FACILITIES PLAN

FINAL REPORT

for the

Washington Township Municipal Utilities
Authority — Lead Agency and the Townships of
Mt. Olive and Roxbury

LAN Associates, Inc.
Hawthorne, New Jersey

Alfred Crew Consulting Engineers, Inc.
Ridgewood, New Jersey

EcolSciences, Inc.
Rockaway, New Jersey

August 1, 1978

LAN
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August 1, 1978

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State of New Jersey
Dept. Environmental Protection
Division Water Resources

Washington Township Municipal Utilities Authority
Washington Township
P.O. Box 216
Long Valley, New Jersey 07853

Attn: James Laughlin III, Chairman

Subject: Final Report
Facilities Plan
LAN Job #2.332.0

Gentlemen:

We submit herewith the Final Report of the Facilities Plan for the Washington Township Municipal Utilities Authority serving as Lead Agency for the Townships of Washington, Mt. Olive and Roxbury. This report was prepared under Federal Contract #C-34-0537-01-0 with the USEPA Region 2.

The record of the Public Hearing, to be scheduled in the Fall, 1978, and the reactions to same will be incorporated as addenda to this report.

It has been a distinct pleasure to work with the three townships, project and staff members of NJDEP and USEPA, the various recognized organizations and the public on this important project. We gratefully acknowledge their work, guidance and contributions.

Very truly yours,

John A. Lacz

John A. Lacz, P.E., P.P.

JAL:cnm

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Notes: (1) * asterisk represents large foldout figure
(2) ** dougle asterisk represents 11" x 17" smaller foldout figure

1.0 INTRODUCTION

1.0 INTRODUCTION & SUMMARY

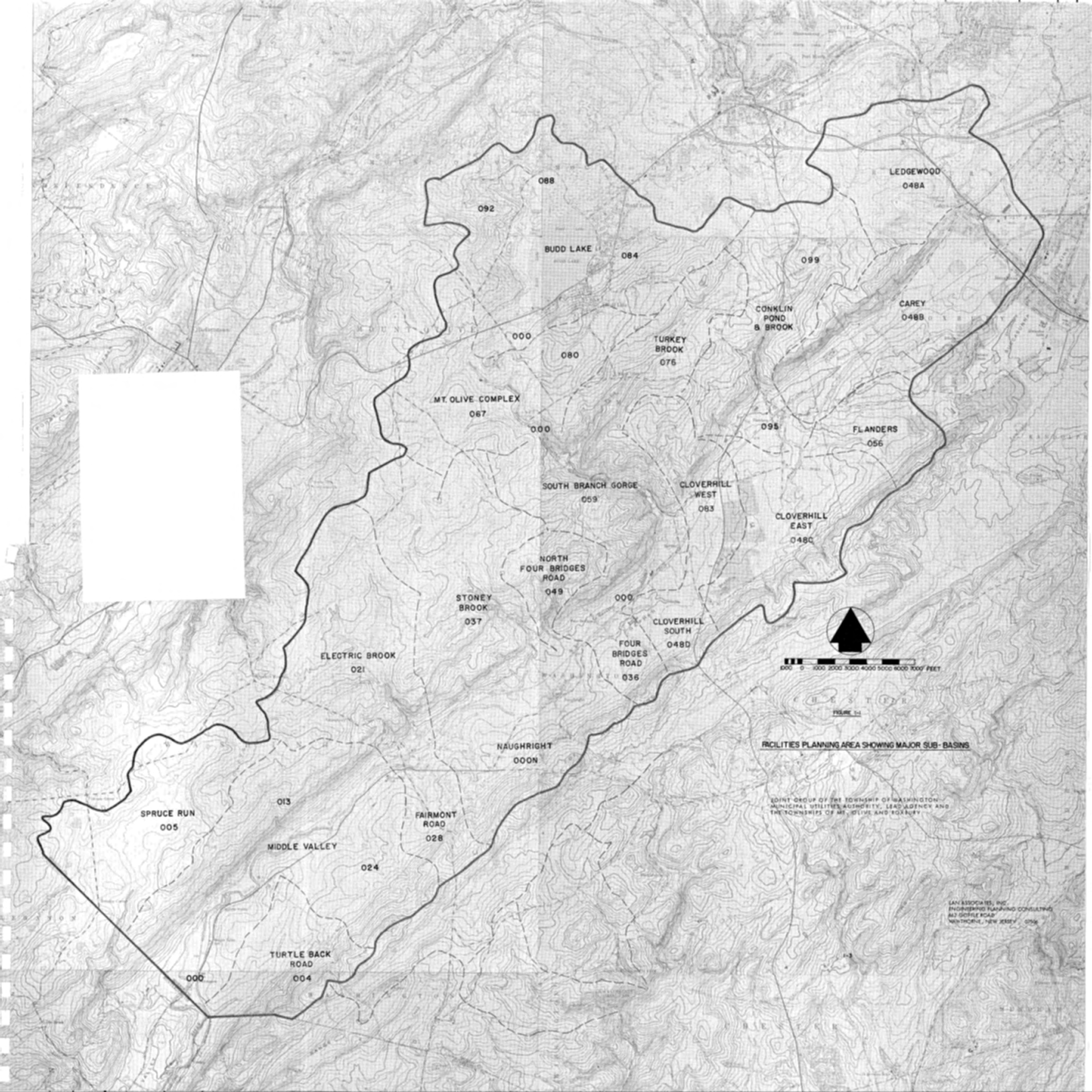
1.1 Authorization: This study has been conducted under an agreement between the Washington Township MUA and LAN Associates, Inc. The Washington Township MUA acted as the lead agency for the Townships of Washington, Mount Olive and Roxbury, the governing bodies of which had each adopted an ordinance authorizing the Washington Township MUA to act for it. LAN Associates signed subcontract agreements with Alfred Crew Consulting Engineers, Inc. who are responsible for the treatment facilities portions, Ecol-Sciences, Inc. who are responsible for the environmental aspects of the Facilities Plan and other associates and consultants, all of whom contributed to this study.

1.2 Purpose and Scope: In order that the participating townships qualify for Federal financial aid under provisions of the Federal Water Pollution Control Act (Public Law 92-500), it is required that a comprehensive facilities plan be developed. Development of the plan requires investigations, analysis, and recommendations relative to water quality management goals and objectives; identification of pollution sources and waste loads, existing wastewater treatment facilities, and environmental characteristics. The plan must further develop a design criteria for the selected study period (20 years), alternatives for collection and treatment facilities, and selection of the best plan based upon cost-effectiveness, environmental effects, and acceptability by the Public. For the selected plan, cost estimates for construction, operation and maintenance, and cost of service to homeowners, and other users, must be estimated. The plan is completed with a discussion of its implementation, i.e., organization, scheduling, financing, operation and maintenance, and cost sharing. This report addresses itself to the full scope of the Facilities Plan, Step 1 Grant. As agreed with NJDEP and USEPA, the preliminary design and site plan layout will be included as an addenda to the report after the conclusion of the Public Hearing. Also, the minutes of the Public Hearing and our commentary from questions asked during the Public Hearing will be answered in this same addendum.

1.3 Planning Area: The study area is identified as the drainage basin of the South Branch of the Raritan River and its tributaries in Morris County. This area is within the Townships of Washington, Mount Olive and Toxbury. The principal tributaries include Drakes Brook, Turkey Brook, Stony Brook, and Electric Brook. Budd Lake is a major water body which drains into the South Branch of the Raritan River. A map of the study area is shown on Figure No. 1-1. The total area of the study area is approximately 30,500 acres. Shown in the below table are the percent of the total in each township.

Township	% of Total Area
Washington	48
Mount Olive	37
Roxbury	15
Total	100

Table 1-1, provides the major sub-basin identification within the facilities plan study area. These sub-basins, where identified, using the Morris County drainage study designation.



FIGURE

FACILITIES PLANNING AREA SHOWING MAJOR SUB-BASINS

Table 1-1 Sub-Basins Identification

South Branch

	Morris County Drainage Study Designation		Basin Description	Approximate Area acres	sq. miles	Remarks
	092	Budd Lake W.				2995 acres*(1)
000	088	Budd Lake NW	Budd Lake	2950	4.61	4.68 sq. mi.*
	084	Budd Lake E				
	067	Drakestown	Mount Olive Complex	1907	2.98	
000	080	Wolf Rd.				
076	-	-	Turkey Brook	986	1.54	
	059	River Road	South Branch	1459	2.28	
000	000	South Branch Gorge	Gorge			
036	-	-	Four Bridges Road	653	1.02	
037	-	-	Stoney Brook	2970	4.64	
049	-	-	North Four Bridges Road	505	.79	
000 N	-	-	Naughright	768	1.2	
021	-	-	Electric Brook	2195	3.43	2510 acres* 3.92 sq.mi.*
028	-	-	Fairmont Road	525	.82	732 acres* 1.14 sq. mi.*
	013	W. Springtown Rd.	Middle Valley	3276	5.12	
000	024	Scott Farm				
005	-	-	Spruce Run	1548	2.42	
004	-	-	Turtle Back Road	921	1.44	
048 A	-	-	Ledgewood	1459	2.28	
048 B	-	-	Carey	2259	3.53	
048 C	-	-	Cloverhill East	1593	2.49	

Table 1-1 (continued)

Morris County Drainage Study Designation			Basin Description	Approximate Area acres	sq. miles	Remarks
048 D	-	-	Cloverhill South	384	.60	
083	-	-	Cloverhill West	864	1.35	
099	-	Rt. 206 S	Conklin Brook	1913	2.99	
095	-	Rt. 206 N				
056	-	-	Flanders	639	1.00	
			Totals	29774	46.54	
			Inter-Basin Transfer			
-	-	-	Parker Acres (Z30)	150	.23	Lamington Basin Pump to Sub-Basin 028 (Fairmont Rd.)
-	-	-	Darby Dan Farms (Z31)	57	.09	do
-	-	-	Unidentified Development (X-4)	45	.07	Transfer to Sub-Basin Budd Lake 092
-	-	-	Unidentified Development (Z-2)	11	.13	Transfer to Sub-Basin Stoney Brook 037
-	-	-	Karen Ann Estates (Z-21)	185	.29	Transfer to Sub-Basin Electric Brook 021
-	-	-	Schooley's Mt. Intersection	81	.13	do
-	-	-	Township Property	49	.07	do
			Totals	648	1.01	
			Grand Total South Branch & InterBasin Transfer	30422	47.55	

Notes: (1)* Includes interbasin transfer - Total area

1.4 Planning Participation and Coordination: Execution of this Facilities Plan has been accomplished by the following:

LAN Associates, Inc. - Project management responsible for report preparation, demographic and land use studies, pollution source and waste load analysis, existing collection facilities, infiltration/inflow analysis, plan selection analysis and cost analysis and implementation. Liaison with Local, State and Federal Agencies.

Alfred Crew Engineering Associates, Inc. - Water quality goals and objectives, existing treatment facilities, treatment plan alternatives, and cost analysis.

EcolSciences, Inc. - Environmental inventory, environmental evaluation of alternatives, and detailed environmental effects of the selected plan.

In addition to the mutually interdependent activities of the foregoing consultants, they have maintained liaison, directly or indirectly as expediency dictated, with personnel of the Environmental Protection Agency and the New Jersey Department of Environmental Protection. By reports, correspondence and conferences, the Consultants have maintained a continuing dialogue to keep the EPA and DEP informed concerning the progress of this Facilities Plan, and the findings developed as the study advanced from one stage to another. Feedback information from EPA, DEP, other agencies and the Public was used by the Consultants to develop a Facilities Plan of the scope, detail of presentation, and soundness of conclusions to be acceptable to all concerned. The Consultants also maintained close liaison with local authorities, township personnel, and individuals who furnished valuable data and information or contributed their comments. These have served to guide the Consultants in completing the Facilities Plan.

1.5 Summary: The results of this study indicate that regional facilities are the best and most economical method of meeting the water quality goals for the South Branch-Raritan River in Morris County. The selected plan, #6, will consist of ; a 4.4 MGD confluence plant just south of the confluence of Drakes Brook and the South

Branch, interceptors, pumping stations and local collection systems,(see Figure 8-5) and the organization of a Regional Authority, which will manage the "regional" facilities. Local facilities, that is,existing and proposed local collection systems will continue to remain the responsibility of the three townships.

Referring to Table 9-3, the total capital cost (1985 construction) is estimated to be $84,378,000 of which the Federal Grant (65% estimated) is $54,845,700 and Local Share (35% estimated) is $29,532,300. The total annual cost per connection, i.e. O & M and debt service (1985 CY) is estimated to be $395, which includes the Federal Grant.

2.0 WATER QUALITY MANAGEMENT GOALS AND OBJECTIVES

2.0 WATER QUALITY MANAGEMENT GOALS AND OBJECTIVES

2.1 General: It is a primary purpose of a sewage collection and treatment system to upgrade the quality of wastewater so it may be discharged to streams, or on the surface, without degrading the receiving waters below standards established by the Department of Environmental Protection.

Wastewater standards are established to limit or control the changes brought about by pollution in the quality of waters which flow in public streams. The principal changes in stream water quality caused by pollution are the introduction of possibly infectious organisms, reduction in dissolved oxygen content, increase in carbon dioxide content, extreme variations in pH value, extreme increases in temperature, introduction of excessive amounts of fibrous suspended matter, and introduction of toxic or other deleterious chemicals and materials.

A stream's flow characteristics is an important consideration as regards standards of quality. The flow is quite variable from the peaks of flood periods to the lows of drought periods. Therefore, the discharge of a quantity of waste material into a stream may cause significantly detrimental effects at some flows and not at others, depending upon the volume and quality of dilution water available. The stream flow at which a particular standard applies is of fundamental importance. In some cases, the governing stream flow must be the minimum possible at any time; in others, a flow above the minimum and below which some polluting effects must be accepted. This choice is one of economy between the expense of waste treatment and the benefits derived.

Within the study area, the Department of Environmental Protection has established a policy of non-degradation of the receiving stream in accordance with N.J.A.C. 7:9-11.3.

2.2 Surface Water Use Classifications: The quality of water in each stream depends upon its public use, i.e., water supply, fish propagation , recreation and bathing, industrial water supply, agricultural use, water power, navigation, and disposal of sewage and industrial wastes. The quality of water declines generally in the order mentioned. The standard of water quality for a stream is determined on the basis of its highest order of use if it is used for more than one purpose.

The quality of treatment plant effluent discharges must conform with the designation of water use categories in the State. These designations are made by the New Jersey Department of Environmental Protection, and they have designated all the surface water bodies in the study areas as FW-2 waters. The best usage includes aquatic life, water supply, recreation, and other reasonable uses.

2.3 <u>Water Quality Criteria:</u> A "208" Plan, employing a stream model, has been completed by the State Department of Environmental Protection and indicates that all streams in the study area will be water-quality limited. There must be no degradation of the present water quality.

DEP requires in a stream segment where water quality (DO levels) is below a satisfactory level, the baseline design condition is that defined as minimally acceptable by State standards. Where water quality is presently high, however, such as in the North and South Branches of the Raritan River, the baseline condition is established in accordance with the antidegradation policy.

The stream model (a computer-generated mathematical model for the South Branch of the Raritan River Basin) starts at Drakes Brook at the existing Township of Roxbury/Skyview Wastewater Treatment Plant and terminates at the confluence of the North and South branches of the Raritan River. The model is based upon a water quality survey conducted by the U.S. EPA Region II Office during the summer months of 1969 to 1972, and hydrologic data furnished by the USGS and the DEP's Bureau of Water Supply Planning. The model was based on the summer of 1970 conditions and the dissolved oxygen (DO) parameter for a simplified analysis. Non-point sources of pollution, DO increase from photosynthesis or depletion from benthal demands were not considered in the model (which are reasonable approximations) to provide as simple and workable a model as possible.

The low stream flow conditions, minimum 7-day stream flow in a 10-year period (MA7CD10), were estimated to be 8.7 cfs at the confluence of the South Branch Raritan River and Drakes Brook (17.6 cfs at the Highbridge gauging station).

Stream qualities have been presented for various stream segments and mile points as shown on Figure 2-1. Point source data used for the stream model development is shown on Table 2-1. Table 2-1 summarizes the point-source discharges used for the development

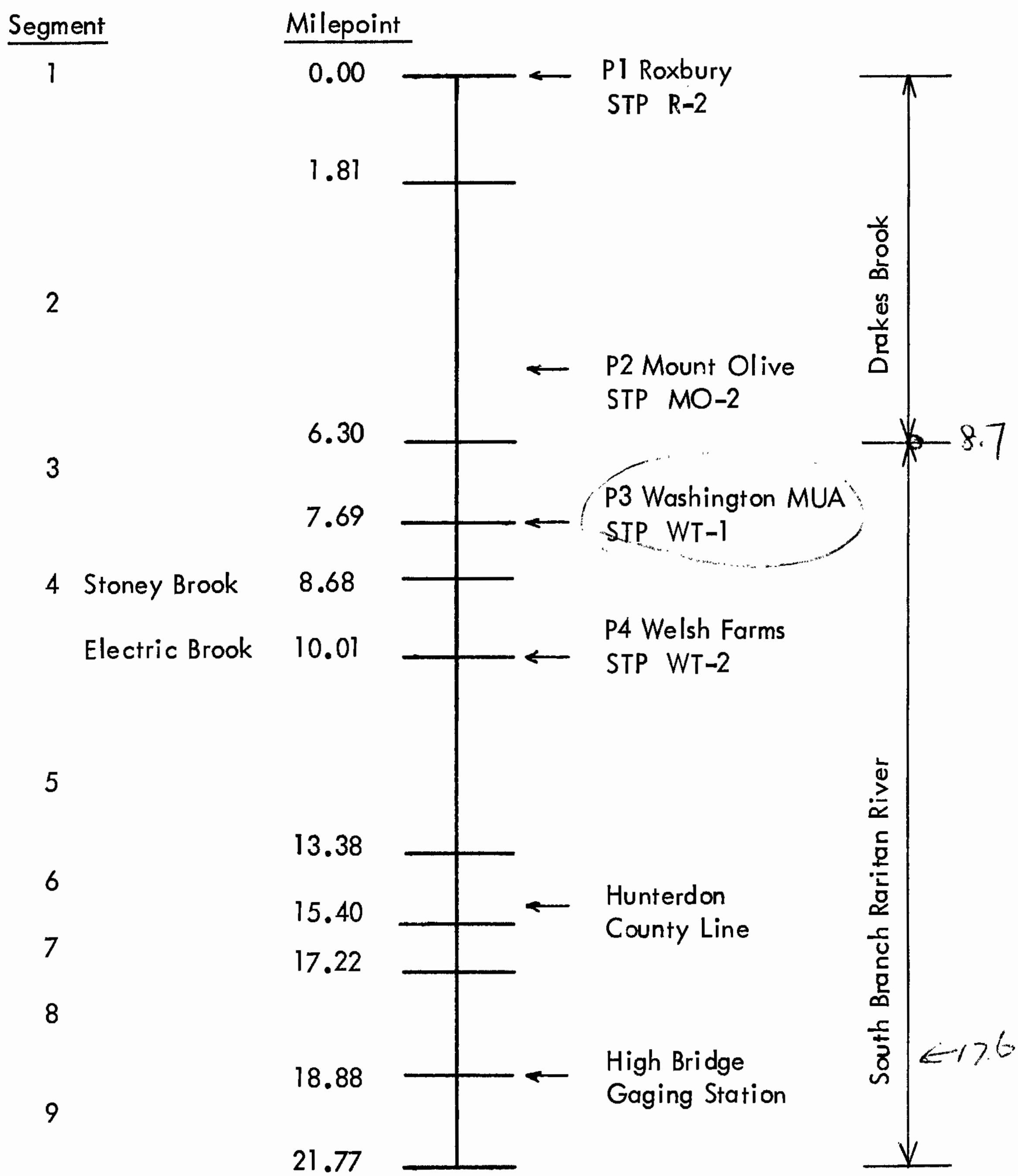


Figure No. 2-1

SOUTH BRANCH SCHEMATIC
FOR MATHEMATICAL MODEL

Source: DEP, Phase I Water Quality Management Basin Plan, Raritan River Basin

Table 2-1 South Branch Point-Source Data Used for Model Development

No.	Name	Average Flow MGD	DO mg/l	CBOD mg/l	NOD mg/l	Receiving Stream
P1	Skyview STP	0.03	6.7	6	12	Drakes Brook
P2	Mount Olive STP	0.15	5.0(1)	13	18	Drakes Brook
P3	Washington MUA	0.03	5.0(1)	70	12	Stoney Brook
P4	Welsh Farms	0.06	6.7	8	2	Electric Brook

Source: DEP, Division of Water Resources files, averaged Summer 1970 figures.

Note: (1) Estimated, due to gaps in collected data.

Table 2-2 South Branch Water Quality Data Used for Model Development

Station Code	Station Description	Temp. °C	DO mg/l	BOD_5 mg/l	TKN mg/l
SB-8	Middle Valley Road Bridge at Middle Valley	19.0	9.1	3.1	1.1
SB-9	Route 24 Bridge at Long Valley	18.1	10.0	2.8	1.4
SB-10	Private road at Four Bridges downstream of confluence with Drakes Brook	16.2	9.0	3.8	1.5
SB-11	Manor House Road near Budd Lake outlet	23.7	7.9	7.9	5.2
SBB-1	Penn Ave. Bridge on Bush-kill Creek downstream of Flemington STP and industrial discharges	21.5	7.7	3.2	0.9
SBN-1	Route 514 Bridge on Neshanic River at Hillsborough Township	23.0	8.7	4.0	1.3
SBR-1	Route 53 Bridge on Beaver Brook	21.8	9.6	6.9	2.1
SBD-1	Road on Drakes Brook about 1 mile downstream of Budd Lake STP	15.0	9.2	1.9	2.2

Source: U.S. EPA STORET Inventory, Summer 1970 Data of a D.O. profiles for the summer 1970 conditions. Most of point-source discharge data was compiled from DEP files. As noted in the table, estimations have been made where there are data gaps.

The EPA-collected stream water quality data were taken at 4 field sampling stations on the mainstem of South Branch and 4 stations at the mouth of four major tributaries to the river. The 1970 data used for the model development are summarized in Table 2-2. Recorded flows at the High Bridge and Stanton Gauging Stations were used for hydrogolic and hydraulic data calculations. Base gauge flows at High Bridge and Stanton during the sampling period were 38 and 135 cubic feet per second, respecitvely.

Figure 2-2 is a profile of dissolved oxygen concentration generated by the model for summer 1970 conditions plotted along with field data. The model-calculated D.O. profile fits the field data well and demonstrates that the model is acceptable for engineering purposes in planning. It is essential to note, however, that this simplified D.O. model does not account for non point or other unrecorded sources of pollution and assumes no D.O. contribution from photosynthesis or depletion from benthal or other demands. These are reasonable assumptions for the purpose of this simplified analysis.

An understanding of the waterway system and the simplified mathematical model provide the means to establish the baseline water quality condition (in this case, D.O. levels) of the segment being anayzed. In a segment where water quality is below a satisfactory level, the baseline design condition is that defined as minimally acceptable by State standards. Where water quality is presently high, however, such as in the South Branch of the Raritan, the baseline condition is established in accordance with the State's antidegradation policy.

The antidegradation policy simply requires that, where existing water quality is superior to established minimum criteria, existing quality will be maintained unless overriding social or economic factors dictate otherwise. For any given water body, however, "existing conditions" change from day to day, or moment to moment, and some baseline design condition, must therefore be established to define the water quality characteristics to which an antidegradation principle can be applied.

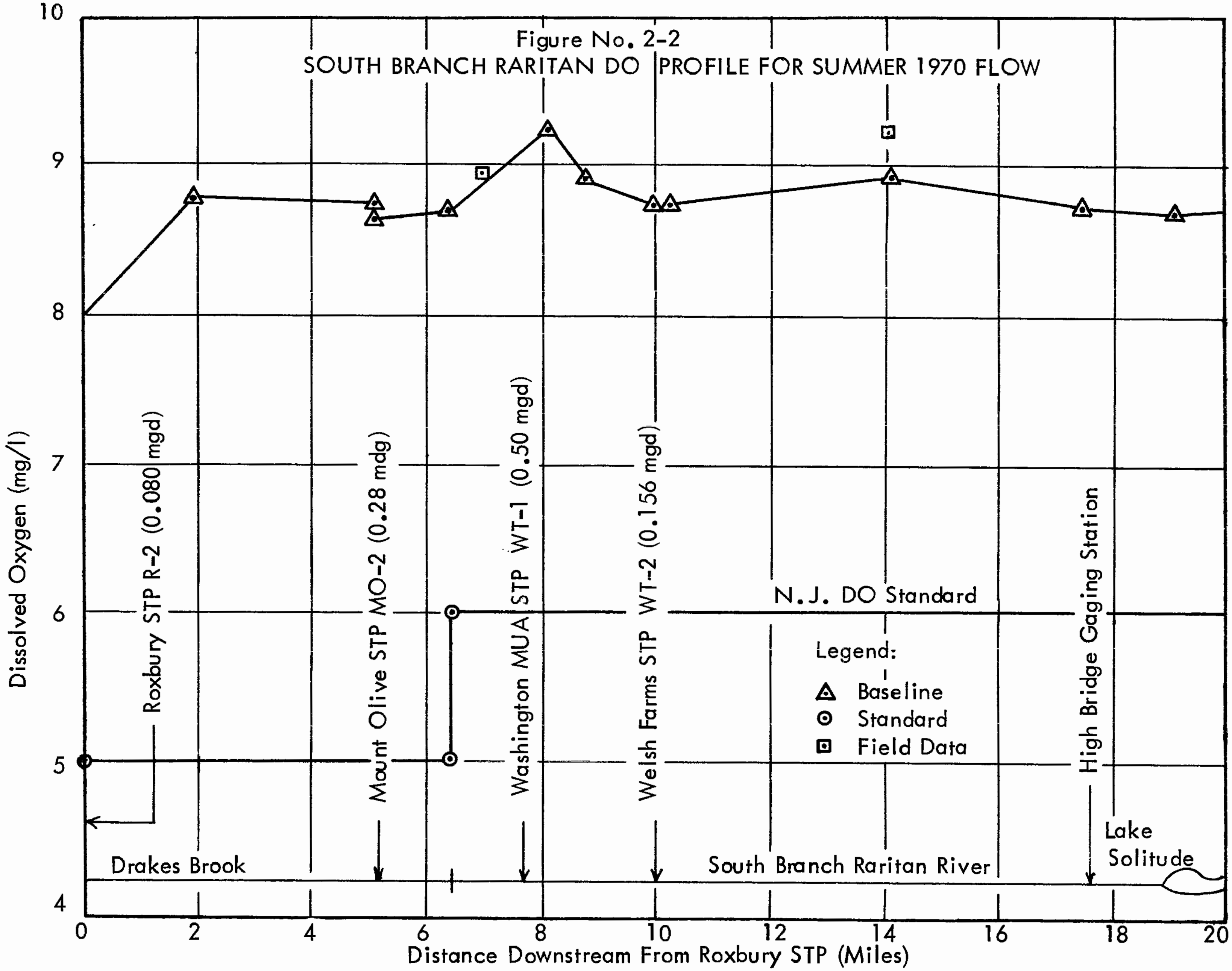


Figure No. 2-2
SOUTH BRANCH RARITAN DO PROFILE FOR SUMMER 1970 FLOW

Source: DEP, Phase I Water Quality Management Basin Plan, Raritan River Basin

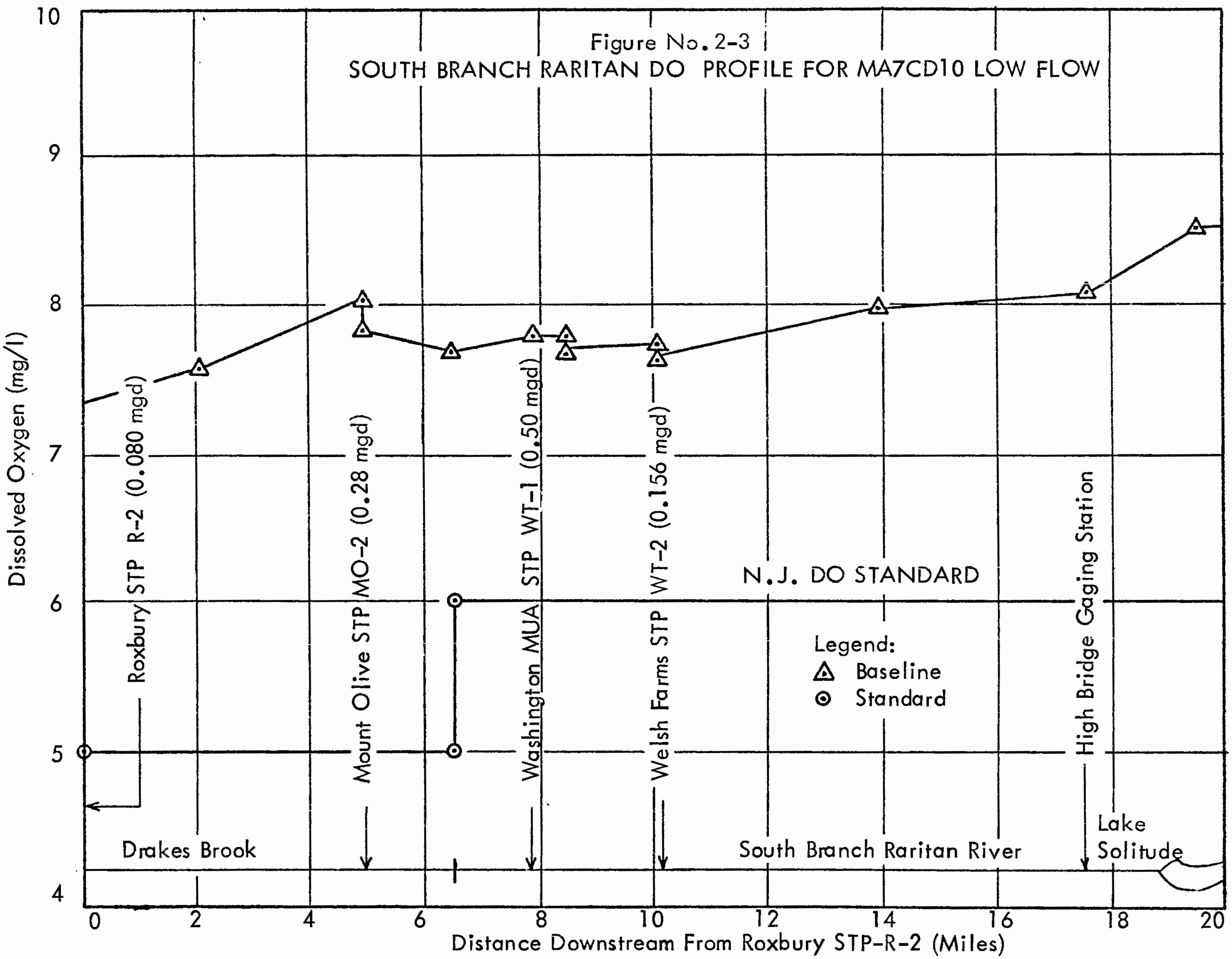
The baseline design condition is determined by extrapolating down from existing conditions to design flow conditions. The reaction rates estimated in the model development process are employed using the simplified model, with waste load inputs as the latest discharge information available. Summer 1975 point-source data, as listed in Table 2-3, were used to establish baseline conditions, and MA7CD10 flows of 17.9 cfs and 69 cfs were used for the High Bridge and Stanton gauging stations, respectively. The resulting D.O. profile projected by the model is presented in Figure 2-3, and this exhibits baseline D.O. concentrations generally between 7.5 and 8.5 mg/1. The baseline D.O. levels shown in Figure 2-3 are the values against which alternatives are evaluated in this study.

Table 2-3 Point Source Data Used for the Development of South Branch Baseline Design Conditions

No.	Name	Average Flow MGD	DO mg/1	CBOD mg/1	NBOD mg/1
P1	Skyview	0.08	4.5	70	29
P2	Mt. Olive	0.28	4.2	56	56.5
P3	Washington MUA	0.14	5.7	33	21
P4	Welsh Farms	0.11	6.0	22	11.7

Source: Division of Water Resources files, averaged summer 1975 figures.

2.4 Effluent Limitations: Based upon the DO model for the basin, it is indicated that usual secondary treatment of wastewaters for the alternative treatment plants at estimated initial flows would meet the minimum DO's of 5.0 mg/1 and 6.0 mg/1 stipulated in the State standards for the various portions of the stream. However, taking into account the State's antidegradation policy, the model shows in general a stream DO content of more than 7.5 mg/1 during low stream flows at present point source discharge conditions. It is concluded that in no alternative plan would secondary treatment of wastewaters be acceptable to meet the antidegradation policy. Six levels of treatment of wastewaters were analyzed by the DEP with effluent concentrations of various parameters estimated to determine the degree of treatment required in the basin, as follows:



Source: DEP, Phase I Water Quality Management Basin Plan, Raritan River Basin

Table 2-4

Levels of Treatment: Oxygen Demand
Publicly Owned Wastewater Treatment Plants

Treatment Level	Approximate % Removal CBOD(1)	NBOD	Effluent Concentration (mg/l) CBOD	NBOD	BOD_5	NH_3-N	DO
1(2)	85	35	36	130	24	26	4
2	90	75	24	50	16	10	6
3	90	90	24	20	16	4	6
4	95	95	12	10	8	2	6
4.2	95	75	12	50	8	10	6
5	97.5	97.5	6	5	4	1	6

(1) Refer to definitions and symbols,

(2) Secondary treatment

The initial model analysis made by the DEP in July 1976 indicated the requirement of treatment level 3 or better and a DO of 7.5 mg/l for almost all of the proposed alternate plans and plants. The treatment level requirements and stream low flows were reviewed and discussed with the DEP representatives and the DEP agreed to rerun the model analysis with the revised estimated 1990 plant discharge flows, for a variation of low flows and with the required DO level reduced to 6.5 mg/l for Plans 1 and 5. (Alternate Plans 2, 3, and 4 were eliminated for consideration for reasons which are described elsewhere in this report). Revised model data was received in August 1977 and additional data was transmitted to the Consultants by letter of September 8, 1977 from the DEP. In summary, the required treatment levels for direct discharges to the area streams for 1990 estimated flow rates at varying low flows are as follows:

Table 2-5

Required Treatment Levels
For Point Source Discharges

Alternate Plan	Plant	Facility Name	1990 Flow (MGD)	Required Treatment Level at Drought Flows (1) MA3CD20 (17.9 cfs)	MA7CD10 (20.9 cfs)	MA60CD10 (25.0 cfs)
1	A	Budd Lake (Existing Mt. Olive Complex)	1.996	3(2)	4.2(2)	2(2)
	B	Long Valley	.562	4.2	4.2	2
	C	Schooley's Mtn.	.344	2	2	2
	D	Confluence Drakes Brook & So. Branch	1.056	2	2	2
	E	Roxbury	1.131	2	2	2
	Welsh Farms		.200	2	2	2
5(3)	A	Confluence Drakes Brook & So. Branch	4.737	4(2)	4(2)	3(2)
	B	Long Valley	.535	3	3	3
	Welsh Farms	Existing Welsh Farms	.200	3	3	3

(1) Flow measured at High Bridge Gauging Station.
(2) With post aeration to 6.5 mg/l to meet antidegradation policy.
(3) See Section 1.0.

It may be noted that under Alternate Plan 5, which plan calls for the point discharges to be downstream of the confluence of Drakes Brook with the South Branch, the treatment level is about one level higher than for Plan 1 because of the flow concentration. It would be expected that as effluent flows increase beyond year 1990, higher treatment levels would be required to maintain stream quality. Because the estimated flows for 1990 treatment levels are about fifty percent of the estimated saturation development flows to maintain stream quality, the ultimate levels of treatment will be about one to two levels higher than are required for 1990 treatment levels.

Although it was not so stipulated by the Department of Environmental Protection, preliminary review of wastewater treatment plant sizes and discharge locations by EcolSciences, Inc. have indicated that residual chlorine will detrimentally affect the waters of the study area with respect to trout propagation and maintenance. Therefore, dechlorination has also been included as a voluntary treatment process for any proposed plants have a direct effluent discharge to receiving streams. The recently expanded Schooley's Mountain Wastewater Treatment Plant in Washington Township has a zero residual chlorine requirement for its discharge to the Stony Brook.

The DEP representatives advised that the effluent discharge point for the plant for systems 1A or 2A must be located downstream from the Old YMCA pond on the South Branch to minimize eutrophication in this impondment. Also, discharge permits, when issued, will probably be based upon DO, BOD_5 and ammonia removals. Nitrogenous BOD_U and carbonaceous BOD_U, although listed in the DEP's treatment level requirements, will not be used for the permit.

2.5 Water Quality Objectives: The Water Quality Act of 1965 established water quality for interstate and coastal waters. The primary aim was to protect the public health and to ameliorate the condition of interstate water bodies, to the extent that any reasonable use, such as for industry or recreation, would not be impaired.

The National Environmental Policy Act of 1969 established the policy of having an environmental impact statement included in any recommendation or report affecting the quality of the human environment.

In 1972, the amendments to the Federal Water Pollution Control Act (Public Law 92-500) wer passed, which expanded the existing water pollution control legislation and set more stringent time limits. The amendments establish three deadlines to be met for discharges of wastewaters into the nation's streams and lakes. By 1977, all publicly-owned waste treatment facilities must discharge effluents equal to or better in quality than secondary treatment standards which have been set by the U.S. Environmental Protection Agency. By 1983, waste treatment plants must provide "best practicable waste treatment technology" to meet more stringent effluent limitations. While an interim goal of protection of all terrestrial and aquatic biota and protection of existing water usages will result from the 1983 quality standards, the ultimate goal of zero discharge is envisioned for 1985. Public Law 92-500 (Amendments Act) states "that discharge of pollutants into navigable waters will be eliminated by 1985".

This Facilities Plan for the South Branch of the Raritan River in Morris County has, as its primary objective, the maintenance or improvement of the water quality of the surface and ground water resources for the best uses as established by the Department of Environmental Protection.

In providing treatment facilities to meet the Federal and State water quality criteria, consideration has been given to "best practicable waste treatment technology" (BPWTT). BPWTT as defined by EPA states,

> "Waste treatment management plans and practices shall provide for the application of the best practicable waste treatment technology before any discharge into receiving waters, including reclaiming and recycling of water, and conf ned disposal of pollutants so they will not migrate to cause water or other environmental pollution and shall provide for consideration of advance waste treatment techniques."

The variety of alternative wastewater treatment methods investigated in the course of the Study to determine BPWTT included: activated sludge; trickling filter; physical-chemical; land application; and advanced waste treatment.

Based on Department of Environmental Protection criteria for the South Branch Raritan River and its tributaries, a minimum of DEP 4.2 level of treatment is required to meet the anti-degradation standards.

Based on EPA criteria for the South Branch, the level of treatment will also meet the requirements of best practicable wastewater treatment technology, for the design period.

The Department of Environmental Protection, Division of Water Resources, Water Policy and Supply Council, at a meeting held on September 20, 1976, adopted the following resolution:

WHEREAS, the Spruce Run-Round Valley Reservoir Complex represents a most important element of water supply in New Jersey;

WHEREAS, the State of New Jersey has invested approximately $40,000,000 in the development of Spruce Run-Round Valley to the present stage and will ultimately invest many more millions to complete its functional purposes;

WHEREAS, the capability of this system to provide the sustained yield ascribed to, it is totally dependent upon the capability of the watershed above the intake and impoundment points to produce the water in sufficient quantity and quality in a sustained manner;

WHEREAS, significant portions of the watershed serve as a sponge or natural reservoir storing water that produces the sustained low flow and serves to level out the "flood" or pumping flows;

WHEREAS, it is calculated that the highlands region representing 40% of the watershed upstream of Stanton Gauging Station is responsible for 60% of the base flow during drough years which fact is sustained by a dry stream survey done in August of the 1966 drought year (South Branch Watershed Association);

WHEREAS, if the natural reservoir capabilities of the highlands watershed are destroyed by man's activity, runoff patterns will become more flashy resulting in a dimunition of the sustained Spring "flood" flows on which pumpage to Round Valley depends and likewise a dimunition of the base flows during drought thereby requiring greater releases from Spruce Run-Round Valley to maintain guaranteed flows at Bound Brook;

WHEREAS, there are already in being major developments which have destroyed natural retention areas, accelerated runoff and impaired groundwater recharge;

WHEREAS, there is now No. 208 Study completed for the Upper Raritan but there are 201 Facilities Studies in active process which propose to sewer this area so as to encourage intensive development;

WHEREAS, these plans propose to gather all effluent from the highest headwaters into interceptors to be discharged back to the South Branch considerably downstream from the sources;

WHEREAS, these plans propose to gather all effluent from the highest headwaters into interceptors to be discharged back to the South Branch considerably downstream from the sources;

WHEREAS, these proposed plans and activities are presently proceeding without consideration for protecting the origins of the water resources and with insufficient data and standards of instream quality of this major source of potable water for populous regions of New Jersey;

WHEREAS, it is the interest and responsibility of the Water Policy and Supply Council to act as shepherd of the State's water supply resources;

NOW, THEREFORE, BE IT RESOLVED that we do hereby request the Commissioner of the Department of Environmental Protection to:

1. Declare the highland regions of the Raritan Basin as critical to the State's water supply.

2. Promulgate high water quality standards of non-degradation commensurate with the present excellent quality of the stream as a potable water source.

3. Review 201 plans for present problem solving objectives and protection of the origins of supply as to treatment strategies, land use, interceptors, et al.

4. Require that any major projects involving water use or ground distrubance be subject to environmental impact evaluation as related to the complete water resource cycle.

This Facilities Plan has been developed to promote the objectives of this resolution; and the Plan also responds to New Jersey Water Quality Standards Criteria as condensed in Appendix A and the NJDEP 208 Program.

3.0 POLLUTION SOURCES, WASTE LOADS AND WATER QUALITY

3.0 POLLUTION SOURCES, WASTE LOADS AND WATER QUALITY

3.1 General: To establish[(1)] the facilities requirements and degree of treatment, it is necessary to determine first the volume, or flow, of wastewater and its degree of pollution. This requires identification of the wastewater sources - domestic, commercial, industrial - and their pollution characteristics. Treated wastewater blended with streams, when it is so disposed, must result in a stream quality prescribed by DEP. The criteria is based on MA7CD10 stream flows. In the following, the wastewater loads and resulting stream qualities are discussed.

3.2 Domestic Wastewater Loads: The waste loads for the alternative plans, assuming point discharges, were estimated for the various wastewater treatment plants for existing conditions, the years 1990 and 2000 and saturation population. "Existing conditions" loads are based upon the 1976 flows of existing treatment plants. The waste loads are listed in Table 3-1. The loads shown are based upon wastewater effluents with the following characteristics (in milligrams/liter):

Characteristics	Treatment Level				
	2	4.2	3	4	5
BOD_5	16	8	16	8	4
C BOD	24	12	24	12	6
N BOD	50	50	20	10	5
Phosphorus (P)	8	8	8	8	8
Ammonia nitrogen (NH_3-N)	10	10	4	2	1
Suspended Solids (SS)	15	15	15	5	3

The required treatment levels for alternate Plans 1 and 5 were only designated by the DEP for 1990 estimated wastewater flow rates. The DEP memorandum of August 31, 1977 with required treatment levels is in Appendix B. The DEP analysis only used a flow estimate of .08 MGD for the existing Roxbury plant ("IE") instead of the projected flow of 1.131 MGD flow estimated by the Consultant. Based upon estimated stream flows at the point of discharge for the Roxbury (IE) plant, it was therefore assumed that the required level of treatment would be 2 instead of 1 as indicated in the 8/31/77 DEP memorandum.

Notes: (1) In this Section 3.0, reference and analysis were conducted for Plans 1 and 5. Since Plan 6, the selected plan, is similar to Plan 5 in the aggregate, this section was not revised since its revision would have little impact in the overall report and plan.

TABLE 3-1
POINT SOURCE PLANT EFFLUENT WASTE LOADS (pounds/day)
ALTERNATIVE PLANS 1 and 5

PLAN	PLANT	LOCATION	EXISTING CONDITIONS				1 9 9 0							2 0 0 0							S A T U R A T I O N						
			Flow(a) (MGD)	Approx. Treat Level	BOD_5	SS	Flow (MGD)	Treat Level	^CBO_D	^NBO_D	NH_3	SS	P	Flow (MGD)	Treat Level(e)	^CBO_D	^NBO_D	NH_3	SS	P	Flow (MGD)	Treat Level(e)	^CBO_D	^NBO_D	NH_3	SS	P
1	A	Eagle Rock Vill.	.06	2	8	8	1.996[g]	4.2[c]	200	832	166	249	133	2.914[g]	3[c]	583	486	97	364	194	3.327[g]	4[c]	333	277	55	139	222
	B	Long Valley	-	-	-	-	.562	4.2	56	234	47	69	37	.895	3	179	149	30	112	60	1.176	4	118	98	20	49	78
	C	Schoolevs Mt.	.12	4	8	5	.344	2	69	143	29	43	23	.477	3	95	80	16	60	32	1.162	4	116	97	19	48	78
	D	S. Branch@ Drakes Brook	.38[b]	1	76	38	1.056	2	211	440	88	131	70	1.386	4.2	139	578	116	174	92	1.802	3	361	301	60	225	120
	E	Roxbury	.06	1+	12	6	1.131[f]	2[c]	226	472	94	141	75	1.657[f]	4.2[c]	166	691	138	207	111	2.355[f]	3[c]	471	393	79	294	157
	WT-2	Welsh Farms	.10	2	13	13	.20	2[c]	40	83	17	24	13	.20	2[c]	40	83	17	24	13	.20	2[c]	40	83	17	24	13
		Total	.72		117	70	5.289		802	2204	441	657	351	7.529		1202	2067	414	941	502	10.022		1439	1249	250	779	668
5	A	S. Branch@ Drakes Brook	.62[d]	-	104	53	4.737	4[c]	474	395	79	198	316	6.750	5[c]	338	281	56	169	450	8.759	5[c]	438	365	73	219	584
	B	Long Valley	-	-	-	-	.535	3	107	89	18	68	36	.810	4	82	68	14	34	55	1.099	4	110	92	18	46	73
	WT-2	Welsh Farms	.10	2	13	13	.20	3	40	33	7	24	13	.20	3	40	33	7	24	13	.20	3	40	33	7	24	13
		TOTAL	.72		117	66	5.472		621	517	104	290	365	7.769		460	382	77	227	513	10.058		588	490	98	289	670

Foot Notes:

a. Avg. daily flow 1976
b. Mt. Olive STP @ .33 MGD, treatment level 1 plus Oakwood Village STP @ .05 MGD, treatment level 2±
c. Treatment level + aeration to 6.5 mg/l
d. Total of all upstream existing treatment ~~plants, including existing plants~~ with land disposal of effluent (Eagle Rock Village & Oakwood Village)
e. Treatment level estimated (without benefit of stream model) to keep waste load about equal to 1990 required level of treatment
f. Discharge below Eyland Ave.
g. Discharge below old YMCA Camp

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To estimate the year 2000 and saturation population treatment levels and waste loads, it was assumed that the effluent waste loads resulting from the designated treatment levels would have to remain about the same in the future years. Therefore, as waste load quantities increase, treatment levels must be higher to maintain the waste loads at about the year 1990 requirements. Using effluent carbonaceous BOD (C BOD) and nitrogenous BOD (N BOD) as a guide, the treatment levels and future waste loads were estimated as listed in Table 3-1.

The waste load tabulation includes the loads from Mount Olive Complex/Eagle Rock Village and the Oakwood Village facilities although both facilities are non-point discharges with land disposal spray systems.

The "existing conditions" loads no not include the several minor existing facilities - West Morris Regional High School, Mount Olive Upper Elementary School and the Holiday Inn (Ledgewood), with point-source and non-point discharges in the basin. The 1990, 2000 and saturation loads do include all of the estimated basin waste loads.

3.3 Industrial Wastewater Loads: There is only one existing industrial wastewater treatment facility in the basin, the Welsh Farms facility, which processes milk and manufactures ice cream mix.

A review of monthly report data filed with the NJDEP for 1976 for the subject plant indicates that the plant met the stipulated BOD_5, Suspended Solids, pH, floating solids or visible foam effluent limitations of its present discharge permit. On a monthly basis, the 1976 results were as follows:

Characteristic	Permit * Condition	Poorest Month	Average Per Year	Best Month
BOD_5 (#/day)	31.2	13.3	10.5	7.5
pH (std units)	6 to 9	X	7.7 to 8.2	X
Suspended Solids (#/day)	46.8	15.0	8.5	1.9
Floating Solids	0	X	0	X

*Daily average required from November 1, 1977 to February 1, 1981 (prior to November 1, 1977 the suspended solids requirement is 57.8 #/day - Daily Avg.)

The allowable effluent BOD_5 limit (daily average) with respect to the plant design flow of 0.20 MGD and existing permit conditions is 18.7 mg/l. The point source effluent requirements for the Welsh Farms plant are governed by EPA "Effluent Guidelines and Standards for Dairy Products", Title 40, Chapter 1, Part 405 - "Effluent Limitations Guidelines for Standards of Performance and Pretreatment Standards for New Sources for the Dairy Products Processing Industry Point Source Category".

It has been assumed that the Welsh Farms facility waste load would be maintained at the present effluent discharge permit requirements although strict interpretation of the 8/31/77 DEP treatment level designated would require a BOD_5 of 16 and waste load of 27 #/day instead of the existing nitrogen in the plant effluent have been in the range of only 2 to 4 mg/l; therefore no special treatment considerations need be given to meeting the 4 mg/l effluent concentration for the highest level of treatment estimated for this plant (level 3). However, the dissolved oxygen (DO) content of the effluent has ranged from 1 to a maximum of about 8 mg/l. This would indicate that at least part of the time additional aeration of some form would be required to meet the "non-degradation" policy to maintain a DO of 6.5 mg/l in the Electric Brook or in the South Branch if the discharge point is later directed to that stream. The project waste load from this plant is listed separately in Table 3-1.

Concerning future industrial waste loads, they will be regulated by the EPA guidelines for effluent limitations or pretreatment requirements for the particular type of wastewater to be introduced into the basin. At the present time, there are special guidelines and standards for 43 industrial or special wastewaters.

3.4 Summary of Point Source Waste Loads: Table 3-1 which shows the estimated waste loads for each plant also shows by subtotal the wasteloads for each alternate plan for years 1990, 2000 and saturation population. It may be noted that because loads for Plan 1 are spread out over the basin (compared to one rather large loading just below the confluence of the South Branch and Drakes Brook, under Plan 5) the treatment levels are lower and the waste loads of the various constituents can be about three times greater than Plan 5.

For identification and information purposes, the stream mile point for point discharges, the low flow (MA7CD10) and average flow of the stream and the projected wastewater flows have been summarized in Table 3-2.

TABLE 3-2
STREAM FLOWS-POINT SOURCE PLANT EFFLUENT WASTEWATER FLOWS(MGD)
ALTERNATE PLAN 1 AND 5

Stream Milepoint	Location	ESTIMATED STREAM FLOW Low Flow (MA7CD 10)	ESTIMATED STREAM FLOW Avg. Flow	PLAN I Wastewater Flows Plant	PLAN I 1990	PLAN I 2000	PLAN I Satur.	PLAN 5 Wastewater Flows Plant	PLAN 5 1990	PLAN 5 2000	PLAN 5 Satur.
0.[a]	Roxbury-Skyview STP	.15[e]	.72[e]								
1.66[b]	Drakes Brook @ Roxbury boundary	1.13[e]	5.42[e]								
2.16[b]	Drakes Brook @ Eyland Ave.	1.71[e]	8.21	1E	1.131	1.657	2.355				
2.71[c]	S. Branch below YMCA Pond	.99[e]	7.52[e]	1A	1.996	2.914	3.327				
6.59[c]	S. Branch at confluence Drakes Brook	4.8[d]	27.8[d]	1D	1.056 (4.183)	1.386 (5.957)	1.802 (7.484)	5A	4.737	6.750	8.759
8.67[c]	S. Branch @ Stony Brook	7.7[e]	39.0[e]	1C	.344 (4.527)	.477 (6.434)	1.162 (8.646)				
10.00[c]	S. Branch @ Electric Brook	9.2[e]	46.6[e]	WT-2	.20 (4.727)	.20 (6.634)	.20 (8.846)	WT-2	.20 (4.937)	.20 (6.950)	.20 (8.959)
11.70[c]	S. Branch near Police Sta.			1B	.562 (5.289)	.895 (7.529)	1.176 (10.022)	5B	.535 (5.472)	.819 (7.769)	1.099 (10.058)
15.23[c]	S. Branch @ County Line	10.3[d]	52.3[d]								

a = Branch of Drakes Brook
b = Drakes Brook
c = S. Branch Raritan River

d = From Sect. 2 Report data Table 2.1.9 page 2.1-27
e = Estimate based on area & base flow of Table 2.1.9
( ) = Accumulated Total

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In addition to the liquid stream wasteload, the solids wastes (sludge) produced was estimated for each plan and plant. Table 3-3 summarizes the pounds of dry solids (DS) produced from the liquid process for each plant, for estimated wastewater flows for the years 1990, 2000 and saturation population. The actual weight of dry solids to be disposed of will be less than the weight shown depending on the type of sludge distruction/disposal method to be used. Solids destruction ranges from about 35% for digestion to about 75% for incineration.

3.5 Summary of Existing Nonpoint Source Waste Loads: The South Branch watershed is presently receiving waterborne waste loadings from both point and nonpoint sources. Point sources are the existing wastewater treatment facilities in the study area, while nonpoint sources include runoff from urban sources and agricultural land. Modeling of the runoff from urban sources and data for the agricultural and open areas indicate a greater potential for surface water pollution than do the point sources. Sampling data indicate that renovation is occurring, reducing BOD and nitrogen levels but not affecting the phosphorous levels. A more detailed explanation is found in Section 2.1.4.2 of the Section 2 Facilities Plan Progress Report.

3.6 Summary of Receiving Water Quality: Water quality data on the South Branch and its tributaries has been compiled by the US EPA, USGS, the NJDEP and the South Branch Raritan Watershed Association.

The water quality in the South Branch and its tributaries is relatively good although it is being subjected to some stress. Table 3-4 summarizes the water quality data that is presented in Section 2.1.4.1 of the Section 2 Progress Report.

TABLE 3-3

ESTIMATED SOLIDS (SLUDGE) PRODUCTION (pounds/day dry solids)
ALTERNATIVE PLANS 1 and 5
1990 TO SATURATION POPULATION

Plan	Plant	1990	2000	Saturation
1	A	5,230	7,630	8,720
	B	2,000	2,870	3,610
	C	900	1,250	3,040
	D	2,770	3,630	4,720
	E	2,960	4,340	6,170
		13,860	19,720	26,260
5	A	12,410	17,680	22,950
	B	1,930	2,670	3,400
		14,340	20,350	26,350

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TABLE 3-4

SUMMARY OF WATER QUALITY
[Minimum-Maximum (Mean)]

	Dissolved Oxygen % Sat.	5-Day BOD mg/l	Nitrate Nitrogen mg/l	Kjeldahl Nitrogen mg/l	Log Total Califon/ 100 ml	Total PO4
South Branch						
Califon	70-125 (92)	0.6-4.0 (1.5)	0-3 (1.4)	0.2-1.55 (.7)	1.5-6.25 (3.7)	0-2.5 (0.5)
Middle Valley	84-135 (103)	0.9-1.4 (1.1)	0.8-1.35 (1.1)	0.2-1.45 (.75)	2.5-6.25 (3.9)	-
Long Valley	80-115 (102)	1.0-5.0 (2.9)	0.1-3 (1.3)	0.3-1.5 (.8)	1.85-5.5 (3.8)	0-2.0 (0.5)
Naughright	94-110 (100)	0.6-1.2 (1.1)	0.8-1.25 (1.05)	0.05-.6 (.35)	4.25-4.75 (4.5)	-
Flanders Drakestown Road	94-99 (96)	0.7-1.3 (1.2)	0.6-1-1 (.8)	0.4-1.7 (.45)	3.75-4.5 (4.25)	-
Drakes Brook	80-109 (95)	0.7-6.0 (1.9)	0.8-1.35 (1.15)	0.3-1.75 (.85)	1.15-4.75 (3.0)	1.15-4.1 (2.9)
Electric Brook	94-102 (97)	0.3-1.0 (0.6)	0.35-0.55 (.45)	0.5-0.35 (.2)	3.5-4.25 (4.0)	-
Stony Brook	80-135 (100)	1.0-9.0 (3)	-	-	0.3-3.2 (2.0)	0.3-3.2 (2.0)

4.0 EXISTING WASTEWATER TREATMENT FACILITIES AND I/I ANALYSIS

4.0 EXISTING WASTEWATER TREATMENT FACILITIES AND I/I ANALYSIS

4.1 General: The study area is partly served by several smaller wastewater treatment facilities. These have been built to receive wastewaters from developments of more or less recent construction, not the areas of intense initial development such as at Budd Lake. The existence and characteristics of these treatment facilities have been investigated not only for their identification, but also to assess their probably incorporation in the regional facilities plan.

4.2 Municipal Systems: There are five existing municipal or semi-municipal wastewater treatment plants within the study area. They were identified and described in Section 2 report starting on page 2.4-1. They are:

Designation	Name of Facility	Present Design Capacity (MGD)
WT-1	Schooley's Mountain (Washington Twp. MUA)	.50 (1)
MO-2	Mount Olive/Flanders (Twp. of Mount Olive)	.28 (2)
MO-3	West Morris Regional High School (Regional Board of Education)	.025
MO-4	Mount Olive Upper Elementary School (Mount Olive Board of Education)	.028
R-2	Roxbury Knolls/Skyview (Twp. of Roxbury)	.080

Notes: (1) With future discharge to South Branch and minor plant additions.
(2) Plans have been submitted to NJDEP to expand plant to .6 MGD.

Subsequent to issuance of Section 2 (Inventory) of this report in December 1975, the Schooley's Mountain plant was expanded and the process was changed from contact stabilization to an intermediate treatment phase using rotating biological discs. A new discharge permit was issued for the plant in May 1976. The permit conditions stipulate the following minimum effluent quality requirements:

BOD_5	10 mg/l
SS	10 mg/l
NH_3 - N	2 mg/l
D.O.	6 mg/l
Chlorine	0.0 mg/l

The permit stipulates that the effluent also must:

- be free of noticeable color, oil or grease
- be free of toxic or deleterious substances and free of offensive odors
- have a pH range between 6.5 and 8.5

The permit limits effluent discharge to the Stony Brook to no more than 216,000 gallons per day. Flows beyond that limit must be discharged to the South Branch of the Raritan River and when the outfall to the South Branch is constructed, all effluent discharge to the Stony Brook must cease.

The expanded plant as constructed has a liquid process design flow of .30 MGD. By the installation of additional biological disc mechanisms, the design flow can be increased to .50 MGD. Some operational problems are still being corrected at the recently completed facility.

A review of the 1976 monthly operating reports furnished to the NJDEP indicates the following:

Month	Avg. Flow MGD	BOD mg/l	SS mg/l
January	.159	?	11
February	.136	?	10
March	.11	?	10.3
April	.11	?	14.7
May	.096	?	12
June	.085	24	6
July	.089	19.3	4.6
August	---	---	---
September	.107	21.6	5.7
October	.131	15.8	4.2
November	.126	12.7	4.5
December	.142	11	4.8

The monthly flows and suspended solids are within the permit limitations. For the first five months, the reports noted there were laboratory equipment problems in estimating the BOD_5 of the effluent which is performed by photogrametric methods. The BOD_5 estimates for the balance of the year do not meet the permit requirements.

4.3 Private Wastewater Facilities: There are four private wastewater treatment facilities in the study area and they also are described in the Section 2 report. They are:

Designation	Name of Facility	Present Design Capacity (MGD)
WT-2	Welsh Farms	.20
MO-1	Oakwood Village	.25
MO-5	Eagle Rock Village/ Mount Olive Complex	.25
R-2	Holiday Inn	.04

There have been no substantial changes in the above facilities subsequent to completion of the Section 2 Report. Additional spray field area is being proposed this year for the Eagle Rock Village/Mount Olive complex plant.

Reported average daily flows on a monthly basis during 1976 range from .046 to .075 MGD for the Eagle Rock Village Plant and .039 to .057 for the Oakwood Village Plant.

Table 4-1 following provides additional information on the existing plants.

Table 4-1
Existing Treatment Plant Inventory

1 Ident. No. and NPDES Permit No.	2 Identification and Location Latitude Longitude	3 Flows Design Capacity MGD	4 Process Description
W.T. - 1 NJ 0023493	Washington Township MUA Schooley's Mountain 40° - 48' - 50" N 74° - 46' - 00" W	.50	Rotating biological discs. Expanded capacity will be 0.500 MGD with outfall to South Branch.
W.T. -2 NJ 001236	Welsh Farms, Inc. 40° - 47' - 15" N 74° - 47' - 00" W	.20	Activated sludge with mechanical aeration Treats waste from ice cream plant.
M.O. - 1 Exempt	Oakwood Village Apts. 40° - 51' - 10" N 74° - 42' - 00" W	0.25	Activated sludge, extended aeration. Serves approximately 310 apartments.
M.O. -2 NJ 0021954	Mt. Olive Township/Flanders 40° - 48' - 55" N 74° - 42' - 45" W	0.28	Contact variation of activated sludge biological treatment. Formerly owned by Budd Lake Sewerage Company
M.O. - 3 Exempt	West Morris Regional High School 40° - 51' - 30" N 74° - 42' - 55" W	0.025	Packaged unit, Lyco, extended aeration.
M.O. -4 Exempt	Mt. Olive Upper Elementary School 40° - 51' - 30" N 74° - 43' - 50" W	0.028	Packaged unit, Pollution Control, Inc. extended aeration.

Table 4-1 (cont'd)
Existing Treatment Plant Inventory

1 Ident. No. and NPDES Permit No.	2 Identification and Location Latitude Longitude	3 Flows Design Capacity MGD	4 Process Description
M.O. - 5 Exempt	Eagle Rock Village/Mt. Olive 40° - 51' - 10" N 74° - 45' - 15" W	0.250	Activated sludge, contact stabilization.
R-1 NJ 0028304	Holiday Inn 40° - 51' - 30" N 74° - 40' - 10" W	0.040	Aer-O-Flo, extended aeration.
R-2 NJ 0022683	Roxbury Knolls/Skyview 40° - 51' - 55" N 74° - 41' - 40" W	0.080	Amcodyne Corp., activated sludge, contact stabilization.

4.4 On-Site Disposal: Currently, about 7% of basin study area is sewered serving approximately 55 % of the total population. The balance of the area, approximately 93 % is either undeveloped or served by on-site or septic systems. However, very few soils in the study area can adequately accommodate septic systems due to groundwater levels, permeability, slope and bedrock characteristics. Satisfactory soils are generally small areas scattered throughout the townships as discussed in the Section 2 and 3 Reports. The largest concentration of soils with slight limitations is in the area of Long Valley and is principally composed of soil in the Washington series. Soils that could be used for septic systems are concentrated in the active agricultural areas.

In rural type disposal systems, troublesome conditions arise from a variety of factors. In a sense, trouble with these systems is inevitable since, for proper operation, they are dependent upon the ability of the soil to absorb wastewaters which are administered to it for disposal by percolation. The ability of any soil to perform this service decreases with time, even under optimum conditions of use, such that at some time the soil becomes clogged and a virgin disposal area must be found. Soils differ markedly in their seepage (percolation) capacities such that certain installations will outlast by many years other, close-by systems. As an area develops, less and less land is available for the necessarily periodic transfer of the seepage function of such systems, from an overload area to a virgin area. Troublesome conditions then become recurring nuisances and finally, a serious mance to public health.

Much of the trouble with rural type disposal systems in certain areas is due to a high ground water table. In such cases, troublesome conditions arise and subside with the rainfall. Prolonged rains or periods of snow melt usually intensify the situation. Here again, if an area is well developed, a serious and frequent recurring health hazard results.

The causes of troublesome conditions as discussed in the preceding are attributable to natural phenomena. There is no doubt that these conditions are very frequently intensified by or result directly from faulty design of disposal facilities, their improper construction or both.

The unsewered communities of the district experience the conditions which have been discussed herein in varying degree as between communities and as between areas of each community. The severity of the situation in each community is dependent primarily upon the character of subsurface formations, the extent of development, and the concentration of population within the various areas of each community.

The Consultants investigated the current status of septic systems in the study area. Based upon data furnished by the sanitarian in each of the three townships, the areas of poor or unfavorable soil conditions was identified and located on the map, Figure No. 4-1 This map identifies troublesome areas only where they are currently developed or have near-term potential for development. Steep slopes, for example, are obviously poor and non-developable and, therefore, not identified. The severity of soil condition and level of percolation is indicated by a hierarchy of numbers, as follows:

- 0 - No percolation. High water table.
- 1 - Severe
- 2 - Moderate
- 3 - Satisfactory

The map shows, convincingly, that in the areas where septic systems are located, or expected to be built, the soils conditions are generally unsatisfactory and an inordinately high frequency of septic system failures may be anticipated. Data furnished by the township sanitarians support the conclusion that the septic systems are a source of difficulties.

4.4.1 Mount Olive: Referring to Figure 4-1 , it is noted that the most densely populated area of Mount Olive, around Budd Lake, is largely identified as category 0, no percolation or high ground water. Lesser areas are identified as categories 1 or 2, severe or moderate. Other areas of Mount Olive, Mount Olive Complex, Clover Hill West, Clover Hill East, and Clover Hill South - likewise, are in the 0 to 2 range of categories, i.e., severe to moderate and much in 0 category, no percolation of high ground water.

Mr. Thomas Craig, Sanitarian, estimates that there are approximately 1,040 on-site disposal systems within the boundaries of the Study Area in Mount Olive. In calendar year 1975, a typical year, there were 35 new septic systems installed and 81 alterations. These alterations were for existing septic systems with problems, mainly poor percolation, ground saturation, initially undersized in construction, and poor construction to start with. Based on these statistics, approximately 10% of the septic systems have problems or have failed and remedial work, if possible or practical, was done.

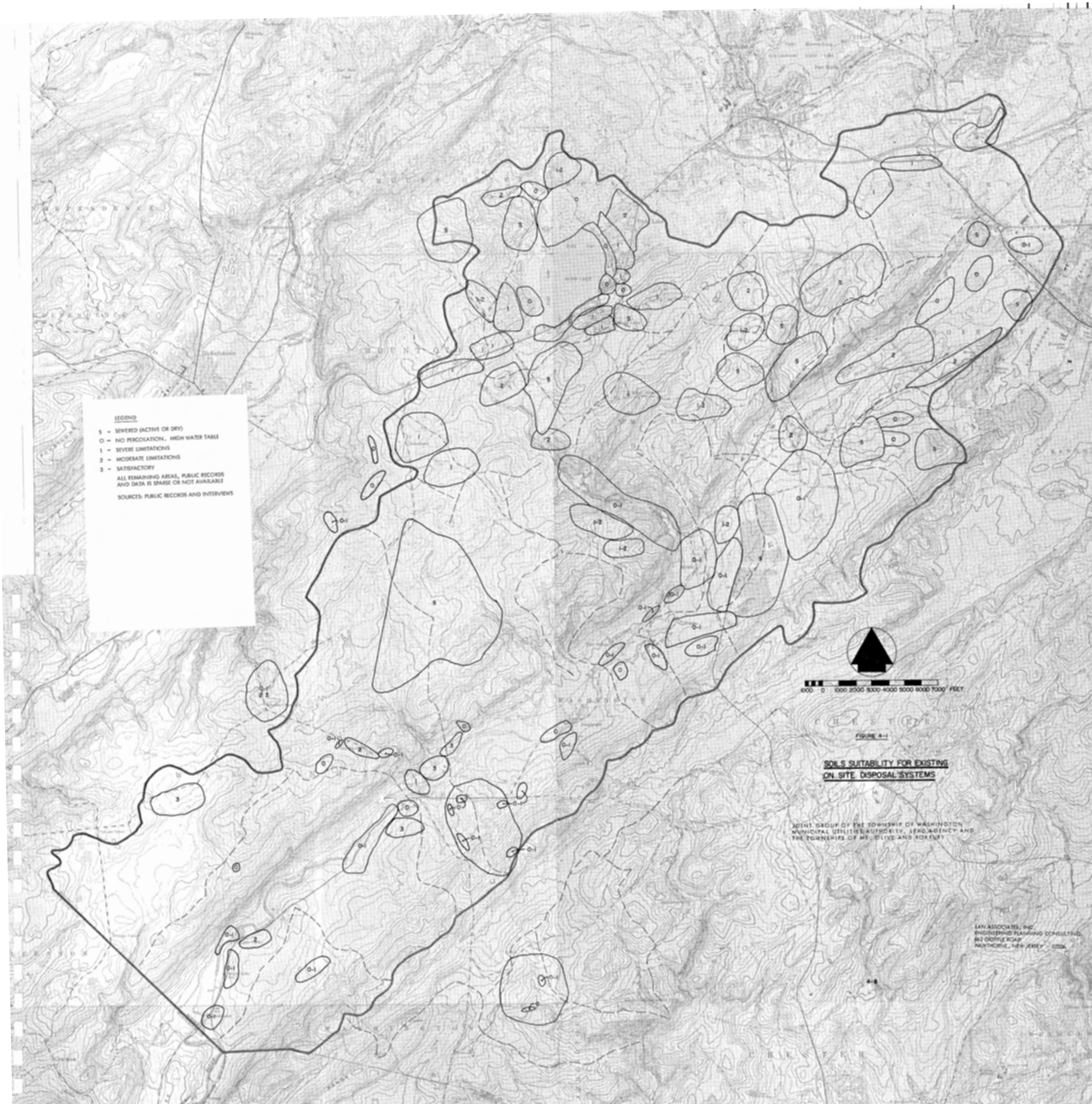

FIGURE 4-1

SOILS SUITABILITY FOR EXISTING ON SITE DISPOSAL SYSTEMS

It must be recognized that those areas with high water table and zero percolation are continuing problems to be resolved only by construction of sewerage systems.

Mount Olive Township impliments Chapter 199 of the N.J. Codes and its ordinance for on-site disposal systems includes additional and more rigid requirements. An official of the Township observes percolation tests which must be done under the supervision of a professional engineer. On-site disposal system designs must be submitted to the Health Officer for approval prior to the granting of a building permit and certificate of occupancy. New developments in Mount Olive Township now must include dry sewers to be connected to the Township system at a later date. Where dry sewers are installed, it is the practice to install the on-site disposal system in the front yard, where practical, to facilitate future house connections.

4.4.2 Washington: Septic systems data for Washington Township were furnished by Mr. Raynour Rudolph, Sanitarian. In identifying soils conditions on Figure 4-1 only the developable areas within the basin and where sewerage systems might be constructed have been considered. Thus, only a small part of the Township area is classified on Figure 4-1 As shown on the map, the areas identified are mostly classed in categories 0 or 1, no percolation, high water table or severe. Only a small area at Springtown is classed Category 2, moderate, and two other small areas, one north and one south of Long Valley, are classed Category 3, satisfactory.

Washington Township follows N.J. Administrative Code Chapter 199, supplemented slightly for minimum tank sizes, bed sizes and distances to streams, wells, water courses, etc. Basically, the Washington Township Ordinance follows the Mt. Olive Township Ordinance. All percolation tests are observed by the Sanitarian, or his representative. Percolations are observed at the elevation of the seepage pit or leaching field, and a soil log is required down to 12 to 15 feet. Should there be any questions with regard to the percolation and soils log, the Sanitarian has the authority to order a second test. All work must be done under the supervision of a professional engineer. Percolation tests are done at three levels; 3 ft., 6 ft., and 9 ft. Any percolation above 40 minutes per inch is rejected and precludes issuance of a building permit or certificate of occupancy. Prior to issuance of a building permit, the well and on-site disposal systems applications must be complete and approved by the Sanitarian.

Records of the Sanitarian indicate the following:

a. During 1975, a total of 120 septic tank permits were issued, including 29 alterations.

b. In 1976, 140 septic tank permits were issued, 25 of which were alterations.

According to Mr. Rudolph, the alterations relate only to failing septic systems. Based on the information taken from the septic tank permit file, there are approximately 25 to 30 failures per year in Washington Township; of these, 20 to 25 are in the study basin.

4.4.3 Roxbury: Soil conditions in Roxbury, as indicated on Figure 4-1 , predominate in the 0 category in areas currently undeveloped. Other areas are in categories 1 or 2, severe or moderate. The currently installed septic systems total 600$\pm$. During the past year the number of permits issued total 30 of which 1/3 were for alterations to correct failures. Roxbury, like Mount Olive and Washington Townships, follows N.J. Administrative Code 199 with additional more stringent provisions in the local ordinance. Percolation tests are witnessed by the Roxbury Health Department and must be performed under the supervision of a professional engineer.

4.4.4 Continuation of On-Site Disposal: In discussing the on-site (septic) disposal systems it is appropriate to cite the purpose of this facilities plan study, i.e., to determine whether or not sewerage systems are required, where required, and other economic and environmental considerations. This does not imply that septic systems are inferior to and must be replaced by sewage collection and treatment systems. On the contrary, a satisfactory septic system, economical to construct and maintain, should be continued in use unless it contributes significantly to the degradation of ground or surface water quality.

The Environmental Protection Administration in Program Requirements Memorandum #76-3 submitted to the Consultants with the DEP's letter, dated November 5, 1976, focuses on the eligibility of septic tanks, and other small treatment systems for construction grants. The memorandum provides guidance for the interpretation of the construction grant regulations relative to the eligibility of the costs of septic tanks, holding tanks, and package plant treatment systems serving individual homes and small clusters of homes.

Given the generally unsuitable soils conditions and the inordinate frequency of septic system failures, continued reliance on this method of on-site disposal cannot be justified in areas that can be sewered economically and especially where the ground and surface water quality is degraded. In all areas proximate to the proposed interceptors, the use of holding tanks cannot be justified for a number of practical reasons, i.e., investment in collection system, holding tank, site, and trucks, and reliance on personnel to pump and haul and avoid overflows. Further, consideration of these systems intended for individual or small clusters of homes falls within the scope of analysis pertaining to local collection systems for which separate facilities plans would be required. This study develops the interceptor requirements for the study period and provides for service in the developable areas to saturation. Hence, with staged construction of interceptors, some individual homes or small clusters will not be connected to the sewerage system until late in the study period, or beyond the year 2000, when it is economical to extend the local collection systems or environmental considerations become dominant.
Sewerage service will continue the use of septic systems in many areas including the following sub-basins (See Figure 1-1):

a. Spruce Run
b. Turtle Back Road
c. Middle Valley
d. Naughright
e. Four Bridges
f. South Branch Gorge
g. Lower two-thirds of Turkey Brook
h. Southwest part of Mount Olive Complex Basin (Drakestown)
i. Southern portion of Ledgewood

By the year 2000, it is estimated that under Alternative No. 6, approximately 35 % of the basin area will be sewered and the remainder will continue using septic systems or remain undeveloped.

On-site disposal systems are not inexpensive. With the promulgation of the revised Chapter 199, more rigid design and construction requirements are now being implemented. For example, many health officers are requiring the following:

(1) Two systems; one for the "gray water", i.e., sink, dishwasher and laundry and one for sanitary wastes.

(2) Installation of septic system(s) before house building permit is issued.

(3) Extensive excavation of bed even though suitable perc has been obtained.

(4) Design of system based on 125 gpdc not 75 or 100 gpdc.

(5) Oversized leaching fields.

(6) Perc tests and soils log at 2 and 3 locations within proposed field or field(s).

(7) Excavation of test pit to 15' below grade requiring in many cases as tracked shovel vs. a less expensive rubber tired backhoe.

(8) Construction supervision under a licensed engineer and certified "as built" drawings.

(9) Relief pit(s).

(10) Hybrid systems

(11) Licensed septic system contractors with a license fee of $500/year.

(12) Grease interceptors.

It is not unusual, based on our recent experience, that for a one-family house, on site disposal costs can run as high as $5,000 to $6,000 installed. Assuming a capital cost of $5,500 for an on-site disposal system, a 20-year life, a 20-year mortgage at 8%, the principal and interest (capital recovery factor = .10185) is $560 annually. Assuming 1 clean-out every 3 years at $150 each, the "O&M" for an on-site disposal system is $610; annually; a very important factor in conducting cost effective analysis.

4.5 Infiltration/Inflow Analysis: The Section II Report of the Facilities Plan covered the inventory and infiltration inflow analysis. The results of the analysis were provided in Section 2.7 of our report, pages 2.7-1 to 2.7-93, inclusive. Referring to the EPA Municipal Wastewater Treatment Works Construction Grants Program Handbook, and more specifically, the Guidance Book for Sewer System Evaluation, dated March, 1974, the procedures for the infiltration/inflow analysis are described. Bascially the I/I analysis should provide the information necessary to establish the non-existence or possible existence of excessive infiltration/inflow in the sewer systems and justify any proposed sewer systems evaluation. The analysis would include each sewer system tributary to the treatment works project. In the Section II Report previously described, the various active and dry sewer systems were described and shown graphically. Reference is also made to Figure No.4-2, page 4-20, for location of existing systems.

Basically, the actual domestic and industrial flow rates were determined using water system data for determining the number of connections and/or calculated flow rates. The difference between the maximum domestic/industrial flow rate and the total flow rate would represent the total infiltration/inflow entering the system. The difference between the maximum domestic and industrial flow rate and the maximum flow rate during periods of high ground water (with no rainfall) normally represents the infiltration entering the sewer system. The nominal flow increase during storm events (including bypasses and overflows) normally represents the inflow entering the sewer system. In the conduct of the I/I analysis, various data sources were used including maps, operation and maintenance records, interviews with municipal employees and previous engineering reports. In addition, to confirm the plant data, certain field measurements were taken using various techniques including the slope area method, the dye method, V-notch weirs, volume displacement and time, and time clocks located on the motors at the pumping stations. Concurrently, the official precipitation data published by the U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration (weather station located in Long Valley) were used, and hydrographs were plotted showing precipitation, flow through plants, and the potable water supply flow rates. Series of these graphs are provided, again, in the Section II Report.

The total domestic and industrial wastewater flow rates for each of the systems, and their relationship to water consumption plus domestic wastewater flow per capita are included elsewhere in the report. Also, a general description of the geographical and geological characteristics of the areas served by the sewer systems are included in Section 5 of the report. General discussions of each of the sewer systems are provided in the Section II Facilities Plan Report and are discussed and summarized briefly in this report.

The summary of the I/I analysis is provided in Table 4-2 following this page. In this table, we identify the existing sewerage collection system, the NPDES number, if applicable, a reference to the detail description of the system, the flow through the system based on water consumption or calculated connected load, if applicable in mgd, the infiltration, inflow and remarks as required. Based on the I/I analysis, we have found that the dry systems, which in almost all cases, amount to a very limited amount of lineal feet of 8" pipe have been constructed using accepted engineering practices, good quality control and construction adminstration and inspection, and based on this, have no problems with regard to inflow infiltration. Therefore, it is recommended that at this time no sewer system evaluations be conducted for the dry systems. For the small package treatment plants servicing one or a limited number of connections, such as the public grammar school, high schools and the Holiday Inn, it is concluded that there are no inflow infiltration problems associated with these small package treatment plants, therefore, further I/I work is not recommended at this time.

During the Section II I/I analysis plan, certain problems were identified at MO-1 Oakwood Village Garden Apartments, and MO-5 Eagle Rock/Mt. Olive Complex Garden Apartments. Since then, the owners and/or the builders of these garden apartments have corrected the I/I problems which were mostly associated with open manholes and sewers which were collecting surface water runoff and directing same to the treatment plants.

The three sewer systems which we recommend for further I/I evaluation study are MO-2, NJ0021954, Mt. Olive/Flanders system, WT-1, NJ0023493, Schooley's Mountain, and R-2, NJ0022683, Roxbury Knolls/Skyview. For the Mt. Olive/Flanders System, also known as Clover Hill

Table 4-2 SUMMARY OF I/I ANALYSIS

1	2	3	4	5	6
Identification No. & NPDES No. (if applicable) & Identification	Detailed Description of System - Reference	Flow Based on Water Consumption or Calculated Connected Load (if applicable)MGD	Infiltration MGD	Inflow MGD	Remarks
MO-1 (Exempt) Oakwood Village 405 Garden Apts. (Private)	Section 2 Report, Page 2.7-12 and Section 3 Report, Page 3-7	.048 Based on water consumption	< 1% or .00048	< 1% or .00048	Based on water consumption & treated sewage data, there are no I/I problems at this privately owned system. Water consumed equals sewage treated. Ref: letter Oakwood Village to LAN dtd. 6/7/77.
MO-2 NJ0021954 Mt. Olive/Flanders also known as Clover Hill/Sutton Park	Section 2 Report, Page 2.7-2 to 2.7-8 and Section 3 Report, Page 3-6	.320 Based on water consumption	.0731	Heavy rain .2810 Normal rain .0079 Torrential rain: offscale estimated to be over .400 MGD	Inflow continues for a period of 5 to 7 days after storm event. Very serious I/I problem. Recommend SSE (Sewer System Evaluation).
MO-3 (Exempt) West Morris Regional High School - Mt. Olive Bd. of Education	Section 2 Report, Pages 2.4-20 to 2.4-22	.010 estimate	-	-	No collection system.
MO-4 (Exempt) Mt. Olive Upper Elementary School - Mt. Olive Bd. of Education	Section 2 Report, Pages 2.4-23 to 2.4-25	.010 to .014	-	-	No collection system.

Table 4-2 (continued)

1	2	3	4	5	6
MO-5 (Exempt) Eagle Rock/Mt.Olive Complex 410 Garden Apts. 20 one-family homes (Private)	Section 2 Report, Pages 2.4-26 to 2.4-29 and 2.7-12 to 2.7-13	.0715 Based on water consumption	.027 (The accuracy of the flow meter at low flow rates is variable.)	Varies from .002 to .0065	Since Section 2 report, the developer have improved the operation and maintenance of collection system.
MO-D-1 Alcrest, Duo-Equities Sandshore	Section 2 Report, Pages 2.7-15 and 2.7-16 and Figure 2.7-2	Dry system	< .00035	.00144	
MO-D-3 Mt. Olive Knolls	do	do	> .00864	.00324	
MO-D-4 Mt. Olive	do	do	< .00072	.00144	
MO-D-5 Ramar	do	do	< .00072	.00072	
MO-D-6 Puglisi	do	do	< .00072	< .00072	

Table 4-2 (continued)

1	2	3	4	5	6
WT-1 NJ0023493 Schooley's Mountain WTMUA	Section 2 Report Pages 2.7-10 to 2.7-12 and Figure 2.7.1	.101 Based on water consumption	.075	.103	Inflow/infiltration is serious. Recommend SSE
WT-2 NJ0023493 Welsh Farms (Private-industrial)	Section 2 Report Pages 2.4-6 to 2.4-9	.100	-	-	No collection system
WT-D-3' Parker Acres	Section 3 Report Pages 3-7 & 3-8	N/A	trace	trace	Dry sewers
R-1 NJ0028304 Holiday Inn (private)	Section 2 Report Pages 2.4-30 to 2.4-33	-	-	-	No collection system
R-2 NJ0022683 Roxbury Knolls/ Skyview	Section 2 Report Pages 2.4-34 to 2.4-37 and 2.7-6 2.7-9	.054	.0056	Torrential rain .1284 Heavy rain .0734 Normal rain .0544	This collection system has significant I/I problems. Recommend SSE.

Table

1	2	3	4	5	6
R-3 Eyland Avenue/ Grove Street	Section 3 Report Figure 3-2	N/A			
R-4 Toby Drive off Pleasant Hill Road	do	N/A			
R-5 N/A					N/A
R-6 Bari Street off Emmanus Road	do	N/A			
R-7 Robinson Avenue off Hillside Avenue	do	N/A			

Sutton Park, the flow based on water consumption is .320 MGD. Infiltration was measured to be .0731 MGD; and inflow during heavy rain was .2810 MGD for normal rain, .0079 MGD, and for torrential rain, which occurred once or twice a year, the flow meters went off scale and estimated to be over .400 MGD. For this system, inflow continues for a period of 5 to 7 days after the storm event. These problems are associated with several factors including high water table, localized flooding and initial poor construction of the collection system.

The calculated flow rate based on connections for the Roxbury Knolls Skyview Plant, R-2 is .054 MGD. Infiltration is .0056 MGD. For torrential rains, the infiltration is .1284 MGD for heavy rains .0734 MGD and light or normal rains .0544 MGD.

Schooley's Mountain has had continuing problems with inflow/infiltration since the sewer system and treatment plant were constructed. Remedial work from time to time has been performed. Currently underway is an inflow/infiltration sewer system evaluation survey being done with WTMUA funds. The results of this study are not available at the time of this writing. However, based on our measurements, which were taken during the fall of 1977, the flow rate into the plant based on water consumption is .101 MGD. Infiltration was measured to be .075 MGD, and the infiltration under normal rain conditions is .103 MGD.

The results of the updated I/I analysis were discussed at a meeting held at DEP on 8/23/77, attended by representatives of LAN Associates and DEP. At that time, Mr. Russell Nerlick indicated that based on experience, it is not cost effective to repair sewer systems when the I/I is 1,000 gallons per inch mile day for fairly new systems, and for the older systems, it is not cost effective to repair same when the I/I is in the range of 5,000 gallons per inch per mile day.

Inasmuch as the infiltration/inflow is equal to or double the calculated or measured flow rates based on water consumption, it was concluded at this meeting that Sewer System Evaluation surveys should be conducted for the three plants, that is MO-2, Mt. Olive/ Flanders, WT-1, Schooley's Mountain, and R-2, Roxbury Knolls/Skyview. An amendment to the basic contract is being developed and will be submitted shortly to the Washington Township MUA, and then forwarded to DEP and EPA for their review and action accordingly.

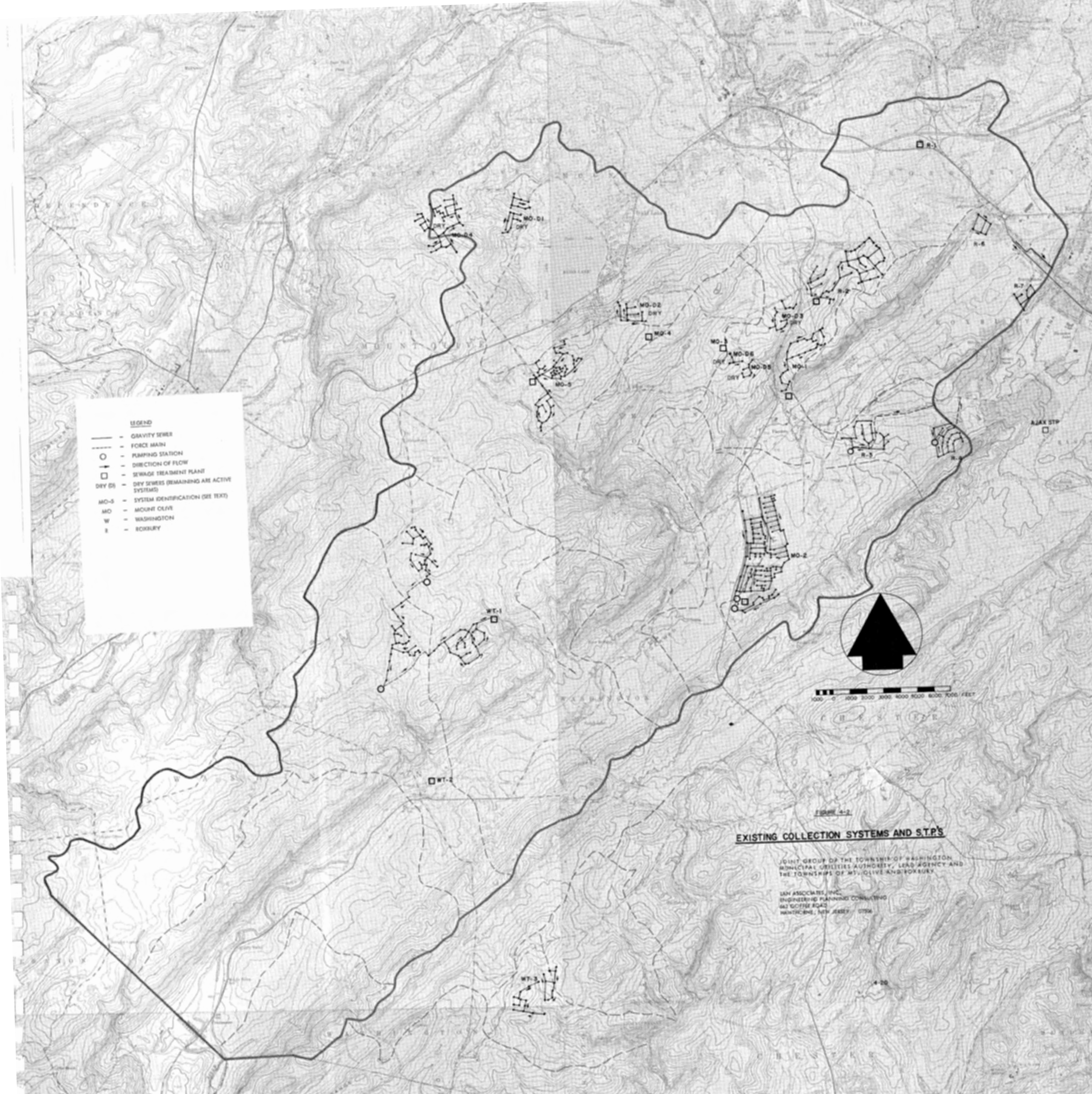

FIGURE 4-2

EXISTING COLLECTION SYSTEMS AND S.T.P.'S

5.0 ENVIRONMENTAL INVENTORY

5.0 ENVIRONMENTAL INVENTORY

5.1 Summary of the Environmental Inventory: The study area is characterized by a continental climate, experiencing hot summers and cool winters. Precipitation averages 48 inches annually and its distributed throughout the year. The topography is hilly, a result of the gneiss and granite ridges and the limestone valleys. Glaciation resulted in modification of the surface features and the deposition of material that weathered into the soils. These soils exhibit a wide range of characteristics. Many areas are unsuitable for septic tank systems and for land application of sewage effluent. A glacial moraine was responsible for the formation of Budd Lake.

The South Branch of the Raritan River, Drakes Brook and their tributaries are the major streams in the study area. Budd Lake and numerous smaller ponds are also present. The upper portions of the streams show high water quality, as is indicated by their designation as trout production streams. As they pass through more developed areas, the quality of the water decreases. Budd Lake has also been shown to be impacted by neighboring development.

Groundwater in the study area ranges in recharge capacity from 100,000 gpd/sq. mile for granite to 250,000 gpd/sq. mile for limestone. The quality of the water used in the study area for household supplies, ranges from adequate to good (Gill & Vecchioli, 1965).

The aquatic biota in the lakes and streams range from pollution-intolerant trout to pollution tolerant tubifeds and flatworms. Fish sampling indicates a wide-range of fish species typical of North Jersey. Wetlands, including swamps, bogs and floodplains, are present. Swamps and floodplains are generally comprised of tree species that are tolerant of standing water. Budd Lake bog is a unique habitat, containing species that are out of their normal distribution. These wetlands are important in the hydrology of the area, mitigating flood conditions and assisting in groundwater recharge.

The terrestrial biota are characteristic of the eastern deciduous forest, mixed oak forest association. The variety of habitats present would provide for a rich assortment of faunal species. Although no endangered species were observed during field investigation, the necessary habitats are present, indicating that these species may be found in the study area.

The USEPA had designated certain areas as being sensitive to development. These include wetlands, surface waters, prime agricultural land, forests, endangered species habitats, steep slopes and historical/archaeological sites. The Washington/Mt. Olive/Roxbury planning area includes sections fulfilling each of the environmentally sensitive areas criteria. In addition, the forested slopes and pastoral valley provide an aesthetically pleasing view. A more complete description of the study area is given in Section 2 Report.

5.2 Water Supply - Water Usage: The study area is dependent upon its subsurface water supply for all uses. A number of public systems distribute water to consumers, particularly to areas of greater development, and individual wells serve homes in remote or underdeveloped areas. Data on water supply and usage for each township is summarized below and is shown in Figure 5-1.

5.2.1 Mount Olive: A recent study, completed January 1975 by Pandullo, Chrisbacher and Associates, lists a total of 24 water systems as shown on Table 5-1. These include 5 systems which were then dry and would serve areas under development. As of the time of this study, the total average daily flow was 790,800 gallons, including 10,000 GPD to an industrial customer, and the population served was 9,760. Average use in the separate water systems ranged from 45 to 120 gallons per capita per day. The overall average was 80 gallons per capita per day.

At present, there are 31 wells, located as shown on Figure 5-1, which are being used as the main water supply for approximately 2/3 of the Township's population. The remaining 1/3 of the population is served by individual on-site wells. The 20 wells shown on Figure 5-1, as well numbers 1, 2, 4, 5, 11 to 15, 17, 21 to 26, and 28 to 31, provide the greatest potential as sources of water for an integrated township water system. These 20 wells have a combined capacity of 2400 GPM. Discharge pressures vary from 40 psig to well over 100 psig.

The 11 wells not considered to be of value in meeting Mt. Olive's long range water needs have been considered unacceptable for one or more of the following reasons:

(1) Well required to meet consumption demands in Netcong and Stanhope.

(2) Low or unpredictable yield.

(3) High in nitrates.

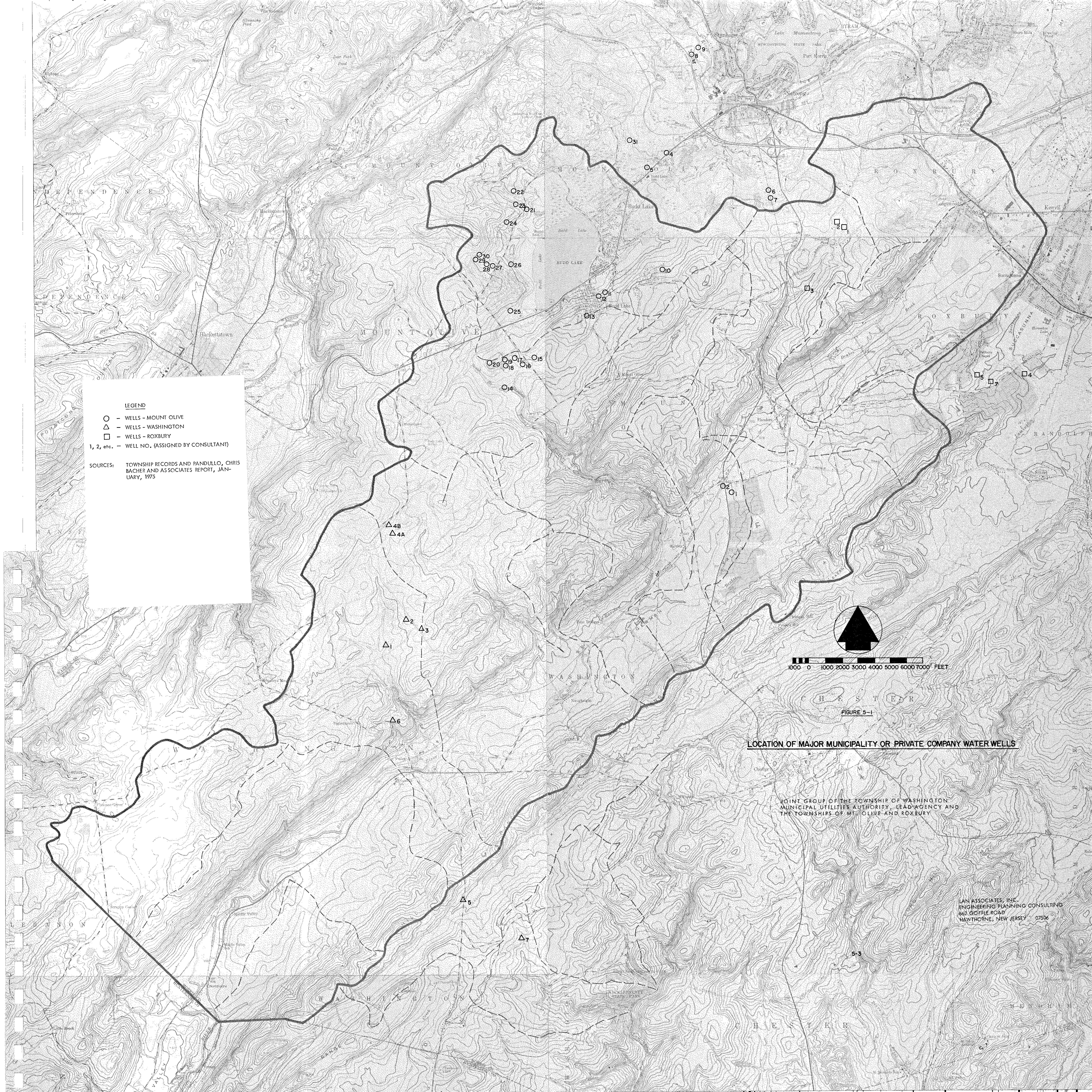

FIGURE 5-1

LOCATION OF MAJOR MUNICIPALITY OR PRIVATE COMPANY WATER WELLS

Table 5-1

PRESENT WATER CONSUMPTION

Mt. Olive Township

	POPULATION SERVED	AVERAGE DAILY FLOW IN GALS.	PER CAPITA CONSUMPTION IN GALS. PER DAY
MOUNT OLIVE MUNICIPAL WATER SYSTEMS			
Cloverhill	3,300	260,000	80
Flanders	250	20,000	80
Sand Shore	135	8,600	66
Rt. 206 & Oakwood	700	70,000	150
MOUNT OLIVE BUILDERS AGREEMENT SYSTEMS			
Duo Equities Sec. 3	70	7,000	100
Duo Equities Sec. 4	70	7,000	100
Alcrest Homes	160	7,500	47
Village Green	2,200	176,000	80
Eagle Rock	300	22,500	75
The Villages	0	0	-
PRIVATE WATER COMPANIES			
Pincrest Improvement Assoc.	650	44,700	69
Juckett Drilling	70	3,500	50
Indian Springs Water Co.	220	26,500	120
West Jersey Water Service	740	67,000	90
High Ridge Water Co.	235	10,500	45
Vasa Homes	300	15,000	50
PUBLIC WATER COMPANIES			
Hackettstown M.U.A.	300	30,000	100
Netcong Water Dept.	60	6,000	100
Stanhope Water Dept.	None	10,000	-
TOTALS	9,760	791,800	81

Source: Township of Mt. Olive, Water System Study and Master Plan. Pandullo, Chrisbacher and Associates. 1975

A summary of existing wells is presented on Table 5-2.

Well names shown represent the names most often used by local operators and engineers when referring to the well. Under the heading ownership, the condition "Builders Agreement" means Mt. Olive has permitted a developer to install the well in question under an agreement that allows Mt. Olive to assume ownership of the well without cost at the discretion of the Township.

5.2.2 Washington: All public water systems in Washington Township are now owned and operated by the Municipal Utilities Authority. The systems data are shown on Table 5-3 and the locations of wells are shown on Figure No. 5-1. There are a total of 8 wells. Those in systems 1, 2, 3, 4a and 4b are interconnected; and those in systems 5, 6 and 7 are similarly interconnected. The total daily capacity of wells 1, 2, 3, 4a and 4b is 221,300 gallons and for wells 5, 6 and 7; 368,000 gallons. Average daily flows from the two groups of wells are 105,700 gallons and 136,546 gallons, respectively, for a total of 242,246 gallons. These water systems currently serve a population of approximately 3,230 people resulting in an average consumption, according to Municipal Utilities Authority records, of 75 gallons per capita. The population not now served by the public water systems rely upon independent on-site wells; and it is anticipated this source of supply will continue for some areas of Washington Township beyond the year 2000.

5.2.3 Roxbury: The study area in Roxbury is supplied with water by two public systems. One is owned by the Township and serves the areas of Skyview Estates and Roxbury Knolls. The other is owned by the Roxbury Water Company and serves the area generally to the east of Hillside Avenue and South of Route 46. Well locations are shown on Figure No.5-1.

The Skyview Estates/Roxbury Knolls water system is supplied by 3 wells as follows:

Well No.	Location	Capacity GPD
1	Conkling Road	43,000
2	Conkling Road	86,000
3	AT&T Road	165,000
	Total Capacity	294,000

TABLE 5-2 SUMMARY OF EXISTING WELLS
PRIVATE WELLS, PUBLIC WELLS, & MOUNT OLIVE TOWNSHIP WELLS

REPORT WELL NUMBER	WELL NAMES	OWNERSHIP*	LOCATION	DEPTH (FEET)	YEAR WELL PLACED IN SERVICE	CAPACITY (GPM)	PROBLEMS
1	Cloverhill #1	Mt. Olive Twp.	Bart. Fl. Rd	110	1965	380	Agressive, iron
2	Cloverhill #2	Mt. Olive Twp.	Route 206	171	1957	380	Agressive
3	Luciano Well	Mt. Olive Twp.	Route 206	--	--	60	Scheduled-Abandonment
4	Village Green #1	Builders Ag.	Route 46	344	1971	44	No Chl. Residual
5	Village Green #2	Builders Ag.	Route 46	81	1971	100	No Chl. Residual
6	Netcong Water Dep.	Netcong	Route 206	--	1927	200	Unknown
7	Netcong Water Dep.	Netcong	Route 206	--	1929	300	Unknown
8	Stanhope Water Dep.	Stanhope	Dynapak Co.	--	--	275	Unknown
9	Stanhope Water Dep.	Stanhope	Dynapak Co.	--	--	200	Unknown
10	High-Ridge W.C.	High Ridge	Chelsa Drive	210	--	43	Agressive, hitrate
11	Pinecrest Imp. As.	Pinecrest	Springdale Ter.	105+	1918	60	Agressive
12	Pinecrest Imp. As.	Pinecrest	Springdale Ter.	105+	1918	125	Agressive
13	Juckett Drill Co.	Juckett	Carteret Street	100+	1925	20	Unknown
14	Eagle Rock	Builders Ag.	Wolfe Road	300-	1974	250	Unknown
15	Eagle Rock	Builders Ag.	Wolfe Road	130	1973	150	Unknown
16	Vasa Homes	Vasa Comm.	By Club House	30	1962	30	No Chlorination
17	Vasa Homes	Vasa Comm.	By Entrance	400	1962	50	No Chlorination
18	Vasa Homes	Vasa Comm.	Within Dev.	--	1962	30	No Chlorination
19	Vasa Homes	Vasa Comm.	Within Dev.	--	1962	30	No Chlorination
20	Vasa Homes	Vasa Comm.	Within Dev.	--	1962	30	No Chlorination
21	Sand Shore Estates	Mt. Olive Twp.	Sand Shore Road	93	1968	20	Unknown
22	Alcrest Homes	Builders Ag.	Alcrest Drive	266	1972	61	Agressive
23	Duo-Equities Sec. 3	Builders Ag.	Alcrest Drive	200	1971	40	Unknown
24	Duo-Equities Sec. 4	Builders Ag.	Alcrest Drive	350	1972	20	Unreliable Yield
25	West Jersey #2	West Jersey	Stone House Rd.	48	1935	130	Agressive
26	West Jersey #5	Builders Ag.	Pine Grove Rd.	220	1971	70	Agressive
27	West Jersey #3	West Jersey	Orchard Street	62	1953	70	Out of Service
28	West Jersey #4	West Jersey	Orchard Street	110	1960	150	Unreliable Yield
29	Indian Springs	A. Mue'bauer	Old Ind. Spr. Rd.	97	1961	85	Agressive
30	Indian Springs	A. Mue'Bauer	Old Ind. Spr. Rd.	97	1965	300	Agressive
31	Village Green #3	Builders Ag.	Route 46	50	1974	140	No Chl. Residual

*Builders Agreement permits Mount Olive to assume ownership of the well without cost at the discretion of the Township.

Source: Pandullo, Chrisbacher and Associates Report, January 1975

This system has delivered a maximum of 34,000 GPD (May 1973) and a minimum 25,000 GPD (January 1973) when serving a population of approximately 500. Average daily flow was 30,000 gallons or 55 GPD per capita. There are now, and in the future there will continue to be, a significant number of homes that will depend upon individual wells and not upon the public system for water.

The Roxbury Water Company system is supplied by 4 wells as follows:

Well No.	Location	Capacity GPD
4	Highland Avenue	144,000
5	Condit Street	170,000
6	First Avenue	446,000
7	Condit Street	432,000
	Total Capacity	1,192,000

The maximum flow delivered was 525,000 GPD (March 1973); the minimum, 341,000 GPD (December 1973). The average daily flow was 430,000 gallons serving a population of 6,650 or 65 GPD per capita.

5.2.4 Summary: The foregoing analysis indicates the adequacy of existing wells for the study period. It is probable that in some areas, growth may diverge from projections, due to unforeseeable circumstances, and the need for additional wells or other source of water supply must be developed. Should the study area be confronted with this situation, additional groundwater supply exists, as discussed in Section 5.1, to permit drilling additional wells.

Although this report does not discuss the potential of additional water supplies, these exist in the planned Pulaski Reservoir to be located north of Budd Lake and another reservoir proposed for Schooley's Mountain. Another possibility for increased water supply would be to purchase from the Morris County Municipal Utilities Authority and to integrate the Mt. Olive water systems with the Hackettstown MUA, Stanhope, and Netcong systems as recommended by Pandullo, Chrisbacher and Associates.

Table 5-3 Water System Data - WTMUA

No.	Well Identification	Location	Capacity Max. GPD	Capacity Average GPD	Remarks
1	Dogwood	Dogwood Drive at cul-de-sac. Merrybrook Development	44500	44500	Systems 1,2,3, 4a & 4b are interconnected.
2	Hemlock	Hemlock Drive near Naughright Road, Merrybrook Development.	33200	3400	
3	Fawnridge	Fawnridge Drive and Naughright Road Wooded Valley Development	50000	16800	
4a	Nestling Pines	Naughright Road Nestling Pines Development	72000	41000	
4b	Nestling Pines	Naughright Road Nestling Pines Development	21600	-0-	
5	Fairmount	Fairmount Road between West Fox Hill Road and West Valley Brook Road	172800	48240	Systems 5,6, & 7 are interconnected.
6	Spring	New Jersey Route 24 (Camp Washington Road)	80000 (approx.)	20100	Two 6" wells with pumps and spring.
7	Parker Acres	Douglas Road and Old Farmer's Road Parker Areas Development	115200	68206	
		Totals	589300	242246	

Notes: (1) Systems 1,2,3 and 4 have 360 connections and expanding.
Systems 5,6,& 7 have 460 connections and expanding.
(2) Average daily water consumption per capita = 75.

6.0 LAND USE AND POPULATION PROJECTIONS

6.0 LAND USE AND POPULATION PROJECTIONS

6.1 General: To establish the design criteria for the proposed sewerage system, population and land use conditions have been projected over the study period 1980 through the year 2000. Preliminary demographic and land use data was included in the Section 2 report, Chapter 2, parts 2.5 and 2.6. In developing the projections, several data sources were used including Bureau of Census data, 1970, Morris County Planning Board statistics, zoning maps and ordinances, master plans, building permit statistics, existing and proposed subdivision maps, U.S. Coast & Geodetic data and maps, and other secondary published sources. In addition, meetings were held with municipal officials and their planning consultants to further refine the published data and to obtain their inputs in terms of future development within their respective Townships. The population and land use projections were submitted to the planning department of each of the three municipalities, the Corps of Engineers, the Tri-State Transportation Commitee, the Regional Plan Association, and the Morris County Planning Board. Various responses received from planning agencies are included in Appendix C.

The South Branch Basin has developed southward from its upper reaches at Budd Lake, Route 46, and Route 10. The least densely populated areas are in the southern portions of the basin from Long Valley southward to the Morris County/Hunterdon County boundary line. Steeply sloped areas, water bodies, low lying or flood plain areas and wetlands have been assumed undevelopable and, therefore, have been excluded in projecting future populations.

Growth in the area is a consequence of the configuration of highway systems. Route 46, major east/west artery, crosses the northern part of the study area. It is intersected by Route 206 from the south, and Route 10, also from the east, terminates in this area. These three roads, serving the area for a considerable period of time, have induced a great deal of growth in the Budd Lake area, Roxbury, and the northern part of the study area in general. More recently, Route 80 has been opened to traffic further stimulating development in the northern area. However, Route 206 continues to offer the convenience of access to the south. Consequently, growth has been spreading, and will continue to spread, in a southerly direction into the South Branch Basin. The pattern of growth tapers off toward the south, and it is expected that population concentration will remain in the northern part of the basin.

Projected improvements to Route 24, an east/west highway originating at the Garden State Parkway, will also induce development in the region of Long Valley and Middle Valley. Route 24 now provides direct access to Morristown, the County seat.

The study area is close to the Morristown area in which there are a number of corporate headquarters and industrial complexes. These account for a large number of employees, many of whom reside, or would reside, in the study area. Morristown and its immediate environs continue to be an attractive location for industry increasing the demand for housing in the study area. Examples of office/industrial developments includes the corporate headquarters of AT&T in Basking Ridge with current employment of 2,000 and expected to increase to 3,000 by 1978. Also, at Flanders (Clover Hill), Sears Roebuck[1] is proposing to construct within the near future a 400,000 sq. ft. office, warehouse, and distribution facility to serve the northern New Jersey, New York Metropolitan area. Employment from this complex is estimated at approximately 1,000 people.

Tables 6-1, 6-2, and 6-3 provide population and densities based on 1970 Census enumeration districts for Mt. Olive, Washington, and Roxbury Townships as they relate to the area in each enumeration district and that portion of the district which lies in the study area.

The population projections for the South Branch-Raritan River Basin was divided into 20 sub-basin areas as shown in Figure No. 1-1 and Table No. 1-1. Table No. 1-1 shows the Morris County drainage designation, description, and approximate areas. The sub-basin identifications will be used throughout this section. Each of these sub-divisions was analyzed for existing and proposed development based on specific developments or areas within each of the sub-basins. Each developed area was assigned a prefix designation based on existing or known developments as shown on Table 6-4.

Note: (1) Sears project inactive at the time of publication of this report.

Table 6-1

Population and Densities, Based on 1970 Census Enumeration Districts

Mt. Olive Township

Census Enumeration District No.	Area Acres District	Area Acres Basin	Population People District	Population People Basin[1]	Basin Average Density People/Gross Acre
1A	5,743	5,743	1,362	1,362	.24
1B	330	330	37	37	.11
1C	1,395	1,395	3,523	3,523	2.53
1D	440	440	550	550	1.25
1E	9,838	2,685	2,304	1,617[1]	.60
1F	624	613	1,283	1,260	2.06
1G	881	881	486	486	.55
Totals	19,238	12,087	10,394	8,835	

Notes:

(1) Pro-rated based on land use map and field survey.
(2) Average density of Drainage Basin in Mt. Olive based on 1970 Census = .73 people/acre.

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Table 6-2

Population and Densities, Based on 1970 Census Enumeration Districts

Washington Township

Census Enumeration District No.	Area Acres District	Area Acres Basin	Population People District	Population People Basin (1)	Basin Average Density People/Acre
13A	16,845	9,908	3,819	3,334 (1)	.33
13B	587	587	340	340	.58
13C	10,056	4,848	1,498	721	.15
13D	1,358	1,134	1,305	1,175 (1)	1.036
Totals	28,846	16,477	6,962	5,570	

Notes:

(1) Pro-rated based on land use map and field survey.

(2) Average Density of Drainage Basin in Washington Township based on 1970 Census = .34 people/acre.

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Table 6-3

Population and Densities, Based on 1970 Census Enumeration Districts

Roxbury Township

Census Enumeration District No.	Area Acres District	Area Acres Basin	Population People District	Population People Basin(1)	Basin Average Density People/Acre
11A	2,755	2,180	728	576	.26
11B	2,534	2,256	2,649	2,358	1.05
11C	1,616	15	3,707	34	2.29
11D	808	0	653	0	-
11E	588	0	1,599	0	-
11F	184	0	966	0	-
11G	4,187	429	1,407	144	.34
11H	440	211	520	249	1.18
11 I	661	0	2,544	0	-
11 J	1,396	539	988	381	.71
	15,169	5,630	15,574	3,742	
Y1 (Mt. Arlington)	755	140	1,318	244	1.74
Total Area of Basin in Roxbury Mt. Arlington	15,924	5,770	16,892	3,986	

Notes:

(1) Pro-rated based on land use map and field survey.

(2) Average density of Drainage Basin in Roxbury including 140 acres in Mt. Arlington based on 1970 census = .69 people/acre.

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Table 6 -4 Township/Development Area Designation per Calendar Year

Townships	CY 1980	CY 1990	CY 2000	Saturation
Mount Olive	X	U	U	O
Washington	Z	W	W	Q
Roxbury	Y	V	V	P

The table can be used to identify the existing or proposed development areas as shown on Tables 6-5, 6-7, 6-9, and Figures 6-1, 6-2, and 6-3.

The base map is by the U.S. Coast and Geodetic Service, scale 1" = 2,000'. The areas of development are shown as an overlay to this map and are so identified on the Figures and the Tables. Each area was identified by an area description, if available, and was measured to obtain the area in acres. Based on local zoning, street maps, aerial photograph, on-site inspections, sub-division maps and other sources, dwelling unit densities per acre were established for each area. With the known acres, the total number of dwelling units were determined. Population projections for each area were based on 3.70 people per dwelling unit for one-family houses and 2.9 people per dwelling unit for garden apartments. These factors have been developed and confirmed by the local planning boards and other sources. Areas considered non-developable, such as steep slopes, wetlands, flood plains, etc., were excluded in developing the population projections. Projections for 1980, 1990, 2000, and saturation, are described in more detail in the following:

6.2 <u>1980 Projections:</u> Using the methodology described above, the projected population and development for year 1980 is shown on Table 6-5 and Figure No. 6-1. Those areas indicated by an asterisk are to be sewered in 1980. Table No. 6-6, abstracted from Table No. 6-5, is a summary of the existing and/or recommended sewer areas as they relate to each of the sub-basins. Those areas where interbasin transfers are proposed are identified in the remarks column. The data provided for 1980 are academic inasmuch

Table 6-5 Population and Development CY 1980

1 Area Designation Refer to Figure	2 Area Description (If Available)	3 Drainage Area Designation	4 Approx. Area (Acres)	5 Approx. No. of D.U.	6 Approx. Population [2]	7 Remarks
X-1 * [1]	Budd Lake SW	Budd Lake	194	680	2570	
X-2 *	Budd Lake SW (Indian Springs)	do	62	81	306	
X-3 *		do	162	250	945	
X-4 *	---	do	45	222	839	100 DU [4]
X-5 *	Budd Lake E	do	253	668	2525	
X-6 *	Golden Hills	do	53	107	404	
X-7 *	Budd Lake SE	do	105	371	1402	
X-8	Budd Lake Homes	do	64	99	374	90 DU [4]
X-9	Budd Lake	do	28	58	219	
X-10	Rt.46 West	Mount Olive Complex	41	35	132	
X-11 *	Vasa Park	do	23	80	302	
X-12 *	Mt. Olive Complex	do	130	1000	2900	Garden Apts. [3] 693 DU [4]
X-13 *	do	do	23	25	95	Garden Apts.
X-14	Budd Lake Homes	do	28	21	80	
Z1	Drakestown	do	48	35	132	
X-15	Brook Glen	Turkey Brook	31	30	113	
X-16	Beechwood Hills		31	34	129	
X-17	Sil'r Spring Manor	do	76	84	317	
X-18	---	South Branch Gorge	39	16	60	
X-19	---	do	26	20	76	
X-20	---	Four Bridges Road	16	10	38	
X-21	Bartley		15	8	57	
X-22 *	Bartley	Conklin Pond & Brook	32	36	136	
X-23 *	Mt. Olive Knolls	do	57	62	234	20 DU [4]
X-24	Oakwood Village	do	195	420	1218	Garden Apts. (3) (4)

Table 6-5 (Continued)

1 Area Designation Refer to Figure	2 Area Description (If Available)	3 Drainage Area Designation	4 Approx. Area (Acres)	5 Approx. No. of D.U.	6 Approx. Population (2)	7 Remarks
X-28 *	Reger Road	Clover Hill East	8	22	88	
X-29 *	Clover Hill E	do	137	508	1930	(4)
X-30 *	Clover Hill W	Clover Hill West	138	508	1930	(4)
X-31 *	Flanders Bartley	do	8	22	88	
X-32	Clover Hill S	Clover Hill South	37	20	80	
X-33	Four Bridges	do	15	8	57	
Z-2	Mis'n Rd/Kim L.	Stoney Brook	81	89	336	
Z-3*	Naugh't Rd. & Spring Lane	do	97	106	401	(3) (4)
Z-4	do	do	81	-	-	80 lots proposed
Z-5	Flockt'n Rd. & Ula Drive	do	28	16	61	
Z-6*	Schooley's Mt.	do	122	187	707	(4) (3)
Z-7	Route 24 N	do	135	5/acre	-	High density Request
Z-8	Naughright	do	32	30	113	
Z-9*	Capitol Acres	do	121	121	457	
Z-10	Spring Acres	Electric Brook	103	149	-	Proposed
Z-11	Wooded Valley		81	146	-	Proposed
Z-12*	Schooley's Mt.	do	54	84	317	(3)
Z-13	do	do	81	101	-	Proposed
Z-14	do	do	24	24	91	
Z-15*	Merry Brook	do	65	100	91	(4) (3)
Z-16	William Roe	do	61	305	-	Proposed
Z-17	Long Valley	do	20	15	57	
Z-18	TWP Property	do	89	-	-	Future development

Table 6-5 (Continued)

1 Area Designation Refer to Figure	2 Area Description (If Available)	3 Drainage Area Designation	4 Approx. Area (Acres)	5 Approx. No. of D.U.	6 Approx. Population(2)	7 Remarks
X-25 *	Flanders	Conklin Brook	81	120	454	
X-26 *	do	do	32	12	45	
Y-1 *	Roxbury Knolls Sky View	do	274	260	983	(4) 200 DU
Y-2 *	Malron Park	Ledgewood	41	23	87	
Y-3 *	Lake Rogerine	do	59	105	397	
Y-4 *	Suc. B.D.	do	24	30	113	
Y-5 *	Succasunna Business District (RT-10)	Carey Carey	187	185	700	
Y-6 *			12	18	68	
Y-7 *	Ledgewood Mall	do	41	-	-	
Y-8 *	Highland Manor	do	28	58	219	
Y-9 *		do	32	25	95	
Y-10 *	Coachman's Hill	do	43	47	178	
Y-11 *		do	28	9	34	
Y-12 *		do	80	50	189	
Y-13	Harrison Estates	do	16	16	60	
Y-14	Carey Road	do	12	10	38	
Y-15	Carey Road	do	12	10	38	
Y-16	Emmans Road	do	8	5	19	
X-27	Flanders	do	40	40	151	
Y-17 *	Ledg'd-Mt.Rd.	Flanders	146	161	609	(4)
Y-18 *	Tobey Road	do	100	262	990	(4)
Y-19 *	Parkview Drive	do	81	89	336	

Table 6-5 (Continued)

1 Area Designation Refer to Figure	2 Area Description (If Available)	3 Drainage Area Designation	4 Approx. Area (Acres)	5 Approx. No. of D.U.	6 Approx. Population(2)	7 Remarks
Z-19	Long Valley	Electric Brook	268	-	-	County Park
Z-20*	Long Valley	do	118	115	434	
Z-21	Karen Ann Estates	do	185	300	-	Proposed
Z-22	Twnshp. Property	do	49	-	-	
Z-23	Schooley's Mt.	do	81	60	227	
Z-24*	Long Valley	Fairmont Road	24	30	113	
Z-25*	Capitol Estates	do	122	122	461	
Z-26	King's Ridge	Spruce Run	61	15	56	
					56	
Z-27	Middle Valley	Middle Valley	186	70	265	
Z-28	Scott Farm	do	16	15	76	
Z-29*	Scott Farm	do	20	20	76	
Z-30*	Parker Acres	Fairmont Road	121	150	567	
Z-31	Darby Dan Farms		57	36	984	Proposed

Notes: (1)* Indicates recommended for sewering-CY 1980

(2) Approx. population based on 3.78 people per D.U. for 1 family house and 2.9 people per D.U. for garden apartments.

(3) Existing plant to remain in operation to CY2000.

(4) Local collection system existing.

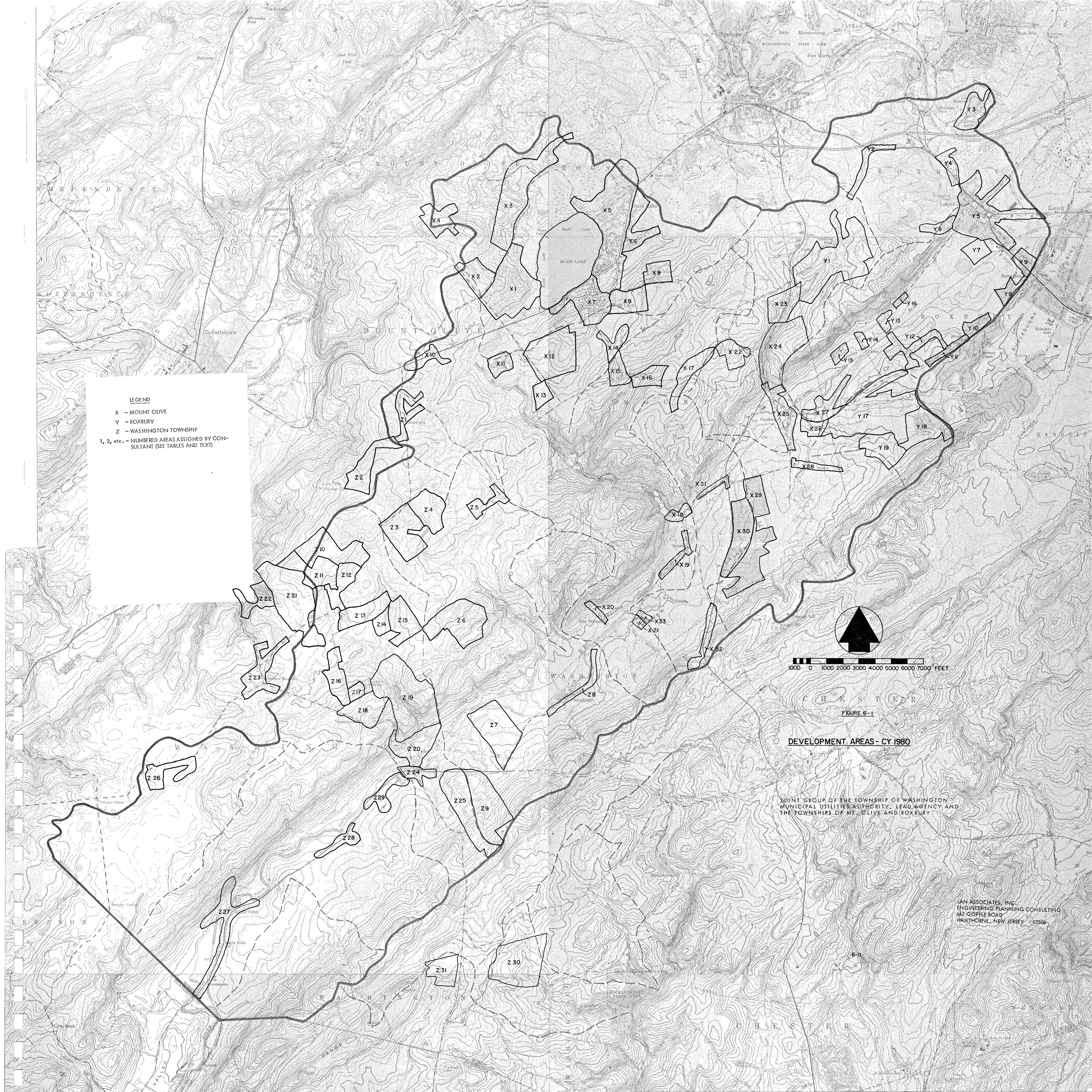

FIGURE 6-1

DEVELOPMENT AREAS - CY 1980

Table 6-6 Summary of Existing and/or Recommended Sewered Areas CY 1980

1			2		3		4
Basin Designation and Description			Approximate Area acres		Approximate Population people		
			Gross	Sewered	Gross	Sewered	Remarks
000	096 088 089	Budd Lake	2995	966	9066	9066	Includes 45 acres sub-basin transfer
000	067 080	Mount Olive Complex	1907	204	3641	3377	
076	-	Turkey Brook	986	107	559	430	
000	059 000	South Branch Gorge	1459	-	136	-	
036	-	Four Bridges Road	653	-	95	-	
037	-	Stoney Brook	3051	421	2075	1444	Includes 81 acres sub-basin transfer
049	-	North Four Bridges Road	505	-	50	-	
000N	-	Naughright	768	121	570	457	
021	-	Electric Brook	2510	261	1217	842	Includes 315 acres sub-basin transfer
028	-	Fairmount Road	732	296	1141	1141	Includes 207 acres sub-basin transfer (Parker Acres, Darby Dan Farms)
000	013 024	Middle Valley	3276	20	417	76	
005	-	Spruce Run	1548	-	56	-	
009	-	Turtle Back Road	921	-	120	-	
048 A	-	Ledgewood	1459	124	597	597	

Table 6-6 (continued)

1			2		3		4
Nsin Designation and Description			Approximate Area acres		Approximate Population people		
			Gross	Sewered	Gross	Sewered	Remarks
048 B	-	Carey	2259	479	1789	1566	
048 C	-	Cloverhill East	1593	145	2018	2018	
048 D	-	Cloverhill South	384	52	120	-	
083	-	Cloverhill West	864	146	2018	2018	
099 095	Rt.206S Rt.206N	Conklin Pond & Brook	1913	202	3070	869	
056		Flanders	639	327	1935	1935	
		Totals	30422	3871	30690	25836	

as the initial design year for interceptors and treatment plants is the year 1990.

6.3 1990 and 2000 Projections: Areas established for 1980 were combined and expanded to reflect the projected growth during the next two decades ending in the year 2000. Comparison of the maps on Figures 6-1 and 6-2 shows the expected growth of the study area based on the factors previously mentioned and taking into account postponed development and exclusion of non-developable areas. The following tables show population and development for year 1990, year 2000, and summaries of existing and recommended sewer areas for calendar year 1990 and 2000. These tables again relate to their respective figures, being Figure No. 6-2 for calendar year 1990 and calendar year 2000.

6.4 Saturation: The design criteria for the South Branch (Morris County) Facility Plan interceptor system, is based on the saturation population developed from existing zoning ordinances. To accomplish this, a map, Figure 6-3 was developed showing the zone designation and description. These zones were superimposed on the sub-basins previously identified and the non-developable areas were excluded. Based on the specific requirements of the zoning ordinances in terms of lot sizes or dwelling unit densities, each designated area was measured and population and densities developed. The results are summarized in Table 6-11, "Population and Development, Saturation" which relates to Figure 6-3 previously described. This analysis indicates that the saturation population would be very close to the population in the year 2000 using the existing zoning ordinances. It should be recognized, however, that changes in zoning ordinances or variances may significantly influence population projections. This is especially true in Washington Township were a major portion of the land, particularly in the southern portion, is zoned for 1 to 5 acres per dwelling unit. Legislation and court decisions such as Mt. Laurel and "Fair Share Housing" could also effect the population projections particularly in those areas where there is exceptionally low density zoning.

6.5 Induced Development: In determining the areas to be sewered under the various alternatives, consideration was given to existing development, existing and dry sewer systems, proposed development, soil limitations in terms of percolation and suitability and other factors. The alternatives being considered in all cases had deleted from the areas highly sloped land, flood plains, wetlands, and areas designated for parks recreation and green acres.

Table 6-7 Population and Development CY 1990

1 Area Designation Refer to Figure	2 Area Description (If Available)	3 Drainage Area Designation	4 Approx. Area (Acres)	5 Approx. No. of D.U.	6 Approx. Population	7 Remarks
U-1*	Budd Lake SW	Budd Lake	267	776	2933	15,000 SF/DU
U-2*	Budd Lake SW (Indian Springs)	do	112	103	389	40,000 SF/DU
U-3*	Alcrest & Sand Shore Estates	do	288	305 100(4)	1153	35,000 SF/DU Average
U-4*	---	do	152	244 222(4)	923	40,000 SF/DU
U-5*	Budd Lake E Golden Hills	do	495	753	2846	20,000 SF/DU Average 1/5 Commercial
U-6*	Budd Lake SE	do	128	371	1402	15,000 SF/DU
U-7*	Budd Lake Homes & Gardens	do	178	260 90(4)	982	1/2 40,000 1/2 15,000 SF/DU
U-8	Budd Lake Homes	Mount Olive Complex	134	124	469	40,00 SF/DU
U-9*	Mount Olive Complex	do	340	1011 693 (4)	2932	7 DU/Acres (3) 2.9 People/DU 50% Developed
U-10*	Vasa Park	do	71	105	397	(3) 25,000 SF/DU
U-11*	Mount Olive Complex	do	49	45	170	(3) 40,000 SF/DU
U-12	Route 46 West	do	62	57	215	do
U-13*	Planned Unit Development	do	866	710	2061	2.9 People/DU 30% Developed
W-1	Drakestown	do	150	139	525	40,000 SF/DU
U-14	Brook Glen & Beechwood Hills	Turkey Brook	103	95	359	do
U-15	Silver Spring Manor	do	98	90	340	do
U-16	---	South Branch Gorge	45	41	155	do
U-17*	---	do	53	50	189	do

Table 6-7 Population and Development CY 1990 (continued)

1 Area Designation Refer to Figure	2 Area Description (If Available)	3 Drainage Area Designation	4 Approx. Area (Acres)	5 Approx. No. of D.U.	6 Approx. Population	7 Remarks
W-20*	---	Four Bridges Road	18	17	64	40,000 SF/DU
W-21*	Bartley	do	70	32	121	80,000 SF/DU
U-18*	Bartley	Conklin Pond & Brook	62	57	215	40,000 SF/DU
U-19*	Office Research	do	312	-	-	(3) 3,000 gal/acre/day 50% Developed Office Research
U-20*	Mount Olive Knolls	do	89	82 20 (4)	310	40,000 SF/DU
U-21*	Oakwood Village	do	195	420	1218	(3) (4) G.A.
U-22*	Flanders	do	339	313	1186	40,000 SF/DU
V-1*	Roxbury Knolls	do	402	372 200 (4)	1406	40,000 SF/DU
V-2*	Malron Park	Ledgewood	89	82	310	40,000 SF/DU
V-3*	Lake Rogerine	do	129	153	578	25,000 SF/DU 80% Developed
V-4*	Succasunna Business District	do	40	74	280	20,000 SF/DU
V-5*	Succasunna Business District	Carey	428	211	797	2/3 Area Business 1/3 Area Resid. 25,000 SF/DU
V-6*	Ledgewood Mall	do	45	-	-	
V-7*	Coachman's Hill	do	178	329	1244	20,000 SF/DU
V-8*	---	do	143	132	499	40,000 SF/DU
V-9*	Harrison Estates	do	214	197	745	do
V-10*	Ledgewood - Mountain Road	Flanders	634	685 423 (4)	2589	6/10 40,000 3/10 20,000 1/10 15,000 SF/DU 80% Developed
U-25*	Neuget Road	Clover Hill East	103	95	359	40,000 SF/DU

Table 6-7 Population and Development CY 1990 (continued)

1 Area Designation Refer to Figure	2 Area Description (If Available)	3 Drainage Area Designation	4 Approx. Area (Acres)	5 Approx. No. of D.U.	6 Approx. Population	7 Remarks
U-26*	Clover Hill E	Clover Hill East	137	508(4)	1930	9,375 SF/DU
U-27*	Clover Hill W	Clover Hill West	138	508(4)	1930	9,375 SF/DU
U-28*	Flander Bartley	do	27	25	95	40,000 SF/DU
U-29*	Clover Hill S	Clover Hill South	67	62	234	do
W-19*	Four Bridges	do	22	20	76	do
W-2	Mission Road/ Kim Lane	Stoney Brook	192	104	393	1/2 40,000 1/2 80,000 SF/DU 80% Developed
W-3*	Naughright Road & Spring Lane		268	248 106(4)	937	40,000 SF/DU
W-4	Flocktown Road & Ula Drive	do	71	66	249	do
W-5*	Schooley's Mountain	do	236	187	707	do (4) (3) 80% Developed
W-6*	Naughright	Naughright	196	72	272	80,000 SF/DU 80% Developed
W-7*	Route 29 N	do	250	92	348	80,000 SF/DU 80% Developed
W-8*	Schooley's Mt.	Electric Brook	2347	639 100(4)	2415	40,000 SF/DU 75% for roads, open spaces and future development (3)
W-9*	Long Valley	do	98	181	684	20,000 SF/DU
W-10*	Long Valley	Fairmont Rd.	134	50	189	20,000 SF/DU 4/10 Commercial 4/10 Industrial
W-11*	Capitol Estates	do	268	248	937	40,000 SF/DU
W-12*	Scott Farms	Middle Valley	223	69	261	120,000 SF/DU

Table 6-7 Population and Development CY 1990

1 Area Designation Refer to Figure	2 Area Description (If Available)	3 Drainage Area Designation	4 Approx. Area (Acres)	5 Approx. No. of D.U.	6 Approx. Population	7 Remarks
W-13*	Middle Valley	Middle Valley	705	190	718	80,000 SF/DU 50% roads, future development
W-14	Long Valley	Electric Brook	268	-	-	County Park
W-15	King's Ridge	Spruce Run	98	45	170	80,000 SF/DU
W-16	Middle Valley	Middle Valley	178	110	416	1/5 20,000 2/5 40,000 2/5 40,000
W-18*	Parker Acres	Fairmont Rd.	398	274	1036	1/2 40,000 1/2 80,000 SF/DU
W-17*	Darby Dan Farms	Fairmont Rd.	134	92	348	do

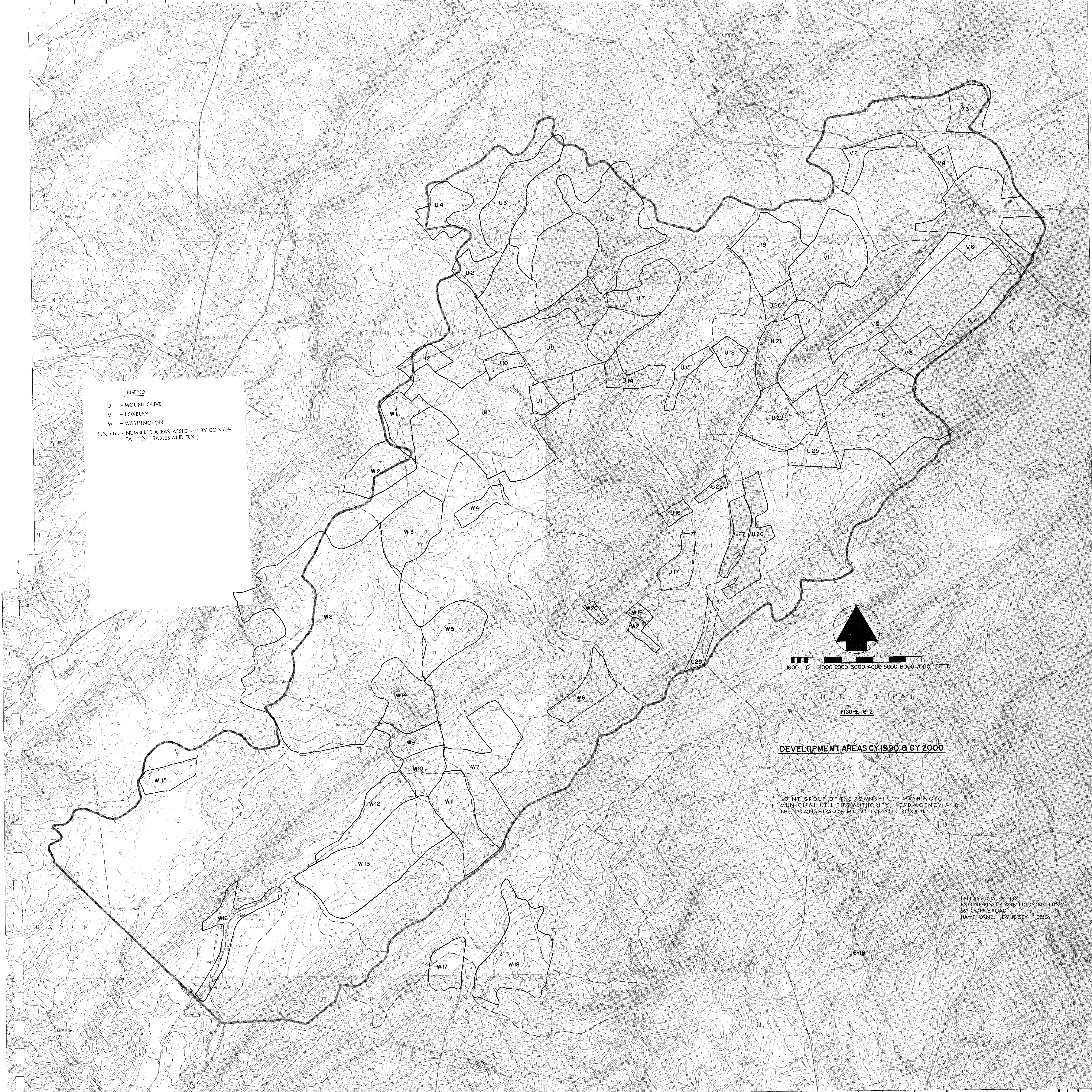

FIGURE 6-2

DEVELOPMENT AREAS CY 1990 & CY 2000

Table 6-8 Summary of Existing and/or Recommended Sewered Areas CY1990

1 Basin Designation and Description			2 Approximate Area acres Gross	 Sewered	3 Approximate Population people Gross	 Sewered	4 Remarks
000	096 088 089	Budd Lake	2995	1620	10628	10628	
000	067 080	Mount Olive Complex	1907	1672	6769	6244	
076	-	Turkey Brook	986	201	699	699	
000	059 000	South Branch Gorge	1459	98	344	344	
036	-	Four Bridges Road	653	88	185	185	
037	-	Stoney Brook	3051	946	2290	1991	
049	-	North Four Bridges Road	505	-	63	-	
000N	-	Naughright	768	446	620	620	
021	-	Electric Brook	2510	2445	3099	3099	
028	-	Fairmount Road	732	934	2510	2510	
000	013 024	Middle Valley	3276	928	1395	979	
005	-	Spruce Run	1548	-	170	-	
009	-	Turtle Back Road	921	-	132	-	
048A	-	Ledgewood	1459	258	1168	1168	

Table 6-8 (continued)

1 Basin Designation and Description			2 Approximate Area acres Gross	 Sewered	3 Approximate Population people Gross	 Sewered	4 Remarks
048B	-	Carey	2259	1008	3285	3285	
048C	-	Cloverhill East	1593	240	2289	2289	
048D	-	Cloverhill South	384	89	310	310	
083	-	Cloverhill West	864	165	2025	2025	
099 095	Rt.206S Rt.206N	Conklin Pond & Brook	1913	1399	1711	1711	
056		Flanders	639	634	2589	2589	
		Totals	30422	13171	42841	40676	

Table Population and Development CY 2000

1 Area Designation Refer to Figure	2 Area Description (If Available)	3 Drainage Area Designation	4 Approx. Area (Acres)	5 Approx. No. of D.U.	6 Approx. Population(2)	7 Remarks
U-1*	Budd Lake SW	Budd Lake	267	776	2933	15,000 SF/DU
U-2*	Budd Lake SW (Indian Springs)	do	112	103	389	40,000 SF/DU
U-3*	Alcrest & Sand Shore Estates	do	288	305	1153	35,000 SF/DU Average
U-4*	---	do	152	244 222(4)	923	40,000 SF/DU
U-5*	Budd Lake E Golden Hills	do	495	753	2846	20,000 SF/DU Average 1/5 Commercial
U-6*	Budd Lake SE	do	128	371	1402	15,000 SF/DU
U-7*	Budd Lake Homes & Gardens	do	178	260(4) 90	982	1/2 40,000 1/2 15,000 SF/DU
U-8*	Budd Lake Homes	Mount Olive Complex	134	124	469	40,00 SF/DU
U-9*	Mount Olive Complex	do	340	693(4)	4106	7 DU/Acres 2.9 People/DU 70% Developed
U-10*	Vasa Park	do	71	105	397	25,000 SF/DU
U-11*	Mount Olive Complex	do	49	45	170	40,000 SF/DU
U-12*	Route 46 West	do	62	57	215	do
U-13*	Planned Unit Development	do	866	1000	2900	2.9 People/DU 50% Developed
W-1*	Drakestown	do	150	139	525	40,000 SF/DU
U-14*	Brook Glen & Beechwood Hills	Turkey Brook	103	95	359	do
U-15*	Silver Spring Manor	do	98	90	340	do
U-16*	---	South Branch Gorge	45	41	155	do
U-17*	---	do	53	50	189	do

W= 525

U= 19928

Table6-9 Population and Development CY 2000 (continued)

1 Area Designation Refer to Figure	2 Area Description (If Available)	3 Drainage Area Designation	4 Approx. Area (Acres)	5 Approx. No.of D.U.	6 Approx. Population(2)	7 Remarks
W-20*	---	Four Bridges Road	18	17	64	40,000 SF/DU
W-21*	Bartley	do	70	32	121	80,000 SF/DU
U-18*	Bartley	Conklin Pond & Brook	62	57	215	40,000 SF/DU
U-19*	Office Research	do	312	-	-	(3)3,000 gal/acre/day 50% Developed Office Research
U-20*	Mount Olive Knolls	do	89	82 20(4)	310	40,000 SF/DU
U-21*	Oakwood Village	do	195	1232 400(4)	3573	
U-22*	Flanders	do	339	313	1186	40,000 SF/DU
V-1*	Roxbury Knolls	do	402	372 200(4)	1406	40,000 SF/DU
V-2	Malron Park	Ledgewood	89	82	310	40,000 SF/DU
V-3*	Lake Rogerine	do	129	184	696	25,000 SF/DU
V-4*	Succasunna Business District	do	40	74	280	20,000 SF/DU
V-5*	Succasunna Business District	Carey	428	211	797	2/3 Area Busine 1/3 Area Resid. 25,000 SF/DU
V-6*	Ledgewood Mall	do	45	-		
V-7*	Coachman's Hill	do	178	329	1244	20,000 SF/DU
V-8*		do	143	132	499	40,000 SF/DU
V-9*	Harrison Estates	do	214	197	745	do
V-10*	Ledgewood - Mountain Road	Flanders	634	822 (4)	3107	6/10 40,000 3/10 20,000 1/10 15,000 SF/DU
U-25*	Neuget Road	Clover Hill East	103	95	359	40,000 SF/DU

W=710 U=25571 V=9094

Table 6-9 Population and Development CY 2000

1 Area Designation Refer to Figure	2 Area Description (If Available)	3 Drainage Area Designation	4 Approx. Area (Acres)	5 Approx. No. of D.U.	6 Approx. Population[2]	7 Remarks
U-26*	Clover Hill E	Clover Hill East	137	508[4]	1930	9,375 SF/DU
U-27*	Clover Hill W	Clover Hill West	138	508[4]	1930	9,375 SF/DU
U-28*	Flander Bartley	do	27	25	95	40,000 SF/DU
U-29*	Clover Hill S	Clover Hill South	67	62	234	do
W-19*	Four Bridges	do	22	20	76	do
W-2*	Mission Road/ Kim Lane	Stoney Brook	192	125	473	1/2 40,000 1/2 80,000 SF/DU
W-3*	Naughright Road & Spring Lane	do	268	248 106[4]	937	40,000 SF/DU
W-4	Flocktown Road & Ula Drive	do	71	66	249	do
W-5*	Schooley's Mountain	do	236	210 187[4]	794	do
W-6*	Naughright	Naughright	196	72	272	80,000 SF/DU 80% Developed
W-7*	Route 29 N	do	250	110	416	80,000 SF/DU
W-8*	Schooley's Mt.	Electric Brook	2347	1022 100[4]	3863	40,000 SF/DU
W-9*	Long Valley	do	98	181	684	20,000 SF/DU
W-10*	Long Valley	Fairmont Rd.	134	50	189	20,000 SF/DU 4/10 Commercial 4/10 Industrial
W-11*	Capitol Estates	do	268	248	937	40,000 SF/DU
W-12*	Scott Farms	Middle Valley	223	69	261	120,000 SF/DU

W - 9861

U= 29760

Table6-9 Population and Development CY 2000

1 Area Designation Refer to Figure	2 Area Description (If Available)	3 Drainage Area Designation	4 Approx. Area (Acres)	5 Approx. No.of D.U.	6 Approx. Population	7 Remarks
W-13*	Middle Valley	Middle Valley	705	503	1901	80,000 SF/DU
W-14	Long Valley	Electric Brook	268	-		County Park
W-15	King's Ridge	Spruce Run	98	45	170	80,000 SF/DU
W-16	Middle Valley	Middle Valley	178	110	416	1/5 20,000 2/5 40,000 2/5 40,000
W-17*	Parker Acres	Fairmont Rd.	398	274	1036	1/2 40,000 1/2 80,000 SF/DU
W-18*	Darby Dan Farms	Fairmont Rd.	134	92	348	do

W= 13,732

Table 6-10 Summary of Existing and/or Recommended Sewered Areas CY2000

Basin Designation and Description			Approximate Area acres		Approximate Population people		Remarks
			Gross	Sewered	Gross	Sewered	
000	096 088 089	Budd Lake	2995	1620	10628	10628	
000	067 080	Mount Olive Complex	1907	1672	13352	13352	
076	-	Turkey Brook	986	201	699	699	
000	059 000	South Branch Gorge	1459	98	344	344	
036	-	Four Bridges Road	653	88	185	185	
037	-	Stoney Brook	3051	1213	2453	2453	
049	-	North Four Bridges Road	505	88	185	185	
000N	-	Naughright	768	446	688	688	
021	-	Electric Brook	2510	2713	4547	4547	
028	-	Fairmount Road	732	934	2510	2510	
000	013 024	Middle Valley	3276	1106	2578	2362	
005	-	Spruce Run	1548	98	170	-	
009	-	Turtle Back Road	921	-	200	-	
048A	-	Ledgewood	1459	258	1286	1286	
048B	-	Carey	2259	1008	3285	3285	
048C	-	Cloverhill East	1593	240	2289	2289	
048D	-	Cloverhill South	384	89	310	310	
083	-	Cloverhill West	864	165	2025	2025	
099 Rt.206S 095 Rt.206N		Conklin Pond & Brook	1913	1399	3883	3883	
056		Flanders	634	634	3107	3107	
		Totals	30422	14070	54724	53938	

Table6-11 Population and Development - Saturation

1 Sub-Basin Description	Designation	2 Zone Designation Symbol	Description	3 Sewered Area Acres	4 Density Sewered Area Capital/Acre	5 Population People	Remarks
Budd Lake	000 092 088 084	O-1	A-AAA	791	4.12	2770	40,000 SF/DU
		O-2	B	283	8.23	1980	20,000 SF/DU
		O-3	C	61	-	-	Retail Business
		O-4	GAC	90	20.3	776	50% Commercial 50% Garden Apartments 7 DU/Acres 2.9 People/DU
		O-5	GA-2	61	20.3	1052	Garden Apartments 7 DU/Acre 2.9 People/DU
		O-6	B	328	8.23	2295	20,000 SF/DU
		O-7	C	25	-	-	Retail Business
		O-8	B	180	8.23	1259	20,000 SF/DU
		O-9	C	111	-	-	Retail Business
		O-10	B	74	8.23	518	20,000 SF/DU
		O-11	AAA	164	4.12	574	40,000 SF/DU
		O-12	E	197	-	-	Rural Industry
Mount Olive Complex	067 080	O-13	A-AAA	119	4.12	417	40,000 SF/DU
		O-14	C	164	-		Retail Business
		O-15	GAC	57	20.3	492	50% Commercial 50% Garden Apartments 7 DU/Acre 2.9 People/DU
		O-16	PUD	783	14.5	11354	Planned Unit Development 5 DU/Acre 2.9 People/DU
		O-17	A	61	4.12	251	40,000 SF/DU
		O-18	AAA	328	4.12	1149	20,000 SF/DU

Table 6-11 Population and Development - Saturation

1 Sub-Basin Description	1 Sub-Basin Designation	2 Zone Designation Symbol	2 Zone Designation Description	3 Sewered Area Acres	4 Density Sewered Area Capital/Acre	5 Population People	6 Remarks
Mount Olive Complex (continued)		O-19	GA-2	33	20.3	569	Garden Apartments 7 DU/Acre 2.9 People/DU
		O-20	B	29	8.23	203	20,000 SF/DU
		Q-1	R-80	262	2.06	459	80,000 SF/DU
Turkey Brook	076	O-21	E	393	-	-	Rural Industry
		O-22	AAA	410	4.12	1436	40,000 SF/DU
		O-23	AA	221	4.12	774	do
South Branch Gorge	000 059 000	O-24	PUD	145	20.3	2500	Planned Unit Development 5 DU/Acre 2.9 People/DU
		O-25	AAA	390	4.12	1365	40,000 SF/DU
		O-26	C	12	-		Retail Business
		O-27	A,B	15	6.18	79	50% 40,000 SF/DU 30% 20,000 SF/DU
		O-28	D-D	98	-	-	Limited Industry
		O-29	AAA	41	4.12	144	40,000 SF/DU
		Q-2	R-80	129	2.06	226	80,000 SF/DU
Four Bridges Road	036	Q-3	R-80	180	2.06	315	80,000 SF/DU
Conklin Pond & Brook	099 Rt. 206S	O-30	E	246	-	-	Rural Industry
	095	O-31	AAA	451	4.12	1579	10,000 SF/DU
	Rt. 206N	O-32	GA-2	115	20.3	1984	Garden Apartments 7 DU/Acre 2.9 People/DU

Table 6-11 Population and Development - Saturation

1 Sub-Basin Description	Designation	2 Zone Designation Symbol	Description	3 Sewered Area Acres	4 Density Sewered Area Capital/Acre	5 Population People	6 Remarks
Conklin Pond & Brook (continued)		O-33	C	98	-	-	Retail Business
		O-34	B	53	8.23	371	20,000 SF/DU
		O-35	C	37	-	-	Retail Business
		O-36	E	39	-	-	Rural Industry
		O-37	AA	57	4.12	200	40,000 SF/DU
		P-1	OR-5	188	-		Office Research
		P-2	R-1	443	4.09	1540	40,250 SF/DU
Ledgewood	048A	P-7	B-2	62	-	-	Highway Business
		P-8	I-5	246	-	-	Limited Industry
		P-9	B-2	147	-	-	Highway Business
		P-10	R-1	156	4.09	542	40,250 SF/DU
		P-11	OR-10	295	-		Office Research
		P-12	R-2	184	6.58	1029	25,000 SF/DU
		P-13	I-5	246	-		Limited Industry
		P-14	R-3	25	10.97	233	15,000 SF/DU
Carey	048B	P-15	R-3	70	10.97	653	15,000 SF/DU
		P-16	B-2	41	-	-	Highway Business
		P-17	R-3	205	10.97	1912	15,000 SF/DU
		P-18	B-3	139	-	-	Planned Shopping Center
		P-19	B-2	4	-		Highway Business
		P-20	B-3	45	10.97	420	15,000 SF/DU
		P-21	I-5	189	-		Limited Industry
		P-22	R-2	107	6.58	598	25,000 SF/DU
		P-23	R-3	12	10.97	119	15,000 SF/DU
		P-24	R-1	393	4.09	1366	40,250 SF/DU
		O-48	A	29	4.12	102	40,000 SF/DU
		P-25	R-1	164	4.09	570	40,250 SF/DU
		P-26	R-1	170	4.09	591	40,250 SF/DU

Table 6-11 Population and Development - Saturation

1		2		3	4	5	6
Sub-Basin		Zone Designation		Sewered Area	Density Sewered Area	Population	
Description	Designation	Symbol	Description	Acres	Capital/Acre	People	Remarks
Flanders	056	P-3	R-1	311	4.09	1081	40,250 SF/DU
		P-4	R-3	78	10.97	727	15,000 SF/DU
		P-5	R-1	123	4.09	428	40,250 SF/DU
Clover Hill East	048C	O-44	C	12	-	-	Retail Business
		O-45	E	549	-		Rural Industry
		O-46	A	12	4.12	42	40,000 SF/DU
		O-47	S	188	17.56	2806	9,375 SF/DU Single Family
		P-6	R-1	205	4.09	713	40,250 SF/DU
Clover Hill West	083	O-38	A	328	4.12	1149	40,000 SF/DU
		O-39	B	25	8.23	175	20,000 SF/DU
		O-40	C	98			Commercial
		O-43	S	131	17.56	1955	9,375 SF/DU Single Family
Clover Hill South	048D	O-41	D-D	372	-	310	Limited Industry
		O-42	C	12	-	-	Retail Business
Stoney Brook	037	Q-6	R-80	516	2.06	904	80,000 SF/DU
		Q-7	R-120	57	1.37	78	120,000 SF/DU
		Q-8	R-40	762	4.12	2669	40,000 SF/DU
		Q-9	R-120	57	1.37	66	120,000 SF/DU
		Q-10	R-120 R-40	148	2.75	346	50% 120,000 50% 40,000 SF/DU
		Q-11	R-80	70	2.06	123	80,000 SF/DU
		Q-12	R-40	82	4.12	287	40,000 SF/DU
		Q-13	R-80	191	2.06	334	80,000 SF/DU

Table 6-11 Population and Development - Saturation

1 Sub-Basin Description	Designation	2 Zone Designation Symbol	Description	3 Sewered Area Acres	4 Density Sewered Area Capital/Acre	5 Population People	6 Remarks
Naughright	000N	Q-14	R-80	426	2.06	746	80,000 SF/DU
		Q-15	R-40	541	4.12	1895	40,000 SF/DU
North Four Bridges Road	049	Q-4	R-120	201	1.37	234	120,000 SF/DU
		Q-5	R-200	164	.82	114	200,000 SF/DU
Electric Brook	021	Q-16	R-40	1164	4.12	4076	40,000 SF/DU
		Q-17	R-120	164	1.37	191	120,000 SF/DU
		Q-18	R-120	246	1.37	286	120,000 SF/DU
		Q-19	R-80	229	2.06	401	80,000 SF/DU
		Q-20	R-200	82	8.23	574	200,000 SF/DU
		Q-21	I-1	41	-		Light Industry & Manufacturing
Fairmont Road	028	Q-22	C-1	123	-		Commercial & Business
		Q-23	R-40	221	4.12	774	40,000 SF/DU
		Q-24	R-80	115	2.06	201	80,000 SF/DU
		Q-25	R-80	29	2.06	51	80,000 SF/DU
		Q-40	Parker Acres	398		1036	do
		Q-41	Darby Dan Farms	134		348	do
Spruce Run	005	Q-26	R-80	1537	2.06	2691	do
		Q-27	R-120	131	1.37	153	do
Middle Valley	000 013	Q-28	R-80	410	2.06	718	do
		Q-29	R-120	82	1.37	95	do
		Q-30	R-120	49	1.37	57	do
		Q-31	R-120	90	1.37	105	do
		Q-32	R-80	41	2.06	72	do

Table 6-11 Population and Development - Saturation

1 Sub-Basin Description	Designation	2 Zone Designation Symbol	Description	3 Sewered Area Acres	4 Density Sewered Area Capital/Acre	5 Population People	6 Remarks
Middle Valley (continued)	013	Q-33	I-1	164	-	-	Light Industry
	024	Q-34	R-40	81	4.12	284	
	do	Q-35	R-80	820	2.06	1436	
	024	Q-36	R-80	49	2.06	86	
Turtle Back Road	004	Q-37	I-1	74	-	-	Light Industry
		Q-38	R-80	475	2.06	832	
		Q-39	R-80	98	2.06	171	

Table 6-12 Summary of Existing and/or Recommended Sewered Areas - Saturation

Basin Designation and Description			Approximate Area acres Gross	Sewered	Approximate Population people Gross	Sewered	Remarks
000	096 088 089	Budd Lake	2995	2365	11224	11224	
000	067 080	Mount Olive Complex	1907	1836	14894	14894	
076	-	Turkey Brook	986	1024	2210	2210	
000	059 000	South Branch Gorge	1459	830	4322	4322	
036	-	Four Bridges Road	653	180	315	315	
037	-	Stoney Brook	3051	2850	4807	4807	
049	-	North Four Bridges Road	505	365	348	348	
000N	-	Naughright	768	967	2641	2641	
021	-	Electric Brook	2510	1926	5528	5528	
028	-	Fairmount Road	732	1020	2410	2410	
000	013 024	Middle Valley	3276	1786	2853	2853	
005	-	Spruce Run	1548	1668	2844	-	
009	-	Turtle Back Road	921	647	1003	832	
048A	-	Ledgewood	1459	1361	1804	1804	
048B	-	Carey	2259	1568	6331	6331	
048C	-	Cloverhill East	1593	966	3561	3561	
048D	-	Cloverhill South	384	384	310	310	
083	-	Cloverhill West	864	582	3279	3279	
099 095	Rt.206S Rt.206N	Conklin Pond & Brook	1913	1727	5674	5674	
056		Flanders	639	512	2236	2236	
		Totals	30422	24564	78594	75579	

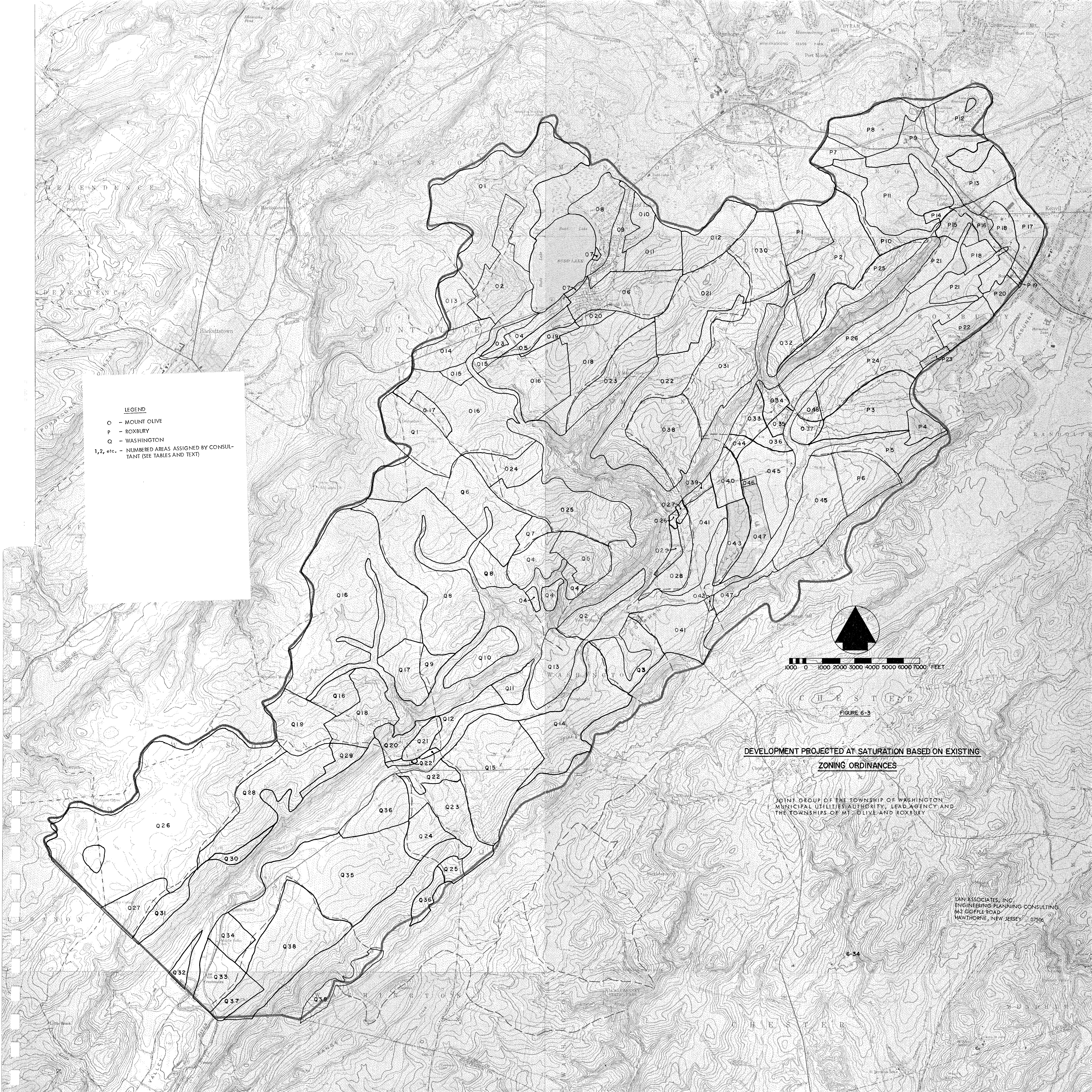

FIGURE 6-3

DEVELOPMENT PROJECTED AT SATURATION BASED ON EXISTING ZONING ORDINANCES

Those areas where density was anticipated or where soil was suitable for on-site disposal systems were, in most cases, not included in the sewered areas. The area in the northern reaches of the basin includes the Budd Lake, Mount Olive Complex, and Succasunna sub-basins are nearing the saturation densities based on the existing zoning ordinances. These areas, in turn, have also been identified with poor soil suitability for septic systems and other problems involving contamination or pollution of Budd Lake and the upper reaches of Drakes Brook. Over the past decade, large areas in the Mount Olive Complex sub-basin, have been designated "planned unit development" for garden apartments and townhouses. It is projected that in addition to the 1500 dwelling units existing, 5,000 dwelling units can be anticipated within the next 10 to 15 years.

Large areas of the basin are not now sewered, nor will they be recommended to be sewered under this Facilities Plan. These areas include all of the Spruce Run Basin, Turtle Back Road Basin; and major portions of the Middle Valley Basin, the South Branch gorge, the southern half of Turkey Brook Basin, and the highly sloped areas of the Ledgewood sub-basin. The highly sloped land of Clover Hill East, Clover Hill South, Four Bridges Road and Naughright basins along the Chester Borough border would not be sewered. Also, because of the sensitive balance, the wetlands north of Budd Lake (the bog) will not be sewered and all wet lands in general. There remains the areas that we can consider to respond to development and would be developed in accordance with the prevailing codes in the separate townships. The effect of a sewerage system in these areas would serve perhaps to accelerate the development and not necessary to induce development that otherwise would not take place there. There is always the tendency that sewers are present to encourage development, however, this can be viewed in two ways. One is to consider the growth of the nature that is intended by the zoning code. The other is to consider an entirely different nature which would require a change in the zoning code, more specifically, high-rise apartments or types of housing that concentrate large numbers of people in small areas. This type of development is not contemplated in this Facilities Plan. No provision is made in the interceptor system to accommodate the higher flows from areas that would be so developed. Also, there is no anticipation that the zoning codes or ordinances would be changed to favor any influx of industries especially of the type that are intense water consumers and hence discharge great volumes of wastewater. In summary, they induce development, as stated previously, only an acceleration of development of the character that is there now and not to multiply the population in such a manner as to entirely change the character of this region.

Should the Facilities Plan not be implemented, one can anticipate the proliferation of small sewage treatment plants as has been historically the case in the South Branch area. Several developers now appearing before the municipal boards of adjustment and planning boards are proposing small package treatment plants. For example, Century East at the northernpart on of Turkey Brook and Compton Pond and Brook sub-basins in Mount Olive and Scott Farms south of Middle Valley in Washington Township. The Schooley's Mountain treatment plant, for example, has been increased in 3 separate phases. The last one to .50 MGD with the construction of an outfall to the South Branch. Small industrial facilities would require either expansions of the existing plant if they are within economical proximity to these plants or would have to construct small treatment facilities.

In summary, the plan as proposed would not accelerate development as conceived by the master plans and existing zoning ordinances. As a matter of fact, major portions of the basin will not be sewered under this program.

6.6 <u>Sewered Population Projections Per Alternative:</u> The sewer system/interceptor network essentially follows the sub-basin designations and as was shown on the Section 3 Report figures identifying each of the alternatives. To develop flows for the sewered areas, it is necessary to assign the sewered areas and the populations to each of the under the alternatives. Table 6-13 a summary of the sewered population projections, shows the estimated population in each alternative by sub-basin designation for CY1980, 1990, and 2000 and saturation. The table includes interbasin transfer from Parker Acres and Darby Dan Farms which would be tied in by force main and pumping stations to the Long Valley interceptor. Also included is the area west of the basin ridge line at Schooley's Mountain to an elevation of approximately 1,000 ft. These interbasins transfers

Table 6-13 Summary of Population Per Alternative

1 Alter-native	2 Sub-Basin Designation	CY 1980	3 Estimated Population People CY 1990	CY 2000	Satur-ation
No. 1					
1A	Budd Lake	9066	10628	10628	11224
	Mount Olive Complex	3377	6244	13352	14894
	Turkey Brook	113	359	359	774
		12556	17231	24339	26892
1B	Electric Brook	434	1650	2229	2280
	Naughright	457	620	688	876
	Fairmont Road	1141	2510	2510	2410
	Middle Valley	76	979	2162	2641
	Stoney Brook	-	-	-	1090
		2108	5759	7589	9297
1C	Stoney Brook	1444	1991	2453	3470
	Electric Brook	408	1449	2318	3258
	North Four Bridges Road				117
		1852	3440	4771	6845
1D	Turkey Brook	317	340	340	144
	Conklin Pond & Brook	869	1711	3883	5674
	Flanders	1935	2589	3107	2236
	Clover Hill East	2018	2289	2289	3561
	Clover Hill South	-	-	-	-
	Clover Hill West	2018	2025	2025	3279
	North Four Bridges Road	-	-	185	128
	Four Bridges Road	-	185	185	315
	South Branch Gorge		344	344	699
		7157	9483	12358	16036

Table6-13 Summary of Population Per Alternative (continued)

1	2	3 Estimated Population People			
Alter-native	Sub-Basin Designation	CY 1980	CY 1990	CY 2000	Satur-ation
1E	Ledgewood	597	1168	1286	1804
	Carey	1566	3285	3285	5761
		2163	4453	4571	7565
	Totals	25836	40366	53628	66635
2A	Budd Lake	9066	10628	10628	11224
	Mount Olive Complex	3377	6244	13352	14894
	Turkey Brook	430	699	699	2210
		12873	17571	24679	28328
2B	Ledgewood	597	1168	1286	1804
	Carey	1566	3285	3285	5761
	Conklin Pond & Brook	869	1711	3883	5674
	Flanders	1935	2589	3107	2236
	Clover Hill East	2018	2289	2289	3561
	Clover Hill South	-	76	76	310
	Clover Hill West	2018	2025	2025	3279
	Four Bridges Road	-	185	185	315
	South Branch Gorge	-	344	344	700
		9003	13672	16480	23640
2C	Stoney Brook	1444	1991	2453	4807
	Electric Brook	842	3099	4547	5528
	Naughright	457	620	688	2641
	Fairmont Road	1141	2510	2510	2410
	Middle Valley	76	979	2162	2767
	Turtle Back Road	-	-	-	832
	North Four Bridges Road	-	-	185	234
		3960	9199	12545	19219
	Totals	25836	40442	53704	71187

Table 6-13 Summary of Population Per Alternative (continued)

1	2	3			
		Estimated Population People			
Alter-native	Sub-Basin Designation	CY 1980	CY 1990	CY 2000	Satur-ation
3		25836	40676	53938	73727
4A	Budd Lake	9066	10628	10628	11224
	Mount Olive Complex	3377	6244	13352	14894
	Turkey Brook	430	699	699	2210
	Stoney Brook	1444	1991	2453	4807
	North Four Bridges Road	-	-	185	234
	Naughright	457	620	688	2641
	Electric Brook	842	3099	4547	5528
	Fairmont Road	1141	2510	2510	2410
	Middle Valley	76	979	2162	2767
	Turtle Back Road	-	-	-	832
		16833	26770	37224	47547
4B	Conklin Pond & Brook	869	1711	3883	5674
	Ledgewood	597	1168	1286	1804
	Carey	1566	3285	3285	5761
	Flanders	1935	2589	3107	2236
	Clover Hill East	2018	2289	2289	3561
	Clover Hill South	-	310	310	310
	Clover Hill West	2018	2025	2025	3279
	South Branch Gorge	-	344	344	700
	Four Bridges Road	-	185	185	315
		9003	13721	16480	23640
	Totals	25836	40676	53938	71187

Table6-13 Summary of Population Per Alternative (continued)

1	2	3			
		Estimated Population People			
Alter-native	Sub-Basin Designation	CY 1980	CY 1990	CY 2000	Satur-ation
5A	See 1C	1852	440	4771	6845
	See 2A	12873	17571	24679	28328
	See 2B	9003	13672	16480	23640
		23728	34683	45930	58813
5B	Naughright				
	Fairmont Road				
	Middle Valley				
	Turtle Back Road	1919	5041	5688	7028
	Totals	25647	39724	51618	65841
6	See 5A & 5B combined	25647	39724	51618	65841
7	See 5A & 5B combined	25647	39724	51618	65841

have been discussed with representatives with EPA and DEP and have been approved for consideration in the Facilities Plan.

In summary, under Plan 6, the selected plan, the estimated population to be sewered for the design year 1990 is 40,000; almost all this population is located in the northern half of the basin.

7.0 DESIGN CRITERIA

7.0 DESIGN CRITERIA

7.1 General: The objective in the design of sewerage systems is to provide sewers and treatment facilities to meet projected demands for reasonable periods in the future. The demands are based on the projected populations to establish the sanitary sewage flows and on the expected industrial and commercial areas for their sewage flows. For the latter, particularly the industrial areas, the character of the sewage may have a pronounced effect on the treatment requirements and, therefore, should be determined or, at best, its severity be anticipated within reasonable limits. In general, the sewage collection systems, particularly interceptors, should be designed to meet demands during their normal life expectancy - about 40 years. This is so because progressive enlargement of interceptors is impractical and costly. However, construction of interceptors, as well as other local systems, is usually staged so the outer reaches of the sewerage system may be extended in the future to serve newly developed areas when the demand for sewers is sufficient to justify the investment or environmental factors compel construction. Treatment facilities, on the other hand, may be designed and constructed for the more immediate demands - usually a period of 10 years - with provision for subsequent expansion, or complimentary facilities, to meet demands thereafter. This assumes that there may be a substantial increase in demands between the initial 10 year period and saturation in the service area. When the estimated increase in demands beyond 10 years to saturation is not large relative to the plant's initial capacity, the decision whether or not to stage construction will depend upon a cost analysis.

7.2 Average Daily Flows: Current per capita daily water consumption in various localities of the study area average from 45 to 120 gallons. The overall average is 75 gallons. Allowing for infiltration and inflow, a per capita daily sewage flow of 100 gallons is used for design of the sewerage system. To this flow are added the commercial and industrial flows. Where these flows are not recorded or the area is still undeveloped, they are estimated at 3,000 gallons per acre per day for industrial zones and 1,000 gallons per acre per day in commercial zones. Table 7-1, repeated from the Section 3 Report, shows the anticipated commercial and industrial flows, which flows amount to approximately 10% of the total flow. This low percentage is expected because the zoning in the three communities is essentially residential with very little heavy industrial and "chemical process" zoning. Table 7-2 is a summary of average sewage flows foreach of the alternatives.

As discussed with municipal officials, the zoning codes encourage "clean" industries; i.e. light industries with low water consumption requirements. In any case, should deleterious waste materials be a by-product, industrial pretreatment would be required prior to discharge in the local collection system.

Table 7-1

Commercial and Industrial Flows

	Area Zoned Acres			Net Area - Acres			Average Flow - MGD		
	Present	'90	2000	Present	'90	2000	Present	'90	2000
Roxbury Township									
Commercial	287	745	1203	172	311	450	.172	.311	.450
Industrial	-(1)	312	624	-	125	250	-	.125	.750
Mount Olive Township									
Commercial	157	161	164	130	140	150	.130	.140	.150
Industrial	47	291	535	25	148	270	.075	.148	.810
Washington Township									
Commercial	-	39	77	-	30	60	-	.030	.060
Industrial	8	457	307	8	96	184	.024	.096	.552

Notes:

1. The absence of a numerical total does not necessarily mean that there is none of the particular type of land development in the Township. Rather, it indicates that these uses may be scattered throughout the township and each covers an area too small to be reflected on the land use map. In the case of Long Valley where there is a mixture of land uses - including commercial - in a limited area, the section was classified under high density.

2. Light and R/D industries are proposed in the three townships with average employee densities of 40/acre. High water consuming industries are not expected. The following is added to the domestic flow component:

   a. Industrial zones 3000 gpapd.
   b. Commercial zones 1000 gpapd.

Table 7-2

Summary of Sewage Flows

Average Flow - MGD

Alternate	Domestic '90	Domestic 2000	Domestic Sat'n	Commercial '90	Commercial 2000	Commercial Sat'n	Industrial '90	Industrial 2000	Industrial Sat'n	Totals '90	Totals 2000	Totals Sat'n
No. 1												
1A	1,723	2,434	2,689	.070	.075	.099	.203	.405	.539	1.996	2,914	3,327
1B	.576	.759	.929	.060	.060	.079	.126	.276	.368	.762	1.095	1.376
1C	.344	.477	.685	0	0	0	0	0	0	.344	.477	1.162
1D	.948	1.236	1.604	.070	.075	.099	.038	.075	.099	1.056	1.386	1.802
1E	.445	.457	.757	.311	.450	.599	.375	.750	.999	1.131	1.657	2.355
Total	4.036	5.363	6.664	.511	.660	.876	.742	1.506	2.005	5.289	7.529	10.022
No. 2												
2A	1.757	2.468	2.833	.070	.075	.099	.271	.405	.539	2.098	2.948	3.471
2B	1.367	1.648	2.364	.381	.525	.699	.596	1.155	1.539	2.344	3.328	4.602
2C	.919	1.255	1.922	.030	.060	.079	.288	.552	.736	1.237	1.867	2.737
Total	4.043	5.371	7.119	.481	.66	.877	1.155	2.112	2.814	5.679	8.143	10.810
No. 3												
3	4.068	5.394	7.373	.481	.660	.879	1.105	2.112	2.815	5.654	8.166	11,067
No. 4												
4A	2.677	3.722	4.755	.100	.135	.179	.509	.957	1.276	3.286	4.864	6.210
4B	1.372	1.648	2.364	.381	.525	.699	.596	1.155	1.539	2.349	4.044	4.602
Total	4.049	5.37	7.119	.481	.660	.878	1.105	2.112	2.815	5.635	8.908	10.812

Table 7-2 (continued)

Summary of Sewage Flows

Average Flow - MGD

Alternate	Domestic			Commercial			Industrial			Totals		
	'90	2000	Sat'n	'90	2000	Sat'n	'90	2000	Sat'n	'90	2000	Sat'n
No. 5												
5A	3.468	4.593	5.881	.451	.600	.799	.818	1.560	2.079	4.737	6.75	8.759
5B	.504	.569	.703	.025	.050	.066	.206	.400	.53	.735	1.019	1.299
	3.972	5.162	6.584	.476	.65	.865	1.024	1.96	2.609	5.472	7.769	10.058
No. 6	3.972	5.162	6.584	.476	.65	.865	1.024	1.96	2.609	5.472	7.769	10.058
No. 7	3.972	5.162	6.584	.476	.65	.865	1.024	1.96	2.609	5.472	7.769	10.058

7.3 Peak Daily Flows: Sewage flows vary considerably during a daily cycle and also during holidays compared with normal work days. These variations are the result of human activities - home occupancy, cooking, washing and bathing, etc. - which effect directly the sanitary sewage flow. Industrial flows tend to follow production rates, i.e., they remain more nearly uniform during the hours of plant operation and falls off precipitiously, sometimes completely, during shutdown,nights, weekends and holidays. Likewise, commercial flows tend to be more even during the hours of normal business with insignificant demands during nights and weekends.

A combination of the sanitary, commercial and industrial flows results in a varying pattern of sewage flow. This variation requires that the interceptors be designed to carry all sewage at the estimated peak rate of flow. Treatment plant design, however, need only have capacity for the daily rate of sewage flow at a steady rate and provide surge volume to receive sewage during periods of peak flow. The peak sanitary sewage flow is estimated as a descending multiple of the average flow as population increases. In accordance with generally accepted good engineering practice, all peak daily flow rates for populations of 1,000 or less are calculated at 5 times the average daily flow. For larger populations, this multiple decreases as shown on Table 7-3.

Table 7-3 Peak Flow Factors

Population	Ratio of Peak to Average Daily Flow
1,000	5.0
5,000	3.60
10,000	3.10
15,000	2.86
20,000	2.70
25,000	2.58
30,000	2.50
40,000	2.40
50,000	2.30
60,000	2.20
70,000	2.15
80,000	2.10

Source: Babbitt, H.E., "Sewerage and Sewage Treatment". 8th Ed.
John Wiley and Sons, Inc., New York (1953).

As the population served by an interceptor increases along its route, the peak flow rate is calculated in accordance with the foregoing. In areas where there are commercial and/or industrial flows, these are added directly to the calculated peak sanitary sewage flows to arrive at the required capacities of the interceptors. The estimated peak total sewage flow for each alternative are shown on Table 7-4.

Table 7-4 Estimated Peak Total Sewage Flows - at Saturation

Alternate	Population	Flows - MGD[1] Sanitary Average	Sanitary Peak	Commercial/ Industrial	Total Peak
1A	26,892	2.689	6.857	.638	7.495
B	9,297	.929	2.936	.447	3.383
C	6,845	.685	2.295	0	2.295
D	16,036	1.604	4.555	.198	4.753
E	7,565	.757	2.498	1.598	4.096
2A	28,328	2.833	7.139	.638	7.777
B	23,640	2.364	6.146	2.238	8.384
C	19,219	1.922	5.266	.815	6.081
3	73,727	7.373	15.336	3.694	19.030
4A	47,547	4.755	23.646	1.455	25.101
B	23,640	2.364	6.170	2.238	8.408
5A	58,813	5.881	12.672	2.878	15.640
B	7,028	.703	2.334	.596	2.930
6	65,841	6.584	15.006	3.474	18.570
7	65,841	6.584	15.006	3.474	18.570

Notes: (1) Saturation based on Existing Zoning Ordinances.

7.4 Raw Sewage Characteristics: The design criteria for raw wastewater strength for domestic sewage was discussed in 6.1 of the Section 3 report. This data has not changed since the preparation of that part of the report and the design criteria for the raw wastewater is as follows:

Parameter	Design Criteria
Bio-chemical oxygen demand (5 day, 20°C)	210 mg/1
Total suspended solids	230 mg/1
Total phosphorus (as P)	11 mg/1
TKN (as N)	30 mg/1
Total N (as N)	30 mg/1
pH	7.3
Alkalinity (as $CaCO_3$)	300 mg/1

The characteristics of any industrial wastewaters to be produced in the study area must be individually considered. The only present industrial waste in the study area emanates from the Welsh Farms plant at Long Valley. The plant discharge permit is based upon processing about 29,000 pounds per day BOD_5 at the receiving station and ice cream mix production facilities. There is some additional discussion of this waste load in part 3.3 of this section of the report.

7.5 Sewer Systems: The sewer systems in the separate alternatives consist of interceptors collecting sewage from local collection systems, existing and contemplated, in the areas currently developed or developable during the study period. Design criteria for the interceptors is the calculated peak flow as discussed in the preceding. Pipe sizes have been determined to maintain a minimum velocity of 2 feet per second when filled to 80% of the diameter. Minimum slope of pipe is 0.10%. Pipe routing is planned to maintain gravity flow and follow as much as possible existing roads and to avoid excessive slopes. Where excessive slopes cannot be avoided, drop manholes are proposed. Pipe material has been assumed as lined reinforced concrete although in final design, under a Step II grant, other pipe materials may be substituted, if they are superior in characteristics and/or cost.

The actual design of the sewer systems would be based on ASCE Manual 30 and NJDEP Design Criteria. Appendix D shows preliminary calculations for sizing the interceptors.

7.6 Pumping Stations: While every effort is made to route interceptors according to surface contours and maintain flow by gravity, this is not always possible nor entirely practical. As a consequence, interceptors slope to lower depths in some areas and require excessively deep trenches. This is costly, and hazardous. When this occurs, a pumping station is used to lift the sewage to a continuing interceptor at a higher elevation. Pumping stations are also used to pump sewage over ridge lines between sub-basins thereby avoiding long runs of gravity pipe following other routes. In these circumstances, the pumping station discharges to a force main - a pressurized sewer - that, in turn, discharges into a gravity system beyond the ridge at the next sub-basin. Pumping stations are intended for continuous operation to keep gravity sewers on the inlet side from backing up. Multi-pump installation are contemplated with automatic controls to start and stop pumps and maintain sewage level between controlled limits in a wet well. The pumping stations would operate unattended and an alarm system would alert a supervisor or other responsible person at some remote central location if any malfunction occurred. Automatic stand-by power would be provided to minimize the possibility of interrupted service.

Pumping stations at the sewage treatment plant(s) are included as part of the STP(S).

7.7 Wastewater Treatment Plants:

7.7.1 General: Parts 4.3 and 6.0 of the Section 3 report outlined the point source effluent requirements and the estimated levels of treatment which they necessitate, plus the treatment process alternatives proposed to accomplish this. Subsequent to issuing that report Section, the populations and estimated wastewater flows were revised; the new populations and flow estimates are in Section 6.0 and Section 7.0 (Table 7-1 and 7-2) of this report. Table 3-1 summarized the flows, treatment levels and waste loads for years 1990, 2000, and saturation population.

Based upon the revised population estimates for the year 1990 and 2000, the plant design capacities for both alternates were recalculated and they are summarized in Table 7-5.

Plan 1: Under Plan 1, the existing wastewater plants: WT-1 (Schooley's Mountain), WT-2 (Welsh Farms), MO-1 (Oakwood Village) and MO-5 (Eagle Rock Village/Mt. Olive Complex) would be continued in use at least until 1990 and probably through the year 2000. The existing wastewater treatment plants MO-2 (Mount Olive Township/Flanders) and R-2 (Roxbury Knolls/Skyview) plants would be abandoned with flows diverted to new plants.

Plan 5: Under Plan 5, the cost effective analysis includes a review of costs for continuing the WT-1, MO-1 and MO-5 plants in service contrasted to phasing out these plants. The existing Welsh Farms industrial waste plant will be continued in service either Plan 1 or 5, since it is meeting present discharge permit requirements and is expected to meet all future requirements except that post aeration will probably be required when the discharge permit is renewed.

7.7.2 Design Flows: The plant design capacities in Table 7-5 are based upon flow contributions of domestic wastewater, commercial areas, industrial areas and an allowance for infiltration/inflow as described in subsection 7.2 and Tables 7-1 and 7-2 of this section of the report. Each plant will have the capacity to hydraulically pass the estimated peak flows as described in subsection 7.3.

7.7.3 Treatment Levels and Processes: For point source discharges, the estimated treatment levels to achieve required removals of pollutants were summarized in Table 3-1 for the alternate plans from 1990 design to saturation population.

Process Changes from Section 3 Report: The treatment processes have changed from those shown in the Section 3 report since the treatment levels required by DEP changed to a range of level 2 to level 5, depending on the time period and related estimated wastewater flows. Pollutant removals required for treatment levels 2, 4.2, and 3 can be met with either basic trickling filter or activated sludge processes, followed by biological nitrification to the degree necessary, with effluent ammonia levels ranging from 10 mg/1 for level 2, to 4 mg/1 for level 3. Since the nitrification process once started would be difficult to limit, for practical purposes nitrification would be carried out to the range of about 2 mg/1 in treatment levels 2 through 4 (See subsection 7.7.5).

TABLE 7-5

SUMMARY OF REQUIRED DESIGN CAPACITIES
NEW WASTEWATER TREATMENT PLANTS

Plan	Plant	General Location	Estimated Flow - MGD* 1990	Estimated Flow - MGD* 2000	Existing Plant Capacity-MGD	Design Capacity MGD-1990 w/ exist. Plants	Design Capacity MGD-1990 w/o exist. Plants	2000 w/o exist. Plants
1	A	Mt. Olive Complex	1.996	2.914	.25(a)	1.75	2.00	3.00
	B	Long Valley	.762	1.095	.20(b)	.60	.80	1.10
	C	Schooleys Mt.	.344	.477	.50(c)	-	-	-
	D	Four Bridges	1.056	1.386	.25(d)	.80	1.10	1.40
	E	Roxbury	1.131	1.657	-	1.20	1.20	1.70
5	A	Four Bridges	4.737	6.750	1.0 (a, c, d)	3.80	4.80	6.80
	B	Long Valley	.735	1.019	.2 (b)	0.60	0.80	1.10
6	A	Four Bridges	5.472	7.769	1.0 (a, c, d) .2 (b)	4.40	5.60	7.90

* From Table 7-2: Summary of Sewage Flows
a = Eagle Rock Village/Mount Olive Complex
b = Welsh Farms
c = Schooleys Mountain (0.50 MGD w/discharge to S. Branch & other improvements)
d = Oakwood Village

Level 4.2: To assure a maximum BOD_5 of 8 mg/1 for level 4.2 treatment, filtration would be required. If the BOD_5 limit could be stipulated at 8 to 10 mg/1, filtration would not be necessary for the treatment process.

Level 4: For treatment level 4, filtration would be added to the previously outlined process to assure the additional removal stipulated.

Level 5: Level 5 treatment, which will be required only under Plan 5 for the major treatment facility (plant 5A), will become necessary when wastewater flows (and related waste loads) increase to those population and commercial/industrial loads estimated for the year 2000. In order to meet the level 5 effluent BOD_5 limit of 4 mg/l and basically all ammonia nitrogen removal, it would be necessary to add filtration and activated carbon adsorbtion to the treatment process after biological nitrification. Since this level of treatment (5) will not be required until the year 2000, current planning should only include allowance for possible future facilities. Reevaluation of the required treatment level, and process development changes between now and the year 2000, will likely change design requirements for the future plant expansion.

7.7.4 Physical/Chemical Processes: In addition to the biological processes briefly outlined above to meet the required treatment levels, three physical/chemical processes were also reviewed based upon available EPA cost comparison data:

1. Two stage line treatment + breakpoint chlorination + filtration.
2. Single stage lime treatment + bio-nitrification + filtration.
3. Two stage lime treatment + bio-nitrification + filtration.

Each of the above processes would produce an effluent with a BOD_5 = 10 mg/l, SS = 5 mg/l and TKN of 1 - 2 mg/l. However, since the initial screening showed all of these processes to be more costly than the biological process alternatives, and since substantially greated solids are produced from the chemical processes, these three were not further considered for the project.

7.7.5 Secondary/Nitrification Process Alternatives: The two basic biological treatment processes each have alternatives to the secondary step process. As an alternate to the trickling filter, rotating biological discs may be used as another type of attached growth reactor. For suspended growth systems, one alternative would be two stage nitrification with carbonaceous BOD removal and nitrification occurring in separate units. For this alternative process, a primary sedimentation tank would not be required. As an alternate suspended growth system, the process would consist of primary sedimentation followed by combined carbon oxidation - nitrification with a final clarifier (single stage nitrification).

7.7.6 Selection: To select the alternative attached growth and suspended growth process for the facility plan the total annual cost for the component units for each process was calculated based upon data presented in the EPA publication "A Guide to the Selection of Cost-Effective Wastewater Treatment Systems" (EPA 430/0-75-002). Data for a single stage carbon oxidation-nitrification system was developed from two stage data by allowance for longer aeration-detention time and sedimentation tank surface overflow rates as required. Cost data for the rotating biological disc alternative was developed from information furnished by a manufacturer of this type equipment. Each alternative was examined for plant sizes of 1, 2 and 5 MGD.

Suspended Growth Systems: The analysis shoed that the two step carbon oxidation-nitrification process was about 10% less costly than the one step process. The two step process was therefore selected as the suspended growth type system to be used in the alternative analysis with other systems.

Attached Growth Systems: With respect to the analysis of the attached growth processes for BOD_5 reduction, the costs for the 1 and 2 MGD plant sizes were about equal, and for the 5 MGD size, the trickling filter alternative was less costly. Considering other factors for comparison, such as recent increases in energy costs, and relative ease of maintaining rotating biological disc filters, the rotating discs are proposed as the alternative attached growth process for all plants under Plans 1 and 5, except for the 5A large plant with a projected capacity of about 5 to 9 MGD (1990 to saturation population).

Nitrification: With respect to nitrification facilities, high density rotating biological discs were reviewed as an alternative to aeration followed by sedimentation. As with the other systems which were compared, costs were developed for 1, 2 and 5 MGD plants, and the total annual cost for a 20-year period was developed on the February 1973 base to coincide with EPA data. The analysis showed that the disc alternative was about 20% more costly than the aeration system followed by sedimentation. Therefore, the aeration-sedimentation nitrification system is proposed for each of the alternative plants.

It must be noted that treatment requirements which include nitrification have been based upon low summer flow conditions. To reduce total operating costs during winter periods when low temperatures can affect the nitrification process and stream flows are higher, nitrification might be discontinued. The terms and conditions for discontinuing nitrification will have to be established with the NJDEP, and if that agency concurs, the conditions should be stipulated in any discharge permit issued.

Metering: Since stream flows are critical for all of the proposed plants (See Table 3.2), under Plans 1 and 5, it is proposed that at each point of effluent discharge a stream metering station will be constructed as part of the plant project so that stream flow and stream temperature factors can be a guide in the use of the nitrification system.

7.7.7 Disinfection Alternatives: Disinfection of the treated effluent is required to maintain possible infectious disease bacteria in the receiving waters at fecal coliform bacteria values of less than 200 per 100 milliliters. Various disinfectants including ozone, ultraviolet irradiation, bromine chloride and other miscellaneous disinfectants have been considered over the years and a few treatment plants have been constructed using these disinfectants. However, the majority of all facilities use chlorine as the disinfecting agent. Of the other available disinfectants, ozone has been used more than the others. An EPA research project on disinfection with chlorine, ozone and bromine chloride and dechlorination with sulfur dioxide started in 1974 at Wyoming, Michigan has not been published to date. EPA's October 1977 Technology Transfer newsletter indicated that ozonation was the most promising alternative to chlorination.

Trout Maintenance: Since in this study Area, the South Branch of the Raritan River from about the YMCA pond to the County boundary is a trout maintenance stream and since it has been established that free chlorine in even small amounts is toxic to aquatic life and specifically trout, dechlorination facilities must be provided for any point source discharges. Also, as previously noted, the effluent would require post aeration to provide a DO of 6.5 mg/l.

Alternatives Analyzed: In light of the dechlorination and aeration required, the alternatives for disinfection and final treatment which were reviewed consisted of (1) chlorination with dechlorination and aeration, and (2) ozonation. The design criteria used in the comparative analysis for the two systems was as follows:

	Chlorination	Ozonation
Contact Time (minutes-at peak flow rate)	20	10
Dose rate (mg/l)	10	8
Tank depth (ft.)	--	12

Other factors used in the analysis and common to both systems were maintained the same as in the EPA Guide on cost effective analysis which was prepared for chlorination disinfection. (The base year, February 1973, may still be used for comparison but not for up-to-date costs). These factors included: electricity at $0.015 per KWH, labor at $5.00 hour, service and interest factor + 27%, amortization period 20 years interest rate 5 5/8%.

Dechlorination: The chlorination-dechlorination system itself was reviewed for alternate means to dechlorinate. Dechlorination by use of sulfur dioxide is the means most commonly used. However, dechlorination by use of sulfur dioxide may remove some of the dissolved oxygen, which in the case of the Study Area plants must be maintainted at 6.5 mg/l in the plant effluent. Dechlorination therefore must be accompanied by aeration to restore the DO to 6.5 mg/l. While dechlorination by activated carbon is also possible, this method was not considered since design data is sparse and the method is still under research by the EPA at the National Environmental Research Center in Cincinnati, Ohio. It may be concluded from that agency's research paper on "Toxicity of Wastewater Disinfectants" by Robert B. Dean, July 5, 1974 that at present dechlorination by use of sulfur dioxide was the most reliable and cost effective system.

Post Aeration: Residual chlorine in an effluent is dissipated by aeration. Dechlorination by aeration was discussed with the EPA project engineer responsible for the disinfection/dechlorination research project and he was unaware of any design data available for this alternative. Therefore, dechlorination by sulphur dioxide has been included now in the chlorine disinfection/aeration alternative. If this system is constructed with post aeration facilities, plant scale study should be undertaken after the plant is operational to determine the possibility of eliminating of at least minimizing the need for sulphur dioxide dechlorination use use of the post aeration facility to dechlorinate the plant effluent.

Cost Analysis: The cost effective analysis for disinfection/aeration systems was made for three plant sizes and the results were as follows:

	Disinfection/Aeration Cost* in ¢ per 1000 gal.		
Plant Size (MGD)	1	2	5
System A			
Chlorination disinfection	2.8	2.2	1.6
Dechlorination (sulfur dioxide)	.9	.7	.5
Aeration	2.2	1.4	0.9
Total System A	5.9	4.3	3.0
System B	1	2	3
Ozonation - Total	11.8	8.4	6.1

* Total Annual Costs (Capital + operation and maintenance).

It may be concluded that the chlorination/dechlorination/aeration system is about 50% of the cost of an ozonation system and therefore that system is proposed for use in the various alternatives investigated in this study.

7.7.8 Final Process Selection: In the review analysis, the two alternative processes for biological treatment of the wastewater attached growth system vs. suspended growth system were examined by updating the EPA February 1973 data base of EPA Publication 430/9-75-002 to 1977. The updated 1977 base factors which were used in the analysis compared to the February 1973 factors are as follows:

Factor	February 1973	1977
Amortization Period (years)	20	20
Interest Rate (%)	5 5/8	6 3/8
Service and Interest Factor (%)	27	27
Labor Rate ($/hour)	5.00	6.75
Wholesale Price Index	120.00	195
EPA Wastewater Plant Index	177.50	315

The two processes which were compared consisted of the following units:

Process I	System Common to Both Processes	Process II
	Bar rack, grit removal, metering raw sewage pumps.	
Primary Sedimentation		Aeration
Attached Growth System (BOD_5)		Sedimentation
Intermediate Sedimentation		Nitrification (air)
Nitrification (air)		Final Sedimentation
Final Sedimentation		
	Chlorination	

The two processes were reviewed for various plant capacities including 0.80, 2.00 and 5.00 MGD facilities. The updated basic costs for the two processes in cents per 1000 gallons to be treated can be summarized as follows:

	PROCESS I			PROCESS II		
Plant Capacity (MGD)	0.8	2	5	0.8	2	5
Amortized Capital Cost	65.4	36.1	22.2	61.6	32.7	19.4
Fixed O&M Cost	23.5	12.1	6.7	23.6	11.9	6.4
Variable O&M Cost	8.7	6.6	5.3	10.3	8.7	7.3
Total Annual Cost	97.6	54.8	34.2	95.5	53.3	33.1

For practical purposes, it may be noted that the total annual costs are just about the same. The fixed Operating and Maintenance costs (mostly labor) are also about the same. However, the variable operating and maintenance costs which are energy and supply related are about 20 to 30% higher in the suspended growth system than the attached growth system. In the ensuing years, it is believed that energy costs will escalate at a higher rate than all other costs, therefore, the process less sensitive to energy costs would be the wiser choice at this time. For that reason, "Process I", the attached growth system with an aerating

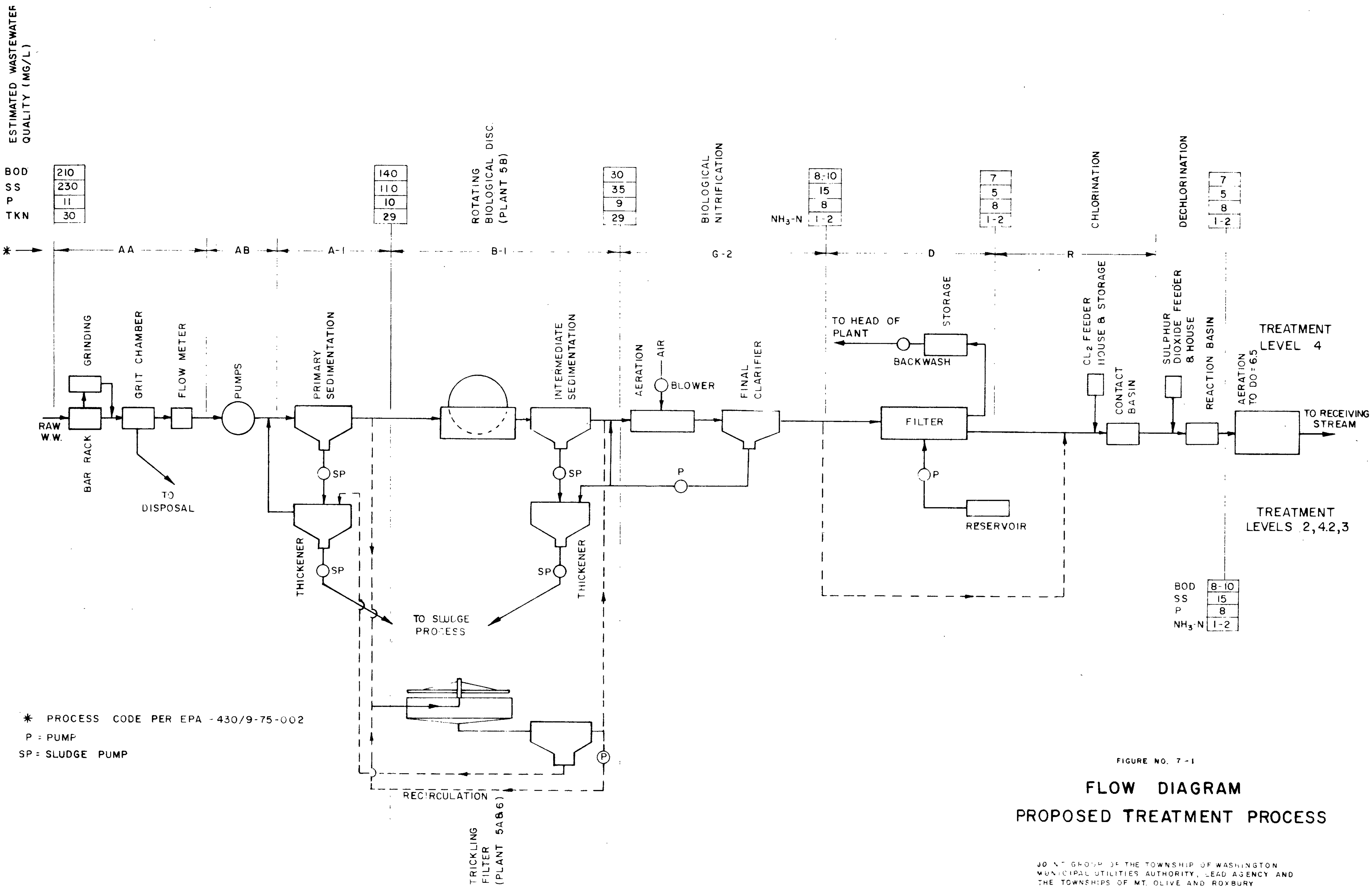

FIGURE NO. 7-1

FLOW DIAGRAM

PROPOSED TREATMENT PROCESS

JOINT GROUP OF THE TOWNSHIP OF WASHINGTON MUNICIPAL UTILITIES AUTHORITY, LEAD AGENCY AND THE TOWNSHIPS OF MT. OLIVE AND ROXBURY

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B-773

nitirification system and supplemented by dechlorination and post aeration has been selected for the various plants to meet treatment levels 2,4.2, and 3. To achieve treatment level 4, filtration will be used in the process after nitrification. Figure 7-1 shows the proposed process and the expected pollutant levels through the process.

7.7.9 Land Disposal Considerations: Effluent land disposal criteria was previously outlined in subsection 6.3 of the Section 3 report (pages 6-3 and 6-4).

Spray Rate: In observing the operation of the Eagle Rock Village/Mount Olive Complex (ER V/MOC) and Oakwood Village (O.V.) systems during warm weather operation, there did not appear to be any runoff problems in either system. The former system had some ponding conditions which could probably be attributed to a ground water condition in the spray field nearest the treatment plant. For 1976, the average application rate of the O.V. spray system was 3.36 inches/week and the ER V/MOC system was .84 inches/week.

We believe that the proposed NJDEP design standard of 2.0 inches/week is conservative and reasonable and that after more spray systems are in operation, the allowable rate could probably be increased.

Storage: In reviewing the Section 3 report, the NJDEP questioned the four month storage volume which was listed in the criteria. The storage required is a function of precipitation, evapo-transpiration, temperatures below about 25°F, and, to a lesser degree, periods of high wind velocity - which may cause bacterial aerosol contamination beyond the 200 foot buffer area proposed.

The Eagle Rock Village/Mount Olive Complex and the Oakwood Village existing land spray systems have no effluent storage facilities for periods which land disposal should not be carried out. An inspection of both spray are facilities after the January-February 1977 severe cold weather disclosed frozen effluent to heights of 4 to 8 feet around the spray heads.

It is believed that with spring rains and warm weather, the melting effluent and rain combination probably produced a runoff from both systems. The adjacent stream flows should be monitored to determine the effect. Perhaps because of higher stream flows, the pollutional effect compared to other non-point sources of pollution will be negligible. However, at this point in time, it is believed that prudent design considerations should include some storage volume for the wastewater for subsequent spraying during suitable periods.

TABLE 7-6
PRECIPITATION - FREEZING TEMPERATURE RECORD
LONG VALLEY, N. J. WEATHER STATION

		Precipitation[a]				Temperature[b]			
Year	Month	Total Days Rain	2 Day Periods	3 Day Periods	Other	1/2 Days	1 Day Periods	2 Day Periods	Other
1975	J	9	2			23	1	2	
	F	4	1			23	2		
	M	4	1			26	2		
	A	5	1	1		20			
	M	5	1			0			
	J	7	2			0			
	J	7			c	0			
	A	4	1			0			
	S	8			d	0			
	O	4		1		1			
	N	4	1			14			
	D	2	1			21	1	2	
1976	J	6	1			16	0	2	1-3 day 1-4 day
	F	3				17	0	1	1- 3 day
	M	3				18	1		
	A	2				3			
	M	3	1			0			
	J	4				0			
	J	3				0			
	A	2				0			
	S	4	2			0			
	O	8	1	1		7			
	N	0				23			
	D	2	1			19	2	3	1-4 day e
1977	J	1				13	3	2	1-3 day 2-4 day
	F	1				15	1	2	

a Greater than 0.5"
b Less than 32° F
c 1, 5 day period
d 8 days within a 9 day period
e Except for 13, 1/2 days (only two consecutive) the temperature was below freezing 38 consecutive days from Dec. 27, 1976 to Feb. 2, 1977

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The EPA design data indicates the need for storage during unfavorable periods. "Unfavorable days" are defined as (1) mean temperature less than 32°F, (2) precipitation greater than 0.50 inches/day and (3) snow cover of greater than 1 inch. A tabulation (7-6) of frequency of rainfalls greater than 0.5 inch and temperatures less than 32° F was made for 1975, 1976 and January and February 1977 based upon the Long Valley weather station. Snow on the ground is not recorded for the Long Valley Station. The nearest station recording this data is at Morris Plains. That record showed the following:

Year	Month	Record of 1" or more of Snow on the Ground	
1975	January	1	9 day period
	February	1	2 day period
		1	4 day period
	March	1	1 day period
	December	2	1 day period
1976	January	1	2 day period
		1	6 day period
	February	1	2 day period
		1	6 day period
	March	1	3 day period
	December	1	1 day period
		1	6 day period*
1977	January	entire month*	
	February	1	15 day period*
		1	4 day period

* Starting with the six day period in December 1976, snow was on the ground continuously until February 16, 1977 - a period of 52 days.

In October 1977, the EPA published the "Process Design Manual for Land Treatment of Wastewater" (EPA 625/1-77-008). This manual was jointly prepared by the Environmental Protection Agency, the U.S. Army Corps of Engineers and the U.S. Department of Agriculture. Figure 3-6 (page 3-13) of this publication indicates a general requirement of 60 days storage in the New Jersey area. A computer program is available for calculation of storage requirements for a project, however, it was not used in this study since the high cost for the land disposal alternative indicated that the land disposal alternative was not cost effective.

Our conclusion from this survey of the factors which affect land spray systems is that a minimum storage capacity of 8 weeks average design flow should be included in any land spray system in the Study Area. Even with that storage volume, it is probable that spraying may still have to be performed during some days when there would be little or no percolation or evaporation.

Soil Suitability: Although the soild suitability with regard to land spraying has been deemed to have moderage to severe limitations in most of the study area, there have been no apparent problems at the Oakwood Village operation with its continuous high rate of application (except for the severe cold period December 1976 to February 1977). Similar areas of soils and topography are available at the Plan 1, Plant A, C and E sites and better soils and topography are available at Plant B and D sites and all other sites downstream of the confluence of the South Branch and Drakes Brook.

Required Land Area: The required land area for land spray disposal of the effluent was estimated for each alternative plant based on the following criteria:

Maximum weekly spray rate	2 inches/week
Non-operating time	8 weeks
Buffer strip width	200 feet

On sites that were not relatively flat, additional area allowance was added to the required spray area for effluent storage ponds because of the smaller sizes of storage ponds which must be constructed on sloping ground to produce the total storage volume required. On the flat sites, the storage ponds were assumed to be within the buffer area. Table 7-7 summarizes the required land disposal areas (for all plants for 100% land disposal of effluent).

7.7.10 Solids Disposal: Four alternatives for solids waste (sludge) treatment were presented in part 6.5 of the Section 3 report:

Process	Treatment
S-1	Anerobic digestion + sludge drying beds
S-2	Anerobic digestion + mechanical dewatering (by vacuum filter, centrifuge or filter press)
S-3	Heat treatment + dewatering + incineration
S-4	Dewatering thickened raw sludge + incineration

In the review of the Section 3 report, the DEP and EPA requested the analysis of a fifth alternate - the composting of the solids wastes. Composting has been under study for several years by the EPA primarily at Beltsville, Maryland in cooperation with the Maryland Environmental Service, Department of Natural Resources which agency operates the Beltsville composting facility. A process has now been developed for the composting of raw sludge (static pile-forced air process) in conjunction with other bulking material such as wood chips. The windrow method which was developed first, requires a larger land area for composting and periodic turning of the compost windrows.

The "Phase 2 Report of Technical Investigation of Alternatives for New York-New Jersey Metroplitan Area Sewage Sludge Disposal Management Program" prepared for the Interstate Sanitation Commission, June 1976 indicates that the recommended plan for ultimate disposal of sludge for the western Morris County area should be by land application of the stabilized sludge.

In July 1977, the DEP issued "Interim Guidelines for the Preparation of 201 Sludge Management Plans. The guidelines indicate that "the aerobic composting of sludge is considered by the DEP to be the most desirable technique for the stabilization of sewage sludge prior to land application".

The composting of raw sewage sludge by the static pile method has been compared to the four other stabilization alternatives considered for the project in a second, more detailed cost effective analysis of sludge treatment/disposal alternatives.

Preliminary Design Criteria: In preparing the cost effective analysis for the various sludge stabilization processes the following preliminary design criteria was used for the various components of the alternative processes:

Anaerobic Digestion (two stage)

Digester capacity - Volatile solids loading of .16 lb/day/ft^3

Primary Digester provided with:

- mixing equipment
- heat exchanger (sewage gas/oil)
- floating cover
- side water depth - 25' minimum
- bottom slope - 1 on 4 minimum

TABLE 7-7
AREA REQUIRED FOR LAND DISPOSAL[a]
OF EFFLUENT
ALTERNATE PLANS AND PLANTS

		1990		2000		Saturation	
Plan	Plant	Design Flow (MGD)	Req'd Land Area (Acres)	Design Flow (MGD)	Req'd Land Area (Acres)	Design Flow (MGD)	Req'd Land Area (Acres)
1	A	1.75	442[b]	3.00	745[b]	3.40	832[b]
	B	.60	167	1.10	290	1.40	350
	C	.35	102[b]	.50	149[b]	1.20	308[b]
	D	.80	220	1.40	350	1.80	440
	E	1.20	308[b]	1.70	431[b]	2.40	591[b]
5	A	3.80	900	6.80	1580	8.80	2000
	B	.60	167	1.10	290	1.30	320
6	A	4.40	1030	7.90	1840	10.10	2220

[a] Based upon following criteria
- 2 inches/week application rate
- Eight weeks non operating time
- 200' buffer area around spray field

[b] Additional area added for effluent storage ponds because of topography

[c] Assuming continuation of Eagle Rock Village/Mt Olive Complex, Welsh Farms, Schooley's Mountain and Oakwood Village existing treatment facilities.

Secondary Digester provided with:

floating cover

side water depth - 25' minimum

bottom slope - 1 on 4 minumum

Sludge Drying Beds (open)

Area, - 18,500 sq. ft./million gallons day capacity (1.85 sq. st./capita)

Sand thickness - 12" (over graded gravel)

Vacuum Filter

Sludge feed - 5 to 6% solids (except from heat treatment = 10% $\pm$)

dewatering capacity - 5#/sq. ft./hr. (except heat treatment = 10#/sq.ft./day)

12 hour/day operation

System includes

Ferric chloride and lime storage/mixing and feed (except for heat treatment)

Vacuum pump

Filtrate receiver and pump

Heat Treatment

Operating time - continuous

Reactor detention time - 30 minutes

Temperature 390°F

Supernatent aeration - 1000 ft^3/# BOD

Incinerator

Type -Multiple hearth

12 hour/day operation

Operating temperature 1400°F

Includes afterburners and air scrubbers

Composting (Raw Sludge) Static Pile Method

Mixing, Composting, Storage Area - concrete

Compost time allowance - 21 days

Curing pile storage time - 30 days

Total storage time - 1 year

Equipment included:

- Rubber tired front end loader - 3 cy capacity
- Composter/Mixer
- Shredder/Screen - 100 cy/hr capacity
- Brush chipper
- Dump truck - 20 cy capacity
- Tractor/spreader wagons

Land Disposal

Spreading Rate	Approx. Area req'd (acres)
Digested sludge 10 tons/acre	262
Composted sludge 20 tons/acre	131

Spreading Period, 12 weeks

April 1 to May 15

October 1 to November 15

Dry Sludge

spread by tractor drawn manure type spreaders

Liquid Sludge

injected in furrows with knife type injection system by tank trucks with high flotation type chassis

8.0 ALTERNATIVES

8.0 ALTERNATIVES:

8.1 Technical Considerations: The plan for a wastewater collection and treatment system results after considering and assessing many factors. The more extensive the sewerage system may be, the more it is probable there will be numerous alternatives as to routing of sewers and the number and locations of treatment plants. The South Branch study area is extensive and includes major portions of the townships of Mount Olive, Washington, and Roxbury. Population is distributed unevenly being higher in the northern part of the basin and in concentrations where development was encouraged by topography and accessibility from major highways. The pattern of population distribution has created areas of concentration where continued dependence of septic systems is unfavorable and the need for sewers and treatment plants is manifest. Continued growth of population in the study area will increase existing concentrations, create new ones, and intensify the wastewater disposal problems.

The development of alternatives in each case recognized the need to provide sewerage systems for those areas where population concentrations, and resulting domestic loads, are high and the need for the system is current. Based upon land use and population estimates, the configuration of the interceptor systems was conceived to allow for a logical extension of the initial system to serve new areas as they may develop sufficiently to make sewers economically and environmentally feasible. The process of routing interceptors to reach areas of concentrated population - existing and projected - followed topographic constraints, ie., local collection systems were assumed to follow as nearly as possible surface grades in separate sub-basins and to avoid crossings of ridge lines where pumping would be necessary. Pumping stations, thus were limited to the few where they were justified in lieu of long gravity sewers. The proposed sewers in all alternatives, therefore, are designed for gravity flow, except for the few instances where pumping stations and force mains are contemplated.

Interceptor routings have been selected to favor gravity flow in local collection systems and follow as nearly as possible existing roads touching those areas to be sewered. Aside from the topographic constraint, the interceptors were routed in various alternatives to achieve a logical grouping of sewered areas with a treatment plant. The latter was located with due regard for its effect on stream quality and alternate on-site disposal of plant effluent. Groupings of sewered areas were selected alternatively to favor contiguity of sub-basins, continuity of gravity flow, and automony of control by political sub-division (separate townships).

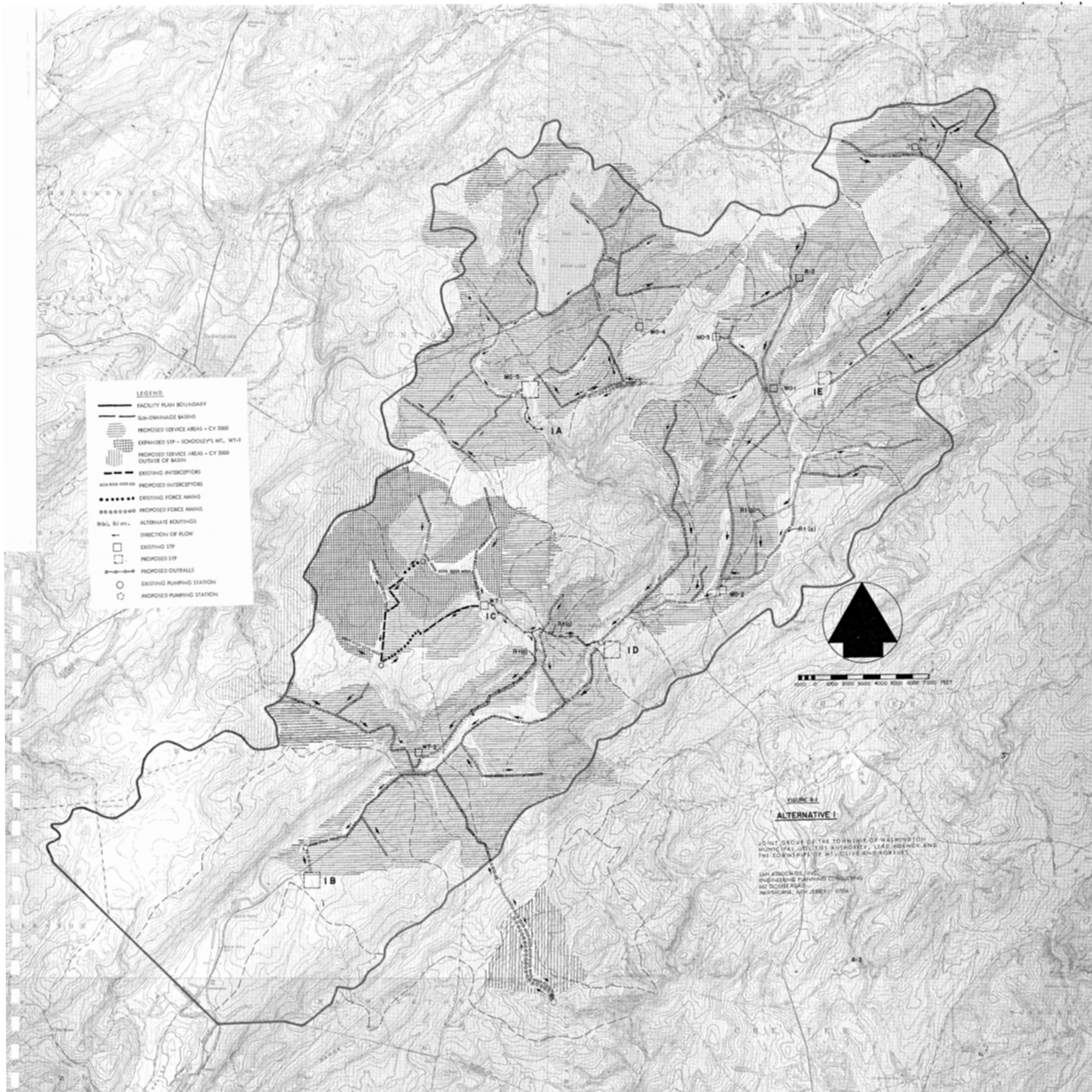
8.2 Proposed Alternatives: A total of 7 alternatives were proposed for intensive consideration and analysis. These alternatives differ basically in the number and locations of treatment plants and the routings of the interceptors. Practically all of the separate sewered areas are common to all alternatives and, consequently, do not affect comparisons. Where an area is included in some alternative and excluded from others, it would be treated as a variable in economic analysis. The separate alternatives are described in the following.

8.2.1 Alternative No. 1: This alternative includes 5 separate collection systems, each with its treatment plant. These are shown on Figure No. 8-1 and described as follows:

System No. 1A: This collection system would originate in the basin area around Budd Lake and progresses south to the proposed treatment plant site on the South Branch of the Raritan River identified as MO-B. The collection system also would include the area south of the South Branch as well as a very small area in the northwest corner of Washington Township. Otherwise, the entire 1A collection system would include the more intensely developed area in the western part of Mt. Olive Township. The drainage area along Turkey Brook would be excluded.

System No. 1B: The sub-drainage areas along the South Branch of the Raritan River south of the confluence with Drakes Brook is included in this alternative. The principal interceptor would run from the vicinity of Four Bridges to a point south of Long Valley and would serve the community along Mill Road north of Beacon Hill Road. An interceptor would collect from the area along Route 24 and the western boundary of the study area. The proposed treatment plan would be located south of Long Valley.

System No. 1C: All the area on the western side of the study area, not included in System 1A and 1B, is included in this alternative. This is generally referred to the Schooley's Mountain area, and, in this study, also includes some area just west of the basin ridge line in the vicinity of Flocktown Road and Spring Lane as previously described. This alternative contemplates treatment at the existing Schooley's Mountain plant with an outfall sewer following Stoney Brook and discharging into the South Branch, as prescribed by the New Jersey DEP. The existing treatment plant, by the addition of 3 bio discs, can treat up to 600,000 gals per day.


LEGEND
FACILITY PLAN BOUNDARY
SUB-DRAINAGE BASINS
PROPOSED SERVICE AREAS – CY 2000
EXPANDED STP – SCHOOLEY'S MT. WT-1
PROPOSED SERVICE AREAS – CY 2000
OUTSIDE OF BASIN
EXISTING INTERCEPTORS
PROPOSED INTERCEPTORS
EXISTING FORCE MAINS
PROPOSED FORCE MAINS
ALTERNATE ROUTINGS
DIRECTION OF FLOW
EXISTING STP
PROPOSED STP
PROPOSED OUTFALLS
EXISTING PUMPING STATION
PROPOSED PUMPING STATION
IA
IB
IC
ID
IE
MO-1
MO-2
MO-3
MO-4
MO-5
R-2
R1 (a)
ALTERNATIVE I
JOINT GROUP OF THE TOWNSHIP OF WASHINGTON
MUNICIPAL UTILITIES AUTHORITY, LEAD AGENCY AND
THE TOWNSHIPS OF MT. OLIVE AND ROXBURY
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System No. 1D: An area in the southwest of Roxbury and the eastern part of Mt. Olive, not included in System No. 1A nor Turkey Brook, are included in this alternative. This may be identified as all of the Drakes Brook Basin in Mt. Olive. The interceptor would conduct sewage to a treatment plant at either of two alternate locations in the vicinity of the confluence of the South Branch and Drakes Brook.

System No. 1E: All of the Drakes Brook Basin in Roxbury would be included in this alternative. The treatment plant would be located south of Valley Airport at Drakes Brook. The interceptor would follow the general route of Drakes Brook.

8.2.2 Alternative No. 2: The number of collection systems in Alternative No. 2 has been reduced to 3 as shown on Figure No. 8-2 and described as follows:

System No. 2A: This plan is the same as System No. 1A with the Turkey Brook Basin added. The proposed treatment plant would remain the same as in System No. 1A. Sewage collected downstream of the plant would be pumped back via a force main following the South Branch.

System No. 2B: All of the basin from the confluence of the South Branch and Drakes Brook is included in 2B. This would exclude the area in System 2A and would, in effect, combine Systems 1D and 1E. A treatment plant would be located in the vicinity of the confluence of the two streams as shown on Figure No. 8-2.

System No. 2C: This alternative includes all of the southern part of the basin from the Hunterdon/Morris County line to the confluence of the South Branch and Drakes Brook. Also included is the Schooley's Mountain area. The treatment plant would be located to the south of Middle Valley. Essentially, System No. 2C combines Systems 1B and 1C and adds the Middle Valley area to the collection system.

8.2.3 Alternative No. 3: This alternative, shown on Figure No. 8-3, provides for collection in the entire basin by a single system of interceptors. All areas as in Alternatives 1 and 2 are included and all wastewater would be treated at a plant located near the Hunterdon/Morris County line. In general, the interceptors would follow the same routes in the other alternatives, but leading to the one closest to the South Branch rather than to separate treatment plants.

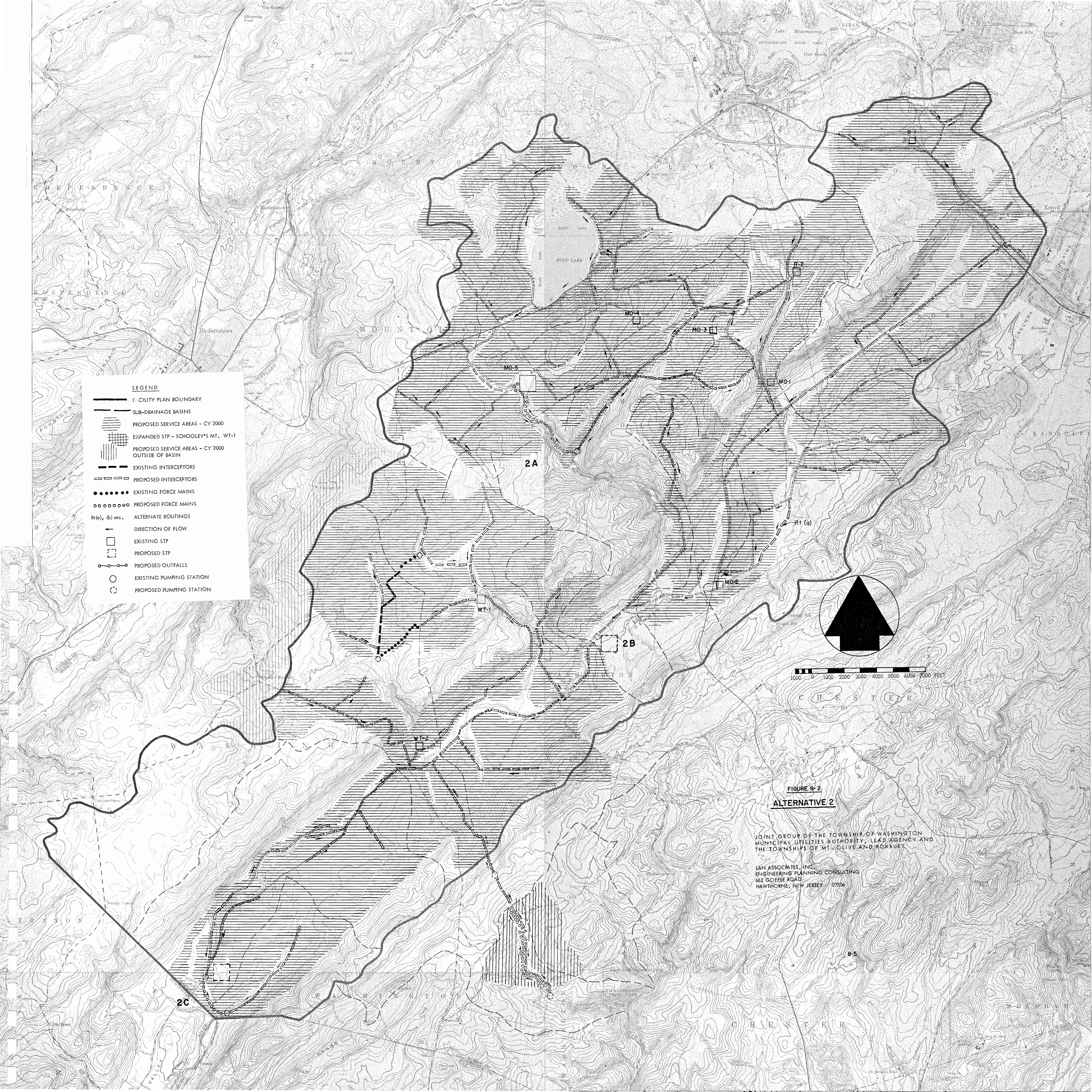

FIGURE 8-2

ALTERNATIVE 2

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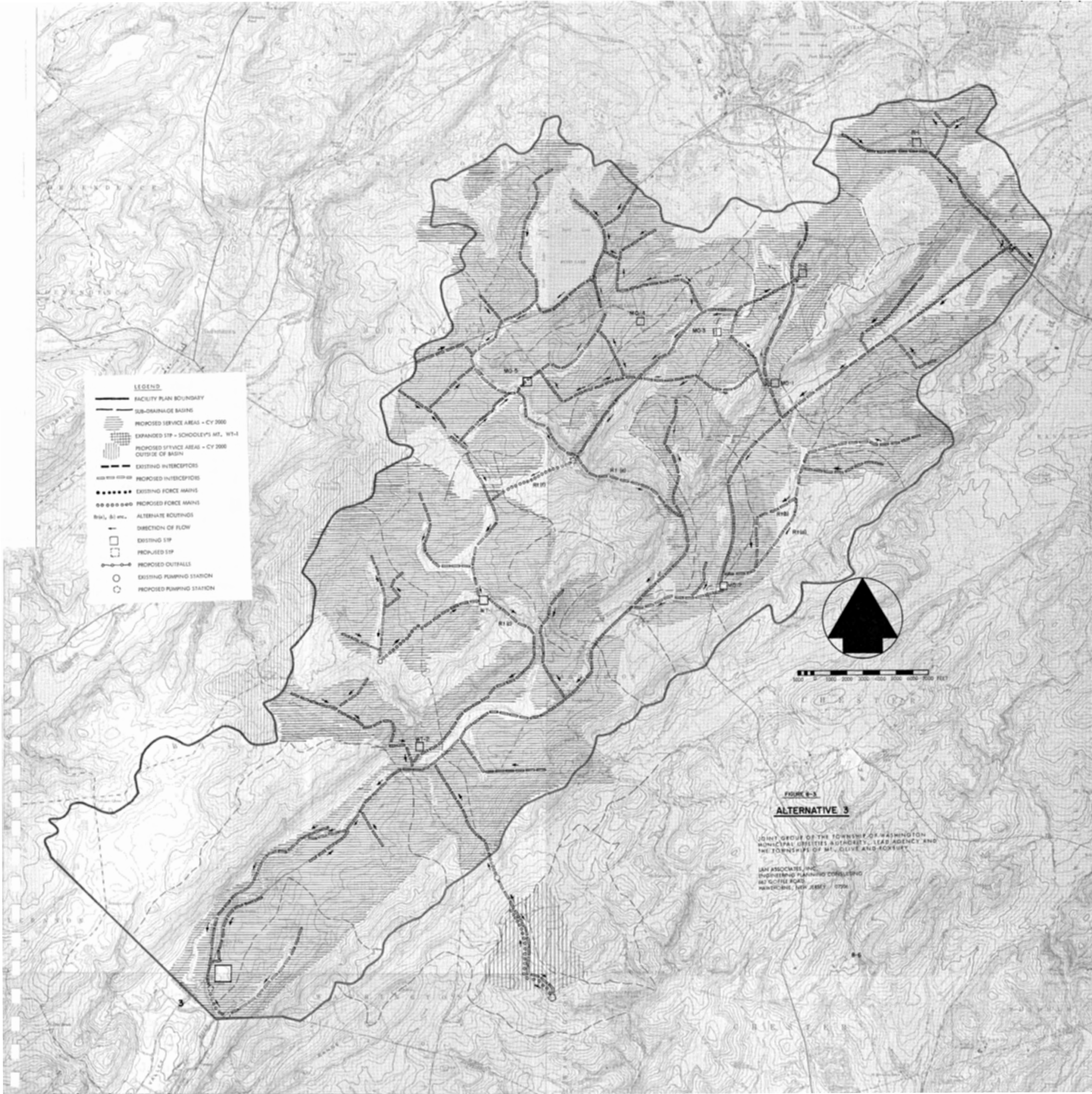

FIGURE 8-3

ALTERNATIVE 3

8.2.4 Alternative No. 4: Two separate collection systems and treatment plants, shown on Figure No. 8-4, are proposed in this alternative to serve all the areas as in the preceding alternative.

System No. 4A: The South Branch basin and Turkey Brook basin would be collected at the location of treatment plant MO-B in Mt. Olive. From here, the wastewater would be pumped and delivered by a force main into the Schooley's Mountain area. The system would include then all the areas below the confluence of the South Branch and Drakes Brook. This alternative, therefore, combines Systems Nos. 2A and 2C, substituting the pumping station for the treatment plant in 2A and provides a single treatment plant for the entire system near the Hunterdon/Morris County line as in Alternative No. 3.

System No. 4B: This system includes all of the basin from the confluence of the South Branch and Drakes Brook and is the same as System No. 2B.

8.2.5 Alternative No. 5: Like Alternative No. 4, this alternative contemplates two separate collection systems each with a treatment plant. The grouping of these areas in each system is shown on Figure No. 8-5 and described in the following:

System No. 5A: The areas previously described in System Nos. 2A, 2B and 1C would be combined and treated at a plant located near the confluence of the South Branch and Drakes Brook. This alternative would combine the basin from the confluence of the South Branch and Drakes Brook with the Schooley's Mountain area.

System No. 5B: A small treatment plant located just south of Long Valley would serve this area and immediate developed areas. The area south of Middle Valley to the County line would not be included in the sewered areas under this alternative.

8.2.6 Alternative No. 6 : Plan 6 combines plants 5A and 5B into a single regional treatment plant located at the 5A plant site (confluence plant - see Figure 8-5).

The areas of Long Valley and part of Middle Valley previously serviced by the Alternative 5B plant would be serviced under Alternative 6 by the construction of a forced main and pumping the sewage up to the confluence plant site. This is the selected plan.

8.2.7 Alternative No. 7 : Like Alternative 6, Alternative 7 (see Figure 8-5) combines the two separate treatment plants of Alternative 5 into a single regional treatment plant

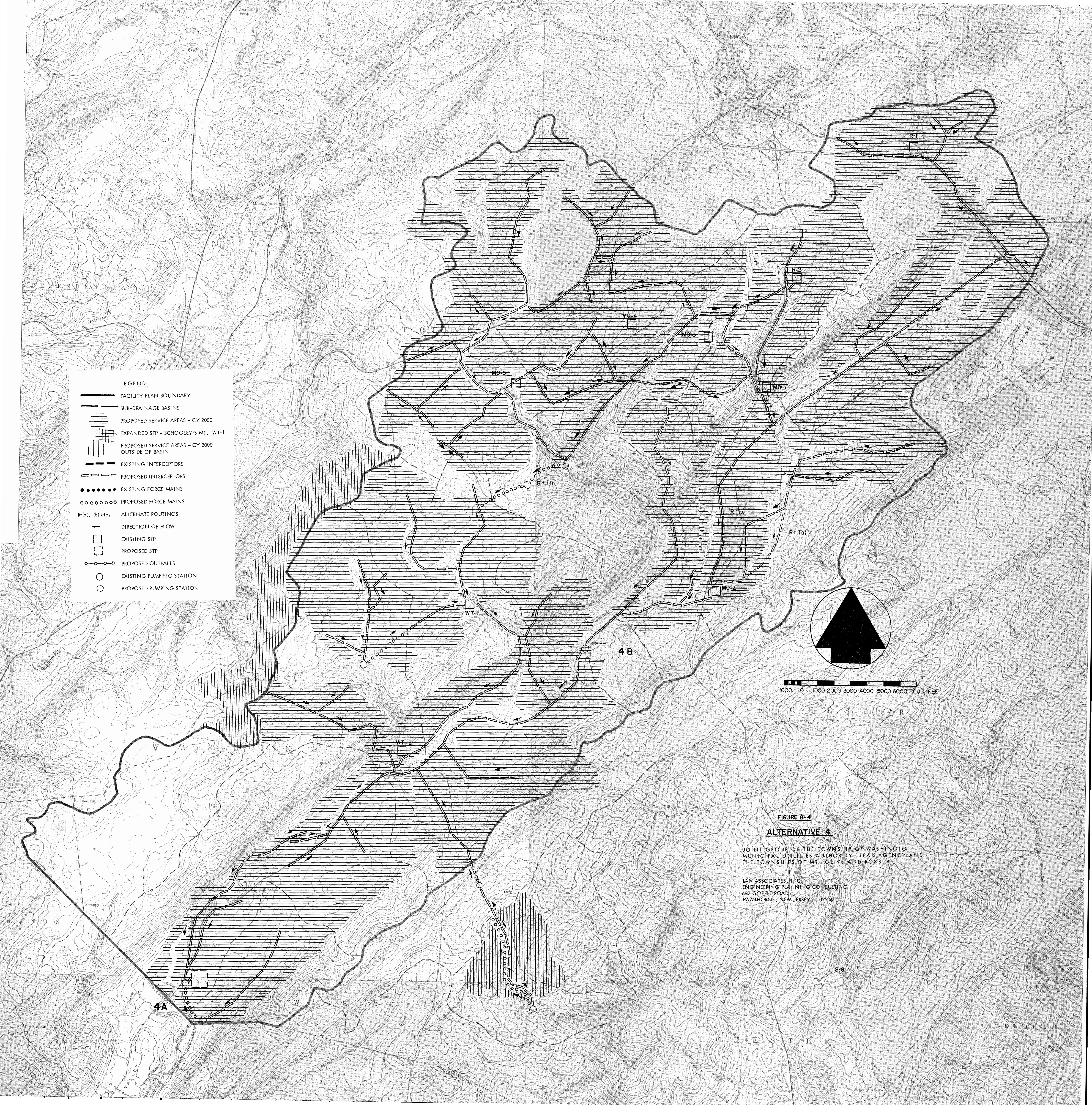

FIGURE 8-4

ALTERNATIVE 4

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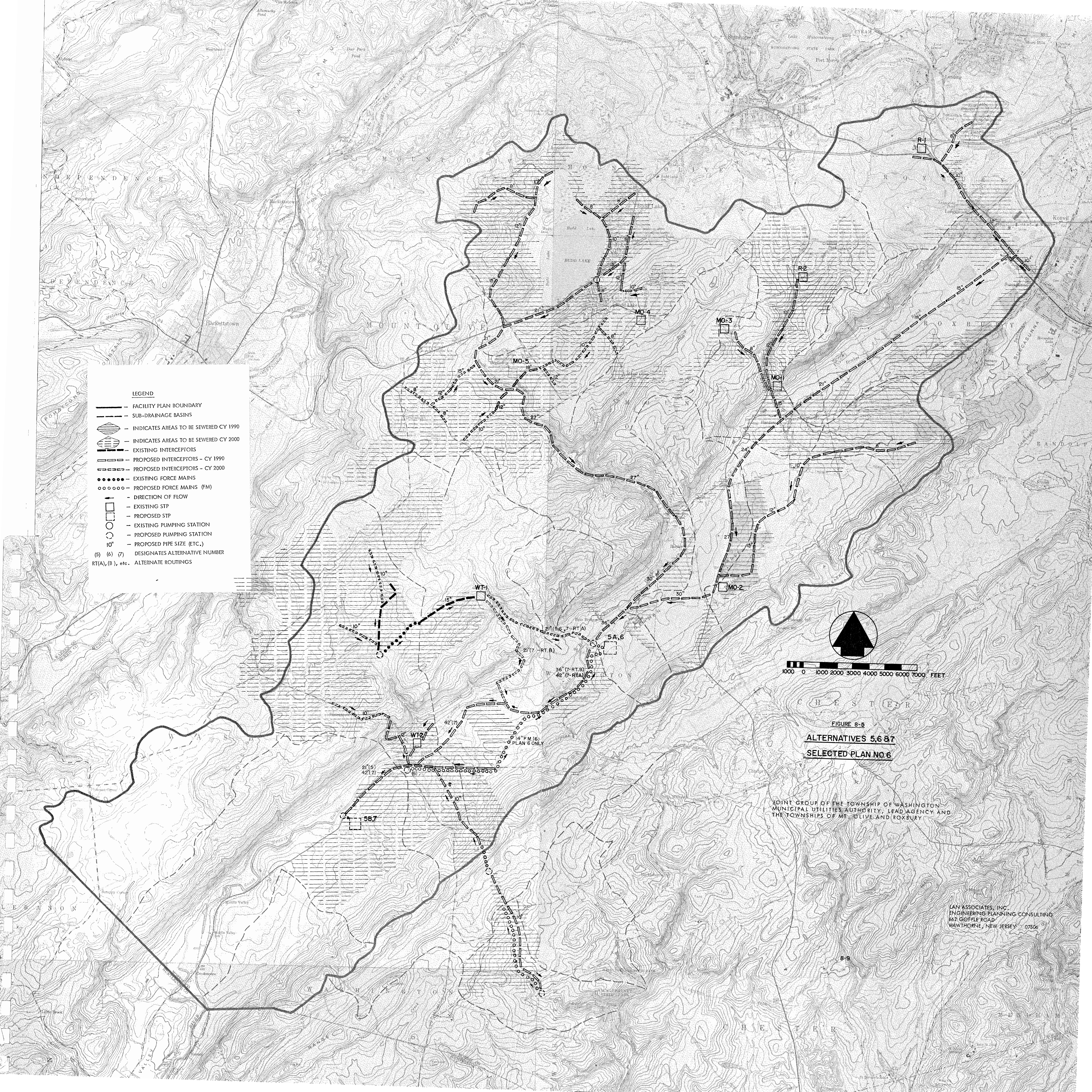

FIGURE 8-5

ALTERNATIVES 5,6 & 7

SELECTED PLAN NO. 6

located at the 5B plant site south of Long Valley. This plan would service the area of Long Valley and Middle Valley by gravity sewers thus the forced main required for Alternative 6 would be eliminated under Alternative 7.

As the Cost Effectiveness Study progressed and the data computed and analyzed, the Consultants found it necessary to revise the alternatives under consideration and to develop two additional alternatives, Nos. 6 and 7, which became variations of Alternative 5. The Cost Effectiveness Study demonstrated that one plant at the confluence of the South Branch and Drakes Brook would be much more cost effective due to lower capital, operating and maintenance costs. This analysis is developed further in Section 8.

It will be noted that the length of the interceptors and the service areas have been decreased from the Section 3 report - Alternative No. 5 to that shown on Figure 8-5 Alternative Nos. 5, 6, and 7. It was determined that since the issuance of the Section 3 report, cost, population, and development factors justified the revised and reduced areas to be serviced.

8.3 Individual and Cluster On-Site Disposal Systems: In dividing regions into sewered and unsewered areas, there are marginal areas that cannot be economically incorporated in a proposed sewerage system but in which developments are sufficiently concentrated to warrant special consideration. The manner in which wastewater in these areas is collected and treated can vary depending upon the basic factors of density of development, and distance from an interceptor or local collection system. As an extreme illustration, a single-family dwelling remotely situated cannot be tied to a collection system economically and, of necessity, would require on-site disposal. A more concentrated development, also remotely situated and beyond the capabilities of an on-site (septic) disposal system, would have to have an alternate means of wastewater collection and treatment. This could be a collection system and small, or package, treatment plant. In lieu of the package treatment plant, a holding tank could be used to collect wastewater for several days. This would be pumped out periodically and the wastewater hauled by tank truck to a treatment plant or a receiving location in the interceptors system. Such a system, regardless of its design characteristics, would be a part of the local collection system to be analyzed in connection with that system in each of the townships, i.e., individual and cluster on-site disposal systems are not part of the proposed regional interceptor systems and, therefore, beyond the scope of this facilities plan. However, the probability that some wastewater would be collected and delivered to the regional system is recognized and anticipated in the design of interceptors and treatment plants.

Upon reviewing the final plan, it can be seen that approximately 70 percent of the basin will not be sewered and hence these areas will continue to utilize on-site disposal systems. In any case, provisions will be made at the regional plant for the receiving and treatment of septic tank "pump out" waste.

8.4 Treatment Plant Alternative Plans: Alternative plans 2,3, and 4 were excluded from further analysis by preliminary screening. A cost effective analysis was made for plans 1 and 5. The cost factors in making the analysis (amortization period, interest rate, service and interest factor, labor rate, wholesale price index and EPA treatment plant index) were the same as outlined in Section 7.7. To be more site specific additional cost allowances were added to the various treatment unit costs for the following items:

Yard Work	Fences, roadways, lawns, stream metering station, clearing and grading, on-site piping, and job mobilization
Buffer Land Areas	300' around plant site proper
Effluent Outfall	
Administration Building	Office area, laboratory and equipment, repair shop, garage, lunch and locker room, storage area.

The treatment plant costs developed for the analysis are not total project costs in that all site specific conditions have not been included. The cost analyses do not include sludge treatment and ultimate disposal costs. These costs were excluded since the analysis must include a composting alternative. The cost of composting is highly sensitive to composting equipment costs. The loader, screening equipment and trucking equipment required for a 1 MGD plant is the same as for a 5 MGD plant. Also, the equipment costs represent about one third of the total capital costs for the composting alternative. Duplication of composting and ultimate disposal equipment for each of the five municipal plants under Plan 1 or two plants under Plan 5 is not a reasonable solution; therefore the screening of final alternatives was performed as follows:

1. Liquid treatment cost analysis for Plans 1 and 5 for Point Source Discharges (see Table 8-1)
2. Liquid treatment cost analysis for Plans 1 and 5 for Land Application (see Table 8-2)
3. Liquid treatment cost analysis for Plans 6 and 7 for Point Source Discharges (see Table 8-3)
4. Preliminary screening of Sludge Treatment processes S-1 to S-4 (see Table 8-4)
5. Sludge treatment cost analysis - Selected Process from Preliminary Screening vs Digestion and Liquid Injection (see Table 8-5) and vs Composting (see Table 8-6)

Under Plans 1,5,6, and 7, the existing Schooleys Mountain plant (1C), the Eagle Rock Village plant and the Oakwood Village plant would be continued in service until about the year 2000.

8.4.1 <u>Liquid Treatment Alternative - Plans 1 and 5:</u> Plan 1 treatment plants would all have the same treatment process which was described under Section 7.7 of this report. The major liquid phase treatment units would consist of bar rack, grit removal, metering; raw sewage pumping; primary sedimentation; attached growth (rotating biological discs) BOD reduction system; biological nitrification (aeration); final sedimentation, chlorination, dechlorination and aeration to increase effluent DO. Since Plan 1 is basically a plan which could be implemented individually by each participating municipality a new combined administration building, laboratory facility, garage-repair shop is included in the cost analysis for each municipality. Such facilities are included in the cost of the treatment plants for Plant 1A (Mount Olive @ existing Eagle Rock Village site), Plant 1B (Washington Township @ Long Valley plant site), and at Plant 1E (Roxbury plant site). For this reason it may be noted in Table 8-1 that the 1B plant (.6 MGD capacity) has the same estimated capital cost as the 1D plant (.8 MGD capacity)- which does not have an administration building. Under Plan 1 it is also proposed to provide an effluent aeration system at the existing Schooley's Mountain (1C) plant to increase the effluent DO to 6.5 mg/l.

Under Plan 5 the treatment process would be the same as Plan 1 except that high rate trickling filters would be used in place of the rotating biological discs for BOD_5 reduction (at the 5A plant) and filtration would be used as an added process unit after final sedimentation. The major 5A plant (3.8 MGD capacity) would include a combination administration building with laboratory etc., since only minimal office area will be provided at the 5B plant site.

Table 8-1 summarizes for each plant (with point source discharge) in Plan 1 and 5, 1990 plant design capacity, required land area, unit land cost used in the analysis, required treatment level, annual manhours operating time, capital cost and total annual cost. A review of Table 8-1 indicates that the total capital cost and total annual cost of Plan 5 is considerably less costly than Plan 1.

A similar analysis of alternatives was made for Plan 1 and 5 plant alternatives with disposal of the wastewaters by land treatment. The result of the analysis is summarized in Table 8-2, which shows the land area required, unit land cost used, capital cost and total annual cost for each plan and plant. Because of the large land area required for land disposal and the relatively high land cost in the north portion of the study area, the capital cost and total annual cost of Plans 1 and 5 are about 100 percent greater than treatment facilities with point source discharges.

Based upon costs, wastewater treatment facilities with point source discharges were selected over the land disposal system and also based upon treatment plant costs, Plan 5 consisting of a new major plant (Plant 5A - 3.8 MGD) at Four Bridges near the confluence of the South Branch of the Raritan River and Drakes Brook and a new plant, (Plant 5B - .6 MGD) at Long Valley was selected over Plan 1. The existing Schooleys Mountain, Eagle Rock Village, Oakwood Village plants and Welsh Farms treatment facilities would be maintained as part of the facility plan.

8.4.2 <u>Liquid Treatment Alternatives - Plans 6 and 7</u>: Upon completion of the analysis of Plan 1 vs Plan 5 an immediate additional alternative became obvious - the use of one plant of 4.4 MGD capacity to serve both the 5A and 5B sites. The plant could be at the 5B site with all wastewater routed to that site via an extended interceptor from the 5A site or

TABLE 8-1
LIQUID TREATMENT COST ANALYSIS
PLANS 1 AND 5 (1990)
POINT SOURCE DISCHARGES

	PLAN 1[1]						PLAN 5[1]			
Plant Designation	1A	1B	1C	1D	1E	TOTAL PLAN	5A	5B	1C[2]	TOTAL PLAN[1]
Design Capacity (MGD)	1.75	.6	.5[2]	.8	1.2	4.85 [1]	3.8	.6	.5 [2]	4.9 [1]
Plant Location/ Service Area	Eagle Rock Village/Budd Lake	Long Valley	Schooleys Mountain	Four Bridges	Roxbury @ Mt. Olive Boundary		Four Bridges	Long Valley	Schooleys Mountain	
Land Area-Including buffer (Acres)	29	22	- -	22	25	98	31	22	- -	53
Unit Cost ($/Acre)	17,000	2,400	- -	2,800	3,800		2,800	2,400	- -	
Treatment Level	4.2[3]	4.2	2	2	2[3]		4[3]	3	3	
Operating Time (Hours/Yr)	13,800	9,900	7,300	11,000	12,000	54,000	20,000	9,900	7,300	37,200
Capital Cost [5]	$4,000,000	2,200,000	50,000[4]	2,200,000	3,100,000	11,550,000	5,700,000	2,050,000	50,000[4]	7,800,000
Total Annual Cost (Debt Service + O & M)	$ 500,000	335,000	7,500	335,000	440,000	1,617,500	830,000	320,000	7,500	1,157,500

(1) Plus existing plants (Eagle Rock Village, Oakwood Village. Welsh Farms - 0.7 MGD Capacity)
(2) Existing Schooleys Mountain Plant
(3) Plus effluent aeration
(4) Effluent aeration added to existing facilities
(5) Under Plan 1 Administration/Garage/Laboratory facilities are proposed at plants 1A, 1B and 1E, Under Plan 5 they would only be provided at plant 5A

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TABLE 8-2
LIQUID TREATMENT COST ANALYSIS
PLANS 1 AND 5 (1990)
LAND TREATMENT

	PLAN 1 (1)					TOTAL	PLAN 5 (1)			TOTAL
Plant Designation	1A	1B	1C	1D	1E	PLAN	5A	5B	1C	PLAN
Design Capacity (MGD)	1.75	.6	.5 (2)	.8	1.2	4.85 (1)	3.8	.6	.5 (2)	4.9 (1)
Plant Location/ Service Area	Eagle Rock Village/Budd Lake	Long Valley	Schooleys Mountain	Four Bridges	Roxbury @ Mt. Clive Boundary		Four Bridges	Long Valley	Schooleys Mountain	
Land Area - Including buffer (Acres)	471	189	149	242	333	1,384	931	189	149	1,269
Unit Cost ($/Acre)	17,000	2,400	2,800	2,800	3,800		2,800	2,400	2,800	
Treatment Level (3)	1	1	1	1	1		1	1	1	
Capital Cost	11,250,000	2,935,000	1,241,000	3,520,000	4,687,000	23,633,000	9,800,000	2,935,000	1,241,000	13,976,000
Total Annual Cost (Debt Service + O & M)	1,270,000	405,000	245,000	480,000	630,000	3,030,000	1,340,000	405,000	245,000	1,990,000

(1) Plus existing plants (Eagle Rock Village, Oakwood Village, Welsh Farms - 0.7 MGD Capacity)

(2) Existing Schooleys Mountain Plant

(3) Secondary treatment for all plants

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the 4.4 MGD plant could be located at the 4A site and wastewater from the Long Valley area could be pumped back upstream to that site. Considering the potential growth aspects in the presently open farmland in the Long Valley area, the pumping of wastewater from Long Valley to the 5A site would be more restrictive to growth. Also, force main routing from the 5B to the 5A site could be along existing roadways where it would have relatively little environmental impact compared to a 36 inch and/or 42 inch interceptor extension from the 5A plant downstream along a gravity route. A cost effective analysis of these alternatives identified as "Plan 6" - one plant at the 5A site and "Plan 7" - one plant at the 5B site was made for a point source effluent discharge and the results are shown in Table 8-3.

In order to keep the cost analysis of Plans 6 and 7 on an equal basis the cost of wastewater transmission facilities to conduct the area wastewater flow from the 5B site to the 5A site was added to Plan 6 treatment costs and the cost of the facilities to conduct the area wastewater flow from the 5A site to the 5B site was added to Plan 7 treatment cost. The facility costs added to Plan 6 consist of a pumping station at Long Valley and a 14-inch force main along East Mill Road and Bartley Road to the 5A site. The facility costs added to Plan 7 treatment cost represent the additional cost for enlarged interceptor costs (36 inch and 42 inch) and additional length of interceptor (about 5000 feet) along the South Branch of the Raritan River from the 5A site to the 5B site.

In summary, the total annual costs for Plan 6 are $1,067,500 and for Plan 7, $1,117,500. It should be noted that the Plans 6 and 7 do not provide service to exactly the same area in that Plan 7 includes an interceptor for a distance of about 5000 feet south of Long Valley to the treatment plant site whereas Plan 6 only includes a pumping station at Long Valley near the Route #24 - West Mill Road intersection with no sewers south of Long Valley at the present time.

The total annual costs of the liquid treatment phase of the wastewater treatment under each of the plans reviewed area as follows:

TABLE 8-3
LIQUID TREATMENT COST ANALYSIS
PLANS 6 AND 7
POINT SOURCE DISCHARGES

	PLAN 6 [1]			PLAN 7 [1]		
Plant Designation	6	6C[2]	Total Plan	7	7C[2]	TOTAL PLAN
Design Capacity (MGD)	4.4	.5	4.9	4.4	.5	4.9
Plant Location	Four Bridges	Schooley's Mountain		Long Valley	Schooley's Mountain	
Land Area-Including Buffer (acres)	33	- - -	33	32	- - -	32
Unit Cost ($/Acre)	2800	- - -		2400	- - -	
Treatment Level	4[3]	3		4[3]	3	
Man hours Operating Time (Hours/Yr)	24,800	7300	32,100	21,500	7300	28,800
Capital Cost	7,300,000[4]	50,000	7,350,000[4]	8,094,000[5]	50,000	8,144,000[5]
Total Annual Cost (Debt Service + O&M)	1,060,000[4]	7500	1,067,500[4]	1,110,000[5]	7500	1,117,500[5]

(1) Plus existing plants (Eagle Rock Village, Oakwood Village, Welsh Farms - 0.7 MGD Capacity
(2) Existing Schooleys Mountain plant
(3) Plus effluent aeration
(4) Includes cost of pumping station at Long Valley & 14 in. diam. force main to Four Bridges
(5) Includes cost of additional interceptor capacity & additional length of interceptor from Four Bridges to treatment plant site south of Long Valley (5B Plant Site)

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Plan	Wastewater Treatment Plant/s	Total Annual Cost ($)
1 (Point Source Discharge)	Four new plants; at Eagle Rock Village, Four Bridges, Long Valley and Roxbury	1,617,500
1 (Land Treatment)	Four new plants; at Eagle Rock Village, Four Bridges, Long Valley and Roxbury	3,030,000
5 (Point Source Discharge)	One large plant at Four Bridges and small plant at Long Valley	1,157,500
5 (Land Treatment)	One large plant at Four Bridges and small plant at Long Valley	1,990,000
6 (Point Source Discharge)	One large plant at Four Bridges and pump wastewater to that plant from Lang Valley	1,067,500
7 (Point Source Discharge)	One large plant at Long Valley	1,117,500

8.4.3 Sludge Treatment and Disposal: Based upon EPA published data in publication EPA 430/9-75-002, July 1975 a preliminary screening was made for sludge treatment alternative processes S-1 through S-4. The processes were described in SubSection 6.5 and schematic process diagrams were shown (Figures 6-4 and 6-5) in the Section 3 report. The preliminary screening of alternatives is summarized in Table 8-4 which shows 1973 capital costs and 1977 total annual costs for the alternative processes for all new plants or plants to be improved under Plans 1 and 5. In all cases it may be noted that Process S-1 (anerobic digestion + dewatering by sludge drying beds) was the least costly process of the four alternatives analyzed. It may also be noted that as in the liquid process analysis Plan 5 (with two new plants) had a total annual cost considerably less than Plan 1 (with four new plants).

TABLE 8-4
PRELIMINARY SCREENING
SLUDGE TREATMENT PROCESSES S-1 to S-4

Plant Designation		PLAN 1 1A	1B	1C	1D	1E	TOTAL PLAN	PLAN 5 5A	5B	1C	TOTAL PLAN
Design Capacity (MGD)		1.75	.6	.5	.8	1.2	4.85	3.8	.6	.5	4.9
Plant Location/ Service Area		Eagle Rock Village/Budd Lake	Long Valley	Schooleys Mountain	Four Bridges	Roxbury @ Mt. Olive Bdry		Four Bridges	Long Valley	Schooleys Mountain	
Process S-1 Digestion + Drying Beds	Capital Cost	456,000	280,000	267,000	309,000	370,000	1,682,000	805,000	280,000	267,000	1,352,000
	Total Annual Cost	93,000	44,000	38,000	54,000	67,000	296,000	147,000	44,000	38,000	229,000
Process S-2 Digestion + Vacuum Filter	Captial Cost	633,000	527,000	515,000	550,000	586,000	2,811,000	832,000	527,000	515,000	1,874,000
	Total Annual Cost	112,000	77,000	66,000	91,000	99,000	445,000	148,000	77,000	66,000	291,000
Process S-3 Heat Treat. + Vacuum Filter +Incineration	Capital Cost	1,517,000	1,061,000	1,030,000	1,122,000	1,303,000	6,033,000	2,196,000	1,061,000	1,030,000	4,287,000
	Total Annual Cost	256,000	153,000	137,000	198,000	224,000	968,000	347,000	153,000	137,000	637,000
Process S-4 Vacuum Filter +Incineration	Capital Cost	1,362,000	885,000	840,000	975,000	1,152,000	5,214,000	2,032,000	885,000	840,000	3,757,000
	Total Annual Cost	210,000	127,000	110,000	154,000	179,000	780,000	301,000	127,000	110,000	538,000

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A review of Table 8-4 with respect to Plant 5A also shows that the total annual cost for Process S-2 (anerobic digestion + dewatering by vacuum filter) was only $1 000 more per year than Process S-1. Considering the fact that drying of sludge on open drying beds is subject to weather conditions and will be sensitive to escalating labor costs for the cleaning of the beds, the dewatering of the sludge by mechanical means (vacuum filter) is the recommended alternative of the four processes analyzed.

Next, an analysis was made to compare the S-2 process (digestion + vacuum filter dewatering with digestion and liquid injection of sludge into the soil and with composting and land spreading as a means of sludge treatment for Plan 5. While only two new plants are proposed for Plan 5, the study area and sludge management plan must also consider the sludge produced at the existing Schooleys Mountain, Eagle Rock Village and Oakwood Village plants. The existing Eagle Rock Village and Oakwood Village plants each have aerobic digesters for stabilization and storage of sludge. Several schemes for sludge treatment become evident and the alternatives have been diagramatically shown on Figures 8-6 and 8-7.

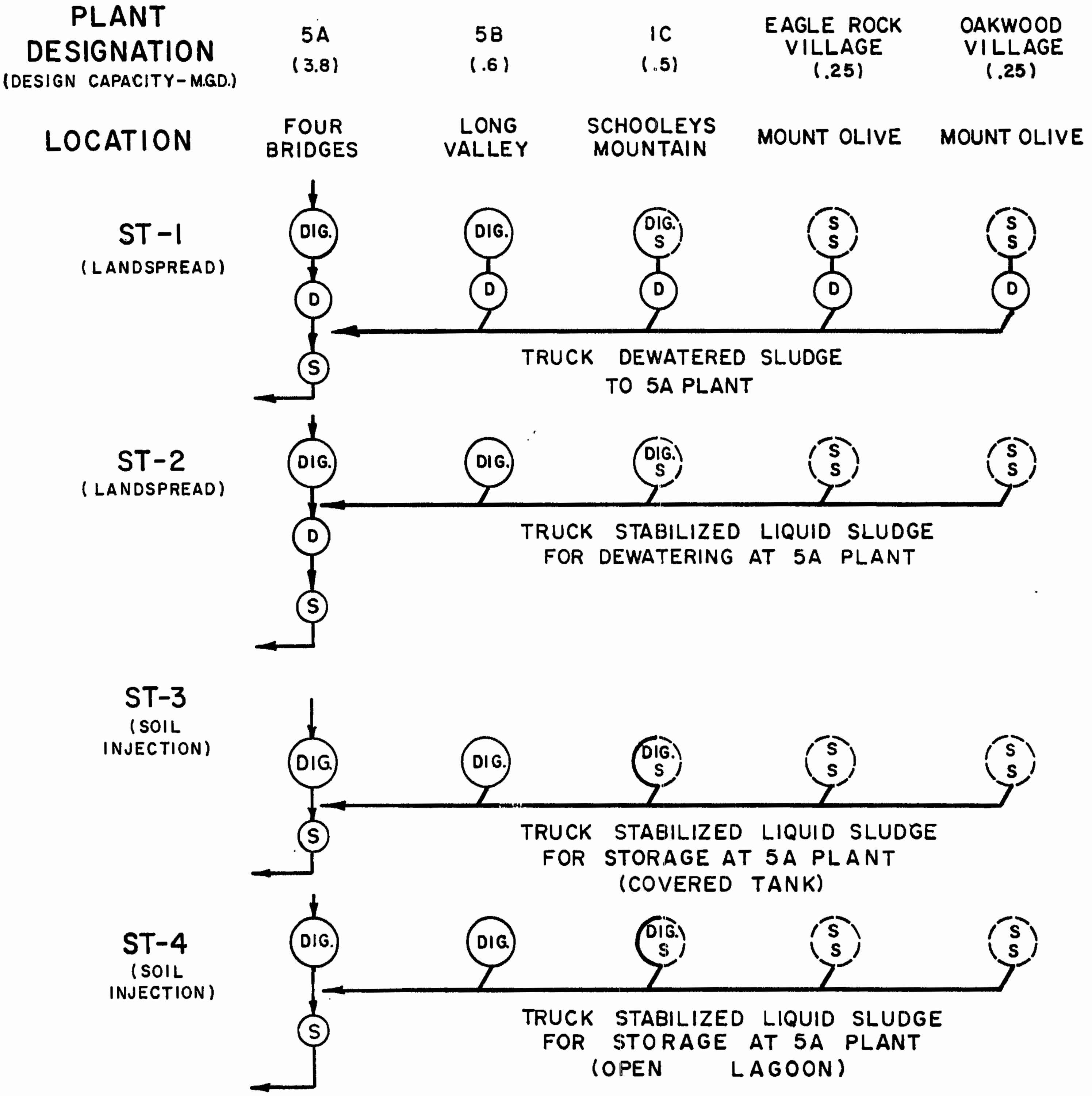
The second sludge alternative cost analysis compared digestion/dry sludge spreading (Plans ST-1 and ST-2) vs digestion/liquid sludge injection (Plans ST-3 and ST-4) vs composting/dry sludge land spreading (Plans ST-5 and ST-6). The cost effective analysis for the six plans are shown in Table 8-5, digestion alternatives and Table 8-6, composting alternatives. A description of the facilities and equipment proposed to be provided under each plan follows:

Plan ST-1

Anerobic sludge digestion tanks at the 5A, 5B and Schooleys Mountain Plant; sludge dewatering equipment at the preceding three plants and at the Eagle Rock Village and Overlook Village plants; a 20-cubic yard dump truck to haul dewatered sludge from all plants to the 5A plant; a dewatered sludge storage area and vehicle garage enclosed by woven wire fence at the 5A plant site; dry sludge land spreading equipment consisting of two farm type tractors, three 12-cubic yard manure spreaders, a 3-cubic yard loader and a second 20-cubic yard dump trailer to haul sludge from the 5A plant to the landspreading sites.

FIGURE 8-6

SCHEMATIC PLANS
SLUDGE TREATMENT ALTERNATIVES
FINAL ANALYSIS
DIGESTION AND LANDSPREADING OR INJECTION



LEGEND

○ - PROPOSED NEW FACILITY

◌ - EXISTING FACILITY

DIG. - ANEROBIC DIGESTER

D - DEWATER

S/S - STABILIZE AND STORE

S - STORE

C - COMPOST

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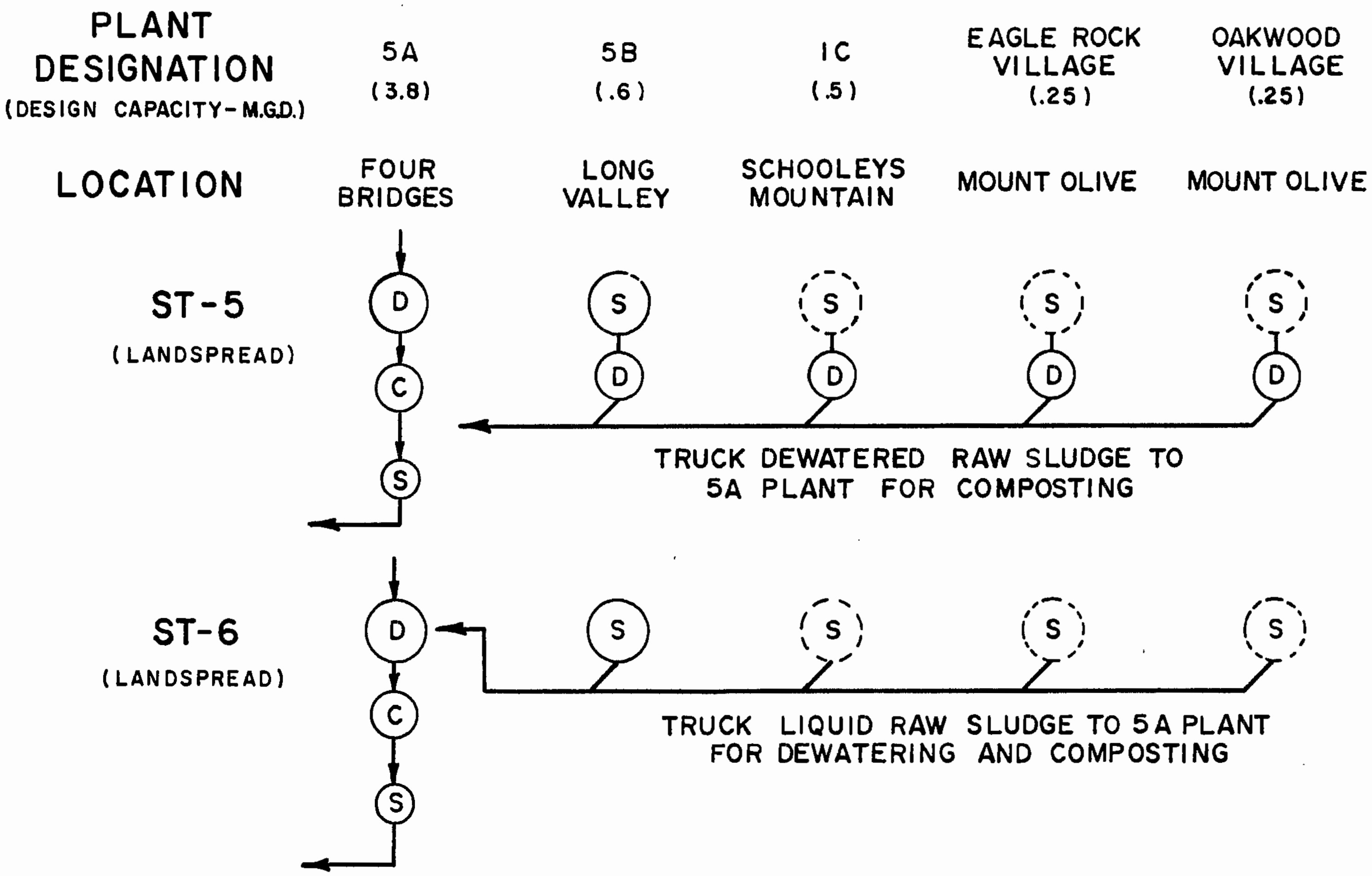
FIGURE 8-7

SCHEMATIC PLANS

SLUDGE TREATMENT ALTERNATIVES
FINAL ANALYSIS
COMPOSTING AND LANDSPREADING



LEGEND

◯ - PROPOSED NEW FACILITY
◌ - EXISTING FACILITY
DIG. - ANEROBIC DIGESTER
D - DEWATER

S/S - STABILIZE AND STORE
S - STORE
C - COMPOST

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TABLE 8-5
SLUDGE TREATMENT/DISPOSAL TOTAL ANNUAL COSTS
DIGESTION + LANDSPREADING DRY SLUDGE VS DIGESTION + LIQUID INJECTION[1]
PLAN 5

	DIGESTION/SPREAD DRY SLUDGE	
SLUDGE TREATMENT PLAN	ST-1	ST-2
System Component		
1. Digestion Facilities	$110,000	$110,000
2. Dewatering Facilities	245,000	125,000
3. Trucking Sludge to Plant 5A	20,000	34,000
4. Sludge Storage (Dry) at Plant 5A	33,000	33,000
5. Land Disposal	44,000	44,000
Total	$452,000	$346,000

	DIGESTION/LIQUID INJECTION	
SLUDGE TREATMENT PLAN	ST-3[2]	ST-4[3]
System Component		
1. Digestion Facilities	$110,000	$110,000
2. Trucking Sludge to Plant 5A	34,000	34,000
3. Sludge Storage (Liquid) at Plant 5A	137,000	60,000
4. Liquid Injection	84,000	84,000
Total	$365,000	$288,000

[1] See Fig 8-6 and 8-7 for schematic of alternative systems

[2] Steel tank covered sludge storage

[3] Open concrete lagoon sludge storage

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TABLE 8-6
SLUDGE TREATMENT/DISPOSAL TOTAL ANNUAL COSTS[1]
COMPOSTING + LANDSPREADING
PLAN 5

SLUDGE TREATMENT PLAN	ST-5	ST-6
System Component		
1. Dewatering Facilities	$273,000	$140,000
2. Trucking Sludge to Plant 5A	20,000	34,000
3. Compost Facility	114,000	114,000
4. Land Disposal	63,000	63,000
Total	$470,000	$351,000

(1) See Figs. 8-6 and 8-7 for schematic of alternative systems

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Plan ST-2

Anerobic sludge digestion tanks as in Plan ST-1 above; a 4000-gallon tank truck to haul stabilized sludge from all plants to the 5A plant; sludge dewatering equipment at the 5A plant; dewatered sludge storage and sludge landspreading equipments the same as Plan ST-1.

Plan ST-3

Anerobic sludge digesters as in Plan ST-1; a 4000-gallon tank truck as in Plan ST-2 to haul sludge to the 5A plant, 2,3-million gallon, 20-foot sidewater depth, covered steel liquid sludge storage tanks and vehicle garage at the 5A plant and liquid sludge land spreading equipment consisting of 2,200-gallon, subsurface injection system vehicles with high floatation-type chassis, and a second 4000-gallon "nurse" tank truck.

Plan ST-4

Facilities and equipment under this Plan are the same as Plan ST-3 except that the sludge storage would be in two open, concrete lined, 12-foot deep sludge storage lagoons.

Plan ST-5

Raw sludge dewatering equipment at the 5A, 5B, Shcooleys Mountain, Eagle Rock Village, and Oakwood Village plants; a dump truck to haul dewatered sludge from all plants to the 5A plant site, a concrete slab composting area for aerobic, static pile composting and curing of sludge with wood chips or other bulking material, equipment garage with all of the area enclosed in a woven wire fence; composting equipment including a Cobey composter, 3-cubic yard loader and screening equipment and sludge land apreading equipment including four farm-type tractors with six 12-cubic yard manure spreaders and a 20-cubic yard dump trailor to truck the composted sludge from the 5A plant site to the sludge land spreading sites.

Plan ST-6

The facilities and equipment under this plan are the same as Plan ST-5 except that all raw sludge dewatering would be done at the 5A plant site and a tank truck would be used to haul raw sludge from storage at each plant to the 5A plant for dewatering.

Review of Alternatives: The means of ultimate sludge disposal proposed under the six alternative plans were reveiwed with representatives of the New Jersey Department of Environmental Protection, Office of Sludge Management and Industrial Pretreatment and their comments were as follows:

1. Open storage lagoons for digested sludge proposed under Plan ST-4 would not be approved by the DEP.

2. Land spreading of digested (stabilized) dewatered sludge proposed under Plans ST-1 and ST-2 would be approved if the sludge were plowed into the soil soon after spreading.

3. Liquid injection of digested (stabilized) sludge would be approved if the digested sludge is stored in closed (covered) tanks.

4. Composted sludge may be landspread for ultimate disposal without plowing into the soil.

As a result of the DEP's preliminary review of the second set of six alternative, Plan ST-4 which was the most cost effective plan and which called for open, digested sludge storage lagoons, can be eliminated for consideration because the plan would not be approved by the DEP. A reveiw of Tables 8-5 and 8-6 indicate that the most cost effective of the implementable sludge management plans (excluding Plan ST-4) are Plans ST-2 (digestion + dewater + landspreading) and ST-6 (composting + landspreading at basically the sam total costs; $346,000 vs $351,000. Criteria other than costs must be applied to select the better sludge management plan. From an engineering standpoint (not considering all environmental factors) the advantages of each plan are as follows:

<u>Advantages Sludge Plan ST-4 (Anerobic Digestion)</u>:

1. The volume of material to be handled for disposal is about one half that of Plan ST-6 since no wood chips are included.

2. If wood chips or other bulking material are not available without cost under Plan ST-6, Plan ST-4 will be even more cost effective than the $5,000 difference in total annual costs between the two plans as shown in Tables 8-5 and 8-6.

3. Digestion stabilization of sludge is not as equipment intensive as composting with the the various trucks, loaders, composters and screening equipment which must be kept functional.

4. The digestion process is less labor intensive than composting operation.

Advantages of Sludge Plan ST-6 (Composting)

1. More complete destruction of pathogen concentrations is accomplished by composting.

2. The operating expertise required for composting is not as great as digestion.

3. The end product of the treatment provided is much less offensive than digested sludge and may be made available to area residents, the municipal participants, landscapers, etc. for parks and reclamation of poor soil areas.

4. The landspread-composted sludge would not have to be plowed into the soil as digested sludge would, therefore composted sludge could be spread at almost any time whereas the digested sludge would have to fit the spring and fall plowing and planting schedules of local farmers.

5. Composting is less energy intensive than digestion and therefore may be less costly if future energy costs for electrical energy and oil for digester heating/mixing escalate faster than the basic gasoline or diesel fuel costs used for composting related equipment.

6. Should stabilization problems arise with the aerobic digestion facilities at the existing Eagle Rock Village and Oakwood Village plants, no capital costs need be expended to correct the problems as would be required under Plan ST-2 since the sludge is merely stored at these plants and tank trucked to the composting site for dewatering and stabilization.

7. Except for providing more impervious composting area, once a composting operation is established, there is very little capital cost that is required to handle increased sludge loads.

8. The area required for landspreading of composted sludge is one half that required for digested sludge since the rate of application is 20 tons per acre for compost and only 10 tons per acre for digested sludge.

Selected Sludge Treatment/Disposal Plan

From an engineering standpoint, based upon the non-monetary advantages, a projection that energy factors related to composting will be less than digestion and future labor costs for composting can be decreased as newer and better equipment is developed, composting (Plan ST-6) would be the selected sludge treatment and ultimate disposal plan for the study area.

At the time this report was issued sludge analyses from the existing wastewater treatment plants were not available, nor included in the report work scope to indicate that the sludge constituents from the plants were within the maximum limits set for pesticides, toxic organis and heavy metal. Since the sludges originate from plants which do not have industrial discharges, it can be reasonably sure that the sludge consituents are within the limits set. An increase in this 201 Plan work scope was discussed with DEP and EPA representatives and will be undertaken to collect and analyze a sample of sludge from each of the five existing wastewater treatment plants; Oakwood Village, Eagle Rock Village, Mount Olive - Flanders, Schooleys Mountain and Roxbury Knolls. The results of the analyses will be included in an addendum to this report.

8.5 Interceptors and Local Collection Systems:

8.5.1 Interceptors: During the development of the alternatives, the Consultant analyzed the various areas to be serviced, selected various interceptor routings in conjunction with the Environmental Consultants and then calculated the line sizes, slopes and other basic preliminary engineering data. Costs were developed from reaognized sources including Engineering News Record, recent local bid summaries and published cost data handbooks to obtain the results tabulated in Table 8-7 Summary Estimated Unit Costs - Interceptors.

Asbestos cement pipe was used for the smaller pipe diameters,8" to 12", and reinforced concrete pipe used for the larger pipe size,16" through 42" diameter. As can be seen from this table, the total cost dollars per lineal foot range is from $46.17 up to $124.41. The cost base is June 1977 and these costs developed will be used throughout the report.

The interceptors for the various alternatives were developed through preliminary engineering based upon design criteria established in Section 7.0. Table 8-7, Interceptor Cost Comparison, shows the pipe size, total interceptor length required the total cost for four alternatives. As can be seen from this table, the required interceptors range from a minimum size of 8" up to a maximum pipe size of 42" diameter.

Table 8-9 Interceptor Costs for Alternatives 5 and 6 was developed to show the interceptor costs for the selected Plan 6 based on a reduced area to be serviced. The total length of interceptors for 1985/1990 period was calculated to be 184,500 feet or approximately 35 miles and for the year 2000; 220,000 feet or approximately 42 miles. Total capital cost based on June 1977 is calculated to be $12,374,000.

8.5.2 Local Collection Systems: The active and dry collection systems were described in detail in Section 2 report and summarized in the Section 3 report, more specifically, Subsection 3.1 of that report and Figure 3-2.

The five major active systems include Schooley's Mountain, Washington Townhip; Oakwood Village, Clover Hill and Mount Olive Complex areas, Mount Olive; and Roxbury Knolls, Roxbury. The other active systems are small (schools and motel). There are two active systems in Roxbury (Drakes Brook Basin) which have pumping stations to transfer the sewage into the Lamington Basin and Ajax STP. Any developments of five or more houses that have

Table 8-7 - Summary Estimated Unit Costs - Interceptors (4)

Size Interceptor "D" Inches		1 Material Cost FOB Site $/LF	2 Labor Cost $/LF	3 Miscell. (1) $/LF	4 OH G&A Profit $/LF	5 Total 1,2,3,4 $/LF	6 T.V. (2) Inspection Rock Excavation & Soil Erosion Control	7 Total 5 & 6 $/LF	8 Manholes (Allowance) $/LF	9 Allowance For (3) Stream Crossings, Syphons, Traffic Control and Unusual Field Conditions	10 Total (4) (5) Cost $/LF
8	ACP	10.00	5.00	10.00	7.50	32.50	3.30	35.80	5.00	5.37	46.17
10	ACP	10.50	5.20	10.00	7.70	33.40	3.40	36.80	5.00	5.52	47.32
12	ACP	11.00	5.50	10.00	7.90	34.40	3.50	37.90	5.00	5.69	48.59
16	RCP	11.50	5.70	11.50	8.60	37.30	4.70	42.00	5.00	6.30	53.30
18	RCP	12.00	6.30	11.50	9.00	38.80	4.90	43.70	5.00	6.55	55.25
21	RCP	14.50	7.20	11.50	10.00	43.20	5.30	48.50	5.25	7.27	61.02
24	RCP	16.00	11.60	12.00	11.90	51.50	6.20	57.70	5.25	8.65	71.60
27	RCP	20.00	11.70	12.00	13.20	56.90	6.70	63.60	5.50	9.55	78.65
30	RCP	21.00	12.90	12.00	13.80	59.70	7.00	66.90	5.50	10.04	82.44
36	RCP	33.00	14.50	14.00	18.50	80.00	9.00	89.00	5.50	13.35	107.85
42	RCP	42.00	15.60	14.00	21.50	93.10	10.30	103.40	5.50	15.51	124.41

Notes:

(1) Grubbing and clearing, pavement removal and replacement. Existing utilities protection, lines and levels.

(2) Allow 10% average for rock excavation, subject to change and contingent upon soil borings.

(3) 15% of column 7

(4) Cost Base June 1977

(5) Cost does not include repaving curb-to-curb, engineering, legal, bonding and interim financing.

Table 8-8 Interceptor Cost Comparison (1) (2) (3)

	ALTERNATIVE 1			ALTERNATIVE 2			ALTERNATIVE 4			ALTERNATIVE 5		
Pipe Size (in.)	Total Length Req'd (ft.)	$ L.F.	$ Total Cost	Total Length Req'd (ft.)	$ L.F.	$ Total Cost	Total Length Req'd (ft.)	$ L.F.	$ Total Cost	Total Length Req'd (ft.)	$ L.F.	$ Total Cost
8	117,750	46.17	5,437,518	153,700	46.17	7,096,329	146,800	46.17	6,777,756	71,200	46.17	3,287,304
10	75,750	47.32	3,584,490	81,000	47.32	3,832,920	72,500	47.32	3,430,700	47,700	47.32	2,257,164
12	33,000	48.59	1,603,470	40,620	48.59	1,973,726	32,250	48.59	1,567,028	28,400	48.59	1,379,956
16	27,750	53.3	1,479,075	20,250	53.3	1,079,325	18,500	53.3	986,050	33,125	53.3	1,765,563
18	19,000	55.25	1,049,750	27,750	55.25	1,533,188	10,000	55.25	552,500	24,100	55.25	1,331,525
21	22,750	61.02	1,388,205	12,250	61.02	747,495	15,000	61.02	915,300	18,500	61.02	1,128,870
24	9,750	71.60	698,100	16,750	71.60	1,199,300	11,000	71.6	787,600	4,500	71.6	322,200
27	-			2,750	78.65	216,288	18,750	78.65	1,474,688	26,500	78.65	2,084,225
30	-			4,000	82.44	329,760	21,250	82.44	1,751,850	2,000	82.44	164,880
36	-			2,750	107.85	296,588	8,250	107.85	889,763	3,500	107.85	377,475
42	-			-						500	124.41	62,205
Totals			15,239,508			18,304,919			19,133,235			14,161,367

(1) See Table 8-7 for Cost Development.
(2) Cost Base June 1977
(3) Alternative 3 eliminated from consideration. (See Text)
(4) Alternative 5 data used for Alternatives 6 and 7 with modification as required. See Table 8-9.

Table 8-9 Interceptor Cost - Final Plan

Pipe Size	Total Length 1985/1990 L.F.	Total Add'l Length 2000 L.F.	Total Final Plan L.F.	$ L.F.[1]	$ Total Cost 1990[2]	$ Additional Total Cost 2000[2]
8"	34,500	5,000	39,500	46.17	1,592,865	230,850
10"	33,000	18,000	51,000	47.32	1,561,560	851,760
12"	25,000	3,000	28,000	48.59	1,214,750	145,770
15"	20,000	2,000	22,000	53.30	1,066,000	106,600
18"	8,000	-	8,000	55.25	442,000	-
21"	23,500	7,500	31,000	61.02	1,433,970	457,650
24"	7,000	-	7,000	71.60	501,200	-
27"	17,000	-	17,000	78.65	1,337,050	-
30"	14,000	-	14,000	82.44	1,154,160	-
36"	2,000	-	2,000	107.85	215,700	-
42"	500	-	500	124.41	62,205	-
Totals	184,500	35,500	220,000		10,581,460	1,792,630

Total Cost Final Plan 12,374,090

Say 12,374,000

(1) See Table 8-7 for cost development.
(2) Cost base June, 1977
(3) For Plan 6, additional pumping station cost and force main included in treatment plant capital cost, see Table 8-3.
(4) For Plan 7, 20,200 LF of 42" interceptor required from Plant 5A or 6 to Plant 7. Cost difference of $1,894,000 included in Capital and O&M cost for treatment Plant 7, see Table 8-3.

been constructed within the last 10 years normally include dry sewers. On-site disposal systems for these developments are located in the front yard so as to minimize the construction costs of the house connection when the dry sewers become active. Another advantage is that the owner can construct an in-ground pool in the rear yard without disrupting the leaching field.

In order to develop the costs per connection or per dwelling unit, in addition to estimating costs for the sewage treatment plants and interceptors, it is necessary to determine the costs for the local collection systems.

The local collection system was estimated through analysis of existing collection systems and dry collection systems presently in the Facilities Plan basin. Referring to Tables 8-10 and 8-11, Existing Collection Systems and Dry Collection Systems, one can see that the approximate lineal foot per dwelling unit ranges from 28 to 121. The 28 lineal feet being related to garden apartments and the 121 lineal feet to existing dwelling units in Roxbury and Washington Townships. From this table and referring to date available, zoning and densities, the following lengths per dwelling unit were established.

Township	Local Collection System Feet per D.U.
Mount Olive	60
Roxbury	85
Washington	100
Garden Apartments	40

It was also necessary to determine the total number of dwelling units which would exist in the calendar years 1980, 1990, and 2000. Table 8-12, Local Collection Systems - Dwelling Unit Development, was developed from Tables 6-5 through 6-9, population and development tables, calendar years 1980, 1990, and 2000 for this purpose. This table shows the total number of dwelling units and apartments for the three Townships for wet and dry sewers. Thus, the total number of dwelling units requiring a new local collection system is 4,125 for calendar year 1980; 8,023 dwelling units for calendar year 1990, and 11,232 dwelling units for calendar year 2000. Since it was found that the lineal feet of local collection systems for garden apartments was much less than the average for single family houses, another words words 40 vs. 75 to 80 average, it was necessary to separate the number of apartments and the number of single family dwelling units.

Table 8-10 - Existing Collection Systems

Identification	Approx. Length Sewer L.F.	# Manholes	L.F. Manhole	# Connections	Approx. L.F./D.U. LCS(1)	Remarks
Clover Hill/Sutton Park Mt. Olive/MO-2	54,969	246	223	957	57	See Table 2.7.1 Section 2 Report
Roxbury Knolls/ Skyview/Roxbury R-2	20,100	78	257	165	121	See Table 2.7.2 Section 2 Report
Schooley's Mountain/ Washington WT-1	35,920	142	253	327	110	See Table 2.7.3 Section 2 Report
Mt. Olive Complex/ Eagle Rock MO-5 and Oakwood Village/MO-1 Mt. Olive	19,653	147	134	693(2)	28	See Table 2.7.4 Section 2 Report Garden Apartments & Updated Information(2)

(1) LCS - Local Collection System

(2) Updated data

Table 8-11 - Dry Collection Systems

Identification	Approx. Length Dry Sewer L.F.	# Manholes	Manholes L.F. Dry Sewer	# Connections	Approx. L.F./D.U. Dry Sewer	Remarks
Mt. Olive D1-D6	35,038	184	190	470	75	See Table 2.7.5 Section 2 Report
Parker Acres Washington WT-3	10,500			150	70	

(1) Partial listing; See Section 6.0 for complete listing.

Table 8-12 Local Collection System - Dwelling Unit Development

Township	CY	Total (2) # SF_a (1)	Total (2) # Apartments		# SF_a Requiring Local Collection System	# Apartment Requiring Local Collection System	
Mt. Olive	1980	3,774	1,420		2,477	307	
Roxbury	1980	1,302	--		699	--	
Washington Township	1980	1,035	--		642	--	
	Sub-Total	6,111	1,420		3,818	307	
	Totals		CY 1980	7,531		CY 1980	4,125
Mt. Olive	1990	4,662	2,141		3,365	1,028	
Roxbury	1990	2,235	--		1,612	--	
Washington Township	1990	2,285	--		2,018	--	
	Sub-Total	9,182	2,141		6,995	1,028	
	Totals		CY 1990	11,323		CY 1990	8,023
Mt. Olive	2000	5,069	3,648		3,772	2,535	
Roxbury	2000	2,403	--		1,780	--	
Washington Township	2000	3,412	--		3,145	--	
	Sub-Total	10,884	3,648		8,697	2,535	
	Totals		CY 2000	14,532		CY 2000	11,232

(1) SF_a = Single Family Unit

(2) Total; sewered (dry and active) plus areas to be sewered.

(3) Developed from Tables 6-5 through 6-9.
Population and Development Tables CY1980, 1990, 2000.

The data obtained from the above mentioned tables was used to develop Table 8-13, Summary Local Collection Systems. This table shows the number of single families and number of garden apartments requiring new local collection systems, the approximate length per single family and garden apartments, and the approximate length proposed of new local collection systems. For 1980, the required local collection system is 285,000 feet; for 1990, 582,000 feet; and for the year 2000, 794,000 feet.

Table 8-14 is a summary of the estimated costs of the local collection systems for each township. Referring to the last column in this table, the average capital cost per D.U. for the LCS is $4,000 based on June 1977 costs.

8.5.3 Lift Stations: In the development of the alternatives, it was determined that pumping and lift stations would be required and these are shown on Figures 8-1 through 8-5 inclusive. In order to limit excavations, service areas outside of natural basins with gravity sewers and to serve areas of little topographical relief, pumping stations are required.

These lift stations represent an additional cost.

Through preliminary engineering, it was determined that five typical design flows for the lift stations would be utilized. These ranged from .5 to 5.75 MGD as can be seen from Table 8-15. The capital cost and annual operating/maintenance (O&M Costs) were developed and are as shown. Costs developed in the above mentioned table were used in the development of Table 8-16, Lift Stations Requirements Per Alternative. As can be seen, the number and lift stations for each alternative were developed with its appropriate capital and annual operating maintenance costs, and annual cost for lift stations for the alternatives being considered.

8.5.4 Discussion and Analysis: Areas requiring local collection systems per EPA criteria, engineering, costs, developmental pattern and environmental factors are utilized in determining the routing, size and location of the interceptors and local collection systems. In our case, and being cost effective, the interceptors were sized based on saturation population developed from the existing zoning ordinances which establish the criteria for the existing and future use of land. Routings were based on gravity flow and utilizing public rights-of-way, existing raods, etc. where practical to minimize the environmental impact on streams and open land (see Section 8.6). Only those areas

Table 8-13 Summary Local Collection Systems

Township	CY	Approx. No. of SF_a (2) Requiring LCS (1,2,3)	Approx. (4) Length/SF_a LCS (L.F.)	Approx. No. (3) of Apartments Requiring LCS	Approx. (2) Length/Apt. LCS L.F.	Approx. length (5) Proposed L.F.
Mt. Olive	1980	2,477	60	307	40	160,900
Roxbury	1980	699	85	--	--	59,415
Washington	1980	642	100	--	--	64,200
	Totals	3,818		307		284,515
Mt. Olive	1990	3,365	60	1,028	40	243,020
Roxbury	1990	1,612	85	--	--	137,020
Washington	1990	2,018	100	--	--	201,800
	Totals	6,995		1,028		581,840
Mt. Olive	2000	3,772	60	2,535	40	327,720
Roxbury	2000	1,780	85	--	--	151,300
Washington	2000	3,145	100	--	--	314,500
	Totals	8,697		2,535		793,520

(1) Developed from Tables 6-5 through 6-9 Population and Development Tables CY 1980, 1990, 2000
(2) LCS - Local Collection System SF_a = Single Family Unit
(3) See Table 8-12 for development.
(4) Data developed from existing dry and wet sewers, data, zoning, densitites, etc. See Tables 8-10 and 8-11.
(5) Total of SF_a and apartments.

Table 8-14 Cost Estimates of Local Collection Systems

Township	CY	Approximate Length 8" Pipe Proposed LF (2)	Est. Cost/LF (3)(7)	Approximate Total Pipe Cost - $	# of Manholes (4)	$ Cost/ Manhole	Total Manhole Cost - $	Total Capital Cost - $	Approx. # of Connections	Capital Cost Per Connection $
Mount Olive	1980	160,900	46.17	7,428,753	649	750	486,750	7,915,503	2,784	2,843
Roxbury	do	59,415	do	2,743,191	238	do	178,500	2,921,691	699	4,180
Washington	do	64,200	do	2,964,114	257	do	192,750	3,156,864	642	4,917
Totals		284,515		13,136,058	1,144		858,000	13,994,058	4,125	11,940
								Total Basin Average		3,980
Mount Olive	1990	243,000	do	11,220,233	972	do	729,000	11,949,233	4,393	2,720
Roxbury	do	137,020	do	6,326,213	548	do	411,000	6,737,213	1,612	4,179
Washington	do	201,800	do	9,317,106	807	do	605,250	9,922,356	2,018	4,917
Totals		581,860		26,863,552	2,327		1,745,250	28,608,802	8,023	11,816
								Total Basin Average		3,949
Mount Olive	2000	327,720	do	15,130,832	1,310	do	982,500	16,113,332	6,307	2,555
Roxbury	do	151,300	do	6,985,521	605	do	453,750	7,439,271	1,780	4,179
Washington	do	314,500	do	14,520,465	1,258	do	943,500	15,463,965	3,145	4,917
Totals		793,520		36,636,818	3,173		2,379,750	39,016,568	11,232	11,651
								Total Basin Average		3,884

(1) Cost Base - June 1977
(2) See Table 8-13 for development.
(3) See Table 8-7 for development.
(4) Allowance of 250LF/manhole; see Tables 8-10 and 8-11.
(5) Allowance of $750/manhole
(6) See Table 8-13 for development.
(7) Based on 8" pipe diameter.

Table 8-15 Lift Station Costs - Typical

Design Flow MGD	Capital Cost (1) $C = 2.25 \times 10^5 Q^{.82}$	Annual (2) O & M ¢/1000 Gal.	$ Total Annual O & M
.5	127,449	2.5	4,400
.75	177,718	2.4	6,336
1.0	225,000	2.2	7,744
1.25	270,177	2.2	9,680
5.75	944,300	2.0	40,480

(1) Ref: Cost Estimate for Construction of Publicy Owned Waste Water Treatment Facilities
Summaries of Technical Data
EPA 1976 MCD-48B
Figure 4: Cost vs. capacity for pumping stations used in interceptor sewer systems

(2) Ref: Costs of Waste Water Treatment by Land Application
EPA MCD-10 June 1975
Figure 5: Transmission Pumping

(3) Cost Base; June 1977

Table 8-16 Lift Stations Requirements per Alternative (Preliminary)

Alternate	Lift Station Designation	# Required	Design Flow MGD	$ Capital Cost	$ Annual Operating and Maintenance Cost
1	Mount Olive Complex	1	.5	127,449	4,400
	Parker Acres	2	.75	355,436	12,672
	Schooley's Mountain	1	1.25	270,177	9,680
				753,062	26,752
2	Mount Olive Complex	1	.75	177,718	6,336
	Parker Acres	2	.75	355,436	12,672
	Schooley's Mountain	1	1.25	270,117	9,680
				803,331	28,688
4	Mount Olive Complex	1	5.75	944,300	40,480
	Parker Acres	2	.75	355,436	12,672
	Schooley's Mountain	1	1.25	270,177	9,680
				1,569,913	62,832
5(3)	Mount Olive Complex	1	1.0	225,000	7,744
	Parker Acres	2	.75	355,436	12,672
	Schooley's Mountain	1	1.25	270,177	9,680
				850,613	30,096

(1) See Table 8-15 for Cost Development.
(2) Cost Base; June 1977
(3) Costs for Alternates 6 and 7, same as Alternate 5.

which are densely populated, having existing wet or dry sewers, with environmental problems (on-site disposal) will be served by interceptors, thus minimizing secondary growth. A major portion of the basin will not be serviced (sewered) under the selected plan (Plan 6).

In Section 6.0, the justification based on population and land development was discussed in great detail. The design criteria for a selected plan was established (Section 7.0) and in Section 8 the various alternatives were analyzed from technical, environmental and cost standpoints. It was concluded that Plan 6 would be the selected plan.

8.6 Environmental Analysis of Alternatives: The alternatives including the no-action option (discussed separately from the seven proposed action alternatives) were analyzed for their environmental impact, using the information presented in the environmental inventory (see Section 2) and field studies of proposed sites. Since many factors are common to all the action alternatives, the analysis discusses those areas of environmental impact in which the alternatives show some difference. This allows for comparison of alternatives so that the most environmentally sound alternatives can be identified. An analysis of land application as an alternative for point discharge is also given. In the later Selected Plan Analysis (Section 9) more detailed descriptions will be given of the chosen alternative.

8.6.1 Action Alternatives: The alternatives will be analyzed by the differences in interceptor alignments and treatment plant sites. The analysis is separated into major areas of impact:

- Soils
- Water Quality
- Biota
- Environmentally Sensitive Areas
- Aesthetics
- Historical and Archaeological Considerations

Since all the action alternatives involve significant construction of interceptor sewers, several subrouting options are available. The following analysis of the impacts of the various subrouting options was made to determine the most sound subrouting. As these are common to several alternatives, they are dealt with prior to the analysis of alternatives.

Figures 8-1 and 8-5, in Section 8, describe the various subrouting options. Along Drakes Brook, Route (a) would result in a greater amount of soil from erosion entering the stream than would Route (b), making (b) the more sound option.

Routes (c) and (d) are for the outfall of the Schooley's Mountain Plant. Route (c) would cross the valley and discharge into the South Branch below Drakes Brook. Route (d) would parallel the South Branch and discharge halfway between Stony and Electric Brooks. By following the stream, Route (d) would result in a greater soil sedimentation problem than (c). The more sound option is therefore Route (c).

Routes (e) and (f) are options for transporting sewage from the northern section of the study area to either the Drakes Brook section [Route (e)] or the Schooley's Mountain system [Route (f)]. Route (e) would be along a road paralleling the South Branch, while Route (f) would basically go through undisturbed areas. Although Route (e) involves longer interceptor length (about 400 feet), the locations in the road would result in less of an environmental impace than Route (f).

These analyses indicate that Routes (b), (c), and (e) would be the most environmentally sound. Due to engineering considerations, however, Route (a) will be used instead of Route (b).

Soils: The major impact on soils in the study area due to the implementation of the sewerage system alternatives is related to soil loss as a result of construction of interceptors, treatment plants, and pump stations. Using the interceptor routings described in the introduction of this section, the differences in interceptor length (linear feet) for alternatives 1, 3, 4, 5, 6 and 7 are slight (Table 8-17). Only Alternative #2 has a somewhat longer interceptor length than the other six.

Where a force main paralleled a gravity sewer, the soil loss impact was counted only once. In order to assess the construction impacts on soil loss, a 40 foot disturbed width would be assumed for interceptors. The Universal Soil Loss Equation (NJSSCC, 1974) was used, based on the soils identified in the study area (see Section 2, Soils). An average slope was calculated and a disturbance time of three months between clearing and establishment of cover was assumed. Also, best and worst case cover condition factors were used. A mulch of 2 tons of hay per acre was used for the best case, while no cover was assumed for the worst case.

TABLE 8-17

SOIL LOSS FROM CONSTRUCTION

[Source: SCS, 1975; NJSSCC, 1974]

	Interceptor				Treatment Plant			Pump Station			Total	
			Tons of Soil Lost			Tons of Soil Lost			Tons of Soil Lost		Tons of Soil Lost	
Alternative	Thousands of Linear Feet	Acres	Worst	Best	Acres	Worst	Best	Acres	Worst	Best	Worst	Best
1	322	295	2,100	30	127	870	13	3.5	25	< 1	3,000	44
2	386	355	2,500	35	81	570	9	4	30	< 1	3,100	44
3	336	308	2,200	30	32	225	3	3	20	< 1	2,400	33
4	336	308	2,200	30	54	380	6	5	35	< 1	2,600	36
5	330	300	2,100	30	54	375	5	2.5	20	< 1	2,500	35
6	330	300	2,100	30	32	225	3	5	35	< 1	2,360	33
7	330	300	2,100	30	32	225	3	2	16	< 1	2,340	33

As shown in Table 8-17 the total soil losses from treatment plant, pump station and interceptor construction are only marginally different with Alternatives 1 and 2 showing higher soil losses than Alternatives 3, 4, 5, 6 and 7.

Water Quality and Quantity: The seven action alternatives may affect water quality and quantity in several ways, including: the effects of treatment plant discharge, surface runoff, reduction of infiltration area, and depletion of available water supplies. The latter three would result from the increase in population and development projected for the study area during the planning period.

The alternatives considered vary in the number of treatment plant discharges from one (Alternatives 3, 6 and 7) to five (Alternative 1). Under any of the alternatives, effluent quality must meet limitations set by State regulations (via NPDES permit). However, certain components of treatment plant discharge could significantly affect surface water quality, especially in those cases where the effluent flow would constitute a significant addition to base flow in the receiving stream.

The augmentation to stream flow (percentage increase) is shown in Table 8-18 for the seven alternatives and their component plant discharges for both average and low (MA7CD10) flows. It should be noted that although the flow data used is the same as for Alternatives 5 and 7 a lesser population would be served by Alternative 6.

In all the alternatives, proposed treatment plant discharges significantly augment stream flow under low flow conditions. Under average flow condisions, components of Alternatives 1 and 2 augment stream flow almost 30% while 3, 4, 5, 6 and 7 exhibit smaller increases. The effects on stream temperature would be dependent on both effluent volume and effluent temperature. Since all segments of the streams in the study area are classified as Trout Maintenance (NJDEP, 1974), temperature increases due to discharges are limited to less than 1.1°C. This could become an important factor during winter months when effluent temperatures would probably be higher than ambient receiving stream temperature. Under those conditions, the larger the flow augmentation due to the effluent the greater the potential for exceeding state limitations and affecting stream biota (see section on Biota for further detail). Table 8- shows the largest differential between ambient and effluent temperatures that would not contravene state standards.

TABLE 8-18

ALLOWABLE EFFLUENT TEMPERATURE ABOVE AMBIENT STREAM TEMPERATURE

Treatment Plant	MA7CD10 Flows Upstream Flow (mgd)	Plant Flow (mgd)	Increase %	Allowable Temp. Differential °C	Average Flow Upstream Flow (mgd)	Plant Flow (mgd)	Increase %	Allowable Temp. Differential °C
1A *	0.81	1.75	216.0	1.61	6.1	1.75	29.0	4.9
1B	10.34	0.6	6.0	20.1	52.4	0.6	1.1	97.2
1C **	4.85	-	-	-	27.8	-	-	-
1D **	4.85	0.8	16.5	7.8	27.8	0.8	2.9	39.3
1E	1.62	1.2	74.1	2.5	7.8	1.2	15.4	8.3
2A	0.81	1.8	222	1.6	6.14	1.8	29	4.9
2B	4.85	1.4	29	4.9	27.79	1.4	5	22.9
2C	10.34	0.9	9	13.7	52.35	0.9	2	65
3	10.34	4.1	40	3.9	52.35	4.1	8	15.1
4A	10.34	2.7	26	5.3	52.35	2.7	5	22.9
4B	4.84	1.4	29	4.9	27.79	1.4	5	22.9
5A	4.85	3.8	78.4	2.5	27.8	3.8	13.7	9.1
5B	10.34	0.6	6.0	20.1	52.35	0.6	1.1	97.1
6	4.85	4.4	91	1.2	27.8	4.4	16	8.0
7	10.34	4.4	43	3.0	52.35	4.4	8	14.0

* Estimated as 50% of flows at Bartley

** Estimated as sum of flows at confluence of Drakes Brook and South Branch (using flows at Bartley)

Groundwater Quality: Groundwater quality may actually be improved by all of the action alternatives. Predicated on large increases in total population and population density, the action alternatives both eliminate existing septic pollution problems and prevent these problems from appearing in the future due to the large potential service areas involved. As shown in Table 8- , the comparative total flows and therefore the corresponding serviced population are quite similar. The seven alternatives are only marginally different in total sewage flow, with Alternatives 5, 6, and 7 exhibiting the largest flows (and largest serviced population) and Alternatives 2, 3 and 4 the smallest.

Biota: Both terrestrial and aquatic biota may be affected by the action alternatives. Terrestrial biota may face a loss of habitat from both construction and increased development. The construction of treatment plants and interceptors would result in the disturbance of the mature vegetation. This is expected to be minimal for the action alternatives, as over the long term the proposed treatment plant sites are the only disturbed areas. Interceptor construction areas experience regrowth and impacts would be limited. Much of the interceptor construction would be in presently disturbed areas such as roads and railroad right-of-ways. Construction in these areas will have a negligible impact on biota. Where interceptor construction does leave the disturbed areas, some mature forests would be impacted. This is expected to be a minimal impact. Although the easement would be devoid of trees, herbaceous vegetation would be established. The shrub and vine growth at the edge of the easement would be increased. As shown in Table 8-17 (refer to Soils) the difference in length of interceptors is slight, resulting in little differential between the alternatives.

The proposed treatment plant sites are basically open areas. Construction impacts would be related to the amount of land used. Alternative 1, requiring the largest area, would have the greatest impact. Alternatives 3, 6 and 7 would have the least. Under any alternative, the amount of land used compared to the entire study area would result in a negligible adverse impact.

Terrestrial species diversity may be affected by the action alternatives. Species that are wary of human presence would tend to migrate from the study area as the population increased. This would result in the loss of some species. This is expected to be a minimal adverse impact in the study area as the area is presently well traversed, resulting in few undisturbed habitats. However, one locale that may be significantly affected would be Budd Lake Bog. This site is unique in the study area, and an interceptor route is planned for its southeastern edge. The resulting population pressure may cause faunal species that reside solely in bog areas to leave.

Aquatic species may be affected by the treatment plant's discharges, construction impacts, and surface runoff from developed areas. Temperature increases in the streams due to effluent discharge could affect stream biota if the addition of the effluent raises the temperature of the streams 1.1°C above ambient conditions. The potential for this adverse impact is greatest during the winter when base flows are cold and effluent temperatures are relatively high. (The exact temperature of the effluent will be a function of the retention time within the plant.) Alternatives 1 and 2 show the largest augmentations to flow and therefore hold the potential for greatest adverse impact due to temperature increases, followed by Alternatives 5, 6 and 7 and then Alternatives 3 and 4.

Construction of interceptors along streams can result in sedimentation in the stream, decreases in shading causing an increase in stream temperature, and reduction in food source. Soil loss during construction would be deposited in the nearest stream. A stream with a low flow would not be able to scour a great deal of soil too readily, potentially causing a change in river bottom characteristics. As different fauna require different substrate, the addition of fine particles could result in a change of species. For example, trout require a sand and gravel base for reproduction. Covering the stream bottom with a layer of mud would result in the loss of reproduction areas for the trout. This could be for one reason or several, depending on the flow of the stream and the amount of soil deposited.

Construction would also remove the natural vegetation (trees) of the floodplain. Some aquatic fauna have narrow tolerance ranges for temperature. If they cannot survive above or below a certain temperature, removal of shade trees may cause the stream to exceed that species' temperature limits. The removal of stream bank vegetation would also reduce the food source, as insects are more plentiful in the shade. This could be a significant impact for fish that have insects as the mainstay of their diet.

The impact of stream bank construction would be moderate for Alternative 1. Although construction would be necessary along some stream banks, most of the impacted streams are either disturbed presently or would have sufficient flow to recover from the sedimentation impacts. Alternatives 2 through 5 would involve similar segments and their impacts, but originally would also impact Turkey Brook which is listed as a trout production stream. Interceptor construction along the brook would result in significant sedimentation, an increase in summer temperature, and a loss of food source. The conditions could cause Turkey Brook to change its trout classification from production to maintenance or nontrout, depending on the degree of impact. This impact would result in Alternatives 2 through 5 having a significant adverse impact on stream biota. Based on these considerations revisions of the alternatives were made to eliminate the Turkey Brook interceptor.

Urban runoff carries oil products, pesticides, and fertilizers into the streams. Slight increases in these substances can make a stream uninhabitable for pollution intolerant species such as trout.

At the possible treatment plant sites, sufficient area exists to prevent construction from affecting aquatic biota.

Environmentally Sensitive Areas: Environmentally sensitive areas (refer to Section 2) include surface waters, forests, wetlands, historical and archaeological sites, and prime agricultural lands. The proposed alternatives will impact all these areas.

Surface waters will be affected by interceptor construction and increased floodwater flows. The degree of impact is similar for all alternatives. Alternative 1 would have slightly less of an impact, as an interceptor is not proposed for any of the Turkey Brook area.

Forests would be slightly affected by the construction of the interceptors and treatment plants for all alternatives. The growth that is predicted to occur would require the removal of trees in the northern section of the study area. Alternatives 1, 6, and 7 would have slightly less development occurring than Alternatives 2 through 5, as the Turkey Brook area would not be included.

The study area contains some fo the few remaining areas of prime agricultural land in Morris County. These are located in the valley southeast of Long Valley. Alternatives 2, 3, and 4 would result in the sewering and developing of these lands, removing them from agricultural use. Although sewering areas adjacent to them, Alternatives 1, 5, 6 and 7 will not directly impact prime agricultural soils.

Budd Lake Bog is a unique area for northern New Jersey, but construction of the interceptors would not significantly affect it. However, the potential exists for development of sections of the bog, which would have an impact.

Endangered animals and plants have not been reported in the study area but may be present. Construction of most of the alignments would not adversely affect biota. Should development occur in areas adjacent to the interceptors that are not predicted to develop (such as the bog and the swamp surrounding the northern portion of Drakes Brook), endangered biota might be impacted.

Aesthetics: The action alternatives would result in the reduction of odors from malfunctioning septic tank systems. This would result in a beneficial impact for those areas immediately surrounding the failing systems.

An adverse impact that would occur with the action alternatives is the visual impact of the additional treatment plants.

In terms of absolute numbers, Alternative 1 (with four new treatment plants) exhibits the greatest impact, followed by Alternatives 2, 4 and 5 (with two new plants) and Alternatives 3, 6 and 7 (with construction of a single regional plant).

Historical and Archaeological Consideration: During construction of interceptors and treatment plants excavation of previously undisturbed areas will occur. This has the potential of disrupting presently unknown historical and archaeological sites that are of significant interest. A historical and archaeological survey is required prior to construction approval; therefore any adverse impacts will be avoided or mitigated.

8.6.2 No-Action Alternative No. 8: Alternative 8, the no-action alternative, would require the continued use of septic tank systems throughout most of the study area, unless additional sewage facilities are provided by private developers. The existing treatment plants would be upgraded if they are not presently attaining water quality standards, but no expansion of service area would occur.

Continuance of existing facilities would result in significant environmental impacts. As was described in Section 2, there are presently areas that contain malfunctioning septic tank systems. The physical conditions that resulted in these malfunctions will cause neighboring systems that do not have problems now to fail as they age. Substances carried in the liquid portion of septage become trapped in the soil, clogging the soil pores and reducing its filtering ability. In order to continue to use a septic system after a malfunction, either a new area must be found in which to construct a new system or all the clogged soil surrounding the existing leaching area must be removed and replaced by clean or uncontaminated fill. Continuing to use malfunctioning systems results in a saturated soil condition and the possibility of seepage of the septic tank effluent. Saturated soil does not allow infiltration of precipitation, reducing the amount of clean water that enters the soil. In addition, most plants do not grow well in saturated soil. Air in the soil pores is necessary for the proper development of roots.

Both surface and groundwater quality may be impacted by the no-action alternative. Surface water would be affected by the seepage from malfunctioning systems and the discharge from the existing small treatment plants. Septic systems fail most often during periods of high groundwater, and rainfall during malfunctions would result in seepage being carried by runoff into receiving streams. As indicated previously, the amount of runoff may be increased from malfunctions. This would increase the potential for impact on surface waters. The total impact on each stream would be dependent upon the number of homes with malfunctions and the severity of the failure. As streams in the area generally have good water quality, any increase in contamination levels could affect the stream's biota. Budd Lake already experiences problems that are believed to be related to septic systems effluent (Noyes, 1975). Nutrients from the effluent are thought to be seeping into the lakes, encouraging algal growth. This increased growth affects the quality of the lake and its use for swimming and other recreational activities.

Nitrates and other substances carried in the liquid fraction of septage may be carried into the groundwater layers under proper operating conditions as well as during malfunctions. As more systems are installed, the efficiency of others decreases and the potential for contamination of groundwater becomes serious. As wells are used in the study area as the main source of potable water, this could result in water of a lower quality than advisable. Infants are particularly sensitive to nitrates in drinking water.

Impacts on biota in the study area could also be expected from the no-action alternative. Housing construction will result in the loss of terrestrial habitats. Without sewers, the population increase can be expected to be moderate. Species that are tolerant of human presence, such as squirrels, chipmunks and various song birds, may be benefited by the increase in households. However, species that are wary of humans would tend to move away from areas being developed. As growth under this alternative would probably be more diffuse, increased human contact would occur, resulting in a decrease in total species diversity even if the number of individuals observed may be greater. Although this would affect the entire study area, the number of habitats available and the expected moderate population increase would result in a minimal impact.

Aquatic biota may be more significantly impacted than terrestrial biota. Small treatment plants are not as efficient as larger plants and may require more effort to maintain effluent quality. The fish present in many of the streams indicate that the water quality is presently very good. Trout are sensitve to low levels of pollution, especially for spawing areas. Should a small plant function at less than acceptable levels, trout may no longer be able to survive in the receiving stream. Should a small plant malfunction, the receiving stream may temporarily become unsatisfactory for all of the native biota. As small plants have low flows, this would be a minimal impact, occurring for a short period of time only. Septic tank seepage may also be a problem. Carried by runoff water, septage entering a stream would be detrimental to the aquatic biota. This could be a minimal to severe impact, depending upon the location of malfuntioning systems in relation to streams, the existing water quality of the stream, and the time of the year. Aquatic biota exhibit different tolerances of contaminants dependent upon their stage of development.

Most environmentally sensitive areas, with the exception of streams, will not be impacted by the no-action alternative. Swamps, marshes, bogs and floodplains have drainage problems that make them unacceptable for septic tank systems. The amount of fill necessary to overcome the drainage problems ordinarily make building uneconomical, unless done for high density units. Without sewer service, high density development is unlikely in these areas. Steep slopes, recreational areas, and historic sites are also unlikely to be developed.

A minor problem associated with malfunctioning septic tank systems is odors. This affects the aesthetics surrounding the household. This impact will increase as more systems in an area malfunction.

In summation, the no-action alternative would result in significant local impacts in the future. The continuance and increase of malfunctioning systems and the use of small treatment plants would continue to degrade the local environmental. These impacts would be of limited degree to the entire study area but are locally significant.

8.6.3 Land Application of Effluent: As an alternative to surface water discharge of wastewater effluent, land application methods were analyzed. Three systems are commonly described in the literature: spray irrigation, infiltration-percolation, and overland flow. When considering the efficiency of water renovation, the site and management requirements, and the locations of the alternative treatment plant sites, spray irrigation is the most feasible system for the study area (U.S. EPA, 1977).

In order to determine the amount of land necessary for land application, the amount of water, nitrogen and phosphorus to be applied must be taken into consideration. Minimum acreage required by the NJDEP have been presented. (Unpublished guidelines, NJDEP, 1977). However, these areas are based on the assumption that nitrogen and phosphorus would not limit application. To determine if the assumption is true, modelling of the expected effluent quality is necessary. The nitrogen model is presented in Appendix E and shows a maximum application rate of 52 inches per year. The assumptions used in the model are based on reported conditions for this area (U.S. EPA, 1977). The 2 mg/1 limit for nitrogen percolation is based on the existing high water quality and the need to prevent its deterioration. The ground water is utilized as a potable water source in the study area. Although higher allowances of nitrogen contamination have been recommended by some sources, only recently have studies begun to determine the filtering ability of aquifers and the fate of pollutants that enter them. As water moves slowly through aquifers, a significant potential exists for serious contamination before the problem is discovered in a drinking water well. This is a potential significant health impact that is best controlled by initially limiting the contamination.

Phosphorus is more difficult to model, as its mobility in the soil is influenced by pH, temperature, water movement and availability, and concentrations of iron and calcium (U.S. EPA, 1977). Consequently, until a site is chosen, effluent being produced and detailed analyses made, only a general indication of the amount of phosphorus that may be applied can be used. Ellis (1976), during studies of Michigan soils and phosphorus models, identified application rates that are suitable for different soil textures (Table 8-19) Assuming that loams or clay loams are used, an application rate of 53-55 acre-inches per year is possible. This is slightly greater than the amount allowed by the nitrogen model.

The amounts of land presented here are for the actual application area only. In addition, allowance is necessary for storage facilities, buildings, road access and a 200 foot buffer around the entire area to limit aerosals and aesthetic problems.

TABLE 8-19

MAXIMUM RATES OF WASTEWATER APPLICATION
RELATED TO SOIL TEXTURE AND THE ABILITY
OF THE SOIL TO ABSORB PHOSPHORUS *

[Source: Ellis, 1976]

Soil Textural Group	Rate of Application Acre Inches/Year
Silty clay to clay	60
Clay loam	55
Loam	53
Sandy loam	40
Loamy sand	45
Sand	40

* Assume 7 ppm total phosphorus in the wastewater and a crop removal of 25 pounds phosphorus/acre/year, with a 50 year expected life of the system. Data from Michigan soils.

Spray irrigation sites require certain conditions for proper operation (U.S. EPA, 1977):

- slope less than 6%,
- moderate permeability,
- loam soils preferred,
- 3-5 feet to groundwater,
- greater than 5 feet to bedrock, and
- a study of CEC, heavy metals and ph prior to application.

In addition, a 200 foot buffer, preferably of trees, is necessary along any roads or surface waters that are adjacent to the application site. Public access should be controlled. In order to allow proper aeration of the soil, a rotation system of application is recommended, with each plot of land receiving its entire allocation of effluent being applied in one day. The land is then allowed to rest for 5 to 10 days before being used again, depending on its drainage abilities and the climate (U.S. EPA, 1977).

Based on the models, the amount of land necessary for each treatment plant can be determined (Table 8-20). Although one site adjacent to the treatment plant is desireable, with the site characteristics necessary and the location of the treatment plants, this will most likely not be possible. Therefore, duplication of pumping and sprinkler systems, an increased buffer zone, and increased piping from the plant would be necessary.

Environmentally, land application of effluent has the greatest potential for affecting groundwater. Although it would significantly benefit the groundwater quantity (adding 4.3 feet of effluent annually to the natural 0.8 feet percolation), it may also adversely affect the quality. The amount of nitrogen entering the groundwater is a potential health hazard, especially for babies who may drink well water tapping the aquifer.

The increased water would benefit streams, as a large portion of the effluent would seep out as base flow. By applying to land an additional filtering occurs, and the water is brought to ambient temperature, removing the potential of temperature shock.

Vegetation should be minimally affected as the areas used would most likely be in a herbaceous stage. This is due to the fact that the soil characteristics necessary for a

TABLE 8-20

LAND AREA (ACRES) REQUIRED FOR EFFLUENT APPLICATION

Treatment Plant	Application Model Type: Water	Nitrogen	Phosphorus
1A	267	451	443
1B	91	155	152
1C	53	90	89
1D	122	206	202
1E	182	309	303
Total	715	1,217	1,189
2A	274	464	455
2B	213	361	354
2C	137	232	228
Total	624	1,057	1,037
3	624	1,057	1,037
4A	411	696	683
4B	213	361	354
Total	624	1,057	1,037
5A	579	979	961
5B	91	155	152
Total	670	1,134	1,113
6	670	1,134	1,113
7	670	1,134	1,113

Note: These acreages do not include provisions for buffer zones.

properly operating land application system are the same characteristics that are found at the prime agricultural lands. Consequently, the use of a land application system would require the purchase by the authority of agricultural lands in an area that has been identified by the state for encouragement of agriculture (N.J. Dept. of Agriculture, 1973).

In summary, a land application system in the study area would provide minimal benefits over point-discharges while requiring the purchase of a large amount of land which may not be readily available, having a high potential for health impacts and would require a significant amount of operation and maintenance.

8.7 Liquid Treatment and Sludge Disposal Costs: In Section 8.4 above, the treatment plant alternative plans were discussed in detail and total annual costs were developed for the liquid and sludge portions of the treatment process.

Table 8-21 following, shows the capital costs and debt service for the selected plan. The first breakdown shows the capital costs for the 1990 population and construction in 1985. The second breakdown shows the additional costs for a future 1995 plant expansion for the 2000 Calendar Year population. The third grouping shows the total debt service which includes the 1995 construction and the 1995 expansion of the liquid and sludge disposal facilities. Again, the cost analysis was based on 1977 costs and extrapolated accordingly to 1985 construction or the 1995 construction for the plant expansion. The basis for the cost factor expansions are shown in the notes of the Table.

The 1985 capital costs for the liquid portion of the treatment plant is $14,776,000 and the sludge disposal facilities is $3,346,000. The 1985 debt service for the liquid portion is $982,000 and the sludge, $288,700.

Table 8-22 summarizes the total annual costs for liquid treatment and sludge treatment for the selected plan; in terms of debt service for the major plant and sludge treatment, and the O & M fixed and plant variable costs. Also included is the debt service and O & M estimated for the Schooley's Mountain plant. The total annual costs for the liquid treatment CY 1985 is estimated to be $1,300,000/year and for the sludge treatment in 1985 is $454,000/year.

8.8 O & M Costs - Collection System: The O & M costs for the local collection systems, interceptors and lift stations for the selected plan are shown in Table 8-23. The O & M for the local collection systems and interceptors is based on $.06/lineal foot. The O & M for the pumping stations was developed in Table 8-16. Based on the number of connections shown, the O & M per connection 1985 is $4.39 for the local collection system, $1.87 for the interceptors and $5.09 for the pumping stations. These O & M costs represent a very small precentage of the total annual cost per connection.

Table 8-21 Plan 6 Liquid Treatment and Sludge Disposal Costs

1980 Design (For 1990 Population)	1977 Capital Costs	1985[2] Cost	1985 Debt Service
A. Liquid (4.4 MGD)	9,271,000[1][6]	14,776,000	982,000[3]
B. Sludge (5.4 MGD)			
Fixed Improvement	1,500,000	2,390,000	158,800[3]
Mechanical Equipment	600,000	956,000	129,900[4]
Total Sludge	2,100,000	3,346,000	288,700

1990 Design (for 2000 Population)	1977 Capital Costs	1995 Plant Expansion Cost[5]	Plant Expansion Debt Service Costs
A. Liquid (6.7 MGD)	4,260,000	10,252,000	681,400[3]
B. Sludge (7.7 MGD)	605,000	1,456,000	99,300[3]

A. Liquid (6.7 MGD)	Total Debt Service Costs[7]	1,663,400
B. Sludge (7.7 MGD)	Total Debt Service Costs[7]	388,000

Notes:

(1) Includes Pump Station at Long Valley with 14" force main to Confluence STP.
(2) Cost Escalated 6% a year for 8 years CAF = 1.5938. CAF (Compound Amount Factor).
(3) Equal Principal payments 40 years, 6% interest CRF = .06646. CRF (Capital Recovery Factor).
(4) Equal Principal payments 10 years, 6% interest CRF = .13587.
(5) Cost Escalated 6% a year for 18 years CAF = 2.4066.
(6) Table 8-3 Capital Cost x 1.27 (service and interest factor)
(7) Total debt service includes 1985 Construction and 1995 Expansion.

Table 8-22 - Plan 6 - Summary of Total Annual Costs

LIQUID TREATMENT
(Includes Pump Station and Force Main Costs)

Year	$ Debt Service Major Plant	$ O & M Plant Fixed	$ Plant Variable	$ Schooleys Mountain Debt Service and O & M	$ Total Annual Costs Actual	Rounded
1985	982,000	159,235	150,893	7,500	1,299,628	1,300,000
1990	982,000	159,235	190,835	7,500	1,339,570	1,340,000
1995	1,663,400	242,471	244,091	7,500	2,157,462	2,160,000
2000	1,663,400	242,471	292,910	7,500	2,206,281	2,210,000

SLUDGE TREATMENT - (ST-6)

Year	$ Debt Service Sludge Treatment	$ Compost (1) O & M	$ Dewatered O & M Fixed	Variable	$ Total Annual Costs Actual	Rounded
1985	288,700	90,833	34,970	38,806	453,309	454,000
1990	288,700	109,413	34,970	44,466	477,549	478,000
1995	388,000	134,186	49,594	54,167	625,947	626,000
2000	388,000	156,894	49,594	63,061	657,549	658,000

(1) Based upon $103,220/year for 5 MGD proportioned to flow.

Year	MGD Flow
1985	4.4
1990	5.3
1995	6.5
2000	7.6

Table 8-23 O & M Cost Development for LCS, Interceptors and Lift Stations - Selected Plan

Item	O & M 1977 $	O & M 1985 $	Connections 1985 Units	O & M Cost per Connection 1985 $
Local Collection System	25991 (1)	41424	9427	4.39
Interceptors	11070 (1)	17643	9427	1.87
Pumping Stations	30096 (2)	47967	9427	5.09

Notes: (1) Based on $.06/LF - Reference Cost to the consumer for collection of and treatment of Wastewater, Water Pollution Control Research Series 17090 7/70.

(2) See Table 8-16

9.0 SELECTED PLAN

9.0 SELECTED PLAN

9.1 Views of Government, Public and Concerned Interests: During the progress of this study, the Consultants have maintained liaison with the officials of Mount Olive, Washington, and Roxbury, and with representatives of the DEP and EPA. In addition, public meetings have been held in which the Consultants presented and explained elements of the facilities plan as they developed. Questions raised by the public were answered and for certain concerned interests a closer liaison was maintained by clarify the plan's details and to secure the benefit of any contribution offered by various individuals.

To the fullest extent possible, a record of communications and meetings is contained in correspondence and meeting reports. Appendix F lists the key communications with the interested parties mentioned above and summarizes their contents. Appendix G lists every meeting attended by the Consultants and summarizes matters discussed.

By process of correspondence and meetings continuing during the progress of the study, the Consultants have either satisfied the concern of officials, DEP, EPA, and individuals or they have adopted suggestions and recommendations to assure the plan's general acceptance. This continuing liaison provided essential reactions from all concerned with respect to major decisions by the Consultants, particularly relating to treatment plant site selections, interceptor routings, recognition of principal areas to be sewered and avoidance of environmentally sensitive areas. The plans recommended in this report, therefore, is the one that is not only the most cost-effective but, in the Consultant's opinion, is the most responsive to input received from government, public, and concerned interests.

Toward the end of the Step 1 Grant, two planning agencies expressed concern with the areas to be serviced under the alternatives. Based on several meetings and correspondence[(1)], the areas to be sewered were reduced to that shown in the selected Plan #6 (see Figure 8-5).

9.2 Environmental Analysis: Table 9-1 presents a summary ranking of the alternatives based on the discussion given in Section 8. Although a ranking has been given, most of the differences in impact are slight.

Soil loss was compared on a worst case basis. Alternatives 6 and 7, Alternatives 3, 4, and 5, and Alternatives 1 and 2 had similar soil losses due to a combination of interceptors, treatment plant and pump station construction.

Notes (1) See Appendix C for key written communications.

Why this rationale

TABLE 9-1

SUMMARY RANKING OF ALTERNATIVES*
(1=least impact, 7=most impact)

	Alternatives						
Impact Area	1	2	3	4	5	6	7
Soil Loss (worst case)	6	6	3	3	3	1	1
Water Quality (low flow)	6	6	2	1	4	5	2
Water Quality	4	1	1	1	5	5	5
Terrestrial & Aquatic Biota (interceptor construction)	1	$\boxed{7}$	5	5	2	$\boxed{2}$	2
Terrestrial Biota (Treatment Plant & Pump Stations)	$\boxed{7}$	$\boxed{6}$	1	4	4	$\boxed{1}$	1
Environmentally Sensitive Areas	1	$\boxed{5}$	5	5	2	$\boxed{2}$	2
Aesthetics	$\boxed{7}$	4	1	4	4	$\boxed{1}$	1

I don't see how these could be different

*Where more than one treatment plant would be in operation, the plant with the greatest impact decides the alternative's impact.

Bull it does

The MA7CD10 flows at discharge points and the amount of effluent to be added was compared for water quality impacts. The temperature differentiation was determining factor as it is the parameter not controlled by the NPDES permit. Where there was more than one plant in an alternative, the discharge point that would have the greatest impact was used as the alternative's impact. Alternative 1 with discharges to Stony Brook would have the greatest impacts as the flow augmentation would have the greatest potential for impacting the water temperature. Alternative 6, with all the effluent discharged at a point in the river with a low flow, would have the next greatest impact. Alternative 4 and 5, with the effluent distributed relatively equally between two plants, would have the least adverse impact.

Water quantity impacts are a result of the total augmentation to be expected from the alternative. Alternatives 2, 3 and 4 would have the least impact on the river (i.e. add the least amount of effluent) while Alternatives 5, 6 and 7 would add the most.

Alternative 1 would have the least amount of interceptor construction, impacting terrestrial and aquatic biota the least. Alternative 3, with the greatest amount of interceptor construction, would remove the greatest amount of vegetation and produce the greatest potential for sedimentation in surface waters. Treatment plant and pump station construction would be in presently disturbed areas. The impacts on terrestrial biota would be related to the total amount of land used. Consequently, Alternative 3, 6 and 7 would have the least impact and Alternative 1 the greatest.

Alternative 1 would have the least impact of environmentally sensitive areas as the interceptor through the gorge would not be necessary and the prime agricultural lands in the Middle Valley area would be little affected by interceptor construction. Although Alternative 5, 6 and 7 would have the gorge interceptor, they would have a minimal impact on the agricultural land.

Aesthetic impact is a result of additional treatment plant construction. Alternatives 3, 6 and 7, with one plant, would have the least impact. All alternatives would reduce the adverse impacts from malfunctioning septic tank systems.

As is shown, there is little to differentiate the environmental impacts. Alternatives 3, 6 and 7 would have similar impacts, although the differences are actually smaller that the rankings in Table 9-1 indicate. This is due to the fact that the difference in scope relating to service area, interceptor construction and total sewage flow is slight between the alternatives. The minor differences precludes selection of an action alternative based on environmental considerations. Consequently, the selection of an action alternative will be made based on engineering, cost and implementation considerations.

Comparing land application to a point discharge system, the large land requirements and potential for health impacts from nitrate contamination of groundwater makes land application less desirable.

9.3 Ranking of Alternatives: After review of the Section 3 Report Alternatives, Alternatives 2, 3, and 4 were dropped from future consideration because of the following reasons: (1) service areas too extensive based on existing and project demographic and land use conditions, (2) secondary impacts and (3) not cost-effective.

The two plans remaining #1 and #5 were given further in-depth analysis from technical and cost standpoints, environmental impact and the ability to be implemented by the Townships. As the final selection was undergoing critical analysis, two slight modifications to Alternative 5 were created as follows:

Alternative 6:	Confluence Plant at location 5A and a pumping station at Long Valley (5B site).
Alternative 7:	Long Valley Plant at 5B site.

The Facilities Plan area is developing from the upper reaches of the basin southward toward Long Valley. The Morris Canal (circa 1900) brought trade to the area followed by Route 46, the Budd Lake recreational community and business, and commercial activity along Route 46, Route 10 and now Route 80. The development flowed southward following Route 206, the N-S State road from Succasunna of Drakes Road and the South Branch and the County and Township roads connecting to these major highways. Growth is continuing along Route 24 to Long Valley and the Schooley's Mountain plateau area, which is "prime" residential. The land south of Long Valley, zoned basically "agriculture" and "large lot" which will be the last to be developed, was considered not within the Facilities Plan time frame. Hence, locating a plant or plants at the southernmost edge(s) on this existing development was given top priority.

The areas to be serviced under the Facilities Plan have been analyzed from demographic, land use, engineering costs and environmental standpoints. These areas were discussed great depth with representatives of the Townships, DEP, EPA, Tri-State, and the Morris County Planning Board. Those areas shown in Figure 8-5 were further refined and delineated during the latter phases of the project to meet the 201 Facilities Plan Guidelines. Proposed expansion of these areas are also shown for CY 2000. The interceptors were designed and cost estimated based on projected populations and land use at saturation using existing zoning ordinances. This was found to be the best solution.

At the request of the three municipalities, the Consultants devoted extensive time in performing technical and cost analysis for Alternative #1 which was a system of five (5) existing and new plants, basically all within the political boundaries of the three Townships. From a cost-effectiveness and technical/environmental standpoint, this alternative could not be justified.

The selected plan, Alternative #6, a slight modification of #5, consists of the following:

a. Reduced service area (See Figure 8-5).

b. A confluence treatment plant just south of Drake's Brook and the South Branch

c. A pumping station just south of Long Valley

d. Interceptors

e. Continued operation of the Schooley Wt. "(WT-1), Mt. Olive Complex (MO-5) and Oakwood Village (MO-1) STP's to CY 1995/ CY 2000.

9.4 Implementation Capability: Selection of a facilities plan, aside from assessment of cost-effectiveness and environmental effects, must recognize the practicality of the plan. The criteria for a plan's practicality, or implementation capability, includes the cost and its sharing, existing organization and management, skill of personnel to operate and maintain, use of existing facilities during construction of new facilities, continued use or retirement of existing facilities and capability of local governments to finance or otherwise bear their share of costs.

9.4.1 Cost Factors: The facilities' costs have a dominant influence on selection, i.e., it is inclined toward the most cost-effective of the alternatives considered. The magnitude of the costs, therefore, become the criteria for determining whether or not the plan can be implemented. Aiding the cost criteria is the sharing of capital cost by the Federal Government which funds 75 % of qualified costs for constructing new facilities. Because some costs do not qualify -cost of land, for example- the Federal Government's share is less than 75%. The total cost of the project includes all construction, land acquisition, engineering and other general and administrative expenses such as interest during construction, financing changes and legal fess, but excluding the cost of this facilities plan study.

The effect of Federal and State Grants is to relieve the Townships of a major percentage of the annual debt service charge. Thus, reducing total costs of sewerage service to all users. This selection of a regional plan is favored because of the cost advantage which would be lost if separate township systems were to be constructed and operated.

The annual cost per dwelling unit is a critical factor in determining whether or not the selected plan's costs are within limits of implementation capability. Further on in this report; the capital costs, the total annual costs and cost per dwelling unit are developed. The selected plan can only be implemented with Federal and State Grants.

9.4.2 Management: Each of the townships currently owns and operates at least one treatment plant and collection system. Therefore, collectively, there exists management capabilities in the three townships. For the selected plan, however, it will be necessary to concentrate management in a single authority. As discussed separately in this report, the three townships would form such an authority with full management authority and responsibilities in accordance with New Jersey laws enabling such authorities. While the Washington Township Municipal Utilities Authority is now acting as lead-agency for Mount Olive and Roxbury, its functions and management responsibilities would be assumed by the regional authority which would be formed as a first step in implementing the selected plan. Recruitment of management personnel for the authority will present no problem and may be selected either from the townships' sewerage managements or from other qualified applicants. Initially, the management would be concerned with the design and construction phases and would receive organizational and precedural guidance from the Consultants. As construction ends, management will become concerned successively with start-up and system operations. The time period available before management confronts these responsibilities would be more than adequate to prepare the necessary procedures and techniques; and these would be done with the assistance and guidance of the Consultants and equipment suppliers. It is contemplated that a complete management plan would be developed for the authority. This would include equipment and sewer system operation and maintenance manuals, preventative maintenance program, cost accounting and billing, and rate schedules.

9.4.3 Operating and Maintenance Personnel: As for management, the existing sewerage systems in the three townships may be the sources of some operating and maintenance personnel. Otherwise, all personnel necessary should be easily recruited from qualified applicants. The skills of personnel would be supplemented or developed by their early recruitment before initial system operation begins and intensive indoctrination and training by equipment service representatives. In addition, the Consultants would provide assistance in a formal training program. All assignments, when required, would be staffed by licensed individuals.

9.4.4 Existing Facilities: Existing facilities - sewers and treatment plants - offer no cause for concern in relation to the implementation capability of the selected plan. Existing sewers -dry and active- would be connected to interceptors when treatment plants are ready for operation. Meanwhile, existing treatment plants would continue operation during construction of new facilities, and thereafter, be phased out of service.

Reference to existing facilities cannot neglect septic systems which would be abandoned after sewers are constructed. Of necessity, the septic systems must be abandoned after treatment plants and collection systems are completed. A reasonable period of time must be made available for property owners to connect to local collection systems. The time span, assumed as 1 year, would permit orderly transfer of wastewater to treatment plants and minimize overburdening of local plumbing contractors making sewer connections.

9.5 Capital Costs - Selected Plan: #6: The capital costs developed for each of the five major categories in Section 8 are summarized in Table 9-2 entitled Plan 6 Summary of Capital Costs. On examination of this Table, it can be seen that the major categories are Liquid Treatment, Interceptors, Local Collection System, Pumping Stations, and Sludge Disposal. References to Section 8 Tables are provided so that one can relate this summary table to the capital costs developed earlier.

As indicated, the cost base for all the costs developed in this report is Calendar Year 1977. Table 9-2 includes, based on our experience, a 27% service and interest factor which considers the cost of temporary financing, engineering, contingencies during construction and project administration costs. These costs have been excalated to the projected Construction Year 1985 at a escalation factor of 6% per year which is a compound amount factor (CAF) of 1.5938 for the eight year period. These costs do not include any State of Federal grants. The total capital costs, as can be seen from the Table with the 27% factor, based on 1977 costs, is $52,942,000. Expanded to the Construction Year 1985, the total estimated capital cost is approximately $85 million. Liquid treatment accounts for approximately 18% of the costs, interceptors 25% of the cost, local collection systems 51% and the pump stations and sludge disposal approximately 6%.

Not part of this immediate study, there will be an additional capital expenditure in Calendar Year 2000 due to expansion of all facilities including the treatment plant, interceptor extension to serve the extended service areas.

9.6 Cost Per Connection: The ultimate user of a regional sewerage system is the homeowner and the business, commercial or industrial owner. His major concerns are what are the capital costs, and what are the annual costs and their comparison with alternate disposal systems such as on-site disposal where practical.

As discussed in previous Sections, the total capital costs, 1985 is estimated to be $84,378,000. Even though the regulations allow for 75% Federal funding and 25% local share, the regulations also provide for certain nonallowables. Hence, it has been the experience to use a 65% Federal Grant and 35% Local Share. Referring to

Table 9-2 -Plan 6 Summary of Capital Costs

Item	1977(1) $	1977(2) $	1985(3) $	% Total Costs
Liquid Treatment (4)	7,300,000	9,271,000	14,776,000	18
Interceptors (5)	10,581,000	13,438,000	21,418,000	25
Local Collection System (6)	21,301,000	27,052,000	43,115,000	51
Pumping Stations (7)	851,000	1,081,000	1,723,000	2
Sludge Disposal (8)	1,654,000	2,100,000	3,346,000	4
Totals	41,687,000	52,942,000	84,378,000	100

(1) Costs base June 1977 - Rounded to nearest thousand
(2) Costs include 27% Service and Interest factor for temporary financing, Engineering, contingencies during Construction and Project Administration costs.
(3) Costs escalated 6% to construction year 1985 CAF= 1.5938
(4) See Table 8-3 for development
(5) See Table 8-9 for development - 1990 Interceptors
(6) See Table 8-12 for development - Average 1980 and 1990 figures
(7) See Table 8-16 for development
(8) See Table 8-21 for development

Township	Approximate Population to be Serviced 1985	No. of Connections 1985	% of Total 1985
Mount Olive	21000	5998	64
Roxbury	6200	1768	19
Washington	5800	1661	17
Totals	33000	9427	100

Table 9-3, the five major categories of the Facilities Plan system show the bonding period for the 35% local share, the capital recovery factor used, the annual debt service based on the local share and the number of connections based on 1985 population and land use statistics which were developed in Section 6.0 of the Report. From an extension of this basic data, the annual debt service per connection was developed. Annual O & M costs per connection were taken from Table 8-23. Combining the debt service with the O & M costs, the total annual costs per connection was calculated to be $395/year. It must be recognized that these are for connections requiring the total service facilities. Those users not requiring a local collection service, that is active sewers or dry sewers, their amount per year would be decreased by essentially that number identified in the category item in column number 11. These figures in column 11 are averaged out over the total user population, however, the municipalities under their 201 Facilities Plans for the local collection systems will further refine the actual charges per user or connection.

As can be seen from column 12 of Table 9-3, the liquid treatment and sludge disposal represent 55% of the total annual costs and the collection system, that is the local collection systems, interceptors and pumping stations represent approximately 45%.

It must be recognized that these costs were developed based on a 6% increase per year compounded, however, based on recent spiralling inflation rates the 6% may have to be adjusted to under the Step 2 Grant to 7% to 8% compounded annually.

1985 Costs

Table 9- Development of Annual Costs Per Connection

1	2	3	4	5	6	7	8	9	10	11	12
Item	Total Capital Costs 1985 $	65% Federal Grant $	35% Local Share $	Bonding Period Years	Capital Recovery Factor CRF	Annual Debt Service Based on Local Share $	Number of Connections 1985 Units	Annual Debt Services per Connection (Local Share Only) 1985 $	Annual O&M Costs per Connection 1985 $	Total Annual Cost per Connection 1985 $	Percentage of Total %
Local Collection Systems	43,115,000	28,024,750	15,090,250	40	.06646	1,002,898	9427	106.38	4.39	110.77	28
Interceptors	21,418,000	13,921,700	7,496,300	40	.06646	498,204	9427	52.84	1.87	54.71	15
Pumping Stations	1,723,000	1,119,950	603,050	40y 80% 15y 20%	.06646 .10296	32,063 12,418	9427 9427	3.40 1.31	5.09	9.80	2
Liquid Treatment	14,776,000	9,604,400	5,171,600	(See Table 8-22)		982,000	7586	129.44	41.87	171.31	43
Sludge Disposal	3,346,000	2,174,900	1,171,100	(See Table 8-22)		288,700	9427	30.62	17.46	48.08	12
Totals	84,378,000	54,845,700	29,532,300			2,816,283		323.99	70.68	394.67	100

per capita income (pci)
$15-20,000

this is OK for (pci)

9.7 Environmental Assessment of the Selected Plan: As described earlier, Alternative 6 has been selected as the most economical and engineeringly feasible solution. It will involve the construction of one treatment plant just south of the confluence of Drakes Brook and the South Branch, six pump stations and approximately 250,000 linear feet of interceptors and force mains. The selected plan will utilize approximately 25 stream crossings and will result in adverse impacts on soils, water quality and quantity, biota, environmentally sensitive areas and aesthetics. However, beneficial impacts will occur on groundwater quality, sociological and aesthetics of the facility planning area.

9.7.1 Interceptor and Treatment Plant Impacts:

Soil Loss: Construction of the proposed system may result in the loss of 28 to 2,320 tons of soil (Table 9-4). This would be equivalent to 4 to 320 dump truck loads of fill. By using a hay mulch and other soil conservation techniques at construction sites the lesser amount would be lost. Over the study area, this would be an insignificant loss from the soil surface. However, a more important impact of soil erosion is the deposition of the soil in streams. This will be discussed in the water quality section.

Construction of the treatment plant, although requiring a longer period of disturbance than interceptors, provides a greater potential for the control of erosion.

TABLE 9-4

SOIL LOSS

[Source: NJSSCC, 1974]

Construction	Disturbed Areas (acres)	Tons Soil Lost Worst Case	Best Case
Treatment Plant	33	236	3
1990 Interceptors	180	1286	18
2000 Interceptors	36	257	4
Pump Stations	3	21	<1

Housing construction that is expected to occur will also result in the loss of soil. However, the magnitude of this loss is unquantifiable.

Water Quality and Quantity: Soil eroded from construction sites will be carried by runoff into the nearest stream. The amount of sediment removed by vegetation or surface features varies by site, resulting in most sediment removed from the construction site reaching the stream. The velocity of some of the streams at or near their headwaters may not be sufficient to remove the soil rapidly. The resulting sedimentation may affect the stream bed characteristics, increase turbidity and possibly modify the channel characteristics. This impact may affect the stream for several years, until the stream has been able to flush the soil out. This may be modified or mitigated by keeping construction as far from the stream bed as feasible.

As demonstrated in Section 8, the temperature impacts of the effluent discharge may adversely affect streams conditions. Under Alternative 6, flow augmentation at the confluence of Drakes Brook and the South Branch from the treatment plant may be 91% during low (MA7CD10) and 16% under average flow conditions. The entire stream, at this point, is designated as trout maintenance (NJDEP, 1974) which limits temperature increase to 1.1°C and below 20°C at all times. Under average flow conditions, these limits would be exceeded if the temperature of the effluent was more than 8°C higher than the receiving stream (which is possible in the winter). This may be mitigated by using a temperature equalization lagoon prior to effluent discharge to the stream. Other effluent characteristics will be regulated by the NPDES permit and will not significantly affect water quality. Dechlorination will be provided, preventing chlorine residuals from affecting stream biota.

Groundwater will also be beneficially and adversely impacted by the selected plan. As described in Section 8, the quality of the groundwater is expected to improve locally, as nitrates, phosphates and other materials from septage effluent will be removed from the groundwater layers.

The predicted development could have a significant impact on groundwater quantity. The domestic water supply is from wells recharged in the study area. The aquifers present are limestone, recharging at a rate of about 250,000 gpd/mi^2 or 400 gpd/acre, and fractured granite, recharging at 100,000 gpd/mi^2 or about 150 gpd/acre. As previously discussed, the projected density for the study area will be 1.0 persons per acre in 1980 and 1.4 persons per acre in 1990. Assuming a water consumption of 100 gpd/capita, the amount used to project flows, this would result in 100 gpd per acre in 1990 being removed from the groundwater table. In addition, another 2 million gallons per day is projected to be required by industrial and commerical use in the study area. This indicates that a significant problem may result from the predicted growth. According to the population predictions, by the year 1990 more than one-half of the annual groundwater naturally returned to the aquifers would be consumed. The aquifers will also not be able to recharge normally as the water that would infiltrate into the ground in an undisturbed area will become increased runoff in a developed area. Although additional potable water may be supplied by reservoirs, reduction of the water level at the headwaters of an aquifer may affect wells outside the study area.

Biota: Construction of the interceptors will require the removal of some floodplain vegetation. Where the interceptors leave the roads, a forty foot construction easement will be used, in which the vegetation is removed. Although the floodplain trees would be removed, the impact on the study area is expected to be minimal. Where trees are removed, the easement will be retained with a grassy cover. The opening of the canopy would result in the proliferation of edge species along the boundaries of the easement, including blackberry, greenbriar, and wildrose. Although considered a nuisance by the human population, these species provide excellent habitat for many animal species.

The treatment plant is proposed for a basically herbaceous locale. The amount of field habitat that would be lost due to construction (33 acres) is minimal for the study area. The pump stations would occupy from 1/4 to 1/2 acre of land each, generally in shrubby or herbaceous areas. Their construction would have a negligible impact on the study area.

The population growth predicted for the study area may result in a change in the terrestrial biota. Housing construction may result in the removal of forests and the disturbance of species that are wary of human presence. This may be a minimal impact, as the area is well traveled presently, and a significant amount of forest occurs on land that is unsuitable for houses and is unlikely to become developed.

Environmentally Sensitive Areas: Several sensitive areas, such as surface waters and forests, have been discussed previously. Other sensitive areas will be affected by the selected plan.

Wetlands, including Budd Lake bog, will be minimally impacted by treatment plant and interceptor construction. The interceptors will be along floodplains, but would be located as far as feasible from the regions that are regularly flooded. The proximity of interceptors to these wetlands may place developmental pressure on them. The swamp along Drakes Brook is an example of this. Because of its easy access to Interstate 80 and State Route 10, the interceptor passing through the swamp along the railroad track may encourage increased usage in this area even though it is not planned fro development. Swamp land is generally less expensive to purchase than adjacent uplands properties.

A section of interceptor extends into a presently disturbed portion of Budd Lake bog. The bog is the area most likely to contain endangered species, as it is an unique habitat (refer to Section 2 Report). As interceptors will only reach a small section of the bog, the primary construction impacts on endangered species are expected to be negligible. An increased population growth may result in the loss of some endangered flora.

The proposed interceptor alignment through the gorge in Mount Olive is designed for construction in the roadway. However, the narrowness of the road, the presence of outcropping bedrock, steep slopes and the South Branch flowing parallel to the road make this a sensitive area. Should the interceptor leave the road, the potential exists for significant adverse impacts. The soils along the gorge are described as having a severe erosion hazard (SCS, 1976). Removal of the vegetation will remove the stabilizing influence of plant roots, allowing erosion and possible slope slippage. Sedimentation in the river at this point will remain longer than other areas further downstream. Blasting of bedrock may also encourage slope slippage. The steepness of the slopes result in a continued erosion problem once it is started. Vegetation only slowly restabilizes slopes of this magnitude.

Washington Township contains some of the few remaining prime agricultural lands in Morris County. However, construction of the selected plan would result in a minimal primary adverse impact on these lands. Population growth predicted in the area could possible occur on the agricultural land, as they are generally level and less difficult and less costly to prepare for housing construction than a comparable section of forest land. This could be a moderate secondary adverse impact on the agricultural lands that are included in the proposed service area. In addition, several sections of prime agricultural land south of the served section may experience increased developmental pressure from the proximity of interceptors.

Prior to the construction of the selected plan, a survey of the interceptor alignments, pump stations and treatment plant sites will be done to determine their impact on potential and existing historical and archaeological sites of National Register quality. The survey will identify all impacts and recommend any migigating measures. The report of this survey will be contained in an addendum to this facility plan.

Aesthetics: The selected plan will require the construction of one new treatment plant. The adverse visual impact of this plant can be modified by the establishment of evergreen trees as a screen. The resulting impact of the treatment plants is expected to the minimal. After a grass cover is established along interceptor easements, their aesthetic impact would be negligible. The presence of pump stations would have a local adverse minimal impact.

9.7.2 Composting: As previously described, the composting site will occupy 6 acres, excluding buffer storage and building areas. The composting will occur in a concrete base, allowing collection of runoff and preventing leaching into the soil. Construction of the site is expected to have minimal impacts on biota and water quality. The operation may result in some odors, but their impact can be minimized by maintaining a sufficient buffer zone.

Woodchips have been proposed for use as the bulking material. The source of woodchips may be: purchased from a sawmill; purchased from a local supplier; obtained from utility or tree removal sources; or chipping of county park and local vegetational debris. Although a guaranteed supply source is desirable, by obtaining utility refuse and chipping their own, the authority may be able to reduce resource costs.

In addition to the composting site and operation, distribution of the compost is also required. Using preliminary NJDEP (1977) guidelines a maximum of 20 tons per acre per year may be applied without monitoring. Based on this, and with a 14,340 lb/day sludge production, about 130 acres would be necessary for land application. This is 1% of the existing farmland in Washington Township. Based on this, it is assumed that all sludge that is produced could be distributed to farmers. Also, a give-away program, where home-owners carry away the compost for use on their properties, is feasible. (A public relations program would be necessary to make the give-away program viable).

When distributing to farmers, two methods of compost application are feasible: application by the authority; or application by farmers after short-term storage on their properties. Although application by the authority ensures proper application rates, it requires additional man-power and equipment and involves timing difficulties for delivery. By delivering to the farmers within a short period prior to application (2-3 weeks) and allowing the farmer to do the application, timing difficulties are reduced. Farmers can apply the compost when it best coincides with their agricultural practices and the authority is not required to deliver and apply the entie supply of compost to all farmers involved within a few days. In any given area, farmers would tend to plant and harvest the same crop at about the same time. By delivering on request to the farmers rather than twice a year during peak cropping periods, farmers maintain a greater flexibility for its use.

A combination of the methods is feasible. By taking bulk orders from farmers or municipalities while also allowing pickup by homeowners, disposal of all the compost in the study area would be feasible.

With the amounts of sludge that will be produced, the quality expected from domestic wastes and the amount of land available, environmental impacts from land application of compost would be negligible. However, monitoring of the sludge quality is recommended to ensure that health hazards are not present. Also, an educational program, explaining the potential uses and limitations of compost, is desirable.

9.7.3 Adverse Impacts Which Cannot be Avoided: Several of the impacts previously discussed cannot be avoided. Soil erosion will occur from construction sites, but the amount of soil lost can be mitigated by using soil conservation techniques. Likewise, sedimentation will occur in streams from soil erosion and stream crossings. The degree can be reduced by the use of soil conservation methods, timing stream crossings for periods of low flow and by expeditous construction to reduce the length of time soil may be lost.

During construction vegetation will be removed. This can be mitigated by restricting the width of easement wherever feasible and be reestablishing a herbaceous vegetation cover upon completion of construction. As the addition of the effluent at the treatment plant site contributes significantly to stream flow, it must be considered that effluent discharge at this point is an adverse impact that cannot be avoided. Related to the augmentation would be the almost inevitable increase in stream water temperature at certain times of the year, possibly in contravention of existing state limitations. Using a temperature equalization pond prior to discharge would mitigate this impact.

9.7.4 Relationship Between Local Short-term Uses of the Environment and the Maintenance and Enhancement of Long-term Productivity: In Section 2 Report, it was stated that local planning goals call for significant increases in population and population density before the end of the century.(1) Therefore, the proposed project can be considered to enhance long-term economical and social

Notes (1) See Appendix C

10.0 IMPLEMENTATION

10.0 IMPLEMENTATION

10.0 Financing of Sewer Projects: Municipalities, either individually or jointly may provide sewerage facilities by 1. Designing and constructing facilities, 2. Contracting for the disposal and treatment with another municipality, local or county sewerage agency or private sewerage company or, 3. Purchasing an existing system or plant or, 4. A combination of one or more of the above. A sound facilities development plan, buttressed by zoning ordinances and subdivision regulations will facilitate the planning and construction of local sewer collection systems. Good overall planning, that is the Facilities Plan, will give proper financial and technical consideration to the regional facilities to meet existing and future needs.

In many cases, the major consideration in planning local and regional sewerage facilities is in the means of financing. Table No. 10-1 is a summary of the alternate methods of organizing and financing for local and municipal sewerage systems.

The design acquisition and/or construction, expansion of a sewerage system may be financed by one or a combination of the following: current revenue (pay as you go method), cash reserves, general obligation bonds amortized by general taxes, local improvement (special) assessment bonds amortized by special assessments, self-liquidating utility bonds amortized by revenue or authority revenue bonds amortized by revenue.

Should the sewerage facilities be financed by bond issues, the various types of bonds permitted and the legal amortization requirements of each must be considered. For example, the general obligation bonds are serial bonds maturing in annual installments commencing not later than one year from the issuing date. No annual installment may exceed the smallest previous installment by more than 50%.

Local improvement assessment bonds are serial bonds maturing in annual installments commencing not later than two years from the issuing date and extending for the period over which special assessments are to be paid, but not exceeding ten years.

Table 10-1 Sewerage Facilities - Alternative Methods of Organization and Financing

1	2	3		4
		Financing		Statutory References (N.J.S.A.)
Organization	Administration	Construction	Operation	
Single Municipality				
Municipal function	Utility superintendent or similar title under supervision of municipal governing body.	General obligation bonds or local improvement assessment bonds	General property tax, sewer rents or charges.	40:63-1 to 30 40:63-41 to 67 40:56-52, 53
Sewerage district	Local governing body.	Local improvement assessment bonds	Special property tax within district.	40:63-32 to 39
Township sewerage district	5 elected commissioners	General obligation bonds of district or local improvement assessment bonds	Special property tax within district, sewer rents or charges	40:154-1 to 13
Self-liquidating utility	Utility superintendent or similar title under supervision of municipal governing body	General obligation bonds or local improvement assessment bonds	Sewer rents or charges	40:63-1 to 30 40:1-78, 79
Self-liquidating joint water sewerage utility	Utility superintendent or similar title under supervision of municipal governing body	General obligation bonds or local improvement assessment bonds	Rents or charges	40:62-106 40:1-78, 79, 9 40:56-52, 53

Ref: N.J. Taxpayers Association

Table 10-1 (continued)

1	2	3		4
Single County or Municipality, or Two or More Municipalities				
Sewerage Authority	(1) 5 members if single county or municipality (2) 3 members or less per municipality if two or more municipalities	Authority revenue bonds	Service charges or rents (participating units may pledge to make up deficits by general taxation)	40:14A-1 to 37
Single 1st or 2nd Class County				
County Sewer Authority	5 or 7 commissioners appointed by Board of Chosen Freeholders	Authority revenue bonds (total debt is limited to 10% of net valuation of real property of participating municipalities plus reserves)	Service payments by participating municipalities, industries or other users	40:36A-1 to 63
Two or More Municipalities				
Joint Meeting	Created by parallel ordinances of participating municipalities; membership as determined by governing bodies	(1) General obligation bonds issued by participating municipalities (limited to 10% of taxable property in a participating municipality on issue date) (2) Temporary notes, or (3) Local improvement assessment bonds	General property tax	40:63-69 to 138

Table 10-1 (continued)

1	2	3		4
Single County or Municipality, or Two or More Municipalities				
Municipal Utilities Authority (water/sewerage)	(1) 5 members if single county or municipality. (2) 3 members or less per municipality. (3) 3 members or less per municipality if two or more municipalities	Authority revenue bonds	Water and sewer service charges (rents, rates, fees)	40:14B-1 to 69

No annual installment may exceed the amount of the smallest previous installment.

Self liquidating bonds are serial bonds maturing in annual installments commencing not later than the end of the second years operation as computed from the estimated date of completion.

Authority revenue bonds have no limitation on bond amortization as scheduled other than application of statutory periods of usefulness.

10.2 Orgnaization: Currently, within the Facilities Plan area, there are several types of organizations which can be identified. For example, the Clover Hill Plant in Mount Olive is a Municipal function under the single municipality organization and the administration is under the Engineering or Public Works Department with a Utilities Superintendent under the supervision of the municipal governing body. Construction or purchase of these facilities and expansion thereof have been done by general obligation bonds or local improvement assessment bonds. Operation is by general property tax, sewer rents or charges. The Washington Township MUA is organized under statutory reference NJSA 40:14B-1 to 69. The organization is under a single municipality and covers not only water but sewerage. The administration is by five members appointed by the municipality. Construction and financing is via authority revenue bonds and the operation financing is via water and sewer service charges, that is rents, rates and fees. In the case of the WTMUA, certain capital cost revenues are provided by developers who will eventually use these facilities. There are other private sewerage facilities which are discussed in more detail in the Section 2 Report. These are owned and operated by developers and/or owners with provisions that at a later date they can be transferred to the municipality at no cost to the municipality.

The organizational structure is closely related to the method of financing but in any case, would have to be in accordance with the New Jersey Statutes. The financing also has a bearing on the debt position of the municipality or municipalities.

A utility operated as a municipal function is financed by general obligation bonds or by local improvement assessment bonds, chargeable against the municipal debt limit; annual operations are supported by general taxation or sewer rentals. Sometimes general obligation bonds are issued to finance construction of mains and treatment plants while local improvement assessment bonds are issued to finance local collection systems. Debt limitation may hinder the financing of a municipally operated utility; however, authority to exceed such a limit must be granted by the State. Also, the State's local government board may authorize special bond amortization arrangements in case of unusual reasons or financial hardship. Organization as a sewerage district involves election each year for Commissioners and budget levy which is then added to the tax bill. Total ratables in the district would be divided into the district levy to arrive at a tax rate. Sewerage facilities constructed in conjunction with sewerage district are financed on a self supporting basis. Special assessments on benefitting properties are pledged to the retirement of local improvement assessment bonds, whereas operating costs are met through a special property tax levy within the district. This is very inflexible and is seldom utilized. There would be an assessment bond issued with this option.

A self-liquidating utility is one which is organized on the self-liquidating basis, with revenues adequate to meet annual cost of operation, maintenance and debt service, and is financed by general obligation bonds or by local improvement assessment bonds. Such bonds are deductable from the municipality's debt limit. If rentals and charges are insufficient to cover all costs, the deficit is made up by property taxes; surplus may be transferred to the municipal general fund regardless of outstanding debt.

A municipality or two or more municipalities may create a sewerage authority and two or more municipalities may unite in creating a "joint meeting". The former is financed by authority revenue bonds and the latter by local improvement assessment bonds or general obligation bonds of the participating municipalities. Circumstances such as municipal debt limitations, service needs over a multi-municipal area, disposal problems, or a difficulty in meeting legal requirements for bond amortization have led to an increasing use of the authority device as a means of overcoming such difficulties. Municipal and county sewerage authorities created under Chapter 138 as ammended (NJSA 40:14 A) have no legal borrowing limits and their bonds are not a liability of the creating governmental unit since public credit is not pledged to the bonds. Furthermore, there is no amortization restriction on sewerage authority bonds, whereas the municipal bond law restricts annual maturities of serial bonds to a maximum of 50% more than the smallest previous annual amortization payment; a limitation suited to slow growing municipalities. Thus, authority financing allows for rapid expansion of population by permitting larger principal payments in the later years of the bond retirement schedule. Also, the sewerage authority law authorizes the municipality to contract for authority service to part or all of the municipality and to pledge general tax revenues to its aportioned share of the annual operating cost if service charges are inadequate to meet financial requirements. The municipality may also agree to serve as the collection agency for the authority.

These financing advantages have offsetting disadvantages. They are created and operated outside the traditional framework of government and are not subject to normal controls exercised by the voting public. Since their decisions and budgets are made by appointed officials, their acts are largely beyond challenge by elected officials who create them and the users who pay for their services. This is doubly the case because the agreements they make with the buyers of the bonds cannot be abrogated.

The team for establishing the organization and the financing would consist of the Sewerage Engineer, the Municipal Engineer, the Municipal Bond Attorney, Investment Banker or Municipal Accountant, and the governing bodies of the municipalities. The bond ordinance is the vehicle for municipal authorization for financing capital improvements. Sewer authority bond issues are ordinarily initiated by the resolution of the authority. This resolution provides the basis of the contract between the authority and the bond holders and is a highly technical and complicated document requiring competent legal and financial advise in its preparation. The scope of the organization of the authority and financing details are not within the work scope of the Facilities Plan. These would be implemented during the latter phases of the Step 1 grant or the early phases of the Step 2 grant.

The state statutes normally establish periods of usefullness of various sewerage projects. For example, house connections to publically owned sewer systems are five years and storm/water sewerage systems are forty years maximum. Treatment plants are forty years.

If construction is to extend over a considerable period of time, there may be advantages in issuing one year bond anticipation notes timed as funds are needed rather than issuing the full amount of the bonds authorized. Such notes may be renewed annually but cannot extend more than two years from the date of original issue in the case of general obligation bonds or five years in the case of local improvement assessment bonds. In any case, competent advice would be obtained from the Municipal Attorney, the Municipal Bond Attorney, the Investment Bankers and the Municipal Accountants.

As far as the Facilities Plan organization is concerned, the following recommendations are made:

a. Washington Township, Mount Olive Township and Roxbury Township create a sewerage authority which would be responsible for the regional sewerage treatment plant, the sludge disposal operations and the interceptors and pumping stations relating to the interceptors and the sewerage treatment plants.

b. For the local collection systems and at the option of the Municipality, a local municipal utilities authority can be organized (40:14B-1 to 69). In the case of the Washington Township Municipal Utilities Authority, this would remain as existing and would be responsible for the existing and expansion of the local collection systems. As an alternate, in the case of Mount Olive Township and Roxbury Township, the utility,that is, the local collection system would be operated as a municipal function and would be financed by general obligation bonds, local improvement assessment bonds, charged against the municipal debt limit with annual operations being supported by general taxation for sewer assessments.

10.3 Time Schedule: The completion of the Facilities Plan, Step 1 Grant is the first phase of a regional sewerage system. Step 2 Grant covers the design phase and the preparation of drawings and specifications suitable for bidding. The Step 3 Grant covers the construction of the proposed facilities.

Prior to submitting the Step 2 Grant Application, several requirements must be met including the following:

a. Acceptance of the Facilities Plan by the three Townships.

b. The three Townships shall provide evidence that it has the legal authority and the financial, institutional and management resources necessary for plan implementation. Plan adoption by the local municipalities should occur as early as possible after the public hearing. Letters of Intent should be provided so that EPA and DEP can start their Step 2 Grant approval process.

c. From the NJDEP we must obtain compliance with requirements, conformance with 303 (E), comment by the 208 planning entities and conformance to the existing Raritan 208 plan.

d. From EPA, we must obtain review and approval of the cost effectiveness of the project, acceptable effluent standards, meeting the I/I analysis requirements, the best practical wastewater treatment technology and other applicable environmental laws and regulations. Concurrently with the above, the State shall make a determination as to the priority rating of the proposed project prior to Grant Application submission.

e. Prior to or concurrently with the Step 2 Application, the historical and archaeological study and the sewer system evaluations must be completed as described in the Facilities Plan report.

f. Prior to award of subsequent grant moneys, negotiations with the three study area Townships must be completed to the extent that satisfactory evidence of compliance with user charge provisions of Public Law 92-500, must be demonstrated. Negotiations with municipal officials will allow for execution of service agreements or signed letters of intent that will guarantee that each participant will pay its proportionate share of the cost of operating and maintaining the regional sewerage facilities.

g. Concurrently with the above, the three Municipalities would apply for Step 1 Grants for the local collection systems. Organization of same would be under the Department of Public Works or municipal utilities authorities may be established.

Under the Step 2 Grant Application, the complete Grant Application must be submitted through appropriate State agencies to EPA and should include the approved Facilities Plan, assurance of compliance and user charges, available site statement, relocation assistance assurance of compliance, compliance with other laws, subagreements, engineering contracts and clearing house comments. In addition, the general requirements for eligibility must be justified and the non-federal costs, applicant capability to insure completion and institutional arrangements must be identified and fairly well documented. The applicants shall also demonstrate that a sewer use ordinance will be enacted and enforeed in each of the municipalities before completion of the interceptors and sewerage treatment plant. The ordinance shall prohibit any new connections from inflow sources and shall insure that the new sewer and connections are properly designed and constructed.

Conferences may be requested from NJDEP and EPA Regional Office to determine what priority has been assigned. In order to expedite the Facilities Plan implementation process and to assist the Municipalities in obtaining Federal Aid for the work in their communities, the Step 2 Grant Application for the local collection system construction and/or rehabilitation work should be submitted with the authority's application as one package. This requires that local sewerage feasibility studies be prepared and approved by the local governing bodies.

After the Step 2 Grant is approved, the design of the regional and local wastewater facilities will commence. Sewer system evaluation and the rehabilitation of the three collection systems identified (Clover Hill, Schooley's Mountain and Roxbury Knolls) should be undertaken.

Drawings and specifications will be prepared for submittal to DEP and EPA for their review and approval prior to public bidding.

The Step 3 Grant Application will cover all the requirements listed under the Step 2 Grant Application plus plans and specifications which would be submitted and approved, the O & M compliance schedule, the general requirements for eligibility and the additional requirements breakdown for non-federal costs and the applicant(s) capability to implement a Sewer Use Ordinance. Once the Step 3 Grant is obtained, the authority will have the authorization to receive bids and once approvals are obtained from DEP and EPA, contracts will be awarded. The construction phase will cover the construction of the facilities, that is the local collection systems, the pumping stations, the interceptors and the regional sewerage disposal plant and sludge handling facilities. During this phase, construction administration services will be provided to assure the authority, DEP and EPA that the work is being done in accordance with the drawings and specifications and accepted engineering practice. Once the facilities are constructed, there will be reviews by the NJDEP and EPA, final inspections, final payment and audit.

Figure 10-1 shows diagramatically the various events of the Facilities Plan process

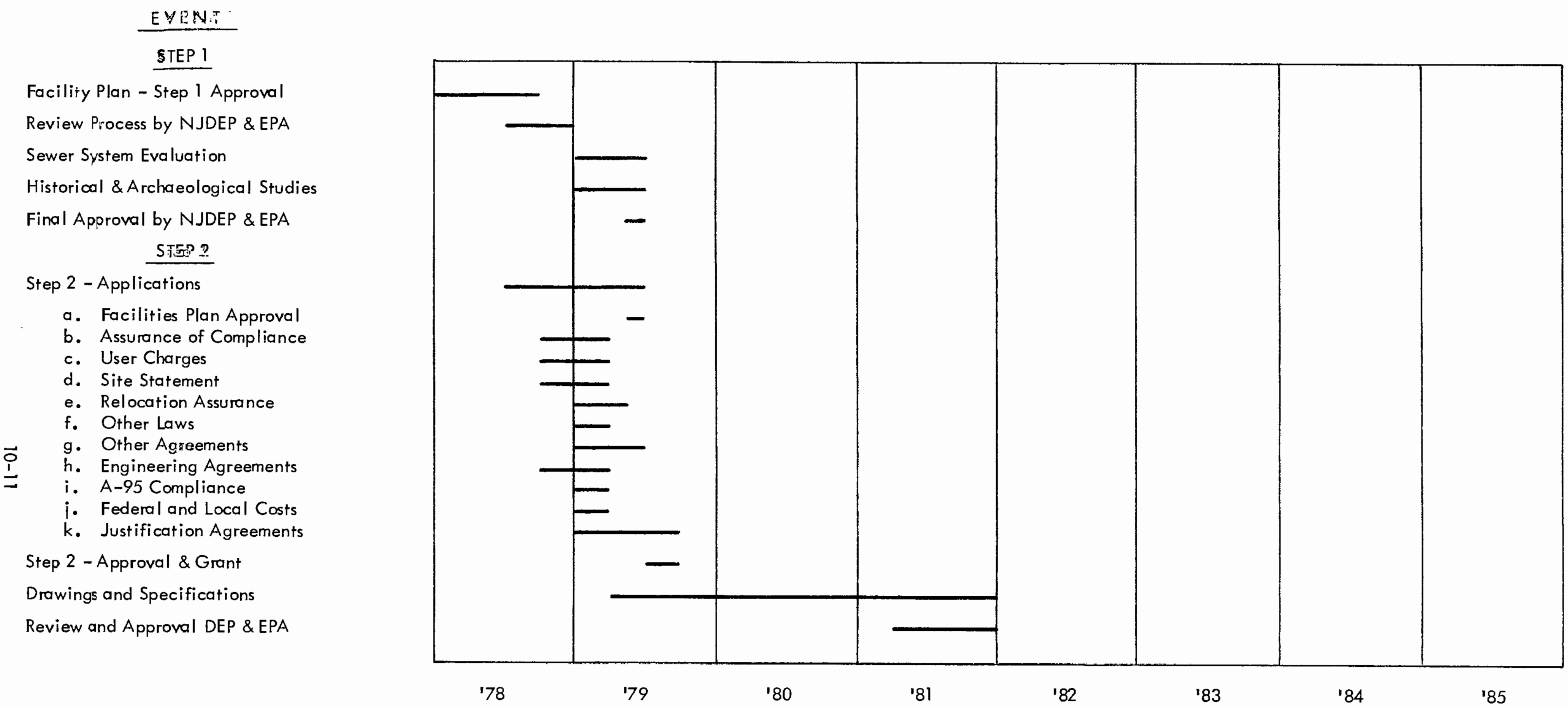

Figure 10-1 Time Schedule - Calendar Years

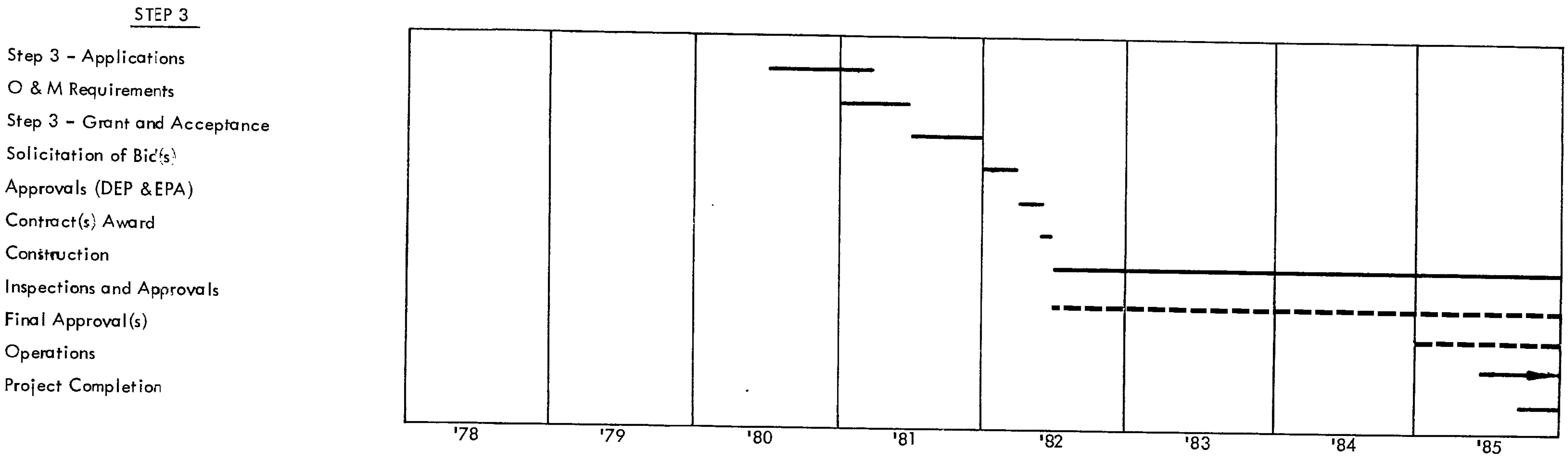

Figure 10-1 (continued) Time Schedule - Calendar Years and its relationship to the calendar year time frame.

The Step 1 Grant is nearing completion with the submittal of this Facilities Plan. Various reviews are required by NJDEP, EPA, A95 documentation, the three Municipalities and the Morris County Planning Board. Concurrently with the above, sewer system evaluations must be done for the three facilities (Clover Hill, Schooley's Mountain and Roxbury Knolls) and the historical and archaeological surveys must be completed.

Referring to Figure 10-1, the requirements for the Step 2 Application are clearly defined in the bar graph. Once the Step 2 Grant is approved, drawings and specifications will be prepared, land acquired either by direct purchase or condemnation and easements obtained.

As part of the drawings and specification phase, various preliminary engineering work must be done including surveys, topography of the sewerage treatment plant and disposal facilities, the interceptors, easements, rights-of- way, stream crossings, etc. and the soils characteristics must be determined. It is expected that the drawings and specification phase including the preliminary work would take approximately two years which would include review and approval by DEP and EPA.

The Step 2 Application can be prepared in mid 1980 and grant review and acceptance by DEP and EPA can be expected during the latter half of 1981 which event occurs at the same time as the completion of the drawings and specifications. Approximately three to four months must be allowed for the solicitation of the various bids, approval by DEP and EPA and contract awards. The construction phase which would cover the municipal local collection systems, the interceptors, the sewerage treatment plant and disposal facilities would take approximately three years from the awards of contracts. Concurrently with the construction, the various approvals will be obtained.

Inspection would be done on a continuing basis by the authority, the local municipalities, the consultants and the DEP and EPA inspectors. Project completion would occur during the latter half of 1985. The Step 2 drawings and specification phase would also include the value engineering study which would be done independently by others.

It is expected that the authority would be formalized, commissioners appointed, construction funding obtained during the last quarter of 1979 and the first half of 1980.

In summary, the Step 2 Grant will take approximately two years, 1979 - 1981 and the construction phase would take approximately three years for the total sewerage system. Operations of all the facilities can be expected toward the middle or end of 1985.

10.4 Operation and Maintenance Requirements: The goal of maintaining high stream water quality can only be achieved by discharging treatment plant effluent that is within prescribed limits of quality and this, in turn, depends upon a facility that is properly maintained and operated. Equipment must be in good operating condition and personnel must be well trained to intelligently control the treatment process. The collection system, too, requires inspection and maintenance to maintain a clear, tight system that minimizes overloading the treatment plant with excess infiltration or inflow.

10.4.1 Interceptor System: The interceptor system would be self-cleaning at the design flow velocity of 2 feet per second, where practical. However, this velocity would not occur until the latter part of the design period. In the initial years, the flows would be less than design flows and self-cleaning may not occur. This will necessitate periodic inspection and cleaning to maintain capacity. To effectively execute this work, the Authority would own and operate flow metering equipment which will lead to early detection of solids deposits and other problems that may develop. The Authority would also own the necessary mobile equipment and tools for inspection and periodic cleaning. The annual operation and maintenance of the interceptor systems has been estimated at 150 man-hours per mile, exclusive of major work such as replacement of pipe sections or major sewer rehabilitation work. These would be done on contract or purchase order basis with other than Authority labor.

10.4.2 Regional Treatment Facilities: Referring to EPA documents including "Estimating Staffing for Municipal Wastewater Treatment Facilities", March 1973 and from previous experiences with the operation and maintenance of existing plants and similar plants, the following arrangement is considered the minimum for operating and maintaining the proposed treatment plant, Plan #6 to meet the water quality goals of the NJDEP. The regional wastewater treatment plant rated at 4.4 MGD and shown diagramatically in Figure 7-1 is an activated sludge plant with provisions for biological nitrification, chlorination and de-chlorination. Sludge processing (Plan ST-6) would consist of dewatering facilities, trucking the sludge to the disposal facility adjacent to the confluence plant, the actual composting and land disposal of the compost.

The staff complement for this treatment facility is estimated to include:

Job Category	No.
Manager	1
Secretary/Assistant Manager	1
Operating and Maintenance	8
Laboratory	1
Total	11

The operating and maintenance costs for the proposed facility are provided in the various Tables in Section 8 & 9 of the Report.

10.4.3 Other Requirements: In addition, other provisions for maintenance and operations include the following:

a. Establishment of a comprehensive emergency operating procedure to minimize the effect of power outages, strikes, etc.

b. Develop a comprehensive and adequate sampling and process control procedure to meet all the requirements established by NJDEP and the NPDES Permit. If necessary, adjustments should be made to the process to insure adequate treatment under varying flow and loading conditions.

c. It is important that the plant personnel be adequately trained in the operation and maintenance of each individual unit in the plant and as would be described in more detail in the "Operations and Maintenance Manual". (Step 2 & 3 Grants).

d. The Authority should establish a preventative maintenance program so that all equipment will be maintained and that the equipment life will be prolonged and emergency repairs and replacement will be kept to a minimum.

e. An adequate supply of chemicals should be maintained to avoid discharging inadequately treated effluents.

f. The Authority should develop a program to encourage local farmers, parks and individual home owners to utilize the sludge compost.

10.5 Financial Program: Funding of the selected Plan 6 assumes 65% of eligible costs will be obtained by Federal grant. The remainder would be funded by local sources, i.e., the three townships and the State. Revenues would provide the funds to own and operate the facilities, service the debt, and make replacements and minor improvements.

In order to develop the debt service, a bonding schedule will be prepared in accordance with the recommendations of the Authority's Bond Counsel. The estimate of annual cost per connection was previously developed and is shown in Table 9-3. The financing schedule which would be prepared by the Bond Counsel would be dependent upon the bonding period and the interest rate which would establish the debt service. In order to develop an equitable schedule, the debt service payments may be adjusted annually in accordance with the projected growth of the study area.

It is probable that bonds would be required when construction is underway. Funds for construction would be generated by the issuance of bond anticipation notes. These would be redeemed by the proceeds of the bonds issued. The interest rates, term, etc. of the bond anticipation notes would be developed by the Authority's Bonding Counsel.

10.5.1 Cost Sharing: All costs incurred by the Authority would be recovered by charges to the three participating townships. These charges would be allocated on the basis of demands and usage. The demand charge would be commensurate with each township's share of the capital cost and would thereby reflect how much of the facilities are in place for its own benefit. Charges allocated on this basis would include debt service, insurance and general and administrative expenses. Charges based on usage would be allocated on flows metered at each township where local collection systems discharge to the interceptor system. Charges so allocated would include fuel, electricity, and chemicals. Other charges such as labor, maintenance and replacement parts would be allocated partially on demand and usage. The separate townships would be charged by the authority on a scheduled basis proportionate total share of the costs for owning and operating the sewerage facilities (interceptors and treatment plant).

In effect, the authority would have only three subscribers for sewerage services. Each township, in turn, would charge its property owners. Such charges would apportion the total charge by the authority and the townships actual costs for owning and operating the local collection system. Charges to property owners would be on an equitable schedule of rates to achieve uniformity of charges to typical homeowners and small property owners. Properties that may be large sources of wastewater, or require excessive treatment would be charged according to the demands of the greater service as they may affect the size of facilities and/or the degree of treatment required. The method of charging proposed would result in some slight difference in annual cost for comparable homeowners in each township and will reflect the amount of facilities in place as well as the volume of wastewater treated for each township.

Billing for sewer services would be the responsibility of the townships each of which would submit bills to homeowners and other properties on a scheduled basis. Billing would be on a flat annual rate for all except very large industrial properties.

10.6 Regional Authority: This Facilities Plan proposed regional facilities requiring an agency with powers to construct, operate and maintain such facilities. It is recommended that a Morris County, South Branch Regional Utilities Authority (SBRUA) be organized and incorporated as the legal Authority to own and operate regional wastewater treatment and conveyance facilities. The SBRUA would be the responsible agency for the construction, operation and maintenance of the regional facilities. Based on the statutory requirements, this Authority will have the legal right to enter into contractural agreements with local agencies or municipalities, County,State and Federal Government agencies and private concerns. In each of the three townships, various conveyance and treatment facilities are being operated within the municipal organization and in the case of Washington Township as a local sewer and water utility. None of these activities have the legal power to construct and operate regional sewerage systems such as those proposed in the selected Plan 6. In any case, each township will have and maintain full control and responsibility over the existing and expanded local collection systems.

10.7 Implementation Procedures: Completion of this report is the first step in the regional and local planning process. Once the Facilities Plan report has been reviewed and approved by the townships, NJDEP and EPA, Step 2 will proceed with the design, drawings and specifications of the wastewater facilities described under the Step 1 work. Step 3, which is approximately three years in the future, is for the construction of the proposed facilities.

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APPENDICES

Appendix A

WATER QUALITY STANDARDS CRITERIA

Following is a compilation of water quality standards criteria in New Jersey:

1. Water Quality Sampling and Analytical Methods: New Jersey Department of Health,[(1)] Division of Clean Air and Water, Water Pollution Control Program; Stream Classification - Standards of Wuality - Implementation; June 1967; Section II, Raritan River Basin, Implementation Plan.

A routine surveillance program is maintained. This provides for inspections of all sewage and industrial waste treatment plants in the State. These inspections include effluent sampling on each occasion. All analyses are performed in accordance with "Standard Methods for the Examination of Water and Wastewater." Of course more complete analyses are made for more intensive studies of plant operation.

The Program maintains a routine sampling schedule covering fixed sampling stations on streams throughout the State.

Flow: Statement of Policy 1.12. The levels of quality specified for various water uses, where applicable, are expected to be maintained under conditions comprising minimum consecutive seven day fresh water flows with ten-year recurrence intervals.

2. General Stream Use Designations:

Fresh Water -	Class FW1 -	Natural aquatic environment.
	Class FW2 -	Public water supply
	Class FW3 -	Recreation
	Class FW4 -	Maintenance, migration and propagation of natural and established biota.
	Class FW5 -	Industrial water supply
	Class FW6 -	Agricultural water supply
	Class FW7 -	Navigation
Tidal Waters -	Class TW1 -	Shellfish harvesting
	Class TW2 -	Public water supply

(1) NJDEP

Tidal Waters - (continued)

Class TW3 - Recreation

Class TW4 - Maintenance, migration and propagation of natural and established biota.

Class TW5 - Fish passage and survival

Class TW6 - Industrial water supply

Class TW7 - Agricultural water supply

Class TW8 - Navigation

Coastal Waters

Class CW1 - Recreation

Class CW2 - Maintenance, migration and propagation of natural and established biota.

3. Mercury and Heavy Metals: No specific criteria.

4. Mixing Zones: Localized areas of surface waters, as may be designated by the Department of Environmental Protection, into which wastewater effluents, including heat, may be discharged for the purpose of mixing, dispersing or dissipating such wastewater without creating nuisances or hazardous conditions.

Trout Maintenance Streams: No heat may be added which would cause temperatures to exceed 2°F over the natural temperatures at any time or which would cause temperatures in excess of 68°F. Reductions in temperatures may be permitted where it can be shown that trout will benefit without detriment to other designated water uses. The rate of temperature change in designated mixing zones shall not cause mortality of the biota.

Non-Trout Waters: No thermal alterations, except in designated mixing zones, which would cause temperatures to deviate more than 5°F at any time from natural stream temperatures or more than 3°F in the epilimnion of lakes and other standing waters. No heat may be added, except in designated mixing zones, which would cause temperatures to exceed 82°F for smallmouth bass or yellow perch waters or 86°F for other non-trout waters. The rate of temperature change in designated mixing zones shall not cause mortality of the biota.

5. Acidity/Alkalinity: pH range: 6.5 to 8.5.

6. Secondary Treatment Requirements: The minimum degree of wastewater treatment now being permitted in the State of New Jersey is that commonly identified as secondary treatment.

In New Jersey, this means treatment necessary to provide as an absolute minimum 80% reduction of biochemical oxygen demand and a maximum permissible biochemical oxygen demand concentration of 50 parts per million. In most areas in New Jersey, this standard is raised to require biochemical oxygen demand reduction of 85% and 90% with appropriate maximum permissible biochemical oxygen demand concentrations.

7. Disinfection: Year-round effective disinfection is an accepted method of treatment required in New Jersey for most domestic wastes and other wastewaters. Effective disinfection is hereby defined as:

(a) One (1) mg/l combined chlorine residual after a thirty (30) minute contact period based on design flow or a twenty (20) minute contact period during peak hourly flow or maximum rate of pumping.

(b) Coliform organisms not to exceed an MPN or 240 per 100 milliliters.

8. Settleable Solids: None noticeable in the water or deposited along the shore or on the aquatic substrate in quantities detrimental to the natural biota. None which would render the waters unsuitable for the designated uses.

9. Nitrates: The narrative statement limibiting toxic or Deleterious Substances states the following:

"Toxic or Deleterious Substances Including But Not Limited to Mineral Acids, Caustic Alkali, Cyanides, Heavy Metals, Carbon Dioxide, Ammonia or Ammonium Compounds, Chlorine, Phenols, Pesticides, Etc.: None, either alone or in combination with other substances, in such concentrations as to affect humans or be detrimental to the natural aquatic biota or which would render the waters unsuitable for the designated uses. None which would cause the Potable Water Standards of the Department for drinking water to be exceeded after appropriate treatment."

The State Standards include an approved non-degradation statement which could be used to protect existing high quality waters from harmful amounts of nitrates.

10. Bacteria:

Class FW1 - (natural): No man-made wastewater discharges.

FW2 - (PWS after treatment, primary contact recreation): Fecal coliforms geometric mean 200/100.

FW3 - (primary contact recreation): Same as FW2.

TW1 - (tidal-PWS, shellfishing): Shellfish, requirements of National Shellfish Sanitation Program Manual of Operations; Others, fecal coliforms geometric mean 200/100.

TW2 - (secondary contact recreation): Fecal coliforms geometric mean, 770/100.

TW3 - (navigation, fish survival): Fecal coliforms geometric mean, 1,500/100.

CW1 - (ocean within 1,500 feet from shore: primary contact recreation): Fecal coliforms geometric mean 50/100.

CW2 - (ocean beyond 1,500 feet: secondary contact recreation): Fecal coliforms geometric mean 200/100.

11. Turbidity: None noticeable in the water or deposited along the shore or on the aquatic substrata in quantities detrimental to the natural biota. None which would render the waters unsuitable for the designated uses.

12. Dissolved Oxygen:

Trout Production Waters

Not less than 7.0 mg/l at any time.

Trout Maintenance Water

Daily average not less than 6.0 mg/l. Not less than 5.0 mg/l at any time.

Trout Maintenance Lakes

Daily average not less than 6.0 mg/l. Not less than 5.0 mg/l at any time. In eutrophic lakes when stratification is present, not less than 4.0 mg/l in or above the thermocline where water temperatures are below 72 degrees F. At depths where the water is 72 degrees F. or above, daily average not less than 6.0 mg/l and not less than 5.0 mg/l. Daily average of 5.0 mg/l. Not less than 4.0 mg/l at any time.

Tidal Waters

Fish maintenance (TW-2). Not less than 4 mg/l at any time. TW3 nav. not less than 3.0 mg/l at any time.

Ocean Waters

Not less than 5.0 mg/l at any time.

13. Dissolved Solids: No specific requirement found in standards.

14. Radiation: USPHS Drinking Water Standards will apply.

15. Antidegradation: It is the primary objective of the Water Pollution Control Program in New Jersey to protect and enhance the quality of all surface waters of the State including those classified as FW1 which are to be retained for posterity in their natural state and which shall not be subject to any man-made wastewater discharges. The objective of protecting and upgrading our waterways will take precedence over allowable minimal quality limits for surface waters established through promulgation of rules and regulations.

In all situations where there may be an impingement of a lesser quality water upon that of a higher quality, it is the objective of the New Jersey program to upgrade the lesser quality water in order to protect or improve adjacent waters having a more critical use. It is anticipated that the surface water classification and the standards of quality for New Jersey waters will be subject to continual review and revision to achieve our basic objectives.

The overriding consideration, however, regardless of the establishment of water quality levels is that of wastewater treatment requirements. The minimum degree of wastewater treatment now being permitted in the State of New Jersey is that commonly identified as secondary treatment. In New Jersey this means treatment necessary to provide as an absolute minimum 80% reduction of biochemical oxygen demand and a maximum permissible biochemical oxygen demand concentration of 50 parts per million. In most areas in New Jersey, this standard is raised to require biochemical oxygen demand reduction of 85% and 90% with appropriate maximum permissible biochemical oxygen demand concentrations. At many inland locations where only small tributaries to streams are available, the policy in New Jersey is either to prohibit the discharge of any effluent to surface waters or to require so-called tertiary treatment which is the reduction of biochemical oxygen demand of 95% as a minimum with a maximum concentration of 15 parts per million. It has been and is presently the policy of the Department that wastewaters prior to discharge into any fresh water streams in the State must receive as a minimum at least 90% treatment.

Source: Water Quality Standards Digest, A Compilation of Federal/State Criteria by the Environmental Protection Agency.

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WATER RESOURCES
P. O. BOX 2809
TRENTON, NEW JERSEY 08525

SEP 8 1977

Lan Associates, Inc.
662 Goggle Road
Hawthorne, New Jersey 07506

Gentlemen:

Please find enclosed additional stream modeling data regarding the Washington Township/Mount Olive 201 as prepared by Mr. Robert Mancini of Areawide Planning. I hope that this additional information will aide you in the selection of the various alternatives presented.

If you have any questions regarding this matter, please contact Mr. Richard Cranmer of this office at (609) 292-7765.

Very truly yours,

Russell E. Nerlick

Russell E. Nerlick, P.E., Manager
Raritan River and ISC Basins
Public Wastewater Facilities Element

RLC:gl

Enclosure

MEMORANDUM

STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTIC

TO: Russell Nerlick

FROM: Bob Mancini

SUBJECT: Washington Twp/Mount Olive 201

DATE: August 31, 1977

This memo summarizes the effluent requirements obtained from the computer analyses of the in-stream discharger alternatives (see Table 1) requested earlier last week during our meeting with the facilities planning consultants.

Three stream flow conditions were tested against the antidegradation policy using the base flows at the High Bridge station, namely 17.9 cfs (representing the lowest recorded value for seven consecutive days over the last 10 year period), a flow of 20.7 cfs (representing the MA7CD10 low flow), and 25.0 cubic feet per second at the High Bridge stream gaging station.

Wastewater facilities 1A (the new Budd Lake facility of alternative 1) and 5A (the new Drakes Brook facility of alternative 5) will accomodate the antidegradation policy for their discharge segment but would require post-aeration of treated effluent to 6.5 mg/1 of dissolved oxygen at the noted treatment levels in Table 2.

Alternative 1 is the preferred wastewater management scheme with regard to water quality. However, the projected wastewater flow for the Budd Lake/Turkey Brook service area(wastewater facility 1A, 1.996 mgd, serving an area of approxamately 5000 acres) appears to be extremely high and as noted in the segment analysis would require extensive wastewater treatment.

The feasibility of utilizing individual and land disposal systems should be investigated for the service area of facility 1A as a part of alternative 1.

cc. H. Ike
D. Whang
R. Cranmer

	Alternative 1		Alternative 2	
Discharge Location	Facility Name	Flow (mgd)	Facility Name	Flow(mgd)
Drakes Brook near Eyeland Ave.	1E Roxbury STP	0.080		
South Branch below YMCA Camp	1A New Budd Lake Facility	1.996		
South Branch @ Drakes Brook Confluence	1D Mount Olive STP	1.056	5A New Drakes Brook STP	4.737
South Branch @ Stony Brook	1C Schooley's Mtn. STP	0.500		
South Branch @ Electric Brook	Welsh Farms (Industrial)	0.200	Welsh Farms (industrial)	0.200
Long Valley	1B New Long Valley STP	0.563	5B New Long Valley STP	0.535
	Total Wastewater Flow	4.394		5.472

Table 2

Results of Treatment Level Analyses

Alternative 1

Facility Name (Flow-mgd)	Treatment Level Acceptability Drought Flow (17.9 cfs)	Drought Flow (20.7 cfs)	Base-High Eri 25.0 cfs
1E Roxbury STP (0.080)	1	1	1
1A New Budd Lake STP (1.996)	3*	4.2*	2*
1D Mount Olive STP (1.056)	2	2	2
1C Schooley's Mtn. STP (0.500)	2	2	2
Welsh Farms WWTP (0.200)	2	2	2
1B New Long Valley STP (0.562)	4.2	4.2	2
Total Wastewater Flow (year, 2000) 4.394			

*Post-aeration to 6.5 mg/1 dissolved oxygen would be required to accomodate the antidegradation policy.

Alternative 5

Facility Name (Flow-mgd)	Drought Flow (17.9 cfs)	Drought Flow (20.7 cfs)	Base-High Eri 25.0 cfs
5A New Drakes Brook (4.737)	4*	4*	3*
Welsh Farms (0.200)	3	3	3
5B New Long Valley STP (0.535)	3	3	3
Total Wastewater Flow (Year 2000) 5.472			

*Post-aeration to 6.5 mg/1 at dissolved oxygen is required to accomodate the antidegradation policy.

Appendix C

Contents

OFFICE of the PLANNING BOARD
201 - 347-5400

Township of Mt. Olive

December 22, 1976

Mr. John Lacz
Lan Associates
662 Goffle Road
Hawthorne, New Jersey 07506

RE: Sewer System- Facilities Plan - Washington Township Utilities Authority P.N.R.S. N.J. 1387 Your File 2.332

Dear Mr. Lacz:

I have reviewed the Facilities Plan Section 3, dated August 2, 1976, as it relates to Mt. Olive Township's future land use and population and generally concur in the contents. Given the constraints of the existing economics of the area as well as other input and it's relation to the State and County, I would tend to think your population figures are in the "ball-park". These figures could of course change should the economics and growth patterns be altered to a substantial degree. Should the growth pattern remain fairly constant as in the past several years, your figures would appear to be fairly accurate. In fact, this office has been monitoring the township's growth and population statistics for the past several years, and find that the-

1974 Population was estimated at 13,460
1975 Population was estimated at 16,637
1976 Population was estimated at 18,093

Unless there is a change as indicated previously, I anticipate the township will grow at a rate of 1,300 - 1,800, approximately, dwelling units per year.

I trust this information will be of interest to your firm. Should you desire further information, please contact me.

Sincerely yours,

Donald A. Ferguson

Donald A. Ferguson, Director,
Planning, Development & Inspections

DAF:osr

P.O. BOX A Budd Lake, New Jersey 07828

HARVEY S. MOSKOWITZ / AIP

community planning & development consultant

TO: John A. Lacz, P.E., P.P.

RE: Population Projections; Section 3 Report, Facilities Plan

DATE: April 25, 1977

1. I have completed my review of the population projections for Washington Township contained in Section 3 of the Facilities Plan dated August 2, 1976. The forecasts in the report for Washington Township are as follows:

	Area						
	sq.mi.	Acres	1960	1970	1980	1990	2000
Washington Township:	45.1	28,863	3,330	6,962	11,679	22,924	39,744
Drainage Area:	25.7	16,477	2,664	5,570	9,334	18,309	31,243

The projected population figures appear to be reasonable and consistent with our estimates and that of other agencies.

2. The Master Plan notes a potential population saturation in Washington Township of approximately 55,000 persons. The bulk of development outside the drainage area will be in the PURD area along the Musconetcong River. This is approximately 1,000 acres and zoned for 4 units per acre. I estimate that when completed, approximately 10,000 to 12,000 persons will be living in the PURD. At this time, it is difficult to estimate when construction for the PURD will begin.

3. The Master Plan estimates the Township population by 1980 should reach close to 16,000 persons. This compares to your

estimate of about 11,700. The County also estimates a 1980 figure of 12,100, very close to your estimate.

It should be noted, however, that the Master Plan figure assumed that the PURD and higher density housing in the Town Center area (Route 24 and Bartley Road) would be half completed by 1980. The completed Town Center population estimate was about 1,300 and 10,776 for the PURD. Without these developments, the population estimate would be close to 10,000 persons.

4. Another measure of estimating population is to use the "step-down ratio" approach.

	1950	1960	1970	1975	1980	1985
Morris County:	164,371	261,620	383,454	432,612	513,000	575,000
Washington Township:	2,147	3,330	6,962	8,963	11,679	17,301
Washington Township: (as percentage of County)	1.3%	1.3%	1.8%	2.1%	2.3%	3.0%

Source: 1975, 1980 & 1985 County population estimates and projections from Morris County Planning Board.
1975 Washington Township population estimate from MCPB.
1980 Washington Township population estimate from Section 3 report.
1985 Washington Township population estimate interpreted from Section 3 report.

The trend from 1960 through 1975 is a logical one. New population growth in Morris County will be centered in the western region of the county. The municipalities in this region -- Roxbury, Mt. Olive and Washington Township -- will continue to house a larger percentage of the county population.

5. Your projected population increase over the next several years is also reasonable in view of the active major subdivisions before the Planning Board. A list compiled as of March 1977 (attached) shows 20 active major subdivisions with a total of 1,356 lots. Of this total, 453 lots have been given final approval. Assuming 4 persons per house, the 453 lots will generate about 1,800 persons. If this is added to the 8,900 1975 population, a total of a population of 10,700 can be expected. This is quite close to the 11,679 you project by 1980.

6. In conclusion, the new zoning ordinance and map presently being considered for adoption by the Township is designed to implement the Master Plan. As such, it provides for higher density residential uses in the PURD and Town Center areas. It also provides for a modest expansion of the existing mobile homes park at a density of 8 units per acre. The other zoning districts generally follow the recommendations of the Master Plan.

I believe your population estimates are consistent with those of the Master Plan and at this time I would conclude they are reasonable.

ACTIVE MAJOR SUBDIVISIONS

MARCH, 1977

BLOCK	LOT	NAME OF SUBDIVISION/APPLICANT	LOCATION	# OF LOTS	SKETCH PLAT SUBMISSION	SKETCH PLAT APPROVAL	PRELIMINARY SUBMISSION	PRELIMINARY APPROVAL	FINAL SUBMISSION	FINAL APPROVAL
42	7	Black River Estates/J.VanDalen	Hacklebarney Rd.	20		1974	2/7/77			
59	9,11,13	Darby Dan Farms/H.Fleming,Sr.	Fairmount Rd.	36		1974				
58	20	Donald Duryea	W.Valley Brook Rd.	15		7/12/76	3/11/77			
38	2	East Valley Estates/Custom Living	Old Farmers Rd.	20		11/15/76	2/14/77			
15	20-5	Fairview Estates/Eldan Const.	Fairview Ave.	10		1971		1976		1976
13	56	Goldstein, Sanford	Flocktown Road	52 conventional 50 cluster	12/10/76					
29	10	Hemmings, John	Rt.24 & Coleman Rd.	13		1/14/77	3/11/77			
36	43	Long View Ridge/Donald Grant	E. Mill Rd.	9	2/8/77					
63	3,4,25,26, 28-1,29	High Hills, Ltd.	Pickle & Black River Rd.	49		1974				
31	13-9 & 14	JMG Consultants	Wherli Road	3		1976		1976		1976
31	13	JMG Consultants	Wherli Road	6		1976		1976	2/2/77	
51	1-1	Kings Ridge/Branco Realty	Pleasant Grove Rd.	13		1973		1975		1976
23	3-46.18, 20	Merrybrook Estates,IV	Flocktown Road	101		1974		1975		1976 (24 & 24 lots)
41	3	Parker Acres, Section I	Parker Road	123						1971
42	15	Parker Acres, Section II	Parker Road	146						1974
20 22	21 30	Quail Ridge	Flocktown Rd.	197		1966		1973	5/24/76 (162 lots)	1976 (35 lots)
10	78	Spring Acres	Spring La.	147		1975		1976		1976 (45 lots)
25	9-3,10, 22	Stoney Brook Estates	Fairview Estates	11		1974		1976		1976
13	59	Stoney Brook Subdivision	Flocktown Rd.	77		1968	(sewer ban	1968 on 11/10/70-lifted 10/21/76)		
12	28	Washington Heights	Flocktown Rd.	78		1976				
34	31	West Valley Estates/Custom Living	W.Valley Brook Rd.	31	2/10/77					
20	12,15,75, 76,77	Wooded Valley East	Flocktown Rd.	146		1975		1975		1976 (43 lots)

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WATER RESOURCES
P. O. BOX 2809
TRENTON, NEW JERSEY 08625

JUL 12 1977

Lan Associates, Inc.
662 Goggle Road
Hawthorne, New Jersey 07506

Gentlemen:

This Element, in conjunction with the Bureau of Water Quality Planning and Management, has reviewed the facilities planning submitted to date. This letter presents comments based on that review with the emphasis on the multi-plant scheme which presently seems to be the most feasible alternative. We again emphasize that under the federal construction grant program the purpose of facilities planning is the selection, development and ultimate construction of facilities that serve to abate water pollution control problems. Although facility planning does consider future needs and conditions, it is not a master plan in which facilities are proposed for projected populations in currently undeveloped areas or areas in which pollution problems cannot be documented.

The following is our comments on Alternative No. 1 as presented to date:

1.A Justification for the 1.996 MGD projected waste flow from the Budd Lake area must be presented. There appears to be no reason to serve the Turkey Brook drainage area or convey the existing wastes from the Mount Olive Complex Development (Eagle Rock) to a site downstream. According to the results of the MA7CDIO South Branch Segment analysis a treatment level of three (3) would be required for a flow of 1.4 MGD to be discharged below the YMCA Pond, while a treatment level of 5+ would be required at a 2.0 MGD flow. Thus the treatment level that should be provided must be based on a cost effective analysis to determine at what flow would alternative means of disposal, other than direct stream discharge, be feasible. (e.g. storage or spray irrigation during 7 day 10 year low flows.

1.B There appears to be no reason, other than providing for future development, to construct a treatment facility in the Long Valley area. Strong justification, such as degradation of water quality, soil limitations, failing septics, and public health problems must be provided.

It is now within the scope of this 201 facility plan to evaluate on a township by township basis the exact extent of the size of the collection system necessary to serve the existing population. Please be aware of the new Federal criteria that must be met in order for a proposed collection system to be eligible for grant participation under P.L. 92-500. This new criteria was released on June 21, 1977, as Program Requirements Memorandum No. 77-8. If the communities that are proposed to be sewered do not meet this new criteria, and are considered to be ineligible for Federal funding, there may, in fact, be an alteration or delay in implementation of the various alternatives proposed due to a decrease in wastewater flows. The new guidelines require the facility planner to demonstrate, where population density is less than ten (10) persons per acre, that alternatives other than gravity sewers are less cost-effective. Please consult this PGM for further information.

1.C The Schooly's Mountain Treatment Plant in Washington Township (500,000 gpd) has been upgraded to meet existing water quality standards and presents no water pollution problem. However, the permit requirements state that a maximum of 216,000 gpd is to be discharged to the Stony Brook, and any additional flows must be discharged via a proposed outfall to the South Branch.

From our discussions with the Washington Township Municipal Utilities Authority, they are proceeding with preliminary plans to construct this outfall in the near future.

1.D Mount Olive - The Budd Lake sewage treatment plant which currently serves the Clover Hill and Sutton Park South Developments of Mount Olive Township is operating over its design capacity and is not meeting the effluent limitations imposed by the N.P.D.E.S. permit. A connection ban was imposed on the Budd Lake sewage treatment plant by this Department on March 28, 1973. The need to upgrade and improve the quality of effluent currently being discharged is apparent.

1.E Drakes Brook (Roxbury Plant) - Justification to provide a treatment facility to serve this portion of the Drake's Brook Drainage Area must be clearly demonstrated. As we have stated before, the alternatives of sewering the area along Route 10 in Roxbury Township and pumping it to the Ajax Plant should be fully evaluated. This office sees no need to provide a treatment facility as called for under this alternative.

Again, as we have mentioned previously, with regard to all of the alternatives, this Department has no intention of approving a facility plan that calls for the construction of treatment plants or interceptors in areas that are currently undeveloped. The purpose of the facility plan is to present the need for proposed facilities, evaluate feasible alternatives in meeting established effluent and water quality goals and demonstrate that the chosen alternative is the most cost-effective, environmentally sound and implementable alternative (Reference Federal Register 35.917, Construction Grants for Waste Treatment Works).

With regard to your requests for additional modeling data and our telephone conversation of June 27, 1977, we will provide some additional information based on your latest flow figures although we do feel that the above comments should be satisfactorily addressed before the determination of final effluent limitations. We will be contacting you once this information is obtained. In the interim, we suggest that you closely examine our comments stated in this letter, and if further clarification is required, a meeting should be arranged in the near future.

Very truly yours,

Russell E. Nerlick

Russell E. Nerlick, P.E., Manager
Raritan River and ISC Basins
Public Wastewater Facilities Element

RLC:jh

cc: U.S. Environmental Protection Agency
Township of Roxbury
Township of Mount Olive
Township of Washington
Alfred Crew Consulting Engineers

CONNECTICUT NEW JERSEY NEW YORK

TRI-STATE REGIONAL PLANNING COMMISSION

ONE WORLD TRADE CENTER, 82 FLOOR
NEW YORK, NEW YORK 10048
TELEPHONE (212) 938-3300

November 15, 1977

Mr. John A. Lacz, P.E.
LAN Associates, Inc.
662 Goffle Road
Hawthorne, New Jersey 07506

Re: Washington-Mount Olive-Roxbury Sewerage Plan: Section (3) Report

Dear Mr. Lacz:

We regret that we are so late in responding to the above report which gives the projections of population and sewer service areas for the study areas. The report had been filed away by mistake by our A-95 processing staff. In the last two weeks, Robert Richmond of my staff had tried to reach you to find out the status of the project but his phone calls were not returned.

We have a serious problem with the recommendations of the study. The areas proposed for sewering in alternatives 1 and 5 are much more extensive than the areas we propose for urban development in the Tri-State Regional Development Guide 1977-2000. This sets forth our land use plan, and it shows that only the communities of Long Valley in Washington Township, Budd Lake and Flanders-Bartley in Mount Olive Township, and Succasunna in Roxbury Township are to be urbanized and therefore will require public sewer systems.

We suggest a three party meeting with the Morris County Planning Board to attempt to resolve the differences.

Sincerely yours,

Stephen C. Carroll

Stephen C. Carroll
Director
Regional Development Division

SCC:hm
cc: R. Richmond
D. Woodbridge, Morris County Planning Board

the official metropolitan planning organization for the interstate urban region of Connecticut, New Jersey and New York

TRI-STATE REGIONAL PLANNING COMMISSION

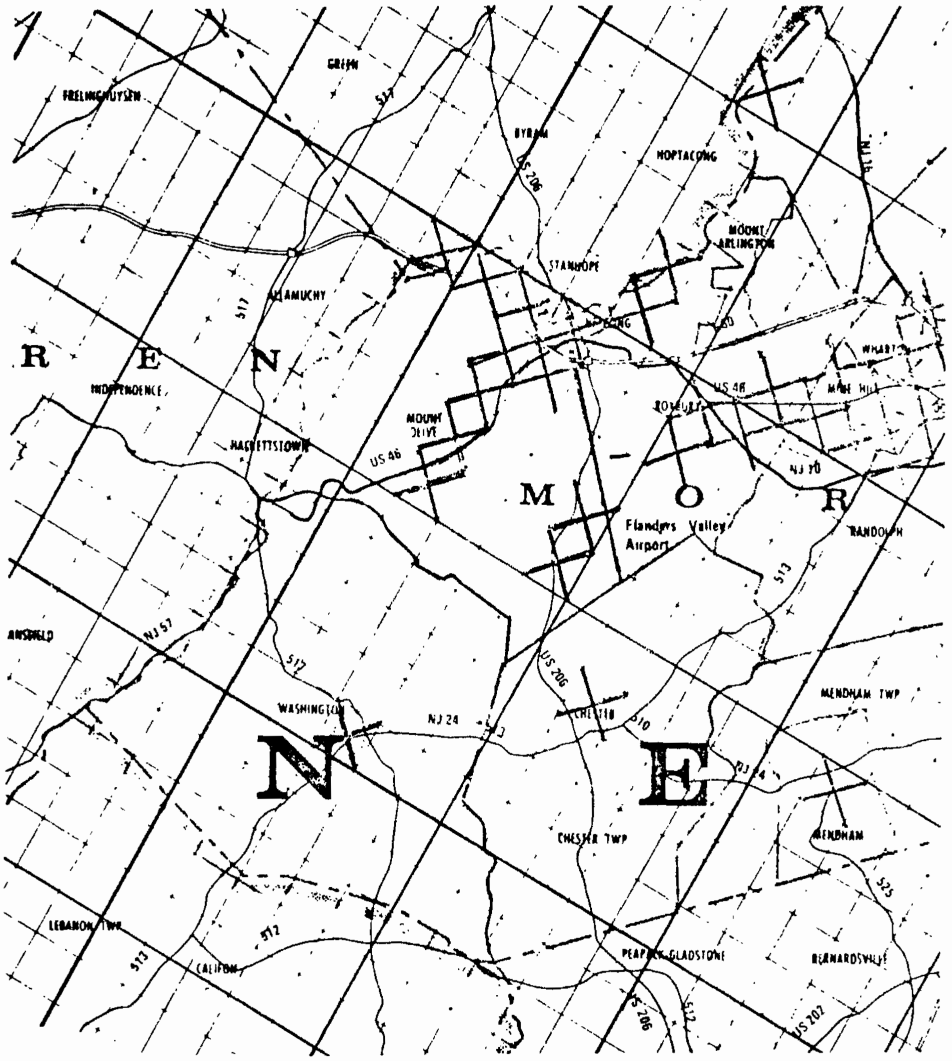
TO: John A. Lacz, LAN Associates ....12/5/77.... 197
Don Ferguson, Mt. Olive Twp.
Ray Zabihach, Morris County Planning Board

FROM: ROBERT J. RICHMOND

Enclosed is a map showing the areas to be urbanized, according to our Regional Development Guide 1977-2000.

These areas are indicated by an X.

We are now reexamining our review of the sewerage study and I or Steve Carroll will be getting back to you shortly.



FRELINGHUYSEN
GREEN
517
BYRAM
US 206
HOPTACONG
MOUNT ARLINGTON
STANHOPE
ALLAMUCHY
R E N
INDEPENDENCE
MOUNT OLIVE
HACKETTSTOWN
US 46
ROXBURY
US 46
NJ 10
M O R
Flanders Valley Airport
RANDOLPH
513
NJ 57
517
US 206
WASHINGTON
NJ 24
CHESTER
510
MENDHAM TWP
N E
NJ 24
MENDHAM
CHESTER TWP
525
LEBANON TWP
512
513
CALIFON
PEAPACK-GLADSTONE
BERNARDSVILLE
US 206
512
US 202

State of New Jersey
DEPARTMENT OF COMMUNITY AFFAIRS

PATRICIA Q. SHEEHAN
COMMISSIONER

363 WEST STATE STREET
POST OFFICE BOX 2768
TRENTON, N.J. 08625

January 6, 1978

Mr. John A. Lacz, P. E.
LAN Associates
662 Goffle Road
Hawthorne, New Jersey 07056

RE: Washington Township MUA
Facilities Plan

Dear Mr. Lacz:

We have received the Section 3, Facilities Plan Alternatives Report for the above referenced project which was submitted under the cover letter of December 8, 1977. The report has been reviewed by the Bureau of Statewide Planning in relation to the State Development Guide Plan (SDGP) which has recently been completed in draft form. The Bureau of Statewide Planning also reviewed the Plan of Study for the Facilities Plan in January 1975 through the A-95 Project Notification Review System.

The SDGP classifies land within the State into five general categories, three of which apply to the facilities planning area. These are:

Growth Area - An area where development has occurred to some extent, and where basic services for more intensive development are generally available. Such an area is considered appropriate for further development and should receive preference in the allocation of financial assistance or public investment for growth supporting facilities.

Limited Growth Area - An area where development currently is generally scattered and of relatively low density. Such an area lacks extensive development supporting facilities and services. Public investment in such areas should be limited to correcting existing problems rather than to encourage major new growth.

Agriculture Preservation Area - An area where natural features and existing uses support the continuation of agriculture. Public facilities and services generally are lacking. Growth supporting investment in such areas should not be encouraged except as needed to correct existing deficiencies. Such areas should receive high priority for investments or other public actions designed to sustain agricultural activities.

The Growth Area generally comprises the land in the facility planning area along I-80 as far west as Netcong and extending in a southerly direction through Drakes Brook Valley to Bartley. This includes the built-up area of Ledgewood, the western edge of Succasunna, Flanders and Bartley.

The Limited Growth Area encompasses most of Mount Olive Township and the eastern edge of Washington Township within the facilities planning area. The settlement around Budd Lake falls within this category.

The Agriculture Preservation Area encompasses most of Washington Township between the South Branch of the Raritan River on the east and the Musconetcong River on the west and includes a small section of Mount Olive Township to the south of Budd Lake. Schooley's Mountain, Middle Valley and most of Long Valley are within the Agricultural Area.

An analysis of the Facilities Plan Alternatives Report shows that the Sewerage Authority is planning to sewer a much more extensive area than is recognized as acceptable according to the recommendations of the SDGP. The alternative sewerage plans are based on major growth expectations that may not occur in the absence of sewerage facilities. Development in the study area is expected to increase from 12% to 35%. This would precipitate a 430% increase in the population from 18,391 in 1970 to 79,342 in 2000. According to the alternative plans, sewers would be extended to much of the rural and agricultural areas, as well as to the existing built-up areas and other areas currently experiencing sewage problems. The SDGP recognizes the open character of much of the facilities planning area and suggests that major growth supporting facilities not be encouraged in the greater portion of this area. Should sewers be constructed to the extent prescribed by the various alternative plans, the ensuing development may cause increased runoff and non-point pollution that may be more harmful than the existing pollution problems. In addition, a significant amount of the most productive agricultural land in Morris County may be lost to development.

In recognition of the major potential problems which may result from a project of this nature, it is recommended that an Environmental Impact Study be prepared. This study should fully analyze the secondary impacts associated with the various alternative plans. Other alternative plans should be considered, including a plan to provide major sewerage facilities only to the northern part of the study area, which would include the Budd Lake area, the area along I-80 and the Drakes Brook Valley. Sewerage improvements in other parts of the facilities planning area should be limited to correcting existing problems without encouraging major new growth. This alternative offers the potential to eliminate most of the existing pollution problems without stimulating significant growth in the rural agricultural areas.

Thank you for this opportunity to review the Section 3, Alternatives Report. Should you have any questions regarding our comments, you may contact Mr. Barry Sullivan of the Bureau of Statewide Planning.

Sincerely yours,

Richard A. Ginman, Director
Division of State & Regional Planning

RAG:kcj

cc: Russell Nerlick, Division of Water Resources
Dudley Woodbridge, Director, Morris County Planning Board
Robert Richmond, Tri-State Planning Commission

State of New Jersey

DEPARTMENT OF COMMUNITY AFFAIRS

PATRICIA Q. SHEEHAN
COMMISSIONER

363 WEST STATE STREET
POST OFFICE BOX 2768
TRENTON, N.J. 08625

March 21, 1978

Mr. John Lacz
Lan Associates, Inc.
662 Goffle Road
Hawthorne, New Jersey 07506

Dear Mr. Lacz:

The attached memorandum to Mr. Ginman summarizes the results of our meeting of March 7 in which we had discussed the proposed Facilities Plan for the Washington Township MUA. Most of this information is covered in your transmittal of March 9; however, the discussion on alternatives and your assessment of needs was not mentioned in your comments on the meeting. The memorandum also clarifies our position on the Facilities Plan, and should eliminate some confusion that may exist as a result of grammatical problems inherent in transcribing direct tape recordings.

Please feel free to discuss any aspects of this memorandum with me at your convenience.

We are looking forward to receiving your final Facilities Plan and hope that it will address all of the issues that were discussed at the meeting.

Very truly yours,

Barry F. Sullivan

Barry F. Sullivan
Bureau of Statewide Planning
Division of State & Regional Planning

BFS:kcj
Attachment
cc: Dudley Woodbridge
Russell Nerlick
Helen Chase
Robert Richmond
Ed Markus

Richard A. Ginman

Barry Sullivan March 17, 1978

Meeting - Washington Township (Morris County) MUA Facilities Plan
March 7, 1978

TTANDANCE: Lan Associates - John Lacz, Robert Cascone
Morris County Planning Board - Dudley Woodbridge
DSRP - Barry Sullivan

The meeting was scheduled by Barry Sullivan at the request of John Lacz to discuss certain issues raised by the Division after reviewing the Section 3 Alternatives Report through the A-95 process. Representatives of Tri-State and the DEP 208 and 201 planning sections were also invited to attend the meeting, but they were not represented.

John Lacz suggested that discussion of the proposed Facilities Plan be organized in relation to the following specific categories: Geographic Location, Population and Land Use. Barry Sullivan indicated that the State Development Guide Plan is a general plan that does not contain the level of detail that is necessary to discuss population projections on a municipal or sub-municipal basis. The Division generally refers to regional, county or other state population numbers in order to provide some perspective to local population numbers. The remaining two discussion categories are so closely related that it was difficult to discuss them independent of each other. Thus, the discussion flowed freely with the two topics viewed in relation to each other.

John Lacz provided a fairly detailed description of the proposed Facilities Plan which included an explanation of certain design choices. Barry Sullivan mentioned that the Division is concerned with the extensive sewerage coverage provided for in the Facilities Plan and indicated how this was in conflict with the SDGP. He also expressed concern with the possible secondary impacts that may be generated by such an investment and wondered if there were any alternatives to such an extensive system. John Lacz indicated that all of the proposed sewers were needed and added that from an engineering and cost-effective point of view a one-plant-concept is the only acceptable alternative. Barry Sullivan mentioned that DEP had suggested other alternatives, e.g., overland disposal, septic maintenance, and construction of a treatment plant just south of Budd Lake with an outfall extending to the South Branch below Drakes Brook, and questioned whether these alternatives had been considered. John Lacz indicated that all of these alternatives had been considered and were rejected either for engineering or cost-effective reasons. He also mentioned that this information will be contained in the final Facilities Plan. At this point, Barry Sullivan indicated that it would be appropriate to wait until the Facilities Plan is completed and DEP and DCA have had an opportunity to review the report before an A-95 Clearance can be further considered.

Dudley Woodbridge agreed with Mr. Sullivan that the sewerage coverage seems extensive and also questioned the feasibility of other alternatives. He also agreed that it would be appropriate to wait for completion of the Facilities Plan before further comments could be provided. Mr. Woodbridge did express concern with the impact of the sewerage system on the valuable agricultural soils in the southern part of Washington Township below Long Valley and suggested that the Facilities Plan seriously consider the effects that sewers would have on this area.

In closing, Barry Sullivan suggested that the State may not recommend funding for this project even if the Facilities Plan were approved. In view of the limited resources and other projects that may have a more immediate need, a project of this nature could receive a rather low funding priority.

BS:kcj

CONNECTICUT NEW JERSEY NEW YORK

TRI-STATE REGIONAL PLANNING COMMISSION

ONE WORLD TRADE CENTER, [redacted]
[redacted] NEW YORK, NEW YORK 10048
[redacted]
TELEPHONE (212) 938-3300

January 5, 1978

Mr. John A. Lacz, P.E.
LAN Associates
662 Goffle Road
Hawthorne, New Jersey 07506

RE: Washington Mt. Olive Roxbury Sewerage Plan

Dear Mr. Lacz:

Subsequent to our meeting last December 1st on the above project, we have obtained information from 1976 aerial photographs to modify our original findings. These findings related to the area to be urbanized, and therefore require sewering, according to the Tri-State land development plan, which used 1970 data as a base. Although again we feel that the total extent of the basin proposed for eventual sewering is too extensive, more of Mt. Olive and Roxbury Townships warrant sewering than we had indicated in our letter of November 15.

We recommend the following four systems in the basin:

1. The Budd Lake area (as served by plant 1A in Alternative 1).

2. The Drakes Brook basin, from Shippenport south to Clover Hill.

3. Schooley's Mountain area -- the same service area as at present (that served by plant WT-1) without much future expansion of sewer service.

4. Long Valley area -- a system to serve the existing community of Long Valley without much expansion beyond.

This recommendation would be consistent with the policy of the Tri-State Regional Development Guide of directing growth to those areas adjacent to existing development and where the infrastructure, including major highways, is already in place, and of holding back growth in rural areas, including those (such as much of Washington Township) with prime soils for agriculture.

Thank you for the opportunity to submit our review of this plan.

Sincerely, Bob Richmond

Robert J. Richmond, Senior Planner
Land Use Section

RJR:fh
cc: D. Woodbridge, Morris County Planning Board
R. Ginman, N.J. Division of State and Regional Planning
H. Ike, N.J. Division of Water Resources
R. Nerlick, N.J. Division of Water Resources

the official metropolitan planning organization for the interstate urban region of Connecticut, New Jersey and New York

Appendix D

PRELIMINARY INTERCEPTOR DESIGN (TYPICAL)

The Consultants have made a preliminary design of the interceptor systems in each alternative. The results of this preliminary design for Alternative No. 1 are presented in this Appendix to illustrate the procedure followed for all of the five alternatives considered.

The procedure followed conforms with that prescribed by the American Society of Civil Engineers Manual No. 37 entitled, "The Design and Construction of Sanitary Storm Sewers", 1974 Edition. Although the study period is for 20 years, to the year 2000, it is recommended good engineering practice to design sewers for their anticipated life, 40 or more years. Thus, the design criteria assumes population at saturation as discussed in this Facilities Plan Report. Reference is made, in particular, to Section 7, Design Criteria, for discussion of the factors used in establishing sewer sizes. It will be noted, referring to that section, that flows are assumed at 100 gallons per person per day. This exceeds the current overall average for water consumption of approximately 75 gallons per day and allows for additional flow due to infiltration and inflow. Industrial flows have been estimated at 3,000 gallons per acre* per day and commercial zone flows at 1,000 gallons per acre* per day. Commercial flows are assumed to occur during a twelve hour day and the industrial flows during an eight hour day.

Sewer lines have been designed with flows at 0.8 full. This, in effect, may be considered an open channel flowing partially filled. The Manning formula has been used to calculate the flow and slope. This formula is expressed mathematically as follows:

$$Q = \frac{1.49}{n} AR^{2/3} S^{1/2}$$

where:

Q = flow, mgd
A = cross-sectional, sq. ft.
R = hydraulic radius, feet
S = slope, per cent
n = friction factor

* Areas occupied by buildings

The flow, Q, is determined from the population estimate at 100 gallons per person and then increased to reflect the peak flow condition as discussed in Section 7. As may be seen by the examination of the formula, the flow can be the same for various combinations of cross-sectional area (pipe size) and slope. The object in selecting the pipe size is to achieve a design flow in the range of 2 to 3 feet per second. This is in the range of velocities that would permit self cleaning of the pipe. A low velocity could result in clogging requiring manual cleaning of the systems. A higher velocity, say 5 feet per second, would result in scouring the interior of the pipe and require repair or replacement in a shorter period of time. The factor "n" in the equation, coefficient of friction, varies with different pipe materials. For typical applications, such as in this study, a value of 0.013 has been used. Pipe sizes increase progressively with flows and at manholes where branches combine. It will be noted, referring to Table 7-4 in Section 7, that the ratio of peak to average daily flows decreases as population increases.

The sizing of interceptors for Alternative No. 1 is summarized in Table D-1. The locations of nodes and branches were determined by the Consultant. Referring to the table, it will be noted that a section of the sewer, identified by node and branch, is sized for the projected population. As the system progresses downstream, population is accumulated. Then, depending upon the total population to the point of design (identified by node and branch), the maximum sanitary flow factor is applied to arrive at the peak sanitary flow in MGD. commercial and industrial flows in mgd are added to the maximum sanitary flows to arrive at a cumulative domestic, commercial and industrial flow. The sewer size and velocity are then determined by use of charts or special slide rules which solve the Manning equation. Selection is made to achieve reasonable slope and velocity as discussed in 7.0 Design Criteria. The design slope, velocity and sewer size are tabulated in the last three columns in Table D-1. It will be noted that no interceptor size is less than 8 inches in diameter regardless of flow.

The final design of the interceptors will be dependent upon the historical and archeological surveys, soils conditions, availability of rights-of-way, topography, and the final selected plan and most important Federal and local funding.

Table No. D-1 - Summary of Preliminary Interceptor Sizing
Alternate No. 1

1 Node	2 Branch	3 Population	4 Cummu-lative Population	5 Max. Sanitary Flow Factor	6 Max. Sanitary Flow mgd	7 Commer-cial Flow mgd	8 Industrial Flow mgd	9 Total C&I Flow mgd	10 Cummu-lative C&I mgd	11 Total mgd	12 Slope %	13 Velocity fps	14 Pipe Diame Inches
					ALTERNATE NO. 1A								
E	X	1848	1848	4.5	.8316	-	-	-	-	.832	.38	2.4	10
		1980	3828	3.8	1.455	-	-	-	-	1.455	.42	2.8	12
		368	4196	3.7	1.553	-	-	-	-	1.553	.15	2.0	15
A	X	261	261	5.0	.1305	-	-	-	-	.1305	.40	2.2	8
A	Y	1984	1984	5.0	.4920	.0113	-	.0113	.0113	.5033	.44	2.3	8
A	Z	1245	1245	4.8	.5976	.0113	-	-	.0113	.6089	.65	2.8	8
B	X	885	885	5.0	.4425	.0085	-	.0085	.0085	.45	.40	2.2	8
B	Y	1744	1744	4.5	.7848	-	.539	.539	.539	1.324	.35	2.7	12
B	Y	1046	1046	4.5	.4707	-	.539	.539	.539	1.009	.55	2.9	10
B	Z	2629	2629	4.1	1.077	.0085	.539	.5475	.5475	1.624	.155	2.1	15
D	X	4096	4096	3.75	1.536	.0204	.539	.5594	.5594	2.095	.25	2.65	15
D	Y	263	263	5.0	.1315	.007	-	.007	.007	.1322	.90	2.2	8
E	Y	5273	5273	3.55	1.872	.0381	.539	.5771	.5771	2.45	.40	2.2	18
F-E	Y-Z	9469	9469	3.15	2.9827	.0381	.539	.5771	.5771	3.56	.13	2.4	21
F	X	554	554	5.0	.277	-	-	-	-	.277	.40	2.5	21
G	X	10937	10937	3.05	3.336	.0972	.539	.6362	.6362	3.97	.16	2.7	21

Table D-1 (continued)

ALTERNATE NO. 1A (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13	14
G_A	X	3703	3703	3.8	1.4	-	-	-	-	1.41	.38	2.8	12
G_A	Z	14640	14640	2.8	4.1	.0972	.539	.6362	.6362	4.76	.50	4.3	18
H_A	X	315	315	5.0	.156	-	-	-	-	.16	.40	2.2	8
H_A	Y	640	640	5.0	.320	-	-	-	-	-	.40	2.2	8
H_A	Z	2460	2460	4.1	1.0	-	-	-	-	-	.50	2.8	10
I_A	X	601	601	5.0	.3	-	-	-	-	-	.40	2.2	8
I_A	Y	469	469	5.0	.23	-	-	-	-	-	.40	2.2	8
I_A	Z	2017	2017	4.3	.867	-	-	-	-	-	.40	2.5	10
J_A	X	4035	4035	3.8	1.53	-	-	-	-	-	.45	3.0	12
J_A	Z	18675	18675	2.75	5.13	.0972	.539	.6362	.6362	5.77	.16	2.9	24
K_A	X	555	555	5.0	.278	-	-	-	-	.28	.40	2.2	8
K_A	Y	352	352	5.0	.18	-	-	-	-	.18	.40	2.2	10
K_A	Z	2144	2144	4.3	.92	-	-	-	-	.92	.45	2.7	10
L_A	X	387	387	5.0	.19	-	-	-	-	.19	.4	2.2	8
L_A	Y	387	774	5.0	.387	-	-	-	-	.39	.4	2.2	8
L_A	Z	5100	5100	3.6	1.836	-	-	-	-	1.836	.2	2.4	15
M_A	Y	5100	5100	3.6	1.836	-	-	-	-	1.836	.32	3.0	15
M_A	Z	7244	7244	3.3	2.39	-	-	-	-	2.39	.13	2.2	18

Table D-1 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13	14
ALTERNATE NO. 1B & 1C													
A_B	X	890	890	5.0	.45	-	-	-	-	-	.40	2.2	8
A_B	X	765	1655	4.5	.74	-	-	-	-	-	.31	2.3	10
A_B	Y	3404	3404	3.9	1.33	-	-	-	-	-	.35	2.7	12
A_B	Z	1014	6073	3.45	2.1	-	-	-	-	-	.26	2.85	15
B_B	X	2038	2038	4.3	.876	-	-	-	-	-	.40	2.5	10
B_B	Y	2295	2095	4.3	.900	-	-	-	-	-	.42	2.7	10
B_B	Z	4333	4333	3.7	1.6	-	-	-	-	-	.15	2.1	15
C_B	X	1201	1201	4.8	.58	-	-	-	-	-	.6	2.6	8
C_B	Y	700	700	5	.35	-	-	-	-	-	.4	2.2	8
C_B	Z	381	2282	4.2	.96	-	-	-	-	-	.5	2.8	10
D_B	X	2351	2351	4.2	.987	-	-	-	-	-	.50	2.8	10
D_B	Y	746	746	5.0	.37	-	-	-	-	-	.4	2.2	8
D_B	Z	3097	3097	3.95	1.22	-	-	-	-	-	.30	2.4	12
E_B	X	948	4045	3.75	1.52	-	-	-	-	-	.14	2.0	15
E_B	Y	948	988	.51	.47	-	-	-	-	-	.4	2.2	8
E_B	Z	5398	5398	3.5	1.89	-	-	-	-	-	.23	2.5	15
F_B	X	2356	2356	4.2	.989	-	-	-	-	-	.20	2.0	12
F_B	Y	410	410	5.0	.205	-	.368	.368	-	.57	.56	2.7	8
F_B	Z	2766	2766	4.0	1.11	-	.368	.368	.368	1.47	.40	2.9	12

Table D-1 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13	14
						ALTERNATE NO. 1B & 1C (continued)							
G_B	Y	1384	1384										
G_B	Z	6782	6782	3.4	2.30	-	-	-	.079	2.56	.12	2.2	18
H_B	Z	286	9834	3.1	3.05	.079	.368	.447	.447	3.50	.12	2.3	21
I_B	Y	2158	2158	4.25	.917	.079	-	.079	.079	.996	.20	2.0	12
I_B	Z	11992	11992	3.0	3.6	.079	.368	.447	.447	4.05	.15	2.7	21

Table D-1 (continued)

ALTERNATE NO. 1D

1	2	3	4	5	6	7	8	9	10	11	12	13	14
A_D	X	1252	1252	4.7	.58	-	-	-	-	.58	.56	2.7	8
A_D	X	1286	2538	4.1	1.04	-	-	-	-	1.04	.55	2.8	10
A_D	Y	713	713	5.0	.3565	-	.017	.017	-	.3735	.44	2.4	8
A_D	Z	3251	3251	3.9	1.267	-	.017	.017	.017	1.284	.33	2.6	12
B_D	Z	2848	2848	4.0	1.14	-	.024	-	.024	1.16	.28	2.6	12
C_D	X	8238	8238	3.2	2.636	-	-	-	.085	2.72	.17	2.4	18
C_D	Y	6099	6099	3.6	2.19	-	-	-	.041	2.23	.30	2.8	15
E_D	Y	4333	4333	3.7	1.6	-	.03	.03	.03	1.63	.50	3.2	12
E_D	Z	5912	5912	3.5	2.7	-	.03	-	-	2.1	.28	2.7	15
E_D	Z	371	6283	3.3	2.07	-	-	.055	.085	2.155	.29	2.8	15
F_D	X	730	730	5.0	.36	-	.02	-	.02	.38	.4	2.4	8
F_D	Y	770	770	5.0	.385	-	.03	-	-	.415	.40	2.4	8
F_D	Z	1500	1500	4.8	.77	-	-	-	-	.77	.35	2.4	10
G_D	X	789	789	5.0	.39	-	-	-	-	.59	.4	2.4	8
G_D	Y	789	789	5.0	.39	-	-	-	-	.39	.4	2.4	8
G_D	Z	1579	1579	4.5	.71	-	-	-	-	.71	.50	2.8	10
I_D	X	-	-	-	-	-	.06	-	-	.06	.4	2.4	8
I_D	Y	14337	14337	2.9	4.16	.038	.099	.137	.137	4.29	.095	2.2	24
I_D	Z	14337	14337	2.9	4.16	.038	.159	.197	.197	4.35	.085	2.2	24

Table D-1 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13	14
ALTERNATE NO. 1D (continued)													
J_D	X	1372	1372	4.7	.644	.022	.007	.009	.009	.653	.70	3.0	8
J_D	Z	15709	15709	2.85	4.47	.038	.159	.197	.197	4.67	.11	2.4	24

Table D-1 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13	14
						ALTERNATE NO. 1E							
M_E	X	514	514	5.0	.26	-	-	-	-	.26	.4	2.2	8
M_E	Y	514	514	5.0	.26	-	-	-	-	.26	.4	2.2	8
M_E	Z	1029	1029	5.0	.51	-	.08	.08	.08	.58	.70	2.9	8
N_E	X	-	-	-	-	.345	.224	.57	.57	.57	.40	2.2	8
N_E	Z	1029	1029	5.0	.51	-	-	-	.65	1.16	.25	2.3	12
O_E	X	1282	1282	4.8	.62	.062	.465	.527	1.17	1.79	.2	2.3	15
O_E	Y	1912	1912	4.4	.84	-	-	-	-	.84	.38	2.5	10
O_E	Z	3194	3194	4.0	1.28	.218	.19	.41	1.58	2.86	.22	2.6	18
P_E	X	591	591	5	.3	-	-	-	-	-	.4	2.2	8
P_E	Z	1366	5151	3.5	1.8	-	-	-	1.58	3.38	.110	2.2	21
S_E	X	1615	4809	3.6	1.7	-	-	-	1.58	3.28	.11	2.2	21
S_E	Y	717	717	5	.36	-	-	-	-	-	.4	2.2	8

APPENDIX E

Nitrogen Model

In order to use the USEPA (1977) model for an annual nitrogen balance with an allowed leaching rate of nitrogen prior to operation of a plant, several assumptions are necessary:

1) the concentration of nitrogen in the effluent will be 25 mg/l
2) a grass crop utilizing 200 lbs/A/yr nitrogen will be grown
3) 20% of the applied nitrogen will denitrify
4) in the study area, precipitation exceeds evapotranspiration by about 0.8 ft/yr
5) 2 mg/l of nitrogen is allowed to percolate to groundwater

The annual nitrogen balance may be calculated using (USEPA, 1977):

$$Ln = U + D + 2.7\ Wp\ Cp$$

where: Ln = wastewater nitrogen loading, lb/A/yr

U = crop nitrogen uptake (lb/A/yr)

D = % denitrification of applied nitrogen

Wp = percolating water = (Lw + 0.8 ft/yr.)

L_w = wastewater applied = 0.015 L_n

C_p = allowable nitrogen concentration in percolate

This becomes:

$$L_n = 200 + .2\ L_n + 2.7\ (.015\ L_n + 0.8) \quad (2)$$

$$L_n = 204.32 + .281\ L_n$$

Therefore:

$$0.719\ L_n = 204.32$$

L_n = 284.17 lbs N/acre/yr applied

L_w = 4.26 ft/yr effluent/acre =

W_p = 5.06 ft/yr water percolating to groundwater

P_n = 27.3 lbs/A/yr nitrogen carried into the groundwater

Assuming 4.3 ft/yr (or 51.6 inchs/yr) of effluent applied to each acre as a maximum and a possible application period of 4.6 weeks, each acre could only receive 1.1 inch per week. Therefore, each mgd would require 260 acres of application site.

APPENDIX F

KEY COMMUNICATION SUMMARY, INTERESTED PARTIES

Item	Date	From	To	Summary
1	2/6/75	South Branch Watershed Association	Norma Hessic, Tri-State Regional Planning Commission	The SBWA expressed its intention to become deeply involved in the public sector with respect to the development of the Facilities Plan and urged that public presentations be made in the manner that would be understandable to the public at large.
2	8/1/75	South Branch Watershed Association	Rocco Ricci, (DEP)	This letter expresses Mr. Reilley's concern for baseline water quality in the Raritan River. It overlooks the fact that the stream modeling done by DEP furnished this information and the concern expressed did not materialize.
3	2/20/76	South Branch Watershed Association	LAN Associates	South Branch Watershed Association transmitted comments on the Section 2 Report.
4	3/8/76	LAN Associates	South Branch Watershed Association	This answers the letter in Item 3.
5	3/8/76	Mark H. Savidoff, P.E. (EPA)	Washington MUA	Comments on the Section 2 Report: 1. The relationship between storm water runoff and the need for adequate planning should be answered in the final report. 2. EPA cited a number of critical items relative to the Infiltration/Inflow Analysis to be resolved by further investigation and analysis and presented in this final report.

Item	Date	From	To	Summary
6	4/7/76	John A. Lacz (LAN)	LAN File #2.332.21	This memorandum ducoments Mount Olive septic tank on-site disposal statistics obtained from Mr. Thomas Craig, Sanitarian.
7	4/13/76	South Branch Watershed Association	Commissioner David Bardin, DEP	Mr. Reilley, representing SBWA, expresses his opinion concerning various 201 plans being prepared in the Raritan watershed area. His criticism is directed to environmental inventory and I/I analysis, preparation of alternatives, selection of alternatives, and plant selection. While many of the comments made in this letter are premature with respect to the subject Facilities Plan, they have been discounted by the subsequent development of the Facilities Plan, or contributed to the techniques of analysis.
8	4/26/76	W. Page Taggart	Mark H. Savidoff, P.E., (EPA)	Letter is critical of the Facilities Plan as it advanced through Section 2 Report particularly with respect to infiltration/inflow analysis and certain elements of environmental impact. It also furnished some statistics and general information on prior studies and plans made with respect to the sewerage systems proposed while Mr. Taggart was employed by the Budd Lake Sewerage Co. This letter induced a meeting between Mr. Taggart and Mr. Lacz of LAN Associates to resolve some of the open questions and to gather additional information that Mr. Taggart could offer for the benefit of the 201 plan development.

Item	Date	From	To	Summary
9	6/21/76	John A. Lacz (LAN)	LAN Files #2.332.4 and 2.332.21	This memorandum documents a telephone conversation between Mr. Lacz and Dr. Dong Whang of DEP. The discussion concerned the DEP 303 Basin Study Report which, at the time, was scheduled for rough draft to be issued about July 1, 1976 and a public meeting to be held 3 to 4 months thereafter. In summary relating to this topic, Dr. Whang furnished the following: 1. Because of certain low flow conditions, DEP was recommending plants be located below the confluence of Drakes Brook and the South Branch. 2. Alternative No. 3 was the most favorite in terms of water quality because of the higher stream flows in the vicinity of the Hunterdon/Morris County boundary. 3. Characteristics of effluent were furnished for the guidance of the Consultants. A meeting with Dr. Whang in the immediate future was scheduled to be attended by the Consultants.
10	6/22/76	Harry A. Ike, P.E., (DEP)	LAN Associates	This letter states that it was the DEP's intention to release a draft of a Raritan Basin Plan and to have a public hearing on it in the early Fall. Six levels of treatment were evaluated for each alternative proposed in the Section 2 Report. Preliminary results indicated that some alternatives with discharges to small tributaries will not result in the maintenance of acceptable DO levels even with the highest levels of treatment. Levels of treatment required were stated for the guidance of the Consultants.

Item	Date	From	To	Summary
11	9/27/76	Mark H. Savidoff, P.E., (EPA)	Mr. Wm. L. Treadway	Mr. Treadway requested of Mr. Savidoff a copy of the LAN memorandum concerning the meeting with Mr. W. Page Taggart (Item 5, Appendix), and he was advised that a copy of this memorandum could be furnished to him for his information as he requested.
12	10/12/76	South Branch Watershed Association	LAN Associates	This letter presents comments on the Section 3 Report and also offers an additional input for continued development of the Facilities Plan.
13	10/18/76	K.S. Stoller, P.E.,(DEP)	Washington Township MUA	The purpose of this letter was to draw the Municipal Authority's attention to another planning program, Water Quality Management (WQM) planning which may impact how and when the Facility Plan is implemented. It points out that WQM planning must be coordinated with the Facility Plan to maximize compatibility and minimize duplication in accomplishing the respective tasks. The Grantee and the Consultants were made aware of the requirements as stated in Sections 208 and 303 (e) of the Federal Water Pollution Control Act.
14	11/3/76	Mark H. Savidoff, P.E. (EPA)	Washington Township MUA	Comments on the Section 3 Report on Alternatives. This letter served as the basis for a subsequent meeting at the EPA office where the comments were discussed with the Consultants and representatives of DEP.

Item	Date	From	To	Summary
15	11/5/76	Helen P. Chase,(DEP)	LAN Associates	Letter transmitted a copy of a memo to EPA regional administrators from John T. Rhett on the subject of less costly treatment systems. The thrust of this memorandum was to consider the continued use of on site (septic) systems or small collection systems and holding tanks rather than extending interceptors. The Consultants have utlizied this information in developing their selected plan.
16	11/18/76	Russel Nerlick, P.E. (DEP)	Washington Township MUA	This letter transmits DEP comments on the Section 3 Report.
17 to 21	12/6/76	LAN Associates	Washington Township, Roxbury Township, Mount Olive Township, Tri-State Regional Planning Commission, Morris County Planning Board	These letters requested that each of the addressees advise if they concur with the population projections included in the Section 3 Report on the Facilities Plan.
22	12/21/76	LAN Associates	Washington Township MUA (forwarded to DEP by MUA).	This letter responding item by item to the comments in the letter from DEP (Mr. Nerlick), Item 15 above.
23	2/17/77	LAN Associates	DEP, Division of Water Resources	This letter responds to a question raised at the meeting with the DEP on January 26, 1977 concerning the possibility of transferring the sewage flow from the Succasunna Basin to the Ajax Plant. A copy of a letter from Alred Crew Consulting Engineers, Inc. to LAN Associates dated January 31, 1977 was forwarded as an enclosure. The Alfred Crew letter presented data on the average monthly flow for the Ajax

Item	Date	From	To	Summary
23 (cont.)				Plant and expressed the opinion that the alternative suggested by DEP is not feasible because of insufficient capacity at the Ajax Plant.
24	3/3/77	Alfred Crew Consulting Engineers, Inc.	DEP, Russel Nerlick, Basin Manager Raritan River	This letter requested DEP rerun the stream model on the basis of reused treatment plant design capacities for the year 1990. It was pointed out that the facilities plan report could be completed on the basis of previous stream DO profiles developed by the stream model, but if the actual design figures were to be followed, a new set of stream DO profiles should be provided. It was left to DEP to advise if the data can be furnished within a short time or if the consultants should proceed with the final report on the basis of the data as prepared previously.
25	3/3/77	Washington Township MUA	LAN Associates, Inc.	This letter expresses the opinion and recommendation of the Washington Township MUA that all future sewer facilities in the Township should be of a local nature and not tied to any currently proposed regional system. In effect, this confirms their previous expression of preference for Alternative #1 rather than Alternative #5.

Item	Date	From	To	Summary
26	12/22/76	Donald A. Ferguson, Director - Planning Common Development & Inspection, Mt. Olive Twsp.	LAN Associates	This correspondence was in reference to the population projections of the Section 3 report. The Consultants received Mr. Ferguson's review of the population projections and his general consent and agreement to the projected population for the Calendar Years 1990 and 2000.
27	1/28/77	Twsp. of Roxbury, James A. Benson, Sanitarian	LAN Associates	Mr. Benson brought to the attention of the consultants that Roxbury Twsp. has a Sanitary Landfill with a significant leachate problem. Mr. Benson requested that this situation be incorporated into the facilities planning.
28	3/21/77	Twsp. of Roxbury, James A. Benson, Sanitarian	LAN Associates	At the request of LAN Associates, Mr. Benson submitted a list of references concerning Sanitary Landfill leachate treatment.
29	3/3/77	Washington Twsp. MUA	LAN Associates	In this letter, the WTMUA stated that their preference would be Alternative #1. It was their recommendation that all sewer facilities in the Township be of a local nature and not tied into a proposed regional system.
30	5/17/77	LAN Associates	EPA, Mr. Ed Markus, Project Engineer	The Consultants advised EPA that the municipalities appear to favor Alternative #1 with treatment plants within municipal boundaries vs. Alternative #5, a regional treatment plant which at the time appears to be the most cost effective. The Consultants advised EPA that they would be required to conduct an indepth analysis from a technical, environmental and cost standpoint to compare the prefered Alternative to a regional treatment system. The

Item	Date	From	To	Summary
				Consultants requested the expediting of the 208 waste allotments from DEP.
31	7/12/77	DEP	LAN Associates	This letter summarized DEP's review of Alternative #1 with their request for further justification for the various projected waste flows with requests for further technical data and backup. This letter promptec a meeting which was held on 8/23/77 to review DEP comments and to present the consultants data substantiating the population projections and waste water stream flows.
32	8/23/77	DEP, Dong Whang/ Bob Mancini	LAN Associates	This correspondence essentially contained the updated information on levels of treatment.
33	2/1/78	LAN Associates	WTMUA	This correspondence contained the Consultant's review of the proposed Schooley's Mountain out full line as designed by Couvrette Associates. The compatability of this out full line with the Consultant's recommendations of the interceptor routings were presented.
34	2/23/78	EPA	WTMUA	This letter from EPA was a summary of a meeting held on 1/17/78. EPA expressed their concern over the continued delays which have prevented the issuance of the final draft, Facilities Plan. EPA requested the Consultants to issue the report with the information to date and to receive EPA and municipalities input and recommendations before continui with the preliminary design.

APPENDIX G

MEETING SUMMARY

Item	Meeting Date	Purpose	Participation	Report Date	Remarks
1	4/29/75	To present to the public what the Facilities Plan Project is going to do for the municipalities involved.	All Consultants and representatives of DEP, the Township, citizens, and interest groups.	4/30/75	At this meeting, attended by 30 to 40 persons, the Consultants presented an introduction to a facilities plan. After this introduction, the meeting was opened to questions from the floor from officials of the municipalities, interest groups, and citizens. Questions were answered relating to water quality in Budd Lake, which would be considered; the possibility of intra-basin transfer to which the Consultants replied that the study would be on the basis that there would be none, and the possibility that land use and related demographic data would be used to determine the needs of the municipalities. For the latter, it was explained that such a study was a function of Section 301 of P.L. 92-500. DEP advised that this study would be started within the next two years. One citizen expressed concern that a treatment plant would be located in an environmentally sensitive area. It was explained that this would be a very important factor to be considered before deciding on a site.
2	1/27/76	DEP discussion of the Section 2 report (Inventory and I/I), and preliminary alternatives in relation to DEP 303 program.	DEP, LAN, and Crew	2/3/76	DEP advised that DEP 303 program for the Raritan was scheduled to be completed June 1976. They also indicated that water quality in the South Branch and Drakes Brook would be the criteria for treatment requirements and would develop outside stream criteria by March 1, 1976.

Item	Meeting Date	Purpose	Participation	Report Date	Remarks
					The alternatives proposed in Section 2 report were discussed. DEP indicated that the confluence reservoir at the South Branch and North Branch at Duke Island County Park, just west of Raritan, would become a reality within the next five or ten years.
3	2/3/76	Public information meeting for Consultants to present their findings to date and schedule the remaining sections of the report.	The meeting was attended by representatives of the Consultants, Townships, DEP and some citizens. Approximately 20 persons attending this meeting were recorded.	2/9/76	The Consultants made a public presentation of the overall plan, existing plant inventory, environmental inventory and the alternatives. The meeting was then opened for questions. Several dealt with the procedure to determine the I/I in the existing collection systems. These were answered generally with the understanding that specific details would be dealt with in the future. In response to a question concerning demographic and land use projections, the Consultants advised they had made extensive use of existing master plans, zoning ordinances, tax maps, building permits and certificates of occupancy. The no-action alternative was discussed and, in accordance with the requirements of Federally funded projects, this would be given consideration in determining the selected plan.
4	2/25/76	To secure municipal officials' comments on proposed treatment plant sites.	Township officials, LAN and Alfred Crew	2/7/76	Ten proposed plant sites were inspected. The officials found no reason why any of these sites should not be considered.

Item	Meeting Date	Purpose	Participation	Report Date	Remarks
5	6/15/76	To obtain from Mr. Taggert all the information that he could furnish concerning the Budd Lake Sewer Co., a Mt. Olive/Drakes Brook interceptor design, and a proposed treatment plant on Drakes Brook at Mt. Olive/Washington Township borderline, and all similar information	W. Page Taggert and John Lacz of LAN Associates.	6/18/76	Mr. Taggert, superintendent of the Budd Lake Water and Sewer Co. prior to its acquisition by Mt. Olive, is familiar with the existing plant (Flanders at Clover Hill, Drakes Brook and Route 206), the collection system at Clover Hill and Sutton Park and, apparently, many of the transactions and feasibility studies that occurred prior to the acquisition by Mr. Olive. The discussion with Mr. Taggert was over a broad range of subjects all related to the 201 facilities plan. The meeting with Mr. Taggert resulted in a clarification of some questions he had and the acquisition by Mr. Lacz of information that was not available from other sources.
6	7/1/76	Discuss the effluent requirements determined by the DEP stream model.	Personnel representing DEP and the Consultants	7/6/76	A preliminary copy of the DEP modeling program report was reviewed and explained by DEP personnel. Levels of treatment were established and furnished to the Consultants for their use in the treatment plant design criteria. Copies of South Branch/Raritan River dissolved oxygen profiles for various flow conditions in Drakes Brook and South Branch were also furnished for use by the Consultants. These charts also indicated the N.J. dissolved oxygen standards for Drakes Brook and South Branch.

Item	Meeting Date	Purpose	Participation	Report Date	Remarks
7	8/27/76	Informal meeting following submission of Section 3 Report.	E.Markus of EPA and John Lacz of LAN Associates	9/1/76	Mr. Lacz delivered additional copies of the Section 3 Report requested by Mr. Markus. The following items were discussed briefly: 1. LAN Associates was attempting to set up a public meeting for September 14. 2. EPA, in general, will not go along with the treatment above level 4 as established by DEP. This could preclude expansion of existing plants or location of new plants with direct discharges into the streams above the confluence of Drakes Brook and South Branch. 3. Tying in of the Roxbury developments and the Drakes Brook Basin area to the Roxbury/Ajax STP on the Lamington would be determined by cost effectiveness study. 4. Level of treatment as shown in the Section 3 Report would be reviewed by EPA. Various alternatives of the activated sludge process would also be analyzed from a cost effectiveness standpoint. 5. Areas outside the study basin-Schooleys, Mt. new development and Parker Acres in the Lamington Basin-may not be included in the Facilities Plan. Mr.Markus was advised that Washington Township MUA is including the new developments in the Schooley's Mt. area outside the basin into the Schooley's Mt. treatment plant. Mr. Markus suggested that these areas could be analyzed as part of the regional sewerage system since the Washington Township MUA is including these areas.

Item	Meeting Date	Purpose	Participation	Report Date	Remarks
8	9/21/76	A public meeting to explain and receive comments on the Section 3 Report Alternatives	The Consultants and representatives of the Townships, Washington Township MUA, DEP, citizens and public interest groups. The attendance numbered approximately 30.		The Consultants described the basin area, subdrainage basins, existing and proposed wastewater plant locations, existing sewered areas, proposed interceptor routings, the 5 alternate plans for sewering the basin, and the estimated population and wastewater flows for the various plants. Also described were the point source effluent requirements and basic stream model prepared by DEP together with the proposed treatment plant alternate processes for the effluent discharges, DEP draft land disposal requirements, and alternate slude disposal system and land areas required for treatment plants. Environmental factors which would be reviewed for each of the alternate plans were described as well. Following the presentation, a series of questions were raised by individuals in attendance and answered by the Consultants. Both the questions and the answers served to clarify the presentation of the alternatives and the methods used in developing them and analyzing their comparative merits.
9	10/8/76	Field inspection of the Facilities Plan area.	Representatives of EPA, DEP, the Consultants, South Branch Watershed Association and W. Page Taggert	10/18/76	The purpose of this meeting, scheduled by request of EPA, was to familiarize EPA and DEP personnel with the Facilities Plan area, particularly population concentrations, existing and new development, problem areas, existing and proposed locations of treatment sites, general routing of proposed interceptors under the various alternatives, and make

Item	Meeting Date	Purpose	Participation	Report Date	Remarks
					other observations as may be required. This inspection fulfilled the purpose for which it was conducted and the EPA and DEP personnel were better acquainted with the local conditions. The inspection supplied additional in-information to EPA and Mr. Markus indicated that he would be issuing a review letter and comments on the Section 3 Report and inputs for the final report shortly. During the inspection, comments made by Mr. Reilley, representing South Branch Watershed Association, and Mr. Taggert were noted for future consideration in developing the final report.
10	11/3/76	To discuss the EPA comments on the Section 3 Report on Alternatives.	Representatives of EPA, DEP, the Consultants	11/19/76	The EPA comments were contained in the letter dated 11/3/76 from EPA (Mark H. Savidoff, P.E.), to Washington Township MUA. The EPA comments were discussed and, where appropriate, clarification and answers were furnished by the Consultants. These serve not only to clarify the Section 3 Report submitted but also to give direction to the Consultants concerning the final report to be submitted. Additional comments were made by the DEP. representative, in particular, requesting additional information concerning septic system failures which the Consultants would include in the final report.

Item	Meeting Date	Purpose	Participation	Report Date	Remarks
11	11/9/76	To solicit feedback from Washington MUA and the Townships of Mount Olive & Roxbury.	Washington MUA personnel and representatives of LAN Associates.	-	Mr. Lacz requested inputs from the Townships and the MUA on the Section 2 and 3, especially Section 3, reports. Attempts to meet with the Mount Olive and Roxbury Townships had not been successful up to this point. The MUA would make an attempt to organize a meeting of the Townships with them and the Consultants to obtain the feedback and to crystalize their adherence to the regional plan rather than separate systems for each Township.
12	1/20/77	To review the alternatives as proposed in the Section 3 Report and obtain comments of the separate Townships. To discuss the organization concept for a regional authority.	Representatives of the Townships and the Consultants.	-	A description of the alternatives was given to those present and there was a discussion concerning the existing facilities under present conditions. The project schedule was also discussed and it was cited that, currently, this project was number 70 on the NJDEP priority list out of a total of 150 projects. A summary of revised treatment plant capacities prepared by Alfred Crew Engineering Associates, Inc., was presented for the information of the Township representatives. This tabulation showed the effect of continued operation of the existing treatment plants as well as their abandonment.
13	1/26/77	Conference held at the request of DEP to discuss the Section 3 report and the requirements for the final report.	Representatives of the DEP and the Consultants.	-	This conference supplemented the Washington Township MUA reply to a letter dated 11/18/76 by Russell E. Nerlich, P.E. There was a discussion concerning the need for sewerage systems in the various areas at intervals in the

Item	Meeting Date	Purpose	Participation	Report Date	Remarks
13 (cont'd.)					future, i.e., 1980, 1990 and the year 2000. The requirements for saturation were also presented. A series of tables,which will appear in the final report,was also presented. These tables identified the various sub-basins by number and area descriptions, approximate area in acreage, approximate number of dwelling units, approximate population and pertinent comments. A description of the proposed plants under each alternative was presented by Mr. Brackmann,representing Alfred E. Crew Engineering Associates, Inc. He explained that in the cost effectiveness analysis, the three existing plants would be considered as possible alternatives. Reference was made to septic systems or collection systems for small clusters of dwellings. DEP personnel emphasized that the cost of service should include the costs for local collection systems as well as the interceptors and treatment plants. It may be necessary to apply for additional funds to expand the 201 Facilities Plan to include the local collections systems in each Township. The DEP refused to endorse a request for a grant to investigate tying in of the Roxbury area to the existing Ajax plant. The Consultants agreed, if possible, to develop this on the basis of readily available information. It was indicated, based on the current state of the study, that Alternative 5 would be the alternative to be recommended. A cultural resource report is required and application

Item	Meeting Date	Purpose	Participation	Report Date	Remarks
13 (cont'd.)					for a grant amendment to cover this cost will be prepared. Consultants have also applied to the Corps of Engineers for approval as required for a 404, Section 10 Permit. Left for later resolution by the townships and the Consultants are the questions concerning the obligations relative to debt service on bonds and mode of billing homeowners and townships.
14	2/2/77	To present information to the Washington Township MUA	Representatives of Washington Township MUA, LAN Associates, and Alfred Crew Engineering Associates.	2/8/77	Consultants reported on a meeting with the DEP on January 26, 1977 concerning population projections, water quality maintenance, ground water and individual disposal units operations/ sewer needs. The Consultants pointed out that no response has been received from the Township Planner concerning the Consultant's population estimates. It was the consensus of the MUA representatives that the estimates and population center projected by Consultants were more realistic than those of the Township's Planning Board. Consultants pointed out that as a result of the meeting with the DEP, an amendment to the grant application will be prepared for the following additional work: Aerial photograpy Sewer system evaluation survey Historic and cultural survey Local collection system facilities plan for each of the three townships.

Item	Meeting Date	Purpose	Participation	Report Date	Remarks
15	2/28/77	To discuss the Section 3 Report and present latest developments in this study.	Mayor and council representatives of Mt. Olive, Township Engineer, Alfred Crew Engineering Associates, and LAN Associates.	2/28/77	Mt. Olive representatives were advised of the meeting at DEP on February 2, 1977, and the subjects discussed. The Consultants explained how the water balance, sewered areas, areas of population and development, and developable and non-developable areas would be presented by means of a base map with separate overlays for each of these presentations. Mayor Roland informed the Consultants of a planned adult community which would consist of 600 units and have an estimated population of 1100. The probable presence of this community will be reckoned with in the facilities plan study. Probable plant sites were discussed including a tract of approximately 25 acres, acquired by Mt. Olive from the Budd Lake Water Co. This particular area, however, would have only approximately 15 acres dry and useable. The remainder is in the flood plain. The probability of inadequate stream flows during the MA7CD10 stream flow period was put out by the Consultants and would mitigate against treatment plants located in Mt. Olive without supplementary provision for disposal of plant effluent during low stream flows. Consultants advised that Alternative #5 is indicated as being the selected plan although the final analysis has not been completed. Mt. Olive officials, however, are inclined toward Alternative #1 because this tends to honor political boundaries and would permit, if necessary or desired, that each township would have control of its own sewerage system.

Item	Meeting Date	Purpose	Participation	Report Date	Remarks
16	6/10/77	To expedite calculations from NJDEP for waste load allotments and to advise EPA of status of the final report.	John Lacz of LAN Associates and Ed Markus, EPA Project Engineer.	6/13/77	During this meeting, NJDEP were contacted to determine when the waste load allotments would be provided to LAN Associates for their incorporation in the final report. It was determined that LAN Associates should have the information within the next few days. Data received 8/23/77.
17	8/23/77	To discuss the Bureau of Water Quality, planning and management review of the Facilities Planning submitted to date.	John Lacz of LAN Associates, John Brackmann, Alfred Crew Consulting Engineers, Inc., Russel Nerlick, Richard Cramer, Helen Chase and Bob Mancini of DEP.	9/6/77	The purpose of the meeting was to justify the population and land use projections submitted in the Section 3 report. The meeting essentially concerned itself with Alternate #1 and the justification of same or a reduced scale Alternative #5.
18	1/17/78	The meeting was called by Ed Markus, Project Engineer, EPA for the purpose of coordinating the project to date and to review the rough draft of the Facilities Plan.	Ed Markus, Larry Karas, EPA, Anthony Fellini, DEP, John Lacz, and Robert Cascone of LAN Associates, John Brackmann, Alfred Crew Consulting Engineers, Inc.	1/18/78	Various representatives of the Townships of Mt. Olive, Washington Twsp. and Roxbury were invited but did not attend this meeting. EPA expresses concern over the delays which have prevented the issuance of the final draft of the Facilities Plan. It was decided that the final report should be issued as soon as possible and the preliminary design of the plants would be excluded from the final report. The preliminary designs of the plants being accomplished after final inputs are received from all parties concerned.
19	6/6/78	To provide status report to the officials of Mt. Olive Twsp. on the contents and recommendations of the final reports.	John A. Lacz, LAN Associates, Mayor and Council representatives of Mt. Olive Twsp.	6/6/78	John Lacz informed Mt. Olive representatives that the selected plan is Alternative #6 with a confluence plant and pumping station at Long Valley. At this meeting capital cost as well as cost to homeowners were discussed. A time schedule for the completion of the report, public hearing and a Step 2 grant were discussed.