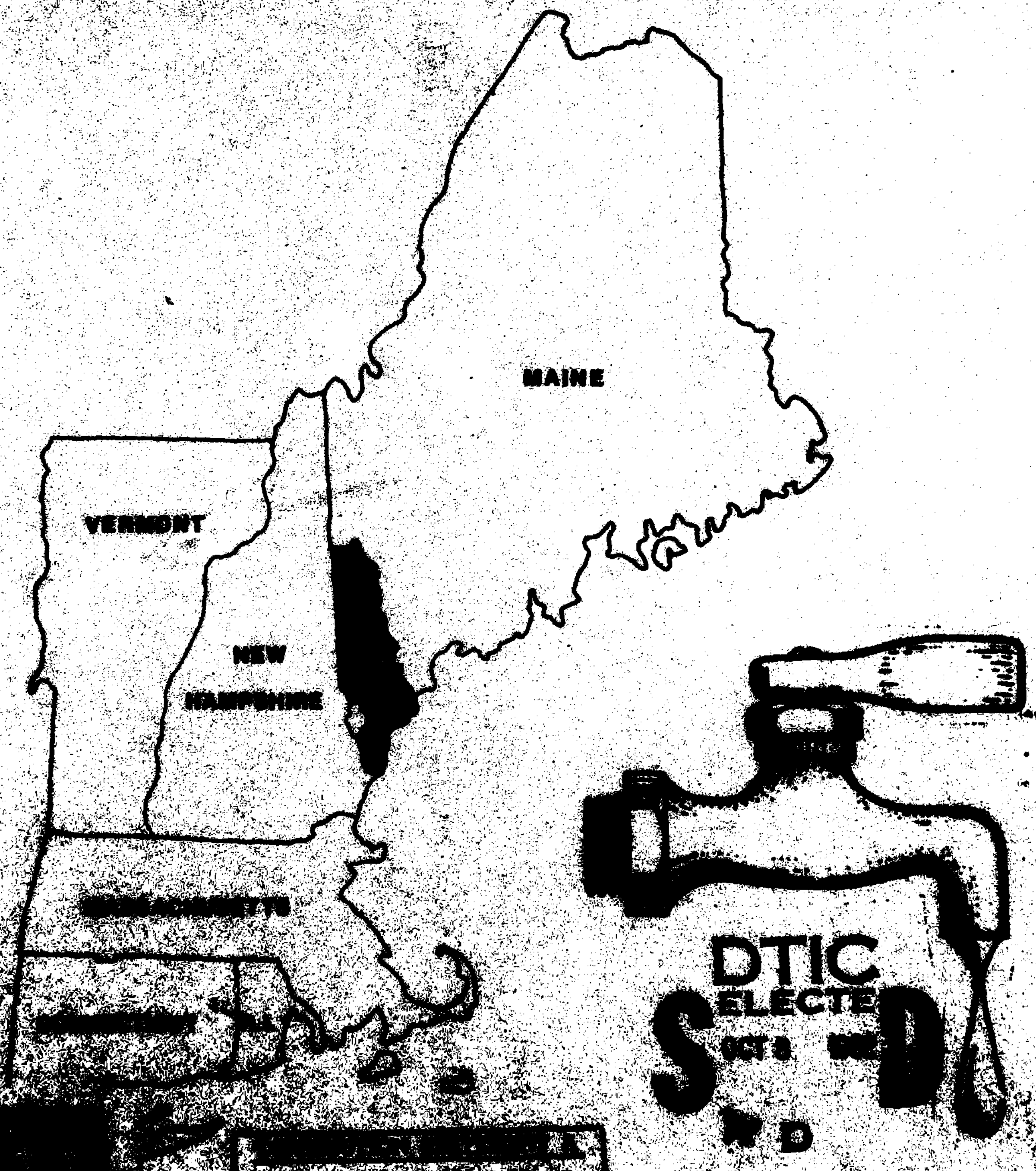
WATER SUPPLY STUDY

Saco and Southern Maine Coastal River Basins

STATE OF MAINE



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Water shortage
Water utilization
Ground water
Ground water availability

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The goal of the report is to determine existing and future water supply versus demand outlook for the Maine communities in the Saco and Southern Maine Coastal River Basins. Several very serious water supply deficiencies are indicated in this report.

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Sverdrup

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Engineers
Architects
Planners

March 22, 1982

Mr. Joseph L. Ignazio
Planning Division
U. S. Army Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

ATTENTION: Basin Management Branch

Dear Mr. Ignazio:

SUBJECT: Contract No. DACW33-80-C-0085
Saco and Southern Maine Coastal
River Basins Water Supply Study
Work Order No. 3

We are pleased to submit the final report, Water Supply Study - Saco and Southern Maine Coastal River Basins, in accordance with the above mentioned contract. It was a pleasure working with Paul Pronovost and the Corps of Engineers and their cooperation is greatly appreciated. We look forward to being of further service to the Corps.

Very truly yours,

SVERDRUP & PARCEL AND ASSOCIATES, INC.

Joseph G. Anthony, II

Joseph G. Anthony, II
Project Engineer

Enclosure

ACKNOWLEDGEMENTS

This Water Supply Study was prepared under the direction and with the involvement of Department of the Army, New England Division, Corps of Engineers. Assistance in the development of this study and the assembling of the report was provided by many government agencies, private organizations and individuals who include: The State of Maine's Department of Human Services, Department of Conservation, Planning Office and Public Utility Commission; The United States Department of The Interior-Geological Survey; The Southern Maine Regional Planning Commission and the various water companies and districts. The cooperation and participation of all is hereby gratefully aknowledged. Special appreciation is extended to the following individuals whose cooperation and willingness to help greatly facilitated the preparation of this study: Paul Pronovost of the Corps of Engineers, Brian Chernack of the SMRPC and Gerald Bates and Andrew Tolman of the State of Maine. Various reports have played an important role in the completion of this document and are footnoted throughout the text and summarized in the bibliography.

Staff members of Sverdrup & Parcel and Associates, Inc. of Boston who have contributed to the development of this report include the following: H. L. Magee, management supervisor; Manuel Salgado, project engineer; Joseph Anthony, engineer; and Philip Runyan, graphics and editor. This staff appreciates the opportunity to prepare this report and looks forward to being of further service to the Corps.

I PREFATORY MATERIAL

A. TABLE OF CONTENTS

B. LIST OF MAPS AND TABLES

II INTRODUCTION

A. GENERAL DISCUSSION

The Saco and Southern Maine Coastal River Basins comprise a total of 39 Maine communities and 19 New Hampshire communities. This report will examine only the Maine communities within the basins. The water supply in the Saco River and Coastal River basins is presently able to meet the water demands of all its residents and industries. However, the absence of uniform information on existing and projected water use and potential supply sources has been a barrier to effective water supply planning in the basins.

The public water supply systems in the study area serve about 71 percent of the basins' 1980 population of 136,410. This results in an average daily use of about 12.5 million gallons per day (MGD), of which about 4.4 MGD is used by industry. The portion of the basin populace not served by public water supply systems, predominantly in rural areas, depends on groundwater supplied from private wells. Nearly all industries in both the Biddeford-Saco area and in Sanford rely on public water systems. Many industries in other localities within the study area rely on private supplies.

The attractive environment for recreational development throughout the basins and the coastal belt's favorable conditions for urban and industrial development are expected to generate increased demands for water supply in the basins. The peak demand of several study area towns is now approaching the safe yield of their supply system. A study of the water supply needs of the coastal area found that water supply problems are developing within the region and may require region-wide solutions.* An example of this type of solution is the recent Kennebunk, Kennebunkport and Wells (KKW) Water District's tie-in with the Biddeford and Saco Water Company (supplied by the Saco River) to augment its Branch Brook water supply.

The public water supply situation in the study area warrants an immediate comprehensive analysis of both the short-term and long-term demand/supply problems along with the identification of sources of regional supplies for coastal towns.

B. PURPOSE AND SCOPE

The goal of this report is to determine the existing and future water supply versus demand outlook for the Maine communities in the Saco and Southern Maine Coastal River Basins. In keeping with this goal, this study performs the following tasks:

1. Determine current and future populations expected to be served by public water supply systems through the year 2030.

2. Analyze both regional and national trends in per capita water consumption through the 50 year study period.

3. Develop criteria for projecting peak seasonal demands for public water due to the influx of seasonal users.

4. Develop criteria for projecting maximum daily peak demands for public water.

* Maine State Planning Office, 1978

5. Project industrial and commercial water demands for the study period.

6. Define a program of water conservation techniques and project their impacts on per capita consumption over the study period.

7. Using the data developed above, project a total demand throughout the study period for both alternatives (with and without concerted conservation).

8. Document present supply limitations considering the constraints of the water source, treatment facilities and distribution system.

9. Project a trend of impact on the study area's supply sources due to water quality considerations.

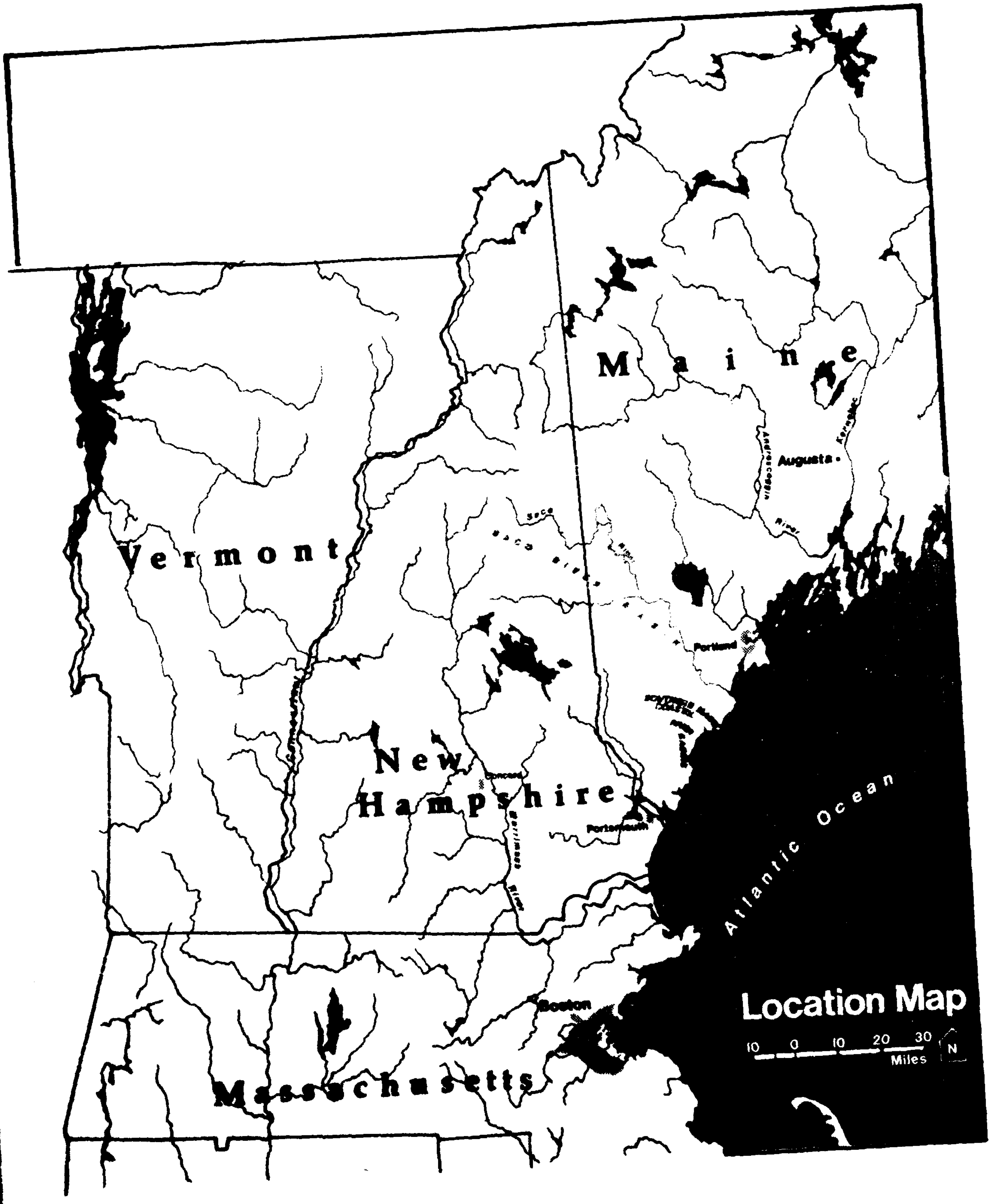
10. Using the data developed above, determine the timing and extent of shortages/surpluses of public water supply for each of the communities in the study area.

11. Discuss the relative location of excess capacity with respect to any of these shortages.

The results of the above tasks will be organized by each water supplier and then the data for each supplier will be broken down for each town within the supplier's district. This will allow a town to see its own public water demand throughout the study period, independent of other towns within its supplier's district. The town will then be able to evaluate the supplier's capability to serve it and all other towns within the district.

C. STUDY AREA DESCRIPTION

1. Geographic Characteristics - The Saco River Basin comprises an area of approximately 1,697 square miles, with 827 square miles lying in


Maine
Augusta
Portland
Vermont
New Hampshire
Concord
Portsmouth
Massachusetts
Boston
Atlantic Ocean
Location Map
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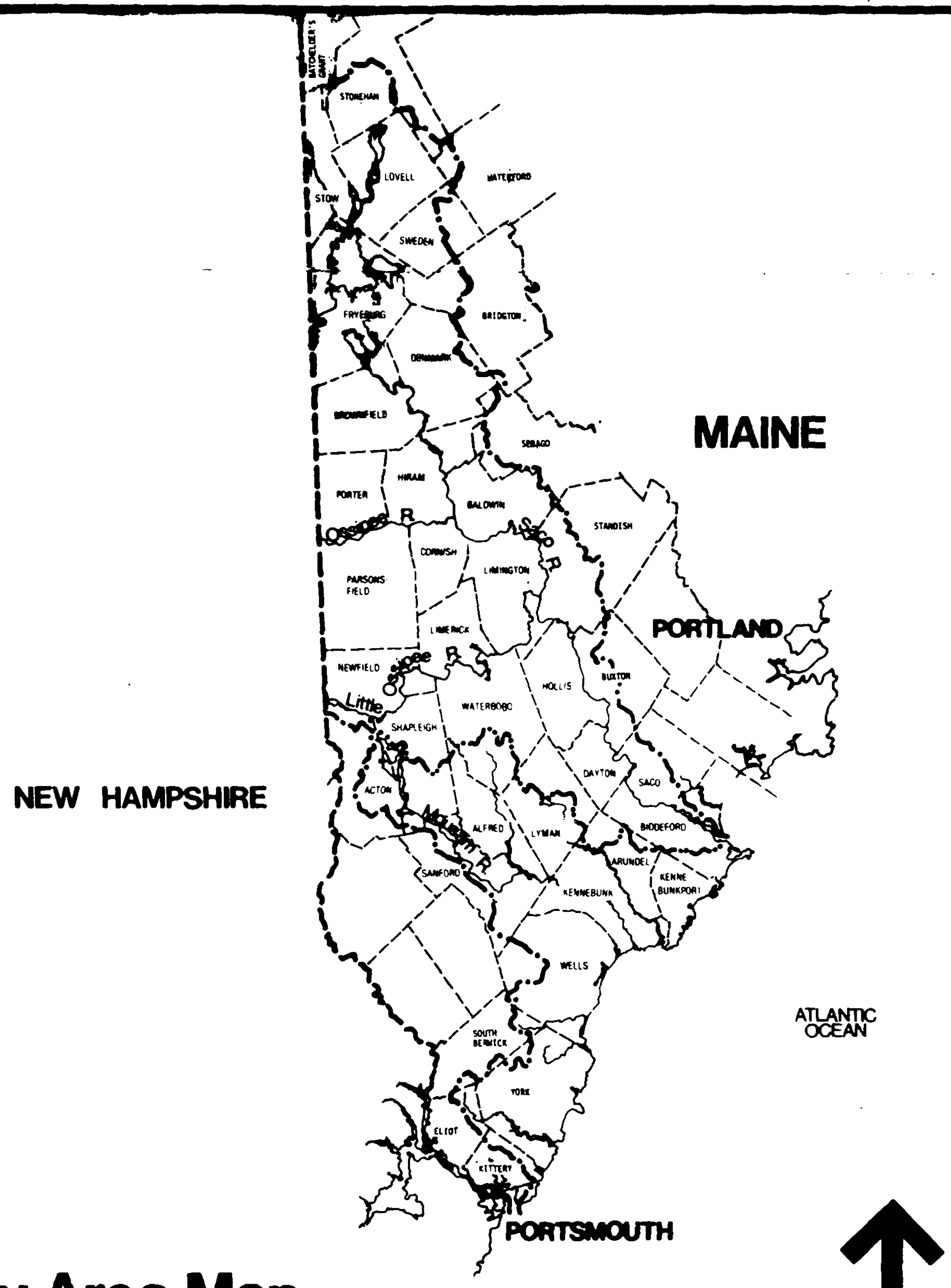

Study Area Map
Saco River & Maine South Coastal River Basins

0 miles 5 10

BASE MAP SOURCE:
WATER RESOURCES
PROGRAM, MAINE
STATE PLANNING
OFFICE, 1:500,000.

Maine and 870 square miles in New Hampshire. The Saco River originates in the White Mountains near Crawford Notch, New Hampshire and ends about 75 miles away near Biddeford, Maine. Major tributaries of the Saco River are: the Swift River, with a drainage area of 100 square miles; the Ossipee river, with a drainage area of 455 square miles and the Little Ossipee River, with a drainage area of 187 square miles.

The Southern Maine Coastal River Basins have a total area of 370 square miles. The largest stream in the basins, with a drainage area of 119 square miles, is the Mousam River, which flows from Mousam Lake in Shapleigh, Maine southeasterly to its mouth in Kennebunkport. The Kennebunk River is the next largest stream, with a drainage area of 56 square miles. The Kennebunk River flows from Kennebunk Lake, southeastward to its mouth at Kennebunkport. The other major coastal streams are the York and Ogonquit Rivers.

Average annual precipitation in the Saco/Southern Maine Coastal River basins is 45 inches with 60 inches recorded in the mountainous inland regions and 42 inches along the coast. The average annual runoff of the upper basins is 31 inches (approximately 50 percent of annual precipitation in the area). The average annual runoff for the central basin is 26 inches (57 percent) and that of the coastal belt is 21 inches (50 percent). The remaining precipitation infiltrates the soil to become part of the groundwater resource or is returned to the atmosphere by direct evaporation or by evapotranspiration from vegetation. Average annual flow from the Saco River Basin is estimated to be about 2,520 million gallons per day (MGD) or about 1.5 MGD/square mile.

Extensive groundwater resources are present in large glacial deposits throughout the basins. Although a very significant portion of the study area's public water supply relies on groundwater resources, little is known about the extent, location, and potential yield of the basins' groundwater deposits. Groundwater investigations are currently being carried out by the U. S. Geological Survey (USGS) and the Maine Geological Survey to provide this information. The latter has preliminary findings that indicate good sand and gravel aquifer beds in central, northern, and inland sections of the study area. However, in the southern and coastal sections subsurface silts and clay layers are encountered that reduce the yields of these aquifer beds and also cause turbidity problems. These same preliminary findings have recently identified a buried valley of sand and gravel deposits characterized by good yields of good quality water. This valley extends from the west-central edge of Standish south almost to Wells. The final report of this major aquifer study is due to be completed in mid-1982.

2. Population in the basins as a whole has increased substantially over the past twenty years, making the area the fastest growing region in Maine. Of the total population in the basins (136,410 in 1980), 45 percent resides in the four major industrial communities (Biddeford, Saco, Sanford, and Kittery). The largest community is Biddeford with a 1980 population of 19,488. The smallest is Sweden with a 1980 population of 158. The coastal communities and those along the Interstate 95 corridor have shown consistent growth increases over the last 20 years. There have also been significant spurts of growth in some of the smaller inland towns such as

Limington, Lyman, Waterboro, Shapleigh, etc. This trend will continue as more people migrate from the urban areas to the northern, more rural communities and as additional public services are provided. A significant factor in the basins' population figures is the annual influx of seasonal residents. Southern Maine's sandy beaches along the coast attract a summer population as much as five times the size of the winter population.*

3. Economy - The manufacturing industry is the leading source of employment in the basins, with Saco, Biddeford, and Sanford acting as centers of industrial activity. In the past twenty years, the manufacturing industry in the lower Saco and Coastal River Basins has been steadily increasing at a rate that has made the area one of the fastest growing employment areas in the State of Maine. From an earlier dependence on non-durable goods (consumed during use), industries have diversified their primary products to include shoes, textiles, wooden products, electronic and automotive parts, and machine tool products. The growth of total employment in this area has, however, declined relative to other occupations.

The wholesale and retail trade industry is the second largest employer. Tourism plays a major role in this industry, as the basins are rich in recreational resources that have long attracted visitors from all over. The Saco River Basin in particular depends upon the recreational use of forest and water resources to support the area.

* Public Affairs Research Center of Bowdoin College, 1970

Educational and financial services have also shown substantial employment increases in recent years. On the other hand, agriculture, forestry and fisheries, once an important part of the basins' economy, have steadily declined as the manufacturing and trade industries increased.

III PRESENT WATER SITUATION

This documentation of 1980 supply limitations and demands for public water consumption is based on the latest information available from the following groups or agencies: Division of Health Engineering for the State of Maine; the various Water Districts or Companies; the Southern Maine Regional Planning Commission; the New England River Basins Commission; the Maine Geological Survey; and the various water supply reports listed in the bibliography. The information is presented separately for each supplier and each town in the supplier's district, thus enabling a town or supplier to see its own public water demands and its capability to meet those demands. A small portion of Biddeford is served by the K.K.W. Water District as is a small portion of York by the Kittery Water District. These portions of demands are relatively small and have been added to each town's principal supplier for simplicity.

The towns in the study area that presently have no public water service will be discussed later under Section VI, Supply Versus Demand (1980-2030).

A. 1980 SUPPLY LIMITATIONS

In Tables I-A and I-B, each supplier's capability to produce potable public water is shown, as are the towns served by each supplier. The most current information available on the safe yield and type of the supply source(s) along with plant treatment and distribution capacities is also indicated. Any limitations on supply due to water quality are addressed later in this section under III-C, Supply Versus Demand-1980.

TABLE I-A PRESENT WATER SITUATION - SOUTHERN MAINE COASTAL

SUPPLIER	TOWN(S)	SOURCE		PLANT CAPACI	
		TYPE	SAFE YIELD (MGD)	TREATMENT	PRIM INT
KITTERY WATER DISTRICT	KITTERY ELIOT	SURFACE	3.7	5.0	8.
YORK WATER DISTRICT	YORK	SURFACE	2.7	-	2.
SOUTH BERWICK WATER DISTRICT	SOUTH BERWICK	GROUNDWATER	.27	3.5	3
KENNEBUNK, KENNEBUNKPORT, AND WELLS WATER DISTRICT	ARUNDEL KENNEBUNK KENNEBUNKPORT WELLS	SURFACE	3.0	3.5	3
SANFORD WATER DISTRICT	SANFORD	GROUNDWATER	3.0	-	2
ALFRED WATER COMPANY	ALFRED	GROUNDWATER	.28	-	
TABLE I-A SUBTOTAL TABLE I-B SUBTOTAL					
STUDY AREA TOTAL					

HERN MAINE COASTAL RIVER BASIN

PLANT CAPACITY (MGD)			PUBLIC WATER DEMANDS		
TREATMENT	PRIMARY DISTRIBUTION				
	INTAKE	DISCHARGE	AVG. DAILY	PEAK SEASONAL	MAX. DAILY
5.0	8.0	8.0	3.643	3.721	5.027
-	2.5	2.5	1.354	1.912	2.627
3.5	3.5	3.5	0.215	-	.387
3.5	3.0	3.0	1.956	3.333	4.261
-	2.11	2.11	2.108	-	2.677
-	.28	.28	0.037	-	0.043
			9.313	8.966	15.022
			4.802	5.684	8.988
			14.115	14.650	24.010

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TABLE I-A

TABLE I-B PRESENT WATER SITUATION - SACO RIVER BA

SUPPLIER	TOWN(S)	SOURCE		PLANT CAPACI	
		TYPE	SAFE YIELD (MGD)	TREATMENT	PRI IN
BIDDEFORD AND SACO WATER COMPANY	BIDDEFORD SACO	SURFACE WATER	20.0+	16.0	20.
PORTLAND WATER DISTRICT	STANDISH	SURFACE AND GROUNDWATER	2.2+	-	2.2
LIMERICK WATER DISTRICT	LIMERICK	GROUNDWATER	.432	-	.
PINE SPRINGS DEVELOPMENT CORPORATION	SHAPLEIGH	GROUNDWATER	EST. .070	-	ES .
CORNISH WATER COMPANY	CORNISH	GROUNDWATER	.11	-	.1
MAINE WATER COMPANY-KEZAR FALLS DIVISION	HIRAM PORTER PARSONSFIELD	GROUNDWATER	.72	-	.3
BRIDGTON WATER DISTRICT	BRIDGTON	SURFACE WATER	.648+	-	.6
FRYEBURG WATER DISTRICT	FRYEBURG	GROUNDWATER	.30	EST. .45	.8

- SACO RIVER BASIN

PLANT CAPACITY (MGD)			PUBLIC WATER DEMANDS		
TREATMENT	PRIMARY DISTRIBUTION				
	INTAKE	DISCHARGE	AVG. DAILY	PEAK SEASONAL	MAX. DAILY
16.0	20.0	20.0	3.896	5.684	7.637
-	2.2	2.2	0.305	-	0.459
-	.432	.432	0.040	-	0.060
-	EST. .070	EST. .070	0.016	-	0.024
-	.11	.11	0.050	-	0.059
-	.36	.36	0.071	-	0.110
-	.648	.648	0.295	-	0.444
EST. .45	.86	.86	0.129	-	0.195

TABLE I-B

B. 1980 PUBLIC WATER CONSUMPTION

The average daily consumption rates or demands for 1980 are shown as reported by each supplier in Tables I-A and I-B. The rates represent the total public water demand which comprises residential, commercial, industrial and public components of demand. These components are discussed and shown later under Water Demand Projection (Section V). Factors have been developed to be applied to these average daily demand figures to produce both peak seasonal and maximum daily demands as discussed below.

The peak seasonal demands reflect the increase in water consumption which occurs due to the seasonal population influxes during the summer months in the Southern Maine coastal areas. Peak seasonal factors have been developed by dividing the 1980 seasonal average daily consumption rates by the 1980 annual average daily consumption rates and have been applied only to the average daily demands of residential and commercial users. The seasonal influxes are not expected to increase to any degree of significance over the next 50 years. Very little shore frontage is currently available for development and therefore it is likely that any increase in the number of seasonal dwellings would be offset by conversion of seasonal units (or area) to year-round use.* Hence the seasonal factors are assumed to remain constant throughout the 50 year study period and have been applied to only those study area towns with significant seasonal population influxes.

* Letter from SMRPC to Army Corps of Engineers dated October 21, 1980

The maximum daily peak demands usually occur in the summer months due to such activities as gardening, lawn watering, car washing, bathing and cooling. Maximum daily peak factors have been developed from information gathered from State utility surveys and local water supply studies. Where the appropriate information was not available, a generally accepted design factor of 1.5 was used. These factors have been applied to all four components of average daily demands and include seasonal factors for towns having significant seasonal influxes. It is assumed that these maximum daily peak factors will remain constant throughout the study period due to the expected insignificant changes in the nature of land use, development and climate.

The 1980 average daily, peak seasonal and maximum daily peak demands which have been generated are shown in Tables I-A and I-B for each public water supplier. The factors that produced these demands are shown in Table II below.

TABLE II

1980 PUBLIC WATER DEMAND FACTORS

Supplier Towns	Peak Seasonal Demand Factor	Max. Daily Demand Demand Factor
Kittery Water District	1.08	1.38
York Water District	1.45	1.94
South Berwick Water District	-	1.80
Kennebunk, Kennebunkport and Wells Water District	1.74	2.23
Sanford Water District	-	1.27
Alfred Water District	-	1.17

TABLE II (Continued)

Towns	Peak Seasonal Demand Factor	Max. Daily Demand Demand Factor
Biddeford and Saco Water Company	1.60	1.96
Portland Water District	-	1.5
Limerick Water District	-	1.5
Pine Springs Development Corp.	-	1.5
Cornish Water Company	-	1.17
Maine Water Company - Kezar Falls Division	-	1.5
Bridgton Water District	-	1.5
Fryeburg Water District	-	1.5

Notes:
1. Each factor is to be applied to the average daily demands.
2. Peak seasonal demand factors are applied to residential and commercial components of demand only.
3. Maximum daily demand factors are applied to all four (residential, commercial, industrial and public) components of demand.

C. SUPPLY VERSUS DEMAND-1980

This discussion of the present water situation (1980) is presented by supplier and compares the current average daily, peak seasonal (where applicable) and maximum daily demands to each supplier's ability to meet those demands (Tables I-A and I-B). Consideration is given to the water source safe yield and its quality in addition to treatment plant and primary distribution line capacities.

1. Kittery Water District

This district's current major concern is to find a new source, or sources, that will augment its ability to meet its demand. The safe yield of the district's current surface supply sources is 3.7 MGD, which is sufficient to meet the 1980 average daily demand of 3.6 MGD. The maximum day peak demand of 5.0 MGD exceeds this safe yield, but in most cases the overdraft can be absorbed by use of equalization storage facilities and by pumping in off-peak hours. The use of emergency restrictions can also be implemented. The maximum day peak demands are also approaching the plant's capacity for treatment.

2. York Water District

The current safe yield, 2.5 MGD, of the district's supply source, Chases Pond, is a major concern. The current maximum day peak demand, which can extend over a relatively long period, is right at the source's safe yield. The distribution system is capable of handling all current demands, and improvements are underway to increase the efficiency of the system. Such improvements include the burying of transmission mains to keep them from freezing and the looping of distribution mains to maintain good pressures and water quality. The quality of water is good, but occasionally requires treatment for color and algae.

3. South Berwick Water District

This district's average daily demand of 0.215 MGD is rapidly approaching its supply source's safe yield of 0.27 MGD, while the maximum day peak demand of 0.39 MGD is already well in excess of this safe yield. The water from the district's main wells requires no treatment; an additional 0.15 MGD requiring treatment for high iron content is available from other wells. The district lacks the funds to construct other shallow wells, or to construct transmission lines from ponds capable of furnishing the amount of water required. The distribution system is reportedly in good condition with pressures ranging between 80 psi and 120 psi. The district uses what funds it can for main replacement. The storage reservoir provides a normal 3-day supply which helps the district equalize its average and peak demands.

4. Kennebunk, Kennebunkport and Wells Water District

This district's situation is that its current peak seasonal demand of 3.3 MGD exceeds the 3.0 MGD safe yield of the its main source of supply, Branch Brook. This overdraft is likely to occur for a month or two each year. The capacities of the treatment plant and the primary distribution system, 3.5 MGD and 3.0 MGD respectively, are also overtaxed by a maximum day peak demand of 4.3 MGD.

Presently the K.K.W. has met these deficits via a contract with the Biddeford and Saco Water Company to purchase up to 1 MGD of treated water.

Development is increasing in the vicinity of Branch Brook, where subdivisions are serviced by individual septic systems. Color problems are worsening, and chlorination dosages are being increased due to the state's requirement for maintaining chlorine residuals within the distribution system.

5. Sanford Water District

This district at the present time has five gravel packed wells with a total safe yield of 3.0 MGD. The sustainable capacity of the primary distribution system is 2.11 MGD. Peak demand rose above 3.0 MGD in 1975 but has dropped to a current level of 2.68 MGD, due mainly to a decrease in local industrial consumption. The district is able to pump

3.5 MGD for a few days at a time, but eventually, at that rate, reservoirs are overdrawn. During these periods of excessive demand water can be drawn from Littlefield Pond, although it must be heavily treated because of the taste of algae.

The district owns very little land around its well fields which makes it vulnerable to groundwater pollution. Its wells are tapped into deep sands, which have very good transmissibilities enabling any form of pollutants to move rather quickly to the wells.

6. Alfred Water Company

The town's supply source, a dug well with a safe yield of 0.28 MGD, is more than capable of meeting its current average daily demand of 0.037 MGD. The capacity of the primary distribution line is also more than adequate. The current water quality is good, requiring only chlorination.

7. Biddeford and Saco Water Company

This company's source of supply, the Saco River, has a more than sufficient capacity to meet its present needs. The present average daily usage is 3.9 MGD with a maximum day peak demand of 7.6 MGD. The treatment plant is capable of treating 16.0 MGD. The existing primary distribution system, consisting of an intake from the river and a discharge from the plant, is capable of handling 20.0 MGD. The company is now delivering up to 1.0 MGD into the K.K.W. Water District system, and is capable of delivering an additional 5.0 MGD.

There are no present water quality problems, although the water receives extensive treatment.

8. Portland Water District

The Portland Water District is supplying Standish and Sebago Lake Village from Sebago Lake, which is an almost unlimited source of supply. The primary distribution line from the lake can handle up to 2.16 MGD.

The village of Steep Falls in the town of Standish is being supplied by a well-point system penetrating a sand and gravel aquifer and which has a safe yield of 0.288 MGD. The primary distribution system from the wells also has a carrying capacity of 0.288 MGD.

The combined average daily demand for the district in 1980 was 0.305 MGD, well within the district's capabilities. The existing supplies require screening, chlorination, and pH adjustment. The district does not have a treatment plant; screening takes place at the intake, and chlorination and pH adjustment at the pumping station.

9. Limerick Water District

The Limerick Water District supplies only the town of Limerick, and uses dug and drilled wells as its main source of supply. The 1980 average daily demand was 0.040 MGD, while the safe yield of wells is 0.432 MGD. The intake and discharge lines also have a carrying capacity of 0.432 MGD, which is more than sufficient to meet existing demands. Water quality is considered good, although the nitrate concentration is slightly higher than the legal limit. The primary source of this nitrate concentration apparently is due to houses upstream of the present source of supply. The only form of treatment now being used is chlorination.

10. Pine Springs Development Corporation

The corporation supplies the town of Shapleigh which has an average daily demand of 0.016 MGD. Its main source of supply is a spring-fed well with an estimated safe yield of 0.070 MGD. Intake and discharge lines from the well to the pumping station and from the station to the distribution system have a carrying capacity estimated at 0.070 MGD. The primary distribution system and the supply source are both sufficient to meet all current demands.

The water is occasionally treated in the spring of the year when the rising water table, brought about by rains and melting snow, causes septic systems to overflow, thereby allowing sewage to permeate the groundwater. When this occurs, the water supply is chlorinated at the pumping station.

11. Cornish Water Company

The Cornish Water Company supplies the town of Cornish from a spring-fed infiltration pipe which has a safe yield of 0.11 MGD. Present average daily demand is 0.05 MGD, well below the source's safe yield. The primary distribution lines, with a carrying capacity of 0.11 MGD, are also adequate. The water quality is good, requiring only chlorination.

12. Maine Water Company - Kezar Falls Division

The Maine Water Company supplies the towns of Hiram, Parsonsfield, and Porter, which have a combined 1980 average daily demand of 0.071 MGD. The company's main source of supply is a gravel-packed well and two auxiliary wells, with a combined safe yield of 0.72 MGD. The carrying capacity of the existing intake and discharge lines is 0.36 MGD, which is more than sufficient to meet all current needs. Treatment is soda ash for pH adjustment; otherwise the water is of good quality.

13. Bridgton Water District

The Bridgton Water District supplies the town of Bridgton from Highland Lake, which is a relatively unlimited source of supply. The average daily demand in 1980 was 0.295 MGD. The primary distribution lines can carry 0.648 MGD which is more than sufficient to handle all current demands. The water quality is good, and treatment consists of chlorination and fluoridation only.

14. Fryeburg Water Company

This company's supply sources are shallow wells which have a total safe yield of 0.30 MGD. This currently satisfies the average daily demand of 0.129 MGD. The primary distribution system is designed to carry 0.86 MGD and the treatment plant can handle 0.45 MGD, both of which are sufficient to meet all current demands. Water quality is good, with treatment consisting of chlorination and fluoridation only.

IV POPULATION PROJECTION MODELING

A. U.S.D.A. COOPERATIVE STUDY - DEMOGRAPHIC AND ECONOMIC PROJECTIONS

This projection model provided total community population and household numbers for this report through the 50 year study period. These numbers were used to develop criteria for determining the number of future public water consumers, as discussed later in this section. The model started with July 1, 1975 and made projections of demographic and economic conditions at five-year intervals through the year 2030. Demographic variables included such items as population, births, deaths, migration, households, labor force, etc., while economic projections included employment, earnings, and personal income. Individual equations were developed for each community based on historical population growth with somewhat more weight being placed on growth during the last decade.

B. PROJECTION OF PUBLIC WATER CONSUMERS

The Department of Human Services for the State of Maine provided the most current information available on the actual number of 1980 public water consumers in each water district. In cases where more than one town is being served by the same district, these district consumer populations were broken down into their respective towns by the same proportions shown on the Water Utility Surveys. These surveys are kept by the State Department of Health and Welfare and are reported periodically by each water district or company.

With the number of 1980 public water consumers for each town known, projection factors were developed to determine the increase in the number of public water consumers over the next 50 years. Assuming that the growth in sewer services correlates directly to water service growth, projection factors from the southern Maine Section 208 Areawide Wastewater Management study were used to develop the public water service projection factors.

For towns in this water supply study which were not addressed in the "208" study, certain "208" towns with similar populations, population growths, degree of public water service, and geographic locations were used as projection models for consumer growth factors.

Communities with no public water supply sources have been examined to see if a future public water supply system would be warranted. Future development of new public water systems will be highly dependent on available funds. The availability of these funds is unpredictable and was not used as criteria for such development. The development of new public water systems was related to household densities by observing the relationships of household densities to the extent of public water system development for other towns in the study area. Average household densities of each community were used.

The current and projected populations, from the Saco River Basin U.S.D.A. Cooperative Study, and the projected public water consumer populations are shown in Tables III-A and III-B for each study-area town, by decade through the year 2030.

It is shown in Table III-B that the towns of Buxton and Hollis, which currently are not served by public water, will require public water service at some time during the study period. This, as mentioned previously, was based on their household densities as compared to other similar towns in the study area which currently have public water.

Potential supply sources for these towns will be discussed later under Supply vs. Demand (1980-2030), Chapter VI.

TABLE III-A POPULATION AND PUBLIC WATER CONSUMER PRO
SOUTHERN COASTAL MAINE RIVER BASI

TOWNS	POPULATION							
	1980	1990	2000	2010	2020	2030	1980	1
ACTON	847	1,016	1,101	1,186	1,267	1,413	-	
ALFRED	1,821	2,263	2,503	2,747	2,967	3,336	730	
ARUNDEL	1,780	2,243	2,511	2,764	2,989	3,360	1,020	1
ELIOT	4,824	6,103	6,834	7,522	8,135	9,143	2,416	2
KENNEBUNK	7,409	9,007	9,819	10,641	11,419	12,812	6,970	9
KENNEBUNKPORT	2,785	3,317	3,584	3,851	4,103	4,554	2,380	2
KITTERY	10,292	11,012	11,273	11,543	11,818	12,200	10,292	11
LYMAN	1,269	1,606	1,799	1,980	2,142	2,407	-	
SANFORD	17,758	18,497	18,911	19,225	19,473	19,984	17,500	18
SOUTH BERWICK	4,156	4,467	4,610	4,748	4,871	5,085	2,500	2
WELLS	7,406	9,371	10,493	11,551	12,493	14,041	5,950	9
YORK	7,898	9,978	11,175	12,298	13,296	14,944	6,618	[illegible]
Table III-A Sub-Total	68,245	78,880	84,613	90,056	94,973	103,279	56,376	6
Table III-B Sub-Total	68,165	75,250	80,234	85,163	89,418	97,039	39,633	[illegible]
STUDY AREA TOTAL	136,410	154,130	164,847	175,219	184,391	200,318	96,009	1

IC WATER CONSUMER PROJECTIONS
STAL MAINE RIVER BASIN

	PUBLIC WATER CONSUMERS					
	1980	1990	2000	2010	2020	2030
	-	-	-	-	-	-
	730	803	949	1,095	1,241	1,387
	1,020	1,183	1,367	1,581	1,826	2,111
	2,416	2,416	3,552	4,034	4,518	5,001
	6,970	9,007	9,819	10,641	11,419	12,812
	2,380	2,689	2,904	3,118	3,332	3,547
	10,292	11,012	11,273	11,543	11,818	12,200
	-	-	-	-	-	-
	17,500	18,497	18,911	19,225	19,473	19,984
	2,500	2,850	2,950	3,050	3,150	3,250
	5,950	9,044	10,493	11,551	12,493	14,041
	6,618	8,339	9,464	10,589	11,714	12,839
	56,376	65,840	71,682	76,427	80,984	87,172
	39,633	44,744	48,877	50,677	54,927	59,180
	96,009	110,584	120,559	127,104	135,911	146,352

TABLE III-A

TABLE III-B POPULATION AND PUBLIC WATER CONSUMER P
SACO RIVER BASIN

TOWNS	POPULATION						
	1980	1990	2000	2010	2020	2030	1980
BALDWIN	1,167	1,219	1,428	1,725	1,899	2,316	-
BIDDEFORD	19,488	19,579	19,702	19,754	19,778	19,935	19,488
BRIDGTON	3,334	3,357	3,444	3,594	3,646	3,772	2,250
BROWNFIELD	785	1,016	1,153	1,246	1,404	1,650	-
BUXTON	4,959	6,273	7,025	7,733	8,363	9,399	0
CORNISH	1,058	1,179	1,236	1,292	1,343	1,432	700
DAYTON	700	867	956	1,046	1,130	1,270	-
DENMARK	508	528	536	542	551	565	-
FRYEBURG	2,830	3,399	3,652	3,837	4,163	4,696	1,925
HIRAM	903	1,036	1,092	1,132	1,203	1,314	120
HOLLIS	2,575	3,257	3,647	4,015	4,342	4,880	0
LIMERICK	1,423	1,772	1,957	2,148	2,322	2,610	840
LIMINGTON	1,679	2,124	2,379	2,619	2,833	3,183	-
LOVELL	753	919	993	1,047	1,144	1,302	-
NEWFIELD	566	682	740	799	855	956	-
PARSONSFIELD	1,285	1,463	1,549	1,634	1,712	1,850	340
PORTER	1,162	1,250	1,286	1,310	1,353	1,418	540
SACO	14,227	15,400	15,891	16,276	16,573	17,028	12,650
SEBAGO	772	797	892	1,058	1,134	1,338	-
SHAPLEIGH	834	1,055	1,181	1,300	1,406	1,581	180
STANDISH	4,135	4,407	5,500	6,791	7,632	9,296	600
STONEHAM	208	270	306	331	373	438	-
STOW	146	171	182	190	204	226	-
SWEDEN	158	205	233	252	284	334	-
WATERBORO	1,520	1,788	1,921	2,054	2,179	2,401	-
WATERFORD	990	1,237	1,353	1,438	1,592	1,849	-

IC WATER CONSUMER PROJECTIONS
) RIVER BASIN

	PUBLIC WATER CONSUMERS					
	1980	1990	2000	2010	2020	2030
	-	-	-	-	-	-
	19,488	19,579	19,702	19,754	19,778	19,935
	2,250	2,362	2,498	2,633	2,768	2,925
	-	-	-	-	-	-
	0	1,255	3,513	3,867	6,690	7,519
	700	735	777	819	861	910
	-	-	-	-	-	-
	-	-	-	-	-	-
	1,925	2,022	2,137	2,252	2,368	2,503
	120	144	173	208	248	299
	0	651	729	803	868	2,440
	840	974	1,126	1,302	1,504	1,739
	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-
	340	408	490	588	704	847
	540	648	778	934	1,118	1,345
	12,650	15,054	15,891	16,276	16,573	17,028
	-	-	-	-	-	-
	180	216	259	311	373	448
	600	696	804	930	1,074	1,242
	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-

TABLE III-B

V WATER DEMAND PROJECTION

Current public water demands are projected throughout the study period, by each decade, using two assumptions. The first assumption, "without conservation measures", uses historical trends in residential, commercial, public and industrial water demands and projects these trends without considering any conservation measures which might be taken by the consumer. The second assumption, "with conservation measures", involves applying certain demand-oriented conservation measures to the projected demands and, by observing how these measures have affected other similar consumers, generating factors to be applied to the current water demand rates. By looking at the projections of demand for each assumption, a decision can be made as to what extent such conservation measures can help a public water supplier meet its obligations.

A. METHOD OF PROJECTION WITHOUT CONSERVATION MEASURES

The factors developed for projecting public water demand in this method were applied to the current (1980) demand rates. Historical trends and growth projections from other studies listed in this section were used to project the 1980 data base. Projection without conservation methods should show maximum future demands for public water consumption.

1. Per Capita Consumption Rate Projections

In projecting per capita consumption rates from the year 1980 to 2030, information was obtained from various sources. These sources include:

a. Water Use By Domestic Users in Communities Supplied By The MDC, prepared by William C. Melia, August 1981.

b. Water Supply Inventory, York County 208 Study Area, by Southern Maine Regional Planning Commission, June 1976.

c. Report Relative to Sanford Water District, Sanford, Maine by Whitman & Howard Inc., Engineers and Architects.

d. Water Utility Surveys, State of Maine, Department of Health & Welfare, Division of Health Engineering.

In going through the available historical information on per capita consumption trends in the study area, it was discovered that accurate figures on consumer population in the last 10 to 20 years were not to be found. The State Department of Health Engineering agreed that these consumer population figures are only rough estimates based on an average number of people for each public water service connection. Another complication existed in the communities with seasonal population influxes; these seasonal influxes make it very difficult to pinpoint the actual number of water consumers at any one time.

The next best available information in the region was provided in the above-mentioned M.D.C. Report (Metropolitan District Commission-Massachusetts). This report analyzed per capita water consumption using controlled data from the years 1960 to 1980. The study area was composed of 10 metropolitan communities in coastal and eastern Massachusetts with a total 1980 population of 284,900. The historical trend of per capita consumption resulting from this analysis is shown in Table IV. These figures show an increasing per capita consumption trend, but at a decreasing rate. The southern Maine Study area communities of South Berwick, Sanford and Kittery (including Eliot) have relatively insignificant seasonal population influxes which correlate well with the M.D.C. trends over the last 10 years. The average yearly increases in per capita consumption for these three towns are 0.65, 0.82 and 1.08 gallons per capita day per year respectively. This compares with increase of 0.86 gallons per capita day per year for the M.D.C. communities.

TABLE IV

HISTORICAL PER CAPITA CONSUMPTION

Year	1960	1970	1980
Gallons per Person	83.2	107.1	115.7

The projection of per capita consumption through the 50 year study period is therefore assumed to be an extension of the historical trends shown in Table IV. The projected increasing per capita consumption at a decreasing rate can be explained by continued purchasing of water consuming appliances during the early decades followed by a tapering off of this purchasing during the later decades. In addition, these water consuming devices should be designed to use less water as time goes on. The projected per capita consumption rates shown in Table V were used to generate the projected residential components of demand by applying them to the projected growths in consumer population.

TABLE V

PROJECTED PER CAPITA CONSUMPTION RATES - WITHOUT CONSERVATION MEASURES

Year	1980	1990	2000	2010	2020	2030
Per Capita Consumption Factor	1.0	1.06	1.12	1.16	1.20	1.25

2. Commercial Consumption Projections

It was assumed that commercial and residential growth are closely related. Based on this assumption, the per capita consumption factor used for residential projections was also used for commercial projections. (See factors in Table V.)

3. Industrial Consumption Projections

The projections of industrial water use were developed by relating historical records of the study area's major public water consuming industries to regional public water use projections for these industries. Historical data was gathered from the following sources:

a. The Biddeford and Saco Water Company.

b. The Kennebunk, Kennebunkport and Wells Water District.

c. The Sanford Water District.

d. The U. S. Department of Commerce Reports: The Census of Manufacturers and Water Use in Industry - 1967, 1972 and 1977.

The regional projections of public water use by industries were developed from two sources:

a. The Nations Water Resources 1975-2000, Volume 4: New England Region by the U. S. Water Resources Council.

b. U.S.D.A. Cooperative Study - Demographic and Economic Projections - Saco River Basin, Maine-Employment by Place-of-Work.

Historically, industrial demand in the New England Region has dropped by about five percent a year since 1975 when it appears to have peaked. Since 1975, industrial demand in this area has declined for the following reasons:

a. The Federal Water Pollution Control Act, which places pollution control limitations on waste discharge and therefore encourages water management within plants.

b. The slow but steady growth of light manufacturing which does not utilize process or cooling water. This growth has been accompanied by the decline of leather and textile industries which are heavy consumers of public water.

c. Competition for water resources has increased to the point that industrial extractive uses are decreasing in priority.

This decline in industrial demand will level off near the year 2000, at which time waste management measures should reach their peak efficiencies and a balance between the growth of light manufacturing and the decline of heavy water consuming industries, such as leather and textiles, will take place. From that time forward, growth in industrial water consumption should correlate well with the increases in employment projected for the study area to the year 2030. The resulting projection factors are shown in Table VI.

TABLE VI - PROJECTION FACTORS FOR INDUSTRIAL CONSUMPTION*

Year	1980	1990	2000	2010	2020	2030
Projection Factor	1.0	0.63	0.52	0.57	0.59	0.63

* Does not apply to Kittery Water District

The industrial water consumption in Kittery was handled as a separate entity. The only industry in Kittery is the U. S. Naval Base, for which the consumption trend is unique due to its sensitivity to political decisions and other outside forces not associated with the study area. The historical data shows a relatively steady increase in consumption over the past ten years; however, in 1980 a large increase took place.

A conservative approach, for the purpose of this study, has been taken and it was assumed that the naval base's water consumption will continue to increase throughout the study period, but at a slightly lesser rate. The resulting projection factors are shown in Table VII.

TABLE VII

PROJECTION FACTORS FOR KITTERY NAVAL BASE PUBLIC WATER CONSUMPTION

Year	1980	1990	2000	2010	2020	2030
Projection Factor	1.0	1.08	1.17	1.21	1.25	1.28

4. Public Consumption Projections

The use of public water by a town's public facilities represents a very small percentage of the town's overall water consumption. It was assumed that public water consumption growth will be the same as residential growth. It was also assumed that water consumption by these public facilities is relatively unaffected by peak (seasonal) demands.

B. CONSERVATION MEASURES

In this section, a program of conservation measures is developed that can be applied to each community in the study area to help the community to deal with either an existing or projected insufficient water supply. The following demand-management type measures have been successfully used nationwide and have resulted in substantial decreases in water supply requirements.

1. Pricing

Increasing the marginal or peak price will decrease the demand by encouraging users to conserve water to save money.

2. Regulation

Regulating water usage through legal restrictions, especially during summer months, with respect to lawn sprinkling, irrigation and car washing.

3. Water Saving Fixtures

Water saving kits are now available to individual consumers in the form of water-dams for water closets, aerators for faucets and adapters for shower heads. These require no changes in plumbing and can easily be installed in both existing and newly constructed facilities.

4. Educational Programs

These are conducted by the water suppliers with the assistance and cooperation of advisory committees formed by community and political leaders.

All these measures are especially effective in modifying both peak and average demands within the domestic sector. A substantial reduction in per capita consumption (10 to 20 percent) can be realized. This rate of reduction is based on observations of the success similar measures have had in other communities nationwide as shown in Before The Wells Run Dry, a handbook for designing a local water conservation plan. This publication is dated October 1980 and has been compiled by the New England River Basins Commission.

Table VIII indicates projected per capita consumption factors for both "with" and "without" conservation. These factors were applied to the residential, commercial and public components of demand. The results are shown in Tables X and XI of Section VI and allow each supplier to evaluate the effectiveness of these measures in relieving existing or projected supply deficits.

TABLE VIII

PER CAPITA CONSUMPTION RATE PROJECTION FACTORS

WITH AND WITHOUT CONSERVATION MEASURES

Year	1980	1990	2000	2010	2020	2030
Without Conservation	1.0	1.06	1.12	1.16	1.20	1.25
With Conservation	1.0	0.90	0.95	0.99	1.02	1.06

Supply management programs such as metering, leak detection and repair and pressure reduction are also effective conservation measures that will be discussed in Section VI-B, ANALYSIS BY WATER DISTRICT. In this section, such programs will be mentioned as potential conservation measures where appropriate. The quantitative effects of such measures are not addressed in this report; however, an example of the effectiveness of such measures is in Massachusetts where the Boston Water and Sewer Commission, through improving its system's efficiency, has reduced average use from 150 MGD to 134 MGD, a reduction of 10.7 percent.

C. PROJECTIONS OF WATER DEMAND: 1980-2030

The present (1980) average daily demand for public water was projected through the year 2030 and is shown in Tables IX-A and IX-B. The projections, in MGD, are broken down for each public water supplier and town for each decade through the year 2030. They also break down the demands into the residential, commercial, industrial and public components of water consumption. This breakdown should assist the towns and suppliers with future planning and regulation.

TABLE IX-A PUBLIC WATER DEMANDS: 1980 - 2030 AVERAGE DAILY DEMANDS WITHOUT CONSERVATION MEASURES SOUTHERN MAINE COASTAL RIVER BASINS (ALL FIGURES ARE MGD)		1980 RESIDENTIAL	1980 COMMERCIAL	1980 INDUSTRIAL	1980 PUBLIC	1980 TOTAL	1990 RESIDENTIAL	1990 COMMERCIAL	1990 INDUSTRIAL	1990 PUBLIC
KITTERY WATER DISTRICT	KITTERY	.620	.117	2.634	.030	3.401	.703	.133	2.845	.0
	ELIOT	.242	-	-	-	.242	.256	-	-	-
	TOTAL	.862	.117	2.634	.030	3.643	.959	.133	2.845	.0
YORK WATER DISTRICT	YORK	.968	.272	-	.144	1.354	1.293	.363	-	.1
KENNEBUNK, KENNEBUNKPORT, AND WELLS WATER DISTRICT	ARUNDEL	.082	.020	-	-	.102	.100	.025	-	-
	KENNEBUNK	.551	.217	.078	-	.846	.756	.298	.048	-
	KENNEBUNKPORT	.196	.056	-	-	.252	.234	.067	-	-
	WELLS	.456	.279	.012	-	.756	.749	.451	.007	-
	TOTAL	1.285	.572	.090	-	1.956	1.839	.841	.055	-
SOUTH BERWICK WATER DISTRICT	SOUTH BERWICK	.194	.015	-	.006	.215	.235	.018	-	.0
SANFORD WATER DISTRICT	SANFORD	1.510	.060	.520	.018	2.108	1.692	.067	.328	.0
ALFRED WATER COMPANY	ALFRED	.030	.002	-	.005	.037	.035	.002	-	.0

1990				2000					2010					2020				
COMMERCIAL	INDUSTRIAL	PUBLIC	TOTAL	RESIDENTIAL	COMMERCIAL	INDUSTRIAL	PUBLIC	TOTAL	RESIDENTIAL	COMMERCIAL	INDUSTRIAL	PUBLIC	TOTAL	RESIDENTIAL	COMMERCIAL	INDUSTRIAL	PUBLIC	TOTAL
133	2.845	.034	3.715	.761	.144	3.082	.037	4.024	.807	.152	3.187	.039	4.185	.854	.161	3.293	.041	4.1
-	-	-	.256	.398	-	-	-	.398	.468	-	-	-	.468	.542	-	-	-	.[illegible]
133	2.845	.034	3.971	1.159	.144	3.082	.037	4.422	1.275	.152	3.187	.039	4.653	1.396	.161	3.293	.041	4.
363	-	.152	1.808	1.550	.436	-	.183	2.169	1.797	.505	-	.212	2.514	2.506	.578	-	.242	2.
025	-	-	.125	.122	.032	-	-	.154	.147	.037	-	-	.184	.176	.043	-	-	.
298	.048	-	1.102	.869	.343	.040	-	1.252	.976	.385	.045	-	1.406	1.083	.426	.045	-	1.
067	-	-	.301	.268	.077	-	-	.345	.298	.085	-	-	.383	.329	.094	-	-	.
451	.007	-	1.207	.918	.552	.007	-	1.477	1.047	.630	.007	-	1.684	1.172	.706	.007	-	1.
841	.055	-	2.735	2.177	1.004	.047	-	3.228	2.468	1.137	.052	-	3.657	2.760	1.269	.052	-	4.
018	-	.008	.261	.257	.020	-	.009	.286	.275	.021	-	.009	.305	.294	.023	-	.010	[illegible]
067	.328	.020	2.107	1.828	.073	.270	.022	2.193	1.924	.076	.296	.023	2.319	2.016	.080	.307	.024	2.
002	-	.005	.042	.044	.002	-	.007	.053	.052	.003	-	.008	.063	.061	.003	-	.010	[illegible]

2020			2030				
INDUSTRIAL	PUBLIC	TOTAL	RESIDENTIAL	COMMERCIAL	INDUSTRIAL	PUBLIC	TOTAL
3.293	.041	4.349	.919	.173	3.372	.044	4.508
-	-	.542	.625	-	-	-	.625
3.293	.041	4.891	1.544	.173	3.372	.044	5.133
-	.242	2.876	2.347	.660	-	.276	3.283
-	-	.219	.211	.054	-	-	.265
.045	-	1.554	1.266	.498	.048	-	1.812
-	-	.423	.364	.104	-	-	.468
.007	-	1.885	1.371	.824	.007	-	2.202
.052	-	4.081	3.212	1.480	.055	-	4.747
-	.010	.327	.316	.025	-	.011	.352
.307	.024	2.427	2.150	.085	.328	.026	2.589
-	.010	.074	.072	.004	-	.011	.087

BIDDEFORD AND SACO WATER COMPANY	BIDDEFORD	1.120	.860	.590	.010	2.580	1.193	.916	.372
	SACO	.560	.440	.310	.006	1.316	.706	.555	.195
	TOTAL	1.680	1.300	.900	.016	3.896	1.899	1.471	.567
PORTLAND WATER DISTRICT	STANDISH	.065	.010	.215	.015	.305	.079	.012	.136
LIMERICK WATER DISTRICT	LIMERICK	.040	-	-	-	.040	.049	-	-
PINE SPRINGS DEVELOPMENT CORPORATION	SHAPLEIGH	.016	-	-	-	.016	.021	-	-
CORNISH WATER COMPANY	CORNISH	.040	.009	-	.001	.050	.045	.010	-
MAINE WATER COMPANY KEZAR FALLS DIVISION	HIRAM	.005	.0003	-	.002	.007	.006	.001	-
	PORTER	.023	.004	.003	.001	.031	.029	.006	.002
	PARSONSFIELD	.017	.006	.010	.0001	.033	.022	.008	.006
	TOTAL	.045	.010	.013	.003	.071	.057	.015	.008
BRIDGTON WATER COMPANY	BRIDGTON	.265	.017	.004	.009	.295	.295	.019	.002
FRYEBURG WATER COMPANY	FRYEBURG	.065	.035	.028	.001	.129	.073	.038	.018

1990				2000					2010					2020				
COMMERCIAL	INDUSTRIAL	PUBLIC	TOTAL	RESIDENTIAL	COMMERCIAL	INDUSTRIAL	PUBLIC	TOTAL	RESIDENTIAL	COMMERCIAL	INDUSTRIAL	PUBLIC	TOTAL	RESIDENTIAL	COMMERCIAL	INDUSTRIAL	PUBLIC	
.916	.372	.011	2.492	1.269	.973	.307	.011	2.560	1.317	1.012	.336	.012	2.677	1.364	1.048	.348	.012	2
.555	.195	.088	1.464	.788	.619	.161	.008	1.576	.836	.657	.177	.009	1.679	.880	.692	.183	.009	1
1.471	.567	.099	3.956	2.057	1.592	.468	.019	4.136	2.153	1.669	.513	.021	4.356	2.244	1.740	.531	.021	4
.012	.136	.019	.246	.096	.015	.113	.023	.247	.116	.018	.123	.027	.284	.138	.022	.127	.033	
-	-	-	.049	.060	-	-	-	.060	.072	-	-	-	.072	.086	-	-	-	
-	-	-	.021	.026	-	-	-	.026	.032	-	-	-	.032	.040	-	-	-	
.010	-	.001	.056	.050	.011	-	.001	.062	.055	.012	-	.001	.068	.060	.013	-	.001	
.001	-	.003	.010	.008	.0004	-	.004	.012	.010	.001	-	.005	.016	.012	.001	-	.006	
.006	.002	.001	.038	.037	.007	.002	.001	.047	.045	.009	.002	.002	.058	.056	.011	.002	.002	
.008	.006	.0001	.036	.028	.010	.005	.0001	.043	.035	.012	.005	.0002	.052	.043	.015	.006	.0003	
.015	.008	.004	.084	.073	.017	.007	.005	.102	.090	.022	.007	.007	.126	.111	.027	.008	.008	
.019	.002	.010	.326	.329	.021	.002	.011	.363	.359	.023	.002	.012	.396	.391	.025	.002	.013	
.038	.018	.001	.130	.081	.043	.015	.001	.140	.088	.047	.016	.001	.152	.096	.051	.017	.001	

	2020			2030				
	INDUSTRIAL	PUBLIC	TOTAL	RESIDENTIAL	COMMERCIAL	INDUSTRIAL	PUBLIC	TOTAL
48	.348	.012	2.772	1.433	1.098	.372	.013	2.916
92	.183	.009	1.764	.942	.740	.195	.010	1.887
740	.531	.021	4.536	2.375	1.838	.567	.023	4.803
22	.127	.033	.320	.166	.026	.136	.039	.376
-	-	-	.086	.104	-	-	-	.104
-	-	-	.040	.050	-	-	-	.050
013	-	.001	.074	.066	.015	-	.001	.082
001	-	.006	.019	.016	.001	-	.007	.024
011	.002	.002	.071	.071	.014	.002	.002	.089
015	.006	.0003	.064	.054	.018	.006	.0003	.078
027	.008	.008	.154	.141	.033	.008	.009	.191
025	.002	.013	.431	.430	.028	.002	.014	.474
051	.017	.001	.165	.106	.056	.018	.001	.181

TABLE IX-B

VI SUPPLY VERSUS DEMAND (1980-2030)

By comparing the projected demands shown in Tables X (without conservation measures) and XI (with conservation measures) to the capabilities of each supplier to provide public water as shown in Table I, conclusions can be made as to the timing and extent of shortages or surpluses for each supplier. It is assumed that the present capabilities of each supplier are maintained throughout the study period. This section defines those shortages/surpluses and discusses possible solutions to the shortages in terms of relative locations of excess capabilities and likely new sources. Present and future constraints due to water quality are also considered and discussed as are the conservation measures that were outlined in Section V-B, Conservation Measures. Financial conditions and strategies are not addressed.

A. NEWLY FORMED PUBLIC SUPPLIERS

The projection of the Public Water Consuming Populations shown in Table III-B shows that the towns of Buxton and Hollis, which presently do not have public water systems, will need such services by the year 1990. This is based on the criteria of household densities previously discussed. These towns share a common boundary formed by the Saco River, which is an ideal potential water supply source. These towns are also located in the area of a buried valley of sand and gravel deposits. These deposits were recently detected during the preliminary stages of a major groundwater aquifer study being conducted by the Maine Geological Survey, and may be a *potential* water supply source. The feasibility of both sources should soon be considered in terms of safe yields, water quality, and economic feasibility. Buxton will have an average daily demand for public water of about 0.47 MGD in the year 2030 without conservation measures being applied vs. about 0.40 MGD with the application of conservation measures. These numbers are based on an average per capita consumption in 1980 of 50 gallons per day (GPD). This seems to be about average for this area of Maine.

Similarly, Hollis will have an average daily demand of about 0.15 MGD in the year 2030 without conservation measures and about 0.13 MGD with the use of conservation measures. There should be no significant peak seasonal demands in these towns and very little, if any, industrial demand for public water.

B. ANALYSIS BY WATER DISTRICT

1. Kittery Water District

This district's surface water supply sources, located in York, have a safe yield of 3.7 MGD which will meet projected average daily demand only into the early 1980's. Currently the peak seasonal demand of 3.72 MGD is right at the safe yield and the maximum day peak demand of 5.0 MGD well above such yield. Conservation measures will not significantly improve this situation; nevertheless, these measures should be applied. Pricing and regulation can also be somewhat effective in reducing the peak demands.

A potential short-term solution to the district's supply versus demand problem might be found by scrutinizing the water use of the Portsmouth Naval Shipyard. Currently this facility uses 77 percent of the district's current water. A significant reduction in the shipyard's public water use should lead to a similar reduction in the district's overall demand. The availability of supplemental water supply sources for shipyard use has been pursued unsuccessfully. For the most part, good quality water is required for all current operations; i.e., contact cooling, processing and housing. Implementation of conservation measures such as leak detection and repair, pressure reduction and reuse/recycle systems may produce significant reductions in the facility's water use, and therefore in the entire district's demand for public water. Reuse/recycling alone, although expensive, is capable of cutting water use by about one half.*

The district will have to seek new sources to solve its long-term supply problems. Bed rock wells in Kittery are usually of good yield and quality, and high yields are common along the northeastern boundary of town.**

A more immediate and substantial solution, which should be considered, is the further extension of the newly installed coastal transmission line from the Biddeford and Saco Water Company's plant. Currently this line supplies the K.K.W. Water District with up to 1 MGD, but it is designed to transmit up to 6 MGD of treated water to other communities to the south.

The Bell Marsh, just to the west of a current source, Folly Pond, provides a site for a potential surface water impoundment with the construction of a dam. Such an impoundment would help defray the overdraft from maximum day peak demands. This site faces serious pressure from urban development and would require a lot of money to purchase sufficient

* Before The Well Runs Dry - New England River Basins Commission
** Maine Coastal Area Water Supply and Demand - Maine Coastal Program

buffering land around the site. Lack of such land around the present surface water supplies is a concern to the district in its attempts to protect its supplies from contamination.

Unless demand is reduced significantly at the shipyard or treated water is purchased from the Biddeford and Saco Water Company, Kittery's treatment plant capacity of 5 MGD will probably have to be increased within the next ten years. The primary distribution lines appear to be sufficient throughout the study period.

2. York Water District

Public water demand in York is projected to increase by 242 percent over the 50 year study period. This, coupled with the community's relatively high maximum day peak demands, presents imminent concerns for the district. The 2.5 MGD safe yield of the district's water source, Chases Pond, will be reached by the district's average daily demand near the year 2010 and by the peak seasonal demand near the year 1990. Conservation can significantly delay these occurrences by nearly 15 years and 10 years respectively, and should be implemented. The most serious problem is with the maximum day peak demand, which currently exceeds both the supply source's safe yield and the primary distribution system's capacity. Conservation will moderate this problem but additional measures will soon be required and are addressed later in this discussion.

Although bedrock wells can usually be found and can yield from 15,000 to 30,000 GPD, their use as a major supplement to the district's supply sources seems to be infeasible due to the relatively large projected growth in demand. In addition, some wells in York have problems with high iron content and road-salt infiltration.

A 1968 study, as discussed under the K.K.W. Water District, revealed the Ogonquit River as a future potential water supply source if developed as a joint venture with the York Water District. Although this river reportedly has low summer flows, it should be further investigated as a potential future water supply.

As in Kittery, a very promising future source is the Biddeford and Saco Water Company's excess supply. Access to this excess would require extending the newly installed transmission line that taps the Biddeford and Saco Water Company's plant. If Kittery and York combine their efforts and resources in the construction of such an southward extension, they could significantly improve the feasibility of this project and take advantage of a relatively distant but abundant supply source, the Saco River.

The district's secondary distribution system is old and has some low pressure problems. There could also be some leakage in some of the older segments. An upgrading of the system could reduce leakage and at the same time take care of the low-pressure problems.

As previously mentioned, the district's current maximum day peak demand is overtaxing the capacity of the primary distribution lines. Maximum day peak demand can usually be met by equalizing storage facilities and short-term regulation measures. If the district chooses to acquire additional water from the Biddeford and Saco Water Company as described above, then increasing the size of the primary distribution lines to handle increasing peak demand may not be necessary. However, if other sources are developed instead, then additional capacity must be added to the primary distribution lines.

3. South Berwick Water District

This district draws from groundwater sources which have a safe yield of 0.27 MGD. Although projected average daily demand will not reach this amount until the mid 1990's, the current maximum day peak demand of 0.39 MGD is already well in excess of the safe yield. Long-term conservation measures can significantly delay the time when average daily demand exceeds supply but will have little effect in satisfying the maximum day demand overdraft. Short-term regulation and peak pricing can be more effective in reducing these peak demands.

The treatment plant and its primary distribution lines are more than adequate to handle all demands throughout the 50 year study period. However, the secondary distribution system is old and has low pressure problems and probably some leakage. Improvements including the elimination of dead ends by closing loops and leak-detection and repair would not only raise pressures, but also possibly lower demand. Equalizing storage facility capacities should also be increased to help handle the peak demands.

The most likely long-term means for this district to satisfy its projected average daily demand is the development of new supplementary water sources, probably of the surface water type. The Great Works River could supply the town with enough water for some time, but presently the water requires heavy treatment because of upstream effluents. Water from Knights Pond and Warren Pond would require less treatment, but these ponds are about 2 miles from the town and their use would require a costly transmission line installation. Thousands of dollars have been spent on test borings, and no suitable groundwater yields have yet been found. The cost of the above-mentioned improvements and developments would require the establishment of a better revenue base. The Town of South Berwick must take a greater share of responsibility for this support than it has in the past.

4. Kennebunk, Kennebunkport and Wells Water District

The K.K.W. Water District's source of supply is Branch Brook, which has a safe yield of 3.0 MGD. The district's average daily demand will reach this amount by the mid-1990's although the implementation of conservation techniques could delay this by about ten years. However, its major problem is that peak seasonal demand and maximum day peak demand are already in excess of this figure. This problem is amplified by a projected 240 percent increase in demand over the 50-year study period.

Current demand in excess of the district's capacity is being satisfied by up to 1.0 MGD purchased under a contract with the Biddeford and Saco Water Company, and supplied via the recently constructed 20-inch diameter coastal transmission line. This contract, combined with the K.K.W.'s current supply and treatment capacity, gives the district the capability to handle its peak seasonal demands until the year 1990, if conservation measures are implemented.

The transmission line has the capacity, and the Biddeford and Saco Water Company the capability, to supply 6.0 MGD; however, other communities may purchase some of this water and it is uncertain how much more might be available to the K.K.W. in the future. In a search for additional supply sources, a study was completed in 1968 on three possible surface water supplies, two on the Ogonquit River and one on the Batson River.* One site on the Ogonquit River was thought to have potential as a source, though it would have been economical only if developed as a joint venture with the York Water District, which was not interested at the time. However, in looking at the projected public water demand growth in York through the study period, it appears that a solution of this type may be both feasible and desirable in the not too distant future. Exploration by the K.K.W. Water District for groundwater sources has been unsuccessful and has been abandoned for the time being.

The K.K.W. Water District's treatment plant has a capacity of 3.5 MGD, which exceeds the safe yield of their current source by 0.5 MGD. Even if the plant were operating at maximum capacity, that 3.5 MGD plus the 1.0 MGD from the Biddeford and Saco Water Company could handle the district's maximum day peak demands only until the mid-1980's. Unless additional water can be purchased, new sources will have to be found and treatment capacity expanded. The capacity of the district's primary distribution system will also have to be increased. The secondary distribution system is very old and reportedly has significant leakage. A leak detection and repair program would help meet demands in the future.

The long-term solution of this district's supply-versus demand problems may very well require cooperative action among the suppliers in the region. There appear to be potential solutions, but they must

* Water Supply Inventory-York County "208" Study Area, SMRPC, June 1976

be further examined for feasibility and relative economy. See Section VII, Conclusions for a region-wide summary.

5. Sanford Water District

This district's current well system has a good quality safe yield of 3.0 MGD and is capable of handling projected average daily demand through the year 2030. If conservation measures are implemented, this safe yield can also handle maximum day peak demand through the year 2030. The district is not significantly affected by peak seasonal demands.

A major concern to this district is the inadequacy of its primary distribution system, which has a capacity of 2.1 MGD. The current maximum day peak demand of 2.7 MGD is projected to grow to 3.3 MGD by the year 2030 without the implementation of conservation measures or to 2.9 MGD with these measures. The primary distribution system's capacity of 2.1 MGD should be increased or additional sources having their own primary distribution systems should be developed. Short-term regulation and peak pricing measures can provide a more immediate but not as complete a solution to this problem.

Future groundwater supplies may be found to the north and east of the existing town wells, in an aquifer consisting of lake wash deposits with a reportedly good yield. Other locations, such as the site of Cyanamid Corporation, and an area near the Country Club, are potential sites having problems; namely, too high a purchase price and high iron and managanese content, respectively. The recently identified buried valley of sand and gravel deposits indicated by the Maine Geological Survey lies to the east of the district and is a potential future source with preliminry indications of low iron and managanese content. The economic feasibility of this source may require a cooperative effort of other nearby communities faced with similar needs.

6. Alfred Water Company

The projected demands for public water in Alfred are well within the company's present supply capabilities. The dug well that is used has no known water-quality problems but the water is treated by chlorination. If the water quality of this source is protected adequately, the community's water supply will be sufficient. If additional supply sources are needed in the future, there exist good alluvial deposits to the north that should support high yields.

7. Biddeford and Saco Water Company

This company, with the Saco River as its relatively unlimited supply source and its treatment plant capable of handling 16 MGD, is easily able to handle the projected mild growth in public water demand throughout the study period. Part of the excess capacity of the company is currently relieving a deficit in supply of the nearby K.K.W. Water District through the sale of up to 1 MGD of treated water to that district. The transmission line for this water is capable of carrying 6 MGD. The extension of the line further south has the potential of relieving the York and Kittery Water Districts of their expected deficits in the near future.

It can be seen that the quality of the Saco River water at the site of the Biddeford and Saco Water Company intake is not only crucial to this company's consumers, but to the entire Southern Maine coastal area with its current and projected water supply deficits. It is therefore crucial that every precaution be taken to preserve this vital resource.

8. Portland Water District

This district also has a relatively unlimited source of supply, Sebago Lake. The capacity of its primary distribution lines is 2.2 MGD and the projected maximum day peak demand, without conservation for the year 2030, is 0.55 MGD. Peak seasonal demand in this area is insignificant. The district does not appear to have any supply or distribution problems throughout the study period.

The district maintains sufficient land area around its well fields supplying Steep Falls and also prohibits water contact sports, boating and swimming in Sebago Lake near the intake, so deterioration of water quality is highly improbable. At the present time the district does not have a treatment plant, although screening is done at the intake with chlorination and pH adjustment taking place at the clear well of the pumping station.

9. Limerick Water District

This district's demands for public water will not reach the safe yield of its dug and drilled wells by 2030. Its projected maximum day peak demand without conservation is 0.16 MGD compared to the safe yield of 0.43 MGD. The difference between average daily demand and peak seasonal demand is so slight as to be insignificant. The capacity of the intake and discharge lines is designed for the wells' safe yield of 0.432 MGD.

The water quality is considered good, but at times the nitrate concentration is higher than the legal limit. The source of this pollution is residential septic tank leaching fields located upstream from the supply source. The only form of treatment is chlorination, which is takes place at the pumping station.

The district has a number of test wells in lake outwash deposits ranging in distance from 1/3 of a mile to 1.5 miles from the existing wells. These test wells indicate a good yield of good quality water. In order to protect the existing and future sources of supply, the district will have to acquire sufficient land areas around the well fields and restrict activity in those areas.

10. Pine Springs Development Corporation

The safe yield of this supplier's water source, a spring-fed well, and the capacity of its primary distribution system, has been estimated at 0.070 MGD due to the lack of available information. This estimate is based on a 4-inch diameter iron pipe flowing at 1.5 f.p.s. (to prevent the infiltration of fines from the spring bed) and a Hazen and Williams "C" factor of 80. This safe yield will meet projected average daily and maximum day peak demands without conservation measures throughout the 50-year study period. The difference between the average daily demand and the peak seasonal demand in this area is relatively insignificant. The water is of good quality although it is treated occasionally in the spring of the year. At this time the rising groundwater table, due to rains and melting snows, causes septic systems to overflow thereby allowing sewage to permeate the groundwater. To remedy this condition, the water is chlorinated at the pumping station.

A potential future water source is Pine Springs Lake, which appears to have an abundant supply. The water from the lake appears to meet, without treatment, the standards of the 1977 Safe Drinking Water Act. In order to maintain the present water quality, the corporation will have to maintain control of activities in the vicinity of its intake lines of both its groundwater and lake sources.

11. Cornish Water Company

The water company has a sufficient yield from its spring fed infiltration pipe to meet its projected average daily and maximum day peak demands without conservation measures to the year 2030. The capacity of the primary distribution line is also sufficient to carry the projected demands throughout the study period. Peak seasonal demand is relatively insignificant in this area and was not considered in this analysis.

The only treatment the existing water supply receives is chlorination, which is takes place at the pumping station. The company should maintain sufficient land area around the recharge areas of its supply source so as to prevent development of such areas and thereby prevent possible contamination.

12. Maine Water Company, Kezar Falls Division

The company has a safe yield of 0.72 MGD from its well system, which is more than adequate to meet its projected average daily and maximum day peak demands of 0.191 MGD and 0.289 MGD, respectively for the year 2030. The carrying capacity of the primary distribution line is also adequate at 0.36 MGD to meet the projected demands to the year 2030. The difference between the average daily demand and the peak seasonal demand is so slight that for this study it is considered insignificant. The only treatment required for the existing water supply is pH adjustment at the pumping station.

Future water supplies can be obtained by drilling wells into the aquifer that runs through the area. The aquifer consists of good lake outwash deposits which have a high yield and good quality water.

13. Bridgton Water District

The Bridgton Water District falls mostly in the Presumpscot River Basin and draws from a relatively unlimited supply source, Highland Lake. The primary distribution line's carrying capacity of 0.65 MGD can handle the projected maximum day peak demand without conservation measures to the year 2020. If conservation measures are implemented, the lines should handle demand through the year 2030. The difference between the average daily demand and the peak seasonal demand is so slight that it is considered insignificant. The only type of treatment for the water supply is fluoridation, which takes place at the pumping station.

If so desired, future water supplies may be obtained by tapping into the aquifer running through the area. The aquifer in the northern section of the study area consists of deep sand and gravel water-bearing strata. This would most likely furnish high yields of good quality water.

14. Fryeburg Water Company

The company's groundwater supply source, with a safe yield of 0.30 MGD, is capable of meeting the projected average daily and maximum day peak demands without conservation measures to the year 2030. The 0.86 MGD carrying capacity of the primary distribution line is also adequate to meet all projected demands to the year 2030. The same is true for the treatment plant, which has an estimated plant capacity of 0.45 MGD. The treatment used on the existing water supply is chlorination and fluoridation.

If needed, future water supply potentials could be realized by tapping wells into the aquifer running under Fryeburg. This portion of the aquifer consists of good lake outwash deposits which have a capacity for high yield and good quality water. Surface water sources are another alternative, because of the number of streams and lakes with relatively good quality water in the region.

C. INDIVIDUAL WATER SUPPLIES

The communities discussed in this section are not being serviced by public water supplies, and it is not anticipated that they will need such services. They are currently being serviced by individual groundwater sources, from an aquifer system described under Study Area Description in the Introduction.

1. Acton, Newfield and Baldwin

The towns of Acton, Newfield and Baldwin are located in the central inland section of the study area. The aquifer system in this section of the study area consists of good lake outwash deposits. Driven or drilled wells into these deposits should produce sufficient amounts of good quality water.

2. Batchelders Grant, Stoneham, Lovell, Sweden, Waterford, Brownfield, Denmark, and Sebago

These towns are located in the northern and north central section of the study area. This portion of the aquifer also consists of good lake outwash deposits which have sufficient yields of good quality water.

3. Limington, Waterboro, Dayton, and Lyman

These towns are located in the south central to southeastern inland portion of the study area. They are all within the limits of the recently identified buried valley of sand and gravel discussed under Study Area Description - Geographic Characteristics in the Introduction. Preliminary indications show good yields of relatively good quality water although low levels of iron and manganese have been detected.

4. Conclusion

In general, there should be sufficient amounts of acceptable quality groundwater for individual supplies if state and local sanitary codes are maintained and enforced throughout the study area.

PROJECTED WATER SITUATION

SOUTHERN

(

SUPPLIER	TOWN(S)	SOURCE		PLANT CAPACITY		
		TYPE	SAFE YIELD	TREAT-MENT	PRIMARY DISTRI-BUTION	Av
KITTERY WATER DISTRICT	KITTERY ELIOT	SURFACE	3.7	5.0	8.0	3
YORK WATER DISTRICT	YORK	SURFACE	2.5	-	2.5	1.
SOUTH BERWICK WATER DISTRICT	SOUTH BERWICK	GROUND WATER	.27	3.5	3.5	.
KENNEBUNK, KENNEBUNKPORT, AND WELLS WATER DISTRICT	ARUNDEL KENNEBUNK KENNEBUNKPORT WELLS	SURFACE	3.0	3.5	3.0	1.
SANFORD WATER DISTRICT	SANFORD	GROUND WATER	3.0	-	2.11	2.
ALFRED WATER COMPANY	ALFRED	GROUND WATER	.28	-	.28	.

TABLE X-A

SITUATION 1980 - 2030 WITHOUT CONSERVATION MEASURES

SOUTHERN MAINE COASTAL RIVER BASINS

(ALL FIGURES ARE MGD)

ACITY	PUBLIC WATER DEMANDS										
RIMARY DISTRI-BUTION	1980			1990			2000				
	Avg. Day	Pk. Seas.	Max. Day	Avg. Day	Pk. Seas.	Max. Day	Avg. Day	Pk. Seas.	Max. Day	Avg. Day	P
8.0	3.643	3.721	5.027	3.971	4.058	5.479	4.422	4.527	6.102	5.133	
2.5	1.354	1.912	2.627	1.808	2.553	3.507	2.169	3.063	4.208	3.283	
3.5	.215	-	.387	.261	-	.469	.286	-	.514	.352	
3.0	1.956	3.333	4.261	2.735	4.752	6.039	3.228	5.656	7.182	4.747	
2.11	2.108	-	2.677	2.107	-	2.676	2.193	-	2.786	2.589	
.28	.037	-	.043	.042	-	.049	.053	-	.062	.087	

	2030		
Day	Avg. Day	Pk. Seas.	Max. Day
2	5.133	5.271	7.084
3	3.283	4.636	6.368
4	.352	-	.634
2	4.747	8.349	10.592
6	2.589	-	3.289
2	.087	-	.102

TABLE X-A

PROJECTED WATER SITUATION

(A

SUPPLIER	TOWN(S)	SOURCE		PLANT CAPACITY		
		TYPE	SAFE YIELD	TREAT-MENT	PRIMARY DISTRI-BUTION	Av
BIDDEFORD AND SACO WATER COMPANY	BIDDEFORD SACO	SURFACE	20.0+	16.0	20.0	3
PORTLAND WATER DISTRICT	STANDISH	SURFACE AND GROUND WATER	2.2+	-	2.2	
LIMERICK WATER DISTRICT	LIMERICK	GROUND WATER	.432	-	.432	
PINE SPRINGS DEVELOPMENT CORPORATION	SHAPLEIGH	GROUND WATER	EST. .070	-	EST. .070	
CORNISH WATER COMPANY	CORNISH	GROUND WATER	.11	-	.11	
MAINE WATER COMPANY-KEZAR FALLS DIVISION	HIRAM PORTER PARSONSFIELD	GROUND WATER	.72	-	.36	
BRIDGTON WATER DISTRICT	BRIDGTON	SURFACE	.648+	-	.648	
FRYEBURG WATER DISTRICT	FRYEBURG	GROUND WATER	.30	EST. .45	.86	

CAPACITY	PUBLIC WATER DEMANDS									
	1980			1990			2000			
PRIMARY DISTRI-BUTION	Avg. Day	Pk. Seas.	Max. Day	Avg. Day	Pk. Seas.	Max. Day	Avg. Day	Pk. Seas.	Max. Day	Avg. Da
20.0	3.896	5.684	7.637	3.956	5.979	7.754	4.136	6.325	8.107	4.803
2.2	.305	-	.459	.246	-	.370	.247	-	.372	.367
.432	.040	-	.060	.049	-	.074	.060	-	.090	.104
EST. .070	.016	-	.024	.021	-	.032	.026	-	.039	.050
.11	.050	-	.059	.056	-	.066	.062	-	.073	.082
.36	.071	-	.110	.084	-	.128	.102	-	.156	.191
.648	.295	-	.444	.326	-	.490	.363	-	.546	.47[illegible]
.86	.129	-	.195	.130	-	.196	.140	-	.212	.18[illegible]

	2030		
Max. Day	Avg. Day	Pk. Seas.	Max. Day
8.107	4.803	7.331	9.413
.372	.367	-	.551
.090	.104	-	.156
.039	.050	-	.075
.073	.082	-	.096
.156	.191	-	.289
.546	.474	-	.711
.212	.181	-	.272

TABLE X-B

PROJECTED WATER SITUATION

SOUTHERN

(AL

SUPPLIER	TOWN(S)	SOURCE		PLANT CAPACITY		
		TYPE	SAFE YIELD	TREAT-MENT	PRIMARY DISTRI-BUTION	Avg.
KITTERY WATER DISTRICT	KITTERY ELIOT	SURFACE	3.7	5.0	8.0	3.6
YORK WATER DISTRICT	YORK	SURFACE	2.5	-	2.5	1.3
SOUTH BERWICK WATER DISTRICT	SOUTH BERWICK	GROUND WATER	.27	3.5	3.5	.2
KENNEBUNK, KENNEBUNKPORT, AND WELLS WATER DISTRICT	ARUNDEL KENNEBUNK KENNEBUNKPORT WELLS	SURFACE	3.0	3.5	3.0	1.
SANFORD WATER DISTRICT	SANFORD	GROUND WATER	3.0	-	2.11	2.
ALFRED WATER COMPANY	ALFRED	GROUND WATER	.28	-	.28	.

TABLE XI-A

[W]ER SITUATION 1980 - 2030 WITH CONSERVATION MEASURES

SOUTHERN MAINE COASTAL RIVER BASINS

(ALL FIGURES ARE MGD)

[CA]PACITY	PUBLIC WATER DEMANDS									
[P]RIMARY DISTRIBUTION	1980			1990			2000			
	Avg. Day	Pk. Seas.	Max. Day	Avg. Day	Pk. Seas.	Max. Day	Avg. Day	Pk. Seas.	Max. Day	Avg. Day
8.0	3.643	3.721	5.027	3.803	3.877	5.248	4.220	4.311	5.823	4.868
2.5	1.354	1.912	2.627	1.537	2.170	2.981	1.845	2.604	3.580	2.791
3.5	.215	-	.387	.222	-	.400	.243	-	.437	.299
3.0	1.956	3.333	4.261	2.333	4.048	5.147	2.751	4.816	6.116	4.041
2.11	2.108	-	2.677	1.840	-	2.337	1.905	-	2.420	2.250
.28	.037	-	.043	.036	-	.042	.045	-	.052	.073

		2030		
s.	Max. Day	Avg. Day	Pk. Seas.	Max. Day
	5.823	4.868	4.986	6.718
	3.580	2.791	3.941	5.415
	.437	.299	-	.538
	6.116	4.041	7.105	9.014
	2.420	2.250	-	2.858
	.052	.073	-	.086

SUPPLIER	TOWN(S)	SOURCE		PLANT CAPACITY	
		TYPE	SAFE YIELD	TREAT-MENT	PRIMARY DISTRI-BUTION
BIDDEFORD AND SACO WATER COMPANY	BIDDEFORD SACO	SURFACE	20.0+	16.0	20.0
PORTLAND WATER DISTRICT	STANDISH	SURFACE AND GROUND WATER	2.2+	-	2.2
LIMERICK WATER DISTRICT	LIMERICK	GROUND WATER	.432	-	.432
PINE SPRINGS DEVELOPMENT CORPORATION	SHAPLEIGH	GROUND WATER	EST. .070	-	EST. .070
CORNISH WATER COMPANY	CORNISH	GROUND WATER	.11	-	.11
MAINE WATER COMPANY-KEZAR FALLS DIVISION	HIRAM PORTER PARSONSFIELD	GROUND WATER	.72	-	.36
BRIDGTON WATER DISTRICT	BRIDGTON	SURFACE	.648+	-	.648
FRYEBURG WATER DISTRICT	FRYEBURG	GROUND WATER	.30	EST. .45	.86

TABLE XI-B

R SITUATION 1980 - 2030 WITH CONSERVATION MEASURES

SACO RIVER BASIN

(ALL FIGURES ARE MGD)

CITY	PUBLIC WATER DEMANDS									
RIMARY ISTRI- UTION	1980			1990			2000			
	Avg. Day	Pk. Seas.	Max. Day	Avg. Day	Pk. Seas.	Max. Day	Avg. Day	Pk. Seas.	Max. Day	Avg. Day
20.0	3.896	5.684	7.637	3.448	5.167	6.758	3.586	5.447	7.030	4.168
.2	.305	-	.459	.229	-	.344	.228	-	.343	.332
432	.040	-	.060	.042	-	.063	.051	-	.077	.088
ST. 070	.016	-	.024	.018	-	.027	.022	-	.033	.043
.11	.050	-	.059	.048	-	.056	.053	-	.062	.070
36	.071	-	.110	.074	-	.115	.088	-	.136	.164
648	.295	-	.444	.278	-	.418	.309	-	.464	.404
6	.129	-	.195	.113	-	.170	.122	-	.185	.157

	2030			
Max. Day	Avg. Day	Pk. Seas.	Max. Day
7.030	4.168	6.316	8.170
.343	.332	-	.499
.077	.088	-	.132
.033	.043	-	.065
.062	.070	-	.082
.136	.164	-	.248
.464	.404	-	.606
.185	.157	-	.236

TABLE XI-B

VII CONCLUSIONS

Several very serious water supply are indicated in this report. For the most part, these deficiencies occur with public water suppliers whose communities undergo relatively large population influxes. In analyzing these problems, the safe yield of the supply source has been compared to peak seasonal demand, which usually extends over a two to three-month period and requires a water supply source with an equivalent safe yield. There are, however, two districts in the study area which do not have peak seasonal demand problems but are currently having trouble meeting their maximum day peak demands. This problem is also shared by several of the communities suffering from high seasonal demands. A short-term solution to these maximum day deficits can be achieved in most cases through the use of equalizing storage facilities, peak pricing and regulation measures.

The most significant seasonal peak deficits are and will be located along the southern coastal area, more specifically in the seven communities of Kittery, Eliot, York, Wells, Kennebunk, Arundel and Kennebunkport. The combined peak seasonal demand for these communities, projected without conservation measures, will total over 18.2 MGD in the year 2030. Implementation of conservation measures can reduce this demand to 16.0 MGD. Conversely, the combined safe yield of their current supply sources is 9.2 MGD, not including the 1.0 MGD purchased by the K.K.W. Water District from the Biddeford and Saco Water Company. This indicates that even if extensive conservation measures are taken, the area will face a peak seasonal demand deficit of 6.8 MGD, and an even greater maximum day demand.

The Kittery Water District may potentially reduce its projected 2030 demand by reducing water consumption at the Portsmouth Naval Shipyard as discussed in Section VI-B-1 of this report. It is likely that the district could eliminate its projected 2030 peak seasonal demand deficit (with conservation measures) of 1.3 MGD if such measures were taken. This would represent a 38 percent reduction of shipyard water use which appears to be reasonable for the indicated measures. Such a reduction, if realized, could preclude the need for other more expensive solutions to the district's projected supply versus demand problems, also discussed in Section VI-B-1.

In York, the projected peak seasonal demand (without conservation measures) for the year 2030 is 4.6 MGD, a supply deficit of 2.1 MGD; however, this deficit could be reduced to 1.4 MGD if conservation measures were implemented. A further estimated* reduction of 0.4 MGD can be realized through distribution system improvements. The remaining 1.0 MGD will have to be accounted for by the development of additional supply sources as previously discussed in Section VI-B-2.

A potential solution to the supply deficit problems of the southern coastal area involves the Biddeford and Saco Water Company. This company has a relatively unlimited supply source, the Saco River, and a large treatment plant capacity of 16 MGD which could easily be increased to 20 M.G.D. The projected peak seasonal demand (without conservation

* Maine Coastal Area Water Supply and Demand by Caswell and Ludwig, 1978

measures) for this company in the year 2030 is 7.3 MGD. Conservation can reduce this demand to 6.3 MGD and thereby create a potential 13.6 MGD surplus of treated water. This shows the definite capability of the current facilities to provide treated water to the distressed communities to the south. The 20 inch diameter transmission line recently installed by the K.K.W. Water District and tapped into the Biddeford and Saco Water Company is capable of handling 6 MGD of this excess water. This 6 MGD falls just short of satisfying the aforementioned southern coastal area's 6.8 MGD peak seasonal supply deficit; however, if Kittery can reduce the Naval Shipyard's water use and York can improve its distribution system's efficiency as discussed above, this projected deficit could easily be brought under 6 MGD.

On the other hand, if the Kittery Water District does manage to reduce its projected demands and/or locate new water supply sources, it could then avoid the expensive and lengthy task of extending the coastal transmission line. This would allow the K.K.W. and York Water Districts to use the line's 6.0 MGD capacity to offset most of their projected (with conservation measures) maximum day peak demand deficit of 8.5 MGD for the year 2030. This would then leave these two suppliers with a projected combined deficit of 2.5 MGD, which would require them to find additional water sources and to significantly increase their treatment and distribution capacities. A discussion of possible new sources can be found in Section VI-B.

This discussion points out the importance of the Saco River as a vital source of good quality water to a region that is projected to have serious deficits in water supply. It is therefore crucial that every precaution be taken to preserve the river's ability to provide large quantities of relatively good quality water.

In 1972 discussions took place at the legislative level between the States of Maine and New Hampshire, initiated by the U. S. Department of Agriculture, on the potential for upstream contamination of the Saco River. It seems highly desirable that talks should resume and legislation be considered to preserve this vital water supply source for the downstream communities in the State of Maine.

The South Berwick Water District faces imminent problems in meeting its maximum day peak demands. The implementation of both short and long-term conservation measures along with storage facility and distribution network improvements must be pursued in the near future. At the same time the district must continue its search for additional water supply sources as indicated in <u>Section VI-B-3</u>.

The only other immediate problem pointed out in this report concerns the Sanford Water District. Its primary distribution system is currently being overtaxed by maximum day peak demands. Increasing the capacity of the primary distribution system and the implementation of both long and short-term conservation measures must be pursued as discussed in <u>Section VI-B-5</u>. There are no apparent regional or intercommunity type solutions to the problems of either South Berwick or Sanford.

The towns of Buxton and Hollis will have average household densities which imply that a public water supply may be warranted. These towns should have a closer look at their current population distributions and planned growth patterns to see if, in fact, a public supply system would be economically feasible. Both towns have good potential supply sources as discussed in Section VI.

People who are served by their own individual water supplies appear to have more than adequate amounts of good quality groundwater at the present time. Whatever groundwater contamination now exists can be corrected and good quality water can be maintained through the following procedures:

- The enforcement of state and local codes that will prevent contamination of groundwater by human activity.
- The use of state and local land and water-use regulations and sanitary codes that protect the groundwater.
- The enforcement of state and local individual water supply construction standards.
- The use of driven and drilled wells in place of dug wells to minimize iron and managanese concentrations.
- The development of public water supply systems where population or household densities warrant such developments.

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