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BINGHAMTON WASTEWATER MANAGEMENT STUDY. BACKGROUND INFORMATION --FTC(U)

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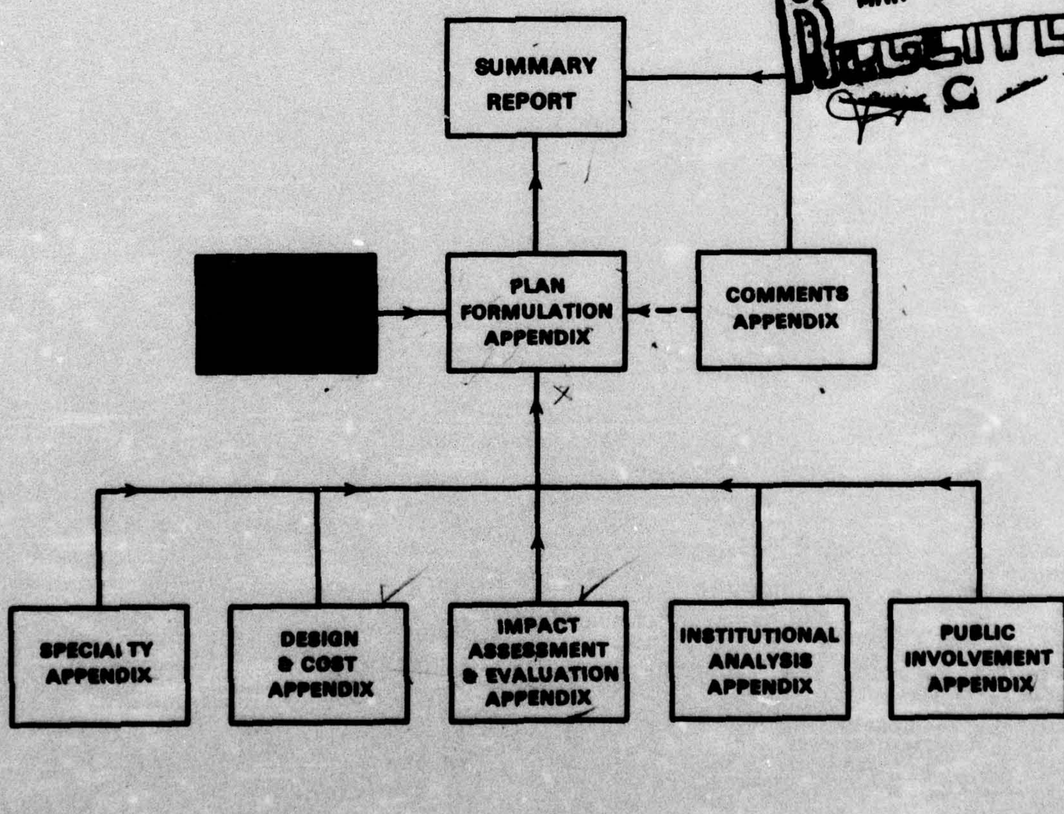
"The Raft of Summer"
Courtesy of Paul Smith, Binghamton, New York

Someone once said a picture is worth a thousand words, and the cover photograph summarizes the study in a simple but graphic manner. Today, the modern Huck Finn can enjoy many scenic and recreational opportunities associated with a Susquehanna River relatively free of pollutants. But tomorrow when the boy is grown, will the river still offer clean water for his children's enjoyment? This study suggests some ways to keep the Susquehanna clean and to ensure that future generations in Broome and Tioga Counties can enjoy "The Raft of Summer."

The Report for the Binghamton Wastewater Management Study consists of nine appendices. The Summary Report, Background Information Appendix, Plan Formulation Appendix, and Comments Appendix consitute the primary study documents. The five remaining documents support the Plan Formulation Appendix. The relationship of the Background Information Appendix to the other documents is indicated in the diagram below.

The Background Information Appendix presents the legislative history of the Study, the physical environment of Broome and Tioga Counties, existing and projected demographic and economic characteristics, wastewater management practices, and the goals and objectives of the Study.



BINGHAMTON WASTEWATER MANAGEMENT STUDY

BACKGROUND INFORMATION APPENDIX

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DEPARTMENT OF THE ARMY

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BINGHAMTON WASTEWATER MANAGEMENT STUDY

BACKGROUND INFORMATION APPENDIX

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CHAPTER I

INTRODUCTION TO THE STUDY AND THE REPORT

The Binghamton Wastewater Management Study was a joint Federal, State, and local planning effort to develop viable alternatives for the protection and enhancement of water quality and associated resources of the Susquehanna River Basin within Broome and Tioga Counties, New York. The Background Information Appendix discusses the events leading to the study, the existing regional profile, specific problems, issues, needs, and concerns pertaining to water quality and related resources, and the projected conditions for the future. Detailed discussions of plan formulation, impact assessment and evaluation and institutional arrangements are presented in other appendixes.

STUDY PURPOSE

The purpose of the Binghamton Wastewater Management Study was to develop both short and long-range wastewater management plans for Broome and Tioga Counties, New York. The Study identified both present and potential water quality problems and designed and evaluated alternative wastewater management plans to solve these problems. The plans will complement the water quality programs of the State of New York while meeting the planning requirements of the Federal Water Pollution Control Act Amendments of 1972, Public Law 92-500.

LEGISLATIVE BACKGROUND OF THE STUDY

COMPREHENSIVE SUSQUEHANNA RIVER BASIN STUDY

Prior to 1960, various Federal and state agencies conducted surveys and studies of the Susquehanna River and its tributaries. These studies usually were authorized for a specific water resource problem. A need existed, however, for a comprehensive report on all of the water and related land resources of the Susquehanna River Basin.

Therefore, on 5 October 1961, the Senate Committee on Public Works adopted a resolution directing that a study of the Susquehanna River be made to develop a comprehensive plan for the water and related land resources of the Basin in the States of New York and Maryland, and the Commonwealth of Pennsylvania. The House Committee on Public Works adopted a similar resolution on 10 May 1962.

This comprehensive study, combining the above resolutions and five outstanding resolutions, was assigned on 11 October 1961 to the U. S. Army Corps of Engineers, Division Engineer, North Atlantic Division and to the District Engineer, Baltimore District, on 24 October 1961. The result of the study is a comprehensive 19 volume report on the Susquehanna River Basin completed in June 1970. Appendix F, Water Supply and Water Quality identified 13 areas of severe water pollution problems that required further study. The Binghamton metropolitan region was one of these areas.

SECTION 235 OF THE FLOOD CONTROL ACT OF 1970

Subsequent to the findings of the Susquehanna River Basin Study, authority was granted for detailed investigation of specific water resource problems. Section 235 of the Flood Control Act of 1970 directs the Corps of Engineers to investigate and study the availability, quality, and use of water and to develop comprehensive plans for construction, operation, and maintenance of facilities in the Susquehanna River Basin. Applicable parts of the text for Section 235 of Public Law 91-611 follow:

Sec. 235. (a) The Secretary of the Army, acting through the Chief of Engineers, is authorized and directed, as part of the comprehensive study of the water and related resources of the Susquehanna River Basin, to investigate and study, in cooperation with the Administrator of the Environmental Protection Agency and other interested departments, agencies, and instrumentalities of the Federal Government and of the governments of States and their political subdivisions, the availability, quality, and use of waters within the basin with a view toward assisting in the preparation of a comprehensive plan for the development, conservation, and use of such waters. The Environmental Protection Agency shall have the responsibility in carrying out this section for those aspects of the development, conservation, and use of such waters which are essentially within its jurisdiction.

b. In connection with such investigations and study, the Secretary of the Army, acting through the Chief of Engineers, and in cooperation with the Environmental Protection Agency and all other interested Federal agencies, shall make such studies and develop such plans as deemed necessary for the construction, operation, and maintenance of facilities in selected regions of the basin, including augmentation of streamflows by releases of stored waters.

c. Such facilities may include, but shall not be limited to, water conveyance systems; regional waste treatment, interceptor, and holding facilities; water treatment facilities; and facilities and methods for recharging ground water reservoirs.

d. The Secretary of the Army, acting through the Chief of Engineers, shall submit to the Congress any and all parts of plans prepared pursuant to this section, which are approved by the Susquehanna River Basin Commission as in accordance with its comprehensive plan for the immediate and long-range development and use of the water resources of the basin, including all recommendations of the Environmental Protection Agency with respect to matters under its jurisdiction, and shall include recommendations for authorization and appropriate financial participation and cooperation by the States, political subdivisions thereof, and other local interests.

PILOT WASTEWATER STUDIES

In 1970 Congress authorized the Corps of Engineers to conduct a series of pilot wastewater management studies in several major metropolitan areas of the United States. Thus, the Corps of Engineers directed its planning efforts toward helping urban areas solve their water and related land resource problems. From these studies, valuable experience was acquired in wastewater management planning.

FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1972

On 18 October 1972, the Federal Water Pollution Control Act Amendments of 1972 (P. L. 92-500) became law. These amendments established water quality objectives, goals, and policies for the Nation. Section 101 of P. L. 92-500 states, in part:

> "The objective of this act is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. In order to achieve this objective it is hereby declared that, consistent with the provisions of this Act -
>
> (1) it is the national goal that the discharge of pollutants into navigable waters be eliminated by 1985;
>
> (2) it is the national goal that wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water be achieved by July 1, 1983;
>
> (3) it is the national policy that the discharge of toxic pollutants in toxic amounts be prohibited;
>
> (4) it is the national policy that Federal financial assistance be provided to construct publicly owned waste treatment works;
>
> (5) it is the national policy that areawide waste treatment management planning processes be developed

and implemented to assure adequate control of sources of pollutants in each state; and

(6) it is the national policy that a major research and demonstration effort be made to develop technology necessary to eliminate the discharge of pollutants into navigable waters, waters of the contiguous zone, and the oceans."

Section 208(h) of P. L. 92-500 specifically mentions the Corps of Engineers as a possible participant in areawide waste treatment management planning. "The Secretary of the Army, acting through the Chief of Engineers, in cooperation with the Administrator is authorized and directed, upon request of the Governor or the designated planning organization to consult with, and provide technical assistance to, any agency designed under subsection (a) of this section in developing and operating a continuing areawide waste treatment management planning process..."

URBAN STUDIES PROGRAM

In its continuing program to aid metropolitan areas with water quality management planning, the Corps of Engineers also has set forth policies and procedures for the Urban Studies Program in the 3 November 1975 issue of the Federal Register. The objective of the Urban Studies Program of the Corps of Engineers is "to develop, in conjunction with the public, plans which not only offer a realistic prospect for solving specific urban water resource problems, but, equally important, also have the potential to serve as a catalyst for solving other related urban problems."

IMPLICATIONS FOR THE BINGHAMTON WASTEWATER MANAGEMENT STUDY

The above authorizations and study programs, primarily Section 235 of the Flood Control Act of 1970, afforded the opportunity for Federal, State, and local representatives to express their interest for a wastewater study in Broome and Tioga Counties, New York. Consequently, the Baltimore District, Corps of Engineers prepared and distributed a Plan of Study in 1973. The New York State Department of Environmental Conservation (NYSDEC) signed a letter-of-agreement in January 1974 formalizing its commitment to the Binghamton Wastewater Management Study, and work on the study began immediately.

MANAGEMENT STRUCTURE FOR THE STUDY

Three separate groups were organized to ensure that Federal, State, and local needs and objectives were incorporated in the study. Figure I-1 outlines the managerial elements. The Interagency Study Management Group (ISMG) provided overall study guidance and direction. The ISMG was composed of the U. S. Army Corps of Engineers, Baltimore District; the U. S. Environmental Agency, Region II; the New York State Department of Environmental Conservation; the Southern Tier East Regional Planning Board; and the Susquehanna River Basin Commission. The ISMG had the responsibility for conducting a Study that was consistent with government policies and regulations and was responsive to local needs and objectives. The Citizens Advisory Committee (CAC) consisted of residents of Broome and Tioga Counties. Their responsibility was to provide citizen review and direction to the planning effort. In particular, the CAC's review process ensured that the Study was responsive to local issues and problems. The Technical Advisory Committee (TAC) included professional personnel from various government agencies involved in the Study. The Committee facilitated information exchange among Study participants and reviewed technical analyses and decisions. Citizens were encouraged to participate either by direct discussions with representatives to the CAC or by attendance at public meetings.

The management structure, then, allowed Federal, State, local, and interstate representatives to make direct contributions to the study effort.

MANAGEMENT STRUCTURE FOR THE BINGHAMTON WASTEWATER MANAGEMENT STUDY

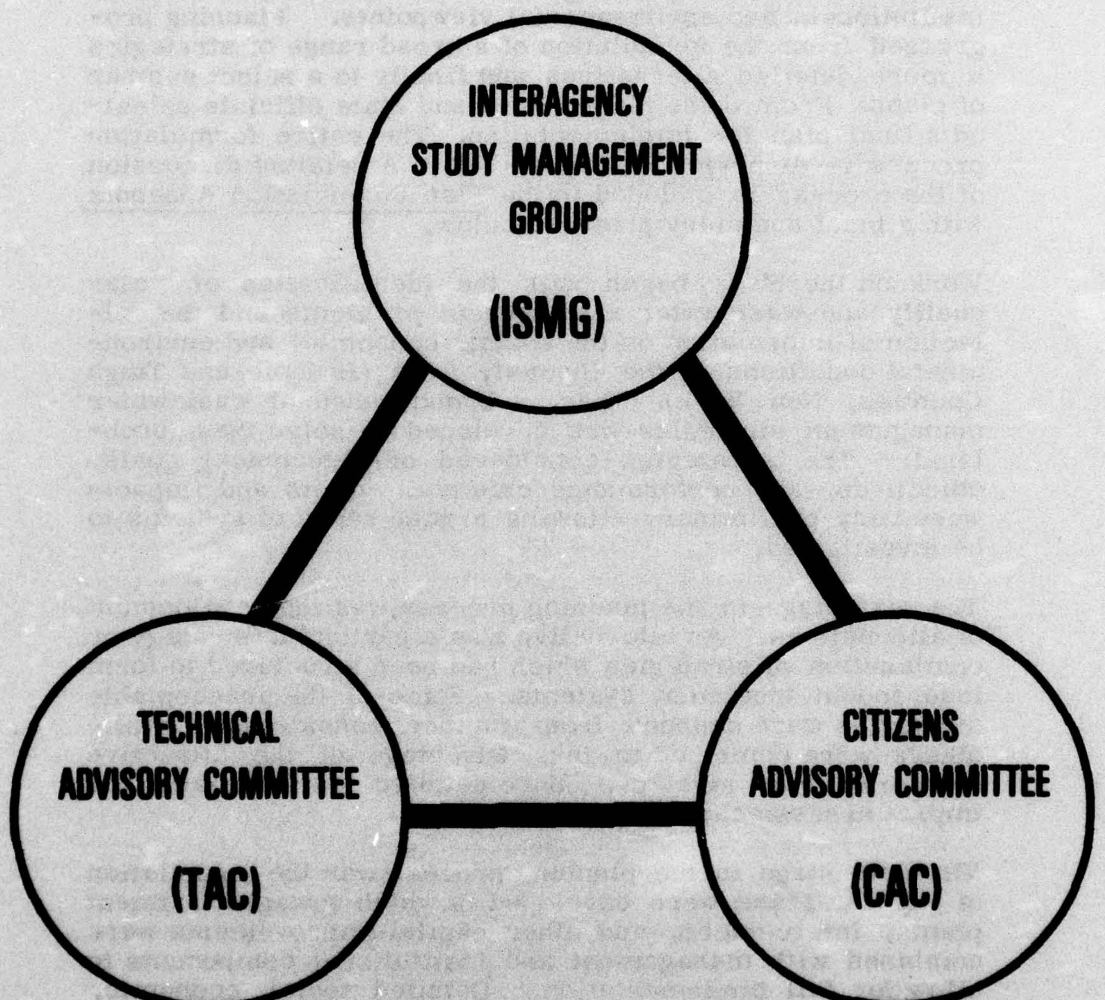


FIGURE I-1

PLANNING PROCESS

A sequential planning process was established to develop implementable plans for the Binghamton Wastewater Management Study that were acceptable from technical, economic, institutional, and environmental viewpoints. Planning progressed from the formulation of a broad range of strategies to more detailed alternatives and finally to a select number of plans. From these plans, local and State officials selected a final plan for implementation. The entire formulation process is displayed in Figure I-2. A detailed discussion of the process is included in the Plan Formulation Appendix with a brief summary provided below.

Work on the Study began with the identification of water quality and wastewater management problems and the collection of information on the social, economic, and environmental conditions in the Bicounty Area (Broome and Tioga Counties, New York). Then, a broad range of wastewater management strategies was developed to solve these problems. The strategies considered only technical goals, objectives, and performance criteria. Costs and impacts were very preliminary allowing a wide range of systems to be investigated.

The next stage in the planning process was the development of alternatives. An alternative was a particular strategy or combination of strategies which had been structured to form independent treatment systems. Some of the unacceptable strategies were dropped from further consideration while others were combined to take advantage of the attractive features of each strategy. More detailed cost estimates and impact assessments were made.

The final stage in the planning process was the formulation of plans. Plans were developed in which sewage treatment plants, interceptors, and other capital improvements were combined with management and institutional components to allow for full implementation. Detailed social, economic, and environmental impact assessments were conducted for all plans.

PLAN FORMULATION PROCESS

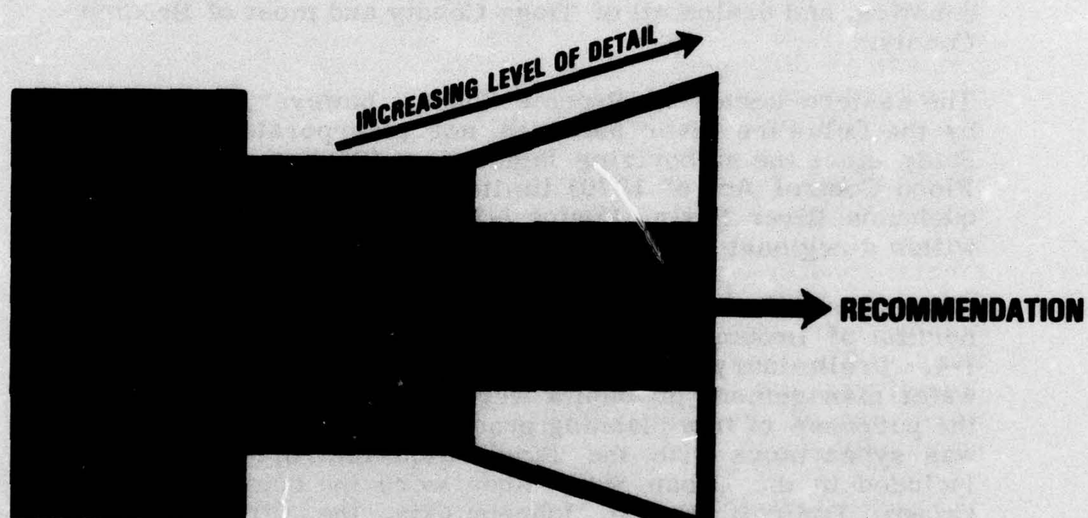


FIGURE I-2

SCOPE OF STUDY

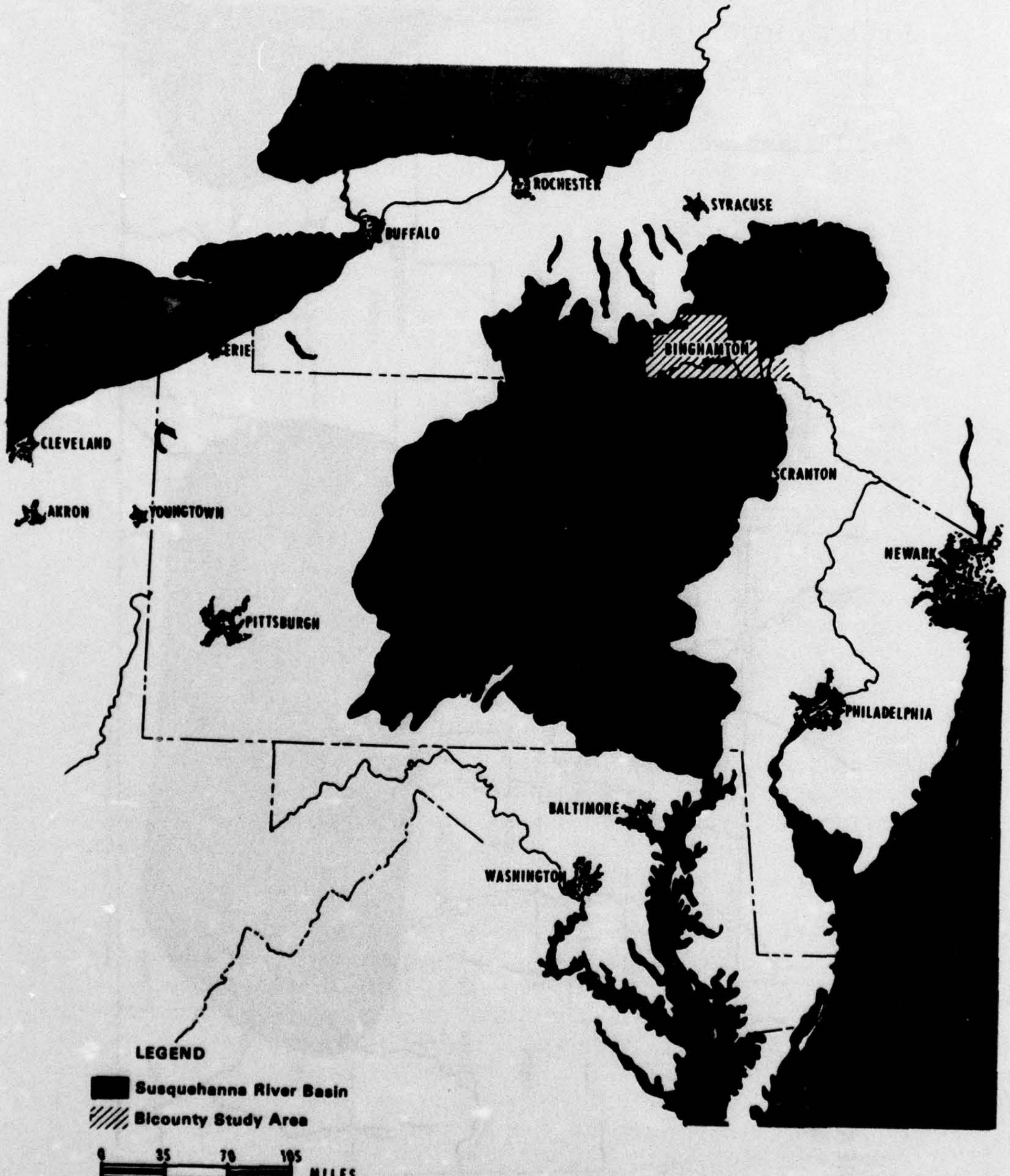
STUDY AREA

The Bicounty Area is located along the southern tier of counties bordering the Commonwealth of Pennsylvania. The Susquehanna River flows in the southern portion of both counties, and drains all of Tioga County and most of Broome County.

The eastern sector of Broome County, however, is drained by the Delaware River and was not incorporated into the Study since the authorizing legislation (Section 235 of the Flood Control Act of 1970) limits Study activity to the Susquehanna River Basin. Figure I-3 locates the Bicounty Area within a regional context.

The major effort in this Report focuses on the urbanized portion of Broome and Tioga Counties as shown in Figure I-4. Preliminary findings indicated that the major wastewater management problems were found in this region. For the purposes of this planning process, the Urban Study Area was synonymous with the Binghamton metropolitan area. Included in the Urban Study Area were the communities of Owego, Endicott, Vestal, Johnson City, the City of Binghamton, and other smaller municipalities along the Susquehanna and Chenango Rivers. Expanding developments along Nanticoke Creek Valley upstream to the Town of Maine, the Chenango River Valley upstream to Chenango Bridge, and the Five Mile Point area were considered part of the Urban Study Area.

Wastewater management problems of communities outside the Urban Study Area were investigated to determine the impact on water quality in the Binghamton metropolitan area. The communities included: Spencer, Candor, Newark Valley, Waverly, Nichols, Lisle, Whitney Point, Harpursville, and Windsor. The problems of these Outlying Communities were not investigated to the same level of detail as municipalities within the Urban Study Area. However, a separate section is devoted to the Outlying Communities in the Specialty Appendix. This section investigates current problems, discusses existing plans for wastewater management, and outlines the broad range of options available for future wastewater management in these Outlying Communities. Primary emphasis, though, was placed on the Urban Study Area as delineated on Figure I-4.



LOCATION OF THE BICOUNTY AREA

FIGURE I-3

URBAN STUDY AREA

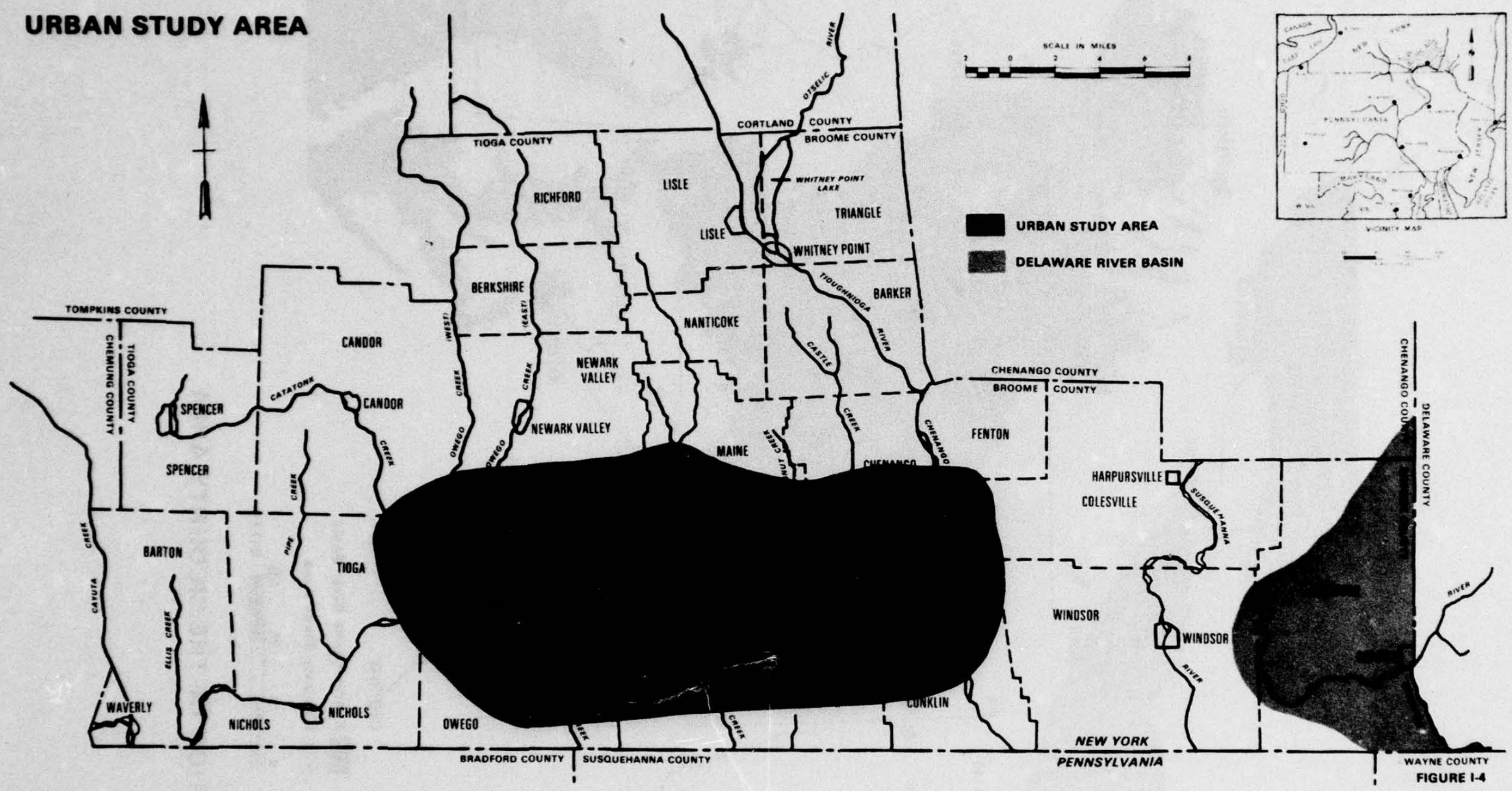


FIGURE I-4

LEVEL OF DETAIL

The Binghamton Wastewater Management Study made a systematic comparison of major alternatives in terms of technical feasibility; environmental, social, and economic impacts; implementation arrangements; and public acceptability. The level of design detail used in the study was of "survey scope" detail. The investigation developed sufficient design and evaluation detail to allow a choice to be made from a range of alternatives; it did not, however, provide the detailed design data necessary for construction of a specific project.

PRODUCT OF THE STUDY

The product of the Binghamton Wastewater Management Study was an areawide investigation of wastewater management problems and solutions in Broome and Tioga Counties, New York. In this regard, the product of the Study was comparable to the planning activities accomplished under EPA's "208" programs. The Binghamton Wastewater Management Study fulfills most of the requirements of the EPA 208 program while satisfying the Corps' guidelines for survey scope reports.

The survey scope Study, then, formulated and analyzed cost-effective and environmentally effective wastewater management alternatives. These alternatives ranged from a plan to meet current requirements within the immediate future to a plan to achieve the highest levels of wastewater treatment by the year 1985, consistent with the goals of P. L. 92-500. Additionally, the alternatives were designed to the year 2020 with an accompanying schedule of construction priorities and implementation procedures. The Plans for Choice are displayed in this Report as an aid for decisions on an areawide basis.

The Plans for Choice have been presented to State and local officials for their selection of a recommended plan. This adopted areawide plan now forms a basis for applying to EPA for grants in connection with the 201 facilities program for advanced planning (Step 1), detailed design and specifications (Step 2), and construction (Step 3) of individual projects.

Some of the advanced planning normally accomplished under the 201 Step 1 activity has already been performed in the development of the survey scope report for the Binghamton Wastewater Management Study.

The adopted plan can also be used to evaluate and, if necessary, amend the current wastewater comprehensive plans for each county. Whichever course of action the local and State decision-makers choose, the Report is intended as an aid to Broome and Tioga Counties in future planning for wastewater management.

The Corps of Engineers' role in this effort was limited to providing a wastewater management planning service for local and State governments. The Corps of Engineers has no authority for construction of wastewater treatment facilities.

CHAPTER II

PHYSICAL ENVIRONMENT OF BROOME AND TIOGA COUNTIES

The purpose of this chapter is to describe the natural characteristics of the region, including climate, geology, water resources, and the biotic environment. An understanding of the physical environment of the Bicounty Area is essential for identifying problems, formulating plans, and determining impacts of these plans.

CLIMATE

Broome and Tioga Counties have a cool, humid, continental type climate. Summers are usually cool and short while winters are long and cold with periods of changeable weather. The geographic location and local topography frequently result in varying climatological conditions. Official climatological data are observed at the Broome County Airport in the Town of Maine.

WINDS

Winds in the two counties generally have northeast and westerly components. Winds from the north or northwest usually result in cold and dry weather while those from the south and southwest bring warm and humid weather. Occasional winds from the Atlantic Ocean result in cloudy, damp, and cool days. Winds average less than 5 miles per hour (mph) in the warmer months and approximately 7 mph in the winter.

Moist winds from the Great Lakes and the St. Lawrence Valley result in very cloudy skies over Broome and Tioga Counties. This condition is intensified by advective fogs from the Susquehanna River. In November, December, and January, Binghamton averages less than one-third of the possible sunshine. Most sunshine occurs in June and July when there is an average of slightly more than 50 percent of the possible sunshine. An average of 47 days in a year are clear, 104 are partly cloudy, and 214 cloudy.

TEMPERATURE

The average minimum, average maximum, and mean monthly temperatures for 1952 - 1973 in the Study Area are summarized in Table II-1 and presented in Figure II-1.

Summer temperatures occasionally reach 90 degrees Farenheit (F), but the daily average temperature is usually between 62 and 75 degrees F. The highest winter daytime temperatures average from 32 to 36 degrees F, while the lowest nighttime temperatures range from 15 to 20 degrees F. The temperature may reach 0 degrees F several times a season, but temperatures much below this seldom occur. The freeze-free period averages between 150 and 160 days. The average date for the last freezing temperature in spring is the first week in May and the average time for the first freeze in autumn is the last week in October. Freezing temperatures have been recorded as late as May 19, and as early as September 14.

PRECIPITATION

The total annual precipitation of 37.35 inches is uniformly distributed throughout the year although the greatest average monthly rainfall occurs during the growing season of April through September. Thunderstorms are the source of most of the rainfall, with a normal year having 31 such storms.

TABLE II-1

Monthly Temperature (°F)
Maximum, Minimum, and Mean [1]

Month	Average Maximum	Average Minimum	Mean Value
January	28.1	13.5	20.8
February	30.1	15.3	22.7
March	38.0	23.7	30.9
April	53.4	35.2	44.3
May	64.3	45.0	54.7
June	74.2	54.8	64.5
July	78.2	59.3	68.8
August	76.4	57.6	67.0
September	69.3	51.0	60.2
October	58.4	41.0	49.7
November	44.5	31.4	38.0
December	32.3	20.2	26.3

[1] 1952-1973 data

Source: U.S. Department of Commerce, NOAA, 1973 Local Climatological Data, Annual Summary with Comparative Data, Binghamton, New York.

MONTHLY TEMPERATURES (°F)
MAXIMUM, MINIMUM, AND MEAN
(1952-1973)

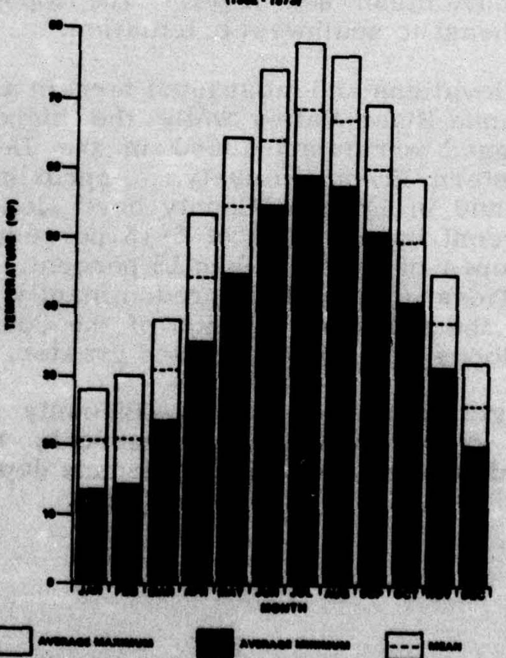


FIGURE II-1

In an average year, 162 days receive some form of precipitation greater than 0.1 inch. Table II-2 and Figure II-2 present tabular and graphic analyses of the average maximum, average minimum, and mean monthly precipitation.

The average annual snowfall in the City of Binghamton is approximately 50 inches. However, the Broome County Airport, which is north-northwest of Binghamton and about 700 feet higher in elevation, has an average annual snowfall of approximately 88 inches. About half of the annual snowfall occurs during January and February, although snows can occur in early November and in late April. Table II-3 and Figure II-3 present the average maximum, the maximum in 24 hours, and mean monthly snowfall recorded during 1951-1973.

GEOLOGY

Situated in the Appalachian Plateau Province of the Appalachian Highlands of southern New York, Broome and Tioga Counties encompass an area of 1,238 square miles. Geologic folding, glaciation, and stream action have produced a landscape of varied topographic features. Hills are gentle and rolling with elevations ranging from 750 feet to 2,000 feet above mean sea level. The topography has a slightly northeast to southwest orientation.

The lowest elevations and most level terrain are found along the Susquehanna River Valley while the highest elevations and most rugged terrain are found in the Delaware River Valley in eastern Broome County. Approximately 13 percent of the land in Broome County have slopes of 0-5 percent, 60 percent have slopes of 5-15 percent, and 27 percent have slopes of greater than 15 percent. The southwest portion of Tioga County has predominantly 9-14 percent slopes while the northeast portion of the County is characterized by slopes of 6-15 percent and greater.

Major geologic formations in the Bicounty Area area of three basin types: sedimentary bedrock, unconsolidated Pleistocene deposits, and recent Holocene deposits.

TABLE II-2

Monthly Precipitation (Inches)
Maximum, Minimum, and Mean [1]

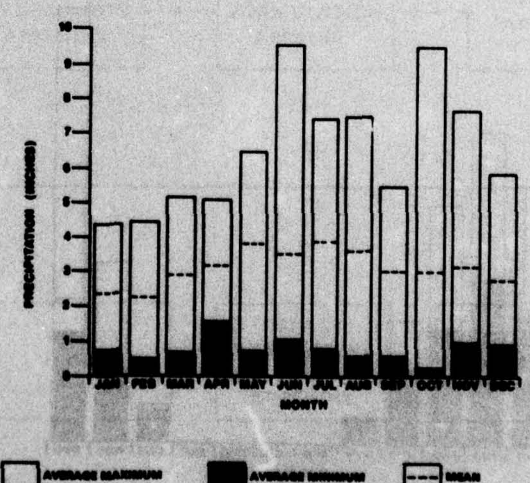
Month	Average Maximum	Average Minimum	Mean Value
January	4.31	0.76	2.32
February	4.36	0.51	2.25
March	5.11	0.69	2.87
April	5.09	1.61	3.18
May	6.46	0.78	3.83
June	9.46	1.15	3.59
July	7.40	0.83	3.83
August	7.48	0.61	3.61
September	5.47	0.61	3.02
October	9.43	0.26	3.00
November	7.62	1.01	3.10
December	5.81	0.94	2.75
Total Average Annual			37.35

[1] 1952 - 1973 data

Source: U.S. Department of Commerce, NOAA, 1973 Local Climatology Data Annual Summary with Comparative Data, Binghamton, New York.

MONTHLY PRECIPITATION (INCHES)

MAXIMUM, MINIMUM, AND MEAN
(1952 - 1973)



SOURCE: U.S. Department of Commerce, NOAA, 1973 Local Climatological Data Annual Summary, with Comparative Data for Binghamton, New York.

FIGURE II-2

TABLE II-3

Monthly Snowfall (Inches)
Maximum, Maximum in 24 hours, and Mean [1]

Month	Average Maximum	Maximum in 24 Hours	Mean Value
January	36.6	18.4	18.9
February	44.3	23.0	20.4
March	33.5	15.8	15.5
April	16.4	11.5	5.1
May	3.4	3.4	0.4
June	0.0	0.0	0.0
July	0.0	0.0	0.0
August	0.0	0.0	0.0
September	TR	TR	TR
October	2.6	2.4	0.5
November	24.4	10.1	8.1
December	59.6	15.6	19.4
Average Annual			88.3

[1] 1951 - 1973 data

Source: U.S. Department of Commerce, NOAA, 1973 Local Climatological Data, Annual Summary with Comparative Data, Binghamton, New York.

MONTHLY SNOWFALL (INCHES)

MAXIMUM, MAXIMUM IN 24 HOURS, AND MEAN
(1951 - 1973)

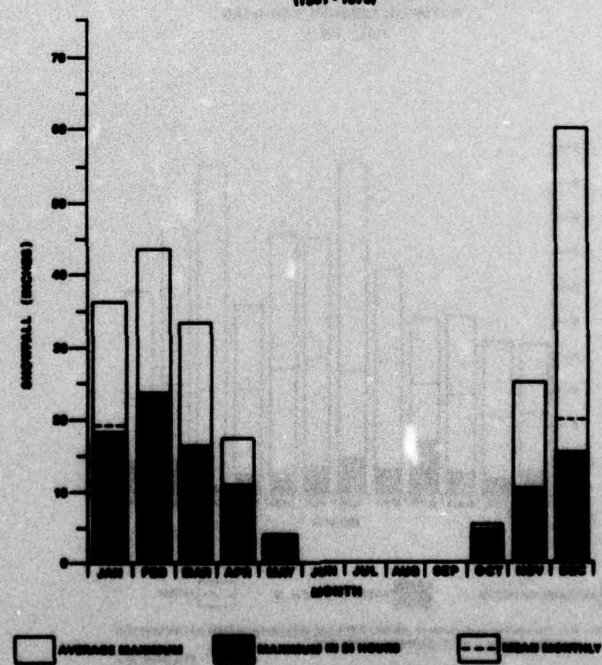


FIGURE II-3

SEDIMENTARY BEDROCK

Consolidated sedimentary bedrock materials of sandstone, siltstone, and shale were originally laid down as sand, silt, and mud during the upper Devonian Period in geologic history. The bedrock is nearly horizontal, dipping slightly toward the south. Beneath the Susquehanna River Basin, shale predominates and is interspersed with beds of siltstone and sandstone. The sandstone content of the bedrock increases toward the eastern and southern sections of the Bicounty Area. The overlying unconsolidated deposits are derived primarily from these parent bedrock materials.

PLEISTOCENE DEPOSITS

Glacial Till

Strongly acidic glacial till (materials deposited by glacial ice) average up to 60 feet in depth throughout the Bicounty Area. In some upland locations, though, the till may be less than 4 feet in depth. The till is primarily derived from bedrock materials and is composed of clay, silt, and sand which are compact, unsorted, and unstratified.

Glacial Outwash

Loose, well-sorted stratified glacial outwash (material deposited by glacial meltwaters) consisting primarily of sand and gravel can be found nearly everywhere in the major valleys. The average thickness of the outwash deposits is 10 to 40 feet. The most extensive outwash with a thickness of more than 40 feet occurs in the Binghamton-Endicott area.

Other Pleistocene Deposits

Materials slumped from stagnant ice blocks or washed out of the melting ice were deposited next to the margin of glaciers forming ice-contact deposits and discontinuous moraines. These deposits are found primarily at the confluence of major river valleys. The composition of the ice-contact deposits and discontinuous moraines is generally heterogenous consisting of small lenses of coarse, compact, poorly sorted and poorly stratified sediment.

Stratified lacustrine sediments of clay and silt were washed into glacial lakes where they eventually settled. These deposits can be found nearly everywhere in the major valleys often separating older from younger outwash deposits.

HOLOCENE DEPOSITS

The most recent geological action includes numerous alluvial, marsh, and swamp deposits. These Holocene materials are distributed throughout the Bicounty Area.

SOILS

The interactions of geologic parent materials with factors such as climate, plant and animal life, and topography have formed the soils of the area. A soil differentiated on the basis of parent material and profile characteristics is known as a soil series. For a broad overview of a large area, soil series can be grouped into soil associations.

SOIL SERIES

Of the numerous soil series described for Broome and Tioga Counties, there are approximately 25 which comprise the majority of the area. These soil series are outlined in Table II-4. Three main categories are differentiated: soils developed on glacial till, soils developed on glacial outwash, and soils developed on recent alluvium.

Glacial Till Soils

The soils on glacial till or frost fractured materials are made up of a mixture of siltstone, shale, and sandstone. Glacial till soils are very strongly leached and may not have a fragipan. A fragipan is a horizon in the subsoil that is very tightly packed and slowly permeable to water.

The glacial till soils have four principal horizons with the surface layer being dark and strongly acidic while lower layers are leached and very strongly acidic. Although generally low in fertility, the deep, medium textured, well drained soils of the glacial till group may be highly productive with sufficient additions of lime and fertilizer.

The Lordstown, Oquaga, and Arnot soils series do not have fragipans. The Lordstown and Oquaga soils are well drained and the Arnot soils are moderately well drained.

The occurrence of fragipans is common in acidic soils from glacial till. In well drained and moderately well drained soils fragipans are found from 18 to 30 inches below the surface and extend to depths of 4 to 7 feet. In poorly drained soils the fragipan is only 12 to 15 inches from the surface. Fragipans retard the downward movement of water causing seepage downhill and poor drainage even in steeply sloping areas. Glacial till soils with fragipans include: Bath, Canaseraga, Cattaraugus, Chippewa, Culvers, Dalton, Langford, Mardin, and Volusia. Mardin, with moderately good drainage and Chippewa, with poor drainage, all have acidic fragipans. Langford, with moderately good drainage and Volusia, with good drainage have neutral fragipans. Canaseraga, which has moderately good drainage and Dalton, which has poor drainage, are in silty deposits above the fragipan. Cattaraugus, Culvers, and Morris range from well drained to somewhat poorly drained.

TABLE II-4

PARENT MATERIAL AND SOIL SERIES BY SOIL DRAINAGE CLASS
FOR BROOME AND TIOGA COUNTIES, NEW YORK

Parent Material	NATURAL SOIL DRAINAGE CLASS				
	Well Drained	Moderately Well Drained	Somewhat Poorly Drained	Poorly Drained	V. Poorly Drained
A. SOILS DEVELOPED IN GLACIAL TILL					
I. Till derived mainly from gray shale and sandstone.					
a. With dense impermeable layer					
1. Very low lime	Bath	Mardin	Volusia	Chippewa	
2. Low lime		Langford			
b. Without dense impermeable layer					
1. Very low lime	Valois				
II. Till derived mainly from red shale and limestone.					
a. With very dense layer					
1. Very low lime	Chattaraugus	Culvers	Morris		
III. Thin till over bedrock					
a. Red shale and sandstone					
1. Very low lime	Oquaga				
b. Gray shale and sandstone bedrock					
1. Very low lime	Lordstown			Allis	
c. Red and gray shale and sandstone					
1. Very low lime		Arnot			
IV. Silty deposits over glacial till					
a. With dense impermeable layer					
1. Very low lime		Canaseraga	Dalton		

(Continued)

TABLE II-4 Continued

Parent Material	Well Drained	Moderately Well Drained	Somewhat Poorly Drained	Poorly Drained	V. Poorly Drained
	NATURAL SOIL DRAINAGE CLASS				
B. SOILS DEVELOPED IN GRAVELLY WATER SORTED MATERIALS					
a. Gravel from shale and sandstone, mainly with some limestone	Howard				
b. Gravel from shale and sandstone only	Chenango	Braceville			Atherton
c. Silty deposit over shale and sandstone gravel	Unadilla				
C. SOILS DEVELOPED IN RECENT ALLUVIUM					
a. Yellowish-brown sediments, medium to slightly acid	Tioga		Middlebury	Holly Wayland	Papakating

Degree of Drainage:
- Well drained: soil is not wet for long periods of year.
- Moderately well drained: soil is wet for a small but significant part of the time.
- Somewhat poorly drained: soil is wet for significant periods but not all the time.
- Poorly drained: soil is wet more than 50 percent of the time.
- Very poorly drained: soil is wet for 10 or more months of the year.

Source: Egner & Niederkorn, Ass., Inc., Southern Tier East Regional Plan, Broome-Tioga Counties: Policies and General Plan.

Glacial Outwash Soils

A number of soil series are developed on the gravelly water-sorted material of glacial outwash with clay concentrations in the subsoil. Although the upper layers of these soils are moderately leached, they are nevertheless moderately to highly fertile. The clays in the subsoil hold nutrients and water for plants. The upper soil horizons range from slightly to strongly acid and are calcareous 36 to 70 inches below the surface. Howard soils are well drained and are in till containing limestone, sandstone, and shale. Well drained Chenango soils are chiefly composed of gray siltstone, shale, and sandstone and are calcareous at depths greater than five feet. Unadilla soils are silty deposits with good drainage. The Atherton soils are very poorly drained, acid silt loams. Braceville soils are very acid and moderately well drained with a fragipan at a depth of approximately 30 inches.

Recent Alluvial Soils

Those soils which were developed on recent alluvium are classified as silt loams or loams of medium texture. Tioga, which is well drained, Middlebury, which is moderately well drained, Holly which has poor drainage, and Papakating, with very poor drainage, are made up of gray materials derived from shale and siltstone. They are acid soils with acid substratums. Wayland, with poor to very poor drainage, is a nearly neutral soil.

SOIL ASSOCIATIONS

A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of two or more major soils and at least one minor soil, and is named for the major soils. The soils in one association may occur in another, but in a different pattern.

In Broome and Tioga Counties, there are twelve major soil associations. These associations, the name and extent of each soil series, the dominant slope gradient, the topographic location, the limitations for on-site development of sewage disposal systems, and the susceptibility to erosion are displayed in Table II-5.

Figure II-4 depicts the areal distribution of soils by soil association. Due to the similarities between the Howard-Chenango association and the Chenango-Howard association, they are mapped as one unit in Figure II-4.

WATER RESOURCES

The two major river systems that drain the Bicounty Area are the Susquehanna and Delaware Rivers. Most of Broome County and all of Tioga County are drained by the Susquehanna River and its tributaries. Approximately 90 square miles in eastern Broome County are drained by the Delaware River.

In eastern Broome County, the Susquehanna River flows north to south until it crosses into Pennsylvania where it begins to flow in a generally east to west direction recrossing the New York-Pennsylvania border below Conklin in Broome County, New York. The Chenango River converges with the Susquehanna in the City of Binghamton. Numerous large streams and creeks including Nanticoke and Owego Creeks flow into the Susquehanna as it proceeds west toward Waverly in Tioga County, New York. The Tioughnioga River converges with the Chenango River at Chenango Forks in Broome County approximately 13 miles above the Chenango-Susquehanna River confluence. Figure II-5 shows the major streams in Broome and Tioga Counties. There is only one large reservoir, Whitney Point Lake, in the Bicounty Area. It is located on the Otselic River, a tributary of the Tioughnioga River.

The following discussion of water resources is divided into sections on groundwater and on surface water.

TABLE II-5

SOIL ASSOCIATION CHARACTERISTICS

Soil Association	Principal Series: Name	Principal Series: % of Assoc.	Dominant Slope Gradient	Topographic Location	Limitations for on-site Sewage Disposal	Susceptibility to Erosion
Volusia-Mardin	Volusia	45	5-15%	Steep uplands	S(1, 2, 7)	Moderate
	Mardin	30	5-25%		M-S(1, 2, 4, 7)	Moderate
	Lordstown	15	5-25%		S(3, 4)	Severe
	Chippewa	5	0-5%		S(1, 2, 7)	Slight
	Other	5	Unclass.		Variable	Variable
Volusia-Lordstown	Volusia	40	5-15%	Uplands	S(1, 2, 7)	Moderate
	Lordstown	35	0-25%		S(3, 4)	Severe
	Mardin	10	5-25%		M-S(1, 2, 4, 7)	Moderate
	Chippewa	5	0-5%		S(1, 2, 7)	Slight
	Bath	5	0-15%		M(4)	Moderate
	Others	5	0-15%		Variable	Variable
Volusia-Mardin-Lordstown	Volusia	50	5-15%	Level uplands	S(1, 2, 7)	Moderate
	Mardin	30	5-25%		M-S(1, 2, 4, 7)	Moderate
	Lordstown	15	5-25%		S(3-4)	Severe
	Others	5	5-15%		Variable	Variable
Lordstown-Volusia	Lordstown	40	5-25%	Hilltops and Uplands	S(3, 4)	Severe
	Volusia	30	5-15%		S(1, 2, 7)	Moderate
	Mardin	20	5-25%		M-S(1, 2, 4, 7)	Moderate
	Arnot	5	0-15%		S(3)	Moderate
	Chippewa	5	0-5%		S(1, 2, 7)	Slight

(continued)

TABLE II-5 Continued

Soil Association	Principal Series: Name	Principal Series: % of Assoc.	Dominant Slope Gradient	Topographic Location	Limitations for on-site Sewage Disposal	Susceptibility to Erosion
Lordstown-Volusia-Mardin	Lordstown	35	0-25%	High, steep uplands	S(3, 4)	Severe
	Volusia	30	0-15%		S(1, 2, 7)	Moderate
	Mardin	20	0-25%		M-S(1, 2, 4, 7)	Moderate
	Chippewa	5	0-15%		S(1, 2, 7)	Slight
	Bath	5	0-15%		M(4)	Moderate
	Others	5	0-15%		Variable	Variable
Chenango-Howard	Chenango) Howard)	65	0-15%	River valley terraces	S1-M(4)	Slight
	Unadilla	15	0-5%		S1	Slight
	Canaderaga	10	5-15%		M(1, 2, 4, 7)	Moderate
	Middlebury	5	0-5%		S(5)	Slight
	Wayland	5	0-5%		S(2, 5)	Slight
Howard-Chenango	Howard	35	0-8%	River valley terraces	S1-M(4)	Slight
	Chenango	25	0-8%		S1-M(4)	Slight
	Tioga	15	0-3%		S(5)	Slight
	Middlebury	10	0-3%		S(5)	Slight
	Unadilla	5	0-8%		S1-M(6)	Slight
	Others	10	0-15%		Variable	Variable
Tioga-Chenango	Tioga	55	0-5%	River valley	S(5)	Slight
	Chenango) Howard)	25	0-15%	Flood plains	S1-M(4)	Slight
	Middlebury	10	0-5%		S(5)	Slight
	Unadilla	5	0-5%		S1-M(5)	Slight
	Wayland	5	0-5%		S(2, 5)	Slight

(continued)

TABLE II-5 Continued

Soil Association	Principal Series: Name	Principal Series: % of Assoc.	Dominant Slope Gradient	Topographic Location	Limitations for on-site Sewage Disposal	Susceptibility to Erosion
Howard-Langford	Howard	30	0-8%	River valleys	Sl-M(4)	Slight
	Langford	25	0-15%	Lower uplands	M-S(1, 2, 4, 7)	Slight
	Valois	20	0-15%		M(4)	Moderate
	Chenango	10	0-8%		S-M(4)	Slight
	Others	20	0-15%		Variable	Variable
Middlebury-Chenango	Middlebury	45	0-3%	River valleys	S(5)	Slight
	Chenango	25	0-8%		Sl-M(4)	Slight
	Holly	10	0-3%		S(2, 5)	Slight
	Papakating	5	0-3%		S(2, 5)	Slight
	Others	5	0-5%		Variable	Variable
Canaseraga-Dalton	Canaseraga	55	5-15%	River valley walls	M(1, 2, 4, 7)	Moderate
	Dalton	30	5-15%		S(1, 2)	Slight
	Unadilla	5	0-5%		Sl	Slight
	Chenango) Howard)	5	0-15%		Sl	Slight
	Mardin-Volusia	5	5-25%		M-S(1, 2, 4, 7)	Moderate
Oquaga-Cattaraugus	Oquaga	30	15-25%	Rugged valley ridges and uplands	S-(3, 4)	Moderate
	Cattaraugus	30	5-25%		M-S(1, 4, 7)	Severe
	Morris	20	5-15%		S(1, 2, 7)	Moderate
	Culvers	20	5-15%		M-S(1, 2, 4, 7)	Moderate

Soil Characteristics that are limiting:

1. Slow permeability
2. Depth to seasonal high water table
3. Depth to bedrock
4. Slope gradient
5. Flood hazard
6. Unfavorable texture of surface soil
7. Depth to fragipan

TABLE II-5 Continued

Sl - slight — No special problems are expected to be encountered in developing areas where slopes are nearly level or moderately sloping.

M - moderate — Usually satisfactory but there may be increased development costs.

S - severe — Soil properties are severely limiting for designated use.

Source: Egner & Niederkorn Associates, Inc., Southern Tier East Regional Planning Board Broome-Tioga Counties: Policy and General Plan

GENERAL SOIL ASSOCIATION MAP

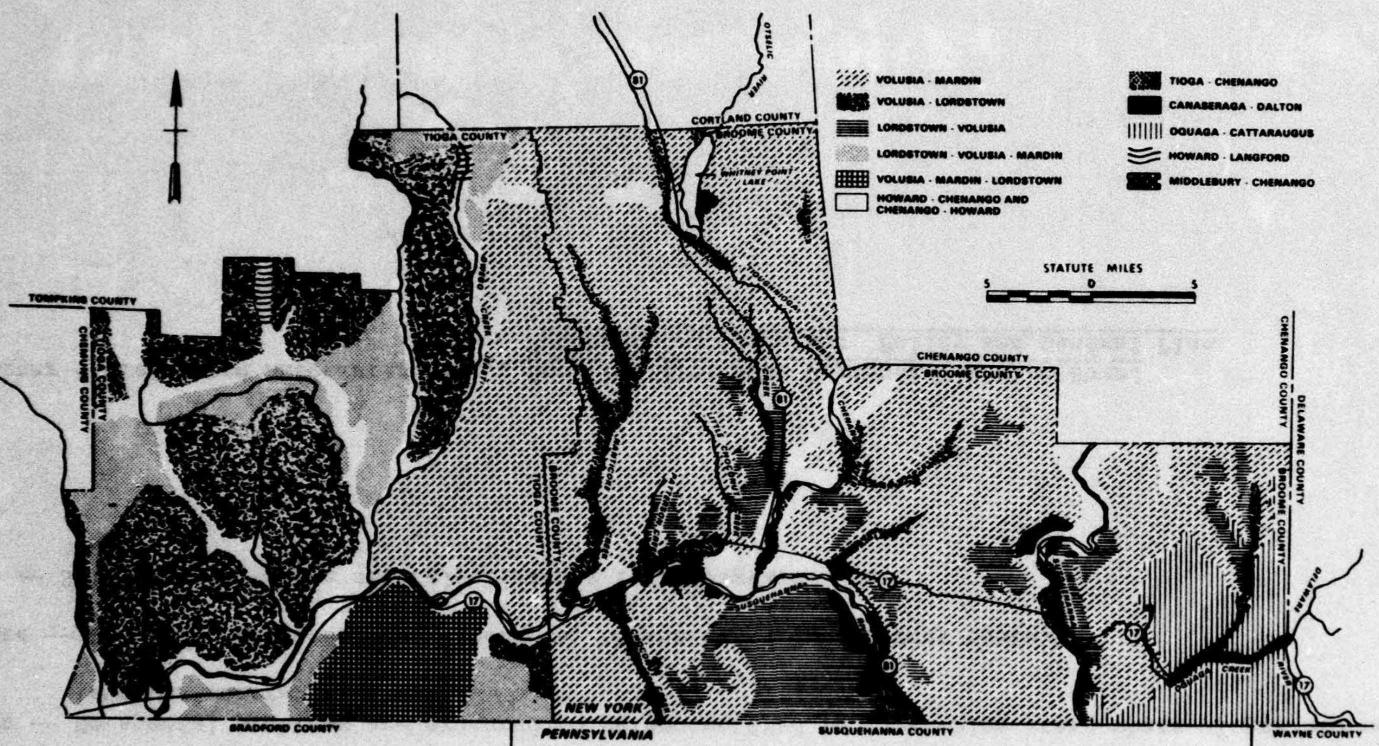


FIGURE II-4

MAJOR STREAMS IN THE BICOUNTY AREA

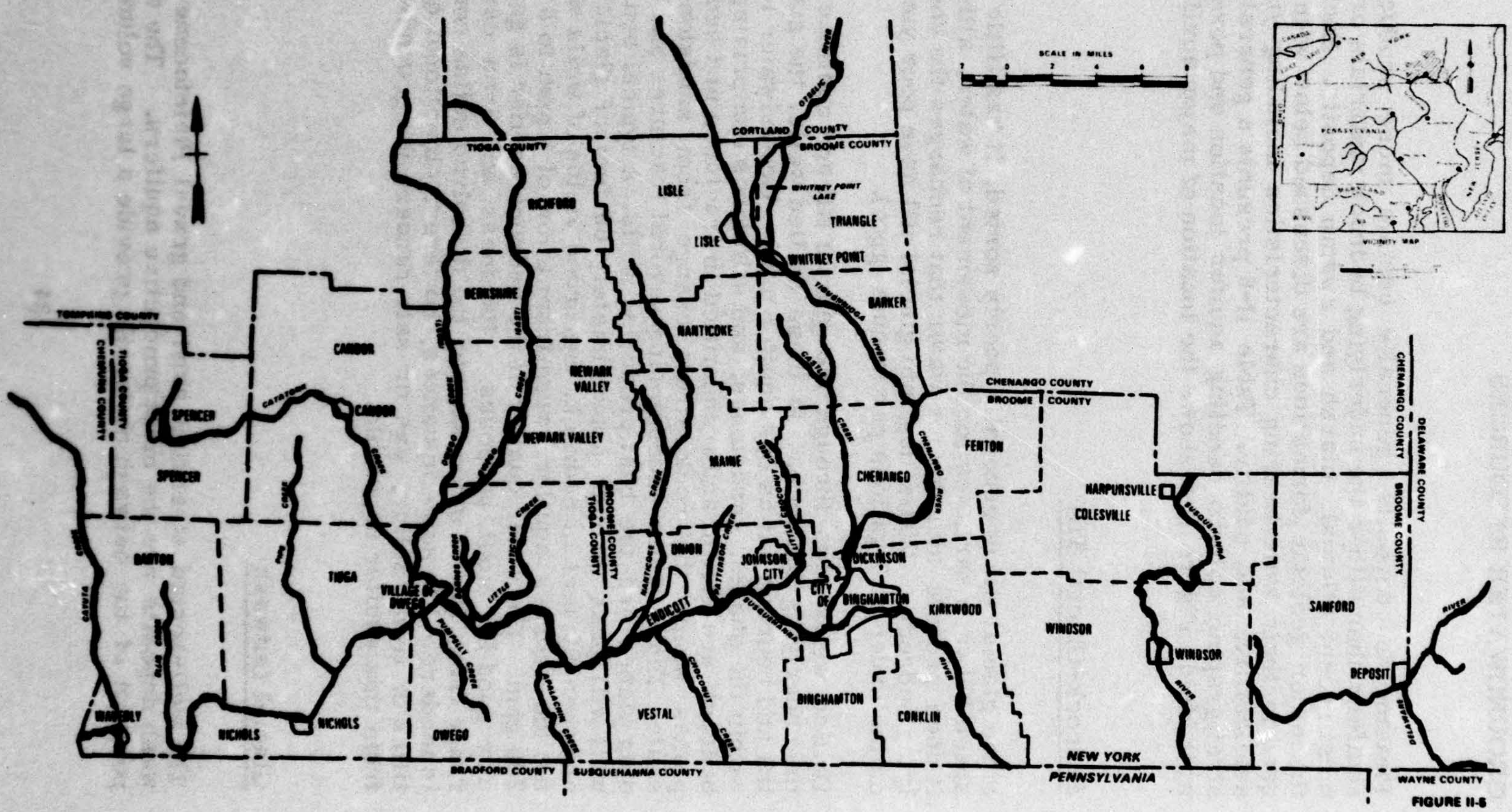


FIGURE II-6

GROUNDWATER RESOURCES

Pleistocene deposits generally contain more productive aquifers than either the underlying bedrock materials or the most recent alluvial, marsh and swamp deposits. Each of the major geologic formations are discussed below with regard to their waterbearing characteristics including yield, availability, and quality. Table II-6 presents a generalized stratigraphic column denoting aquifer location and possible well yield. Figure II-6 shows the location of major aquifers.

Bedrock-Glacial Till

Since glacial till is generally poorly sorted, it has little free space between particles for the movement of water, although it does provide storage for water that recharges the underlying bedrock. Wells dug into glacial till have poor yields, on the order of 7 gallons per minute (gpm).

Drilled wells pass through the glacial till and continue into the underlying bedrock. In these drilled wells, the glacial till and bedrock act as one aquifer unit. Groundwater found within the shales, sandstones, and siltstones comprising the bedrock are stored and transmitted in fractures and bedding planes where the rock strata change from sandstone to shale. Those wells encountering several fractures and bedding planes are the best producing wells. A typical bedrock well will pass through approximately 60 feet of glacial till and then 90 feet of bedrock. Recorded yields of wells which tap the bedrock aquifer range from a low of 1 gpm to a high 200 gpm. The water quality of the bedrock aquifer is generally good for most purposes. Hardness and iron content range from low to moderate and the dissolved solids content is moderate. In some instances, however, objectional quantities of iron, sulfur, gas or salt renders the groundwater from this aquifer unpotable.

Glacial Outwash

The well-sorted stratified sand and gravel Pleistocene outwash deposits are the most productive aquifers. The composition of the outwash materials provide a large volume of

TABLE II-6

GENERALIZED STRATIGRAPHIC COLUMN AND HYPOTHETICAL WELL YIELDS OF AQUIFERS

(See Figure II-6)

Geologic Age	Aquifer	Symbol on Figure II-6	Depth (feet)	Thickness (feet)	Well Yield (gpm)[1]		
					Poor	Medium	Good
Pleistocene	Outwash	Q_1	50	<10	66	180	500
Pleistocene	Outwash	Q_2	50	10–40	550	1100	2400
Pleistocene	Outwash	Q_3	50	>40	1500	3700	9000
Pleistocene	Outwash	Q_4	50–200	<10	120	550	3000
Pleistocene	Outwash	Q_5	50–200	10–40	520	1300	3300
Pleistocene	Outwash	Q_6	50–200	>40	1200	1900	2900
Pleistocene	Outwash	Q_7	200	-	110	600	3700
Pleistocene	Lacustrine Deposits		Entire Section	-	32	98	320
Pleistocene	Morainal Deposits	Q_m	Entire Section	-	84	260	840
Devonian	Bedrock	D_b	0–200	-	29	60	130

[1] Hypothetical drilled well yields based on certain well design criteria and estimated aquifer specific capacity as stated in reference source.

Source: Hollyday, Este F., An Appraisal of the Ground-Water Resources of the Susquehanna River Basin in New York State.

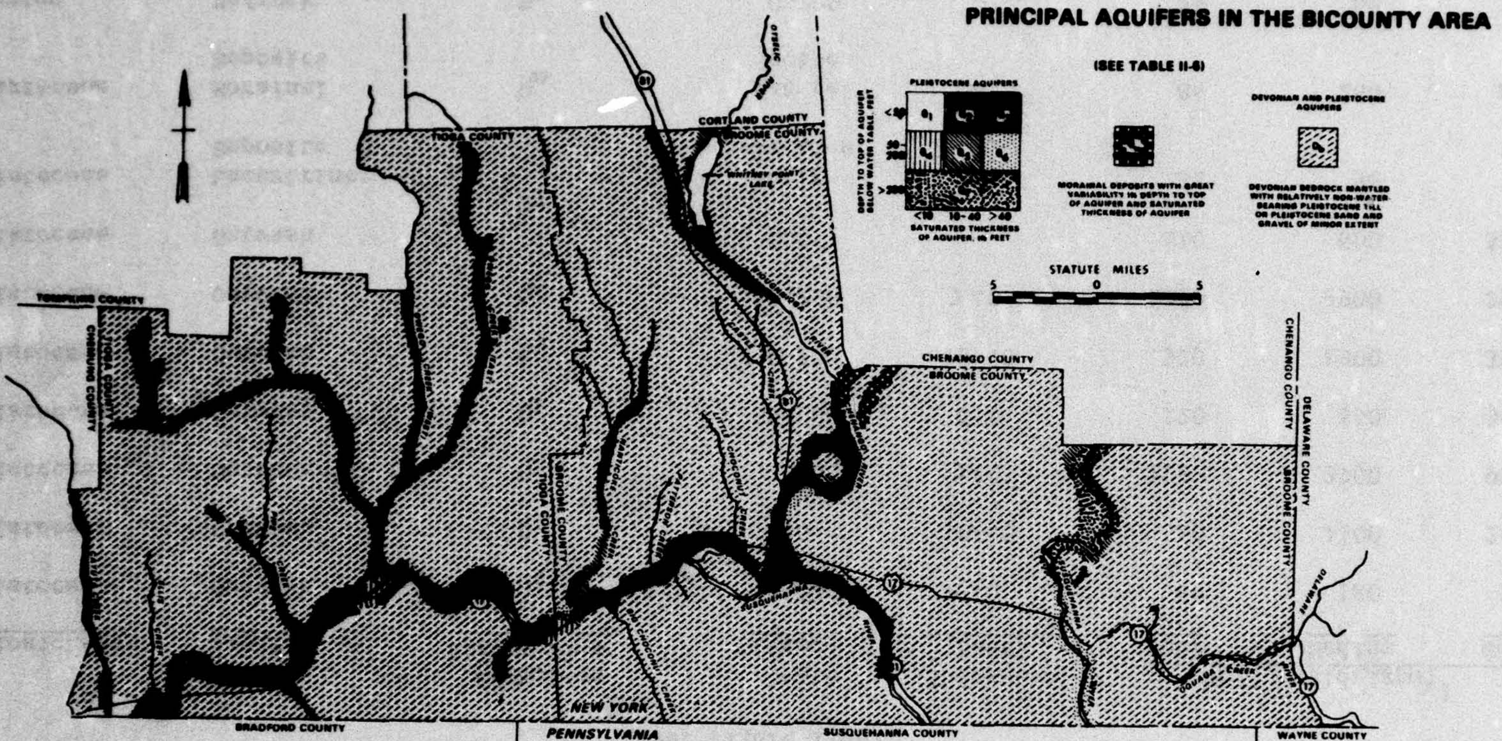

PRINCIPAL AQUIFERS IN THE BICOUNTY AREA
(SEE TABLE II-6)
PLEISTOCENE AQUIFERS
DEPTH TO TOP OF AQUIFER BELOW WATER TABLE, FEET
<10
10-40
>40
SATURATED THICKNESS OF AQUIFER, IN FEET
MORAINAL DEPOSITS WITH GREAT VARIABILITY IN DEPTH TO TOP OF AQUIFER AND SATURATED THICKNESS OF AQUIFER
DEVONIAN AND PLEISTOCENE AQUIFERS
DEVONIAN BEDROCK MANTLED WITH RELATIVELY NON-WATER-BEARING PLEISTOCENE TILL OR PLEISTOCENE SAND AND GRAVEL OF MINOR EXTENT
STATUTE MILES
5
0
5
TOMPKINS COUNTY
TIOGA COUNTY
CHEMUNG COUNTY
CORTLAND COUNTY
BROOME COUNTY
CHENANGO COUNTY
DELAWARE COUNTY
NEW YORK
PENNSYLVANIA
BRADFORD COUNTY
SUSQUEHANNA COUNTY
WAYNE COUNTY
81
17

FIGURE II-6

interconnected pore space which function well in both the storage and transmission of ground water. Outwash deposits contain numerous aquifers at varying depths and are usually separated by more impermeable layers of clay and silt. The most common thickness of outwash deposits is generally between 10 and 40 feet. Groundwater quality of the outwash deposits depends on the depth and thickness of the aquifer and the underlying and overlying materials. The quality of the ground waters is generally good although at greater depths high proportions of iron may be encountered. The content of dissolved solids and hardness ranges from low to moderate. Wells tapping the glacial outwash aquifers in Endicott, Johnson City, and Vestal are capable of producing more than 1,000 gpm.

Although the unconsolidated deposits are primarily derived from parent bedrock materials, they do contain an assortment of foreign materials carried into the area by the Pleistocene glaciers. Such extraneous material as limestone, dolomite, igneous, and metamorphic rocks are generally concentrated in the upper outwash deposits. The limestone and dolomite materials contribute to the calcium-magnesium hardness of the wells tapping the glacial outwash aquifers.

Other Pleistocene Strata

The heterogeneous nature of the materials comprising ice-contact and morainal deposits results in a wide variation of interconnected free spaces suitable for the movement and storage of ground water. These deposits are available for groundwater development in the Binghamton area. Water quality is generally good for most purposes. The hardness and iron content range from low to moderate and the dissolved solids content is generally moderate.

Deposits of stratified lacustrine clay and silt, although well sorted, are so fine-grained that the interconnected free spaces are too small for the transmission of any appreciable quantities of ground water. Although these deposits are widespread in the major valleys, they are not considered to be a major source of well water since better yielding aquifers are available. However, they act as a storage reservoir for the sand and gravel outwash aquifers. The groundwater quality of the lacustrine deposits is generally good with a low amount of dissolved solids, a moderate amount of hardness, and a low to high iron content.

SURFACE WATER RESOURCES

Broome and Tioga Counties lie within two major drainage basins: the Susquehanna River and Delaware River drainage basins. All of Tioga County and most of Broome County lie within the Susquehanna River drainage basin, with only the eastern most part of Broome County situated within the Delaware River drainage basin. The Susquehanna River and its major tributaries including the Chenango River, the Tioughnioga River, Owego Creek, Nanticoke Creek, and Castle Creek form a converging surface water pattern within the Bicounty Area.

Of the 37 inches of average annual rainfall, approximately 15 inches or 41 percent returns to the atmosphere by the process of evapotranspiration and 22 inches (59 percent) is runoff which contributes to surface water flows.

Streamflow Records

The United States Geological Survey (USGS) has maintained several gaging stations on the Susquehanna River and its tributaries. Table II-7 presents the location, drainage area, and period of record for each of these gaging stations. Figure II-7 locates the gaging stations with respect to the river system.

Table II-8 summarizes the maximum and minimum discharges as recorded by the USGS gaging stations and also presents the estimated minimum average seven day consecutive discharges which could be expected to occur once in ten years (MA-7-CD-10) for these river locations. Table II-9 presents the monthly mean and yearly average discharge of the period of record for each stream gaging station.

Low Flows

In the early 1960's the Bicounty Area experienced a period of drought when flows in the Susquehanna River system equalled the estimated MA-7-CD-10 flows. Diversions of water from the Susquehanna River upstream of Binghamton for potable water supply for the City of Binghamton are reflected in downstream river discharges especially during low flow periods.

TABLE II-7

GEOLOGICAL SURVEY GAGING STATIONS

Gage Number	Figure Number[1]	River	Location	Drainage Area (Square Miles)	Period of Record
01503000	1	Susquehanna	Conklin Lat. 42° 02' 07" Long. 75° 48' 12"	2,240	1913 - Present
01513500	2	Susquehanna	Vestal Lat. 42° 05' 30" Long. 76° 03' 25"	4,780	1937 - 1967
01515000	3	Susquehanna	Waverly Lat. 41° 59' 05" Long. 76° 30' 05"	5,960	1937 - Present
01512500	5	Chenango	Chenango Forks Lat. 42° 13' 05" Long. 75° 50' 55"	1,492	1912 - Present
01510500	8	Otselic	Upper Lisle Lat. 42° 25' 20" Long. 75° 57' 00"	216	1937 - 1969
01511000	7	Otselic	Whitney Point Lake Lat. 42° 20' 30" Long. 75° 57' 55"	255	1942 - Present
01511500	6	Tioughnioga	Itaska Lat. 42° 17' 55" Long. 75° 54' 30"	735	1929 - 1967
01514000	4	Owego Creek	Owego Lat. 42° 07' 45" Long. 75° 16' 15"	186	1930 - Present

[1]See Figure II-7

USGS GAGING STATION LOCATIONS

(SEE TABLE II-7)

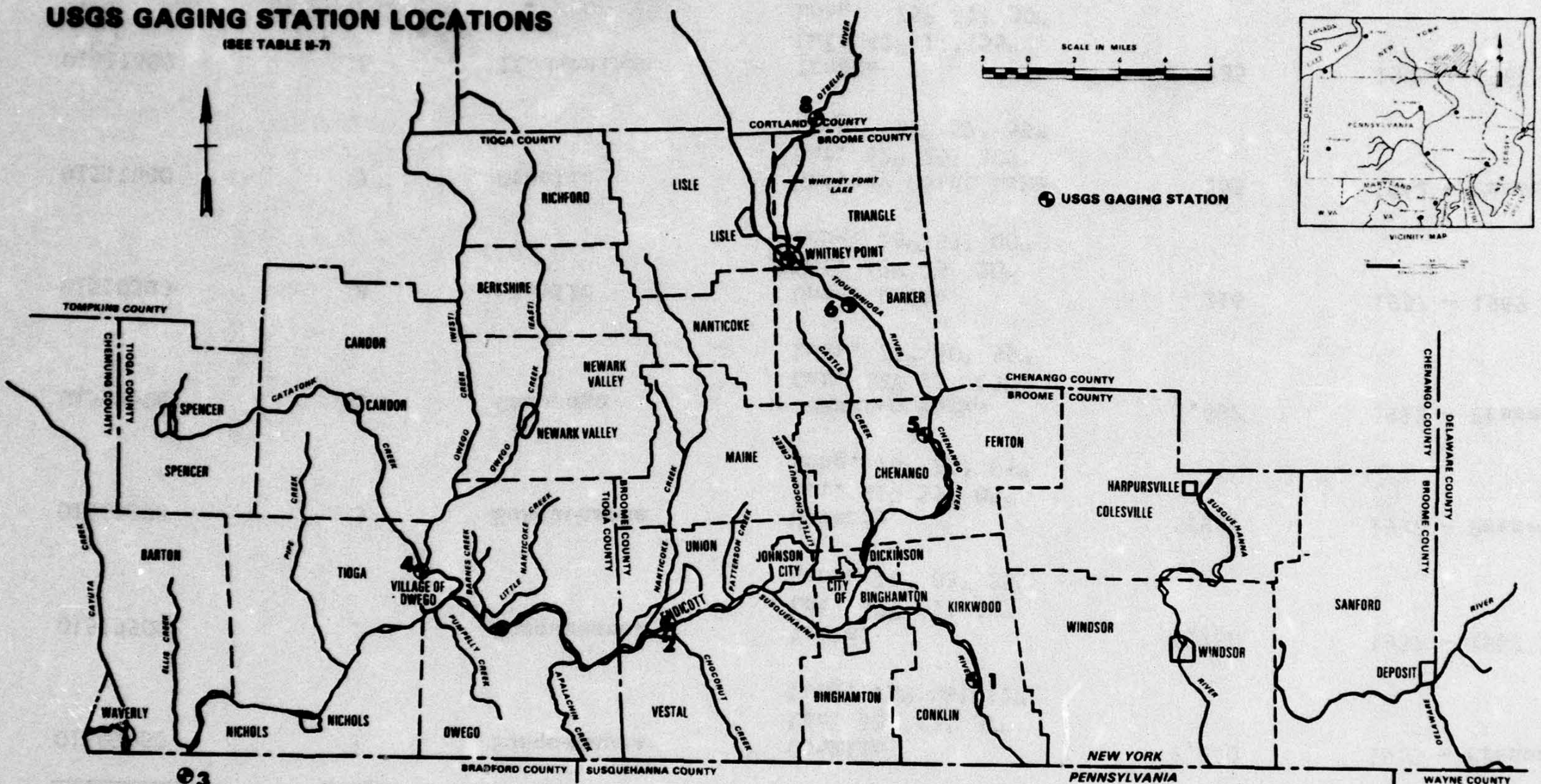


FIGURE II-7

TABLE II-8

MAXIMUM AND MINIMUM DISCHARGES AT EACH GAGING STATION

Gage* Number	Gage Location	River	$MA-7-CD_{10}$ [A] (cfs)	DISCHARGE (cfs) Maximum[B]	Minimum[B]
1	Conklin	Susquehanna	190	61,600[C]	83
2	Vestal	Susquehanna	330	107,000[D]	230
3	Waverly	Susquehanna	370	121,000	237[E]
5	Chenango Forks	Chenango	135	96,000[F]	84
8	Upper Lisle	Otselic	-	15,400[G]	6.7
6	Itaska	Tioughnioga[H]	59	61,000[I]	39
4	Owego	Owego	15	23,500[J]	8.1

A. Minimum average seven consecutive day discharge which will occur once in ten years

B. Instantaneous for period of record except where noted

C. March 18, 1936

D. Flood of March 1936 estimated cfs from floodmarks

E. Minimum daily for September 22, 23 of 1964

F. From rating curve extended above 32,000 cfs on basis of slope-area measurement of peak flow on July 8, 1935

G. Flood of July 1935 from rating curve extended above 9,000 cfs on basis of slope-area measurement of peak flow

H. Flood flows regulated by Whitney Point Reservoir since 1942

I. Flood of July 1935 from rating curve extended above 22,000 cfs on basis of velocity-area and slope-area studies and studies of peak discharges at downstream stations

J. Flood of July 1935 from rating curve extended above 7,800 cfs on basis of slope-area measurement of peak flow

cfs = cubic feet per second

*See Table II-7 and Figure II-7 for gage locations.

TABLE II-9

MONTHLY MEAN AND YEARLY AVERAGE DISCHARGE (CFS) FOR THE PERIOD OF RECORD FOR EACH U.S.G.S. STREAM GAGING STATION

Gage Number	Gage Location and River	J	F	M	A	M	J	J	A	S	O	N	D	Yearly Average Discharge
		MONTH												
1	Conklin (Susq. River)	3967	3710	7748	8858	4127	2270	1490	1018	1118	1450	3266	5009	3538
2	Vestal (Susq. River)	6314	6955	13894	15386	8257	3788	1877	1376	1876	2484	4750	6345	6150
3	Waverly (Susq. River)	7698	8122	15992	27029	9347	5162	2485	1599	2042	2611	6256	7963	7331
5	Chenango Forks (Chenango R.)	2621	2450	5517	5920	2646	1508	951	621	691	1102	2168	2550	2388
8	Upper Lisle (Otselic R.)	397	410	877	969	404	223	113	72.6	110	170	339	447	378
6	Itaska (Tioughnioga R.)	1372	1257	2868	3205	1377	671	425	249	308	513	929	1295	1212
4	Owego	289	282	720	689	320	159	92.1	42.0	61.4	108	235	298	273

Flood Flows

The predominant flood season for the Bicounty Area is in the late winter and early spring during the months of February, March, and April. A combination of moderate snowfall, sudden thaws and consequent runoff,' along with heavy rains have produced most of the higher flood flows. Intense thunderstorms and hurricanes, however, have also resulted in flood flows. Some of the higher flows along the Susquehanna River near Windsor and Colesville have been caused by ice jams in the river with subsequent backup and overflow of water due to a rapid thaw or intense rain. Flood flows have been regulated in the lower reaches of the Tioughnioga River and, to some extent, in the lower reaches of the Chenango River since 1942 by Whitney Point Dam and Lake. The lake, situated on the Otselic River, is impounded by an earth-fill dam with concrete spillway and was constructed by the Corps of Engineers for the purposes of flood control and recreation. Usable capacity of the lake is 86,440 acre-feet between elevations 950 feet (sill of gates) and 1,010 feet (crest of spillway). The dam, which is part of the flood protection program serving Binghamton, has a drainage area of 255 square miles or 16 percent of the greater Chenango River watershed.

Although the lake is Federally owned, it is managed by the New York State Department of Environmental Conservation (NYSDEC) and Broome County Park Department. Recreation activities in and around the lake include fishing, swimming, sailing, picnicking, hiking, sports car races on ice, and camping. There are no other major flood regulating structures on either the Susquehanna or Chenango Rivers in the Bicounty Area, except for a system of levees and walls in the Triple-Cities area. East Sidney Lake, on Ouleout Creek in Delaware County, provides some flood protection for Binghamton.

In July 1935, the Chenango and Tioughnioga Rivers experienced their largest floods of record. The maximum peak discharges during this flood at Chenango Forks on the Chenango River was 96,000 cubic feet per second (cfs). At Chenango Forks the river rose from a bankfull stage of 10 feet to a crest stage of 20.3 feet in 7 hours. Other major floods on the Chenango River occurred in March 1936 (peak discharge 50,100 cfs), December 1942 (peak discharge 41,000 cfs), March 1964 (peak discharge 37,800 cfs), and April 1940 (peak discharge 37,000 cfs). The Intermediate Regional Flood (flood having an average frequency of occurrence in the order of once in 100 years) for this location would have a peak discharge of 53,000 cfs based upon the present channel configuration.

Maximum peak discharges of 61,600 cfs and 107,000 cfs occurred at the Conklin and Vestal gaging stations, respectively, on the main stem of the Susquehanna River during the flood of March 1936. This was also the greatest flood experienced on the Susquehanna near Windsor. During this flood, hundreds of families were evacuated and damages were estimated in millions of dollars. The most recent damaging flood in the Triple-Cities section of the Susquehanna River occurred in March 1964 and had an estimated peak discharge of 72,600 cfs at the Vestal gaging station. Although flood damages were not severe, many homes in low-lying areas had to be evacuated. The Intermediate Regional Flood peak discharges for the Conklin and Vestal stations are 64,000 cfs and 114,000 cfs, respectively.

At the Waverly gaging station, the largest flood of record occurred during the passage of Tropical Storm Agnes in June 1972 when the estimated peak discharge of the Susquehanna River at this station was 121,000 cfs. Tropical Storm Agnes, although creating flood flows in the Susquehanna within Tioga County, did not greatly affect Broome County where only low-lying riverbank areas experienced minor flooding.

Recently, several communities within the Bicounty Area have qualified through the Department of Housing and Urban Development (HUD) for flood insurance. To qualify, a community must adopt some form of land use regulations such as zoning ordinances or building codes. The communities in Tioga County that had qualified up to November 1975 included: the Towns of Barton, Newark Valley, Nichols, Owego, Spencer, and Tioga; and the Villages of Candor, Owego, and Waverly. The communities in Broome County that had qualified for the program up to November 1975 included: the Towns of Barker, Binghamton, Chenango, Colesville, Conklin, Dickinson, Fenton, Kirkwood, Lisle, Maine, Nanticoke, Sanford, Union, and Vestal; the Villages of Endicott, Lisle, Johnson City, and Port Dickinson; and the City of Binghamton.

Watershed Protection Programs

Watershed protection programs in the Bicounty Area have been carried out by the United States Department of Agriculture Soil Conservation Service (SCS) under "The Watershed Protection and Flood Prevention Act of 1954" (P. L. 566); the New York State "County Small Watershed Protection

District Act of 1957;" and County Law Article 5, Section 223 and Article 5-D, Section 299.

Following these directives, Broome County, with the assistance of the SCS, has constructed dams on numerous small watersheds which are located primarily within Broome County. Table II-10 gives the storage capacity and drainage area of each of the existing or proposed watershed projects shown in Figure II-8. These earthen dams range in height from 40 to 60 feet and have storage capacities of up to 2,500 acre-feet. Most of the dams which have been constructed to date are primarily for the purpose of flood control; however, they can have multiple purpose objectives including agricultural management, recreation, fish and wildlife protection, municipal and industrial water supply storage, and water quality enhancement.

BIOTIC ENVIRONMENT

Topographic features, geophysical resources, and climate have shaped the ecological patterns of Broome and Tioga Counties. The following discussion of the existing biotic environment includes characteristics of the urbanized area, of which the City of Binghamton constitutes the core, and the rural hinterlands apart from the concentrated urban area. Figure II-9 depicts the general urban area, the outlying population clusters, and the rural hinterlands. The biotic environment is discussed with respect to flora and fauna resources, and includes a description of the natural ecology of the area as well as the man-influenced vegetative and animal habitats.

FLORA

Terrestrial Flora

Virgin forests of white pine, hemlock, white oak, red oak, chestnut, hard maple, and beech covered Broome and Tioga Counties in the past. Early settlers in the area cleared

TABLE II-10*

SOIL CONSERVATION SERVICE SMALL WATERSHED PROJECTS

Watershed & Dam	Storage Capacity (acre-feet)	Watershed Area (square miles)
Finch Hollow		
#1 (c)	335	2.73
#1A (c)	200	1.21
Little Choconut Creek		
#2 (c)	300	5.0
#2A (c)	155	0.63
#2B (c)	212	1.6
#2C (c)	730	3.49
#2E (c)	150	1.02
Trout Creek		
#3C (c)	39.4	0.31
Patterson Creek		
#1 (c)	848	4.42
Brixius Creek		
#2 (c)	187	1.34
Nanticoke Creek		
#3	544	0.63
#4A	427	3.04
#4B	678	4.95
#7A	878	5.66
#7B (c)	453	3.58
#8 (c)	327	2.22
#9A (c)	486	3.17
#9C (c)	707	4.33
#9E (c)	320	2.71
#10	698	4.28
#13 (c)	930	6.1
Butler Creek)		
Bone Creek)	In Planning Stages	
Big Hollow)		

*See Figure II-8 for location.
(c) = Completed as of November 1975.

SOIL CONSERVATION SERVICE SMALL WATERSHED PROJECTS

(SEE TABLE II-10)

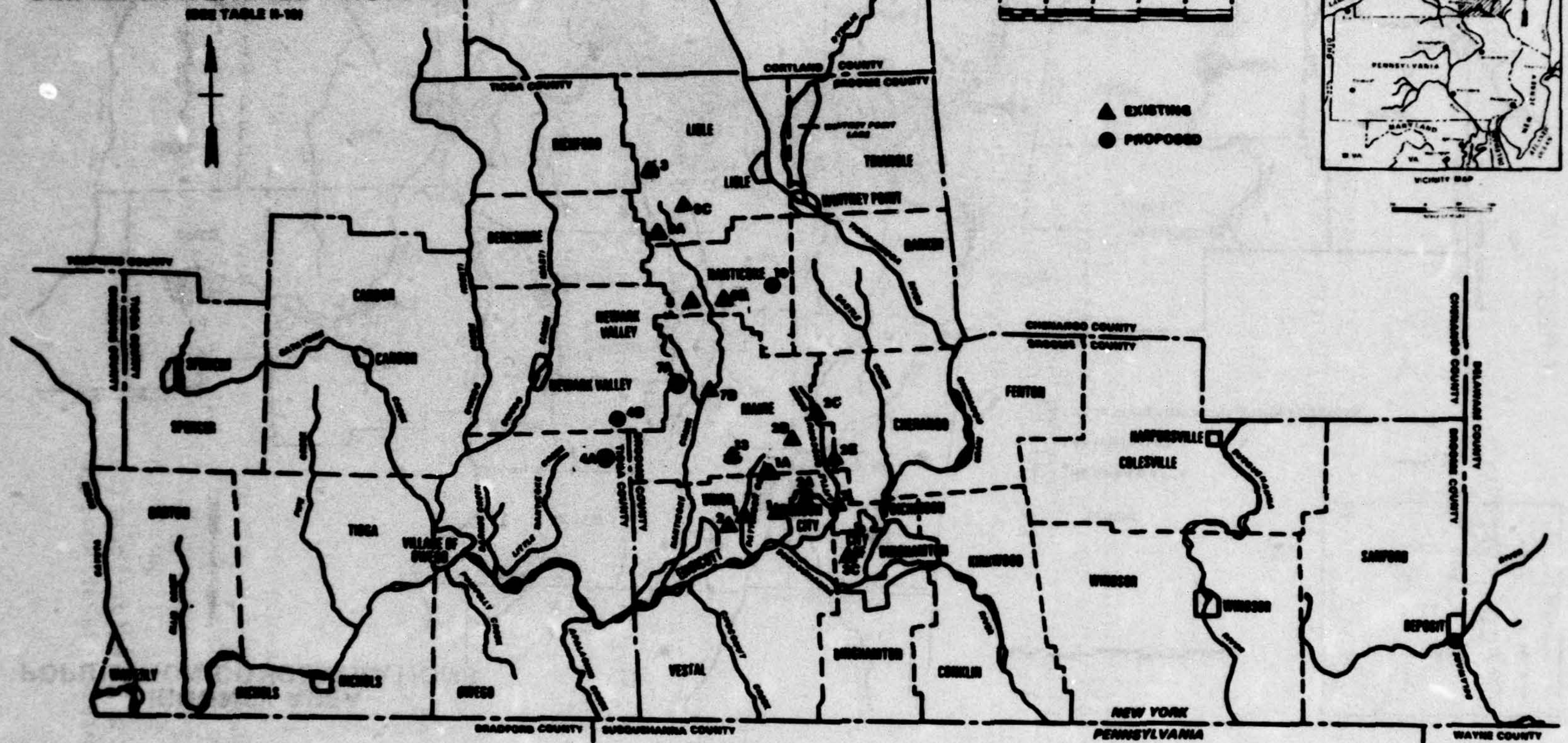


FIGURE II-8

BICOUNTY AREA POPULATION CONCENTRATIONS

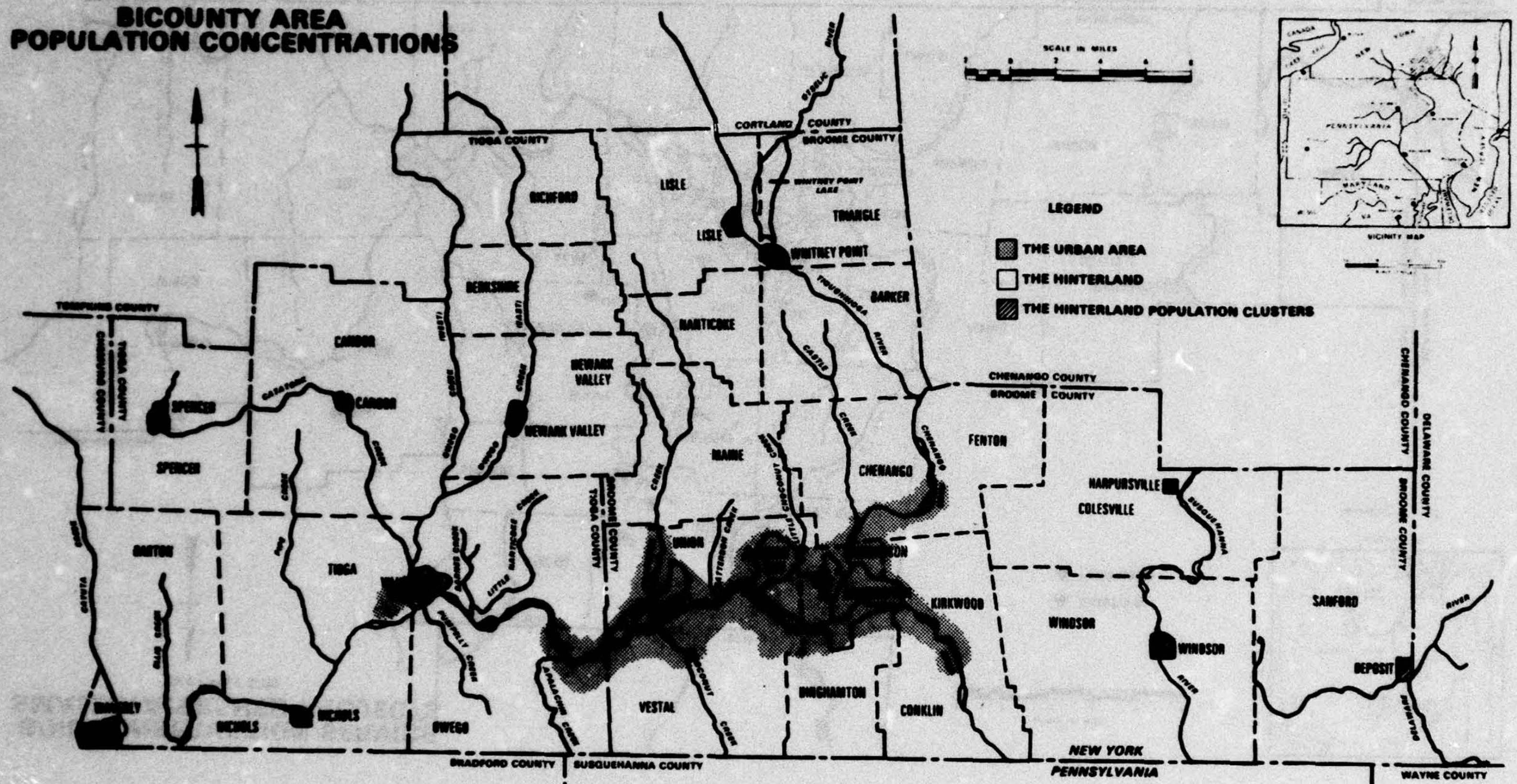


FIGURE II-9

much of the land for farming and this has resulted in a present timber stand of primarily second and third growth hardwoods. The chestnut, an important member of the original native forests, has disappeared as a result of the chestnut blight.

Presently, there are five major forest types in the Bicounty Area: northern hardwood, oak, hemlock-hardwood, white pine, and bottom-land hardwood. The northern hardwood forest type consisting primarily of sugar maple, beech and red maple is found throughout both counties. This forest type may also consist of black birch, yellow birch, basswood, white ash, aspen, red oak, black cherry, elm, and hemlock. The oak forest type consisting chiefly of red oak, white oak, chestnut oak, black oak, and red maple is found along steep river valley slopes and in the more rugged sections of Broome County. The hemlock-hardwood forest type, found in the northern portions of the Bicounty Area is comprised of 25 percent hemlock with 75 percent of various other hardwoods. The white pine forest type may occur as isolated small stands of white pine or as white pine and assorted hardwoods. The bottom-land hardwood forest type, consisting of elm, sycamore, willow, and such moisture-tolerant species as hickory, ash, and soft maple is found along streams or in flood-prone soils.

In Tioga County, forested lands are more predominant in the northern portions of the county than in the southern portions. The most extensive forested lands in Broome County occur in the rugged southeastern portion of the county.

Smaller trees and larger shrubs beneath the forest canopy commonly include witch-hazel, hazelnut, juneberry, hawthorne, sumac, wild rose, American alder, dogwood, and red cherry. At higher elevations, small shrubs of the forest and woodlots include lowbush blueberry, late upland blueberry, dwarfbush honeysuckle, sweetfern, poison ivy, trailing arbutus, wintergreen, and mountain laurel.

Upland and valley pastures with poor drainage and steeper slopes consist of poverty oatgrass, Indian paintbush, goldenrod, blackberry briers, and thorn apple. On wetter valley soils sedges, reeds, and rushes are common. The more favorable pasturelands contain bluegrass and white clover. Fallow abandoned fields, roadsides, and fence rows are marked with seedlings of various tree species as well as such herbaceous plants as cinquefoil, Queen Anne's l ace, yarrow, Canadian thistle, daisy, wild aster, and ragweed.

At higher elevations which are unsuitable for development, because of soils and slopes, occur patches of forest that are predominantly of the northern hardwood or oak forest types. Abandoned farms surrounding the urban area are gradually being subdivided for residential development or are reverting to forest. Some cropland, pasture land, and small woodlots still do exist at the outskirts of the urban area. The urban area itself sustains very little natural terrestrial flora.

Aquatic Flora

The aquatic flora of lakes and ponds is characterized by a zonation of aquatic growths from the shoreline to deeper waters. Close to the shoreline emergent rooted aquatics such as cattails, bullrushes, and arrowheads are predominant. As water depth increases, rooted plants with floating leaves such as water lilies can be found. At even greater depths, submerged vegetation including water milfoil, pond weed, and wild celery become predominant. Except for such green plants as duckweed, the floating phytoplankton are algae such as diatoms, desmids, and green and blue-green algae. The abundance and occurrence of these species depend upon numerous conditions including temperature, light, and available nutrients (e.g., phosphorus and nitrogen).

Streams and rivers are by far the major aquatic habitat in the Bicounty Area. In addition to such factors as temperature, nutrients, and light, the aquatic flora is also governed by current velocity and the type of bottom (e.g., silt, pebbles, sand). Along slow moving stretches of large streams or rivers or in backwaters, the flora is very similar to that previously described for lakes and ponds. Although phytoplankton species are much less abundant in rapid flowing streams, they may be present in large numbers in the slower rivers such as the Chenango or Susquehanna. Filamentous green algae such as Cladophora can be found attached to stones, logs, and other debris in more rapidly flowing streams.

FAUNA

Terrestrial Fauna

Wildlife resources of the Bicounty Area may be found in three basic habitats: openland, woodland, and wetland. Openland wildlife habitats include species such as pheasants, meadowlarks, field sparrows, doves, cottontail rabbits, red foxes, and woodchuck. These animals find food and shelter in areas of cropland, pastures, meadows, lawns, and areas overgrown with grasses and smaller shrubs. Cottontail rabbit, woodchuck, and pheasants are the major small game openland wildlife species.

Wildlife species found in woodlands commonly include wild turkey, ruffed grouse, woodcocks, thrushes, vireos, scarlet tanagers, gray and red squirrels, gray foxes, raccoons, hare, and white-tailed deer. White-tailed deer and ruffed grouse are found throughout Broome and Tioga Counties in the second and third growth forests. Wild turkeys, however, prefer more mature forest stands. Hare frequent wooded, preferably coniferous, areas with dense low cover. Woodcock, a popular game bird, prefer forest cover in moist lowland areas.

In wetland habitats, including ponds, marshes, and swamps, wildlife species such as wood and black ducks, geese, sora rails, redwing blackbirds, minks, muskrats, and beavers can be found. Whitney Point Lake and the larger rivers and streams are used by migratory birds. Generally speaking, there are few suitable waterfowl habitats aside from Whitney Point Lake.

In the urban environment, the number and diversity of wildlife diminishes. Where parks or other natural areas do exist, wildlife, such as squirrels, skunks, and some bird species can be found.

Aquatic Fauna

The warmwater rivers and streams provide the primary fishery resources of the Bicounty Area. The few cold water streams are found in the northern and central portions of the two counties. Several of the streams are stocked by

NYSDEC with trout and bass. Table II-11 indicates the location of the fishery resources for the rivers and streams of Broome and Tioga Counties.

TABLE II-11

Fishery Resources of Rivers and Streams in Broome and Tioga Counties*

Susquehanna (main stem)	Walleys, smallmouth bass, carps, and various "panfish"**
Cayuta Creek	Smallmouth bass, pickerel
Owego Creek (east and west branches)	Brook and brown trout
Catatonk Creek	Walleyes, smallmouth bass, pickerel, bullheads, and other assorted warm water "panfish"
Nanticoke Creek	Brown trout, smallmouth bass, and pickerel
Chenango River (main stem)	Walleyes and smallmouth bass
Tioughnioga River (main stem)	Walleyes, smallmouth bass, pickerel
West Branch Delaware River - Oquaga Creek	Brown trout

*Stock or native
** "panfish" include such fish as crappies, sunfish, and bluegills

Lakes and ponds, either natural or man-made, are few in the area. Whitney Point Lake, managed by NYSDEC and the Broome County Park Department, is the largest artificial lake in the two counties. Table II-12 lists the larger and more popular lakes and ponds in the Bicounty Area together with their native or stocked fish species.

TABLE II-12

Fishery Resources of Lakes and Ponds in Broome and Tioga Counties*

Stream or Pond	Lake Acres	Principal Fish Species
Spencer Lake	77	Largemouth bass, chain pickerel, bullheads, perch
Whitney Point Lake	1,200	Chain pickerel, bullheads, Northern pike, calico bass, smallmouth bass, muskellunge, norlunge
Oquaga Lake	134	Brown trout, speckled trout, lake trout, rainbow trout, (experimental stock)
Chenango (Lily) Lake	45	Rainbow trout, brown trout
Pickerel Pond	38	Chain pickerel
Marsh Pond	30	Brown trout
Greenwood Lake	25	Rainbow trout
Perch Pond	15	Brook trout, rainbow trout

* Native or stocked

The most widely used lakes and ponds include Whitney Point Lake, Oquaga Lake, Spencer Lake, Chenango (Lily) Lake, and Perch Pond. Within Broome County there are 13 lakes or ponds which cover ten or more acres for a total of 1,614 acres. Tioga County, however, has only five lakes or ponds which cover ten or more acres for a total of 140 acres.

In the urban area, small mouth bass and walleye inhabit the Susquehanna River downstream of the Rockbottom Dam and in the backwater created by the retention weir of the New York State Electric and Gas Company power plant. These same species are also found in the pools and waterfalls created by sewer interceptor lines as they cross the waterways.

CHAPTER III

DEMOGRAPHIC AND ECONOMIC CHARACTERISTICS OF BROOME AND TIOGA COUNTIES

The land which now comprises the Binghamton region was originally settled by American Indian tribes. The Iroquois found the flat, fertile valleys carved by the Susquehanna River and its major tributaries an excellent area for their settlement. An Indian village was located near the confluence of the Chenango and the Susquehanna Rivers, and that village was the first settlement in the area now called Binghamton.

Late in the eighteenth century, settlers rapidly moved into the region and villages soon developed on the sites of the old Indian settlements. The Susquehanna River was the major transportation route used for conveying produce from the new farms to market areas to the south. The settlement at the confluence of the two major rivers developed into a major shipping center.

In 1800, the area was platted and by 1808 a bridge was constructed across the Chenango River near the Susquehanna River. The area surrounding the confluence of the two rivers was named Binghamton in honor of William Bingham, a Philadelphia financier who owned much of the land. The community was organized as a village in 1834 and incorporated as a city in 1867.

During the early 1800's, the importance of the central location of the Binghamton area with respect to the surrounding region began to emerge. Completion of the Chenango Canal in 1836 linked the Binghamton area with the Erie Canal at Utica. Twelve years later the western terminus of the Erie Railroad was in Broome County; and by 1849, the railroad had reached Owego. With the improvement of transportation, the economic character of Binghamton began to change from agriculture to manufacturing. Trading and service centers for rural hinterlands developed at Owego and Waverly.

By the time of its incorporation in 1867, the City of Binghamton had assumed considerable importance as a service area for the rich farm hinterland and as a major rail center. Population grew from 1,500 in 1834 to 9,000 in 1855. Basic manufacturing industries included cigars, lumber, and agricultural processing.

Early in the 20th century, two large industrial enterprises were established in the study area: Endicott Johnson Corporation and International Business Machines (IBM). Henry B. Endicott, of the Commonwealth Shoe and Leather Company, took over the Lester Brothers Boot and Shoe Company. Soon he bought out his partners and took on George F. Johnson. Johnson had been a foreman in the firm before its move and he began with Endicott as a superintendent. When he became a partner, the firm became Endicott Johnson. As the firm grew another factory was established in the Village of Endicott.

Thomas J. Watson of Campbell, New York, was general sales manager for the National Cash Register Company when he took over the Computing-Tabulating-Recording Company of Endicott in 1914. The firm had been formed by the merger of three local companies making punch cards and time clocks. It became IBM, one of the world's largest multinational corporations and an unquestioned giant among manufacturers of electronic data processing equipment.

Since 1900, the foundation of the economy of the Binghamton area has changed from cigars to shoes and then to electronics. IBM, with a major manufacturing facility and laboratory in Endicott and another installation in Owego, has replaced Endicott Johnson as the area's largest employer. GAF Corporation (a diversified manufacturer of film products, office equipment, and building supplies), Singer's Simulation Products Division, and General Electric have chosen the Binghamton area for their operations.

The remainder of this chapter examines population, economic, and land use characteristics of Broome and Tioga Counties.

POPULATION

During the first half of the twentieth century, the population in Broome County increased more rapidly than the population of Tioga County which retained its rural character. Since 1950, however, the trends have reversed as Tioga County has rapidly suburbanized. Overall, the Bicounty Area has experienced moderate population growth since 1950.

In 1950, about 215,000 people lived in Broome and Tioga Counties; and by 1960 this total increased to 250,000 for a ten-year growth rate of 16.6 percent. For the decade from 1960 to 1970, growth in the Bicounty Area slowed appreciably to a ten-year rate of 7.1 percent. By 1970, population reached 268,000.

STANDARD METROPOLITAN STATISTICAL AREA

The Binghamton Standard Metropolitan Statistical Area (SMSA) includes both Broome and Tioga Counties in the State of New York, and Susquehanna County just to the south in the Commonwealth of Pennsylvania. Population trends for the 1950-1970 period for the Binghamton SMSA are presented in Table III-1.

The table indicates that Broome and Susquehanna Counties showed a slightly slower growth rate than the total SMSA with Tioga County having the highest growth rate. The combined Broome and Tioga growth rate was slightly higher than the overall Binghamton SMSA growth rate.

Two reliable indicators of growth trends for an area are birth and death rates. Although the death rate has fallen continuously because of general improvement in health care and preventive medicine, the birth rate, both nationally and locally, has recently decreased more rapidly. Much of the decline in the growth rate for the Bicounty Area, is not only attributable to outmigration but also declining birth rates. In the central cities such as Binghamton, the decline in birth rate has been even greater than for outlying areas.

TABLE III-1

POPULATION STATISTICS FOR THE BINGHAMTON SMSA COUNTIES - 1950 to 1970

Bicounty Area	1950	Growth Rate 1950-1960 (%)	1960	Growth Rate 1960-1970 (%)	1970
Broome	184,698	15.1	212,661	4.3	221,815
Tioga	30,166	25.3	37,802	23.0	46,513
Total	214,864	16.6	250,463	7.1	268,328
% of SMSA	87	-	88	-	89
Susquehanna County, PA	31,970	3.7	33,137	3.5	34,344
Total SMSA	246,834	14.9	283,600	6.7	302,672

POPULATION TRENDS FOR COMMUNITIES IN BROOME AND TIOGA COUNTIES

Figure III-1 delineates the town, village, and city boundaries within the Bicounty Area. The population since 1950 in each town is shown in Tables III-2 and III-3 for Broome and Tioga Counties, respectively. The City of Binghamton lost population from 1950 to 1970 (81,000 to 64,000). However, many of the small municipalities within the Binghamton metropolitan area have experienced significant growth while several of the older, larger communities such as Johnson City and Endicott have experienced declines in population. A number of older villages in Tioga County have also experienced declines in population. Although the Town of Owego has grown from 9,900 in 1950 to 20,300 in 1970, the population in the Village of Owego has declined. Population trends within the urban areas indicate increasing suburbanization adjacent to the older and larger communities.

The growth rate in parts of Broome County became negative for the first time during the 1960's. The decline in growth is anticipated to continue through the 1970's to yield an absolute decline in population. The municipalities of Binghamton, Endicott, and Johnson City show declines in population with the rest of Broome County slowly increasing. Population continues to increase in most parts of Tioga County in the 1970's but at a slower rate of growth than the 1960's. Broome and Tioga Counties population estimates from 1970 to 1973 are provided in Table III-4. These estimates are based on 1970 census data, birth and death statistics, and 1960-1970 migration patterns.

INCOME

Within the Binghamton SMSA the median income in 1969 of all families and unrelated individuals was $10,033. Broome County had the highest median income of the three counties with $10,338, while Susquehanna County had the lowest with $8,050. Tioga County had a median income of $10,226.

Family incomes within the City of Binghamton were significantly lower than the remainder of Broome County. Census tract median incomes for 1969 within the City ranged

MUNICIPAL BOUNDARIES

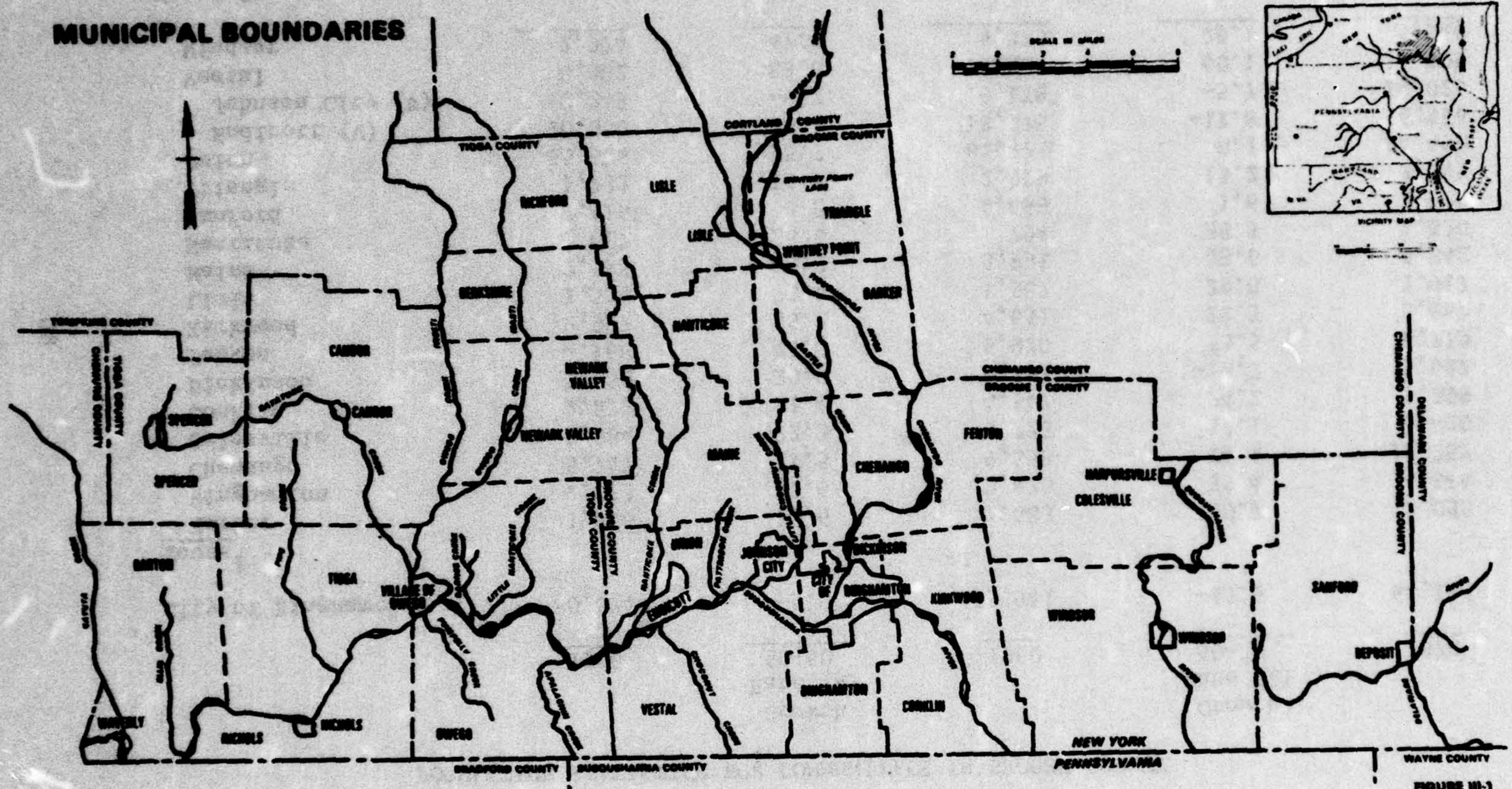


FIGURE III-1

TABLE III-2

POPULATION STATISTICS FOR COMMUNITIES IN BROOME COUNTY

	1950	Growth Rate (%) 50-60	1960	Growth Rate (%) 60-70	1970
City of Binghamton	80,674	-5.9	75,941	-15.6	64,123
Towns[1]					
Barker	1,456	15.6	1,683	20.7	2,032
Binghamton	2,073	67.6	3,475	39.4	4,844
Chenango	5,747	71.5	9,858	24.4	12,267
Colesville	3,084	22.3	3,773	17.1	4,420
Conklin	2,872	51.4	4,347	24.2	5,399
Dickinson	5,450	20.9	6,591	-13.7	5,687
Fenton	4,168	42.0	5,920	13.5	6,719
Kirkwood	2,997	55.2	4,651	22.3	5,687
Lisle	1,534	3.4	1,587	20.8	1,917
Maine	2,315	69.8	3,931	48.6	5,842
Nanticoke	627	26.6	794	28.5	1,020
Sanford	2,416	3.0	2,489	1.6	2,528
Triangle	1,733	16.5	2,019	13.2	2,285
Union	55,676	15.7	64,423	0.1	64,490
Endicott (V)	20,050	-6.4	18,775	-11.8	16,556
Johnson City (V)	19,249	-0.7	19,118	-5.7	18,025
Vestal	8,902	88.8	16,806	60.1	26,909
Windsor	2,974	47.0	4,373	29.1	5,646
Total County	184,698	15.1	212,661	4.3	221,815

[1]Towns include village population

(V) = Village

TABLE III-3

POPULATION STATISTICS FOR COMMUNITIES IN TIOGA COUNTY

	1950	Growth Rate (%) 50-60	1960	Growth Rate (%) 60-70	1970
Towns[1]					
Barton	8,017	4.3	8,365	1.9	8,526
Waverly (V)	6,037	-1.4	5,950	-11.6	5,261
Berkshire	912	4.5	953	15.2	1,098
Candor	2,879	21.2	3,488	20.1	4,190
Newark Valley	2,384	20.8	2,880	15.4	3,323
Nichols	1,685	18.6	1,998	13.7	2,271
Owego	9,941	48.0	14,710	38.2	20,336
Owego (V)	5,350	1.3	5,417	-4.9	5,152
Richford	787	2.2	804	13.9	916
Spencer	1,561	14.7	1,790	24.7	2,232
Tioga	2,000	40.7	2,814	28.7	3,621
Total County	30,166	25.3	37,802	23.0	46,513
Total Bicounty Study Area	214,864	16.6	250,463	7.1	268,328

[1]Towns include village population

(V) = Village

TABLE III-4

POPULATION ESTIMATES, 1970-1973*

	1970	1971	1972	1973	Growth Rate (%) 1970-73
Broome County	222,379	222,381	221,872	220,878	-0.7
Binghamton	63,929	62,731	61,235	59,678	-6.6
Endicott	16,550	16,400	16,150	15,850	-4.2
Johnson City	17,900	17,300	16,700	16,050	-10.3
Rest of County	124,000	125,950	127,750	129,300	4.3
Tioga County	46,800	47,550	48,200	48,750	4.2

* As of July 1 of year indicated

Source: State of New York, Office of Bio-Statistics from a low of $5,684 to a high of $12,208 with an overall median income of $9,321. Within the City of Binghamton, 8.6 percent of all families received incomes below the poverty level, and 32.7 percent of all families received some form of public assistance income. Census tract variations for the number of families below the poverty level ranged from 2.7 percent to 23.2 percent in the City of Binghamton. In the remainder of Broome County, the percentage of families below the poverty level ranged from 1.0 percent in one tract in the Town of Union to 14.6 percent in the Town of Triangle.

In Tioga County, the number of families below the poverty level ranged from 4.0 percent in the Town of Owego to 13.4 percent in the Town of Candor. Although the Town of Owego had a low percent of low income families, Owego Village had a much higher rate (7.8 percent) of low income families and approximately 25 percent of all families received assistance. The Village of Waverly had a relatively low degree of poverty (5.9 percent) but a high assistance rate of 25.7 percent. The Town of Barton had a high poverty level of 10.5 percent, but a low level of assistance of 9.5 percent.

The geographic distribution of upper income groups also varies considerably and is not solely indicated by median income of any particular census tract. This variation within census tracts is particularly evident in suburban-rural areas where new subdivisions have a head of a household who either works in a suburban industrial area or commutes to a business center. Clusters of wealthy families have remained within the City of Binghamton, although many of the higher income groups have located in the suburban areas.

EDUCATION

Income of families reflects education levels within any given census tract. The urban and rural areas of the Bicounty Area are generally lower in educational attainment of the adult population (persons over 25 years old), while the suburban areas are relatively high.

Within both Broome and Tioga Counties the median number of school years completed is 12.3. Within the City of Binghamton, however, the median number of school years completed is 12.1.

In Broome County approximately 60 percent of the adult population completed high school and 11 percent completed four or more years of college. As a contrast, within the City of Binghamton, 53 percent completed high school and 9 percent completed college.

ETHNIC CHARACTERISTICS

A number of ethnic groups are clustered in various locations within the Bicounty Area. Over 65 percent of the black persons within Broome County live in the City of Binghamton. Within one census tract in Binghamton, black persons account for approximately 24 percent of the population. Some fairly large Italian communities are also located in the City of Binghamton. Endicott and Binghamton also have large Czechoslovakian communities.

AESTHETIC AND CULTURAL RESOURCES

Natural topography and man-made changes have combined to form a landscape of rolling hills, with villages, farms, and forests of various sizes, interspersed with rivers and streams. The scenic beauty is an aesthetic resource not only to the people of the area but also the sightseer from other parts of the country.

At present, the urban core contains a mixture of rural, suburban, and urban environments. As is common in cities throughout the country, deterioration of the urban core has resulted in an outward movement of families, businesses, and industries to the surrounding suburbs. The major aesthetic resources in the Binghamton metropolitan area are the Susquehanna and Chenango Rivers, although in many reaches they are inaccessible. Open space, of any kind is at a premium within the urban core. Efforts to revitalize interest in the Susquehanna and Chenango Rivers and to provide more open space have begun in the form of a Riverbanks Improvement Program. Efforts such as the Model Cities Program are also underway to redevelop and renew the older business centers and residential areas.

The Roberson Memorial Center in Binghamton is the major focus of cultural activities within the urban area. It functions as a clearing house for all performing arts programs and major exhibitions. The Center houses permanent art and history collections and provides facilities for symphonic, choral, and theatrical groups and instruction in art, science, music, drama, and photography. The State University of New York (SUNY) in the Town of Vestal and Broome Community College in Binghamton also serve as educational and cultural centers.

There are five historic sites in the urban area which are registered by the National Park Service of the U. S. Department of Interior:

- Binghamton City Hall
- Broome County Courthouse
- Phelps Mansion
- Christ Church
- Tioga County Courthouse

ECONOMY

The foundation of economic activity in the Bicounty Area is manufacturing, primarily electrical machinery. Other sources of employment include government, wholesale and retail trade, services, forestry, and agriculture. The Bicounty Area employment and employment/population (E/P) ratios from 1950 to 1970 are shown in Table III-5. Tioga County has experienced a constant E/P ratio of 0.36, while Broome County experienced a decline from 1950 to 1960. The E/P ratio remained essentially constant in Broome County from 1960 to 1970.

TABLE III-5

EMPLOYMENT AND EMPLOYMENT/ POPULATION RATIO,* 1950-1970

	Broome County	Tioga County	Bicounty Total	Total SMSA
1950				
Total Employed	74,700	10,800	85,500	96,400**
Population	184,700	30,200	214,900	246,800**
E/ P Ratio	0.40	0.36	0.40	0.39
1960				
Total Employed	83,000	13,300	96,300	108,000
Population	212,700	37,800	250,500	283,600
E/ P Ratio	0.39	0.36	0.39	0.37
1970				
Total Employed	87,000	16,700	103,700	116,400
Population	221,800	46,500	268,300	302,700
E/ P Ratio	0.39	0.36	0.38	0.38

*Populations and total employed rounded to nearest hundred
**Midyear

In 1970 the civilian unemployment rates for Broome County were 3.3 percent for males and 4.2 percent for females. Unemployment rates in Tioga County were 3.7 percent and 4.5 percent for males and females respectively. For the entire SMSA, 1970 unemployment rates for males and females were 3.4 percent and 4.3 respectively.

Employment/population ratios and earnings by major economic sectors within the Bicounty Area for the period from 1950 to 1970 are presented in Table III-6. Trends in employment categories in the Bicounty Area have shown an increase in government and service employment and a decrease in agricultural employment. Manufacturing employment has increased in Tioga County but decreased in Broome County. Manufacturing is, however, the dominant industrial category employing 37 percent and 41 percent of Broome and Tioga workers, respectively, in 1970. Although factory jobs are decreasing in significance relative to other job opportunities, the factory related skills still constitute the majority of the jobs.

TABLE III-6

BICOUNTY AREA EMPLOYMENT/POPULATION RATIOS
AND EARNINGS* BY INDUSTRY
1950-1970

	1950	1962	1970
Employment/Population Ratio	.40	.39**	.38
Total Earnings	$ 328,200	$ 554,600	$ 728,000
Agriculture, forestry and fisheries	19,300	10,100	12,800
Mining	160	110	380
Contract construction	15,500	28,300	42,000
Manufacturing	129,300	252,800	327,600
Transportation, communication, and public utilities	25,900	30,500	37,000
Wholesale and retail trade	58,400	78,600	97,700
Finance, insurance, and real estate	9,800	17,200	22,400
Services	32,800	56,800	
Government	34,900	65,500	108,200
Other ***	2,140	14,690	820

* Earnings based on thousands of 1967 dollars

** E/P ratio based on 1960 population and employment

*** Cannot be allocated to earnings category because of disclosure laws

Retail trade employment accounts for approximately 13 percent of workers in both Broome and Tioga Counties although retail trade has been significantly lower in Tioga County during the past century. Numbers of sales workers have increased in both counties but most dramatically in Tioga County during the last decade. The number of professional and technical workers has increased significantly during the last two decades in both counties relative to other areas of the country.

Table III-7 presents employment patterns in the Bicounty Area by major categories. Some of the more important sectors include manufacturing, forestry, and agriculture.

TABLE III-7

EMPLOYMENT BY MAJOR CATEGORIES IN BICOUNTY AREA, 1970

	Employment	Percent	Rank
Agriculture	1,818	2	8
Mining	61	*	9
Construction	5,496	5	5
Manufacturing (Total)	(39,935)	38	1
Furniture, lumber & wood	1,051	-	-
Metal industries	2,920	-	-
Machinery, exc. elect.	6,120	-	-
Electrical machinery	15,521	-	-
Transportation equip.	784	-	-
Other durable goods	4,316	-	-
Food & kindred	933	-	-
Textile products	559	-	-
Printing & publishing	1,539	-	-
Chemicals	433	-	-
Other nondurable goods	5,759	-	-
Transportation, Communication, Public Utilities	4,877	5	6
Wholesale & Retail Trade	17,708	17	3
Finance, Insurance, Real Estate	3,662	4	7
Services	10,805	10	4
Government	19,420	19	2
TOTAL	103,782	100	

Source: U. S. Bureau of the Census, Census of Population, General Social and Economic Characteristics, 1970

*Less than 1

MANUFACTURING

Manufacturing accounts for about 40 percent of the employment in the Bicounty area. Within the manufacturing category, electrical machinery is the largest employer followed by non-electrical machinery (Table III-7). The electrical machinery sector is dominated by such electronics firms as IBM and the Singer Company.

Trends which have been noted in the manufacturing sector of the economy are as follows:

- A decrease in Broome County manufacturing employment which peaked during the 1950's.

- A decline in the City of Binghamton's manufacturing position.

- A transition from low skill employment, historically dominated by the leather industry to high skill employment dominated by the electronics and machinery industry for which IBM and General Electric are the largest employers.

- A rapid growth in high skill employment in Tioga County.

- Reflecting national trends, consolidation and growth of firms have resulted in more employment in larger firms with overall decline in the number of firms.

- The overall growth of employment tapered off during the 1960's.

- New industry has moved to the suburbs and some industry has relocated to the suburbs.

- Some of the largest firms are dependent on defense, aerospace, and other government contracts, the shifts of which have caused local disruption in employment.

The major employers within Broome and Tioga County are the following:

- IBM - employs 10,000 in Endicott and 5,000 in Owego. The Endicott plant specializes in data processing equipment while Owego manufactures aerospace systems.

- Endicott Johnson Corporation - employs 9,000 in Endicott and 150 in Owego. Manufacturers of footwear.

- Singer Company (Simulation Products) - employs 3,000 in Binghamton. Manufacturers of electrical equipment.

- GAF Corporation - employs 2,200 and 530 in two Binghamton plants, and 430 in Johnson City. Manufacturers of photographic equipment and supplies.

- General Electric Corporation - employs 1,300 in Johnson City.

- Kroehler Manufacturing - employs 900 in Binghamton. Manufacturers of furniture.

- Crowley Foods - employs 750 in Binghamton.

- Vail Ballou Press - employs 740 in Binghamton. Binding industry.

The IBM Corporation was founded in the region and has continued to expand. The long existence of IBM has encouraged a gradual development of a labor pool. The existence of that labor pool attracted more firms specializing in electrical parts and electronics. The State University of New York at Binghamton, Broome County Community College and the large number of persons with college educations tend to promote and reinforce the presence of these high skill industries in the region.

Endicott Johnson Corporation and other shoe-related industries have long been established in the area. A tent manufacturer was recently attracted to the region because of the skilled workers available from that labor pool. The central geographic position of the Bicounty Area to other major population centers provides excellent markets especially for highway movement of goods.

Possible future expansions of manufacturing in the study area will depend upon a number of factors related to the attractiveness of the region for a particular industry. Factors influencing industrial location include:

- location of raw material
- location of market
- availability of labor

- availability of utilities, level land, and transportation

- community characteristics such as zoning, housing supply, and amenities.

Much of the land in the Bicounty Area has slopes that are unsuited for development. Additionally, many potential industrial sites do not have sewerage and many municipalities do not have zoning ordinances that provide for manufacturing firms. The major natural resources of the region are water, agricultural hinterlands, and minerals. The cost and availability of water is important for product input, process, and cooling. The overall availability of water in the Bicounty Area may attract water intensive industries to the region.

FORESTRY

The local lumber-related economy of furniture, cardboard, paper, and lumber manufacturing is dependent on the forestry industry. The dominant forest type is the northern hardwood, although a variety of other forest types occur in various parts of the Bicounty Area. Forest productivity is low because of generally poor soil conditions and the existence of a fragipan in many areas. However, approximately 400,000 acres of commercial forests were reported in the Bicounty Area in 1967. The most active forestry is in northwestern Tioga County. Additionally, the Christmas tree industry exports to New York metropolitan areas; and the maple syrup industry has an active, although local, market.

AGRICULTURE

Employment in agriculture has decreased in recent years as has the number of farms. Although the number of farms has decreased, the average size of each farm has increased due to higher levels of mechanization. Yields per acre have also increased slightly with improved farming techniques. Dairy farming is the most significant agricultural activity in both Broome and Tioga Counties. High milk prices and the advent of mechanization have resulted in more intensive use of land. Other farm products include poultry, field crops, and livestock products. The most important field crop is hay which is used primarily in association with dairy farming.

Farms close to urban areas are considered marginal because of the greater returns that urbanized uses generally produce over farming. At the present, approximately 17 percent of Broome County and 27 percent of Tioga County are devoted to agriculture.

LAND USE

The major existing land use patterns including residential, agriculture, recreation, and industrial and commercial areas for Broome and Tioga Counties are shown in Figure III-2. The approximate square miles and percent of each land use category for the Bicounty Study Area are given in Table III-8.

The predominant land uses are woodlands and active agriculture. Woodlands, including forest and bushland, occupy about 58 percent of the land in the Bicounty Area. Broome County has a slightly larger percentage of woodlands than Tioga, which reflects the decline in agricultural lands in Broome County within recent years. Such inactive agricultural land is gradually reverting to forest. Wetlands account for only a minor portion (1 percent) of lands within the two counties.

Agriculture occupies approximately 22 percent of the land area. Most agricultural acres are devoted to crops and pastures associated with dairy farming. Sharp declines in agricultural lands have been noticed in the past two decades as urbanization has advanced.

Residential areas comprise approximately 3 percent of the Bicounty Area with Broome County having more residential land than Tioga. Percentages of high, medium, and low density residential areas within Tioga are similar although Broome County has a greater percentage of high density residential areas than either medium or low density, due to the existence of the urban areas surrounding the City of Binghamton.

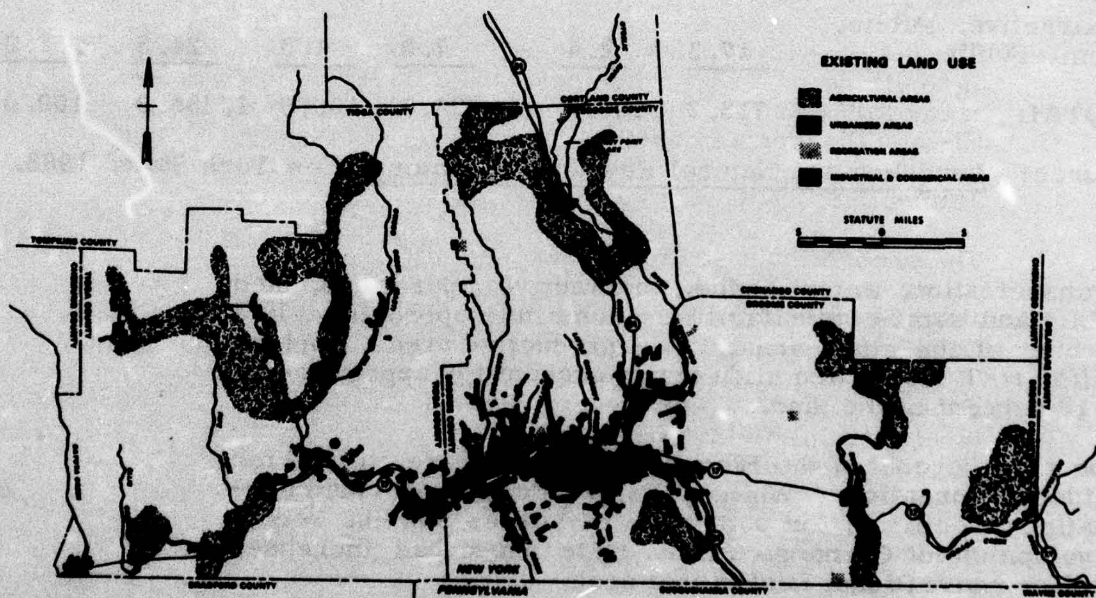

EXISTING LAND USE
STATUTE MILES
5 0 5
TIOGA COUNTY
CORTLAND COUNTY
TOMPKINS COUNTY
CHENANGO COUNTY
BRADFORD COUNTY
NEW YORK
PENNSYLVANIA
SUSQUEHANNA COUNTY
WAYNE COUNTY

FIGURE III-2

TABLE III-8

LAND USE IN THE BICOUNTY AREA, 1968

	Broome		Tioga		Total Bicounty	
Land Use Category	Square Miles	% of County	Square Miles	% of County	Square Miles	% of Bicounty
Agriculture	127.1	17.8	143.6	27.4	270.7	21.9
Residential	26.8	3.8	7.1	1.4	33.9	2.7
Commercial	2.7	0.4	0.7	0.1	3.4	0.3
Industrial	2.4	0.3	0.2	0.0	2.6	0.2
Outdoor Recreation	6.8	1.0	0.9	0.2	7.7	0.6
Woodlands	433.2	60.7	284.2	54.2	717.4	57.9
Transportation	6.9	1.0	1.7	0.3	8.6	0.7
Wetlands	8.2	1.1	6.7	1.3	14.9	1.2
Non-productive	82.3	11.5	72.2	13.8	154.5	12.5
Other - Water, Extractive, Public, Semi-Public	17.3	2.4	7.0	1.3	24.3	2.0
TOTAL	713.7	100.0	524.3	100.0	1,238.0	100.0

Source: Land Use and Natural Resource Inventory, New York State, 1968.

Transportation, water bodies, extractive operations, and public and semi-public facilities constitute approximately 3 percent of the study area. Non-productive areas, such as cliffs, rock slopes and slide areas account for approximately 13 percent of the land.

About one percent of the Bicounty Area lands are utilized for outdoor recreation. Whitney Point Lake has provided recreational facilities for a number of years, and the recent development of Chenango Valley State Park has increased outdoor recreational land in that area.

CHAPTER IV

EXISTING WATER SUPPLY AND WASTEWATER MANAGEMENT SYSTEMS

Water supply and wastewater management, including industrial systems, are identified and described in this chapter. The institutions responsible for their management are also discussed. Detailed examination of institutional characteristics is contained in the Institutional Analysis Appendix.

GENERAL INSTITUTIONAL RESPONSIBILITIES IN WATER MANAGEMENT

FEDERAL RESPONSIBILITY

There are a number of Federal agencies having responsibilities for water management. Three agencies of prime importance for the Binghamton Wastewater Management Study are: the U. S. Environmental Protection Agency (EPA), the Corps of Engineers (COE), and the Susquehanna River Basin Commission (SRBC). Responsibilities of EPA and the COE are briefly described in Chapter I. The SRBC was created as a Federal-Interstate Compact consisting of the U. S. Government, the States of Maryland and New York, and the Commonwealth of Pennsylvania. The Commission is responsible for management of water and related land resources within its jurisdiction. It reviews water resource programs and plans by various agencies for consistency within the entire Susquehanna River Basin.

STATE RESPONSIBILITY

The ultimate responsibility for regulating the water resources of New York State has been vested in the State Legislature. Regulation of these resources as a function of the State is embodied in the State Constitution and in specific legislative documents. Not only does the State Legislature have the power to control and regulate water resources, but it is under a duty to do so.

In exercising its authority, the State Legislature has delegated specific responsibilities to various State departments and agencies. For example, the responsibility for apportioning the water resources of the State among the various municipalities for water supply purposes has been delegated to the Department of Environmental Conservation. Approval by this Department must be obtained before any new department for water supply purposes may be undertaken. In addition, responsibility for preserving the quality of potable water supplies in the State has been delegated to the Department of Health. Before any public water supply system may be placed into operation, it must comply with the Recommended Standards for Water Works established by the Department. The Public Service Commission has been given the responsibility to oversee the operations of investor-owned water companies servicing the residents of the State. It attempts to ensure the quality of that service and to regulate the rates charged.

Two other agencies of the State exercise responsibilities toward water resources. The Environmental Facilities Corporation is authorized to contract for the construction of water management facilities on behalf of State agencies and municipalities. If the facility is constructed on behalf of a State agency, the Corporation may also contract for its operation and maintenance. Additionally, the Department of Transportation is authorized to construct, maintain, and operate a system of reservoirs to supply water for the operation of the State's canal system. It is conceivable that the eventual recommendations of this Commission may call for the utilization of one or more of these reservoirs for water supply purposes.

LOCAL RESPONSIBILITY

In New York State, water supply and wastewater management laws are similar.

Although sovereign responsibility over the water resources of the State is vested in the State Legislature, water supply and wastewater management has traditionally been a local function. Counties, towns, cities, and villages are municipal subdivisions of the State and may exercise powers delegated to them by the State Legislature. General powers and responsibilities in respect to water supply are contained in the County Law, the Town Law, the General City Law, and the Village Law. More specific authority may be found in county and city charters. Related statutory provisions are contained in the Municipal Home Rule Law, the Statute of Local Governments, the General Municipal Law, the Public Authorities Law, the Local Finance Law, the Real Property Tax Law, and the Unconsolidated Laws.

Counties which have not yet adopted county charters may engage in water supply and wastewater management activities only by creating county water districts. Those counties with charters have established Departments of Public Works with Commissioners empowered to engage in such activities on a county-wide basis.

Towns operate under similar statutory constraints. A town may furnish water supply and wastewater management services to town residents by creating a town district, but it may also provide this service as a town function under provisions added to the Town Law during the last ten years. Unlike counties, however, statutory authorization does not exist for towns to adopt charters providing for alternative forms of town government.

Cities and villages engage in water supply and distribution activities as a general function of their respective units of local government. As such, they are constitutionally guaranteed the right to realize a "fair return" on the value of property used for such purposes. Profits derived by cities and villages in their operation of a water or wastewater utility may be applied for any lawful purpose. Revenues derived from the operation of a county or town district, on the other hand, must be applied against operation and maintenance expenses of the district and then against debt service.

All units of local government are authorized to contract indebtedness for water supply purposes. There is no limit to the amount of indebtedness which may be contracted, but indebtedness may not be contracted for a period in excess of the "period of profitable usefulness" which the Local Finance Law designates for water and wastewater service systems.

Water and sewage facilities owned by a municipal corporation and located wholly within the corporate limits of that municipal corporation are exempt from taxation. If the facilities are located outside the corporate limits of the municipal corporation which owns them, they will be exempt from taxation by the municipal corporation in which they are located only if the latter municipal corporation consents to it.

There are also many privately owned water companies operating in southeastern New York State, the vast majority of which are quite small. These companies are subject to the provisions of the Conservation Law and to the rules and regulations of the New York State Sanitary Code as well as to the provisions contained in the Transportation Corporation Law and in the Public Service Law.

All of these levels of government (Village, Town, City, etc.) exist in the Bicounty Area and have formed various institutional arrangements for the management of water and wastewater.

INSTITUTIONAL ARRANGEMENTS

Both Broome and Tioga Counties have a large number of districts and departments which have been created to finance both water supply and wastewater management. Departments are generally used to help single communities manage water and wastewater systems whereas districts usually encompass more than one municipal entity.

As these arrangements do not vary between water supply and wastewater management functions, the following descriptions will apply to both.

Single Community Arrangements

The most common method of providing service is that of single community ownership, operation, and administration.

The governing bodies of many communities exercise the administration of wastewater and water management systems directly, through municipal public works departments, separate wastewater departments, clerks or managers. In other cases, this administration, particularly in day-to-day matters, rests with an appointed board, committee, commission, or similar body whose functions may also include the provision of municipal utilities and drainage. Generally, the elected municipal officials retain the ultimate responsibility for policy and review procedure even though the appointed board exercises much of the decision-making.

Joint Ownership

There are several instances where two or more communities or a community and another entity (such as a governmental agency) have constructed and jointly operate wastewater facilities. In the organization of a joint wastewater effort, the individual local governing bodies define the procedures for administration and financing and usually create a joint body comprised of elected or appointed officials from the cooperating governmental units.

Joint ownership and operation of facilities differs from the district approach, in that vested title remains with the individual units in proportion to their expenditures of capital, or to the cooperating communities as joint tenants. Likewise, indebtedness is incurred by the individual communities rather than by the joint body created.

Methods of apportioning cost among the participants to a joint agreement are usually defined in the agreement. In many cases, the apportionment method or formula differs for capital costs and operating costs. Joint bodies rarely assess and collect the charges from consumers directly, but rather apportion the costs to the cooperating parties for the raising of revenue, and the parties, in turn, make the charges.

Joint ownership is particularly advantageous in the case of a small number of communities, located adjacent to or close to one another, enabling them to take advantage of the lower cost of construction and operation of a joint treatment facility or of a jointly used sewer. If a relatively large number of communities is involved, the joint ownership approach tends to become rather cumbersome to administer.

Contract System

In cases where an existing wastewater or water supply entity is asked to provide service to an area that was heretofore not included in the boundaries of the entity, such as urban facilities serving suburban development, a contract for service may provide the most acceptable method of organization. The contract system approach allows for intercommunity cooperation on either a permanent or a temporary basis, without the necessity of reorganizing the original service entity. The key to utilization of this method is mutual agreement on the terms of a contract that clearly define the quantity and standards of service, the determination and magnitude of charges, the liabilities of the contracting parties, and the duration of the agreement and provisions for renegotiation.

The contract system is particularly advantageous for temporary service to a growing community until development indicates the need for the provision of local treatment facilities, but it is also widely used as a means of long-range agreement between communities, sanitary districts, and other entities as a basis for the use of facilities. The contract for sevice is often mutually advantageous in the area of municipal-industrial cooperation in the construction of treatment facilities. Based on a long-term contract stipulating guaranteed levels of minimum revenue from the industry, municipalities often use their bonding ability, particularly revenue bonds, to construct and finance the facilities required by industry.

One disadvantage to the contract system is the problem of representation. Usually, the secondary contracting party is not involved in the policy decisions of the entity providing service, even though such decisions may affect the secondary party as well. In addition, the contract system does not function well in providing for the necessary capital funds to anticipate long-range capacity needs.

District

The cooperative effort of a number of communities in solving a problem has given rise to the district. In effect, the district approach is similar to joint ownership, but with more power given to the governing body for combining the resource of and providing planning for the communities that are or will be served.

The district, often termed a sanitary district or water district, is particularly adapted to situations where a large capital expenditure is required for joint works. In the organizing of such a district, provisions are made for a method of joint financing, including the apportionment of benefit charges; a basis for administrative organization for planning, construction, and operation of the district's facilities; and means for altering boundaries, enlarging facilities, or otherwise managing its affairs.

The district is usually organized with an elected or appointed board that is representative of the communities involved and has the authority to levy or collect charges as required to finance the district's needs. Debt undertaken to finance the district's capital improvement is often a full faith and credit obligation of all the communities involved, even though the bonds are issued in the name of the district. Some districts do not issue bonds directly; rather, the member communities finance their district obligations directly, as in the joint ownership arrangement.

The district's activities rarely include the construction, operation, and maintanance of individual member communities' conveyance facilities, but rather are confined to sewers and treatment facilities used by more than one community.

While the district arrangement is not a panacea for intergovernmental problem solving in the field of water pollution control, the number of successfully operating districts attests to the advantages of the approach, particularly in the case of a larger municipality and its environs cooperatively engaged in the pursuit of a common goal.

The above mentioned institutional arrangements are found in the Binghamton area. Other institutional arrangements which could evolve at some time in the future could consist of multi-purpose districts, independent authorities, and regional agencies. These however, will be discussed in the Institutional Analysis Appendix.

WATER SUPPLY AND WASTEWATER MANAGEMENT SYSTEMS IN BROOME AND TIOGA COUNTIES

INTRODUCTION

Approximately 90 pecent of the urban population in Broome and Tioga Counties is sewered either with combined or separate sanitary sewers. The remaining population in the two counties, except for Waverly, is served by individual wastewater systems. At this time, Waverly has only combined sewers serving the central area of the Village. The urban area is served by three primary and four secondary sewerage treatment plants.

With reference to water supply, most municipal and private supply systems rely on groundwater and, except for private residences and developments in the upland areas, aquifers are essentially capable of delivering large quantities of high quality water.

Industrial and institutional sectors depend upon municipal systems or their own wells for water supply. Agricultural water use, which is limited to livestock watering, is provided by wells or by farm ponds.

Recent comprehensive water supply studies indicate an overall surplus of supply over demand through the year 2020. Both Broome and Tioga County's demands are given in Table IV-1.

Although the comprehensive studies indicate a sufficient water supply surplus, there could be problems. Supply and demand will not be in balance throughout the region. Programs involving consolidation of water districts, transmission lines, expansion of treatment facilities, and wells will be needed.

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BINGHAMTON WASTEWATER MANAGEMENT STUDY. BACKGROUND INFORMATION --ETC(U)

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TABLE IV-1

PROJECTED WATER DEMANDS - BROOME AND TIOGA COUNTIES

	1973 Supply (mgd)	Projected 2017 Demand (mgd average daily demand)
Broome County		
Binghamton	20.00	19.00
Johnson City	18.10	8.05
Endicott	43.20	11.65
Vestal	13.20	5.88
Chenango-Fenton	5.40	3.50
Tioga County		
Apalachin-Tioga	1.12	2.30
Owego East	-	1.40
Village of Owego	5.00	3.00
Owego West		.40
Lounsberry	(supply is for 20 homes)	

Sources: Development of Water Facilities, Broome County 1967-2017, R. J. Martin/V. O. Shumaker, Joint Venture, Consulting Engineers, 1968.

Tioga County, New York Comprehensive Water Supply Study, R. J. Martin, Consulting Engineer, 1970.

EXISTING WATER SUPPLY SYSTEMS

Table IV-2 lists the areas served by the water supply facilities in Broome and Tioga Counties along with pertinent data about the systems.

TABLE IV-2

EXISTING MUNICIPAL SYSTEMS FOR WATER SUPPLY

Areas Served	Source of Water Supply for the Area	Water Supply System Managed By	Type of Arrangement	Supply Capacity MGD	Demand MGD 1973
BROOME COUNTY					
City of Binghamton	Binghamton City Municipal Department	Binghamton City Municipal Department	Municipal Department	20.0	11.0
Binghamton Town (Six Water Districts)	City of Binghamton	Town of Binghamton Municipal Department	District	-	.08
Town of Chenango (Twelve Water Districts and Fenton)	17 wells 1 well	Chenango Municipal Department	District	2.6 2.8	.28 .70
Town of Dickinson (Three Water Districts)	Johnson City Water System	Town of Dickinson Municipal Department	District	-	.35
(Three Water Districts)	City of Binghamton	"	District		
(Areas of Dickinson not in any water districts)	Johnson City Water System	Johnson City Municipal Department	Service Agreement		
Town of Kirkwood (One Water District)	Wells	Kirkwood Mun. Dept.	District	0.378	.39
(One Water District)	Wells	Kirkwood Mun. Dept.	District		
(One Water District and Conklin)	City of Binghamton	Kirkwood Mun. Dept.	District		

TABLE IV-2 (Continued

Areas Served	Source of Water Supply for the Area	Water Supply System Managed By	Type of Arrangement	Supply Capacity MGD	Demand MGD 1973
Village of Johnson City	Johnson City 7 wells	Johnson City Municipal Department	Municipal Department	18.1	5.2
Village of Endicott	Village of Endicott Water Dept. - wells	Endicott Municipal Department	District	43.2	1.1
West Endicott	Village of Endicott Water Works	Endicott Municipal Department	Service Agreement		0.12
West Corners	"	"	"		0.31
Endwell	"	"	"		1.3
Town of Vestal, Twin Orchards	"	"	"		0.11
Town of Union (One Water District) (One Water District)	Village of Endicott Water Department and Village of Johnson City Municipal Department	Village of Endicott and Village of Johnson City	Service Agreement		
Town of Vestal (One Water District)	Wells	Town of Vestal Municipal Department	District	13.2	1.3
(Five Water Districts)	Wells	"	District		
(Two Water Districts)	Wells	"	District		
(One Water District)	City of Binghamton	"	District		

TABLE IV-2 (Continued)

Areas Served	Source of Water Supply for the Area	Water Supply System Managed By	Type of Arrangement	Supply Capacity MGD	Demand MGD 1973
TIOGA COUNTY					
Village of Nichols	Spring and well	Nichols Water Co.	Private Co.	0.22	0.07
Apalachin-Tioga	4 wells	Partly owned by Owego Water Works & Town of Crestview	District	1.12	0.55
Owego East (Six Water Districts)	Owego Water Works (wells)	Owego Water Works & Town of Owego Mun. Department	District	-	1.09
Village of Owego	Owego Water Works (wells)	Owego Water Works & Town of Owego	Contract	5.0	1.05
Owego West	Individual wells	Individual wells	Private wells		0.09
Lounsberry	Individual wells	Individual wells	Private wells	-	-

Broome County

Binghamton Water Bureau

The Binghamton water system utilizes surface water from the Susquehanna River as its source of supply and is designed to produce 20 mgd of treated water under average conditions. Operated by the Binghamton Municipal Department, the plant serves a number of areas outside its municipal political boundaries including sections of the Towns of Vestal, Binghamton, Kirkwood, Conklin, Dickinson, Chenango, and a portion of the Village of Port Dickinson. Operation and maintenance are performed by the Bureau.

Municipal Department of the Village of Johnson City

The Department is entirely dependent on groundwater as its source of supply. Utilizing seven wells, the system has an installed capacity of 18.1 mgd to meet the demand of 5.2 mgd. It presently operates as an independent system, serving the Village and small areas in the Towns of Dickinson and Union. The existing system is also connected to the City of Binghamton's system at six points along their common boundary, forming a mutual emergency supply arrangement between the two communities.

Village of Endicott Water Department

This system is dependent on groundwater for its supply. With a total of 31 wells, the system provides a combined total of about 41 mgd. The Village of Endicott, West Endicott, West Corners, Endwell, and Twin Orchards in Vestal and two districts in the Town of Union are supplied by the system.

Town of Vestal Municipal Department

Water for all of the districts, except one, is supplied by nine wells. One of the districts is supplied by the City of Binghamton. These sources provide a supply capacity of 13.2 mgd and have a storage capacity of 6.12 mgd. As development continues in this area, the system will be expanded to meet the needs, apportioning costs that will be reflective of property valuation.

Town of Chenango Municipal Department

The area included in this portion is the western section of the Town of Fenton (including Hillcrest and adjacent areas) and the Town of Chenango (including Nimmonsburg, Hinmans Corners, Broad Acres, Chenango Bridge, and the Kattelville area). Seven private companies also function in this area and utilize groundwater for their supplies: Sycamore Gardens, Bert E. Hale, Inc., Riverside Park Corporation, Keeler Water Association, River Road Water Association, Penn View Water Association, and the Applewood Subdivision.

Water supply is entirely from wells. The Town of Chenango has a supply capacity of 2.57 mgd from nine of the 17 wells. Storage capacity is 0.32 mgd.

Town of Kirkwood Municipal Department (inclusive of Conklin)

The Department relies upon groundwater to supply two of the districts. The two districts have very small pneumatic systems that serve a combined total of 55 homes.

Exact details of pump and well capacity for one of the districts are not known. The other has two wells of approximately 20 gpm each.

The third district relies upon the City of Binghamton for its supply and is considered to be adequate to the year 1990, limited only by the transmission ability of the Binghamton system.

Town of Binghamton Municipal Department

Because the Town of Binghamton with its 6 water districts is located away from the water bearing aquifers of the river valley, it is solely dependent upon the City of Binghamton for its source of water.

Town of Dickinson Municipal Department

The Town of Dickinson water system presently consists of six districts, including the Village of Port Dickinson. Water is supplied (0.10 mgd) to three districts from the Johnson City Municipal Department. Three other districts receive water (0.24 mgd) from the City of Binghamton. The State Road Water Association supplies water from four wells and two springs for domestic supply.

Tioga County

Village of Nichols

The Village of Nichols is supplied by a privately owned water corporation. The source of supply is spring water and one well with a capacity of 0.08 mg and a supply of 0.144 mgd, respectively. Storage capacity is 0.20 mg. Although the community is residential with a small commercial center, it is expected to increase in residential development because of highway construction in the area. Because the water company is small, it is operated and maintained by Owego Water Works on a contractural basis.

Apalachin-Tioga Terrace

The hamlet of Apalachin is served by a water district which has its own supply. The Tioga Terrace area is served by two water districts. Although there are four wells to supply water, only one well is fully used because of water quality problems.

There are basic needs in the three districts for supply, storage, and transmission facilities; the most pressing need being the development of new supply sources in two of the districts. Water demand is expected to increase from a present demand of 0.55 mgd to 2.5 mgd in 2020.

Crestview Heights-Campville

The Crestview Heights area is presently served by both a public water system and public sewers. A district of the Town of Owego provides water service to the area because the well supply is of poor quality. This district has its own supply, storage, and distribution facilities and operates independent of any other water district in the Town. The Campville area is not presently served by public water or sewer systems, but the community does have plans for sewage connection to the Town of Owego No. 2 plant. Water demand is expected to increase from a present demand of 0.23 mgd to 0.36 mgd in 1990.

Owego East

This area is that portion of the Town of Owego north of the Susquehanna River and immediately east of the Village of Owego. This area includes two districts in the Town of Owego with a separate system serving IBM Owego.

This entire system is dependent upon the Owego Water Works, and supply is handled either by billing customers directly or by the district purchasing the water and reselling it to the customers.

Storage capacity is 0.45 mg for the two water districts and 1.0 mg for IBM Owego. Operated by the Town of Owego, present demand is 1.09 mgd. This is expected to increase to 1.21 mgd in 1990.

Village of Owego

The Village of Owego is an established municipality that has about reached its maximum development density so that no substantial growth is expected. Owego Water Works operates the water supply; its sources coming from 3 wells. Storage is 1.60 mg and it serves Owego East and West with a supply of 2.22 mgd.

Owego West

The Owego West area covers that portion of the Town of Tioga immediately west of the Village of Owego. Recent industrial development in this area has caused very rapid growth. Because the Village of Owego has reached its maximum density, this growth has been in the towns near the area that is east of the Village.

Water is obtained from individual wells; however, because of this growth, there is need for a public water supply which could be provided by Owego Water Works. Water demand is expected to increase from 0.09 mgd (present demand) to 0.23 mgd in 1990.

Lounsberry

Lounsberry, a settlement of about 20 homes, is approximately five miles west of the Village of Owego. At present, there is no public water supply or sewage disposal system. However, because of the commercial and industrial growth in the areas of Owego and western Broome County, it is expected that there will be residential development in this area.

EXISTING WASTEWATER MANAGEMENT SYSTEMS

The following is a basic description of the wastewater facilities in Broome and Tioga Counties. Tables IV-3 and IV-4 provide further technical information including average flow to the treatment systems and average effluent Biological Oxygen Demand (BOD) and Suspended Solids (SS) loads discharged to the river. Figure IV-1 indicates the service area of the Sewer Districts.

Broome County

Binghamton-Johnson City Joint Sewage Treatment Plant

Raw sewage from the Binghamton-Johnson City area was discharged to the Susquehanna River prior to 1960. At that time, the City constructed a primary treatment plant, with a design capacity of 10.0 mgd to serve the City of Binghamton, Harpur College (SUNY), and the eastern part of Vestal.

Johnson City was discharging raw sewage prior to 1968, when a joint sewage board was formed by the City of Binghamton and the Village of Johnson City. As a result of this agreement, the Binghamton primary treatment plant was expanded to handle wastewater flows from both communities. Capability for secondary treatment was added to the primary treatment plant and the secondary system began operating in the spring of 1973.

Binghamton and Johnson City have both combined and separate sewers, with the majority being of the combined type. Some of the oldest sewers in Binghamton were installed in 1912-13, and in several parts of the City, substantial infiltration into sewers and interceptors is occurring.

The secondary system may operate as either activated sludge or contact stabilization, and was designed with a capacity of 18.25 mgd average daily flow. Based on treatment plant records, there is reason to suspect that this estimate is overly conservative.

TABLE IV-3

EXISTING WASTEWATER MANAGEMENT SYSTEMS

Name of Institution	Service Area and Population	Design Capacity	Type of Treatment	Type of Sewers	Effluent Discharge	Method of Sludge Handling	Digested Sludge Produced Dry Solids (T/Day)
Binghamton-Johnson City Joint Sewage Treatment Plant	Binghamton City, Village of Johnson City, Town of Binghamton (Dist. 1-4, 6, 8) Town of Kirkwood (Dist. #1), Town of Vestal (Dist. 4, 7, 11, 12), Town of Dickinson (Dist. 2, 3, and Stella District), Town of Port Dickinson, Town of Union (Westover S.D.), and Harpur College (100,000 population)	18.25	Activated sludge or contact stabilization and chlorination (Secondary)	Comb.-70% Sep.-30%	S.R.(C)* MP 36.9	Anaerobic digester, mechanical dewatering, vacuum filtration, land fill or to public as soil conditioner	5.5
Vestal Sewage Treatment Plant	Sewer Districts 1, 5, 6 (7,500 population)	1.00	Primary treatment and chlorination (Primary)	Separate	S.R.(C) MP 30.5	Anaerobic digester, drying beds, and to public as soil conditioner	0.28+
Endicott Sewage Treatment Plant	Endicott Village, Endwell, Park Manors, North Endicott, West Endicott, West Corners, Airport Heights (44,700 population)	7.67	High rate trickling filter and chlorination (Secondary)	Comb.-15% Sep.-30%	S.R.(C) MP 29.4	Anaerobic digester, mechanical dewatering vacuum filtration, & land fill	2.64
Owego Town Sewage Treatment #1	W. Section of Town of Owego, S.D. #1 (2,900 population)	0.50	Trickling filter & chlorination (Secondary)	Separate	S.R.(B) MP 18.3	Anerobic digesters, liquid sludge for land application	0.19
Owego Town Sewage Treatment Plant #2	E. Section of Owego Town: S.D. 2, 3, 6, 8 (6,500 population)	2.0	Activated sludge or contact stabilization and chlorination (Secondary)	Separate	S.R.(B) MP 25.4	Anaerobic digester, liquid sludge for land application	0.42
Owego Village Sewage Treatment Plant	Other than Valley View Service Area (3,600 population)	0.62	Primary treatment and chlorination (Primary)	Comb.-65% Sep.-35%	S.R.(C) MP 15.8	Anaerobic digester, drying beds, and disposed to land fill	0.14+
Owego Village - Valley View Sewage Treatment	Small community in southern section of the Village (50 population)	-	Imhoff tank and chlorination (Primary)	Separate	S.R.(C) MP 16.7	Anaerobic digester, drying beds, and to public as soil conditioner	0.02+

*The first line represents river classification (S.R. = Susquehanna River) and the second line is the mile point from New York-Pennsylvania border near Waverly.

TABLE IV-4

WASTE CHARACTERISTICS FOR EXISTING WASTEWATER MANAGEMENT SYSTEMS - 1973*

Name	Avg. Flow (mgd)	BIOLOGICAL OXYGEN DEMAND				SUSPENDED SOLIDS			
		INFLUENT (mgd)	EFFLUENT mg/l	EFFLUENT lbs/day	% Removal	INFLUENT (mgd)	EFFLUENT mg/l	EFFLUENT lbs/day	% Removal
Binghamton-Johnson City ** Joint Sewage Treatment Plant (STP)	18.30	229	17	2,600	93	454	30	4,600	93
Vestal STP	1.00	240	140	1,200	42	139	42	350	70
Endicott STP	4.27	150	37	1,300	75	167	37	1,300	78
Owego Town STP #1	0.20	156	28	90	82	182	38	130	79
Owego Town STP #2	0.37	145	10	30	93	135	17	50	88
Owego Village STP	0.90	-	78	300	-	-	42	180	-
Owego Village - Valley View STP	0.05	-	200	90	-	-	-	-	-

*Note: Information in the table is obtained from treatment plant operation records. Binghamton-Johnson City Sewage Treatment Plant was converted to a secondary system in May 1973. For Endicott, averages are for the operating data from July 1973 through February 1974.

**Refer to Figure IV-1 for location.

SEWAGE TREATMENT PLANTS AND THEIR SERVICE AREAS

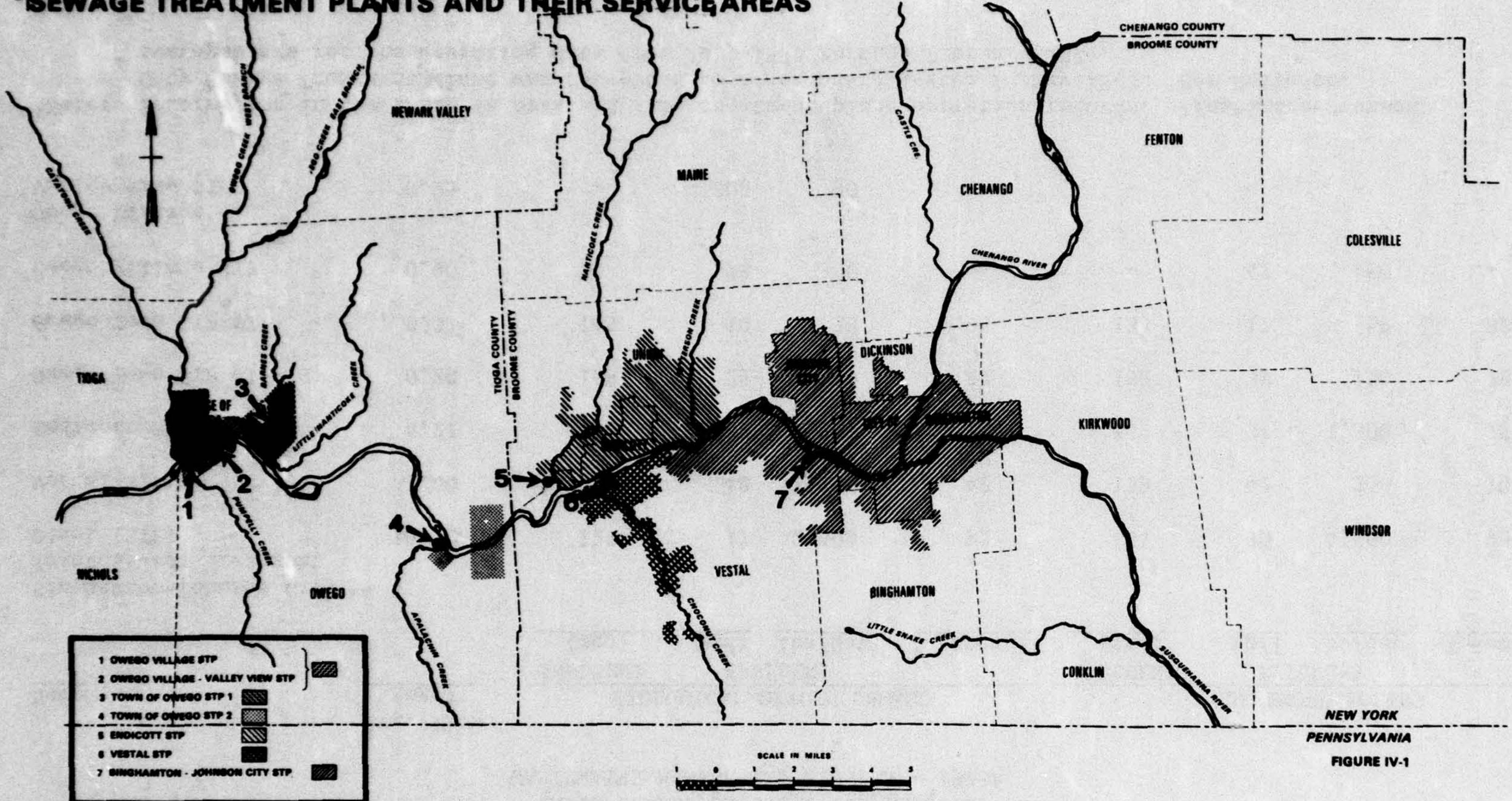


FIGURE IV-1

Primary sludge is withdrawn continously and distributed to three thickeners. Excess activated sludge is transferred, as needed, to the thickeners. Thickened sludge is digested in anaerobic digesters and then dewatered by vacuum filters. The dewatered sludge had been used in private horticultural operations as a soil conditioner. Recently, the owner notified the Joint Sewage Board that this was no longer acceptable. At the present time, a temporary arrangement has been worked out for continued disposal of sludge at this land fill site.

Vestal Sewage Treatment Plant

Since 1960, a primary treatment plant with a design capacity of 1.0 mgd has served Vestal. The western section of Vestal (Rose Corners and Castle Gardens) is presently served by subsurface individual treatment systems. The eastern section, (Sewer Districts 4, 7, 11, and 12) and SUNY at Binghamton are served by the Binghamton-Johnson City STP. In 1976, the Vestal facility will be abandoned after an interceptor is constructed to carry wastewater to the Endicott Sewage Treatment Plant.

Consequently, there are current plans to build two interceptors; one which will transport sewage from the Vestal Plant to Endicott, and a second to serve Rose Corners and Castle Gardens. New York State Department of Environmental Conservation has approved the Federal and State portion, 75 and 12.5% respectively, of the construction grant to build both the interceptors.

As the oldest sewers in Vestal were laid in 1951, with some of them modified in 1961, they are in good condition.

Endicott Sewage Treatment Plant

The Endicott Sewage Treatment Plant serves the Village of Endicott, Endwell, North Endicott, West Endicott, West Corners, Airport Heights, and the sewered communities contiguous to these areas in the Town of Union.

The primary treatment unit, which has a capacity of approximately 12 mgd was put into operation in July 1966, and prior to that, the untreated sewage from the area was discharged directly to the Susquehanna River. Endwell was discharging untreated sewage up to April 1972 before connecting to the Endicott Plant. Primary treatment was upgraded to high rate trickling filter type secondary treatment in April-May 1973. The design capacity of the plant is 7.67 mgd.

The Village of Endicott is completely sewered and has separate sewers in approximately 85 percent of the area and combined sewers in the remaining 15 percent of the area. Areas adjacent to the village boundary in the Town of Union have separate sewers. The sewers in the Village of Endicott and outlying areas are in good condition and will not need any replacement in the near future.

Primary and secondary sludge is treated in anaerobic digesters and dewatered with vacuum filters and then trucked to the Endicott sanitary landfill site.

Tioga County

Town of Owego Sewage Treatment Plants

The Town of Owego is divided into two sections, the eastern section in the Apalachin Creek area, and the western section east of the Village of Owego. Sewer Districts (S. D.) 1, 3, and 5 are located on the north bank of the Susquehanna River and Districts 2, 6, and 8 are located on the south bank. Presently, S. D. 1 and 5 are served by Treatment Plant #1 and S. D. 2, 3, 6, and 8 are served by Treatment Plant #2.

Town of Owego Treatment Plant No. 1. Since 1957, a primary treatment plant was serving S. D. #1. During 1972 it was upgraded to a trickling filter type secondary facility, having a design capacity of 0.5 mgd average flow. S. D. 5 was included in the service area at that time.

The oldest sewer lines in S. D. 1 were laid in 1953 and since then, have gradually extended to new areas. The sewers are separate and in good condition and will not need replacement in the near future.

Influent and effluent wastewater characteristics and BOD and SS removal efficiencies were listed in Table IV-4. BOD and SS removal efficiencies averaged over 75 percent for 1973. However, under the secondary treatment guidelines, better than 85 percent removal efficiencies, or monthly average effluent BOD and SS concentrations less than 30 mg/l, are expected. Therefore, it may be necessary to upgrade the treatment system by either changing operating conditions or by providing additional treatment.

Owego Town STP No. 2. Prior to building this treatment facility in 1972, the eastern portion of the town was served by two primary treatment plants. One was serving S. D. 3 and the other S. D. 2. In 1972, secondary treatment was installed on the south bank of the River, and the primary plants were abandoned. An interceptor was built to connect S. D. 3 from the north bank of the river to the secondary system. This facility was designed for a capacity of 2.0 mgd and the mode of operation can be either conventional activated sludge or contact stabilization.

Primary and secondary sludge is digested in anerobic digesters, and liquid digested sludge is used for land application. Drying beds are available on-site for emergency use. Separate sewers serving S. D. 2, 3, 6, and 8 are in good condition since the oldest sections were built in 1960-61.

Owego Village Sewage Treatment Plants

The Village of Owego has two primary treatment systems. One is actually a preliminary system; an Imhoff Tank at Valley View. In an Imhoff Tank, the BOD and SS removal efficiencies average 10 percent. The Valley View plant serves a population of 500 and the Village primary treatment plant, which began operating in 1966, serves approximately 3,600 people.

The Village has had combined sewers in the central area since 1900. Since 1965, separate sanitary sewers were put in the northern and eastern sections of the Village. The Village has separate sewers in 35 percent of the area; the remaining portion has combined sewers. The Village plant receives high infiltration during storms.

Recent studies recommended building a south-side interceptor to transport sewage from Valley View to the Village plant. The Valley View plant would be abandoned and the Village plant upgraded to a trickling filter secondary treatment system with a dry weather design flow of 1.0 mgd. The studies strongly suggest a need for separate sewers. Proposals for construction grants for the projects have been filed with New York State Department of Environmental Conservation and preliminary work on upgrading the Owego Village STP has begun.

INDUSTRIAL WASTEWATER MANAGEMENT SYSTEMS

Table IV-5 summarizes the major industrial discharges from the industries to streams or rivers in Broome and Tioga Counties and Figure IV-2 shows the locations of these discharges. Total discharge from the industries amounts to about 94 mgd. Approximately 87 percent (83 mgd) of the total industrial wastewater discharge is cooling water. Wastewater flows for industries discharging to municipal sewers are not included in the totals. Wastewater characteristics for the discharges to the river are summarized below, since direct industrial discharges to rivers are used in determining compliance with NYSDEC water quality standards.

DESCRIPTION OF EXISTING INDUSTRIAL WASTES

Plating Wastes

IBM, Endicott, 2.52 mgd

The effluent receives physical-chemical treatment (chemical precipitation, coagulation, and settling) before discharge. Copper and chromium pollutants in the discharge averaged 0.814 and 0.165 mg/l, respectively. Suspended solids concentration in the discharge averages less than 13 mg/l or 27 pounds per day.

IBM, Owego, 0.3 - 0.6 mgd

The nature of the effluent is similar to the IBM Endicott discharge, since comparable treatment is provided.

Robin Tech., Inc., Owego, 1.0 mgd

Untreated plating waste is discharged to Barnes Creek, which flows to the Susquehanna River. No definite plans for treating the waste were available, but some form of treatment may be required in the future.

TABLE IV-5

SUMMARY OF INDUSTRIAL DISCHARGES*

No.	Name	Quantity (mgd)	Type	Discharge Location**
A1	IBM, Owego	0.3-0.6	Treated Plating Waste	S.R. (MP 18.4)
A2	IBM, Owego	0.02-0.06	Cooling	S.R. (MP 18.5)
B	Robintech, Inc., Owego	0.10	Plating Waste	Barnes Creek
C1	IBM, Glendale	0.038	Cooling	Nanticoke Creek
C2	IBM, Glendale	0.13	Cooling	Nanticoke Creek
D	Union Forging, Endicott	0.15	Cooling	S.R. (MP 31.5)
E	IBM, Endicott	2.52 1.80	Treated Plating Waste Cooling	S.R. (MP 32.5) via storm sewers
F	Endicott Forging and Manufacturing, Endicott	0.014 0.022	Cooling	S.R. (MP 32.7) via storm sewers
G	GAF, Vestal	0.02	Cooling	Willow Run Creek via Small Creek
H	Barney & Dickinson, Vestal	1.0	Gravel washing, after settling	S.R.
I	GE, Johnson City	0.23 0.49	Cooling process	Little Choconut Creek Little Choconut Creek
J_1	NYSE & G, Johnson City	79.1	Cooling	Little Choconut Creek
J_2		2.23	Ash Pond Discharge	Little Choconut Creek

TABLE IV-5 Continued

No.	Name	Quantity (mgd)	Type	Discharge Location
K_1	Endicott-Johnson,	0.45	Cooling	Little Choconut Creek
K_2	Johnson City	0.40	Ash Pond Discharge	via storm sewer
L	GAF, Binghamton	1.0	Process	Chenango River via
	GAF, Binghamton	3.48	Cooling	storm sewer
	Corbisell Quarries, Vestal***	0.02	Gravel washing after settling	S.R. via unnamed creek
	Aĺlred Asphalt, Vestal***	0.22	Cooling	S.R. via unnamed creek
	Central Asphalt***	0.0011	Cooling	S.R. via unnamed creek
	TOTAL	93.91		

* See Figure IV-2 for location.
** S.R. = Susquehanna River; MP = mile point from New York-Pennsylvania border near Waverly.
*** Not shown on map.

MAJOR INDUSTRIAL DISCHARGES

SEE TABLE IV-5 FOR KEY TO INDUSTRIAL DISCHARGES

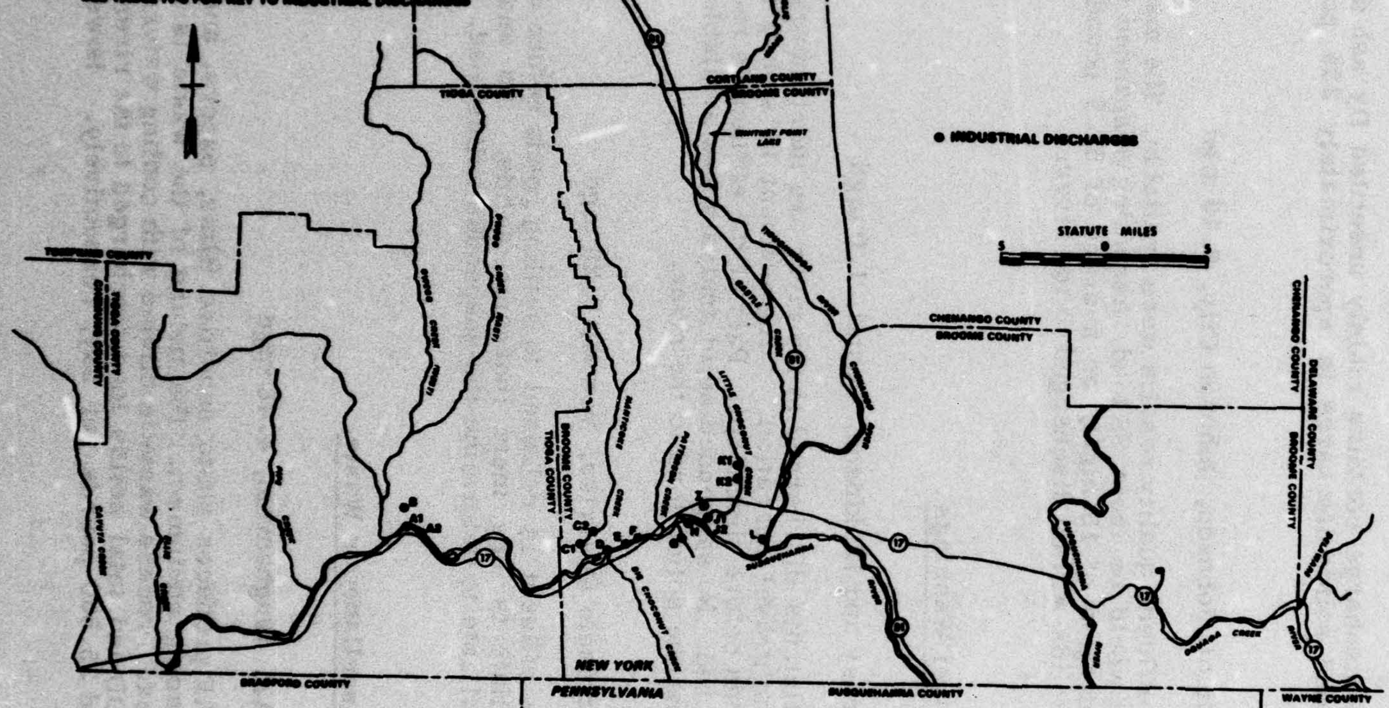


FIGURE IV-2

Ash Pond Discharges

New York State Electric and Gas Company, Johnson City, 0.92 mgd

The discharge contains mainly unsettled fly ash dust. Suspended solids discharge is approximately 235 pounds per day.

Endicott Johnson, Johnson City, 0.40 mgd

No effluent quality results were available. The major pollutant would be inert SS load. Assuming suspended solid concentration of 15 mg/l, an average of 52.5 pounds per day of solids will be discharged to the river.

Gravel Washings

Barney and Dickinson, Vestal, 1.0 mgd

Pollutants discharged to the river are inert inorganic solids from gravel operation. The effluent is stored in settling ponds before discharge. Part of the effluent is recycled and reused. No suspended solid analysis was available to determine the solids load to the river.

Carbiselo Quarries, Vestal, 0.20 mgd

The effluent is released to settling ponds before discharge. Pollutants are inert inorganic solids. No analysis was available to determine the suspended solids load.

Miscellaneous Waste

GAF, Binghamton, 4.48 mgd

GAF produces photo sensitive films, papers, and film processing equipment. The nature of the waste is quite complex. Process waste is diluted with cooling water discharge. BOD and total solids load discharged to the river are 1,850 and 25,560 pounds per day, respectively. However, plans were being made to pretreat part of this waste with subsequent discharge to the Binghamton sewer system.

General Electric, Johnson City, 0.,49 mgd

General Electric manufactures electrical and electronic equipment for aerospace control systems. Waste contains low suspended solids (4 mg/l), and heavy metals such as nickel, copper, and chromium (0.17, 0.06, 0.11 mg/l, respectively). However, 46.3 pounds per day of total oily matter is discharged.

GUIDELINES FOR DISCHARGE OF INDUSTRIAL WASTEWATER

In accordance with P. L. 92-500, EPA has published effluent limitation guidelines and pretreatment standards for different categories of industries.

The proposed guidelines and standards have been periodically amended into Federal regulations. Effluent limitation guidelines apply to those industries which discharge wastes directly to creeks, streams, or rivers. Pretreatment standards apply to those industries which discharge wastes to publicly owned treatment works for additional wasteload reduction.

Effluent Limitation Guidelines

The limitations on industrial effluent discharged directly to streams or rivers are set to attain the waste reduction envisioned by the application of the Best Practicable Control Technology Currently Available (BPT) by the year 1977. By 1983, sources other than publicly owned treatment works are expected to apply the Best Available Control Technology Economically Available (BAT) to effluent discharges. Under the National Pollutant Discharge Elimination System (NPDES) established by P. L. 92-500, any industry discharging effluent to rivers or streams has to obtain a discharge permit. This discharge permit establishes the limitations of pollutant load that can be discharged to the stream and is set after considering factors such as: the nature of the industry, the amount of product manufactured, the process of manufacturing, the age of the plant, water usage, and stream classification at the discharge point. The discharge permit is issued on an individual basis.

In Broome and Tioga Counties, the major industries discharging to streams are the plating industry, gravel washing operations, electric power plants, photographic equipment and supplies manufacturing, and aerospace control systems equipment manufacturing.

Pretreatment Standards

Conformance to pretreatment standards is required for industries discharging wastewater to publicly owned treatment works (POTW). These standards are intended to protect the operation of a POTW and to prevent the introduction of pollutants into a POTW which the treatment plant cannot process adequately. The GAF plant at Binghamton is expected to complete a physical-chemical treatment system in 1976 for pretreatment of about 1.0 mgd of process waste. Discharge to sanitary sewers will follow, with additional treatment at the Binghamton-Johnson City sewage treatment plant.

No information was available concerning the quantity and quality of the waste and the type of pretreatment provided for the effluent from other industries. No apparent harmful effects of industrial waste have been observed at municipal treatment plants, except at the Endicott STP which experienced a heavy metals problem in the spring of 1975.

CHAPTER V

EXISTING WATER AND RELATED LAND RESOURCE PROBLEMS

This chapter identifies and assesses existing water resource and related land resource problems in the Bicounty Area. The discussion is divided into two sections. One section considers water resource problems with particular emphasis on water quality. Existing state standards for water quality, problems with infiltration/inflow, non-point sources of pollution, and sludge management are appraised. The second section considers water related land resource problems.

WATER RESOURCE PROBLEMS

WATER SUPPLY

Most municipal and private supply systems rely on groundwater, and except for private residences and developments in the upland areas, aquifers are capable of delivering essentially unlimited quantities of high quality water.

Comparison of developed water supply capacities and current demand of the existing supply systems indicates a capacity of 105 mgd and demand of 23 mgd in Broome County and a capacity of 10 mgd and demand of 4 mgd in Tioga County.

None of the systems in Broome County are currently experiencing supply problems and Waverly and Candor are the only areas in Tioga County which currently require capacity expansion. Recent studies concluded that the quantity of surface and groundwater supplies will not be a problem in the foreseeable future.

FLOOD CONTROL

The problem of major flooding in the Binghamton area is currently being studied by the Corps of Engineers under separate authorization. Flood control alternatives to reduce costly damage are being investigated in detail. For the purpose of the present report, only a discussion of historical floods will be presented.

Two significant floods have occurred in the Bicounty Area during the past 40 years. These floods occurred in July 1935 and March 1936 and have been described in Chapter II. Briefly, the July 1935 flood was caused by a series of intense thunderstorms, mostly in the Chenango River Basin. The crest of the Chenango River rose rapidly, and large sections of the City of Binghamton were flooded with hundreds of families being evacuated from their homes. The other major flood in March 1936 was caused by rain falling for several days on an unusually heavy snowpack. When the Susquehanna River crested, all previous recorded floods were equalled or exceeded throughout the Basin. Damages in the Binghamton area were approximately 46 million dollars adjusted to 1972 prices.

In June 1972, Tropical Storm Agnes passed over the upper Susquehanna River Basin causing extensive damage. Relatively little loss occurred in the Binghamton area, though, because the storm centered over the Chemung River about 60 miles to the west. A storm of Agnes proportions has been simulated over the eastern portion of the Susquehanna Basin to observe the effects of intense rainfall and heavy runoff in this area. The results indicated that the local flood protection systems around Binghamton would be overtopped by several feet. More than 600 blocks of urban, suburban, industrial, and commerical area would be flooded causing approximately 950 million dollars worth of damage adjusted to 1972 prices.

WATER QUALITY

The surface and groundwaters of Broome and Tioga Counties are in no sense severely polluted. The groundwaters, which serve as an abundant water supply resource, are generally of high quality and are in little danger of degradation from present wastewater disposal practices in the foreseeable future. Surface water quality has improved markedly since 1971 with the installation of four secondary treatment plants along the Susquehanna River. Design capacity of these four plants totals about 28.5 mgd, while the three remaining primary plants have a total design capacity of about 1.6 mgd. Treatment is now provided for nearly 90 percent of the municipal wastewaters of the Urban Study Area. In addition, water pollution from industrial discharges is being brought under control by individual treatment processes or by transmission of wastewater to municipal plants.

In spite of the numerous improvements in wastewater systems of the Bicounty Area during recent years, certain problems existed which required detailed study. Some of the more important considerations were the achievement of State water quality standards, the enhancement of recreation and scenic opportunities, and the provision for the collection and treatment of future wastewater flows. Associated water quality problems were the control of combined sewer overflows during intense storms, control of infiltration from surface and groundwater into the sewer system, provisions for improved sludge management practices, management of non-point sources of pollution, and an assessment of the overall effect of existing water quality conditions on the aquatic environment. Yet another issue which was critical to plan formulation activities is the actual treatment capacity of the Binghamton-Johnson City STP. Implicit in the solutions for any of these water quality management problems is conformance to the goals and objectives of P. L. 92-500.

Achievement of Water Quality Standards

The Susquehanna River and its tributaries in Broome and Tioga Counties have four basic water quality classifications. These classifications are shown in Figure V-1, and are defined in Table V-1. The main stem of the Susquehanna has A, B, and C classifications. The Chenango and Tioughnioga Rivers and Cayuta Creek are Class B waters. The main

WATER QUALITY CLASSIFICATION
(UNLABELLED STREAMS CLASS C-TROUT)

SEE TABLE V-1

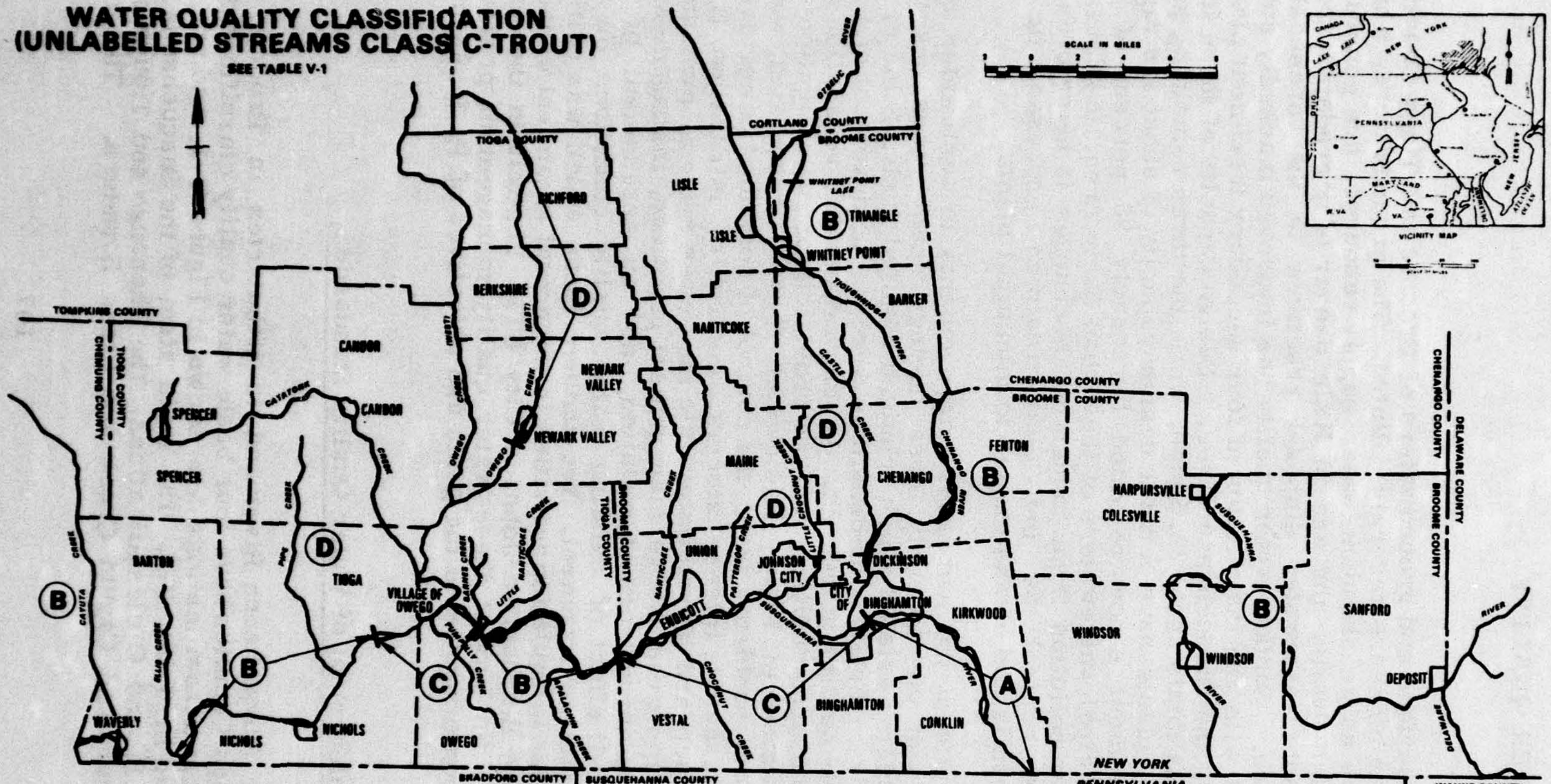


FIGURE V-1

stems of major creeks such as Owego and Nanticoke are Class C trout waters, and the remaining small streams, many of which are intermittent, have a D classification.

TABLE V-1

CLASSIFICATION OF SURFACE WATERS

BY NEW YORK STATE

Classification	Best Usage
A	Source of water supply for drinking, culinary or food processing purposes, and other usages.
B	Primary contact recreation and any other uses except as a source of water supply for drinking, culinary, or food processing purposes.
C	Suitable for fishing and all other uses except as a source of water supply for drinking, culinary, or food processing purposes, and primary contact recreation.
D	These waters are suitable for secondary contact recreation, but due to such natural conditions as intermittency of flow, or upstream bed conditions, the waters will not support the propagation of fish.

Water quality standards that apply to the stream classifications have been published by New York State pursuant to the Environmental Conservation Law. Table V-2 presents the New York State water quality standards. With the exception of coliforms, phenols, and radioactivity, standards for Classes A, B, and C are identical. Class B waters have the highest coliform standards, while phenol and radioactivity requirements apply only to Class A. Within the Broome and Tioga Counties area, the most stringent dissolved oxygen standards apply to Class C trout waters. It should be noted that with the exception of phenols and radioactivity, Class B represents the highest quality standards of the A, B, and C waters of the Susquehanna, Chenango, and Tioughnioga Rivers.

TABLE V-2

NEW YORK STATE WATER QUALITY STANDARDS

COLIFORM (#/100 ml)

1. Monthly median for minimum of five examinations - maximum value.

2. Maximum value for 80% of samples.

3. Monthly geometric mean fecal coliform from minimum of five examinations - maximum value.

	Class A	Class B	Class C	Class D
1. Median:	5,000	2,400	10,000	-
2. 80%:	20,000	5,000	-	-
3. Fecal:	200	200	2,000	-

DISSOLVED OXYGEN

For cold waters suitable for trout spawning, the DO concentration shall not be less than 7.0 mg/l from other than natural conditions. For trout waters, the minimum daily average shall not be less than 6.0 mg/l. At no time shall the DO concentration be less than 5.0 mg/l. For non-trout waters, the minimum daily average shall not be less than 5.0 mg/l. At no time shall the DO concentration be less than 4.0 mg/l. For class D waters DO shall not be less than 3 mg/l at any time.

pH

Class A, B, C:	6.5 - 8.5
Class D:	6.0 - 9.5

TOTAL DISSOLVED SOLIDS

The maximum level for A, B, and C waters is 500 mg/l.

Table V-2 (Continued)

PHENOLIC COMPOUNDS (Class A, only)

Maximum value of 0.005 mg/l (Phenol).

RADIOACTIVITY (Class A; only)

a. Gross Beta - maximum of 1,000 picocuries per liter in absence of Strontium 90 and alpha emitters.

b. Radium 226 - maximum of 3 picocuries per liter.

c. Strontium 90 - maximum of 10 picocuries per liter.

TOXIC SUBSTANCES
(Applicable to all Classifications)

With reference to certain toxic substances affecting fishlife, the establishment of any single numerical standard for waters of New York State would be too restrictive. There are many waters, which because of poor buffering capacity and composition will require special study to determine safe concentrations of toxic substances. However, most of the non-trout waters near industrial areas in this state will have an alkalinity of 80 milligrams per liter or above. Without considering increased or decreased toxicity from possible combinations, the following may be considered as safe stream concentrations for certain substances to comply with the above standard for this type of water. Waters of lower alkalinity must be specifically considered since the toxic effect of most pollutants will be greatly increased.

Ammonia or Ammonia Compounds:	Maximum of 2 mg/l (NH_3 at pH 8.0)
Cyanide:	Maximum of 0.1 mg/l CN
Ferro or Ferricyanide:	Maximum of 0.4 mg/l $Fe(CN)_6$
Copper:	Maximum of 0.2 mg/l
Zinc:	Maximum of 0.3 mg/l
Cadmium:	Maximum of 0.3 mg/l

The dissolved oxygen (DO) standard was of prime importance during plan formulation, assessment, and evaluation procedures documented elsewhere in this report. For the main stem of the Susquehanna River downstream of the water supply intake for the City of Binghamton, the applicable DO standard is stated as follows: "For non-trout waters, the minimum daily average shall not be less than 5.0 mg/l. At no time shall the DO concentration be less than 4.0 mg/l."

Since DO concentrations are a function of the volume of stream flow, the standard must be applied to a specific stream flow. The NYSDEC currently uses the minimum-average-seven-consecutive-day flow which has a probability of occurring once in 10 years (MA-7-CD-10 flow). The MA-7-CD-10 flow is used throughout New York State for water quality planning purposes.

Existing Water Quality Data

Causes of water degradation in the area include both point source wastewater discharges from industries and municipal treatment plants, and nonpoint source pollution associated with urban and rural runoff. Existing municipal sewage and industrial wastewater discharges have been described in Chapter IV. Locations of municipal and industrial discharges are indicated in Figure IV-1 and IV-2, respectively. With one exception, such discharges have not been sufficient quantity or low enough quality to constitute major pollution sources. The one exception, the GAF plant in Binghamton, has recently initiated a program to pretreat its process wastewater before discharging to the City's sewage system. Prior to 1976, about 1.0 mgd of untreated wastewater was discharged to the Chenango River.

Both the NYSDEC and the Broome County Health Department (BCHD) maintain water quality sampling stations on the Chenango, Tioughnioga, and Susquehanna Rivers as shown on Figure V-2 and listed in Table V-3. The first letter of the sampling station number (A, B, or C) indicates the river classification at that point. Sampling stations for surface water quality are not maintained on streams other than the Chenango, Tioughnioga, and Susquehanna Rivers.

WATER QUALITY SAMPLING STATIONS

SEE TABLE V-3

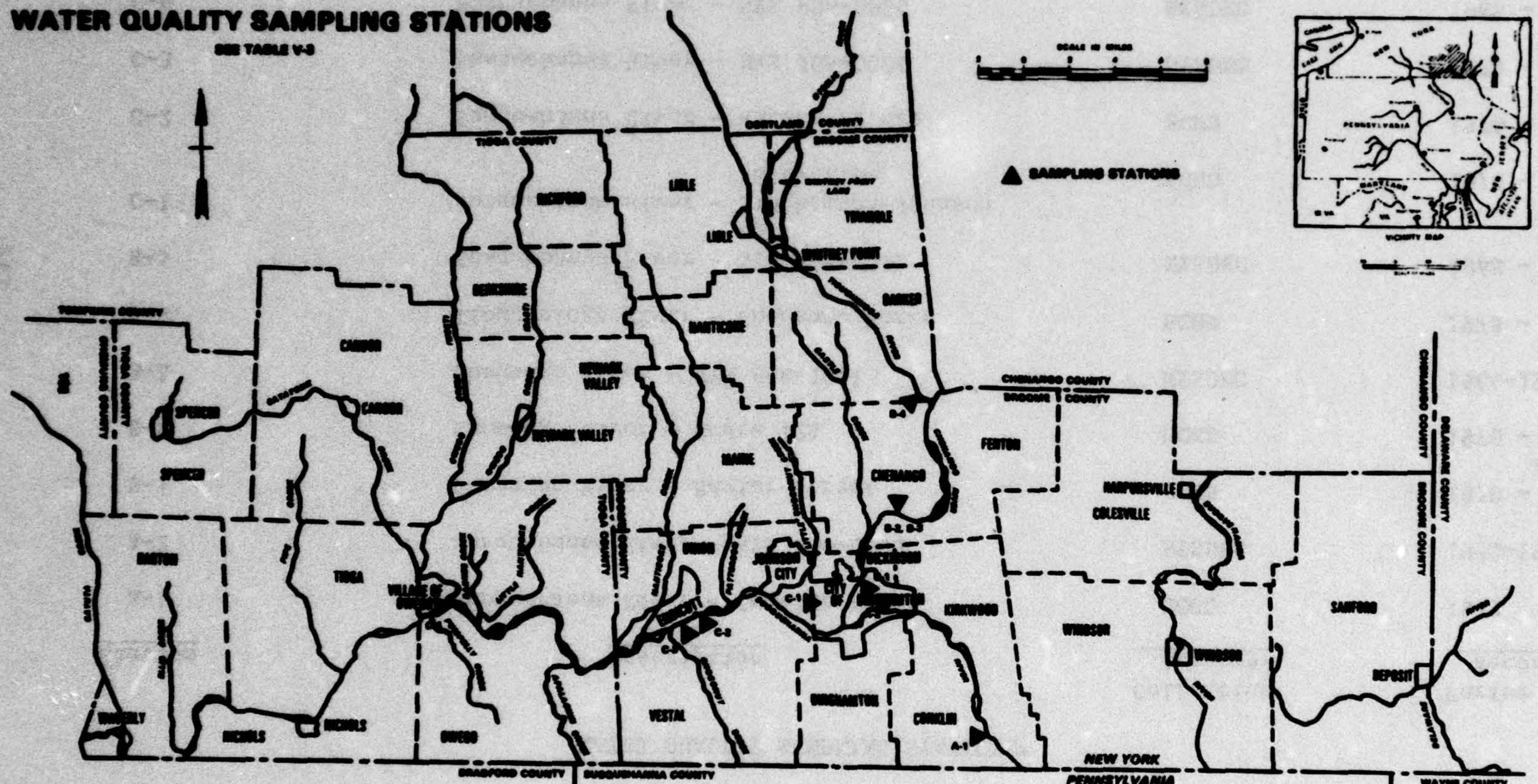


FIGURE V-2

TABLE V-3

WATER QUALITY SAMPLING STATIONS*

Station	Description	Collection Agency**	Period of Record
A-1	Susquehanna River - Conklin Forks	BCHD	1973
A-2	Susquehanna River - NYS #06-0002	NYSDEC	1953-1968
B-1	Chenango River - Bevier Street	BCHD	1970 -
B-2	Chenango River - Route 12A	BCHD	1970 -
B-3	Chenango River - NYS #06-1091	NYSDEC	1964-1967
B-4	Tioughnioga River - Chenango Forks	BCHD	1973 -
B-5	Susquehanna River - NYS #06-0015	NYSDEC	1968 -
C-1	Susquehanna River - Binghamton-Johnson City Line	BCHD	1970 -
C-2	Susquehanna River - Watson Bridge	BCHD	1970 -
C-3	Susquehanna River - NYS #06-0006	NYSDEC	1970 -
C-4	Susquehanna River - NYS #06-0020	NYSDEC	1968 -

*See Figure V-2.
**BCHD - Broome County Health Department
NYSDEC - New York State Department of Environmental Conservation

Sampling results are presented in various tables following this section. Table V-4 summarizes the sampling results for the standard parameters such as coliforms, pH, dissolved solids, dissolved oxygen, and ammonia for each sampling station.

In addition, Table V-5 shows some sampling results for supplemental parameters such as total suspended solids, total nitrogen, phosphate-phosphorous, 5-day BOD, chemical oxygen demand (COD), turbidity, and chlorides. Observed concentrations of metals are presented in Table V-6.

Although the data displayed in Tables V-4, V-5, and V-6 were indicative of existing water quality conditions, it was interpreted with care. First, secondary treatment was not installed at major wastewater discharges until 1973. Hence, most data reflected the discharges of primary effluents and were not indicative of current water quality conditions associated with less contaminating secondary effluents. Secondly, historical data may have reflected the impact of industrial discharges which were no longer occurring. Finally, the magnitude of the river flows influence the concentrations of pollutants. Recorded concentrations at high river flows are in no sense representative of quality levels at low river flows. River discharges during low flow months of July through October are compared in Table V-7. It is important to note that during none of these years did the low flow drop below the MA-7-CD-10 flow which NYSDEC uses for water quality planning purposes.

TABLE V-4

WATER QUALITY SAMPLING RESULTS - STANDARD PARAMETERS

Susquehanna River Upstream of Binghamton

	Station A-1 (1973)	Station A-2 (1953-1968)
Coliform		
median:	510	-
(#/100 ml) 80%	870	-
pH	-	
range:	7.0 - 7.8	6.6 - 7.8
Dissolved Solids		
(mg/l) mean:	-	113
range:		23 - 207
Dissolved Oxygen		
(mg/l) mean	-	10.6
range:	7.2 - 10.6	7.9 - 14.1
Ammonia		
(mg/l) mean:	-	0.3
range:		0 - 1.1

Susquehanna River - Binghamton

	Station C-1		
	1971	1972	1973
Coliform			
median:	3,300	2,050	3,600
(#/100 ml) 80:	5,400	4,500	9,300
pH	-	-	-
range:	7.0 - 7.7	7.0 - 8.0	6.8 - 7.9
Dissolved Solids			
(mg/l) mean:			
range:	-	-	-
Dissolved Oxygen			
(mg/l) mean:	8.0	9.0	8.8
range:	6.6 - 10.2	7.4 - 11.0	6.8 - 10.6
Ammonia			
(mg/l) mean:			
range:			

TABLE V-4 (Continued)

Susquehanna River - Vestal

	Station C-2		
	1971	1972	1973
Coliform median:	22,000*	4,600	2,400
(#/100 ml) 80%:	68,000	19,000	5,100
pH range:	7.2 - 8.3	7.0 - 7.7	7.0 - 8.0
Dissolved Solids (mg/l) mean:			
range:			
Dissolved Oxygen (mg/l) mean:	6.5	7.6	8.4
range	4.6 - 9.2	5.0 - 10.0	6.6 - 10.4
Ammonia (mg/l) mean:	-	-	-
range:			

	Station C-3		
	1968-70	1971	1972
Coliform median:	-	15,000*	5,300
(#/100 ml) 80%:		120,000	22,000
pH range:	6.4 - 8.2	6.4 - 8.3	6.7 - 8.1
Dissolved Solids (mg/l) mean:	164	163	116
range:	12-275	74-527	76-168
Dissolved Oxygen (mg/l) mean:	9.2	7.3	9.6
range:	*3.4 - 14.6	5.0 - 13.6	7.2 - 13.6
Ammonia (mg/l) mean:	0.4	0.3	0.2
range:	0.1 - 1.50	0 - 1.0	0 - 0.3

*Violation of Water Quality Standards

TABLE V-4 (Continued)

Susquehanna River - Owego

	Station C-4 1971	1972
Coliform median:	14,000*	2,850
(#/100 ml) 80%:	49,000	7,600
pH range:	7.4 - 8.2	7.3 - 8.2
Dissolved Solids (mg/l) mean:	200	141
range:	80 - 365	95 - 264
Dissolved Oxygen (mg/l) mean:	8.5	10.1
range:	7.0 - 9.8	6.7 - 12.9
Ammonia (mg/l) mean:	0.2	0.2
range:	0 - 0.7	0.1 - 0.8

Susquehanna River - Waverly

	1968-70	Station B-5 1971	1972
Coliform median:	-	6,400*	1,000
(#/100 ml) 80:		9,300*	19,000*
pH range:	6.2 - 8.3	7.0 - 8.3	7.0 - 7.2
Dissolved Solids (mg/l) mean:	154	167	166
range:	83-297	123-209	89-249
Dissolved Oxygen (mg/l) mean:	10.0	10.2	9.6
range:	6.2 - 14.5	6.4 - 13.4	7.4 - 13.6
Ammonia (mg/l) mean:	0.3	0.2	0.1
range:	0 - 1.0	0.1 - 0.5	0 - 0.1

*Violation of Water Quality Standards

TABLE V-4 (Continued)

Chenango River

	Station B-1 1971	Station B-1 1972	Station B-1 1973	Station B-3 1964-67
Coliform median:	340	390	230	
(#/100 ml) 80%:	1,100	990	850	
pH range:	7.2-8.6	7.1-8.0	7.1-8.0	7.1-8.6
Dissolved Solids (mg/l) mean:	-	-	-	122
range:				12-250
Dissolved Oxygen (mg/l) mean:	8.0	8.4	8.2	
range:	5.0-12.0	7.0-10.6	6.0-11.2	
Ammonia (mg/l) mean:	-	-	-	0.3
range:				0-0.9

	Chenango River-Station B-2 1971	Chenango River-Station B-2 1972	Chenango River-Station B-2 1973	Tioughnioga River Station B-4 1973
Coliform median:	1,200	170	200	305
(#/100 ml) 80%:	12,000*	600	2,000	2,700
pH range:	7.0-8.5	7.0-7.9	7.2-8.4	7.1-8.0
Dissolved Solids (mg/l) mean:	-	-	-	-
range:				
Dissolved Oxygen (mg/l) mean:	9.0	8.8	9.6	8.6
range:	5.2-12.2	7.2-10.8	7.0-12.6	6.8-11.4
Ammonia (mg/l) mean:	-	-	-	-
range:				

*Violation of Water Quality Standards

TABLE V-5

WATER QUALITY SAMPLING RESULTS - SUPPLEMENTAL PARAMETERS

	Total Suspended Solids (mg/l)	Total Nitrogen (mg/l)	Phosphate-Phosphorus (mg/l)	5-Day BOD (mg/l)	COD (mg/l)	Turbidity (Jackson Units)	Chlorides (mg/l)
Susquehanna Upstream							
A-1 1973	22	-	0.19	2.8	-	-	8.5
A-2 1953-68	25	0.9	0.07	1.6	9.5	23	7.3
Chenango River							
B-2 1971	15	-	-	2.6	-	-	14
1972	16	-	-	2.7	-	-	-
1973	24	-	0.16	2.9	-	-	13
B-3 1964-67	29	1.1	0.10	2.0*	14.5	13*	7.7
Susquehanna at Binghamton-Johnson City							
C-1 1971	32	-	-	3.4	-	-	-
C-2 1972	29	-	-	2.6	-	-	-
C-3	25	-	0.19	3.0	-	-	9.1
Susquehanna at Vestal							
C-2 1971	25	-	-	4.0	-	-	-
C-2 1972	49	-	-	3.5	-	-	-
C-2 1973	33	-	0.23	3.7	-	-	11.3
C-3 1968-70	45	1.6	0.13	2.6	11.8	23	9.7
C-3 1971	31	1.6	0.17	3.7	15	10	12.2
C-3 1972	34	1.6	0.06	1.5	11.8	18	9.9
Susquehanna at Owego							
C-4 1971	63	1.5	0.23	3.6	16.7	14	16.0
C-4 1972	80	2.1	0.15	1.9	13.8	30	11.3

TABLE V-5 Continued

	Total Suspended Solids (mg/l)	Total Nitrogen (mg/l)	Phosphate-Phosphorus (mg/l)	5-Day BOD (mg/l)	COD (mg/l)	Turbidity (Jackson Units)	Chlorides (mg/l)
Susquehanna above Waverly							
B-5 1968-70	38	1.5	0.14	2.4	13.4	26	10.0
B-5 1971	30	1.5	0.20	2.6	12.9	14	10.3
B-5 1972	40	1.4	0.11	1.8	9.5	19	8.8

* Single sample.

TABLE V-6

RESULTS OF WATER QUALITY SAMPLING FOR METALS

Susquehanna' River

	Station C-3		Station C-4	
	1971	1972	1971	1972
Cadmium (mg/l)	-	-	-	-
Calcium (mg/l)	25	-	32	27
Chromium (mg/l)	-	-	-	-
Cobalt (mg/l)	-	-	-	-
Copper (mg/l)	-	+	-	-
Iron (mg/l)	0.5	1.0	0.6	0.9
Lead (mg/l)	-	0.12	-	-
Magnesium (mg/l)	5.1	4.8	8.7	4.4
Manganese (mg/l)	0.04	0.04	0.03	0.07
Nickel (mg/l)	-	-	-	-
Potassium (mg/l)	1.3	1.4	1.6	1.6
Sodium (mg/l)	4.9	6.5	9.5	1.6
Zinc (mg/l)	-	-	-	-

+less than detectable limit

Susquehanna River Station B-5

	1971	1972
Cadmium (mg/l)	-	-
Calcium (mg/l)	27	26
Chromium (mg/l)	-	-
Cobalt (mg/l)	-	-
Copper (mg/l)	-	-
Iron (mg/l)	0.7	0.6
Lead (mg/l)	-	-
Magnesium (mg/l)	7.2	5.0
Manganese (mg/l)	0.04	0.08
Nickel (mg/l)	-	-
Potassium (mg/l)	1.5	1.5
Sodium (mg/l)	5.8	5.1
Zinc (mg/l)	-	-

TABLE V-7

HISTORICAL RIVER FLOWS DURING JULY-OCTOBER

	Susquehanna River at Conklin (Upstream of Chenango River Confluence)(mgd)	Susquehanna River Above Waverly (mgd)
Average Flows:	July - October	
1965	271	615
1966	224	512
1967	851	1,816
1968	595	1,811
1969	513	950
1970	589	1,468
1971	349	762
1972	793	1,884
1973	651	1,181
Average-All Years of Record:	817	1,409
MA-7-CD-10 Flow	123	239

Observation of the values in Table V-4 indicate that there has been some violation of water quality standards for coliform and dissolved oxygen in the Susquehanna River below Binghamton. Standards for pollutants such as fecal coliform may also have been violated, but data on such parameters were not available. The majority of the violations were in 1971. This is to be expected since 1971 was a low flow year and secondary treatment had not yet been installed along the river. There were no standards violations in 1973, when river discharge approached the average and secondary treatment plants were in operation. The 1973 data is thus indicative of a normal year of operation for the present treatment systems.

The coliform standard for Class C waters is fairly high; however, some interest was been expressed for upgrading the Susquehanna River downstream of Binghamton to Class B standards suitable for primary contact recreation. If the waters downstream of Binghamton were Class B, then coliform standards would have been violated in 1973. Moreover, this violation would have occurred upstream of sewage treatment plant discharges. Median 1973 coliform counts upstream of Binghamton were 510 and 230 per 100 ml, respectively, whereas at the Binghamton-Johnson City municipal boundary, the median coliform count was 3,600 per 100 ml. As will be described later in this chapter, the likely source of this pollution was combined overflows which occurred in the City of Binghamton.

Other water quality parameters such as suspended solids, nitrogen, and phosphorous have not violated standards. Upstream pollutant levels are generally low, but concentrations of all parameters increase markedly after sewage treatment plant discharges. Relatively low values for chemical oxygen demand suggest little pollution due to refractory (non-biodegradable) organics. The sampling data for metals indicated that there were no observed violations of standards.

With the exception of coliforms, the quality in the Susquehanna River in the last several years was suitable for maintenance of water quality standards. With the installation of secondary treatment in 1972 and 1973, there is little reason to expect that standards violations will occur during a normal flow year in the Susquehanna River with the present volume of wastewater discharge. However, existing water quality data were not indicative of conditions during low flows, and there is no assurance that standards will be met during the MA-7-CD-10 flow which New York State uses for its basin planning and permitting programs.

To resolve questions concerning conformance to in-stream water quality standards, NYSDEC has a mathematical model for the Susquehanna River capable of predicting water quality resulting from sewage discharges and low river flows. The present state-of-the-art limits accurate prediction primarily to dissolved oxygen (DO) concentrations. The DO concentration, though, is traditionally the major water quality parameter, particularly in areas such as Binghamton that are not characterized by major discharges of toxic contaminants. The model has been validated through use of river sampling data and is currently being used by New York State.

Results of the modeling techniques are presented as traditional DO sag curves using the Streeter-Phelps equation. For existing wastewater discharges occurring during the MA-7-CD-10 flow, the DO sag curve as calculated by the model is displayed in Figure V-3. The critical portion of the DO curve falls between 4.0 and 5.0 mg/l for a ten mile reach of the Susquehanna River near the Broome-Tioga

DISSVOLVED OXYGEN PROFILES: EXISTING AND YEAR 2020
(MA-7-CD-10 FLOW)

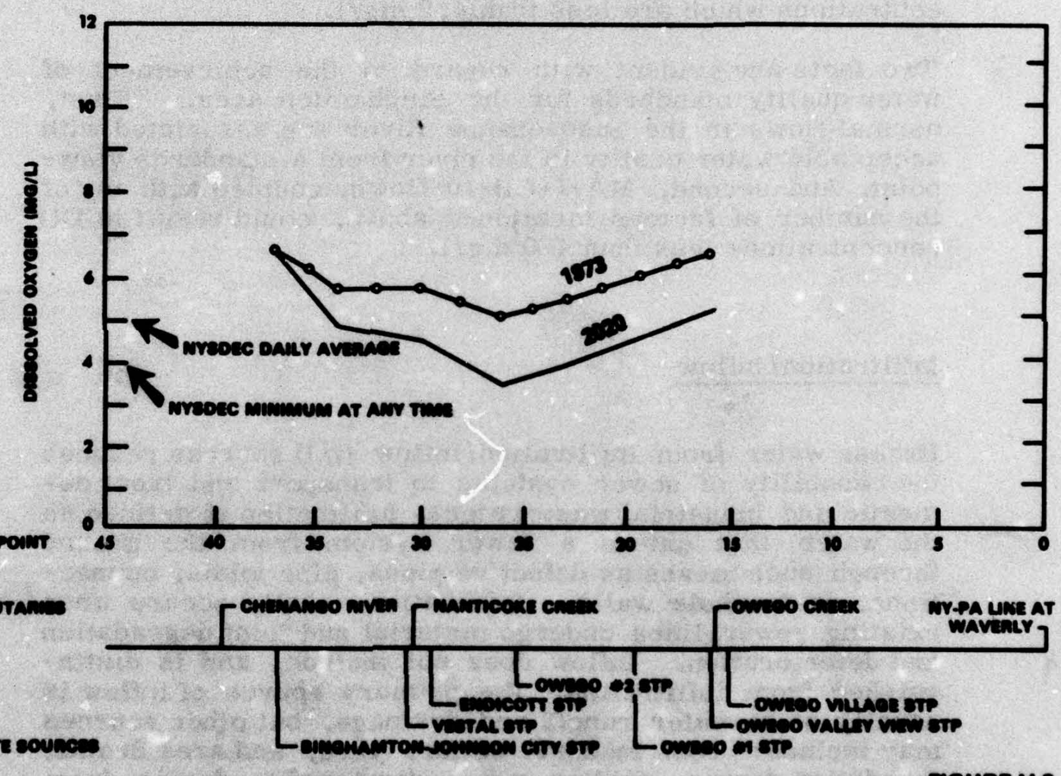


FIGURE V-3

County boundary. The river appears to recover its natural DO level for the MA-7-CD-10 flow by the time it crosses the New York State border into the Commonwealth of Pennsylvania.

As will be discussed in later sections and appendices, projected values of DO concentrations may fall below the minimum standard of 4.0 mg/l in response to certain conditions. Factors such as increased wastewater flows in the future, combined sewer overflows during intense storms, or decreased sewage treatment plant efficiencies (especially at the Binghamton-Johnson City STP) could result in DO concentrations which are less than 4.0 mg/l.

Two facts are evident with regard to the achievement of water quality standards for the Binghamton area. First, normal flows in the Susquehanna River are associated with acceptable water quality in the river from a standards viewpoint. And second, MA-7-CD-10 flows, coupled with any of the number of factors mentioned above, could result in DO concentrations less than 4.0 mg/l.

Infiltration/Inflow

Excess water from infiltration/inflow (I/I) sources reduces the capability of sewer systems to transport and treat domestic and industrial wastewaters. Infiltration is defined as the water that enters a sewer system from the ground through such means as defective pipes, pipe joints, connections, or manhole walls. Infiltration usually occurs when existing sewer lines undergo material and joint degradation and deterioration. Inflow does not include, and is distinguished from infiltration. The primary source of inflow is usually stormwater runoff and drainage, but other sources may include: roof leaders; cellar, yard, and area drains; foundation drains; cooling water discharges; drains from springs and swampy areas; and manhole covers, cross connections from storm sewers, catch basins, or street wash waters.

The purpose of the present discussion is to investigate I/I problems as they impact on water quality and wastewater management planning for the Bicounty Area. In urban areas such as Binghamton-Johnson City and Owego Village served by combined sewer systems, excess I/I causes overflows at several points along the sewer system. The result is a direct discharge of untreated sanitary sewage, stormwater, and infiltration waters to receiving streams such as the Susquehanna River. Such occurrences can cause serious pollution problems with accompanying water quality standards violations. Potential health hazards may also exist for several hours or days following combined sewer overflows.

The Endicott area and the Town of Owego are served mainly by separate sanitary and storm sewers, and do not experience significant amounts of infiltration. As mentioned previously, Binghamton-Johnson City and the Village of Owego are served by combined sewers. Owego Village, however, has been requested by New York State to initiate work on separation of the Village's combined sewer systems. Because the sanitary wastewater flow to the Binghamton-Johnson City STP averages about 20 times the sanitary wastewater flow in the Owego Village area, it can be expected that combined overflows in the Binghamton-Johnson City area will have a far greater impact on water quality in the Susquehanna River. Hence, further discussions in this chapter pertaining to I/I will concentrate primarily on the problems in the Binghamton-Johnson City area.

Conferences with local governments and planning boards of Broome and Tioga Counties, NYSDEC, and EPA indicated that storm runoff and combined overflows resulting from excessive I/I in the Binghamton-Johnson City area were problems of major concern. The area has the largest population in the Bicounty Area and is served by a rather old combined sewer system. The recently completed secondary wastewater treatment facility at the Binghamton-Johnson City site was planned to be a regional facility to handle wastewater flows from surrounding urban areas. Due to infiltration/inflow problems, the plant may not be capable of serving these surrounding areas as originally anticipated.

The major trunk and interceptors of the existing sewer system in the City of Binghamton are shown in Plate 1. The Binghamton sewer system is subject to significantly higher flow rates during wet weather conditions. The combined sewer system overflows to the Chenango and Susquehanna Rivers during these excessive flows, resulting in the discharge of raw sewage to the waterways. The interceptors along the Susquehanna River east of Chenango River appear to be subject to excessive infiltration. The City of Binghamton has recently completed infiltration/inflow and sewer evaluation studies to define the sources of these higher flows and the possible measures to correct these problems. Johnson City has also initiated similar studies for its sewer system.

Analysis of Existing Data

For the purposes of problem identification, a preliminary analysis of urban runoff, inflow and infiltration was performed using the Binghamton-Johnson City wastewater treatment plant continuous flow and quality records. Rainfall records and Susquehanna River stage data were also used in the analysis.

Inflow. In the absence of actual observed values, empirical equations were used to calculate approximate values for the surface runoff, combined overflow volume, and pollutant magnitudes resulting from a given storm.

Existing wastewater flow data recorded by the Binghamton-Johnson City wastewater treatment plant were analyzed to test the existence of infiltration or inflows. Rainfall records and Susquehanna River flow data were examined to test the correlation between treatment plant flows and precipitation or high river stages. Treatment plant influent records were analyzed to check the variation of pollutant mass loads reaching the treatment plant during various wastewater flows.

The plant continuous flow record was analyzed for the year 1973. During the period of August - October, the data indicated that the river was at its lower stages. Infiltration during these months is likely to be significantly smaller than during high river stage periods. Higher river stages cause higher ground water levels in the vicinity of the Susquehanna and Chenango Rivers where the interceptors are located. This may cause an increase in infiltration rates. Also, an increase in river stage may cause direct river water infiltration to the sewer system through faulty regulators or broken parts of the sewer system that may otherwise be above the river elevation. Investigation of the continuous treatment plant flow record indicated that dry weather flow during the period of low river stages was about 15 mgd. During the day, the flow varied between 7 mgd during early morning hours to about 20 mgd around noon time.

During August - October 1973, 14 storms were analyzed. The hourly and daily rainfall data as reported by the U. S. Weather Service at Broome County Airport were utilized to estimate the total volume of rainfall over the area. Treatment plant flow records were studied to determine the increase in treatment plant flow due to the rainfall. During heavy storm conditions, the treatment plant may receive up to 30 mgd due to storm inflow. For a few hours during a rainy day, the flow rate may be above 40 mgd.

The ratio of the runoff volume reaching the treatment plant to the rainfall volume was between 0.05 to 0.10. Experimental studies in other urban areas indicate that the ratio between urban runoff volume and rainfall volume is usually in the range of 0.2 to 0.5. The lower ratio in the Binghamton-Johnson City area is an indication of storm runoff discharged directly from the combined sewer system to the river before reaching the wastewater treatment plant.

Investigation of the influent data record of the treatment plant (January 1973 to August 1974) indicated that the pollutant mass loadings (BOD, SS), measured in pounds per day decreased as the flow reaching the treatment plant increased. That is, overflows at higher sewer flows caused a portion of the daily domestic pollutant mass load to escape from the sewer to the river, thus decreasing the net pollutant load to the treatment plant. These direct discharges of raw sewage to the rivers can cause a reduction of up to 50 percent in the pollutant load reaching the treatment plant. In other words, about 50 percent of the raw sewage load is reaching the natural streams during high sewer flows (due to storms or infiltration).

Approximate empirical equations, based on previous studies of urban storm runoff were used to estimate the storm runoff volume, storm inflow reaching the treatment plant, overflow volume and BOD pollutant overflows to the stream. A summary of the results and the procedure is given in Table V-8.

<u>Infiltration.</u> The Binghamton treatment plant continuous flow records were examined to determine the magnitude of infiltration flows. The treatment plant flow during low river stage and dry weather conditions was found to be about 15 mgd. Dry weather flow, based on water consumption and population, was estimated at 11 mgd. This indicated that at least 4 mgd reaching the treatment plant during dry weather conditions were due to infiltration.

The treatment plant wastewater flow data during 1973 indicated that during the months of July and December, excessive plant flows were recorded. A summary of plant flows, river and rainfall data of selected days is given in Table V-9. The increase in treatment plant wastewater flow above the dry weather flow was plotted against river stage (Figure V-4). An apparent correlation appears to exist between plant flow and river stage. In March 1974, the by-pass at the treatment plant site was closed. An investigation of the treatment plant flow records during March and April 1974 indicated an increase in flow to the plant. Since estimates of dry weather flow did not change, even higher amounts of infiltration were apparently occuring than originally projected. A careful analysis of plant records revealed that during high Susquehanna River stages, infiltration may reach 20 mgd.

TABLE V-8

ESTIMATION OF STORM RUNOFF, OVERFLOW VOLUME AND POLLUTANTS MAGNITUDE USING APPROXIMATE EMPIRICAL EQUATIONS

Rainfall Intensity (inch)	0.25	0.50	1.00
Rainfall Volume (mg)	33.9	67.8	135
Runoff Volume (mg)	2.70	16.2	43.2 [1]
	8.10	21.6	48.60 [2]
Runoff Reaching Treatment Plant (mg) [3]	2.2	3.5	15.0
Overflow Volume [4]	1.50	12.7	28.2
BOD Load as Percentage of Sanitary Load [5]	0.10	0.46	0.66
Overflow BOD Load	2,500	11,500	16,500 [6] 13,250 [7]

1 & 2: Runoff (in) = a (rainfall -b)
b = surface detention losses
a = constant

.....a - was assumed equal to 0.4 based on the imperviousness in the study area

.....b - was assumed equal to 0.2 inch for estimate(1) and 0.1 inch for estimate (2)

3. Based on Binghamton-Johnson Wastewater Treatment plant flow records.
4. Overflow volume = runoff volume (estimate #1) - Runoff reaching the treatment plant.
5. Assume: $\frac{(\text{BOD overflow})}{(\text{BOD domestic})} = \frac{(\text{Volume overflow})}{(\text{Volume domestic + Volume runoff})}$
6. BOD domestic = 25,000 lb/day.
7. From treatment plant influent BOD load as a function of influent wastewater flow.

TABLE V-9

INFILTRATION, RIVER STAGE, AND RAINFALL DATA

Date	River Data* Stage (ft)	Flow (cfs)	Infiltration (mgd)	Rainfall
July 1973				
7/1	6	16,500	10	0
7/2	4.5	10,500	5	0
7/3	4	7,600	8	0
7/4	3.5	6,480	6	0
7/5	3.5	5,820	3	0
7/6	3.3	5,130	4	0
7/7	2.5	3,710	4	0
7/8	2.3	2,860	4	0
7/9	2.1	2,480	2	0
7/10	2.0	2,090	4	0
7/11	1.8	1,800	4	0
December 1973				
12/6	5.19	4,080	6	0
12/7	5.77	5,260	5	0
12/8	5.42	4,550	4	0
12/10	7.93	10,600	7.5	.01
12/11	7.59	9,660	8	.01
12/12	6.42	9,700	7	T
12/13	5.69	5,080	6	.02
12/14	5.40	4,510	6	.03
12/15	5.29	4,270	6	T
12/22	10.98	19,800	10	.03
12/23	9.73	15,900	9	.01
12/24	7.92	10,600	8	0
12/25	6.70	7,380	8	.06

*Susquehanna River at Conklin as reported by U. S. G. S.

Implications for Further Planning

The preliminary analysis of both infiltration and inflow problems indicated that the Binghamton-Johnson City sewerage system was subject to overloading at various times. Particularly during periods of intense storms or high river stages, significant combined sewer overflows may occur that discharge untreated sewage directly to the river.

EXCESS TREATMENT PLANT FLOW VS. RIVER STAGE (DRY WEATHER CONDITIONS)

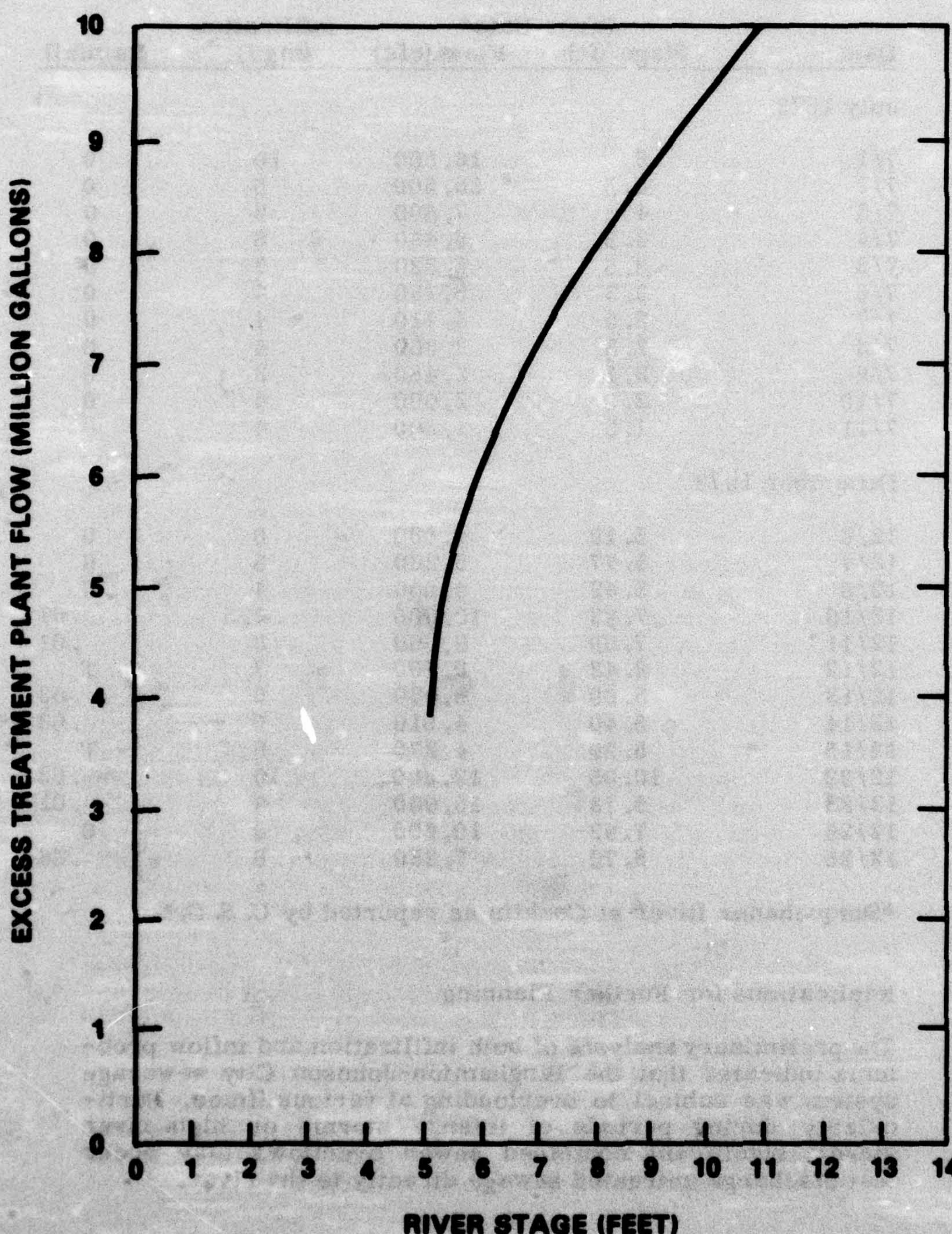


FIGURE V-4

Because of the absence of direct water-quality measurements of (1) urban runoff, (2) infiltration in different sewer elements, and (3) combined overflows at the specific locations, a comprehensive analysis using computer simulation models was warranted. These models provide a more accurate estimate of the storm runoff quantity, overflow volumes and pollutant magnitudes in overflows. Such models also are valuable in evaluating the effectiveness of various alternatives for combined overflow management. A detailed discussion of the applicability of several models and the selection of the model for use in the Binghamton Wastewater Management Study is examined in the Plan Formulation Appendix and the Design and Cost Appendix.

Capacity of Binghamton-Johnson City STP

The present "design" capacity of the Binghamton-Johnson City plant is 18.25 mgd. Local and State officials indicated that this rated capacity appeared to be overly conservative. The general opinion was that the STP would function efficiently at wastewater flows substantially higher than 18.25 mgd. One reason for the closure of the plant by-pass valve mentioned in an earlier section was to observe treatment plant performance at different volumes of flow.

A preliminary analysis of treatment plant records indicated that the existing plant could accommodate as much as 50 mgd from a hydraulic standpoint. At this flow-rate, though, removal efficiencies for pollutants such as BOD and SS are low. Further analysis of treatment plant records showed that the plant would function in the range between 24 and 26 mgd while achieving removal efficiencies normally associated with secondary treatment plants operating under the contact stabilization process.

Because the Binghamton-Johnson City STP is the largest plant in the Bicounty Area, an exact engineering determination of its treatment capability was critical for further wastewater management planning. Addition of new users to the plant may be possible if the capacity is larger than presently stated in the design flow. Other problems such as infiltration/inflow and extension of interceptor networks could then be evaluated from a different perspective if it was found that the plant did have unused capacity.

Wastewater Management in the Chenango Valley

As development has spread through the Chenango Valley in recent years, the effectiveness of individual disposal systems has decreased. In some cases, untreated wastewater was observed in roadside ditches with eventual discharge to the Chenango River. This problem was determined to be a combination of factors such as poor soil conditions and population densities in excess of the safe number for septic tank use.

A number of studies have been done in the past regarding a central sewage treatment system for the area. Basically, reports have investigated a new STP in Chenango Valley versus an interceptor from Chenango Valley to the Binghamton-Johnson City STP. For the purposes of the present Study, it was necessary to review the previous reports, investigate the existing situation, and formulate various alternatives. The study of wastewater management in Chenango Valley was judged to be extremely important because the area is projected for suburban growth in coming years.

Non-Point Source Pollution

The estimation of non-point source pollutants and associated water quality problems is not an exact procedure. Since by definition, such wastewaters enter a stream by means of distributed runoff and seepage waters and not by a direct discharge, they cannot be measured with any degree of precision. Circumstantial evidence must be used to infer the nature and extent of such pollution.

There is little evidence of non-point source pollution in the Susquehanna River upstream of Binghamton or in the Chenango or Tioughnioga Rivers. Not only are coliform levels low, but long-term New York State nutrient sampling (Stations A-2 and B-3) indicate average nitrogen concentrations of 0.9 mg/l for the Susquehanna and 1.1 mg/l for the Chenango and Tioughnioga Rivers. Comparable phosphate-phosphorus concentrations are 0.07 and 0.10 mg/l, respectively. Nitrogen and phosphorus are generally considered as possible non-point source pollutants, but the concentrations listed above are at levels normally associated with undisturbed or forested drainage areas and fall within the range of concentrations reported for rainfall. These "natural" pollution levels do, however, result in large mass flow rates. Utilizing average annual flows, the above concentrations result in an average of 30,900 lb/day of nitrogen and 2,600 lb/day of phosphorus at the confluence of the Susquehanna and Chenango Rivers in Binghamton.

Rural runoff is a possible pollution source, particularly in areas with substantial agricultural activity. Approximately 17 percent and 27 percent of the land in Broome and Tioga Counties, respectively, are devoted to agriculture. However, agricultural pollution is associated with concentrated agricultural practices, such as large dairy farms and high intensity heavily fertilized cropland. The 1969 New York State Census of Agriculture listed 22 dairy farms in the two counties with more than 100 cows. High intensity cropland totals less than 500 acres. Neither activity is of a sufficient level to constitute a possible major pollution source in the area.

Erosion due to construction and agriculture can result in sediment pollution of waterways. Suspended solids concentrations and turbidity levels reported in Table V-5 do not indicate significant erosion problems. For example, the suspended solids loading in the Susquehanna River at Waverly averages approximately 800 tons/day. If this was due completely to erosion in Broome and Tioga Counties, it would represent an average erosion of less than 0.5 ton per acre per year throughout the Bicounty Area, which is generally considered a low level of soil loss.

Aquatic Environment

The introduction of wastewater, particularly raw or insufficiently treated sewage from combined sewer overflows, into the rivers and streams of the Bicounty Area has limited fishery potential in the past. These pollution loadings, in addition to storm runoff, resulted in a population of coarse fish such as carp or suckers in several of the waterways in years prior to the construction of new STP's.

In the past few years, however, this situation has improved due to installation of secondary treatment plants along the Susquehanna River. There are several species of game fish whose abundance and popularity have not been severely limited by pollution. As observed in Chapter II, fishery potentials have actually increased in recent years due primarily to improved water quality. A decline in algal nutrients (phosphorus and nitrogen) has occurred since the installation of upgraded sewage treatment facilities and the elimination of phosphate detergents. Higher than average river flows over the past few years also have helped to create more favorable conditions for aquatic life.

The advent of dry weather, though, with accompanying low river flows could create adverse conditions in the waterways despite existing sewage treatment facilities. Overflows of combined sewers following an intense thunderstorm during an otherwise dry season could create a stressful condition on the aquatic environment in the Susquehanna River. Depressed dissolved oxygen concentrations and high coliform counts in the river could constitute a water quality standards violation as well as a potential health hazard. Depending on the nature of such a storm, degraded water quality conditions may remain only for a few hours, or may extend for several days. Industrial waste discharges that receive little or no treatment only serve to compound the effect of poor water quality on aquatic organisms.

Smallmouth bass and walleye experience respiratory distress and die at low DO concentrations. Carp are very tolerant to low DO concentrations, yet even they will die if the DO levels should remain at or below 2.0 mg/l for any length of time. If degraded conditions persist for an extended time, clean water organisms are replaced by a more pollution tolerant variety. Only a prolonged period of good water quality will reestablish clean water flora and fauna.

Sludge Management

At the present, the digested sludge generated from the existing treatment plants in the urban area of Broome and Tioga Counties amounts to about 9.2 tons per day, based on dry solids. Assuming a 20 percent solids concentration in the dewatered sludge, the amount of sludge to be hauled for disposal is approximately 46.5 tons per day. Table IV-3 summarized approximate quantities and types of sludge generated and existing sludge handling practices for each of the sewage treatment plants.

At the Binghamton-Johnson City STP, sludge is digested by an anerobic process, dewatered, and trucked to a landfill site near Vestal. About 5.5 tons/day (dry sclids) is produced. For years, the sludge has been disposed at no cost in the landfill - a private horticulture operation where the sludge is used as a soil conditioner. In March 1974, however, the operator of the landfill notified the Binghamton-Johnson City Joint Sewage Board that the horticultural operation was ceasing and that the arrangement was no longer desirable. He has officially requested that the Joint Sewage Board provide reimbursement at the rate of $300 per month if continued sludge handling is required. A temporary agreement, however, was arranged for continued disposal of sludge at this landfill site until other sites became available.

The supervisors of the Binghamton-Johnson City STP are undertaking several measures to reduce sludge handling costs and to prepare for the non-availability of the horticulture landfill site. Some of the proposed steps are listed as follows:

- Experimentation with polymers for sludge conditioning to effect dewatering and thereby reduce the quantity of sludge to be hauled for disposal.
- Cleaning of old drying beds to remove about 80 percent of the sludge remaining after filtering (this will decrease the quantity of sludge to be hauled for disposal but would increase costs for handling of the sludge at the STP).
- Request the STERPB director to investigate possible land application programs for year-round disposal of liquid sludge.

At the Endicott STP, about 2.6 tons/day of dry solids are produced from the sludge digestion process. After dewatering, sludge is hauled in trucks to a landfill site adjacent to the Endicott STP for ultimate disposal. The Endicott landfill site, approximately 55 acres, is located on the north bank of the Susquehanna River. This landfill site is used for disposal of solid waste from the Village of Endicott and the Town of Union as well as for the disposal of dewatered digested sludge from the Endicott sewage treatment plant. No information was available on the possible leaching of materials from the solid waste or sludge into the river.

The Vestal Sewage Treatment Plant is a primary treatment system with sludge being digested in an anaerobic digester. Digested sludge is dewatered in drying beds. The dried sludge is removed by farmers or other individuals for use as a soil conditioner. There is a demand for this digested sludge, so a problem of disposal has not occurred.

Owego Sewage Treatment Plants One and Two produce about 0.2 and 0.4 tons/day of dry solids, respectively. Liquid sludge is withdrawn as necessary from the digestors and sprayed onto farmland. The plant operators make individual arrangements with farmers for the land application. Currently, there is only one tank truck servicing both Owego Plants One and Two..

The Owego Village STP produces primarily sludge which is pumped to drying beds. Dried sludge is hauled to a landfill site near Candor. The Owego Village-Valley View plant is an Imhoff tank that currently is causing some odor nuisances because of sludge digestion. As indicated in Chapter IV, the Valley View STP will be phased out after construction of a south side interceptor to transport waste to the Owego Village STP. Construction of the south side interceptor is scheduled for 1976.

Overall implications of present sludge handling techniques for the Bicounty Area indicate that immediate solutions must be found for the imminent sludge disposal problems at the Binghamton-Johnson City STP. Furthermore, problems may occur at the Endicott site when the landfill reaches its capacity or if leaching problems should be observed. Other plants have relatively few sludge disposal problems at the present time. If the demand for liquid sludge for land application decreases, however, alternative methods for sludge management at these other plants must be found.

Summary of Water Quality Problems

The water quality standards as adopted by NYSDEC and approved by EPA must be maintained. Wastewater treatment facilities or management techniques must handle the existing pollutant loadings as well as anticipate future increases in wastewater flows.

Excess infiltration and inflow (primarily stormwater) tend to overload existing systems causing combined sewer overflows in the Binghamton-Johnson City area. These overflows cause untreated wastes to be discharged to receiving waters. Infiltration appeared to be somewhat correlated with the stage of the Susquehanna River; higher stages were thought to cause significantly increased flows to the STP indicating excessive infiltration. Heavy inflow during intense storms causes the discharge of untreated wastewater to the area's waterways. The actual treatment capacity of the Binghamton-Johnson City STP was not clearly defined. Coupled with the problems of infiltration/inflow in the system, anticipated expansions of service areas for the Binghamton-Johnson City STP were in doubt. Choice of a wastewater management system in Chenango Valley must be made. Non-point sources of pollution may generate local problems, but these problems were not observed on an areawide basis. The aquatic flora and fauna are sensitive to changes in river water quality, particularly dissolved oxygen concentrations. Dissolved oxygen standards as established by NYSDEC must be attained even during the MA-7-CD-10 flow. Sludge disposal was a problem of immediate concern for the Binghamton-Johnson City STP.

LAND RESOURCE PROBLEMS

There are a number of land resource problems in the Bicounty Area relating to water quality. Existing land use patterns are considered in Chapter III, while Chapter VII will examine the area's comprehensive regional plans and associated land resource issues. The important land resource problems relating to wastewater management are the recreational and open space aspects of the Riverbanks Improvement Program. The Riverbanks Improvement Program seeks to provide parks and open space along the river for recreation enjoyment.

The Susquehanna and its major tributaries are natural features of great importance in the long-range development plans for the Bicounty Area, including the Riverbanks Improvement Program. Concentrated efforts and major capital expenditures are to be invested in the protection and enhancement of these rivers, and the land along their banks, for public use and enjoyment. Increased water recreation opportunities and development of a riverbank park system can be enhanced by improved water quality in the rivers.

CHAPTER VI

THE BICOUNTY AREA IN THE FUTURE

An important element in the development of plans for future municipal facilities is the projection of population levels and an estimate of future industrial and ecological trends. The first part of this chapter examines the population projections of various agencies, and provides a discussion of the rationale for choice of projections for this specific Study effort. Population is projected for each county and each municipality in the Study Area. A further disaggregation of population estimates to wastewater management areas is also described. The second part of the chapter contains economic projections for the Bicounty Area and associated implications for wastewater management. The final section provides a discussion of the future regional profile extrapolated from existing conditions.

POPULATION PROJECTIONS

A number of projections by local, State, and Federal agencies have been made for future population levels in Broome and Tioga Counties. Three sets of projections, including those produced by OBERS (U. S. Department of Commerce, Bureau of Economic Analysis and U. S. Department of Agriculture, Economic Research Service), OPS (New York State Office of Planning Services), and STERPB (Southern Tier East Regional Planning Board) are summarized on the following pages. A general discussion of each set of projections follows as well as the methodology used to develop projections for the specific wastewater study area.

OBERS

The OBERS Series E projections for the Binghamton Standard Metropolitan Statistical Area (SMSA) include not only Broome and Tioga Counties but also Susquehanna County in Pennsylvania. The projected 10-year growth rate for the SMSA is 3 percent between 1970 and 1980, 5 percent between 1980 and 1990, and 4 percent between 1990 and 2000. The projected 20-year growth for the years 2000 to 2020 is 7 percent, or about 4 percent of each of the 10 year periods between 2000 and 2020. Table VI-1 shows detailed population projection data for the SMSA.

TABLE VI-1

OBERS, SERIES E PROJECTIONS FOR THE BINGHAMTON SMSA

	1970	1980	1990	2000	2020
Population	302,672	312,200	326,800	340,100	365,400
Population Increase		9,528	14,600	13,300	25,300
Growth Rate (%)		3	5	4	7
10 year growth rate (%)		3	5	4	4*

*2000-2010 and 2010-2020

OPS

The OPS preliminary population projections are made individually for Broome and Tioga Counties and then for the total Bicounty Area. The OPS projections indicate a slightly higher rate of growth compared to the OBERS projections for each of the two counties as well as the Bicounty Area. Table VI-2 presents the OPS projections.

The OPS projections show a rapid rate of growth for Tioga County but a low rate of growth for Broome County. The

Bicounty Area rates of growth as projected by OPS are: 6 percent between 1970 and 1980, 7 percent between 1980 and 1990, and 4 percent between 1990 and 2000. The slightly lower rate of growth as predicted by OBERS for the entire SMSA may be influenced by the low rate of growth expected for Susquehanna County, Pennsylvania.

TABLE VI-2

OPS POPULATION PROJECTIONS FOR BROOME AND TIOGA COUNTIES

	1970	1980	1990	2000
Broome				
Population	221,815	229,747	238,543	242,076
Population Increase		7,932	8,796	3,533
Rate of Growth (%)		4	4	1
Tioga				
Population	46,513	54,713	65,124	74,650
Population Increase		8,200	10,411	9,526
Rate of Growth (%)		18	19	15
Bicounty				
Population	268,328	284,460	303,667	316,726
Population Increase		16,132	19,207	13,059
Rate of Growth (%)		6	7	4

STERPB

Population levels and growth rates for villages, towns, and counties have been projected by STERPB to the year 1990. These municipal projections are presented in Table VI-3. Municipal boundaries have been indicated in Figure III-1. Overall, the study area growth rate projected by STERPB for the 1970 to 1980 decade is 5 percent compared to the OPS projected rate of 6 percent. Both STERPB and OPS project a 7 percent growth rate for the study area between 1980 and 1990.

TABLE VI-3

STERPB POPULATION PROJECTIONS FOR BROOME AND TIOGA COUNTIES

	1970	1980		1990	
	Population	Population	Rate of Growth (%)	Population	Rate of Growth (%)
BROOME COUNTY					
Binghamton City	64,123	60,250	-6	57,900	-4
Barker, Town	2,032	2,150	6	2,275	6
Binghamton, Town	4,844	5,475	13	6,225	14
Chenango, Town	12,267	13,075	7	13,900	6
Colesville, Town	4,420	4,700	6	4,950	5
Conklin, Town	5,399	5,750	6	6,125	7
Dickinson, Town	5,687	5,375	-5	5,150	-4
Fenton, Town	6,719	7,025	5	7,300	4
Kirkwood, Town	5,687	6,100	7	6,500	7
Lisle, Town	1,917	2,050	7	2,175	6
Maine, Town	5,842	6,775	16	7,875	16
Nanticoke, Town	1,020	1,125	10	1,225	9
Sanford, Town	2,528	2,525	0	2,525	0
Triangle, Town	2,285	2,400	5	2,500	4
Union, Town *	64,490	63,950	-1	63,550	-1
Endicott, Village	16,556	15,775	-5	15,200	-4
Johnson City, Village	18,025	17,400	-3	16,875	-3
Vestal, Town	26,909	32,125	19	38,500	19
Windsor, Town	5,646	6,150	9	6,725	0
Broome County Total	221,815	227,000	2	235,400	4
TIOGA COUNTY					
Barton, Town*	8,526	8,550	0	8,725	2
Waverly, Village	5,261	4,575	-13	4,100	-10
Berkshire, Town	1,098	1,400	28	1,900	36
Candor, Town	4,190	5,125	22	6,325	23
Newark Valley, Town	3,323	3,725	12	4,200	13
Nichols, Town	2,271	2,525	11	2,950	17
Owego, Town*	20,336	25,350	25	32,450	28
Owego, Village	5,152	4,850	-6	4,650	-4
Richford, Town	916	1,075	17	1,325	23
Spencer, Town	2,232	2,825	27	3,625	28
Tioga, Town	3,621	4,525	25	5,750	27
Tioga County Total	46,513	55,100	18	67,250	22
BICOUNTY AREA TOTAL	268,328	282,100	5	302,650	7

*Town Total Includes Village

The various population projections for Broome and Tioga counties are summarized in Table VI-4. The OPS and STERPB projections for 1980 and 1990 are similar while OBERS projections are somewhat lower.

TABLE VI-4

COMPARISON OF POPULATION PROJECTIONS FOR BROOME AND TIOGA COUNTIES

		1970	1980	1990	2000	2020
OBERS	Population	268,328	276,780	289,733	301,525	323,958
	Rate of Growth (%)		3	5	4	7
OPS	Population	268,328	284,460	303,667	316,726	-
	Rate of Growth (%)		6	7	4	
STERPB	Population	268,328	282,100	302,650	-	-
	Rate of Growth (%)		5	7	-	-

BICOUNTY AREA PROJECTIONS FOR WASTEWATER STUDY

Population projections on municipal, county, and Bicounty Area levels used for the Binghamton Wastewater Management Study are shown in Table VI-5. The 1980 and 1990 projections parallel the projections derived by STERPB. Projections for 2000 are comparable to the OPS projections. Projections for the years 2010 and 2020 were based on the OBERS growth rate for the entire SMSA disaggregated to the county level for the purpose of these projections. Figure VI-1 compares the various population projections and indicates the selected projection for the purposes of this wastewater management study.

Municipal projections shown in Table VI-5 reflect the following trends:

- Continuing suburbanization of Tioga County.

- Slowing of growth in the Owego area.
- Increasing population in the Towns of Tioga and Nichols in Tioga County.
- Increasing populations in the Towns of Conklin, Kirkwood, and Colesville in Broome County.
- Decreasing rate of population loss by the City of Binghamton, Johnson City, and Endicott followed by slight increases.
- Significantly increasing population in the Town of Union as a result of its prime location in the urban area.
- Residential growth from the Town of Union extending into the vacant land in the Town of Maine.
- Moderate growth in the Town of Barton as a result of industrial development.
- Large growth rates in the rural towns of the Bicounty Area although the absolute magnitude of population increases will be small relative to the urban areas.
- Continued implementation of zoning ordinances and building codes to protect flood prone areas from increased development.

Estimates of population trends suggest that the suburbs surrounding the metropolitan areas will continue to grow while the central urban districts should achieve more static population levels than have been observed in recent decades.

TABLE VI-5

MUNICIPAL, COUNTY, AND BICOUNTY AREA POPULATION PROJECTIONS SELECTED FOR WASTEWATER MANAGEMENT STUDY

	1970	1980	1990	2000	2010	2020
Broome County						
Binghamton, City	64,123	60,250	57,900	57,900	58,400	60,000
Barker, Town	2,032	2,150	2,275	2,400	3,000	3,500
Binghamton, Town	4,844	5,475	6,225	6,400	6,600	7,000
Chenango, Town	12,267	13,075	13,900	14,300	14,700	15,000
Colesville, Town	4,420	4,700	4,950	6,000	7,000	8,200
Conklin, Town	5,399	5,750	6,125	6,500	6,800	7,100
Dickinson, Town	5,687	5,375	5,150	5,100	5,200	5,300
Fenton, Town	6,719	7,025	7,300	8,700	9,400	10,200
Kirkwood, Town	5,687	6,100	6,500	6,700	7,000	7,300
Lisle, Town	1,917	2,050	2,175	2,300	2,710	3,100
Maine, Town	5,842	6,775	7,875	8,200	8,480	9,000
Nanticoke, Town	1,020	1,125	1,225	1,500	1,900	2,300
Sanford, Town	2,528	2,525	2,525	2,600	2,800	3,200
Triangle, Town	2,285	2,400	2,500	2,000	2,900	3,500
Union, Town*	29,909	30,775	31,475	31,500	31,700	31,800
Endicott, Village	16,556	15,775	15,200	15,200	15,400	15,600
Johnson City, Village	18,025	17,400	16,875	16,900	17,100	17,300
Vestal, Town	26,909	32,125	38,500	40,000	40,500	41,000
Windsor, Town	5,646	6,150	6,725	7,300	8,300	9,300
BROOME COUNTY TOTAL	221,815	227,000	235,400	241,500	249,890	259,700
Tioga County						
Barton, Town*	3,265	3,975	4,625	5,900	6,300	6,700
Waverly, Village	5,261	4,575	4,100	4,100	4,100	4,100
Berkshire, Town	1,098	1,400	1,900	2,400	2,700	3,000
Candor, Town	4,190	5,125	6,325	7,100	7,500	8,000
Newark Valley, Town	3,323	3,725	4,200	5,000	5,400	6,000

TABLE VI-5 Continued

	1970	1980	1990	2000	2010	2020
Nichols, Town	2,271	2,525	2,950	3,500	3,900	4,300
Owego, Town*	15,184	20,500	27,800	29,460	31,500	33,100
Owego, Village	5,152	4,850	4,650	4,600	4,800	5,000
Richford, Town	916	1,075	1,325	1,600	1,900	2,300
Spencer, Town	2,232	2,825	3,625	4,000	4,300	4,000
Tioga, Town	3,621	4,525	5,750	7,100	7,900	8,500
TIOGA COUNTY TOTAL	46,513	55,100	67,250	74,760	80,300	85,000
TOTAL BICOUNTY STUDY AREA	268,328	282,100	302,650	316,260	330,190	344,700

*Town total does not include Village(s)

COMPARISON OF POPULATION ESTIMATES AND THE PROJECTION SELECTED FOR WASTEWATER MANAGEMENT

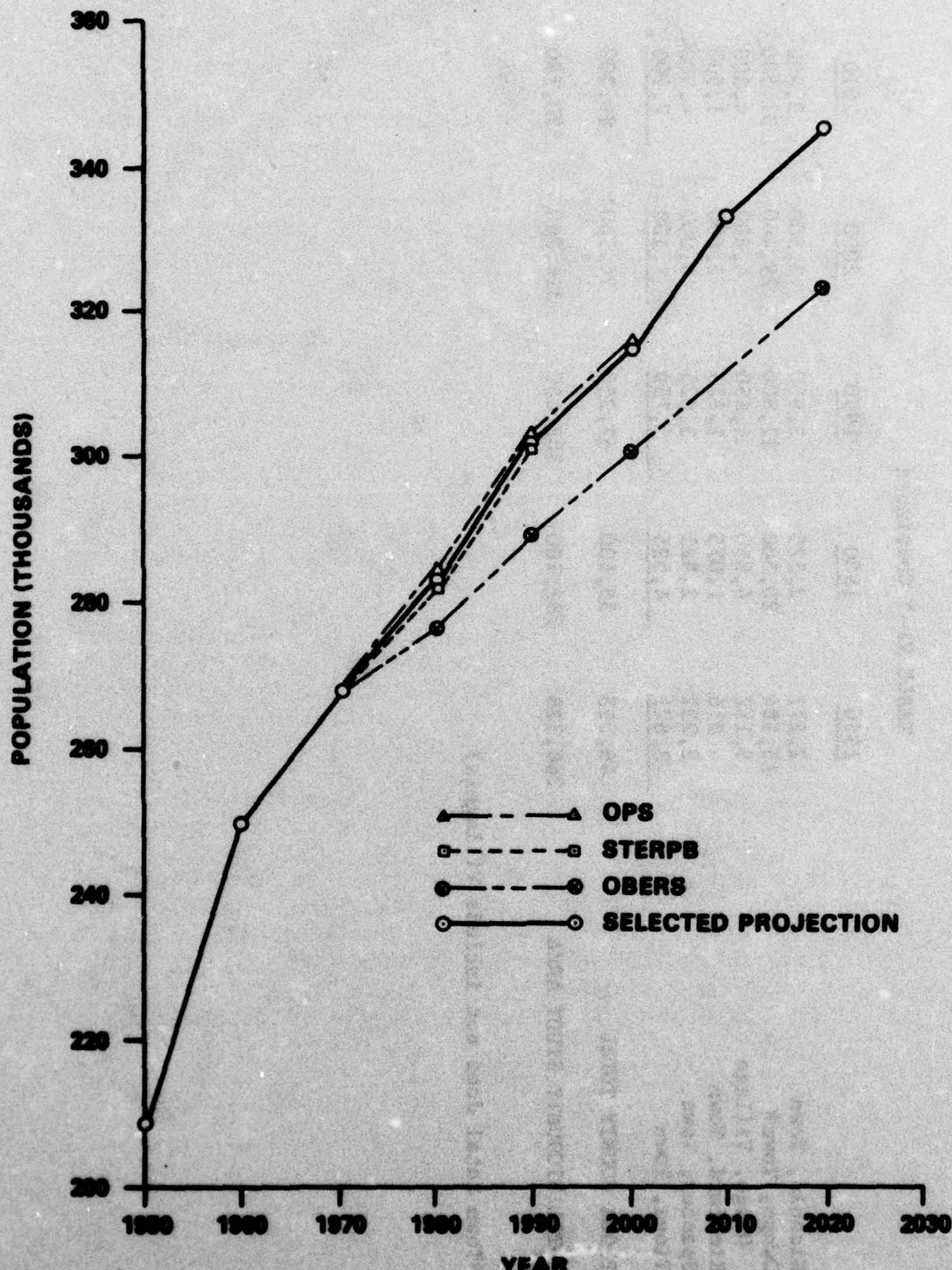


FIGURE VI-1

DISAGGREGATION OF POPULATION ESTIMATES TO SUB-MUNICIPAL AREAS

Sub-municipal areas were identified for wastewater management planning purposes based on sewer service area boundaries together with other political, hydrologic, and topographic data. The sub-municipal areas used for wastewater management planning projections are shown on Figure VI-2 and are described in Table VI-6. Population estimates for 1973 were made for each of the wastewater management planning areas outlined on Figure VI-2 to obtain reasonably accurate data for a mid-census period. A summary of these estimates is given in Table VI-7.

Various techniques were used to obtain the population estimates for 1973. In many cases, a house count was made within a sub-area using 1973 Planimetric Maps, and then this number was multiplied by the average number of people per dwelling unit to obtain total population for the sub-area. The multiplication factor was estimated by dividing the 1970 population for a given area by the number of dwelling units in that area (1970 census data). This ratio of persons per household for 1970 varied by area and was assumed to be reasonably accurate for 1973.

Where there was a significant number of multifamily structures, another correction factor derived from census estimates was applied. Population estimates for 1973 were further refined and/or compared to data available from water connection records and water district maps.

With 1973 as a base, population was disaggregated from the municipal areas shown in Table VI-5 to the sub-municipal areas shown on Figure VI-2 using the ratio method as a guide. Population was then estimated for each sub-municipal area for the years 1980, 1990, 2000, 2010, and 2020. Adjustments to the projections were made using certain judgements reflecting the influence of factors such as topography, vacant land, and availability of support facilities. Projections for sub-municipal areas are shown in Table VI-8.

SUB—MUNICIPAL PROJECTION AREAS

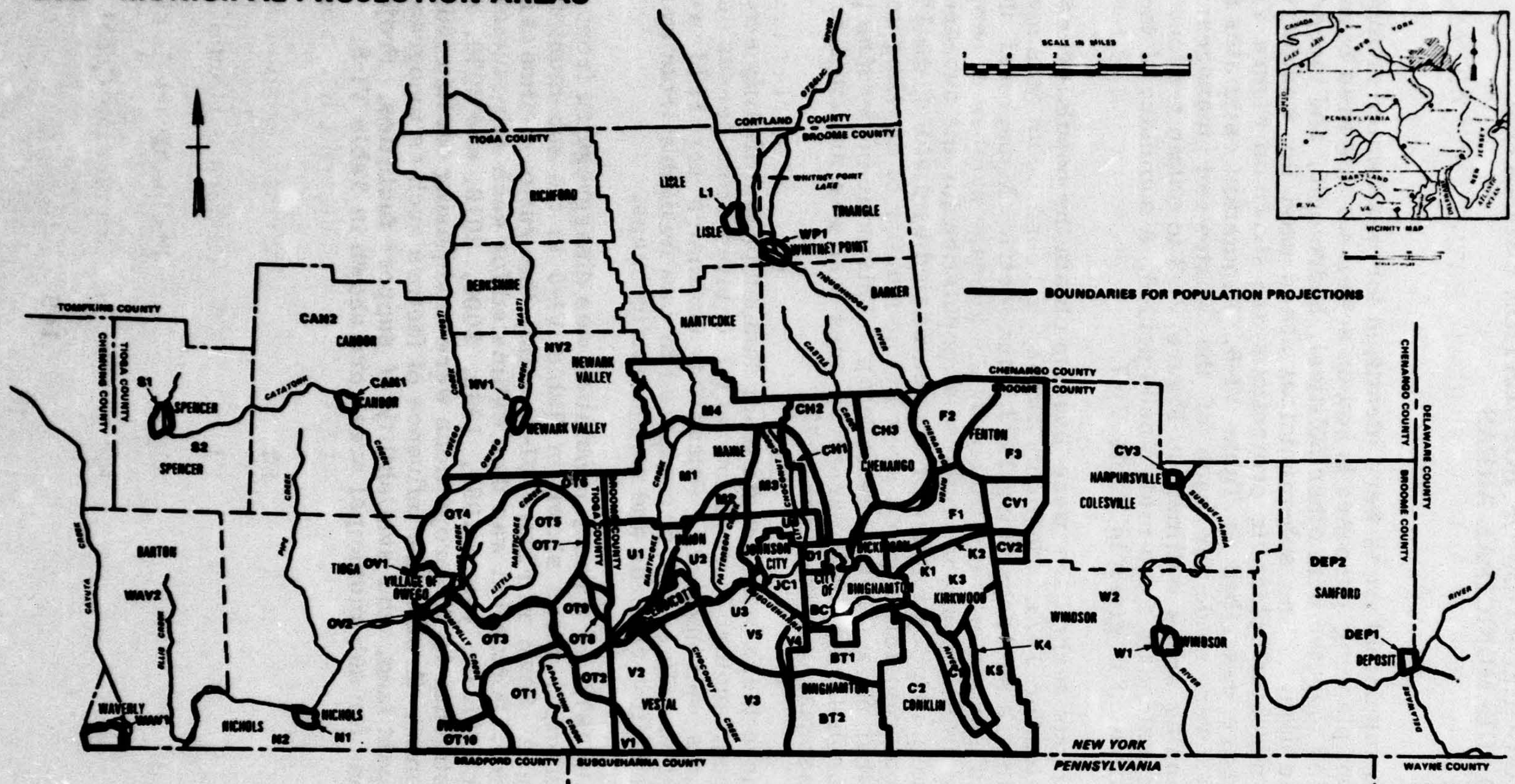


FIGURE VI-2

TABLE VI-6

DESCRIPTION OF SUB-MUNICIPAL PROJECTION AREAS FOR WASTEWATER MANAGEMENT
(See Figure VI-2)

Municipality	Designation	Description
Binghamton City	BC1	entire city
Binghamton Town	BT1	northern half of town drained by Pierce and Boyle Creeks
	BT2	southern half of town
Chenango	CH1	western part of town drained by Little Choconut Creek
	CH2	middle part of town, drained by Castle Creek
	CH3	eastern part of town, drained by Gilbert Creek
Colesville	CV1	western part of town drained by Osborne Creek
	CV2	western part of town drained by Stanley Hollow Creek
	CV3	Harpursville
Conklin	C1	urbanized area along river
	C2	remainder of town
Dickinson	D1	entire town
Fenton	F1	southern portion of town
	F2	northern portion of town
	F3	eastern portion of town
Kirkwood	K1	Phelps Creek Basin
	K2	Brandywine Creek area

TABLE VI-6 Continued

Municipality	Designation	Description
	K3	general area drained by Stratton Mill, Stanley Hollow and Acrea Creeks. Includes the industrial park.
	K4	southern area along river
	K5	rural, eastern part of town
Lisle	L1	entire village
Maine	M1	Nanticoke Creek Basin to Maine Center
	M2	Patterson Creek Basin
	M3	Little Choconut Creek Basin
	M4	northern, rural areas
Whitney Point	WP1	entire village
Deposit	DEP1	entire village
	DEP2	adjacent portion of town of Sanford
Endicott	E1	entire village
Johnson City	JC1	entire village
Union	U1	Nanticoke Creek Basin
	U2	Patterson Creek Basin
	U3	Westover
	U4	Little Choconut Creek
Vestal	V1	Apalachin Creek Basin
	V2	Tracy Creek Basin

TABLE VI-6 Continued

Municipality	Designation	Description
	V3	Choconut Creek Basin except area included in V5
	V4	eastern part of town in Fuller Hollow Creek Basin
	V5	portion of Choconut Creek Basin presently served by Binghamton-Johnson City STP
Windsor	W1	entire village
	W2	adjacent part of town
Candor	CAN1	entire village
	CAN2	adjacent part of town
Newark Valley	NV1	entire village
	NV2	adjacent part of town
Owego Village	OV1	north of Susquehanna River
	OV2	south of Susquehanna River
Owego Town	OT1	Apalachin Creek Basin
	OT2	Tracy Creek Basin
	OT3	Pumpelly Creek Basin
	OT4	Owego Creek Basin
	OT5	Little Nanticoke Creek Basin
	OT6	Crocker Creek Basin
	OT7	Day Hollow Creek Basin
	OT8	Dead Creek Basin
	OT9	Crestview Heights - Campville

TABLE VI-6 Continued

Municipality	Designation	Description
	OT10	portion draining to Pennsylvania and Hunts Creek
Nichols	N1	entire village
	N2	adjacent portion of town
Spencer	S1	entire village
	S2	adjacent portion of town
Waverly	WAV1	entire village
	WAV2	adjacent portion of town

TABLE VI-7

POPULATION ESTIMATES FOR SUB-MUNICIPAL AREAS, 1973

		1973 Estimate	1970 Census
BROOME COUNTY			
Binghamton City	BC1	62,820	64,123
Binghamton Town	BT1	3,780	
	BT2	1,390	
		5,170	4,844
Chenango	CH1	410	
	CH2	5,840	
	CH3	6,780	
	Total	13,030	12,267
Colesville*	CV1	260	
	CV2	170	
	CV3	415	
Conklin	C1	4,540	
	C2	1,210	
	Total	5,750	5,399
Dickinson	D1	5,690	5,687
Fenton	F1	4,740	
	F2	1,490	
	F3	530	
	Total	6,760	6,719
Kirkwood	K1	110	
	K2	240	
	K3	3,100	
	K4	1,580	
	K5	1,052	
	Total	6,080	5,687
Lisle	L1	340	336
Maine	M1	2,860	
	M2	290	
	M3	1,110	
	M4	1,600	
	Total	5,860	5,842

*No totals derived

TABLE VI-7 Continued

BROOME COUNTY		1973 Estimate	1970 Census
Whitney Point	WP1	1,060	1,058
Deposit	DEP1	2,060	
	DEP2	70	
	Total	2,130	1,119
Endicott	E1	16,320	16,556
Johnson City	JC1	17,750	18,025
Union	U1	9,030	
	U2	19,360	
	U3	750	
	U4	860	
	Total	30,000	29,910
Vestal	V1	40	
	V2	1,710	
	V3	13,300	
	V4	6,960	
	V5	4,200	
	Total	27,800	26,909
Windsor	W1	1,100	
	W2	140	
	Total	1,240	1,098
TIOGA COUNTY			
Candor	CAN1	940	
	CAN2	300	
	Total	1,240	939
Newark Valley	NV1	1,290	
	NV2	80	
	Total	1,370	1,286
Owego Village	OV1	4,680	
	OV2	460	
	Total	5,140	5,152

TABLE VI-7 Continued

		1973 Estimate	1970 Census
Owego Town	OT1	3,960	
	OT2	4,200	
	OT3	1,500	
	OT4	960	
	OT5	2,620	
	OT6	190	
	OT7	180	
	OT8	130	
	OT9	3,380	
	OT10	480	
	Total	17,600	15,184
Nichols	N1	640	
	N2	110	
	Total	750	638
Spencer	S1	850	
	S2	40	
	Total	890	854
Waverly	WAV1	5,260	
	WAV2	1,000	
	Total	6,260	5,261

TABLE VI-8

POPULATION PROJECTIONS FOR SUB-MUNICIPAL AREAS, 1980-2020

Broome County		1980	1990	2000	2010	2020
Binghamton City	BC1	60,200	57,900	57,900	58,400	60,000
Binghamton Town	BT1	4,000	4,570	4,700	4,850	5,150
	BT2	1,500	1,650	1,700	1,750	1,850
	Total	5,500	6,220	6,400	6,600	7,000
Chenango	CH1	420	450	480	500	530
	CH2	5,850	6,250	6,420	6,600	6,720
	CH3	6,800	7,200	7,400	7,600	7,750
	Total	13,070	13,900	14,300	14,700	15,000
Colesville*	CV1	250	260	510	710	1,000
	CV2	160	170	210	250	300
	CV3	400	420	760	1,040	1,400
Conklin	C1	4,540	4,850	5,150	5,350	5,500
	C2	1,210	1,270	1,350	1,450	1,600
	Total	5,750	6,120	6,500	6,800	7,100
Dickinson	D1	5,370	5,150	5,100	5,200	5,300
Fenton	F1	4,850	4,950	5,500	5,900	6,200
	F2	1,600	1,720	2,300	2,550	3,000
	F3	570	630	900	950	1,000
	Total	7,020	7,300	8,700	9,400	10,200

*No totals derived

TABLE VI-8 Continued

		1980	1990	2000	2010	2020
Kirkwood	K1	110	120	130	150	160
	K2	240	250	260	300	320
	K3	3,110	3,330	3,400	3,500	3,600
	K4	1,590	1,700	1,800	1,900	2,050
	K5	1,050	1,100	1,110	1,150	1,170
	Total	6,100	6,500	6,700	7,000	7,300
Lisle	L1	350	370	380	430	510
Maine	M1	3,480	3,920	4,070	4,240	4,500
	M2	330	400	430	450	500
	M3	1,140	1,200	1,250	1,300	1,350
	M4	1,820	2,350	2,450	2,500	2,650
	Total	6,770	7,870	8,200	8,490	9,000
Whitney Point	WP1	2,050	2,180	2,300	2,710	3,100
Deposit	DEP1	2,060	2,060	2,060	2,060	2,060
	DEP2	80	90	100	110	120
	Total	2,140	2,150	2,160	2,170	2,180
Endicott	E1	15,800	15,200	15,200	15,400	15,600
Johnson City	JC1	17,400	16,880	16,900	17,100	17,300
Union	U1	9,330	9,550	9,550	9,600	9,650
	U2	19,800	20,230	20,250	20,350	20,400
	U3	750	750	750	750	750
	U4	900	950	950	1,000	1,000
	Total	30,780	31,480	31,500	31,700	31,800

TABLE VI-8 Continued

		1980	1990	2000	2010	2020
Vestal	V1	60	80	80	80	80
	V2	2,080	2,500	2,600	2,620	2,660
	V3	15,040	18,340	18,900	18,970	19,190
	V4	8,400	9,600	10,200	10,580	10,720
	V5	6,000	6,800	7,600	7,600	7,700
	Total	31,580	37,320	39,380	39,850	40,350
Windsor	W1	1,200	1,310	1,420	1,610	1,810
	W2	140	160	170	190	220
	Total	1,340	1,470	1,590	1,800	2,030
Tioga County						
Candor	CAN1	370	450	510	540	600
	CAN2	370	450	510	540	600
	Total	740	900	1,020	1,080	1,200
Newark Valley	NV1	1,440	1,630	1,940	2,160	2,370
	NV2	90	100	120	140	150
	Total	1,530	1,730	2,060	2,300	2,520
Owego Village	OV1	4,390	4,190	4,140	4,340	4,540
	OV2	460	460	460	460	460
	Total	4,850	4,650	4,600	4,800	5,000
Owego Town	OT1	4,300	7,000	7,400	7,670	8,000
	OT2	5,230	6,000	6,300	7,100	7,300
	OT3	1,730	2,610	2,800	2,840	3,100
	OT4	1,270	1,300	1,350	1,400	1,450
	OT5	2,800	4,400	4,800	5,070	5,400
	OT6	230	310	340	370	400
	OT7	230	310	340	370	400
	OT8	160	220	250	270	300
	OT9	4,000	5,050	5,230	5,720	6,000
	OT10	550	600	650	700	750
	Total	20,500	27,800	29,460	31,510	33,100

TABLE VI-8 Continued

		1980	1990	2000	2010	2020
Nichols	N1	710	830	980	1,090	1,200
	N2	120	140	160	180	200
	Total	830	970	1,140	1,270	1,400
Spencer	S1	1,080	1,390	1,960	2,110	2,260
	S2	40	60	80	90	90
	Total	1,120	1,450	2,040	2,200	2,350
Waverly	WAV1	4,580	4,100	4,100	4,100	4,100
	WAV2	1,000	1,000	1,000	1,000	1,000
	Total	5,580	5,100	5,100	5,100	5,100

ECONOMIC PROJECTIONS

OBERS projections of economic activity for the Binghamton SMSA to the year 2020 have been made based on Series E population projections. These economic projections are shown in Table VI-9. The Bicounty Area projections for economic activity are presented in Table VI-10 and parallel the Broome-Tioga proportion of 1970 SMSA earnings within each industry.

Historically, the employment/population (E/P) ratio in the Bicounty Area has been decreasing. This trend, however, is expected to be reversed during the 1970's. The E/P ratios indicate that while population will experience only moderate increases, employment will grow at a higher rate. Implications for future wastewater management plans are that industrial wastewater flow will increase and therefore, the total wastewater flow will be greater. Subsequently, increasing proportions of the costs for pollution control will gradually shift from the residential sector to the industrial sector.

Relative changes in the manufacturing sector of the economy can be expected within Broome and Tioga Counties and are briefly described in Table VI-11.

Since electrical manufacturing is currently one of the largest employers in the Bicounty Area and is expected to exhibit the highest growth rates, most new basic employment will be in this category. In general, new employment will be generated by expansions of existing manufacturing facilities rather than initiation of new firms. New facilities that are constructed will probably be located in the Five Mile Point Industrial Park, the Town of Conklin, and near the Village of Waverly. The construction of Interstate Route 88 may eventually result in the location of some industry in the Town of Fenton. Warehousing activities are projected to increase at Five Mile Point and in Fenton.

TABLE VI-9

BINGHAMTON SMSA ECONOMIC PROJECTIONS: E/P RATIOS AND EARNINGS BY INDUSTRY, 1980-2020
(Thousands of 1967 Dollars)

	1980	1990	2000	2020
E/P RATIO	.43	.44	.45	.45
Total Earnings	1,176,200	1,579,000	2,167,700	3,781,400
Agriculture, forestry and fisheries	15,500	17,100	19,200	24,400
Mining	1,300	1,500	1,900	2,600
Contract construction	82,500	109,900	148,800	251,900
Manufacturing	482,700	613,300	799,400	1,287,700
Transportation, Communication and public utilities	58,500	78,100	107,100	186,900
Wholesale and retail trade	153,900	199,900	269,300	448,800
Finance, insurance and real estate	44,600	66,700	99,500	194,900
Services	154,000	230,500	346,200	688,600
Government	182,800	261,700	375,900	695,400

Source: OBERS Series E Projections

TABLE VI-10

ECONOMIC PROJECTIONS FOR BROOME AND TIOGA COUNTIES:
E/P RATIOS AND EARNINGS BY INDUSTRY, 1980-2020
(Thousands of 1967 Dollars)

	1980	1990	2000	2020
E/P RATIO	.43	.44	.45	.45
Total Earnings	1,034,600	1,389,100	1,907,100	3,327,600
Agriculture, forestry and fisheries	13,600	15,000	16,900	21,500
Mining	1,100	1,300	1,700	2,300
Contract construction	72,600	96,700	130,900	221,700
Manufacturing	424,800	539,700	703,500	1,133,200
Transportation, Communication and public utilities	51,500	68,700	94,000	164,500
Wholesale and retail trade	135,400	175,900	237,000	394,900
Finance, insurance and real estate	39,200	58,700	87,600	171,500
Services	135,500	202,800	304,700	606,000
Government	160,900	230,300	330,800	612,000

Source: OBERS Series E Projections

TABLE VI-11

RELATIVE CHANGES IN THE MANUFACTURING SECTOR

Sector	Change
All Manufacturing	Moderate Increase
Electrical Machinery	Very High Increase
Transportation Equipment	High Increase
Paper	Moderate Increase
Printing	Moderate Increase
Chemicals	Moderate Increase
Machinery except Electrical	Moderate Increase
Motor Vehicles	Moderate Increase
Lumber and Furniture	Gradual Decline
Food	Gradual Decline
Apparel	Gradual Decline (constant level)
Petroleum	Gradual Decline (constant level)
Primary Metals	Gradual Decline (constant level)
Textiles	Very Large Decline
Agriculture	Very Large Decline

FUTURE ENVIRONMENTAL PROFILE

Impacts and changes resulting from implementation of wastewater management plans must be measured against the expected environmental profile in the future without the plans. Thus, a projection of the ecological future was made by extending existing conditions as modified by the patterns of change which were presently occurring. The most important ecological changes, in the context of a wastewater management plan, were those brought about by changes in the extent and type of wastewater treatment facilities. Such changes would be predominantly felt in the aquatic environment. The following discussion examines the regional trends that were expected in the Bicounty Area in the absence of new wastewater management systems and summarizes the future baseline conditions profile for the Binghamton metropolitan area.

REGIONAL TRENDS

Outlying Communities are expected to experience only minor development. Septic systems with leaching fields will still be the major wastewater disposal method. In areas such as Newark Valley which have impervious or otherwise unsuitable soils for septic tank leaching fields, surface and groundwater pollution may occur. At Whitney Point, the discharge of raw sewage, which at present is not apparently detrimental to the aquatic biota, constitutes a potential health hazard and may in the future contribute to an increase in coarse fish with an accompanying decrease in game fish such as bass and pike.

A decline in agriculture will result in the abandonment of marginal farmland which will gradually either revert to forest or be developed. Such a change will bring about an accompanying general decline in openland wildlife and concomitant increase in woodland species.

The present pattern of city decline and suburban expansion within the urban area will most likely continue in the future, although efforts toward revitalization of the inner urban core may slow down the continuous movement to the suburbs. Urbanization will result in the development of presently existing open spaces including farmlands, riverbanks, and perhaps even the more unsuitable forested uplands. Changes in availability of open space will create a decrease in the area's natural wildlife.

Gradual implementation of the Riverbanks Improvement Program will fulfill a desire expressed by many residents of the area for recreation and open space adjacent to the rivers. However, legal and financial difficulties may hamper full implementation of the Riverbanks Program. Development of riverbank parks along the Susquehanna and Chenango Rivers will proceed from the present acquisition sites near the Broome-Tioga boundary east and north along the Susquehanna and Chenango River Valleys.

Without the implementation of new wastewater management plans, it is expected that future domestic and industrial treatment facilities will be similar to those presently in operation, with some modifications. The major modifications of existing treatment facilities include: abandonment of the Vestal plant with wastes being carried to and treated at the Endicott plant, and abandonment of the Owego-Valley View treatment plant with wastes being carried to and treated at the Owego Village plant which will be upgraded to provide secondary treatment. It was also assumed that Broome Community College in the Chenango Valley would continue to use its own septic tank and leaching fields for wastewater treatment and disposal. Other residents of the Chenango Valley area would also continue to use septic tanks and leaching fields with the potential for groundwater contamination and possible surface water pollution. Future STP treatment efficiencies were assumed to be similar to those presently observed. In addition, no efforts to treat the combined sewer overflows were expected. Industrial wastes would be treated either by the municipal treatment plants or by the individual industry.

Although installation of secondary treatment facilities would result in substantial reduction of pollutant discharges, it was expected that restriction on primary contact recreation in some urban area waterways would continue since significant numbers of coliform bacteria would enter the rivers from the combined sewer overflows and general urban runoff. Dissolved (DO) oxygen standards in the rivers would most likely not be met under future wastewater flows despite the utilization of secondary treatment facilities. If poor water quality conditions continued for any length of time, clean water organisms would be eliminated and the pollution tolerant organisms would gradually become more abundant. Improper functioning of septic systems combined with poorly suited soils as exist in the Chenango River Valley could result in pollution of both ground and surface waters.

Problems to future aquatic biota, however, would be even more critical if large overflows from combined sewers occur concurrently with low river flows. Aquatic organisms may be subject to extremely low dissolved oxygen concentrations (3 mg/l) for several hours or days depending upon conditions of river flow and rainfall intensity.

The stress placed on the fish within the waterway during such a pollutional loading, however, is not the only impact associated with aquatic ecology. The low DO levels encountered downstream of combined sewer overflows or wastewater outfalls would create severe conditions for other aquatic organisms in this reach of the river. The present clean water flora and fauna existing in the stream could be stunted or killed. The river would require a considerable length of time to recover from such an event and during this time, if water quality conditions continue to be poor, a new variety of pollution tolerant organisms could become dominant. Only a prolonged period of good water quality could re-establish the clean water flora and fauna.

SUMMARY OF BASELINE CONDITION

To facilitate comparison of alternatives, a summary of the future baseline condition profile is presented in Table VI-12. An assessment of the relative impacts of each alternative with regard to the expected conditions without a plan was necessary for proper evaluation of alternatives identified throughout the study. A detailed impact assessment of each plan in relation to the future baseline condition profile is contained in the Impact Assessment and Evaluation Appendix.

The left column in Table VI-12 lists impact categories which are applicable to all alternatives while the right column discusses items pertinent to the Baseline Condition profile. The impact categories cannot be separated, but rather interact and overlap with each other. Most of the information presented in the table has been discussed or can be inferred from the text of this Appendix. Table VI-12, then, summarizes the expected future condition of the Bicounty Area without any wastewater management plans.

TABLE VI-12

SUMMARY OF FUTURE BASELINE CONDITION PROFILE FOR THE BICOUNTY STUDY AREA

Category	Major Elements
Wastewater Management	Five treatment facilities, providing secondary treatment, including B-JC STP, Endicott STP, Owego STP #1 and #2 and Owego Village STP. Some additions to presently planned sewer extensions. Capacities of all treatment plants most likely will be exceeded by the year 2000, with the possible exception of the B-JC STP (See Chapter IV).
Water Supply	No problems with water supply although some extensions of distribution systems may occur (See Chapter IV).
Sludge Management	Continuation of existing sludge management and disposal practices. Predominance of landfill disposal techniques (See Chapter IV).
Stormwater Management	Continuation of present stormwater overflow problems. Perhaps some implementation of Infiltration/Inflow measures (See Chapter V).
Aquatic Ecology	Violation of stream DO standards especially during low river flow conditions and/or during times of overflowing of combined sewers. Potentially critical conditions especially for game fish within area waterways. No foreseeable problems of excessive nutrients in the forms of phosphate or nitrogen or with toxic metals or refractory organics due to expected industrial waste treatment (See Chapter V).

TABLE VI-12 Continued

Category	Major Elements
Terrestrial Ecology	Similar to existing conditions. Continued reduction of open lands such as abandoned farms or other vacant land as suburbs continue to expand. Concurrently, some shifts in abundance and type of wildlife (See Chapter II).
Demography	Projected growth for the study area indicates only a small increase in population, with the major portion of such increases being suburban expansion near existing urban areas and especially within Tioga County (Chapter VI).
Economy	The employment/population ratio is expected to increase. The major sector of the economy will be manufacturing, especially electrical manufacturing (Chapter VI).
Public Health	Reduction in river coliform concentrations due to installation of secondary waste treatment facilities. High levels of coliform will remain due to stormwater and urban runoff; therefore, primary contact water sports will be prohibited in some sections of area waterways. Possible contamination of surface or groundwater due to septic system failures (See Chapter V).

CHAPTER VII

COMPREHENSIVE REGIONAL PLANS

The General Plan for Broome and Tioga Counties has been published by the Southern Tier East Regional Planning Board (STERPB) in seven volumes over the past several years. The report is primarily concerned with the overall policies and general plans which are intended to guide future growth in Broome and Tioga Counties. Many aspects of broad planning responsibilities are covered including existing physical, social, and economic conditions together with the policies that are intended to direct growth and development in the future. Desired patterns of growth, land use, environmental quality, agriculture, transportation, housing, and health are discussed in the following paragraphs with particular reference to the overall General Plan for the region.

GROWTH PATTERNS

Major settlement concentrations in the Bicounty Area are to focus on the Susquehanna and Chenango River Valleys where water supply, sewage, and transportation facilities are available or can be easily extended. Population densities in these river valleys should be high enough to support utilities and the associated full range of community services. Growth is encouraged in a linear pattern between Binghamton and Owego with provisions for areas of protected open space.

Redevelopment of the urban core is one of the major objectives of the planning and action programs for the Bicounty Area. Continued migration to the suburbs is to be discouraged. An objective for rural areas is to maintain viable agricultural land as long as it is economically justified. Zoning regulations, highway locations, and water and sewer extensions should be planned with this objective in mind. Reforestation and part-time farming activities also should be encouraged in areas which are marginal for commercial farming. The provision of utilities and community services can have a significant influence on growth patterns. Extension of sewer, water, and other community services to undeveloped areas can encourage future growth in desired locations. On the other hand, extension of community services can also be discouraged in areas where growth is not desired.

Therefore, land use planning on a regional level is an essential element for the efficient and rational direction of future development.

LAND USE

Many of the policies and plans outlined in the General Plan prepared by STERPB for Broome and Tioga Counties can be translated into land use proposals for the Bicounty Area. Figure III-2 showed the existing land use patterns.

The basic concept of the General Plan and the intended long-range development patterns are indicated in Figure VII-1. The basic concept is an expanded urban core with smaller support centers in outlying areas. The major urban concentration is expected to remain in the Binghamton-Johnson City area with radial extensions up the Chenango River Valley and the Nanticoke Creek Valley. A secondary urban concentration is expected around the Village of Owego. Support concentrations for the primary urban areas would be established in Waverly, Candor, Whitney Point, and Windsor.

A major thrust of the General Plan is to provide community services in areas where substantial new growth is planned while discouraging development in other areas. For example, development is to be discouraged in the Susquehanna Valley between Apalachin and the Village of Owego so that this part of the valley will remain as a semi-rural environment. Objectives such as these were an integral part of the wastewater management planning.

The major commercial centers are to be located in the urban area of Binghamton which will provide office, finance, entertainment, and specialty shopping areas for the region.

Additional major commerical concentrations are expected for the Village of Owego, for the area near the intersection of Routes 17 and 26 in Vestal, and at Hinman's Corner in the Town of Chenango. A smaller commercial center will be maintained in the Village of Waverly.

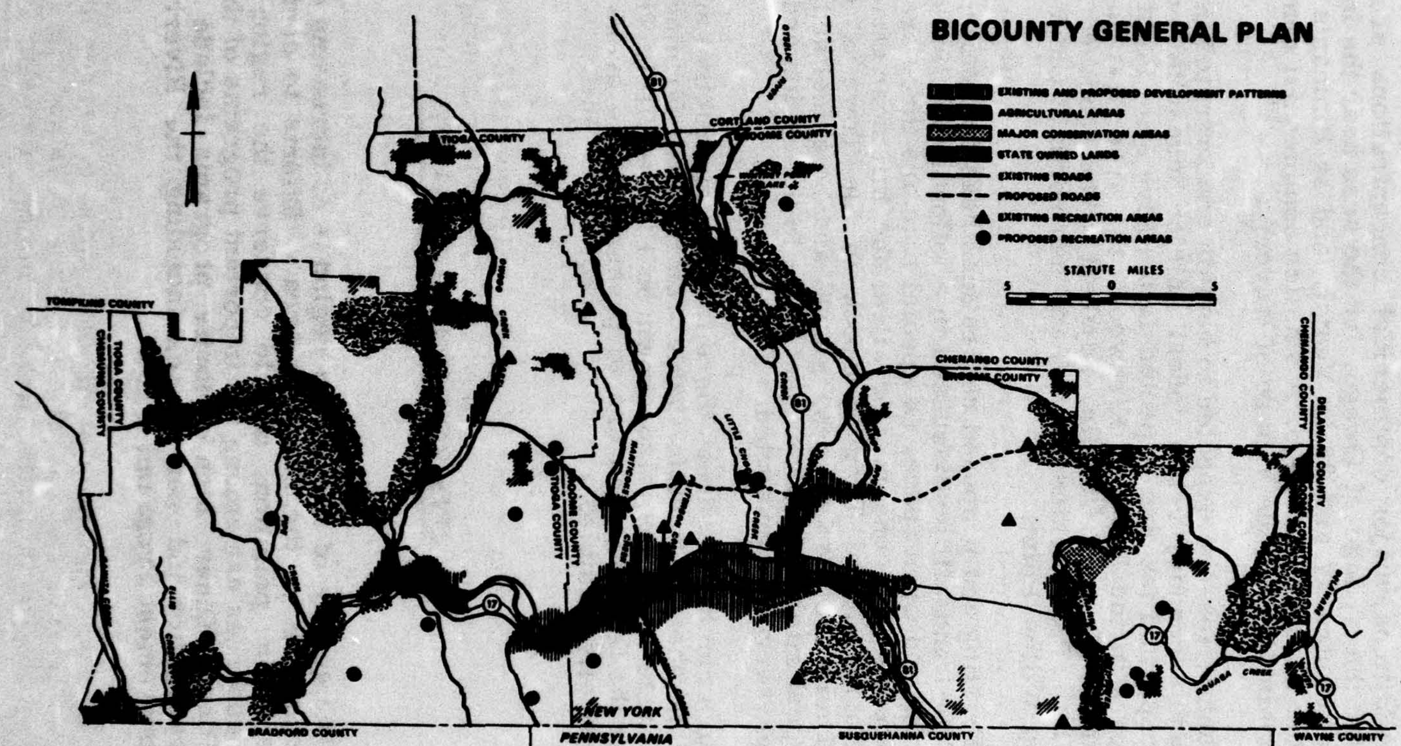
Industries are expected to remain concentrated in the major and secondary urban cores. Major industrial employment opportunities are expected in the Five Mile Point industrial park in the Town of Kirkwood, the area near the railroad in the Town of Conklin, adjacent to the proposed Route I-88 in the Port Dickinson area, and just north of Old Vestal Road at Willow Point.

Existing and proposed recreation areas are shown on Figure VII-1 and will be discussed in a following section on Recreation and Open Space. Of special note are three areas recommended for conservation sites: the hill near Ouaquaga, the Narrows, and Thomas Brook in the Town of Chenango. There are also gorges, glens, and botanical and archeological sites that have great value to the region and should be preserved or protected.

In a number of areas there is highly productive agricultural land that can sustain viable commerical farming activity. These areas are also shown on Figure VII-1. The policies of the General Plan are to preserve these areas if economically feasible.

ENVIRONMENTAL QUALITY

The quality of life in the region is of increasing concern to residents of the Bicounty Area. Efforts to control water and air pollution and to conserve the region's natural resources are among the important programs of the General Plan. Other high priority programs include plans for recreation and open space, including the Riverbanks Improvement Program.



BICOUNTY GENERAL PLAN
EXISTING AND PROPOSED DEVELOPMENT PATTERNS
AGRICULTURAL AREAS
MAJOR CONSERVATION AREAS
STATE OWNED LANDS
EXISTING ROADS
PROPOSED ROADS
EXISTING RECREATION AREAS
PROPOSED RECREATION AREAS
STATUTE MILES
5
0
5
TOMPKINS COUNTY
TIOGA COUNTY
CHEMUNG COUNTY
CORTLAND COUNTY
BROOME COUNTY
CHENANGO COUNTY
DELAWARE COUNTY
BRADFORD COUNTY
SUSQUEHANNA COUNTY
WAYNE COUNTY
NEW YORK
PENNSYLVANIA

FIGURE VII-1

RECREATION AND OPEN SPACE

The development of a regional recreational system related to the overall needs of the Bicounty Area is a prime concern. Programs are to be developed which will make full use of the area's rolling terrain, major rivers, and abundance of glens and surface waterways.

Multipurpose water storage areas are to be developed to retard flooding and provide opportunities for recreation and open space preservation. Certain open space areas are to be maintained and protected so that wildlife and unique natural vegetative cover can be protected. Development in key upland drainage areas is to be controlled to prevent rapid runoff and flooding.

In addition, a series of open spaces and parks is to provide connecting links for recreational facilities of the study area. A number of objectives have been established in the General Plan for guiding the overall development of recreational facilities and open space programs in the Bicounty Area:

Identification of areas with unique natural features which could be preserved as open space for public use.

Provision of a variety of recreation facilities that could be appropriate for rural as well as urban areas.

Discouragement of continuously urbanized land along the Susquehanna and Chenango Rivers by including protected open space as part of the settlement pattern for these areas.

Encouragement of local efforts to plan, acquire, and develop parks and playgrounds for local use, and to advise on the possible funding techniques available to support such programs.

Encouragement of the multiple use of utility easements and abandoned railroad rights-of-way as part of an overall open space system.

Development of plans and control measures for the protection and use of flood plain areas and sites of natural beauty along the banks of major rivers in the region.

THE RIVERBANKS IMPROVEMENT PROGRAM

A basic premise of the Riverbanks Improvement Program is that the Susquehanna River and its major tributaries represent the most important scenic and recreational resource in the region. The General Plan places high priority on the conservation and preservation of this great natural resource. The goals, which are set forth in the Riverbanks Plan, are:

> To preserve and enhance the quality of the Susquehanna and its major tributaries.
>
> To make maximum use of this natural resource for active and passive recreational purposes.

These goals will be accomplished through a system of small and large parks, conservation areas, and strip connections between parks and will maximize the recreational and aesthetic attributes of the waterways in the area. The wastewater management program for the urban area can complement the Riverbanks Plan.

Initiation of the Riverbanks Plan has begun at various levels of government. Lands along Route 81 on the Chenango River from Nimmonsburg to downstream of Port Dickinson are being developed by the State. Additional acreage is to be included in the Chenango Valley State Park. Broome County has begun the legal processes necessary to acquire several acres of land along the Susquehanna River to act as connectors between existing park facilities. Some local communities are also purchasing and developing sites along the riverbanks.

It is expected that future acquisition and development of sites for the plan will extend upstream from the present acquisition areas along the Susquehanna River near the Broome-Tioga boundary to the system of parks currently being developed in the Chenango Valley. Figure VII-1 indicates both existing and proposed recreation and conservation areas within the Bicounty Area in accordance with the General Plan.

AGRICULTURE

A major portion of the land-intensive activities in the Bicounty Area relates to agriculture. With the exception of the large urban complex of Binghamton and the smaller, dispersed village concentrations, development has been largely oriented toward agriculture.

Although there is a significant amount of marginal and abandoned farmland, there are also a number of viable areas where farming has prospered as indicated on Figure VII-1. The best farmland in Tioga County is found in the valley areas along the Susquehanna River southwest of Owego, along Owego Creek valley north of Owego, and in the Willseyville, Spencer, and Candor areas. In Broome County, the viable areas are in the Susquehanna River Valley in the vicinity of Windsor and Harpursville, the area north of Deposit, and two areas north of Whitney Point in the Towns of Lisle and Triangle. Dairying accounts for the majority of all farm products sold in the Bicounty Area. Poultry farms are also important.

The goals and policies of the General Plan are to maintain viable agricultural land as long as is economically justifiable. Zoning regulations, highway location and assessment policies such as set forth in the New York Agricultural District programs are possible means of achieving this goal. Reforestation and part-time farming activities are considered desirable and should be encouraged in rural areas which are marginal for commercial farming.

TRANSPORTATION

Over a period of time, an elaborate network of highways and streets has been constructed to serve the continuously growing volume of motor vehicles.

Two high-speed, limited access highways, Interstate 81 and Route 17, connect this area to others in the State and Nation. A third expressway is proposed to connect Binghamton and Albany. Improvements in the bridges and primary street systems are also planned. Major existing and proposed highways are outlined on Figure VII-1.

The region is presently served by the Delaware and Hudson, Erie-Lackawanna, and Lehigh Valley railways. This service is only for freight, but there are several large switching yards in the area. Rail service is not expected to have a major impact on the economy of the region. The existence of an extensive expressway system makes highway movement of goods and products a satisfactory substitute to rail transportation for most industries. In addition, the older industrial areas of the region that are already located along rail lines have limited room for expansion because of the dense patterns of urbanization that surrounds them. Finally, rail facilities in the area are old and obsolete in many cases.

Two airports serve the Bicounty Area. The Broome County Airport is owned and operated by the county government. It is located in the Town of Maine apppoximately 8 miles northwest of the City of Binghamton. The airport is served by several commercial airlines. The hilltop location makes extension of the runways difficult; therefore, improved service by attraction of other larger commercial carriers seems unlikely. The other, Tri-Cities Airport, is owned and operated by the Village of Endicott. It is located in the southwest corner of the Town of Union on the north bank of the Susquehanna River and presently serves corporation, private, and charter aircraft only.

HOUSING AND HEALTH PROGRAMS

Housing and health programs for low and moderate income persons also have a high priority in comprehensive planning for the Study Area. The establishment of a regional housing authority, provision of housing for the elderly, and the regulation and enforcement of building codes should be encouraged.

The low income urban population is highly vulnerable to serious health problems caused by degraded environmental conditions, poor health practices, and limited access to existing health services. To eliminate some of these problems, a broad range of preventive, diagnostic, and therapeutic services should be provided. These services should be available, accessible, and convenient to the population served.

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BINGHAMTON WASTEWATER MANAGEMENT STUDY. BACKGROUND INFORMATION --ETC(U)
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RELATION OF WASTEWATER STUDY TO GENERAL PLAN

It is within this broad framework of comprehensive planning for Broome and Tioga County that the Binghamton Wastewater Management Study made its specific contribution concerning plans for improved water quality and wastewater management practices. The wastewater management study was necessarily responsive to the objectives of the General Plan for patterns of growth, land use, environmental quality, and other related local concerns. Specifically, wastewater management planning complemented the General Plan by guiding development in areas where growth is desirable, by discouraging growth in designated non-development areas, by supplementing the water-related programs of the Recreation and Open Space Plan, and by enhancing the Riverbanks Improvement Program.

CHAPTER VIII

PLANNING GOALS AND OBJECTIVES

The Binghamton Wastewater Management Study provided a range of urban water resource plans that were compatible with Federal, State, and local goals and objectives. The purpose of this chapter is to consider the broad Federal policies that guided the study effort and to present the specific objectives for the Binghamton Wastewater Management Study. At the completion of the Study, alternative plans were compared and evaluated in light of the goals and objectives the planning effort was directed to achieve.

FEDERAL POLICIES

FEDERAL WATER RESOURCE PLANNING OBJECTIVES

The U.S. Water Resources Council coordinates Federal policies and programs for water and related land resources of the Nation. On 10 September 1973, the Council published the "Principles and Standards for Planning Water and Related Land Resources" in the *Federal Register*. The "Principles and Standards" require Federal and Federally assisted water and land activities be planned toward the achievement of National Economic Development (NED) and Environmental Quality (EQ). The NED objective is to be achieved by increasing the value of the Nation's output of goods and services and improving national economic efficiency. The EQ objective is to be achieved by the management, conservation, preservation, creation, restoration, or improvement of the quality of certain natural and cultural resources and ecological systems. Planning for the use of water and land resources in terms of these objectives helped to identify alternative courses of action and provided the type of information that was required in the public decision-making process.

NATIONAL WATER QUALITY GOALS

The very broad goal of any wastewater management study is to promote the quality of life in the study area through improved water quality management techniques. The Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500) established two primary water quality goals in Section 101 (a).

(1) "It is the national goal that the discharge of pollutants into navigable waters be eliminated by 1985;"

(2) "It is the national goal that wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water be achieved by 1 July 1983."

To achieve the national water quality goals, P.L. 92-500 specifies certain time-phased objectives for wastewater management. Table VIII-1 summarizes these objectives in terms of deadlines for wastewater planning.

TABLE VIII-1

NATIONAL WATER QUALITY OBJECTIVES

Year	Objective
1977	Secondary Treatment
1983	Fishable-Swimmable Waters
1985	No Discharge of Pollutants

Industries discharging to streams or municipal systems are subject to national water quality objectives established by P. L. 92-500. The EPA is defining effluent limitations, including pre-treatment standards for those industries discharging to municipal systems, on an industry by industry basis for 1977 and 1983. These regulations have been published in the Federal Register.

The Corps of Engineers has set forth its own interpretation of effluent limitations that are commensurate with the 1985 "no discharge" goal. Basically, these effluent limitations for 1985 consist of a list of constituents and the critical levels above which they become pollutants. Until such time as the Administrator of EPA publishes effluent limitations for 1985, the Corps of Engineers' interpretation of the 1985 goal shall be used for wastewater management planning in the Urban Studies Program.

OBJECTIVES OF THE BINGHAMTON WASTEWATER MANAGEMENT STUDY

Within the context of the broad water resource planning objectives of National Economic Development and Environmental Quality, specific planning objectives for the Binghamton Wastewater Management Study were defined. These objectives were derived from an analysis of the Bicounty Area within the scope of its resource base and through meetings and discussions with Southern Tier East Regional Planning Board officials, New York State Department of Environmental Conservation representatives, Federal water resource planners, and local individuals and organizations. The management structure (Interagency Study Management Group, Citizens Advisory Committee, and Technical Advisory Committee) for the Study, as described in Chapter I, provided the primary mechanism for communication and identification of the study objectives discussed below.

ACHIEVE SECONDARY TREATMENT FOR ALL SEWAGE TREATMENT PLANTS

All sewage treatment plants scheduled to be operational in 1977 should be upgraded to secondary treatment standards as established by EPA. If the Vestal primary STP and the Valley View Imhoff tank are phased out of service as presently envisioned, then only the Owego Village STP would need to be upgraded from primary to secondary treatment.

ACHIEVE WATER QUALITY STANDARDS

The water quality classifications (A, B, or C) for the Tioughnioga, Chenango, and Susquehanna Rivers should be achieved. Conformance to the standards for each water quality parameter (BOD, SS, DO, coliforms, temperature, etc.) will allow a waterway to be used according to its designated classification.

REDUCE INFILTRATION/ INFLOW

Plans should be formulated that mitigate or eliminate combined sewer overflows, especially in the Binghamton-Johnson City area. Cost savings for wastewater treatment should be investigated to determine the desirability of additional infiltration control. Stormwater control measures should be proposed that will reduce total flow to STP's and eliminate the discharge of untreated sanitary sewage to waterways at combined overflow points.

PLAN FOR FISHABLE-SWIMMABLE WATERS

If the Owego Valley STP is upgraded to secondary treatment and the Valley View and Vestal primary treatment plants are closed as presently planned, then the Urban Study Area would have facilities to provide secondary treatment at each plant. Therefore, it is desirable to look beyond the 1977 secondary treatment requirements and plan for the Federal goal of fishable-swimmable waters by 1983.

ANTICIPATE FUTURE WASTEWATER FLOWS

The provision for collection and treatment of wastewater flows to the year 2020 should be incorporated in the present planning effort. Comparison of projected wastewater flows with existing capacities of municipal waste treatment plants indicated that the Owego Town No. 2 STP and the Endicott STP would be overloaded by 1980. By the year 2000, it is probable that the capacity of all existing plants will be exceeded. Furthermore, it is desirable to plan for sewer service in other areas such as Chenango Valley, Five Mile Point, and Nanticoke Valley where substantial growth is expected during the planning period.

WASTEWATER MANAGEMENT FOR OUTLYING COMMUNITIES

An analysis should be made of the wastewater management practices in Outlying Communities to investigate whether there is any impact on the water quality in the Urban Study Area. Courses of action for wastewater management in Outlying Communities should also be outlined.

CONFORM TO INDUSTRIAL PRETREATMENT GUIDELINES AND EFFLUENT LIMITATIONS

Industries discharging to municipal systems in the Bicounty Area should conform to pretreatment standards as specified by EPA. Industries discharging wastewater directly to waterways should observe the effluent limitations currently being established by EPA.

USE SLUDGE AND SLUDGE BY-PRODUCTS FOR BENEFICIAL PURPOSES

The sludge generated from municipal wastewater treatment should be disposed in such a manner so as to take advantage of its positive attributes. Currently, digested sludge from most STP's is applied to land as a soil conditioner. The one exception is at the Endicott STP where sludge is placed in a landfill. The Binghamton-Johnson City STP, though, is faced with a decision regarding its present sludge handling practices. Most plants also use gas produced by sludge digestion for heating purposes. A continuation of the beneficial uses of sludge materials and digester gas is desirable.

ENHANCE RECREATIONAL AND SCENIC OPPORTUNITIES

The enhancement of recreational and scenic opportunities along the Susquehanna and its major tributaries should be an important objective for the study. The value of these water and related land resources could be significantly enhanced by the maintenance of water quality conditions suitable for primary contact recreation. Present stream classification (Class C) in segments of the Susquehanna River between the City of Binghamton and the Village of Owego does not provide for such usage.

However, current water quality standards for dissolved oxygen in both Class B (primary contact recreation) and Class C waters are equivalent. Class B standards, then, could be achieved by maintaining the lower coliform levels associated with Class B waters. The result would be an uninterrupted stretch of river suitable for primary contact recreation between Binghamton and Owego.

INVESTIGATE METHODS FOR ACHIEVING THE "NO DISCHARGE" GOAL

P. L. 92-500 established a national goal that the "discharge of pollutants into navigable waters be eliminated by 1985." No part of the long-range planning process for the Bicounty Area would be complete without addressing alternative methods for achieving the "no discharge" goal by 1985.

SUMMARY OF STUDY OBJECTIVES

The national water quality goals of "secondary treatment" by 1977, "fishable-swimmable" waters by 1983, and "no discharge" of pollutants by 1985 serve as a foundation for promoting the quality of life in the Bicounty Area through improved water quality management techniques. The two planning objectives of National Economic Development and Environmental Quality provide a framework for planning. Table VIII-2 summarizes the Study objectives as determined by investigations and discussions in the Bicounty Area. Each of the plans developed meets, to varying degrees, the planning goals and objectives indicated in Table VIII-2.

TABLE VIII-2

BINGHAMTON WASTEWATER MANAGEMENT
STUDY OBJECTIVES

A. Achieve the minimum standards defining secondary treatment by 1977 at all wastewater treatment plants in the Bicounty Area.

1. Achieve NYSDEC water quality standards for the Susquehanna, Tioughnioga, and Chenango Rivers.

2. Reduce the occurrence of combined sewer overflows by controlling the volume of infiltration and inflow to the sewer system.

B. Plan for fishable-swimmable waters for the Bicounty Area in accordance with the 1983 goals for interim water quality.

1. Provide adequate wastewater collection and treatment facilities to accommodate projected growth in the Urban Study Area.

2. Outline general course of action for wastewater management in the Outlying Communities.

3. Achieve pretreatment standards, effluent limitations, or waste load allocations specified by EPA for industrial discharges.

4. Consider sludge and sludge by-products as recyclable resources to be used for beneficial purposes.

5. Enhance recreational and scenic opportunities associated with the Riverbanks Improvement Program by providing "Class B" waters from Binghamton to Owego Village.

C. Investigate alternative methods for achieving the 1985 "no discharge" goal.

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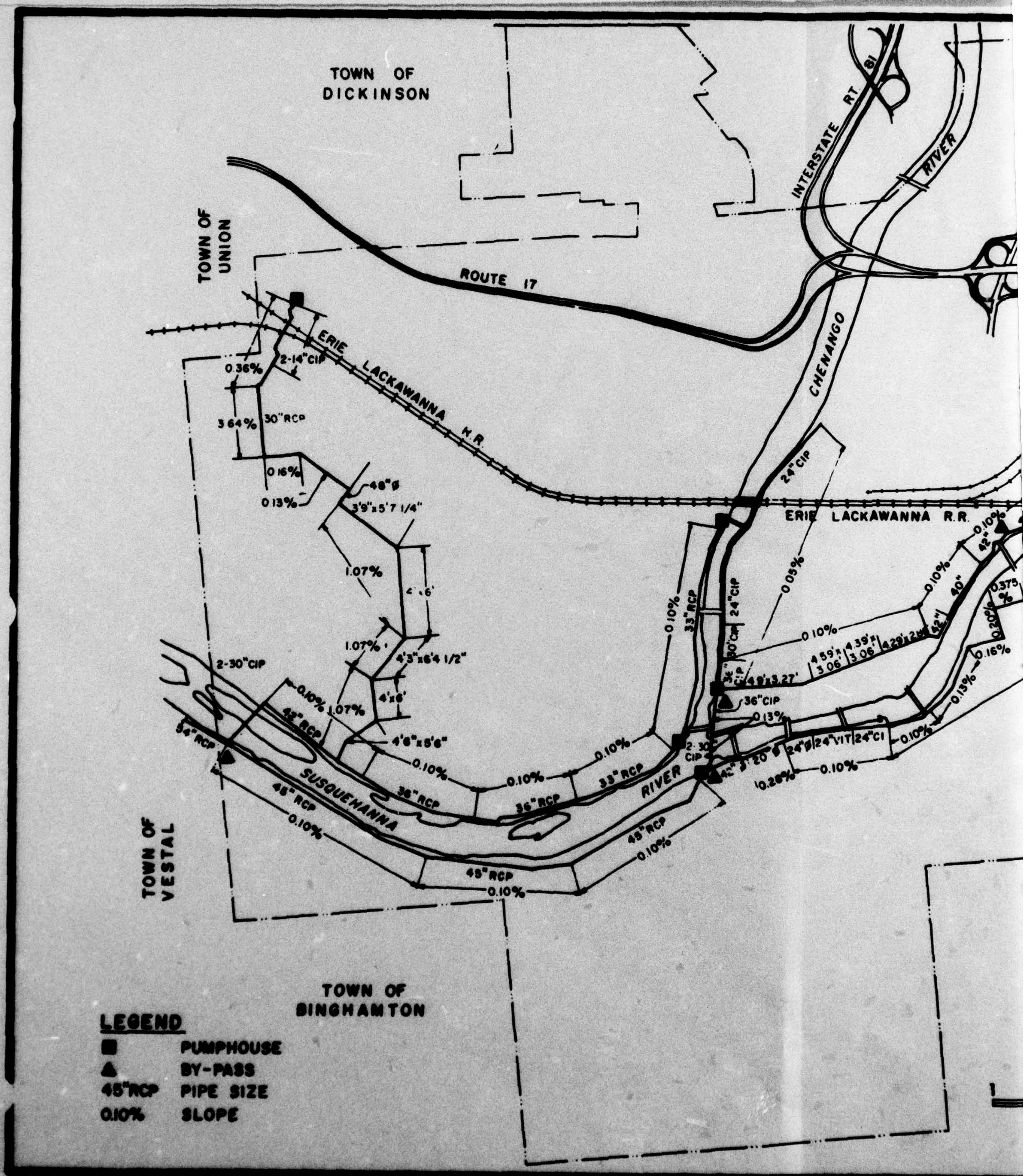
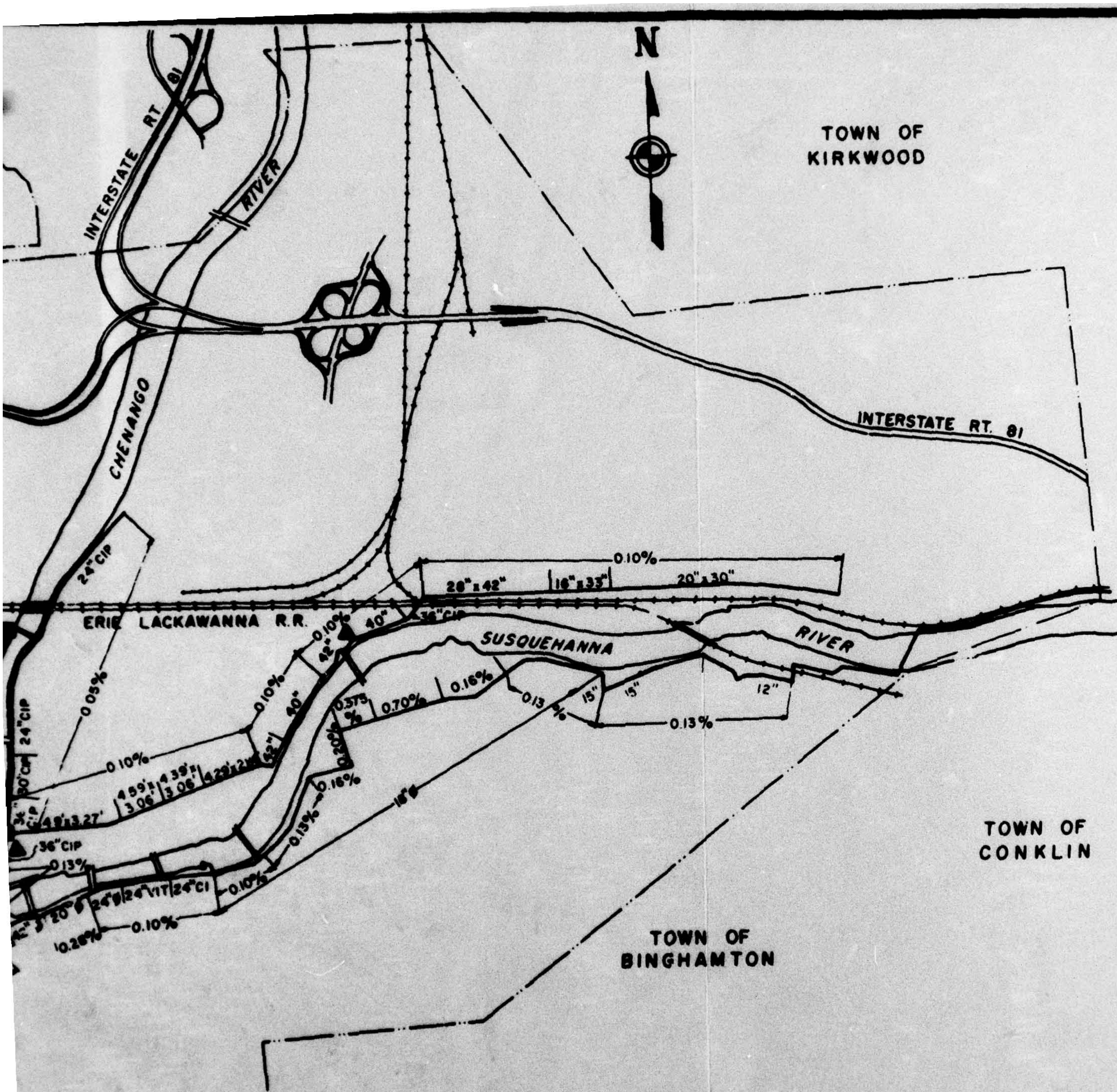

TOWN OF DICKINSON
TOWN OF UNION
ROUTE 17
INTERSTATE RT. 81
RIVER
CHENANGO
ERIE LACKAWANNA R.R.
ERIE LACKAWANNA R.R.
2-14"CIP
0.36%
30"RCP
3.64%
0.16%
0.13%
48"Ø
3'9"x5'7 1/4"
1.07%
1.07%
4'3"x6'4 1/2"
4'x6'
1.07%
4'6"x5'6"
2-30"CIP
54"RCP
42"RCP
0.10%
36"RCP
0.10%
36"RCP
0.10%
0.10%
33"RCP
0.10%
33"RCP
24"CIP
24"CIP
0.05%
30"CIP
36"CIP
0.10%
0.13%
0.10%
0.10%
40"
0.375 %
0.20%
0.16%
0.13%
0.10%
0.28%
24"VIT
24"CI
SUSQUEHANNA
RIVER
45"RCP
0.10%
45"RCP
0.10%
45"RCP
0.10%
TOWN OF VESTAL
TOWN OF BINGHAMTON
LEGEND
PUMPHOUSE
BY-PASS
45"RCP PIPE SIZE
0.10% SLOPE



EXISTING SEWER SYSTEM

CITY OF BINGHAMTON

SCALE 1 : 24000

1 1/2 0 1 MILE