

TOWNSHIP OF UPPER DEERFIELD
CUMBERLAND COUNTY, NEW JERSEY

WATER AND SEWER
MASTER PLAN

FOR

UPPER DEERFIELD TOWNSHIP

MAY, 1991

 **Killam**
Associates □ Consulting Engineers

May 30, 1991

Mayor & Township Committee
Township of Upper Deerfield
Municipal Building
Seabrook, NJ 08302

RE: Water and Sewer Master Plan

Dear Mayor and Township Committee:

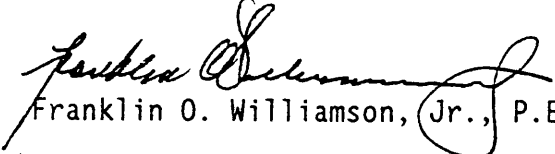
In accordance with your authorization, we are pleased to provide herewith the Final Water and Sewer Master Plan for Upper Deerfield Township. The following Master Plan addresses the water and wastewater needs for the immediate and projected long-term future growth of the Township.

The Final Water and Sewer Master Plan has been revised consistent with Township review comments and is being presented to the Township for adoption for implementation.

Should the Township have any questions relative to the report, please contact our office.

Respectfully submitted,

KILLAM ASSOCIATES


Franklin O. Williamson, Jr., P.E.


Peter E. Kocsik, P.E.

PEK/dk/ud530mp



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May, 1991

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I. INTRODUCTION

A. Background

The Township of Upper Deerfield encompasses approximately 32 square miles of the northeast corner of Cumberland County. The Township is situated just 36 miles to the south of Philadelphia and 30 miles east of Wilmington Delaware. Due to current economic trends and the development of major interstate highways to urban areas, the Township is undergoing major development pressures within its boundaries. In the late 1970's, the Township thought that it was "on the brink" of major development. The only obstacle to overcome was the lack of public water and sewer utilities. However, before the growth could occur, the economy suffered a recession which all but halted development. Between 1970-1987, the population of the Township reportedly increased by only 276 people or approximately 4% as opposed to an anticipated increase of approximately 50% to 10,000 people.

Recently the Township has experienced pressure from numerous developers to construct large housing and commercial projects. During the past decade, the Cumberland County Utilities Authority constructed regional wastewater conveyance facilities through the Township up to Seabrook. The availability of public sewers and the increased demand for housing combined with several major landowners actively marketing over 6,000 acres of land throughout the Township are all factors which suggest that the major development which is already underway will continue through the planning period.

Again, as was the hurdle in the late 1970's, the Township is largely without public water and sewerage facilities. This has prompted residential and commercial developers to propose numerous independent water and sewerage facilities which in turn has encouraged the Township of Upper Deerfield to embark on the preparation of a Master Plan for Water and Sewer Utilities to aid in the management and control of growth within the Township.

This report entitled "Water and Sewer Master Plan for Upper Deerfield Township" addresses, in detail, various elements which affect the development of long term planning for water and sewer utilities. The Master Plan considers the impacts of State and Regional Plans such as the 208 Water Quality Management Plan, the 201 Facilities Plan, and the State Development and Redevelopment Plan. Furthermore, local criteria, such as zoning, environmentally sensitive areas, proposed developments, Township Master Plan, and existing water and sewer facilities are factored into the development of the Master Plan.

The following report provides estimates for projected growth within the Township and estimates of projected water needs and wastewater generation. Ultimate growth projections consider the full build-out of currently zoned buildable areas, although it is undeterminable as to when this may finally occur. A Sewer Master Plan Map and a Water Master Plan Map have been prepared and illustrate existing service areas and locations where future facilities should be constructed; the size of pipelines; and the approximate locations of

recommended pump stations, well stations, water storage tanks, and possible interconnections. The Master Plan also address the needs of proposed developments and provides a staged program for the construction of water and sewer projects for existing developed areas.

B. Goals

The Water and Sewer Master Plan, together with the Township Master Plan and zoning ordinances, will be useful tools in guiding the growth and future development of Upper Deerfield Township. The goals of the Water and Sewer Master Plan parallel the goals established by the Township's overall Master Plan as summarized below:

1. The preservation of the Township's character and physical features;
2. Enhancement of the quality of life for all of the community's residents, and;
3. Innovation in and continued evaluation of the approaches and methods used for resolving conflicts, problems, and pressures.

With the above general goals in mind, the following goals are suggested to be used as guidance in planning, developing and implementing the Water and Sewer Master Plan for Upper Deerfield Township.

Sewer Program

1. The development of a wastewater conveyance system to serve both existing developed areas and future developed areas consistent with Township planning and zoning.

2. Request amendment to the 208 Water Quality Management Plan in conformance with Township planning through a Wastewater Management Plan.
3. Require sewer connection wherever public sewer lines are available.
4. Require new development (ie: 10 or more housing units) to connect into existing sewer utilities. Smaller developments or developments that can demonstrate hardship such as being located a considerable distance from existing sewers or requiring considerable downstream improvements should be given special consideration by the Township. In such instances, it must be demonstrated that the area to be developed is septic suitable. In addition, as a minimum, dry sewers should be provided by all developments requiring road or street extensions and such development should make commitments to assist in the future construction of downstream utilities.
5. Require all proposed sewer facilities to be reviewed and approved by the Township.
6. Require all future development to construct on-site and off-site sewer facilities consistent with the Sewer Master Plan.
7. Where practical or advantageous, participate with a developer in the construction of a sewer line extension that would benefit other areas of the Township.
8. Coordinate with the Cumberland County Utility Authority the development of the Township sewer system as it relates to regional systems.

Water Program

1. The development of an independent Township Water Supply system, complete with supply, treatment, storage and distribution, to serve developed areas of the Township consistent with Township planning and zoning.
2. Require connection to the public water system wherever public water lines are available.
3. Require new developments of 10 units or more or located within one mile of a public water line to connect to the public water system. Smaller developments or developments further away should be judged independently. All future development within the Township within the water service area should be constructed with dry water lines as a minimum.

4. Require all future development to construct on-site and off-site water facilities consistent with the Water Master Plan and at their own cost.
5. Require all proposed water facilities to be reviewed and approved by the Township.

II. PRESENT POPULATION AND PROJECTION OF FUTURE GROWTH

The development of a Water and Sewer Master Plan is dependent upon growth and population projections. The Township has experienced a trend of below average growth as compared to Cumberland County for the past two decades. The Township experienced a moderate increase in population between 1960 and 1970, as illustrated in Table 1, however, the population has increased by only 4% from 1970 through 1987.

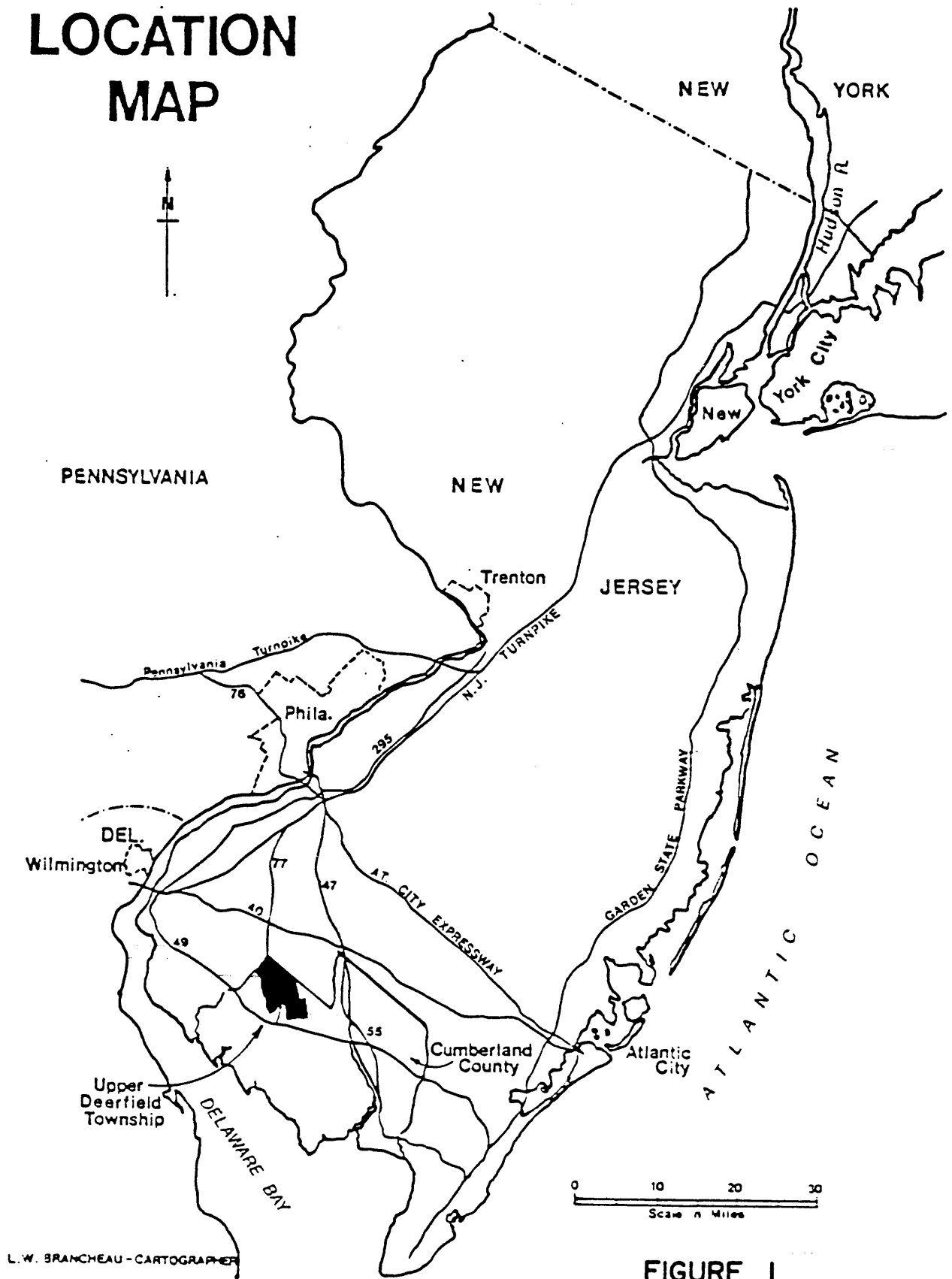
Table 1
Comparison of Population Growth

<u>Year</u>	<u>Upper Deerfield</u>	<u>% Change</u>	<u>Cumberland County</u>	<u>% Change</u>
1960	6,040	--	106,850	--
1970	6,648	10.10%	121,374	13.60%
1980	6,810	2.40%	132,866	9.50%
1987	6,921	1.60%	136,453	2.70%

Since Upper Deerfield is 31.8 square miles in area the average population density is 217.7 persons per square mile based upon 1987 data. In 1980, Upper Deerfield had a reported density of 214.6 persons per square mile. Although Upper Deerfield is the fourth most populated municipality in Cumberland County, the Township's density is well below the County's average density of approximately 264.5 in 1980.

Due to the Township's location in South Jersey (Figure 1), the community has been largely unaffected by the rapid growth experienced in communities between Philadelphia and New York during the past 10 years. However, recent

LOCATION MAP



L.W. BRANCHEAU - CARTOGRAPHER

FIGURE I

SOURCE: UPPER DEERFIELD TOWNSHIP
MASTER PLAN, 1988

trends in development sprawl and favorable conditions for development within the Township, have led the Township to believe that an increase in development will soon occur within its boundaries. Various reports and agencies have predicted that Cumberland County and Southern New Jersey will experience substantial growth by the year 2000. The 208 Water Quality Management Plan for the Lower Delaware Area utilized trend projections prepared by the New Jersey Department of Labor and Industry and the Federal Bureau of Economic Analysis, to project population increases for Cumberland County of approximately 13% between 1975-1985, and an increase of approximately 31% between 1975 and 2000. In the "Cumberland County Cohansey River Basin Wastewater Management Plan Selection Report", prepared for the Cumberland County Sewerage Authority in 1974, projections were included which indicated that the population of Upper Deerfield Township would increase five fold by the year 2000 to approximately 35,000 people and continue to grow to almost 52,000 people by the year 2015. These reports used in the early planning of Regional Sewerage Facilities obviously forecast a large amount of development to occur in both Cumberland County and Upper Deerfield Township. In a subsequent report prepared in 1980 entitled "Preliminary Engineering Report Upper Deerfield Interceptor" prepared for the Cumberland County Utilities Authority, the population projections were greatly reduced. This report suggested a population increase of only 763 people, to 7,391, between 1980 and 2000, or an increase of approximately 11%. Based upon available data, it is difficult to determine the reasons for the reversal in population projections, however, it should be noted that these latter figures were utilized in designing regional sewerage facilities for Upper Deerfield Township.

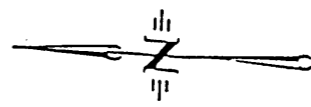
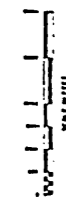
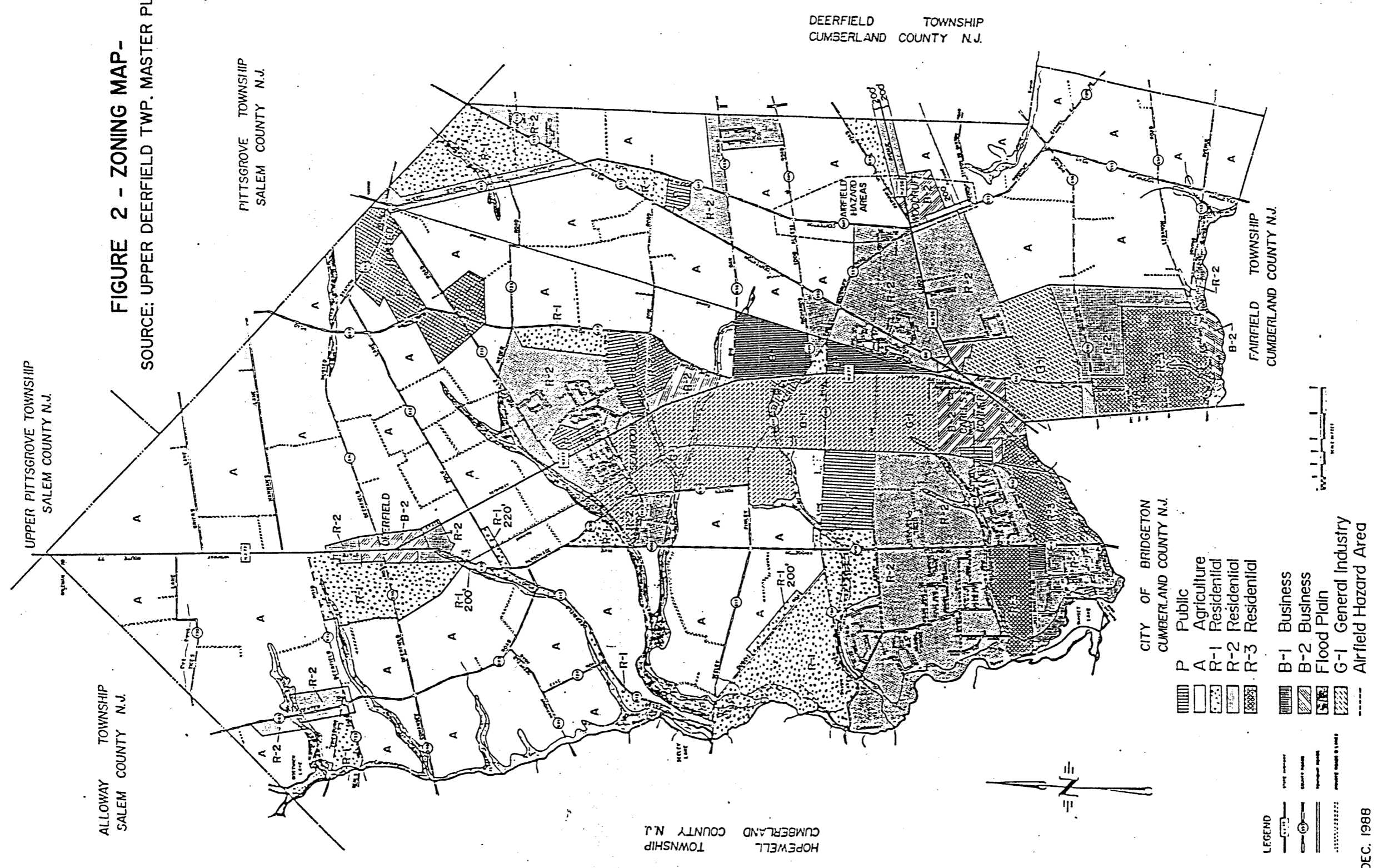
For the purpose of developing the Water and Sewer Master Plan, an independent projection of population is presented below. Since water and sewer utilities normally have life spans in excess of 50-75 years, consideration must be given to the potential development that could occur in that time period. Due to difficulties in projecting even 40 years in the future, a simple approach of estimating the total build-out potential of the current zoned areas was utilized. The assessment of the build-out potential of Upper Deerfield Township considered existing residential, commercial, and industrial development; current zoning plans and ordinances; and a determination of available vacant land in residential, commercial and industrial zones.

Upper Deerfield Township's zoning map is shown in Figure 2. As the map indicates, large portions of the Township have been dedicated to agricultural uses. Table 2 illustrates the breakdown of zoned areas by acreage.

TABLE 2
ZONING AREAS

<u>Zone</u>	<u>Approximate Total Area</u>	<u>%</u>
R-1	1,380	6.8
R-2	3,420	16.9
R-3	720	3.5
B-1	225	1.1
B-2	450	2.2
G-1	1,340	6.6
Agric.	12,200	60.0
Public	600	2.9
	<u>20,300</u>	<u>100%</u>

FIGURE 2 - ZONING MAP-
SOURCE: UPPER DEERFIELD TWP. MASTER PLAN



LEGEND

TOWNSHIP BOUNDARY
 COUNTY BOUNDARY
 WATER BODY
 PROPERTY LINES & LOTS
 AIRFIELD HAZARD AREA

DEC. 1988

The zoned agricultural areas are in general conformance with the Draft Preliminary State Development and Redevelopment Plan which has recommended large portions of the Township to be Tier 6A or agricultural areas. For the purpose of this study, agricultural and public areas were removed from the growth analysis. It is assumed that the agricultural areas will continue the utilization of surficial aquifers for irrigation and domestic purposes and wastewater disposal will be accomplished through on-site disposal facilities. The remaining residential, commercial, and general industrial areas were analyzed in greater detail and projections made for future number of dwelling units, and commercial and industrial development. Table 3 presents the approximate extent of existing and estimated future residential development in residentially zoned areas only.

TABLE 3
Residential Housing Projections

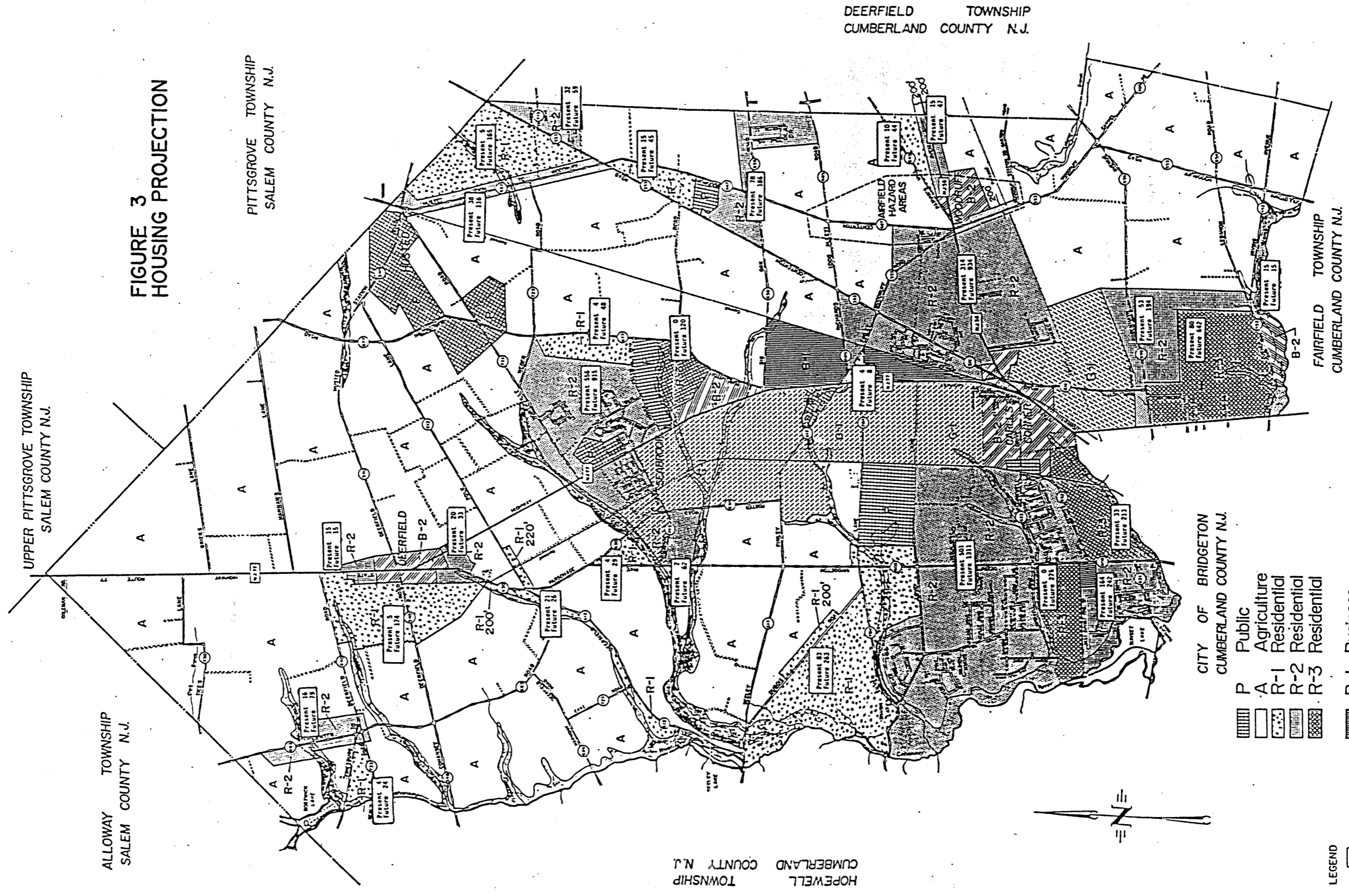
<u>Zone</u>	<u>Existing Units</u> (1)	<u>Estimated Additional Future Units</u>	<u>Total</u> (2)
R-1	155	671	826
R-2	1,819	2,389	4,208
R-3	<u>113</u>	<u>1,137</u>	<u>1,250</u>
	<u>2,087</u>	<u>4,197</u>	<u>6,284</u>

(1) Based on field count in February, 1989.

(2) Does not include approximately 87 houses located in business and industrial areas or additional houses in agricultural areas.

A breakdown of the housing projections on a zone by zone basis is shown in Figure 3. In general, the area of vacant land was calculated by excluding wetland and environmentally sensitive areas, areas of known proposed development and reducing the remaining area by 25% to allow for infrastructure improvements. The resulting areas were then developed at the following densities.

**FIGURE 3
HOUSING PROJECTION**



DEERFIELD TOWNSHIP
CUMBERLAND COUNTY N.J.

UPPER PITTSGROVE TOWNSHIP
SALEM COUNTY N.J.

ALLOWAY TOWNSHIP
SALEM COUNTY N.J.

PITTSGROVE TOWNSHIP
SALEM COUNTY N.J.

HOPEWELL TOWNSHIP
CUMBERLAND COUNTY N.J.

FAIRFIELD TOWNSHIP
CUMBERLAND COUNTY N.J.

CITY OF BRIDGETON
CUMBERLAND COUNTY N.J.

- LEGEND**
- Public
 - Agriculture
 - R-1 Residential
 - R-2 Residential
 - R-3 Residential
 - B-1 Business
 - B-2 Business
 - Flood Plain
 - G-1 General Industry
 - Airfield Hazard Area

DEC. 1988

R-1 - 1 home/acre

R-2 - 2 homes/acre

R-3 - 2.2 homes/acre⁽¹⁾

(1) Based upon current R-3 density of Sencit Development.

As indicated previously, the housing projection considered known proposed development. As of March 1989, sixteen (16) developments were in various phases of planning throughout the Township as shown in Table 4. In all, 10 of those developments proposed over 1,320 dwelling units. These units are included in the housing projection and would represent, by themselves, a 78% increase in housing over 1987 levels.

Table 4

Known Proposed Development

<u>NO.*</u>	<u>NAME</u>	<u>NUMBER OF PROPOSED UNITS</u>
1	Bench, Block 24, Lot 13	53
2	Sandel, Block 64, Lot 8	26
3	Bench - Big Oak	Industrial Area
4	Bench - Industrial Park	45 Industrial Lots
5	Bench - No Plans	Industrial Area
6	Sandel - Woodruff Road	30
7	John Ritter	47
8	No Plans	N/A
9	Quail Ridge	49

Table 4
Known Proposed Development

<u>NO.*</u>	<u>NAME</u>	<u>NUMBER OF PROPOSED UNITS</u>
10	No Plans	N/A
11	No Plans	N/A
12	Tunbridge Hills	24
13	Bench (Love Lane) Block 107, Lot 1	399
14	Sencit (Cornwell Woods)	275
15	Dalessio/Caselli Apt.	208
16	Lerner property	210
TOTAL		<u>1,321</u> ⁽¹⁾ Units

* No. Corresponds to information offered by Township

NOTE: 1) industrial parks are not included in totals

Based upon assumed growth rates for the various proposed developments an estimate of housing growth has been projected and shown on Figure 4. Housing projections can be converted into population projections by multiplying by the average number of people per household. In 1980, Upper Deerfield Township had a total of 2,346 housing units and a population of 6810 or a household density of 2.90 people/home. In 1970, the reported household density was 3.2 people/home. For the purpose of projecting water and sewer needs a household density of 3.0 was used, which resulted in the following population projection.

FIGURE 4
HOUSING GROWTH PROJECTION
(ALL AREAS)

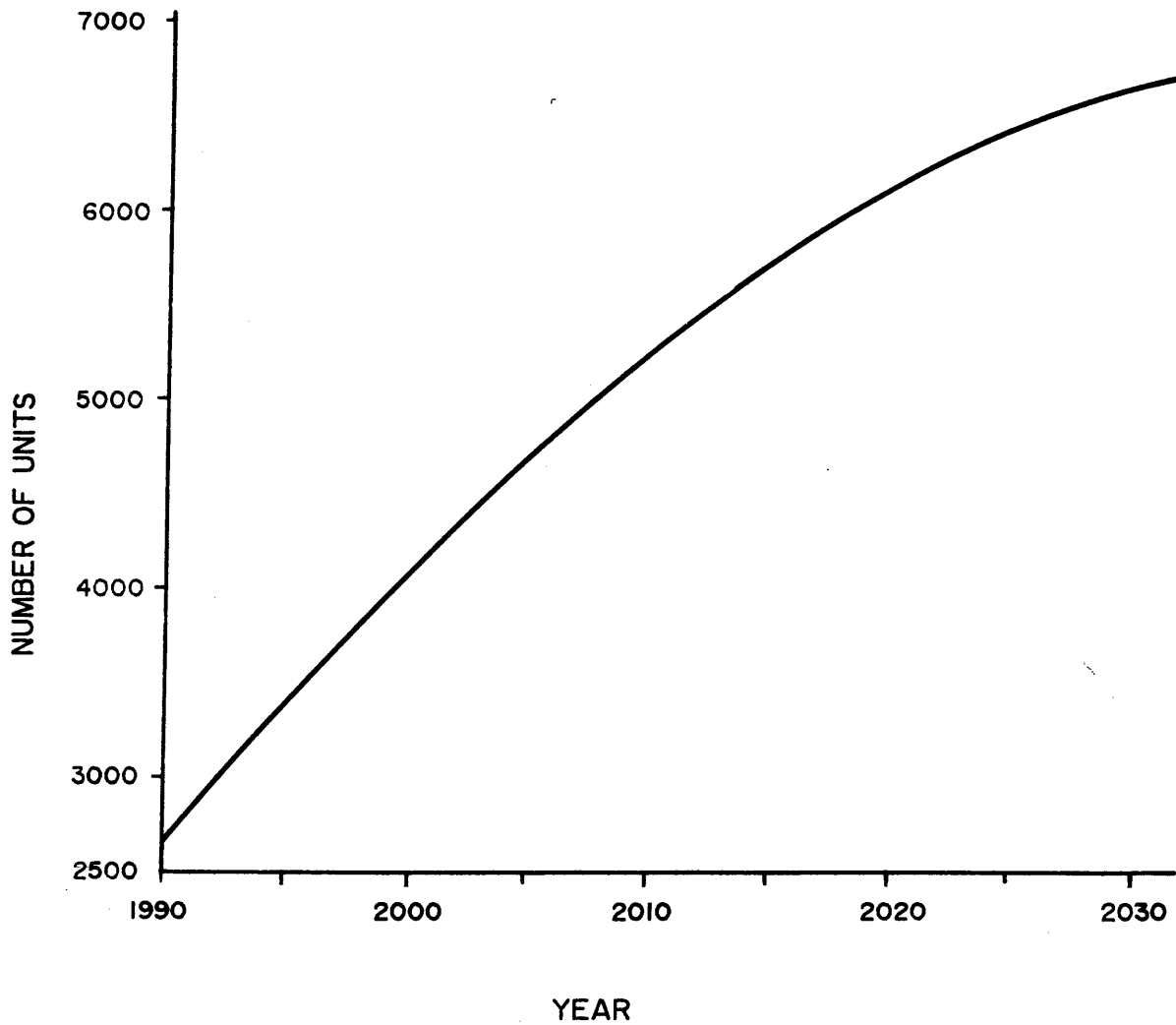


Table 5

Projection of Total Residential Population

Existing = 2087 housing units x 3.0 = 6261 people*

Future build-out = 4197 housing units x 3.0 = 12,591 people*

Total = 6284 housing units x 3.0 = 18,852

* Does not include residents or housing units in agricultural, commercial or public zoned areas.

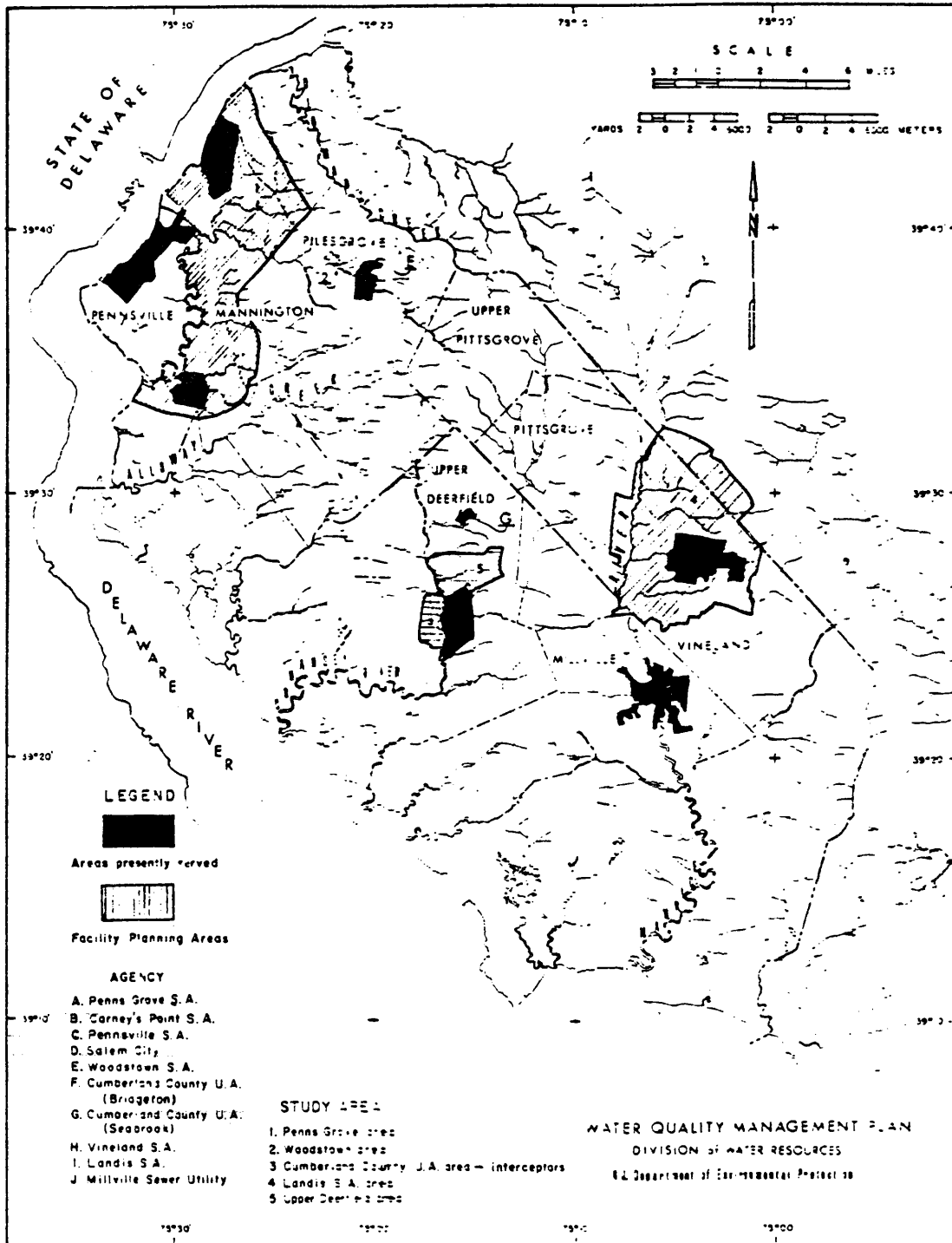
Since the reported population was 6,921 people in 1987, the above approach suggests that approximately 660 people live in non-residential zoned areas. Accordingly, the total future population should be increased by at least 660 people to project total Township population.

III SEWER MASTER PLAN

Numerous factors play a role in developing a Sewer Master Plan, including local, regional, State and Federal governmental policies, regional sewer system capabilities, and local conditions such as terrain, environmentally sensitive areas, existing infrastructure, zoning policies, etc. The following section will discuss the parameters associated with the development of the Sewer Master Plan.

A) The 208 Water Quality Management Plan

As part of the Federal Water Pollution Control Act Amendments of 1972 and 1977, Section 208, required the preparation of Water Quality Management Plans to develop comprehensive programs to abate all forms of water pollution. In response, the NJDEP prepared a Draft Water Quality Management Plan for the Lower Delaware Area. The specific impact of the 208 Plan upon Upper Deerfield Township is that the Plan, with respect to wastewater treatment systems, only concentrated on selected areas. Figure 5 illustrates the planning areas for Cumberland County. These areas were incorporated into the 201 Facilities Plan. Under current regulations, areas outside the 208 Plan area cannot be provided with public sewer systems until additional data is provided to the NJDEP and an amendment to the plan is approved. This process is initiated through a Wastewater Management Plan (WMP) and can be a lengthy process. A review of the 208 Planning area for Upper Deerfield Township suggests that a major portion of the Township including proposed sewer service areas are not included in the 208 Plan and that a WMP and a 208 Amendment will be required before these areas of the Township can be sewerred. The present limits of the approved "208 area" have been shown on the Sewer Master Plan Map.



SOURCE: WATER QUALITY MANAGEMENT
 PLAN LOWER DELAWARE AREA
 MAY 1979.

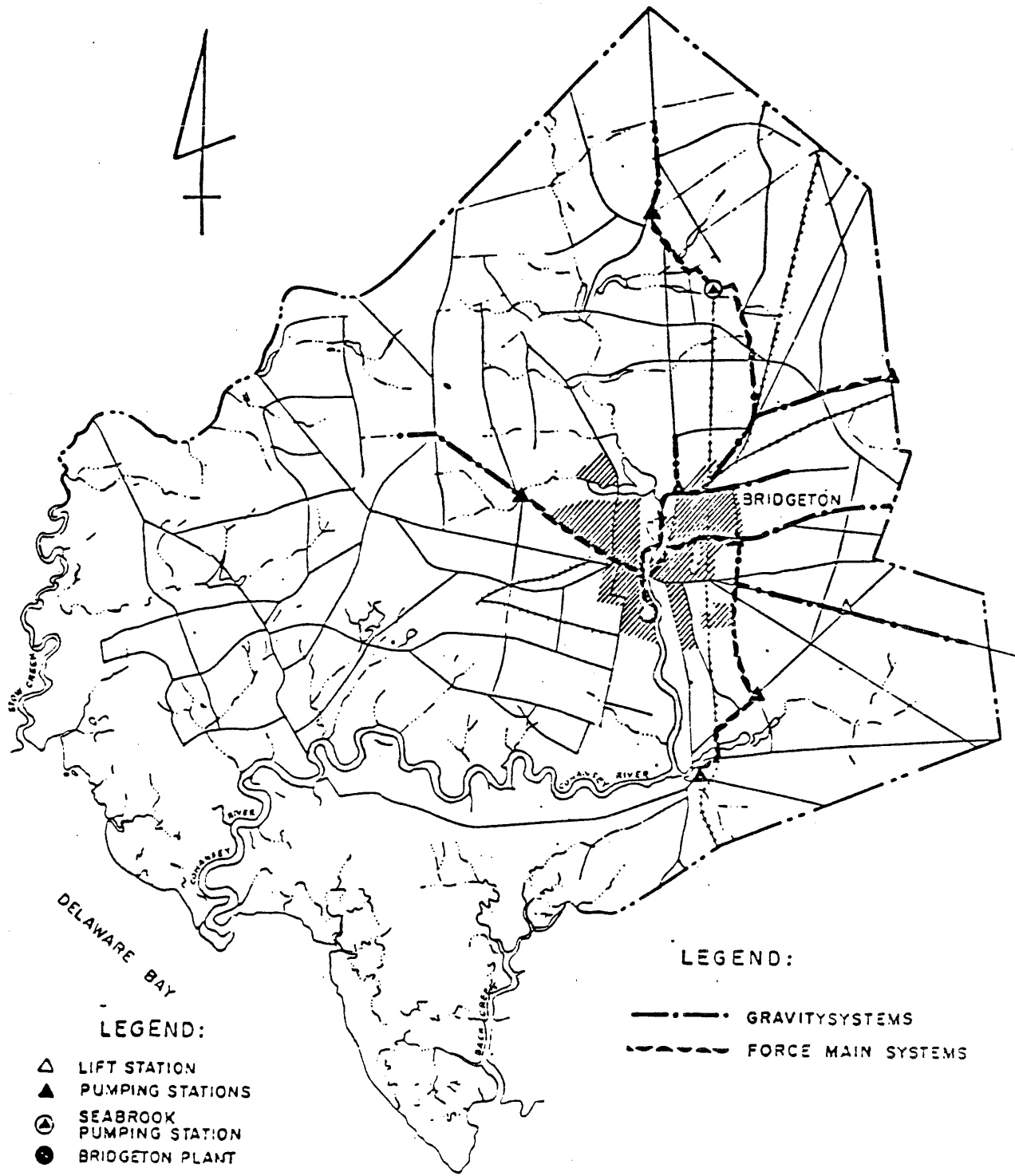
FIGURE 5
 208 PLAN MAP

B. The 201 Facilities Plan

As part of the Federal Water Pollution Control Act, municipalities and regional sewerage authorities who desired to obtain Federal funding were required to prepare 201 Facilities Plans. The 201 Facilities Plans analyzed various alternatives in planning regional sewer systems and treatment works to determine the most cost-effective means of providing immediate and long term sewerage service. The 1974 Plan Selection Report for the Cumberland County Cohansey River Basin recommended the construction of a single treatment facility in the City of Bridgeton with a network of regional interceptor sewers as shown in Figure 6. The service area of the 201 Facilities Plan is shown in Figure 7 and encompasses all of Upper Deerfield Township. However, the final plan did not include sewers throughout the entire service area, although the initial planning was done so that additional portions of the Planning Area could be sewerred at a later date. The reduced planning area closely resembles the 208 Planning area.

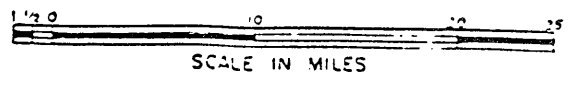
C. Existing Cumberland County Utilities Authority Regional Facilities

The Cumberland County Utilities Authority was established in 1971. By 1979, a new 7.0 MGD wastewater treatment plant was constructed and activated. The treatment plant, located in Bridgeton, along the Cohansey River, has the capability of future expansion to treat 14.0 MGD. The Cohansey River Basin plant is designed to service portions of Upper Deerfield Township, Hopewell Township, Fairfield Township and the City of Bridgeton. The current configuration of the CCUA Regional Facilities is shown in Figure 8.



- LEGEND:**
- △ LIFT STATION
 - ▲ PUMPING STATIONS
 - ⊙ SEABROOK PUMPING STATION
 - BRIDGETON PLANT

- LEGEND:**
- GRAVITY SYSTEMS
 - - - FORCE MAIN SYSTEMS

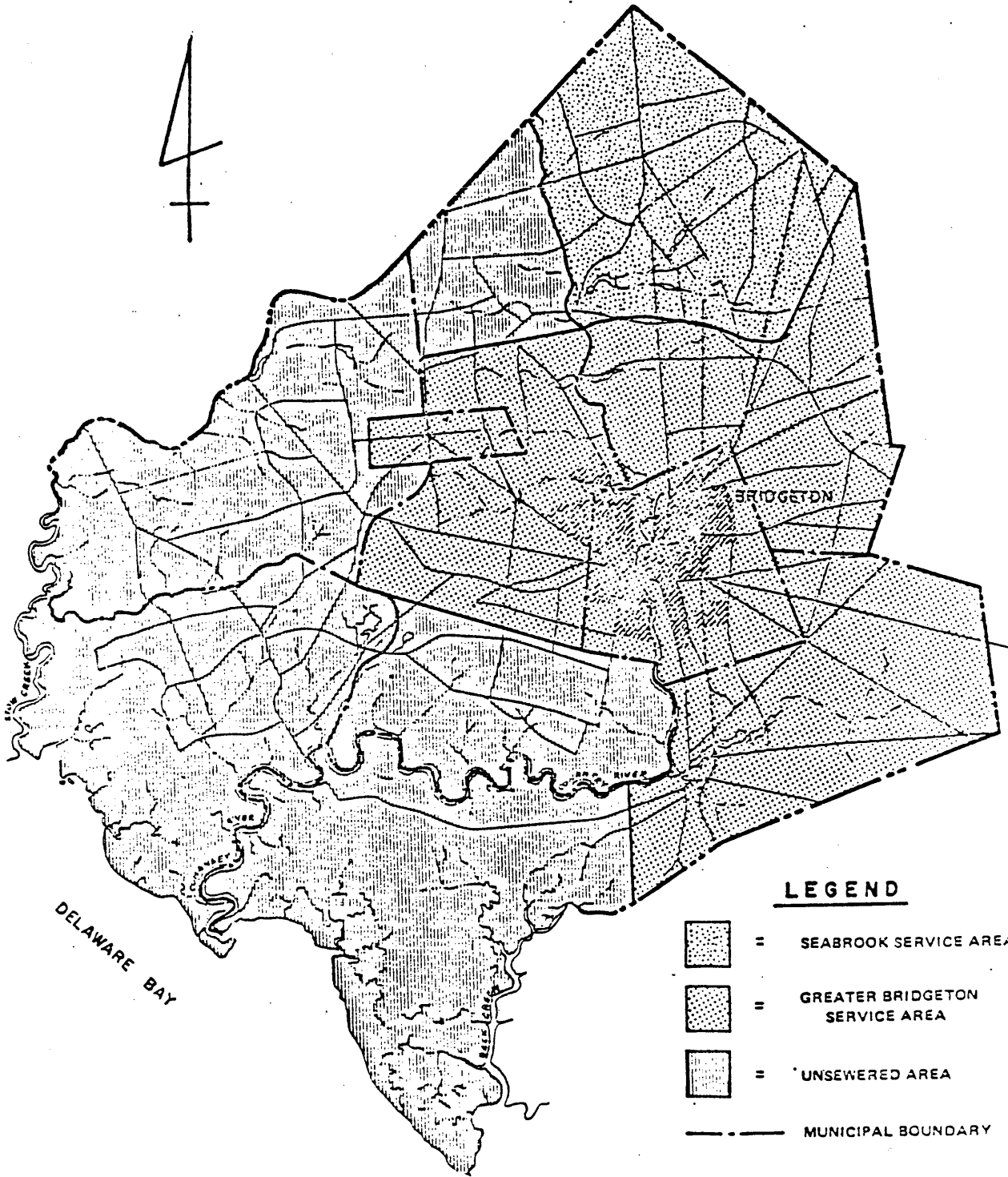


SOURCE:
 COHANSEY RIVER BASIN
 WASTEWATER MANAGEMENT PLAN
 SELECTION REPORT





BY: JOHN G. REUTTER ASSOC.

FIGURE 6
201 SELECTED ALTERNATIVE





LEGEND

-  = SEABROOK SERVICE AREA
-  = GREATER BRIDGETON SERVICE AREA
-  = UNSEWERED AREA
-  = MUNICIPAL BOUNDARY



SOURCE:
 COHANSEY RIVER BASIN
 WASTEWATER MANAGEMENT PLAN
 SELECTION REPORT

BY: JOHN G. REUTTER ASSOC.

FIGURE 7
 201 SERVICE AREAS.



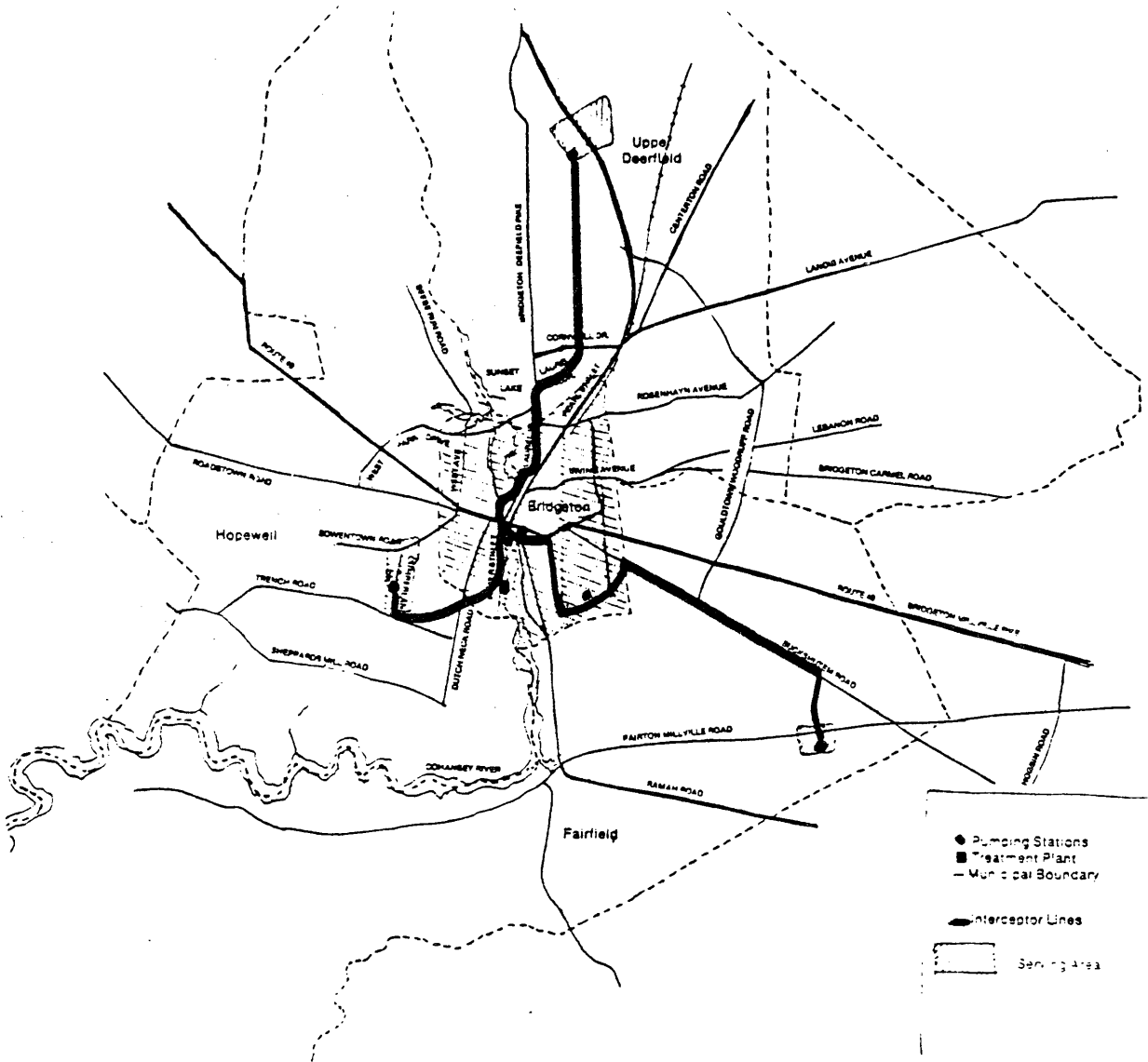


FIGURE 8
CCUA - MASTER PLAN

SOURCE: CUMBERLAND COUNTY UTILITIES AUTHORITY
INFORMATION GUIDE

The Cohansey River Basin WTP was reported to be treating between 2.7 to 3.5 MGD on an average monthly basis. In 1988, the annual average wastewater treated at the facility amounted to 2.72 million gallons per day. It has been reported that the large variation between plant capacity (7.0 MGD) and the actual flow rate (2.72 MGD) is due to: 1) a decline in industrial users in the City of Bridgeton, and 2) an expectation of future development which has yet to occur. Based upon available data, it appears that the existing Cohansey River Basin WTP has treatment capacity for substantial growth within the contributing communities.

In 1980, the CCUA undertook the design and construction of the Upper Deerfield Interceptor. The design report recommended the routing of the interceptor (force main) as well as pipe sizes and sewer connection points. As shown in Figure 8 and on the Sewer Master Plan in Appendix A, the interceptor is located in a portion of Deerfield/Bridgeton Pike, Laurel Heights Drive and the old Conrail Railroad right-of-way to Seabrook. Based upon the "Preliminary Engineering Report for the Upper Deerfield Interceptor", it appears that the interceptor was sized to only accommodate wastewater from the Seabrook area (which includes what is now Clement Pappas Inc., Cumberland Cold Storage, the Seabrook Villages and surrounding commercial and institutional buildings) and portions of Carll's Corner and Cornwell Heights. The report indicated an interceptor service area population of 2666 persons for 1980, with a projected population of 4,586 persons for the year 2000. Estimated wastewater flow projections were 0.225 MGD for 1980 and 0.500 MGD for the year 2000. Based upon this design criteria, the recommended interceptor was constructed as

a force main consisting of 10-inch and 12-inch diameter pipelines. As discussed later in this report, the existing CUA interceptor sewer is limited in the quantity of wastewater it can convey and will require reinforcement in order to meet future development needs within Upper Deerfield Township.

The CUA also owns and operates a pumping station located at the beginning of the Upper Deerfield Interceptor to the south of the old Seabrook Farms processing plant, at the site of the former Seabrook Wastewater Treatment Facility. The pump station was designed for an average daily pumping capacity of 0.236 MGD for the year 2000. The pump station is a wet well/dry well facility with two pumps designed to each pump 650 GPM at a total dynamic head (TDH) of 70 Ft.

The CUA has installed four connection points along the force main for connection by Upper Deerfield Township as shown on the Master Plan. Two of the four connection points have already been utilized by the Carll's Corner sewer system and the Cumberland Regional High School.

D. Existing Township Sewer Systems

Three portions of the Township are currently sewered and connected into the CUA Interceptor, and include the Seabrook area, Carll's Corner and the Cumberland Regional High School.

1. Seabrook Area

The Township now owns and operates the wastewater collection system which had been constructed by Seabrook Farms. The collection system services domestic waste and processing waste from Clement Pappas and Cumberland Cold Storage, as well as the Seabrook Village area. The collection system is comprised of 6, 8 and 10-inch diameter sewer lines and serves the East and West Villages, the township schools and the municipal complex. The Township also purchased a private collection line which had been constructed by Seabrook Bros. & Sons, Inc. and extends north to the CCUA pump station. This sewer line only conveys domestic waste from the Seabrook Bros. & Sons, Inc. processing plant. All processing wastes from this facility are disposed of through spray fields. The major existing sewer lines in the Seabrook area have been shown on the Sewer Master Plan.

2. Carll's Corner

The Township, in cooperation with the McDonald's Corporation, has recently constructed a sewer collection system, pumping station, and force main in the Carll's Corner area. The collection system is shown on the Sewer Master Plan and serves most commercial developments along Route 77, the Carll's Corner Shopping Center, and areas surrounding portions of Landis Avenue and Cornwell Drive. The sewage pump station, located behind McDonald's, was designed with two pumps each rated at 500 GPM and equipped with 15 Hp motors. However, Township personnel indicate that each pump is only capable of producing 350 GPM individually and 450 GPM in parallel operation. The station discharges through a 10" diameter force main to the CCUA Interceptor at a connection point near Cornwell Drive and the railroad tracks.

3. Cumberland Regional High School

The Cumberland Regional High School, located on Love Lane and Silver Lake Road, had a reported student population of approximately 1,550 persons in 1988. Recently the school's sewage facilities were modified, and now discharge wastewater to the CCUA Interceptor near the intersection of Love Lane and the railroad. The school's sewage pump station and force main are sized only to serve the high school and are not beneficial to surrounding areas.

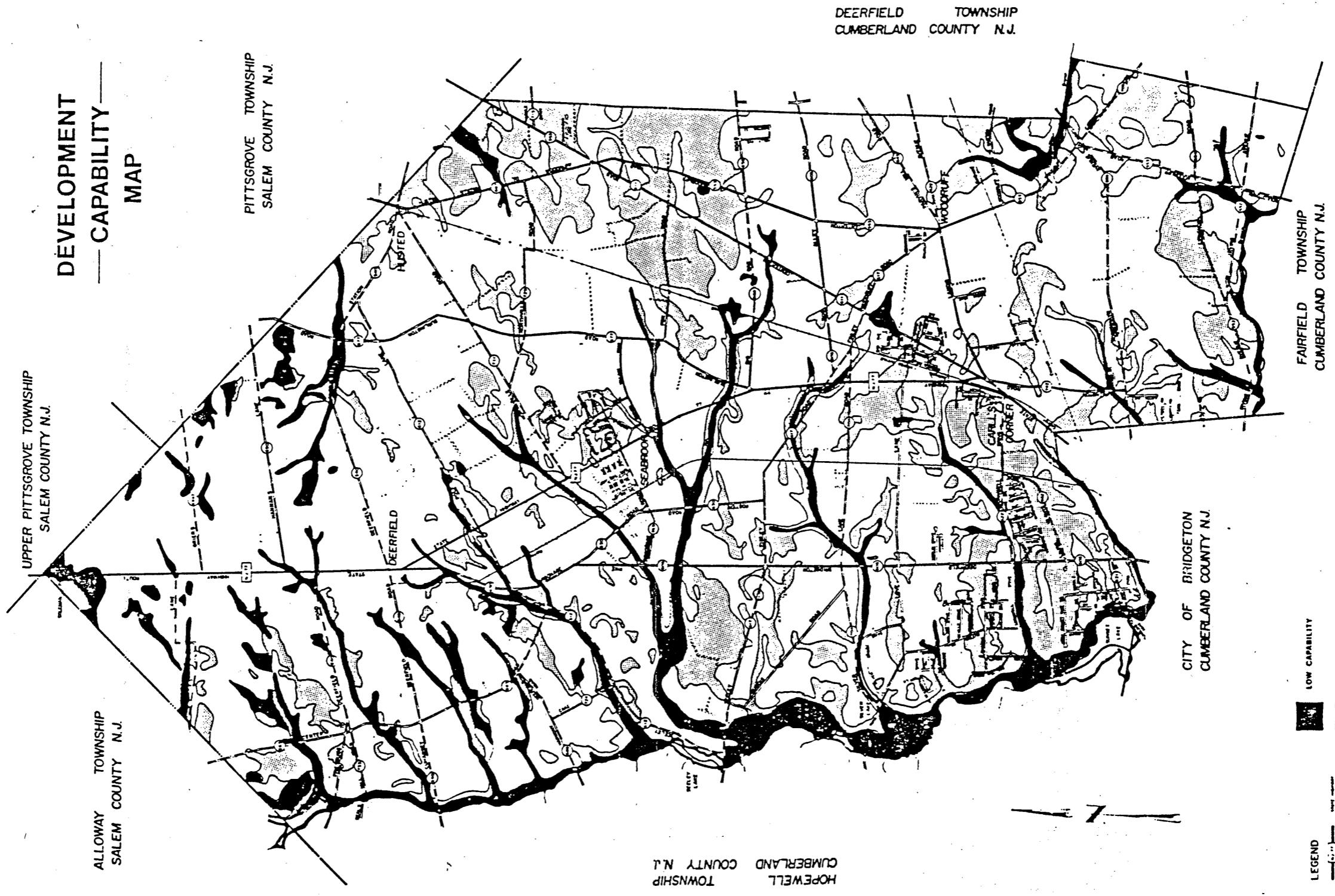
E. Selected Study Area and Septic Management

As previously indicated, the purpose of the Sewer Master Plan is to develop a comprehensive Township sewerage system which will meet the growing needs of existing and future development. Therefore, it is essential to first identify those areas of the Township which should be considered for sewer service. In general, the recommended sewer service areas correspond to the current Land Use and Zoning Map (Figure 2). A review of the Zoning Map reveals that most development or potential development is centered around Route 77 and the southern portion of the Township. The remainder of the Township is comprised of agricultural areas and remote small communities. It is recommended that those portions of the Township which are presently zoned for agricultural use not be provided with a public sewerage system due to the use restrictions in Agriculture Zones. In these areas the current practice of individual subsurface sewage disposal in accordance with current health and State Standards should be maintained.

Several of the residentially developed areas of the Township located to the North and West are also recommended to be excluded from the Township's public sewer system. These areas are relatively remote from the center of the Township and have limited development potential under current zoning. Based upon soil characteristics available from the USDA Soil Conservation Service, these areas of the Township are for the most part suitable for septic systems for individual wastewater disposal. Figure 9 is the Development Capability Map from the Township's Master Plan, which was developed from the SCS data. Areas of moderate or high capabilities are estimated to be suitable for septic systems provided that reasonable spacing is maintained between homes. The Sewer Master Plan Map illustrates those areas of the Township where individual subsurface sewage disposal practices should be utilized in accordance with current State regulations. Recently, the State regulations regarding the construction of Individual Sewage disposal system (NJAC 7:9A-1.1 et seq. (Chapter 199)) were completely revised and expanded to establish new criteria and standards. It is recommended that the Township require all subsequent development and construction in these areas to conform to State Standards and in effect adopt the State's Standards as Township Standards. Although approval of septic systems should still be required to be obtained through the County Health Department, the Township should also require all developers in these areas to provide duplicate copies of all data required by the State Standards

UPPER DEERFIELD TOWNSHIP
CUMBERLAND COUNTY
NEW JERSEY

**DEVELOPMENT
CAPABILITY
MAP**



LEGEND

- (dashed line) —
- (dotted line) —
- (solid line) —
- (thick solid line) —
- (thin solid line) —
- (double solid line) —

LOW CAPABILITY (stippled box)

MODERATE CAPABILITY (white box)

HIGH CAPABILITY (solid black box)



MADE BY: David M. Planning
Consultant, License No. 1510
LaGrande Branch, Cartographer
Base Map: George A. Schick, P.E.

FIGURE 9- TWP. DEVELOPMENT CAPABILITY MAP
SOURCE: UPPER DEERFIELD TWP. MASTER PLAN

(soil suitability classifications, soil logs, soil profile pit, percolation and permeability tests, etc...) for a separate review by Township personnel to satisfy the Township's concerns.

The current zoning in the areas which have been identified as individual subsurface sewage disposal areas requires either 1 acre or $\frac{1}{2}$ acre lots which in itself limits the density of development. Whether or not septic systems can be built within these lot sizes must be determined through the individual analysis required by State Standards. Situations may arise where more than one lot is required to meet State Standards which would further limit development in these areas.

Currently public sewers are not recommended for these areas mainly due to their remote location and cost to extend this service. However, if future conditions change such that high density development does occur in these remote residential areas or agricultural areas, it is recommended that this policy be re-evaluated at that time to determine if public sewers are feasible.

F. Wastewater Flow Projections

1. Existing Wastewater Flow

Existing wastewater flows within the Township are generated from the Seabrook area, Carll's Corner and the Cumberland Regional High School. Table 6 illustrates the approximate flow from each of the three areas.

TABLE 6

<u>Existing Wastewater Flows</u>		
<u>Area</u>	<u>1988 Average Daily Flow (GPD)</u>	<u>Comment</u>
Carl1's Corner	16,000	Estimated - based on approximate pump rate and hours run
Cumberland Regional High School	7,800	Based on 5 GPD/Student-Metered
Pappas	129,000	Metered
Seabrook Area-		
Seabrook Bros. Schools	9,400	Metered
Homes & Other	6,000	Estimated based on 5 GPD/student
	<u>72,800</u>	Estimated based on remainder of metered flow
Total	241,000 GPD	

Of the various areas noted above, only the Seabrook area and Carl1's Corner area services residential units. It is estimated that 562 residential dwellings exist in the Seabrook East and West Villages. However, the East Village is currently being renovated and has temporarily vacated numerous dwellings. Based upon 562 dwellings, it is estimated that each residential unit generates approximately 140 gallons/day. This figure is extremely low as compared to normally anticipated residential flows. The disparity may be due to numerous unoccupied houses and variation of some commercial and institutional use. No meters are available in the Carl1's Corner system to distinguish residential use from commercial use, or determine per capital consumption.

2. Projected Future Wastewater Flow

Wastewater flow projections are based upon the future build-out of the areas within the sewer service area under current zoning regulations.

Table 3 illustrated a projection of approximately 6,284 residential units in the R-1, R-2 and R-3 zoned areas. However, as indicated in Table 7 and as shown on the Sewer Master Plan, not all residential areas are planned to be sewerred. Table 7 presents a breakdown of projected future residential units which are included in the planned sewerred area.

Table 7
Estimated Future Residential Units in Planned Sewered Areas

<u>Zone</u>	<u>Estimated Total Future Units</u>	<u>Units in Sewered Area</u>	<u>%</u>
R-1	826	349	42%
R-2	4,208	3,673	87%
R-3	1,250	1,250	100%
Business ⁽¹⁾	87	50	84%

(1) Housing units located within Zoned Business Areas.

Also contained in the planned sewerable area are various Business and General Industry zones. Projections for future business developments are presented as total building square footage in lieu of number of units. Based upon approximately 360 acres of undeveloped business zoned areas, it is estimated that approximately 3.14 million square feet of building space can be constructed. This correlation assumes that 10% of the land is used for roadways and only 25% of the remaining area is actually covered by floor space with an allowance for one story buildings only. Projections for detailed future industrial facilities were not possible, however average flow estimates were made based upon the available vacant land.



For the purpose of projecting estimated future wastewater flows, various factors were applied to residential, commercial, and industrial facilities. Residential wastewater generation was assumed to be 80 gallons per capita per day with a dwelling density of 3.0 people/house, which equates to 240 gpd/dwelling unit. This factor is slightly higher than the reported 204 gpd/day used by the CUA but does provide a margin for inflow and infiltration and higher densities. Commercial wastewater projections are based upon building square footage and a flow contribution factor of 0.125 gpd/S.F. which is established by the NJDEP. Industrial wastewater projections are difficult to project due to varying water usage by various types of manufacturers. However, an allowance of 1,000 gallons/day/acre has been assigned, based upon experience with similar municipalities. Using the above factors, it is estimated that future build-out will render an ultimate wastewater flow of approximately - 3.31 mgd. A breakdown of the estimated flows are presented in Table 8.

Table 8

Estimated Future Wastewater Flow

<u>Area</u>	<u>Unit</u>	<u>Unit Flows</u>	<u>Estimated Wastewater Flow (Gallons Per Day)</u>
Residential	5,321 D.U.	240 Gal/Day	1,277,000
Cumberland Regional H.S.	-	-	8,000
<u>Industrial</u>			
- Seabrook Area	-	-	129,000
- Seabrook Bros.	-	-	10,000
- Undeveloped	1,045 Acres	1,000 GPD/Acre	1,045,000
- Proposed	145 Acres	-	335,000
<u>Commercial</u>			
- Existing	-	-	67,000
- Undeveloped	3.14 million S.F. net building area (360 Acres)	0.125 Gal/day/S.F.	439,000
TOTAL			<u>3,310,000</u>

Based upon the topography of the planned sewer area and its relationship to the location of existing, known and future development, CCUA utilities and existing roadways, a Sewer Master Plan Map was developed and illustrates recommended routing and sizes of sewer lines, and pump station locations. In all, the overall sewer area will be served by twelve (12) pump station service areas. One of the existing pump stations, located at Seabrook, is owned and operated by the CCUA while the remaining pump stations would be owned and operated by the Township. Table 9 presents a breakdown of future wastewater flow per sewer service area.

As Table 9 and the Sewer Master Plan Map indicate, several of the sewer service areas are dependent upon other facilities in other service areas. This is due mainly to local topography, but is also affected by the location of the existing CCUA Interceptor sewer and the four established connection points. In particular the Silver Lake and Sentry Drive service areas cannot be served until the Cornwell's Run Pump Station and collector sewer system are constructed and operational. Likewise, the Woodruff, Rosenhayn Avenue and Irving Avenue service areas may also be dependent upon each other and is contingent upon the future construction of a new interceptor sewer to serve the South East portion of the Township. Further discussion on a new CCUA interceptor and its impact is provided in Section III - G(4).

TABLE 9
Projected Ultimate Wastewater Flows
per Sewer Service Area

Service Area	Residential Units	Residential Flow (MGD)	Comm/Business Flow (MGD)	Industrial Area (Acres)	Industrial Flow (MGD)	Total Flow (MGD)	Peak Flow (MGD)
Woodruff P.S.	712	0.171	0.073	0	0	0.244	0.836
Rosenhayn Ave. P.S.	228	0.056	0	290	0.29	0.346	1.813 (2) (10)
Irving Avenue P.S.	679	0.163	0.003	0	0	0.166	2.247 (1) (10)
Carl's Corner P.S.	50	0.012	0.053	0	0	0.065	0.250
Sunset Lake P.S.	465	0.111	0.008	0	0	0.119	0.438
Silver Lake P.S. (Future)	240	0.058	0	0	0	0.058	0.224
Sentry Drive P.S.	606	0.145	0	0	0	0.145	0.525
Cornwell Run P.S.	993	0.238	0	0	0	0.238	1.414 (3)
Deerfield Bridgeton Pike P.S. (Future)	91	0.022	0	110	0.110	0.132	0.481
Seeley Finley Rd. P.S.	101	0.024	0.213	220 (4)	0.555 (5)	0.792	2.336
Seabrook P.S.	1083	0.260	0.068	125 (6)	0.263 (7)	0.591	2.170 (8) (9)
Love Lane P.S.	73	0.017	0.088	300	0.300	0.405	1.310
Cumberland Reg. H.S.	--	--	0.008	--	--	0.008	0.034
Total	5321	1.277	0.514	1045	1.518	3.310	--

(1) Includes flows from Woodruff P.S.
(2) Includes flow from Rosenhayn Avenue P.S.
(3) Includes flow from Silver Lake P.S. and Sentry Drive P.S.
(4) Does not include 145 acres for Proposed Bench Realty Industrial Park
(5) Includes flow from Bench Realty Industrial Park
(6) Does not include 125 acres for Seabrook Bros. and Pappas Industries
(7) Includes Seabrook Bros. and Pappas
(8) Includes Flow from Deerfield Bridgeton Pike P.S.
(9) Ultimate peak with repumping of Seeley Finley Rd. P.S. flow is 4.05 mgd.
(10) New CCUA Interceptor Extension (Alternate No. 2) Flow from Woodruff, Irving Avenue, and Rosenhayn Avenue Pump Stations will be independent of each other - Peak Flow at Irving Ave. P.S. alone is 0.591 MGD and Peak Flow at Rosenhayn Ave. P.S. alone is 1.14 MGD.

Table 9 also presents the estimated peak flow to each pump station which is approximately equivalent to the ultimate pumping rate of each station. Since many areas may not be sewered for some time, and since development may not occur as anticipated, certain pump stations which are needed in the immediate future should be constructed structurally to accommodate ultimate flows but initially equipped with smaller sized pumps. It is recommended that each pump stations need be determined at the time they are proposed to be constructed to determine the best design.

G. Development of Sewer Master Plan

As discussed previously, the construction of the proposed sewer facilities is a complex and extensive program that will require many years to implement and complete. The following discussion provides recommendations for initial implementation of the overall plan. In general, it is recommended that all new developments be required to construct all on-site utilities as well as any off-site utilities that are required to provide service and connect into existing utilities. Existing developed areas should be sewered by the Township as the need arises, such as failed septic systems, or as funding becomes available.

Several areas of the Township have been experiencing problems with septic system malfunctions, namely, the Sunset Lake area, and more recently, the Button Mill Road area. Due to these problems, the Township has expressed interest in providing public sewer service to these areas. The Township is also reviewing sewerage plans submitted by various developers. Many of the developers are in a position to construct or contribute towards the construction of a sewer system. Of the sixteen proposed developments, many of them have expressed interest in undertaking their project within the next several years. Table 10 includes a projection of the possible development that could occur in the next 5 to 8 years. Figure 10 illustrates the location of eleven of the known developments in the current planning stage. The remaining proposed developments are not adequately defined to show on Figure 10.

Table 10

PROJECTED RESIDENTIAL HOUSING GROWTH OF KNOWN DEVELOPMENT IN NEXT 5 TO 8 YEARS

NO.*	NAME	NUMBER OF PROPOSED UNITS	YEAR								
			91	92	93	94	95	96	97	98	
1	Bench, Block 24, Lot 13	53		20	20	13					
2	Sandel, Block 64, Lot 8	26		15	11						
3	Bench - Big Oak	Industrial Area		No Data Available							
4	Bench - Industrial Park	45 Industrial Lots		10*	15*	15*	5*				
5	Bench - No Plans	Industrial Area		No Data Available							

Table 10 Con't.

PROJECTED RESIDENTIAL HOUSING GROWTH OF KNOWN
DEVELOPMENT IN NEXT 5 TO 8 YEARS

NO.*	NAME	NUMBER OF PROPOSED UNITS	YEAR							
			91	92	93	94	95	96	97	98
6	Sandel - Woodruff Road	30			15	15				
7	John Ritter	47			17	15	15			
8	No Plans	N/A				N/A				
9	Quail Ridge	49	20	20	9					
10	No Plans	N/A			N/A					
11	No Plans	N/A			N/A					
12	Tunbridge Hills	24	15	9						
13	Bench (Love Lane)	399			75	75	75	75	50	49
14	Sencit (Cornwell Woods)	275			60	104	111			
15	Dalessio/Caselli Apt.	208			60	75	73			
16	Lerner Property	210			70	70	70			
	TOTAL	1,321 ⁽¹⁾ Units	35	64	337	367	344	75	50	49

* No. corresponds to information offered by Township

NOTE: 1) industrial parks are not included in totals

UPPER DEERFIELD TOWNSHIP

CUMBERLAND COUNTY NEW JERSEY

UPPER PITTSBORO TOWNSHIP
SALEM COUNTY N.J.

ALLOWAY TOWNSHIP
SALEM COUNTY N.J.

FIGURE 10

CURRENT PROPOSED DEVELOPMENT

PITTSBORO TOWNSHIP
SALEM COUNTY N.J.

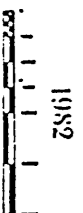
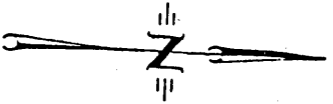
HOPEWELL TOWNSHIP
CUMBERLAND COUNTY N.J.

CITY OF BRIDGETON
CUMBERLAND COUNTY N.J.

DEERFIELD TOWNSHIP
CUMBERLAND COUNTY N.J.

FAIRFIELD TOWNSHIP
CUMBERLAND COUNTY N.J.

LEGEND



1982

Prepared By:
George A. Schuck PE

DR. Killam
Associates Consulting Engineers

As shown on Table 10, it appears that over 1,300 residential units and numerous industrial sites may be constructed over the next five to eight years. Much of the proposed development is located along the Deerfield-Bridgeton Pike area, Route 77, and Carll's Corner. Based upon the Township's current desire to sewer some existing developed areas and upon the apparent willingness of the developers to assist in constructing sewer and water utilities, the following sewer service areas will require immediate planning and coordination:

TABLE 11
Initial Sewer Service Areas

<u>Rank</u>	<u>Sewer Service Area</u>	<u>Comments</u>
1.	Sunset Lake Area	<ul style="list-style-type: none"> a. Serves Sunset Lake area, to replace failing septic systems and improve health and aesthetic conditions b. Serves future Dalessio/Caselli Development
2.	Cornwell's Run	<ul style="list-style-type: none"> a. Serves Sencit Development b. Serves Button Mill Road area c. Required to allow Sentry Drive and Silver Lake areas to be sewered d. Potentially serves the proposed Love Lane Development and Laurel Heights Road developed area
3.	Seeley Finley Rd.	<ul style="list-style-type: none"> a. Serves proposed industrial developments - contingent upon CCUA force main capacity and 208 Plan consistency
4.	Remaining areas to be investigated in greater detail as the need arises.	

1) Sunset Lake Sewer Service Areas -

This portion of the Township has experienced recent and numerous failed septic systems. The initial project scope should include North Park Drive and all side streets, Park Drive, Deerfield-Bridgeton Pike and a portion of Laurel Heights Drive. This project has been contemplated by the Township for several years. The service area would require a sewage pump station near Sunset Lake and should connect into the CCUA Interceptor at the intersection of Deerfield-Bridgeton Pike and Park Drive.

The pump station should be sized to accommodate sewer service to all existing homes with additional capability for future developments. The initial capacity of the pump station would be determined following discussions with the developers and the execution of necessary agreements. Since only a small portion of vacant land contributory to this service area would exist after the construction of the Dalessio/Caselli project it is recommended that the initial pumps installed be capable of handling the estimated ultimate peak flow from this service area if agreement can be reached with the developers. At the time of design the pump rate should be confirmed and proposed developments and available vacant land verified.

2) Cornwell's Run Sewer Service Area -

As shown on the Sewer Master Plan Map this service area covers a very large portion of the Township including a portion of the Sunset Lake area, the proposed Sencit Development, Laurel Heights Road area, Button Mill Road area and the proposed development on Love Lane. The Cornwell's Run Pump Station will also indirectly serve the Sentry Drive service area and the Silver Lake service area by accepting flow from these areas through force mains and subsequently convey the flow to the CUA Interceptor. Due to the anticipated early construction of the Sencit Development, this project can be constructed jointly by the Developer with participation by the Township. The Cornwell's Run service area, when fully developed, is estimated to generate approximately 0.238 MGD on an average daily basis. Ultimately, the pump station will realize an average daily flow of approximately 0.441 MGD from all three service areas and an estimated total peak flow of 1.41 MGD. It is likely that the ultimate sewage flows will not be realized for many years since many existing areas must be sewerred by the Township and large quantities of vacant land remain for development. Therefore, it is recommended that the Cornwell's Run Pump Station be designed and built with a structure sufficient in size to accommodate future sewage flows but initially equipped with pumps suitable to handle the estimated sewage flow for the next five to ten years. Assuming that within the next five to ten years the Sencit Development and Love Lane Developments are completed and that the Township constructs sewers for the North portion of Sunset Lake and the Button Mill Road areas (ie: Laurel Heights Drive area, Sentry Drive area and Silver Lake areas not sewerred), or approximately 900 total residential

units, it is estimated that wastewater flow within the next 5 to 10 years may reach approximately 0.22 MGD on an average daily basis. The estimated peak flow rate is approximately 0.75 MGD. Accordingly, although the Cornwell's Run Pump Station structure and long-term electrical and hydraulic appurtenances should be sized for the ultimate 1.41 MGD peak flow rate, the initial pumps should be sized for 0.75 MGD.

The force main from the Cornwell's Run Pump Station should be 10-inches in diameter which will be capable of maintaining minimum velocities with the initial pump size without experiencing excessive velocity under ultimate pump capacities. Furthermore, it would appear that the force main could be constructed in conjunction with the Sencit Development and eliminate the need for construction in Township and County roads.

3) Seeley Finley Road Sewer Service Area -

Currently an industrial/commercial development is proposed to the north of Seeley Finley Road as shown on Figure 10. More recently, several developers have expressed interest in areas south of Seeley Finley Road including a small shopping mall. It is recommended that these developments be sewered as they are constructed. Due to large areas of vacant land it is difficult to predict where sewer lines should be located to serve future land uses. However, based upon preliminary site plans for the Bench Industrial Park and local topography, a limited amount of sewer lines have been shown on the Sewer Master Plan Map for the Seeley Finley Road service area.

The Seeley Finley Road service area will require a pump station located near Loper Run Creek on Seeley Finley Road. A force main should extend from the pump station to the CCUA Seabrook Pump Station located to the North. The pump station should be designed and built with the structure and related long-term appurtenances sized for ultimate wastewater flows. However, many factors may influence how rapidly this area will develop and tends to suggest that the initial pump rate be down sized to meet immediate needs only. The actual sizing of the initial pumps will require further investigation since conceptual plans for several proposed developments are not available at this time.

Several other factors which will influence this area's growth are: 1) the ability of the CCUA Interceptor to accept additional flow, and 2) the fact that this area is outside the limits of the current 208 Plan which may prohibit the construction of sewers until the 208 Plan is amended.

4) Other Sewer Service Areas -

The construction within other sewer service areas in the Township is dependent upon various factors including Township policies, available funding, health and environmental factors, developer pressure, the ability of the CCUA to accept and convey additional wastewater.

As mentioned previously, both the Sentry Drive and Silver Lake (Future) sewer service areas are contingent upon the availability of the Cornwell's Run Pump Station. Likewise, the Deerfield-Bridgeton Pike service area (west of Seabrook) and the expansion of the Seabrook service area discharge to and are contingent upon the ability of the CCUA Seabrook Pump Station. The Love Lane service area, which is intended to serve zoned General Industry areas and a portion of the residential area north of Carll's Corner, is not dependent upon the facilities in other service areas but like the above noted areas is dependent upon the CCUA Interceptor capacity. The development of all of these areas should be further analyzed in the future after the initial service areas (Sunset Lake, Cornwell's Run, Seeley Finley Road) are developed to determine their exact needs at that time.

The development of the Irving Avenue, Rosenhayn Avenue and Woodruff service areas are contingent upon a new interceptor line to serve this portion of the Township.

These three service areas are remote from the existing CCUA Interceptor sewer and should be served by a new interceptor sewer. The new interceptor sewer should terminate at the CCUA Glass Street Pump Station in Bridgeton. However, the exact routing of the interceptor through Bridgeton and

and into Upper Deerfield Township will require further study. The new interceptor sewer could extend to either Irving Avenue (Alternative 1) or to Woodruff Road near the Woodruff Pump Station (Alternative 2). Under Alternative 1, the Woodruff service area would pump its flow into the Rosenhayn service area and then be repumped along with the Rosenhayn service area flow into the Irving Avenue service area. The Irving Avenue Pump Station would then convey all flow from the three service areas into the New Interceptor. This alternative requires that collector sewers, force mains, and pump stations in the Rosenhayn Avenue service area and Irving Avenue service area be increased in size to convey the flow. However, this alternative requires less length of interceptor sewer than Alternative 2.

An assumed route of the Interceptor force main for Alternative 2 is shown on the Master Plan Map. This route would eliminate the need for all three service areas to depend upon each and could reduce the size of some collector sewers, the force mains, and pump stations. This alternative also offers the feature to the CCUA for a future interceptor extension to Deerfield Township. The negative aspects of this alternative is the additional cost to extend the interceptor and who should pay for it and the task of finding an acceptable route for the interceptor in both Upper Deerfield Township and the City of Bridgeton.

The extension of an interceptor into Deerfield Township has been proposed as a means of providing service to Deerfield Township and several major wastewater generators located there. Deerfield Township was originally part of the Cumberland County Utilities Authority's service area although service has never been extended. Such an interceptor would comply with Upper Deerfield Township's sewer planning provided it were adequately sized to convey anticipated flows from both municipalities.

Determination as to which alternative provides the most benefits and is most feasible relies upon the manner upon which of these service areas develop. It is recommended that both alternatives be studied in the future as the need arises to serve these three service areas.

5) Other Areas Outside of the 208 Plan and
Sewer Master Plan Service Areas

As indicated previously, large areas of the Township have been excluded from the sewer service area. Some of these areas such as the northeast corridor of the Township along Centerton Road may eventually fully develop if future planning conditions allow. Consideration should be given at that time for the extension of public sewerage service. Presently there are too many variables to determine how this area or other portions of the Township would be served.

In the case of the North East section of the Township, it should be noted that the Township may obtain the former Conrail right-of-way located between Burlington Road and Centerton Road. This right-of-way may prove to be a cost effective location for an interceptor sewer to serve the North East corridor and should be evaluated in the future. Other similar opportunities may also present themselves in the future and should be considered independently by the Township as the need arises.

H. Regional Impact

As discussed previously, the existing CCUA Interceptor was designed and initially intended to serve only a portion of the Seabrook Area of Upper Deerfield with provisions for future connection of other areas within the Township at the following average daily flow projections:

<u>Service Area</u>	<u>Projected Flow Year 2000*</u>
1. Carl's Corner	0.082 MGD
2. Cornwell Heights	0.172 MGD
3. Cumberland Regional H.S.	0.010 MGD
4. Seabrook	<u>0.236 MGD</u>
	0.500 MGD

* Ref. "Preliminary Engineering Report Upper Deerfield Interceptor", prepared for The Cumberland County Utilities Authority by John G. Reutter Associates December 1980.

Since the CCUA Upper Deerfield Interceptor is designed as a force main, each respective area requires a pump station for connection into the interceptor and discharge to the CCUA Cohansey River Wastewater Treatment Plant. Because the CCUA force main has numerous connection points along it's

route it acts as a manifold pipe. Hydraulically this means that the operation of each pump station individually will effect all other pump stations operating at the same time. This coincident pumping will increase the pressure required to pump at each station and in turn reduce the amount of wastewater which can be pumped. The worse case scenario is when all the pump stations are operating simultaneously. In order to fully understand the effect of one pump station upon another a computer model and hydraulic analysis of the CCUA force main and all pump stations is required. This can be performed by the CCUA who have modeled the Upper Deerfield Interceptor.

For the purposes of this study, several static hydraulic analyses were performed to estimate the impact of the proposed Sewer Master Plan. One simple comparison is the projected future average daily wastewater flow from service areas utilizing this interceptor (Table 9) approximately 2.55 MGD versus the design flow of 0.50 MGD for the Interceptor. Although it is apparent that the CCUA Interceptor must be reinforced to accept the total future flow, the pertinent question is how much additional immediate wastewater flow can the Interceptor convey before adverse conditions are too great to overcome?

The 1988 average daily flow rate for the Township (ie: Seabrook Cumberland County H.S. and Carll's Corner) was 0.241 MGD or approximately half of the design capacity. As discussed in the last section, several service areas have been prioritized according to immediate needs. The Sunset Lake area

has an estimated ultimate average daily flow of 0.119 MGD and an approximate demand five (5) years in the future, including the proposed garden apartment complex, of approximately 0.105 MGD (430± residential units). Therefore, the Sunset Lake Pump Station should be built and pumps sized for the ultimate flow since the flow five years in the future represents the major portion of projected development in this service area. The Cornwell's Run Pump Station, as stated previously, has an estimated initial size of 0.22 MGD (900± residential units). Combining the current flow rate with the projected 5 year flow rates from Sunset Lake and Cornwell's Run areas results in 0.566 MGD or slightly above the design capacity of 0.500 MGD for the force main. Of course, this scenario does not consider additional flow in the next 5 years from either Carll's Corner or the Seabrook Area. However, the force main is not exposed to the average daily flow rates but rather the pumping rates which are approximately equivalent to peak flows. Based upon the reported pumping rates of the existing pump stations (Seabrook - 0.94 MGD; Carll's Corner - 0.47 MGD; Cumberland Regional H.S. - 0.04 MGD) and the suggested initial pumping rates of the Sunset Lake P.S. (0.40 MGD) and Cornwell's Run P.S. (0.75), a brief static analysis of the CCUA Force Main was undertaken. Again, the static analysis does not represent the actual operation of the force main which is dynamic in nature and requires computer modeling, but does provide some initial conclusions to assist planning at this time. In general, it is apparent that the addition of the Sunset Lake Pump Station and the Cornwell's Run Pump Station will have an effect upon the existing pump stations in the form of increased pressure and reduced pumping capacity. The amount of reduced pumping capacity is a factor of how many pump stations are on simultaneously.

The above analysis did not consider the addition of wastewater from the Seeley-Finley Road Pump Station which obviously would create even greater adverse impacts. This assumption is reinforced by a report prepared by Reutter Associates for the CCUA and the Bench Industrial Park Development in May 1988. This report analyzed the CCUA force main to determine if a proposed connection to the force main at Seeley Finley Road would create adverse impacts. The analysis assumed flows from the Sunset Lake Area (0.30 MGD), Cornwell's Run Area (0.725 MGD), Carl's Corner (0.33 MGD), and the Cumberland Regional H.S. (0.21 MGD) and attempted to measure the effect at the Seabrook Pump Station. The report concluded that not only would flow from the Seeley Finley Road area create adverse impacts but so would the Sunset Lake and Cornwell's Run stations when all facilities are on simultaneously. The analysis, although computer modeled, was not entirely dynamic in that actual pump curves were not input for the Sunset Lake, Cornwell's Run, Carl's Corner or Cumberland Regional H.S. pump stations. It should be expected that the pumping rates at all facilities will be reduced when operating simultaneously which should lessen the impact at every pump station.

In summary, it is recommended that further hydraulic investigation of the CCUA force main be undertaken by the Authority to determine more exact impacts upon the CCUA Seabrook Pump Station, and all other existing and proposed pump stations. Basically, it would appear that the CCUA force main is capable of accepting a limited amount of additional flow for the immediate future (ie, Sunset Lake and Cornwell's Run service areas). However, it is

quite apparent that the ultimate future wastewater flow which has been projected for all service areas utilizing the Upper Deerfield Interceptor cannot be conveyed by the existing pipeline. Therefore, additional studies should be undertaken in conjunction with the Authority to plan for additional force mains or alternative routes to serve the remainder of Upper Deerfield Township.

As discussed elsewhere, it is possible that an additional 2 or 3 interceptors will be required to serve Upper Deerfield Township. One interceptor will need to be extended to serve the Irving Avenue, Rosenhayn Avenue and Woodruff service areas. This interceptor could also potentially serve Deerfield Township in the future. A second interceptor, although long term in the future, may be required to serve the North East portion of the Township should this area ever develop the need for sewer service. Lastly, a third interceptor would be needed to relieve and possibly parallel the existing interceptor to serve the western portion of the Township. Obviously, the construction cost of any interceptor would be substantial and therefore its need must be demonstrated by pending development and developers who are willing to share in its cost.

It is recommended that the Township proceed with the construction of the Cornwell's Run and Sunset Lake pump station as described previously. Second, the Township in cooperation with the CCUA should undertake a thorough detailed study to preliminarily size, locate and design a parallel interceptor to serve the west portion of the Township. This should be undertaken prior to the sewerage of Seeley Finley Road service area. Third, the Township should

require all future developers who were not previously considered in the Cornwell's Run or Sunset Lake pump station and would benefit from a new interceptor to share in its cost.

I) Cost Estimate of Township Sewer System

A review of the Sewer Master Plan Map illustrates the proposed twelve (12) sewer service areas and their respective facilities including gravity sewer lines, force mains, and pump stations. Based upon the utilities shown on the Sewer Master Plan Map a preliminary cost estimate has been prepared for each of the twelve service areas based on present day costs. The cost estimate does not represent the actual cost to the Township since many of these facilities are likely to be built by developers. Table 12 presents the estimated construction cost per service area.

TABLE 12

Estimated Construction Cost
per Sewer Service Area

<u>Service Area</u>	<u>Estimated Construction Cost</u>
Woodruff	\$1,952,000
Irving Ave.	\$2,200,000
Rosenhayn Ave.	\$2,249,000
Sunset Lake	\$1,322,000
Cornwell's Run	\$3,200,000
Sentry Drive	\$1,866,000
Silver Lake	\$ 657,000
Deerfield-Bridgeton Pike	\$ 767,000
Seabrook	\$1,390,000
Seeley Finley Road	\$2,669,000
Love Lane	\$1,726,000
Carll's Corner	0
TOTAL	\$19,998,000

The estimates noted above are based upon the following quantities and unit prices per service area.

TABLE 13
Quantities of Sewer Facilities
Per Sewer Service Area

Woodruff

<u>Unit</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
8"Ø Sewer	21,350	\$ 43.00	\$ 918,050.
10"Ø Sewer	2,000	49.00	98,000.
12"Ø Sewer	2,100	60.00	126,000.
Service Connections	180	500.00	90,000.
Pump Station	1	-	580,000.
8"Ø F.M. (ALT. 1)	4,500	31.00	139,500.
			<hr/> \$1,951,550.

Irving Avenue (ALT. 1)

8"Ø Sewer	6,000	\$ 43.00	\$ 258,000.
15"Ø Sewer	1,300	68.00	88,400.
18"Ø Sewer	2,700	74.00	199,800.
Service Connections	47	500.00	23,500.
Pump Station	1	-	1,560,000.
12"Ø F.M. (To TWP. Boundary Only)	1,700	41.00	69,700.
			<hr/> \$2,199,400.

Irving Avenue (ALT. 2)

8"Ø Sewer	9,800	\$ 43.00	\$ 421,400.
10"Ø Sewer	500	49.00	24,500.
Service Connections	47	500.00	23,500.
Pump Station	1	-	415,000.
6"Ø F.M.	4,300	26.00	111,800.
			<hr/> \$ 996,200.

TABLE 13 Cont'd.
Quantities of Sewer Facilities
Per Sewer Service Area

Rosenhayn Avenue (ALT. 1)

<u>Unit</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
8"Ø Sewer	9,700	\$ 43.00	\$ 417,100.
12"Ø Sewer	600	60.00	36,000.
15"Ø Sewer	5,400	68.00	367,200.
Service Connections	165	500.00	82,500.
Pump Station	1	-	1,260,000.
10"Ø F.M.	2,400	36.00	86,400.
			\$2,249,200.

Rosenhayn Avenue (ALT. 2)

<u>Unit</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
8"Ø Sewer	12,200	\$ 43.00	\$ 524,600.
12"Ø Sewer	3,500	60.00	210,000.
Service Connections	165	500.00	82,500.
Pump Station	1	-	800,000.
8"Ø F.M.	100	31.00	3,100.
			\$1,620,200.

Sunset Lake

<u>Unit</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
8"Ø Sewer	20,000	\$ 43.00	\$ 860,000.
Service Connections	220	500.00	110,000.
Pump Station	1	-	300,000.
6"Ø F.M.	2,000	26.00	52,000.
			\$1,322,000.

TABLE 13 Cont'd.
Quantities of Sewer Facilities
Per Sewer Service Area

Cornwell's Run

<u>Unit</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
8"Ø Sewer	37,300	\$ 43.00	\$1,603,900.
10"Ø Sewer	3,500	49.00	171,500.
12"Ø Sewer	1,400	60.00	84,000.
15"Ø Sewer	300	68.00	20,400.
Service Connections	360	500.00	180,000.
Pump Station	1	-	985,000.
10"Ø F.M.	4,300	36.00	154,800.
			<u>\$3,199,600.</u>

Sentry Drive

<u>Unit</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
8"Ø Sewer	30,000	\$ 43.00	\$1,290,000.
10"Ø Sewer	200	49.00	9,800.
Service Connections	175	500.00	87,500.
Pump Station	1	-	365,000.
6"Ø F.M.	1,500	26.00	39,000.
8"Ø F.M.	2,400	31.00	74,400.
			<u>\$1,865,700.</u>

Silver Lake

<u>Unit</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
8"Ø Sewer	9,200	\$ 43.00	\$ 395,600.
Service Connections	66	500.00	33,000.
Pump Station	1	-	160,000.
4"Ø F.M.	3,100	22.00	68,200.
			<u>\$ 656,800.</u>

TABLE 13 Cont'd.
Quantities of Sewer Facilities
Per Sewer Service Area

Deerfield Bridgeton Pike

<u>Unit</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
8"Ø Sewer	6,800	\$ 43.00	\$ 292,400.
10"Ø Sewer	1,000	49.00	49,000.
Pump Station	1	-	335,000.
6"Ø F.M.	3,500	26.00	91,000.
			\$ 767,400.

Seabrook

<u>Unit</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
8"Ø Sewer	26,000	\$ 43.00	\$1,118,000.
10"Ø Sewer	3,300	49.00	161,700.
12"Ø Sewer	1,500	60.00	90,000.
Service Connections	40	500.00	20,000.
			\$1,389,700.

Seeley Finley

<u>Unit</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
8"Ø Sewer	10,100	\$ 43.00	\$ 434,300.
10"Ø Sewer	3,200	49.00	156,800.
12"Ø Sewer	3,200	60.00	192,000.
15"Ø Sewer	1,200	68.00	81,600.
Service Connections	30	500.00	15,000.
Pump Station	1	-	1,625,000.
12"Ø F.M.	4,000	41.00	164,000.
			\$2,668,700.

TABLE 13 Cont'd.
Quantities of Sewer Facilities
Per Sewer Service Area

Love Lane

<u>Unit</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
8"Ø Sewer	7,200	\$ 43.00	\$ 309,600.
10"Ø Sewer	4,800	49.00	235,200.
12"Ø Sewer	2,600	60.00	156,000.
15"Ø Sewer	200	68.00	13,600.
Service Connections	60	500.00	30,000.
Pump Station	1	-	910,000.
10"Ø F.M.	2,000	36.00	72,000.
			\$1,726,400.

It should be noted that the estimated quantity of sewer facilities and construction cost is based upon the facilities shown on the Sewer Master Plan Map. In addition, the above figures are based upon 1991 prices and do not include any sewer additional cost for the construction of interceptor sewers.

IV. WATER MASTER PLAN

A public potable water system is an essential and valuable utility which provides many benefits including water for fire protection. As noted in the Township's Master Plan, the provision of potable water is probably one of the most pressing of municipal concerns for the future.

Water supply in South Jersey, is for the most part, derived from groundwater sources. This is true in Upper Deerfield Township and surrounding communities. In many areas, each individual dwelling or facility is equipped with private wells. However, some areas, such as portions of Upper Deerfield Township and the City of Bridgeton, are provided with public water supply systems. The need to develop and control groundwater is evidenced by the potential of well contamination from septic systems or other chemicals from surface runoff and by the possibility of limited water resources due to excessive use. The importance of groundwater supply and quality is also highlighted by the fact that this resource is closely monitored and controlled by the State of New Jersey and the Delaware River Basin Commission. Some areas of the State have already been identified as "Critical Areas" due to either ground water quality or quantity problems. Therefore, it is in the best interest of the Township to plan and develop a Water Master Plan to serve the future needs of the Township.

A) Existing Water Supply Systems

Two areas of the Township are currently provided with potable water facilities. One area is provided with water service from the Seabrook Water Corporation, while the second area is served by Upper Deerfield Township.

1. Seabrook Water Corporation

The Seabrook area of the Township is provided with potable water from a private water system owned and operated by the Seabrook Water Corporation. The Township has granted a 50 Year franchise agreement to the Seabrook Water Corporation. The franchise area is shown on the Water Master Plan Map in Appendix B. The franchise granted is non-inclusive and permits the Water Company to utilize municipal streets for the installation and maintenance of water lines. The water system is comprised of a distribution system varying in size from 8 to 2 inches in diameter, groundwater wells, pumps, and treatment facilities. The reported water distribution system and service area is also shown on the Water Master Plan Map.

The water supply system is also connected to an elevated water storage tank which is owned by Upper Deerfield Township. The Seabrook Water Corporation and local industries have entered into a ten year agreement with the Township for use of the water tower. The 250,000 gallon water tower, built in 1937, provides potable water and fire storage for the Seabrook Water Corporation and fire service to local industries. The water tower is approximately 165 feet tall with an estimated high water level of 260 feet based upon U.S.G.S. datum.

The Seabrook Water Corporation provides water to the Seabrook Villages, the Township schools and municipal complex, and industrial users. The water system consists of approximately 16,000 linear feet of water mains and two wells, each rated at 1,200 GPM. The system is equipped with approximately 30 hydrant assemblies.

Since the Seabrook Water Corporation is a separate utility, it is assumed that Seabrook water system will be maintained by the Corporation and provide adequate water service to its customers. If, at some time in the future, the Township assumes ownership of the Seabrook Water Corporation through either mutual agreement or public need, it is recommended that additional study be undertaken at that time to assess the Seabrook Water System and how it can be incorporated into the Township's system.

2. Upper Deerfield Township Water System

The second water supply system in the Township is located around the Township's former sanitary landfill between Centerton Road and Centerton/Woodruff Road. This water system is owned and operated by Upper Deerfield Township and was constructed in 1985 in response to ground water contamination from the sanitary landfill. The water system is comprised of two wells, a hydropneumatic storage tank, distribution lines and hydrants. The system was designed to serve approximately 250 residential homes and currently it serves approximately 91 units.

The distribution system consists of approximately 8,600 linear feet of 6 inch diameter and 11,800 feet of 8 inch diameter ductile iron water main. The system is equipped with only 5 hydrant assemblies, which due to the hydropneumatic tank, are not capable of conveying sufficient water for direct fire fighting, but may be capable of filling fire pumper trucks.

The well supply and treatment consists of two eight (8) inch diameter wells drilled to approximately 160 feet below ground level and screened in the Kirkwood Aquifer. Each well is equipped with a submersible well pump and rated at approximately 150 gallons per minute (GPM). Water from the wells is treated with chlorine for disinfection, hydrated lime for pH adjustment, and sodium hexametaphosphate to prevent precipitation of iron.

Storage and pressure in the system is maintained by a 20,000 gallon (nominal size) hydropneumatic pressure vessel. Hydropneumatic tanks are sealed vessels which are partially filled with air to maintain pressure when the supply pump or well pump is off. Due to the air/water ratio, hydropneumatic vessels generally have a usable storage of only 20 to 30% of the total volume. Therefore, the effective storage capacity of this tank is approximately 4,000 to 6,000 gallons. The limited amount of storage is sufficient to meet normal residential demands but is incapable of providing fire fighting protection.

3. City of Bridgeton Water System

The City of Bridgeton owns and operates a developed water system which consists of supply wells, storage facilities and a large distribution system. In 1980 the City of Bridgeton's water demand was approximately 3.2 MGD on an annual average basis. Reported projections for the year 2000 estimate water demands to be approximately 3.3 MGD annual average or a slight increase of only 3% over 20 years. The City of Bridgeton water system contains 14 wells, many of which are inoperative due to water quality or mechanical problems. The

distribution system is extensive but quite old. Reportedly, approximately 50% of the mains were constructed 60 to 100 years ago. In addition, approximately 55% of the mains are 6" in diameter or smaller. The distribution system does contain a large transmission main which encircles the City ranging in size from 12-inches to 16-inches in diameter. A portion of the transmission system is routed through the southerly portion of Upper Deerfield Township, in the Sunset Lake area. A 16-inch diameter water main is located in Deerfield/Bridgeton Pike and extends from the municipal boundary to the intersection of West Park Drive where it heads west along West Park Drive towards Sunset Lake. Although the water main is located within Upper Deerfield Township, no connections have been made to this main. The storage facilities for the City of Bridgeton consist of two pressure zones which are serviced by a 2.5 million gallon storage tank in the high service zone and a 60,000 gallon elevated storage tank in the low service zone. The high water elevation of the high service zone is approximately elevation 175 while the low service zone is approximately elevation 157.

Water supply for the City of Bridgeton is scattered throughout the City and also includes two wells located within Upper Deerfield Township near Carll's Corner. These wells, No. 14 and 15, are located just east of Route 77 to the north of the municipal boundary. A 12-inch diameter supply line extends from the wells along North Burlington Road and Rosenhayn Avenue in Upper Deerfield Township. Several other wells, which are located in the City of Bridgeton, are situated near the municipal boundary.

4. Industrial Water Users

Located within Upper Deerfield Township are several industrial companies, including Clement Pappas and Cumberland Cold Storage. These industrial users are involved in juice processing and canning or bottling operations and a freezer operations respectively. Each facility is equipped with wells to meet non-potable industrial demands. These facilities also are connected into the Seabrook Water Corp. for potable water service and for fire fighting protection via the Township's elevated storage tank.

B) Water Demand Projections

1. Existing Water Demand

The Township water system has been in operation since 1986. Water usage since 1986 is presented below in Table 14.

Table 14

Water Usage in Township Water System
(in million gallons)

<u>Month</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>
January	0	0.404	0.436
February	0	0.378	0.379
March	0.243	0.440	0.405
April	0.362	0.425	0.471
May	1.020	0.518	0.560
June	1.011	0.783	1.044
July	0.813	0.701	0.951
August	0.700	0.788	0.825
September	0.568	0.523	0.582
October	0.572	0.543	0.591
November	0.500	0.443	0.485
December	<u>0.467</u>	<u>0.447</u>	<u>0.485</u>
Total	6.256 MG	6.393 MG	7.214 MG
Average Daily Demand	20,440 GPD	17,515 GPD	19,765 GPD
Number of Connections	80±	90±	91±
Daily Demand Per Connection	255 GPD	195 GPD	217 GPD

The three year average daily flow demand is approximately 225 gallons per day per connection. Based upon an estimated family density of three people per household, the average per capita usage is approximately 75 gallons per day. The peak month on record is June 1988 with an average day use of 382 gallons per connection. The ratio of average day demand during maximum month to annual average day demand is approximately 1.75 to 1.

The Seabrook Water Corp. system has been in operation for many years. The reported 1988 average day water use was 290,000 gallons per day. The maximum month in 1988 was 347,900 gallons. The reported maximum day was 522,000 on June 16, 1988. The maximum day to average annual ratio is approximately 1.8 to 1. Per capita use is difficult to calculate due to industrial, institutional, and school uses within the Seabrook system.

2. Projected Future Water Demands

Similar to the wastewater flow projections, water demand projections were developed based upon the assumption of future build-out of the water service area and the existing water service areas of the Township with the exception of the area served by the Seabrook Water Corp. In general, water demands are normally higher than wastewater flow rates provided the wastewater collection system does not experience excessive extraneous inflow problems caused by leaky pipe joints, high ground water or illegal connections such as storm drains or roof drains. This variation is due to unaccounted for water used for flushing water mains, fighting fires, unmetered water use for

irrigation, lawn watering, car washing, and water main leaks which cause potable water not to be returned to the sanitary sewer system. The water use projections presented in Table 15 are based upon 100 gallons per day per person, or 300 gallons per day per residential connection. This consumption factor is approximately 20% greater than the wastewater unit flow of 240 gallons per day per dwelling unit used in the wastewater analysis. Similarly, commercial and industrial wastewater projections developed in the previous section were increased by approximately 20% to represent approximate water demand rates for these areas. The residential usage rate of 300 gallons per day per unit is slightly higher than the current usage experienced in the Township's water system. However, the Township's existing system is quite small and may not represent actual water demand when a substantial water supply is available. Table 15, shown below, illustrates projected future water consumption. Water demands have been identified as either residential, commercial, or industrial.

Table 15
Projected Future Water Demands

<u>Area</u>	<u>Total Future Units</u>	<u>Annual Average Day Demand (MGD)</u>
Residential(1)	5,369	1.610
Commercial(2)	-	0.617
Industrial	-	<u>1.656</u>
		3.883 MGD

Maximum Day Demand = Annual Avg. x 2.50 = 9.71 MGD
 Peak Hour Demand = Annual Avg. x 3.25 = 12.62 MGD

- (1) Does not include housing units served by Seabrook Water Corp.
- (2) Includes Cumberland Regional H.S.

It should be noted that the projections shown above do not include any special allowance for specialized manufacturing or processing plants which may require higher water demands.

A further breakdown of the projected future water demands is presented in Table 16 which lists water demand by sewer service areas.

TABLE 16
Projected Future Annual Average Water Demand
per Sewer Service Area

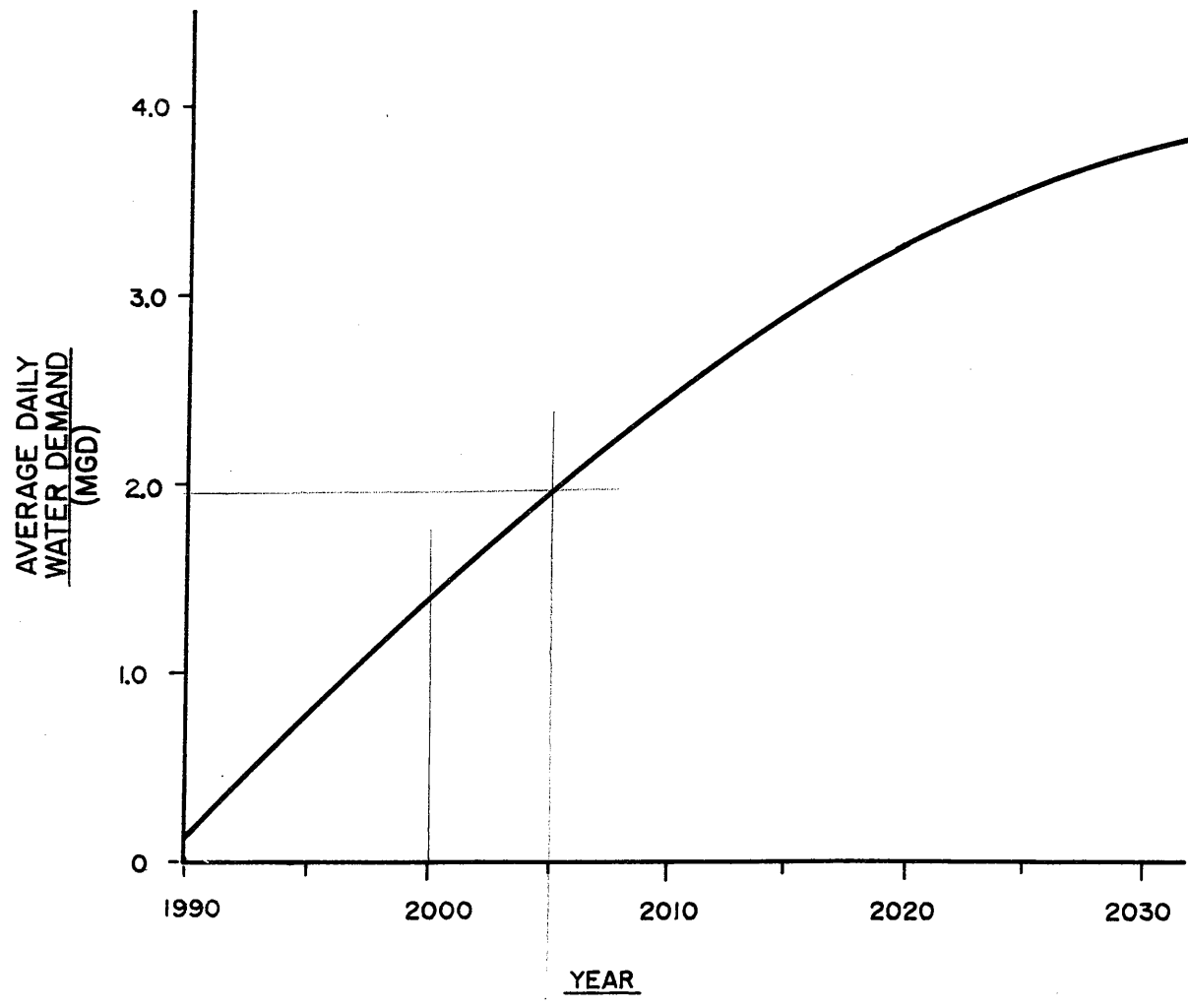
Service Area	Residential Units	Residential Demand (MGD)	Comm/Business Demand (MGD)	Industrial Area (Acres)	Industrial Demand (MGD)	Annual Average Demand Total (MGD)	Maximum Day Demand (MGD)
Woodruff	712	0.214	0.088	0	0	0.302	0.755
Irving Avenue	679	0.204	0.004	0	0	0.208	0.520
Rosenhayn Ave.	228	0.068	0	290	0.35	0.418	1.045
Carl's Corner	50	0.015	0.064	0	0	0.079	0.198
Sunset Lake	465	0.140	0.010	0	0	0.150	0.375
Silver Lake	240	0.072	0	0	0	0.072	0.180
Sentry Drive	606	0.182	0	0	0	0.182	0.455
Cornwell's Run	993	0.297	0	0	0	0.297	0.743
Deerfield-Bridgeton Pike	91	0.027	0	110	0.132	0.159	0.397
Seabrook	560	0.168	0.082	125	0.148	0.398	0.997
Seeley Finley Rd.	101	0.030	0.209	390	0.666	0.905	2.262
Love Lane	73	0.022	0.150	300	0.360	0.532	1.335
Cumberland Reg.H.S.	--	--	0.010	--	--	0.010	0.025
Twp. Water Service Area (expanded)	<u>571</u>	<u>0.171</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0.171</u>	<u>0.427</u>
	5369	1.61	0.617	1340	1.656	3.883	9.712

Similar to the sizing for wastewater sewer systems, proper sizing of a water distribution system is dependent upon maximum day and peak hour demands and the ability to meet fire demands under extreme conditions. Maximum day demands are usually expressed as a ratio to average day demand and vary between 1.5 and 3.0. Based upon experience with water systems for communities of a similar size and nature, a maximum day ratio of 2.5 has been utilized to forecast maximum day demands for Upper Deerfield Township. Accordingly, the estimated future average day demand of 3.88 MGD has a projected maximum day demand of 9.71 MGD. Peak demands occur on an hourly basis and can be as much as five times the average day demand. For this study a factor of 3.25 was assumed to project peak hour water demands of 12.61 MGD. As indicated previously, water system demands are based upon an ultimate build-out of the water service area as shown on the Water Master Plan map. For the purposes of immediate planning, a projection of water demand growth over a 40 year period is illustrated on Figure 11. The graph indicates a sharp increase in water demand for the next ten years which assumes the construction of the numerous developments currently before the Township for approval.

3. Water Demand for Fire Protection (Coincident Draft)

The development of a water supply system must also consider the needs of fire protection in the system. The sizing of water system components, including supply lines, and storage facilities must consider the possibility of fire demands occurring during peak hours. Such an occurrence is called a coincident draft which represents a worst case scenario.

FIGURE II
FUTURE WATER DEMAND PROJECTION



Fire flow demands can be calculated based upon formulas developed by the Insurance Service Organization (ISO) which follows the general guidelines of the National Fire Protection Association. Fire flows are calculated by a formula which considers the type of construction materials used, the size of the building and its relationship to other structures. The minimum value recommended by the ISO is a fire flow rate of 500 gallons per minute. The suggested maximum values range from 6,000 to 8,000 gallons per minute, depending upon the type of construction.

Since future development may range from residential housing to commercial and industrial facilities it is impossible to predict the maximum fire demand necessary for a given facility in the future. Accordingly, for the purposes of this report and for the sizing of the water system, a fire demand of 2,000 gallons per minute has been used. Adding the maximum estimated peak hour demand of 12.61 MGD and the fire demand will develop a coincident draft flow rate of 15.48 MGD. The coincident draft will be utilized in the sizing of transmission mains.

C. Water Supply

1. Ground Water Supply Sources

Extensive studies have been made in the past by the US Geological Survey and other Federal and State agencies of the ground water supply in Cumberland County with the view toward determining the approximate available ground water supply which could be developed to meet future water requirements of the County. These studies include detailed information concerning the

geology of the County, existing wells, the aquifers utilized, and water budgets. The available reports are helpful as they reference and provide general information concerning available supplies in Upper Deerfield Township and Cumberland County.

Aquifers which underlay Cumberland County and Upper Deerfield Township consist of the Potomac and Raritan Magothy Formations, the Wenonah Formation and Mount Laurel Sand, the Piney Point Formation, and the Kirkwood Formation and Cohansey Sands. In general, it is recognized that much of the ground water utilized in Cumberland County is derived from shallow wells tapping the Kirkwood-Cohansey Aquifer. The Kirkwood-Cohansey Aquifer is generally considered to be a water table aquifer throughout most of Cumberland County although semi-confining conditions occur locally.

The second most important ground water source in Cumberland County is the Lower Kirkwood Aquifer which is located approximately 200 to 350 feet below ground surface. Although this Aquifer is reported to be capable of yielding as much as 400 GPM, most existing wells generally yield less than 50 GPM. Development of the lower Kirkwood Aquifer is limited since this formation is a large supply of water for the Atlantic City area and significant additional withdrawals in the Cumberland County area would greatly affect water supply along the Atlantic Coast.

Other Formations, such as the Piney Point Formation is not extensively used as a source of water due to its depth and limited amount of yield (approximately 50 GPM). The Wenonah Formation and Mount Laurel Sand is a potential source of additional fresh water supply in northern Cumberland County. However, this Aquifer is not extensively used because of availability of water from the much shallower Kirkwood-Cohansey Aquifer. Available water found in the Potamac-Raritan-Magothy Formations contain saline water and not currently utilized in Cumberland County. In summary, the principal aquifer utilized in Cumberland County for water supply is the Kirkwood-Cohansey Aquifer which is capable of providing the greatest yield of water. However, this water table aquifer is also highly susceptible to surface contamination.

Reportedly, the water bearing characteristics of the Kirkwood-Cohansey Aquifer are not fully known. The transmissivity is reported to vary between 30,000 GPD per foot of aquifer to approximately 41,700 GPD per foot of aquifer. The coefficient of storage ranges between 3.0×10^{-4} to 1.7×10^{-2} . Large water supplies ranging between 300 to 1200 GPM have been obtained from wells in the Kirkwood-Cohansey Aquifer which are less than 180 feet in depth. Specific capacities of large diameter wells tapping the aquifer range from as high 57 gallons per foot of drawdown to 7 gallons per minute per foot of drawdown with the average of about 20 GPM per foot of drawdown.

2. Surface Water Supply

Upper Deerfield Township is located largely within the Cohansey River Basin. The Cohansey River Basin drains approximately 106 square miles of area. Insufficient data is available to determine the amount of water which flows in the Cohansey River through the portion of Upper Deerfield Township. In general, surface water supply facilities are more expensive to construct and operate than ground water supply facilities. Accordingly, due to the abundance of water supply from the Kirkwood-Cohansey Aquifer further studies have not been performed to determine the feasibility of surface water supplies from the Cohansey River or Sunset Lake.

3. Ground Water Quality

The water quality of the Kirkwood-Cohansey aquifer is characterized by low dissolved solids, low hardness and low pH values. Median values for these characteristics are dissolved solids 53 mg/l, hardness 21 mg/l, and pH 5.5. Without treatment the water is excessively corrosive. Normal treatment for water derived from the Kirkwood-Cohansey aquifer is the addition of lime to adjust pH and chlorine for disinfection. In certain areas high iron and manganese concentrations are found. Depending upon the concentrations of iron and manganese additional treatment through the use of chemicals or filtration may be necessary. Based upon available data, iron concentrations typically range between 0.1 to 15 mg/l. The reported median concentration is 0.1 mg/l.

Since the Kirkwood-Cohansey aquifer is a water table aquifer it is subject to surface contamination. Generally, surface contamination may result from agricultural fertilizers or wastewater disposal facilities. Surface contamination in Cumberland County is generally in the form of high nitrate concentrations which average approximately 0.7 mg/l.

Salt water intrusion in the Kirkwood-Cohansey aquifer is not a present concern in this area of the County.

4. Water Supply Requirements

Based upon a review of available data it is recommended that a water supply for Upper Deerfield Township be obtained through a ground water system. A ground water supply system should be cost-effective compared against a surface water system and should provide sufficient water to meet the demands of the Township. The development of a ground supply system can easily adjust to meet the growth demands of the Township through the drilling of new wells and the construction of water treatment plants in various key locations.

The construction of a ground water supply system as well as all other aspects of the water system must conform to regulations promulgated by the New Jersey Safe Drinking Water Act and enforced by the NJDEP. One important regulation which governs the amount of ground water diversion required is the regulation that total pumping capacity be sufficient to provide at least the maximum anticipated water demands with the largest single unit out of service. This regulation in effect requires well pump capacities to meet peak day

demands with the largest unit out of service. This regulation should serve as one of the criteria which determines the need for additional ground water wells as the water system develops.

As presented previously, the current potable water demand within Upper Deerfield Township is being met by the Seabrook Water Corporation and by Upper Deerfield Township's own water system in the vicinity of the Centerton Road. Based upon the growth projection presented earlier, a projection of future water demand has been estimated and shown on Figure 11. The projected water demands are partially based upon proposed development, as well as the construction of water utilities to provide water service to various existing developed areas of the Township. The water demand projection assumes that within the next 10 years, developments such as the Bench Industrial Park, the Love Lane Housing project, the Sencit Development, the Dalessio/Caselli Development, the Lerner Property and the Sandel and Bench Developments in the easterly part of the Township, will be constructed. In addition, the projection assumes that portions of developed areas of the Township, such as Sunset Lake area, Cornwell's Run area, Carll's Corner and the portion of the Seabrook area will be provided with water through Township projects. The water demand projection is only an estimate and may vary greatly depending upon the rate of development that actually does occur. However, it can be expected that as demand increases a need for additional ground water wells and treatment facilities will be realized.

The Bench Realty had proposed the construction of two (2) 500 GPM ground water wells south of Love Lane and west of the railroad tracks to provide water service to their proposed projects on Love Lane and at the Bench Industrial Park site. Further investigation of this site and well test data by the Township, and the availability of land to the east of the railroad tracks suggest that the well field (2-700 GPM wells) should be located to the East of the railroad tracks along Love Lane. The Township now proposes to construct these wells, the treatment facility and a storage facility which would enable the Township to provide water to the Bench Developments, as well as other developments and existing homes for a period of time. As required by NJDEP, one well must serve as a back up to the other well. Therefore, assuming the largest unit is out of service, one well would be capable of providing approximately 1,000,000 GPD. This is approximately equivalent to the peak day demands, approximately 1300 housing units. Eventually additional wells or treatment facilities would be necessary in order to meet water demands as various sections of the Township are provided with water service and as the Bench Realty projects develop. The location of future wells is flexible and dependent largely upon available land near existing treatment facilities and upon its relationship to other existing wells. Ideally, wells should be located in close proximity to the treatment facility to minimize raw water pumping and conveyance and treatment facility costs.

In addition, it is desirable to situate well fields and treatment facilities remote from storage facilities in order to provide good pressure distribution throughout the Township. However, availability of land is also a

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factor and therefore siting of a storage tank near a well facility is acceptable.

Since the demand for water is expected to be due largely to development pressures, it is recommended that developers be required to construct needed water system improvements including distribution pipelines, wells and treatment facilities in order to provide water service. Therefore, future well sites and treatment facilities will probably be located in currently undeveloped areas of the Township within the water service area.

In general, the Township can be divided into three (3) areas: the northern section which includes parts of Seabrook and the existing Township water system service area; the eastern section, which includes the Woodruff/southeastern areas; and the western section which is mainly that area west of the railroad tracks and centered around Love Lane. As discussed in more detail in the following section, storage facilities are proposed in these three (3) areas. Each area would also need its own water supply until such time that the three areas were interconnected with water transmission mains. It is estimated that the northern section of the Township will have an eventual water demand of approximately .75 MGD, while the southeastern section or the Woodruff area may have a 1.0 MGD demand, and the Love Lane area a 2.1 MGD demand. Accordingly, well supplies and storage facilities should be sized to accommodate these future demands. Therefore, it is anticipated that additional well supplies will be required to be situated in each of these three (3) areas as development occurs and water demands increase.

D. Storage Requirements

Water storage facilities are an integral part of a water system and provides four important benefits as listed below:

1. Provide water for fire fighting needs.
2. Provide adequate system pressure under extreme conditions.
3. Provide a working storage volume to minimize pumping and energy costs and to meet hourly demand fluctuations in the system.
4. Provide potable water during times of emergency or power outages.

Three (3) important criteria used in determining needed water storage are:

1. Location of the storage tank with regards to development and topography.
2. The height of the storage tank to sustain minimum water pressures of at least 20 psi at street level in all parts of the distribution system.
3. The volume of the tank to provide minimum storage requirements.

Currently, storage capabilities within Upper Deerfield Township consist of a 250,000 gallon elevated storage tank in the Seabrook area and a 20,000 gallon hydropneumatic tank in the Township system. The hydropneumatic tank is capable of providing only domestic water service and not fire service, and has a limited capability. The storage tank at Seabrook is owned by Upper Deerfield Township but utilized by the Seabrook Water Corporation and surrounding industries. Due to the difficulties in metering and controlling the utilization of water in the storage tank it is recommended that the Township utilize this storage facility to serve only the Seabrook Water Corporation.

Since the existing storage facilities in the Township are of little value, three new future storage facilities are recommended and should be situated in areas of projected growth. The desired areas for the storage tank have been selected based upon topography, which will minimize the overall height of the storage facility, as well as available undeveloped land. The selected storage sites have been shown on the Water Master Plan Map in Appendix B.

Current NJDEP regulations require that minimum water pressure in all parts of the distribution network at street level be at least 20 pounds per square inch (psi) under all operating conditions. Accordingly, it is recommended that the high water level of the storage facilities be approximately elevation 250 as measured from USGS Datum. The storage facilities should have an operating range of approximately 20 feet or a low water level of approximately elevation 230. Under this operating head range pressures within the Upper Deerfield Township Water Distribution System should range between 45 to 75 psi under static conditions.

The required storage volumes of these facilities is regulated by the NJDEP. Ideally, the storage facilities should be capable of providing enough water supply to meet an average one day demand which assumes that water would be available to all customers under times of emergency or power failure. However, current regulations include provisions which allow the amount of storage to be reduced based upon the type of system as shown in Table 17.

Table 17
Required System Storage⁽¹⁾

<u>Type of System</u>	<u>Minimum Storage Percentage of Average Daily Demand</u>
i. Single, prime source, no interconnection(s), no auxiliary power at water source	100 percent
ii. Single, prime source, no interconnection(s), auxiliary power provided at water source*	80 percent
iii. Single, prime source with interconnection(s)**	50 percent
iv. Multiple source, no interconnection(s), no auxiliary power at water source	80 percent
v. Multiple sources, no interconnection(s), auxiliary power provided at water source*	50 percent
vi. Multiple sources, with interconnection(s)	50 percent
vii. Multiple sources, interconnection(s)**, auxiliary power provided at water source*	30 percent
viii. Same as vii. above, and distributing more than an average of 50 million gallons per day	20 percent.

* Auxiliary power must be able to supply at least 50 percent of average production.

** Combined interconnection(s) must be able to supply at least 50 percent of average production; contract commitment from supplier is required.

(1) Source: N.J.A.C. 7:19-6.7

Unlike well supply facilities, storage tanks have useful lives of 50 years or greater. Therefore, storage facilities should be sized and constructed to meet not just immediate needs but ultimate future needs. Accordingly, the three proposed storage tanks should be sized to meet the ultimate water demand as shown on Table 15. Assuming that 100% of average day demand is the required storage, it would be recommended that a 0.75 MG storage facility be located near Boyd Fox Road, a 2.0 MG storage facility sited near Love Lane (with possible additional storage facility at Bench Industrial Site) and a 1.0 MG facility east of and south of Carlls Corner. However, the development of the Upper Deerfield Township Water System will in all likelihood include multiple sources of supply and auxiliary power at each water source. Under this scenario the required storage volume could be reduced by 50%. Accordingly the recommended storage volumes for the three proposed tanks are as follows:

	Total Storage	
<u>Service Areas</u>	<u>Capacity</u>	<u>Location</u>
Northern Section -	400,000 gallons	Boyd Fox Road
Western Section -	1,100,000 gallons	Love Lane (0.6 MG) Bench Ind. Park (0.5 MG)
Eastern Section -	<u>500,000</u> gallons	Burlington Road
TOTAL -	<u>2,000,000</u> gallons	

Storage facilities are available in various designs and configurations. Standpipe storage tanks are cylindrical vessels which have a height approximately twice the diameter. These types of storage facilities are

usually the least expensive, although the lower portion of the tank provides minimal benefit. Elevated storage tanks, including pedestal type tanks, with a single small diameter column rising to a ball, or legged tanks, which may have between 4 to 8 columns, cost more than standpipes but provide greater storage capabilities at higher elevations. Final selection of the type of tank desired may depend upon local aesthetics and available land.

E. Water Transmission and Distribution System

Similar to storage facilities, a water transmission and distribution system should be designed to maintain a minimum water pressure of 20 psi at ground level at all points in the distribution system under all required flow conditions. The water transmission system as shown on the Water Master Plan Map was developed through the aid of a computer program which analyzed the proposed water system under various water demand conditions, including coincident draft demands. The recommended water transmission system ranges in size from 16-inch to 10-inch diameter pipes. The water distribution system is not shown on the Water Master Plan Map, but should consist of 8-inches and 6-inches in diameter pipelines. In general, all water distribution mains constructed in the Township should be a minimum of 8-inches in diameter. Six inch diameter water mains should be given special consideration in certain areas of the Township where supplemental larger mains are available to assure adequate pressure and conveyance capacity.

The computer analysis of the transmission system, illustrated on the Water Master Plan Map, indicates that water system pressures vary between 30 psi to 70 psi under peak hour demands coincident with fire flows. It is recommended that the transmission mains be constructed in phases and the system ultimately interconnected between the three storage tanks.

F. Interconnections

As shown on the Water Master Plan Map, the City of Bridgeton owns two (2) separate water lines which are located within Upper Deerfield Township. An interconnection with the City of Bridgeton's water system is possible near the intersection of Deerfield-Bridgeton Pike and West Park Drive. Due to development pressure, an interim temporary connection with Bridgeton's water system was approved by Upper Deerfield to provide a potable water source to the Cornwell Woods Development (Sencit). The interim interconnection would have included a meter chamber. In addition, due to a lower pressure gradient in Bridgeton's system, Sencit proposed to construct a booster pump station to supply adequate pressure to the development. Although this interconnection was conceptually acceptable, the Township is currently constructing a dry water system in the Sunset Lake area and is moving towards the development of a source of supply and storage facilities which may be realized before the Bridgeton/Sencit interconnection is constructed. If this interconnection is constructed the interconnection would have the ability of providing the City of Bridgeton with water under almost all operating conditions. However, the City of Bridgeton would only be able to supply Upper Deerfield Township with water if the booster pumping facilities proposed by Sencit or constructed by others

is strategically located to lift water from the Bridgeton system to the pressure gradient of the Upper Deerfield Township water system.

G. Development of Water Master Plan

As illustrated on the Water Master Plan Map, the construction of the proposed water facilities is a complex and extensive program that will require many years to implement and complete. The following discussion provides recommendations for the initial implementation of the overall plan. In general, it is recommended that all new developments be required to construct all on-site utilities, as well as all off-site utilities that are required to connect into existing utilities. Existing developed areas of the Township should be provided with water utilities in response to public demands or as funding becomes available.

The development of the Township's water system is independent of any regional utility authority. Consequently, the development of the water system is not bound by factors such as capacity of existing pipelines. Rather, the development of the water system will rely greatly upon the demand for potable water from either new developments or existing developed areas of the Township. As discussed previously, the Township may experience growth and development in three defined areas of the Township which can be generally described as the Centerton Road/Boyd Fox Road (northern) area, the Woodruff and southeastern area and Love Lane (western) area. As each area develops groundwater supplies, storage facilities, transmission and distribution systems

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will be necessary to provide water service. Due to the great distance between each area, it is foreseeable that each area would develop independently for a period of time until interconnecting transmission mains are constructed between each area. In order of importance and in response to developer needs and existing development, it is recommended that the water system be initially developed in the Love Lane area with particular high priority given to the Sunset Lake area. The development of a water system in the northern and eastern areas will be highly dependent upon developer activity and have a lower immediate priority. The following is a brief discussion on how the water systems in the three defined areas could be initiated.

1. Love Lane Area (Western Area)

The development of a water supply system in the Love Lane area should begin with the siting and construction of two supply wells, an elevated storage tank and a transmission main. In regards to supply the Township can seek to acquire existing wells or drill new wells. Existing wells should be thoroughly investigated to determine their yield and capacity, water quality, age, and anticipated remaining useful life. The location of existing wells should also be considered since raw water mains and a treatment facility may be required. The Township can also drill new wells which can be sited consistent with the Master Plan Map and with regard to available land. Location of new wells should be finalized through test wells to confirm availability, quantity and quality of groundwater. Either the acquirement of existing wells or the development of new wells will require the Township to obtain diversion rights from the NJDEP.

In regards to storage, the availability of land and the elevation of the land should be the two governing factors in the site selection. Land along Love Lane has favorable ground elevations, approximately elevation 100+, and is centrally located in the western portion of the Township.

By locating both storage and supply facilities along Love Lane, the length of interconnecting water mains can be relatively short. Transmission mains can be extended north and south to supply water to demand areas such as Carll's Corner and Sunset Lake.

For the Love Lane (western) area of the Township it is recommended that the initial development of the water system, as a minimum, consist of the following projects:

1. Construction of two 700-gallon per minute wells and water treatment facilities.
2. Construction of a 0.6 million gallon elevated storage tank sited along Love Lane. (Note: An additional 0.5 MG storage tank will be required in the future to meet long-term needs.)
3. Construction of a 16" diameter transmission main from the storage area to serve the Carll's Corner area and Sunset Lake area.
4. Installation of a water distribution system in the Sunset Lake area.

5. Construction of water distribution system in the Carll's Corner area.

The initial water system should be constructed by the Township. As development occurs, the developers should be required to construct water mains consistent with the Master Plan to supplement the Township system. The proposed two 700-gallon per minute wells will be capable of providing water to approximately 1300 equivalent housing units. The Sunset Lake area contains approximately 185 existing residential units plus some commercial development, while the Carll's Corner commercial development is estimated to be equivalent to 60± housing units. Therefore, existing developed areas such as Cornwell Drive (230 housing units), Laurel Heights Drive (125 housing units), and portions of underdeveloped areas such as Love Lane (400 units) and Bench Industrial Park (11 buildings - 250 equivalent housing units) can be served by the initial water system. However, it is evident that in time additional sources of supply and an additional storage tank will be required to meet long term demand.

2. Centerton Road/Boyd Fox Road Area

New developments located to the north of the existing Township water system have proposed to connect into and utilize the existing wells and storage facilities. The two developments would add approximately 90 residential units to the existing 91 units being served by the water system. The existing well facilities can adequately service up to approximately 250 residential units.

Therefore, additional growth may be possible in this area before additional wells are needed. However, storage facilities are required in this area to provide adequate fire protection. It is recommended that an elevated storage tank be located along Boyd Fox Road which will be capable of providing fire service to the existing Township system area, as well as aiding in future pressure stabilization in the Seabrook area.

3. Woodruff/Southeastern Areas

The development of a water supply system in this portion of the Township will require the construction of ground water supplies, elevated storage facilities and a transmission and distribution system. There are no existing water utilities located in this portion of the Township. The construction of a water system in this area would require the following construction projects.

1. Construction of a groundwater supply system, including wells and treatment facilities.
2. Construction of an elevated storage facility.
3. Construction of a transmission and distribution mains.

Due to the uncertainty of when developers intend to build in this area, as well as the Township's willingness to construct water facilities to a limited amount of existing homes, it is difficult to predict when this water system will begin to develop.

H. Cost Estimate of Township Water System

A construction cost estimate of the water facilities shown on the Water Master Plan Map, including supply, storage and transmission mains is presented below. The cost estimate is based upon present day costs for the construction of these facilities. It should be noted that the construction and development of the water system will, in all likelihood, be through a joint effort between the Township and various developers seeking to construct within the service area. Therefore, the total cost noted for the system does not truly represent the actual cost to the Township.

Table 18

Approximate Quantities and Construction Cost of Utilities

Transmission Mains

<u>Size</u> (Diameter)	<u>Length</u> (Ft)	<u>Cost per Foot</u>	<u>Cost</u>
16"	78,000	\$53.00	\$4,134,000
12"	45,000	47.00	2,115,000
10"	20,700	42.00	869,400

Storage Facilities

<u>Location</u>	<u>Size</u> (million gallons)	<u>Cost</u>
Love Lane	0.60	\$ 875,000
Woodruff/Southeastern	0.50	750,000
Boyd Fox Road	0.40	700,000
Bench Industrial Park	0.50	750,000

Supply Facilities

	<u>Cost</u>
Wells - 8 @ 800 GPM @ \$40,000 each	\$ 320,000
2 @ 700 GPM (Love Lane) @ \$40,000 each	80,000
Treatment Plants* - 3 @ \$450,000 each	1,350,000

*consists of well house and equipment for pH adjustment, disinfection and iron sequestering. No filtration facilities.

Based upon the quantities noted above, the following is an estimated cost of the construction of the water system without consideration for the distribution system.

Table 19

Estimated Total Construction Cost of Water Utilities
(Not Including Distribution System)

Transmission Mains -	\$ 7,118,400
Storage Tanks -	3,075,000
Wells and Treatment -	<u>1,750,000</u>
Total	\$11,943,400

Estimated construction costs for the distribution systems for the existing developed areas of the Township, including Sunset Lake, Cornwell Drive, Laurel Heights, and Sentry Drive are presented in Table 20 based on 1991 prices. The construction of a water system in these developed areas would be undertaken by the Township. In general, 8-inch diameter water lines would be installed in each street, and 1-inch service lines extended to all existing homes.

Table 20
Estimated Construction Cost of Water Distribution
Systems in Developed Areas of the Township

Sunset Lake

<u>Unit</u>	<u>Quantities</u>	<u>Unit Cost</u>	<u>Cost</u>
8" Ø Distribution Main	15,400 Ft.	\$ 37.00	\$ 569,800
16" Ø Transmission Main	2,000 Ft.	53.00	106,000
Hydrants	40	1,600.00	64,000
Service Connections	185	500.00	<u>92,500</u>
			\$ 832,300

Cornwell Drive

8" Ø Distribution Main	17,000 Ft.	\$ 37.00	\$ 629,000
12" Ø Transmission Main	5,500 Ft.	47.00	258,500
16" Ø Transmission Main	4,300 Ft.	53.00	227,900
Hydrants	45	1,600.00	72,000
Service Connections	230	500.00	<u>115,000</u>
			\$1,302,400

Laurel Heights

8" Ø Distribution Main	9,650 Ft.	\$ 37.00	357,050
12" Ø Transmission Main	3,300 Ft.	47.00	155,100
16" Ø Transmission Main	3,500 Ft.	53.00	185,500
Hydrants	30	1,600.00	48,000
Service Connections	130	500.00	<u>65,000</u>
			\$ 810,650

Sentry Drive

8" Ø Distribution Main	11,700 Ft.	\$ 37.00	\$ 432,900
10" Ø Transmission Main	1,800 Ft.	42.00	75,600
12" Ø Transmission Main	4,900 Ft.	47.00	230,300
Hydrants	30	1,600.00	48,000
Service Connections	95	500.00	<u>47,500</u>
			\$ 834,300

Total \$3,779,650

Estimated costs for distribution systems in other areas of the Township have not been provided due to the unknown impact of future proposed developments.

V. Summary and Recommendations

Based upon information presented herein, it is apparent that Upper Deerfield Township has a potential to experience increased development and grow significantly over the next 30 to 40 years. The Township is experiencing pressure from numerous developers who desire to construct large housing and commercial projects. This pressure, coupled with the Township's desire to provide public utilities to existing residents in the Township, demonstrates the need for public water and sewer facilities which should be controlled through a Master Plan.

In review, the population of Upper Deerfield Township has been projected to grow from approximately 7,000 people in 1989 to approximately 20,000 people at build-out. Although it is difficult to predict with any certainty, when the build-out will occur, it has been assumed to occur within the expected service life of certain components of the proposed water and sewer facilities.

Based upon the estimated growth projections, the future wastewater flow of Upper Deerfield Township is estimated to be approximately 3.31 MGD. Similarly, the estimated future water demand is 3.88 MGD. These estimated flow rates were utilized in developing Master Sewer and Water Maps which are included in Appendix A and B. The Master Water and Sewer maps illustrate the suggested location of pipelines, pumping stations, well stations, storage tanks, and transmission mains.

The construction of both the water and sewer utilities is expected to occur over the next several decades and be partially constructed by developers. The immediate needs of the Township have been reviewed and suggest that the development of water and sewer facilities begin in the area of Sunset Lake and Cornwell Drive which is the most developed portions of the Township.

Initial sewerage projects include the construction of sewage pump stations on Park Drive and near Cornwell's Run, and the construction of gravity sewers in the Sunset Lake area as well as in the proposed Sencit Enterprises' Development. With the construction of the Cornwell's Run pump station other areas, such as the Cornwell Drive area or Laurel Heights area could be sewered utilizing this pump station. Future growth of the sewer system is dependent upon the ability of the CCUA Upper Deerfield Interceptor to accept additional flow from other portions of the Township without adversely effecting the existing pump stations. Based upon available data, it appears that the conveyance capacity of the CCUA Upper Deerfield Interceptor will be fully utilized once the Cornwell's Run and Sunset Lake pump stations are constructed. Further development of sewer facilities in other service areas is not recommended until additional studies are undertaken to evaluate, in detail, the hydraulic conveyance capacity of the CCUA Upper Deerfield Interceptor. Ultimately, a parallel interceptor sewer and at least one new interceptor sewer in the southwest portion of the Township will be required to convey all of Upper Deerfield Township's future wastewater flows.

Upper Deerfield Township's water system should also develop around the Cornwell Drive and Sunset Lake areas. The initial stages of development should include the construction of a 0.6 million gallon elevated storage tank, well supplies and treatment facilities, and the construction of transmission mains and distribution lines. The water system would be initially used by existing development in the Sunset Lake and Carll's Corner areas with capacity available for the Sencit and Bench Realty developments. The initial wells proposed should be sufficient to provide water to these areas for the first five to ten years. The construction of other proposed developments or the installation of water lines in other developed areas of the Township would necessitate the construction of additional wells and treatment facilities. The exact sizing of future wells and their location should be determined in the future when specific needs can be clearly identified.

In general, it is recommended that the Water and Sewer Master Plan maps be utilized by the Township to inform developers of the needed infrastructure requirements in order to serve those developments. Developers should be required to contribute their fair share toward the construction of off-site utilities where necessary to extend utilities to their site. Developers should also be required to construct on-site water and sewer utilities according to the Master Plans in order to allow extensions to other areas of the Township. The Water and Sewer Master Plan, together with the Township Master Plan and zoning ordinances will be useful tools in guiding the growth and future development of Upper Deerfield Township.



APPENDIX A
SEWER MASTER PLAN MAP

APPENDIX B
WATER MASTER PLAN MAP