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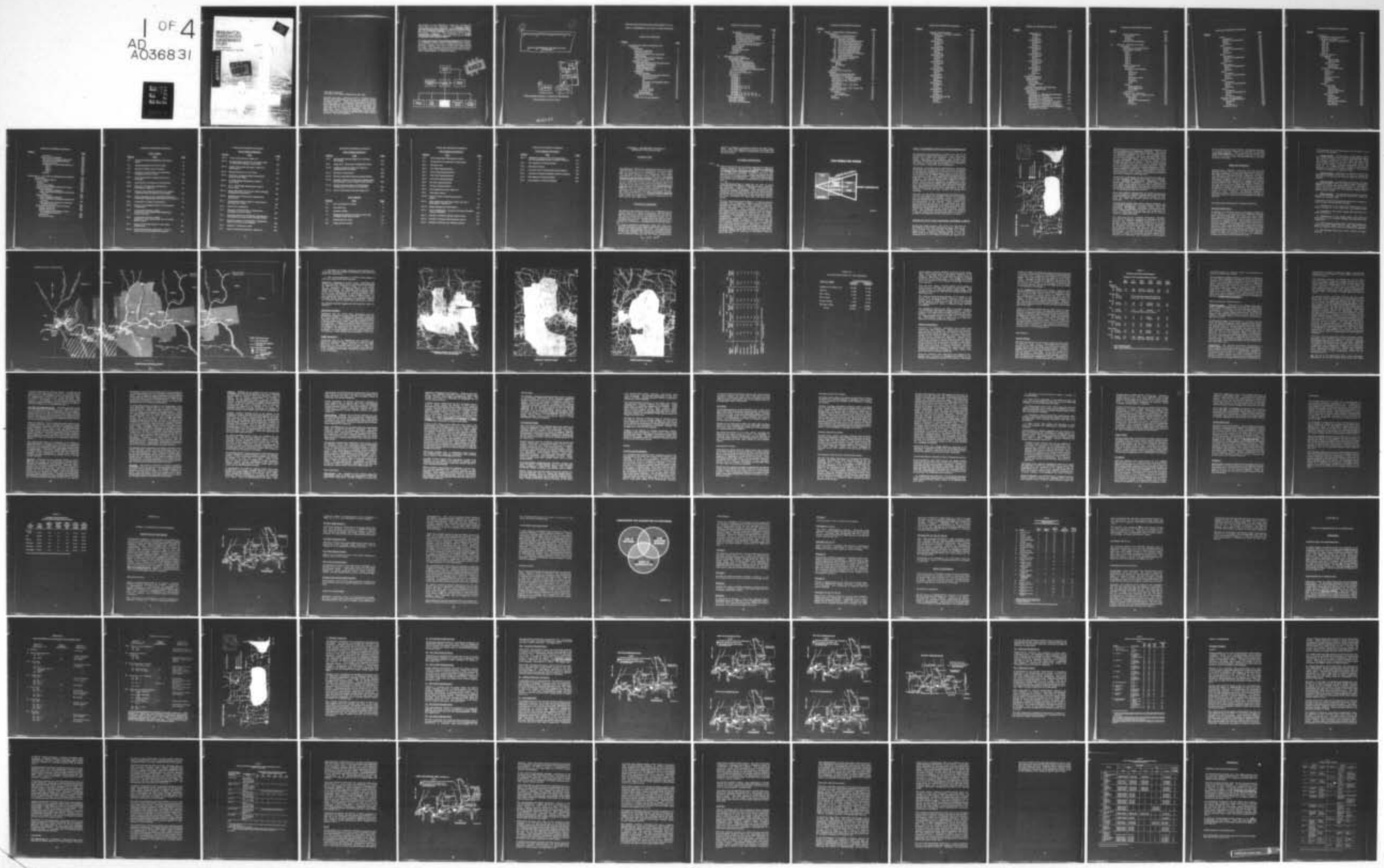
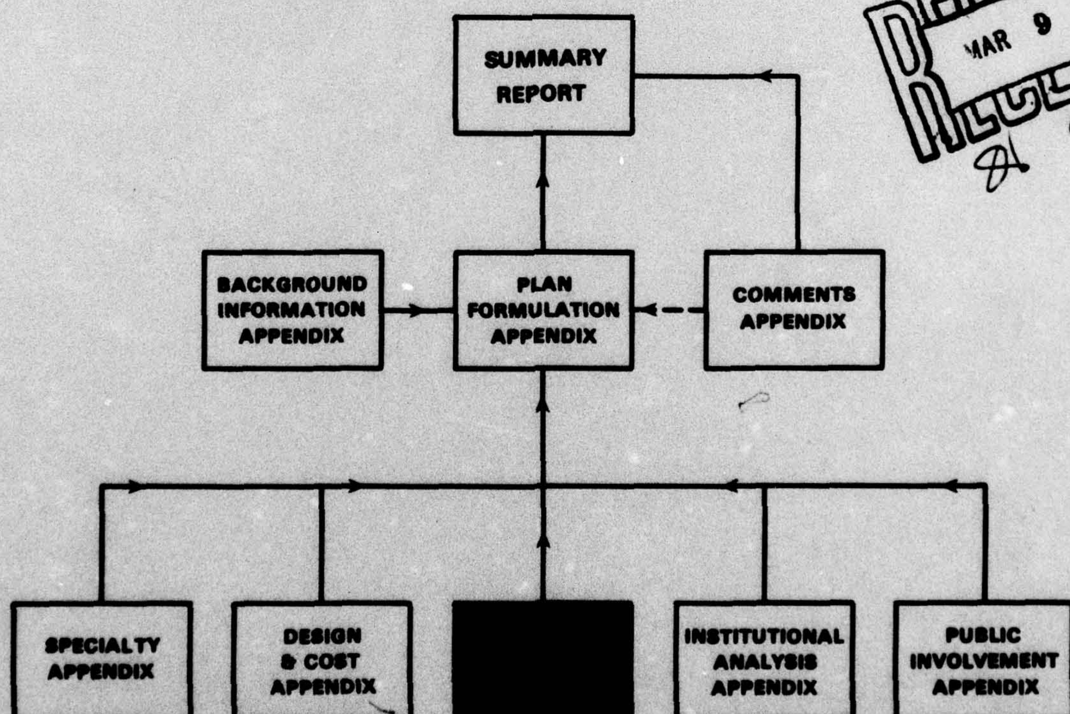


"The Raft of Summer"
Courtesy of Paul Smith, Binghamton, New York

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 constitute the primary Study documents. The five remaining documents support the Plan Formulation Appendix. The relationship of the Impact Assessment and Evaluation Appendix to the other documents is indicated in the diagram below.

The Impact Assessment and Evaluation Appendix investigates the ecological, social, resource commitment, and economic impacts of various wastewater management plans for Broome and Tioga Counties, New York, as they were refined during the Study. This Appendix also discusses the impact assessment and evaluation methodology and its effect on the acceptance, reformulation, or rejection of plans.



BINGHAMTON WASTEWATER MANAGEMENT STUDY,

IMPACT ASSESSMENT AND EVALUATION APPENDIX,

JUNE 1976

12 336p.

Prepared by the

BALTIMORE DISTRICT, CORPS OF ENGINEERS

DEPARTMENT OF THE ARMY

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BINGHAMTON WASTEWATER MANAGEMENT STUDY

IMPACT ASSESSMENT AND EVALUATION APPENDIX

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CHAPTER I - FRAMEWORK FOR IMPACT ASSESSMENT AND EVALUATION

INTRODUCTION

The Binghamton Wastewater Management Study was a joint Federal, State, and local planning effort to develop viable plans for the protection and enhancement of water quality and associated resources of the Susquehanna River Basin within Broome and Tioga Counties, New York. The Impact Assessment and Evaluation Appendix (IAEA) identifies and evaluates significant impacts of the various plans, and is part of a comprehensive nine volume Study Report documenting the results of the intensive two-year planning effort. The main body of the Report is contained in the Plan Formulation Appendix which summarizes impact assessment and evaluation, as well as considerations presented in the other appendices such as design and cost, institutional analysis, and public involvement. The Plan Formulation Appendix also presents the decisions of the Study and the reasons for these judgments in light of the concerns expressed in the IAEA and the other appendices.

PURPOSE OF APPENDIX

The National Environmental Policy Act of 1969 directed all Federal agencies to "utilize a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decision making which may have an impact on man's environment." The purpose of this Appendix is to fulfill the requirements of NEPA, both in letter and spirit.

A range of wastewater management plans have been proposed as solutions to water quality management problems in Broome and Tioga Counties, New York. This Appendix will examine the environmental impacts of each plan in relation to the base condition. The examination of impacts will be done in sufficient detail to allow the reader to weigh these

next page

cont →

impacts in relation to concerns voiced in the other appendices. After this weighing by the reader, he can then rank the final Plans for Choice according to his own conclusions and preferences.

PLANNING FRAMEWORK

Impact assessment and evaluation progressed through three separate stages as outlined by the Principles & Standards for Planning Water and Related Resources. A broad range of strategies were delineated in Stage I and some very general decisions were made. Stage II formulated specific alternatives for solving problems while attempting to outline the impacts of each alternative. In Stage III, detailed plans were refined and evaluated to facilitate the choice of a final plan.

Progressing from Stage I to Stage III, the level of detail increased while the number of alternatives under consideration decreased. Figure I-1 indicates the general plan formulation process for planning. This iterative procedure allowed for deleting alternatives during the Study when the increasing level of detail showed that it did not accomplish its goal or uncovered sufficient reason why another alternative could accomplish the same goal with less adverse impact.

The first impression given by Figure I-1 is that all possible strategies were considered in Stage I and these were successively screened until only a few remained in Stage III. Theoretically, final plans could then be traced back to the original strategies. This conclusion is based on the assumption that once information surfaced about an alternative showing it did not meet its assigned goal (or another alternative could accomplish the same goal in a more effective manner), the alternative was then dropped from further consideration. In actual fact, this smooth procedure for continually decreasing the number of alternatives did not always occur. Rather, alternatives found to be deficient were frequently modified to make them more acceptable and were carried forward for further consideration. Due to the increasing level of information, some stages even uncovered and investigated more possibilities than the previous stage. To aid the reader, tables have been provided at the end of each stage showing the transition of alternatives from one step to the next.

PLAN FORMULATION PROCESS

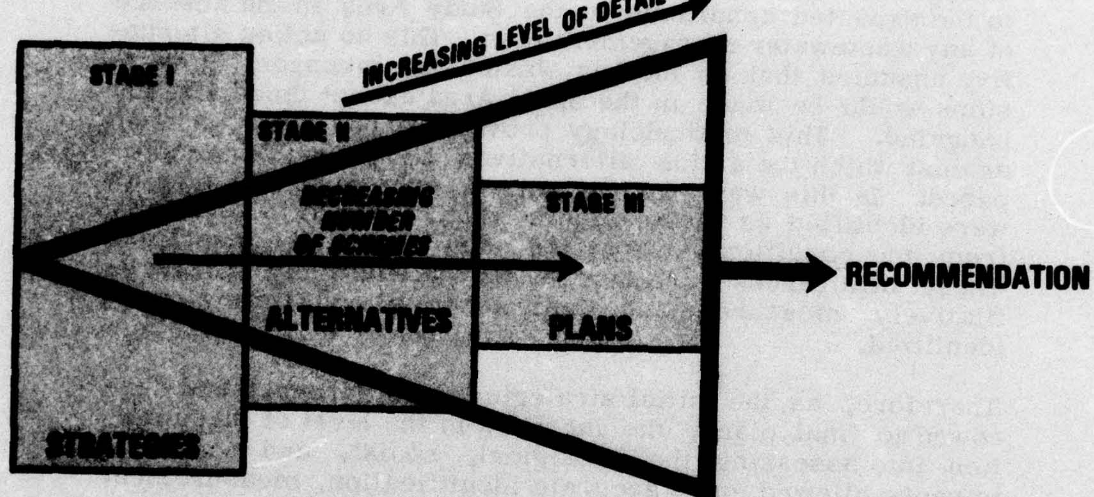


FIGURE I-1

IMPACT ASSESSMENT AND EVALUATION METHODOLOGY

An assessment and evaluation of impacts can only be as detailed as the alternatives themselves. Thus, as the alternatives were refined and presented in more detail, the impact assessment and evaluation also became more detailed. The iterative process for assessment and evaluation enabled a broad range of strategies to be narrowed to a small number of plans for final investigation.

Assessment of impacts was accomplished by a comparison of expected effects associated with a particular alternative to the expected conditions in the Study Area in the absence of any wastewater management plan. This no action alternative assumed that no further wastewater management decisions would be made in the Study Area except those already budgeted. This methodology provided a Baseline Condition against which the action alternatives or plans were compared. In this way, the impacts of an alternative or plan were identified as those effects which differed in some way from the conditions associated with the future baseline. These differences were then either qualitatively or quantitatively measured and their location and timing were identified.

Therefore, as the initial strategies were screened and narrowed to final plans, the increase in the level of investigation into assessing the ecological, social, and economic impacts allowed more accurate identification, measurement and assessment of the impacts. These impacts were measurements of the effects of the alternatives and plans against the existing and project conditions of the Study Area. Evaluation was accomplished from interpretation of these impacts and comparison of the impacts between alternatives. This evaluation considered the degree of beneficial or adverse effects to the environmental and social setting in relation to the Baseline and other alternatives or plans.

SIGNIFICANT STUDY AREA PROBLEMS, CONCERNS, & ISSUES

Broome and Tioga Counties, New York, were the focus of the Binghamton Wastewater Management Study. When necessary, impacts were assessed and evaluated on a larger regional scale. Primary emphasis, though, was on the Urban Study Area along the Susquehanna River from the Chenango River to the Village of Owego (see Figure I-2).

BICOUNTY STUDY AREA

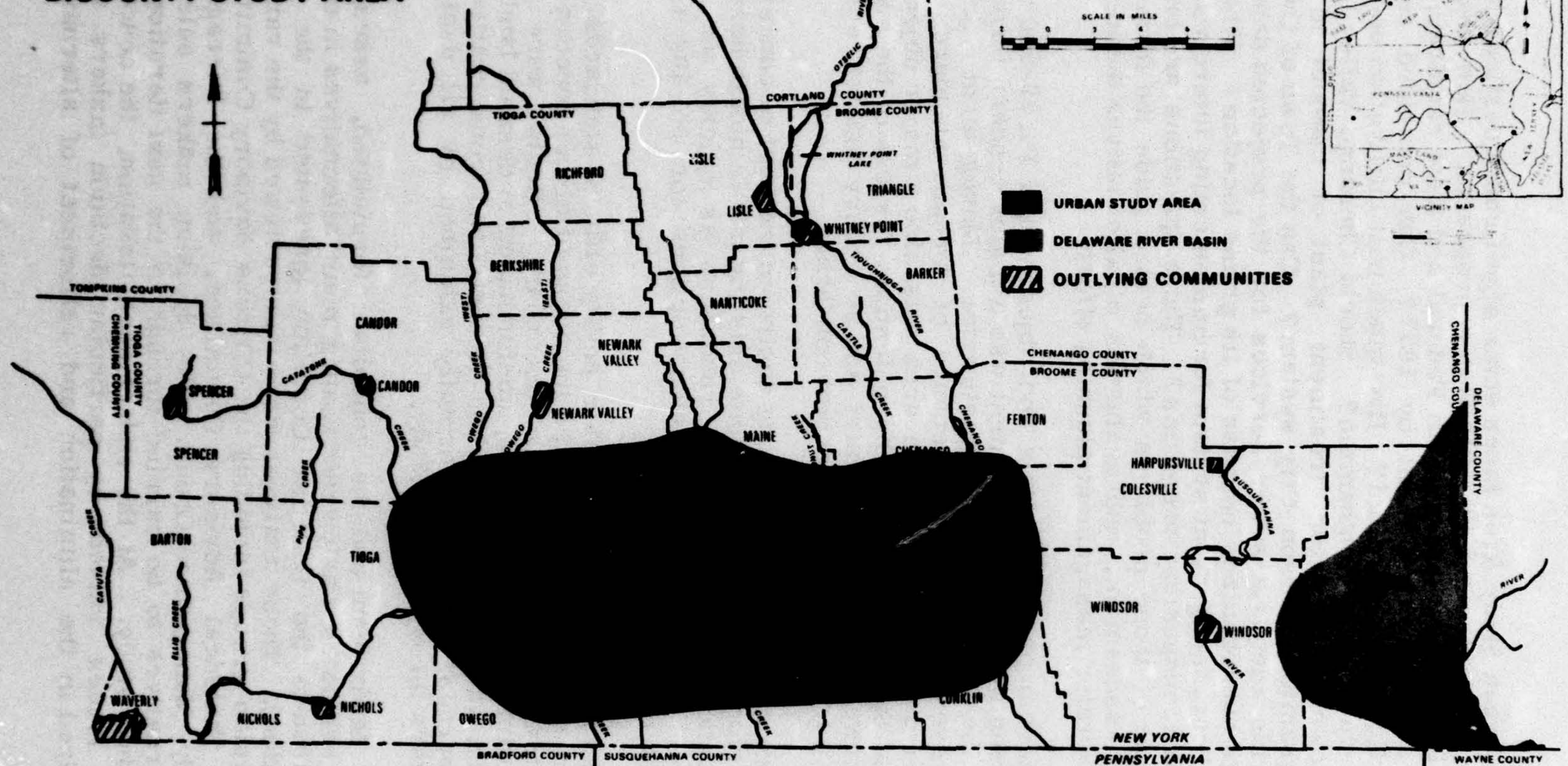


FIGURE I-2

The Urban Study Area faces some significant questions in its future management of wastewater programs. How can the existing system comply with Federal and State requirements for secondary treatment by 1977? Can combined sewer overflows be controlled? How much will infiltration control cost the City of Binghamton? Should Chenango Valley build its own wastewater treatment plant or connect to the Binghamton-Johnson City system? Can the Town of Owego provide adequate sewer services for the projected demand as its suburbanizes because of its prime location? What is the best management system for implementing future wastewater management programs? These questions are only a sample of those problems which helped guide the formulation, assessment, and evaluation of alternatives during the wastewater management planning effort.

Achievement of the goals and objectives of PL 92-500 concerning wastewater treatment was a major concern throughout the Binghamton Wastewater Management Study. Achievement and maintenance of stream standards and water quality in the urban area was also a major objective of the Study. Improving the potentials for use of the area's waterways for both primary and secondary contact recreation was likewise an important concern.

There also existed a strong desire on the part of concerned decision makers to eliminate existing public health hazards associated with their water resources as quickly as possible, yet allow for various options for solving these problems.

Although public health, water quality effluent standards, and recreational potentials were the areas of direct concern with wastewater management, secondary effects were also scrutinized. For example, conformance to desired land use plans, minimization of urban sprawl, and conservation of resources were also carefully examined by all decision makers throughout the Study.

The Study team and the consultant formulated, assessed, and evaluated wastewater management alternatives in comparison to the Baseline Condition (presented in the next section). These analyses were then reviewed by the various decision groups including the Citizens Advisory Committee, the Technical Advisory Committee, and the Interagency Study Management Group. The decision makers selected alternatives to be carried through to the next iteration for further study. At the end of each iteration, the concerns and issues raised by particular decision makers were utilized in the elimination and refinement of alternatives before moving into the next iteration. The detailed sequence of decisions and plan refinement is contained in the Plan Formulation Appendix. The assessment and evaluation of plans as discussed in this appendix assisted the decision makers in arriving at their recommended plan in the final iteration of the study.

BASELINE CONDITION

Environmental conditions associated with the projected Baseline Condition forms the basis against which all action alternative wastewater management plans were compared. The Baseline as discussed herein constitutes not only a basis of assessment, but was also considered as a possible wastewater management plan--the "no action" alternative. The following analysis discusses the changes from existing (1977) conditions which would most probably characterize the Study Area in the year 2020 in the absence of any area-wide plan for wastewater management. The exact details of the Baseline Condition, as discussed in the following pages, actually were not specified as a unique plan until the later stages of study. However, the Baseline Condition is described in detail at this time so that reader may have an evaluative frame of reference as he progresses through the Appendix.

WASTEWATER MANAGEMENT CHARACTERISTICS

Municipal Wastewaters

In defining the ecological, social, and economic projections for the Baseline, it is assumed that no wastewater treatment plants would be added other than those that have already been approved by NYSDEC for construction before 1977. Expansion of existing sewerage service areas were assumed to follow the existing trends. The additional interceptors approved by NYSDEC for funding before 1977 would be constructed. However, the Chenango Valley interceptor was not included in these conditions as Broome County was studying other alternatives. The interceptors, providing service for growth areas that were included in Broome County Sewerage Feasibility Study, were assumed to be in the Baseline. Figure I-3 shows the physical features of the wastewater management system for the Baseline Profile.

The following is a brief description of the facilities to be included in the Baseline.

Owego Village. An interceptor, pump station, and a force main to serve all areas south of the Susquehanna River and within the Village, part of River Road and the Valley View Heights subdivision, the area within the Village lying west of Owego Creek, and the low area lying east of the Court Street Bridge, including Lackawanna Avenue and Route 17. The existing primary treatment plant would be upgraded to provide for secondary treatment. This project is planned by NYSDEC for funding in 1976.

Town of Union. Extension of a sanitary sewer to the Choconut Center area of the Town of Union is planned by NYSDEC for funding by 1977 and was assumed to be in the Baseline.

Town of Vestal. An interceptor sewer from the existing Vestal primary STP to the Endicott STP is planned by NYSDEC for funding and construction by 1977. This interceptor would serve the westerly portion of the Town of Vestal, currently served by a the primary treatment plant, which would be closed.

Town of Owego. An interceptor serving the eastern part of the town and connecting to STP #2 is ranked by NYSDEC for funding by 1977.

In summary, the physical municipal wastewater management characteristics for the Baseline include:

1. Abandonment of the Vestal STP and diversion of its influent sewage via a new interceptor to the Endicott STP.

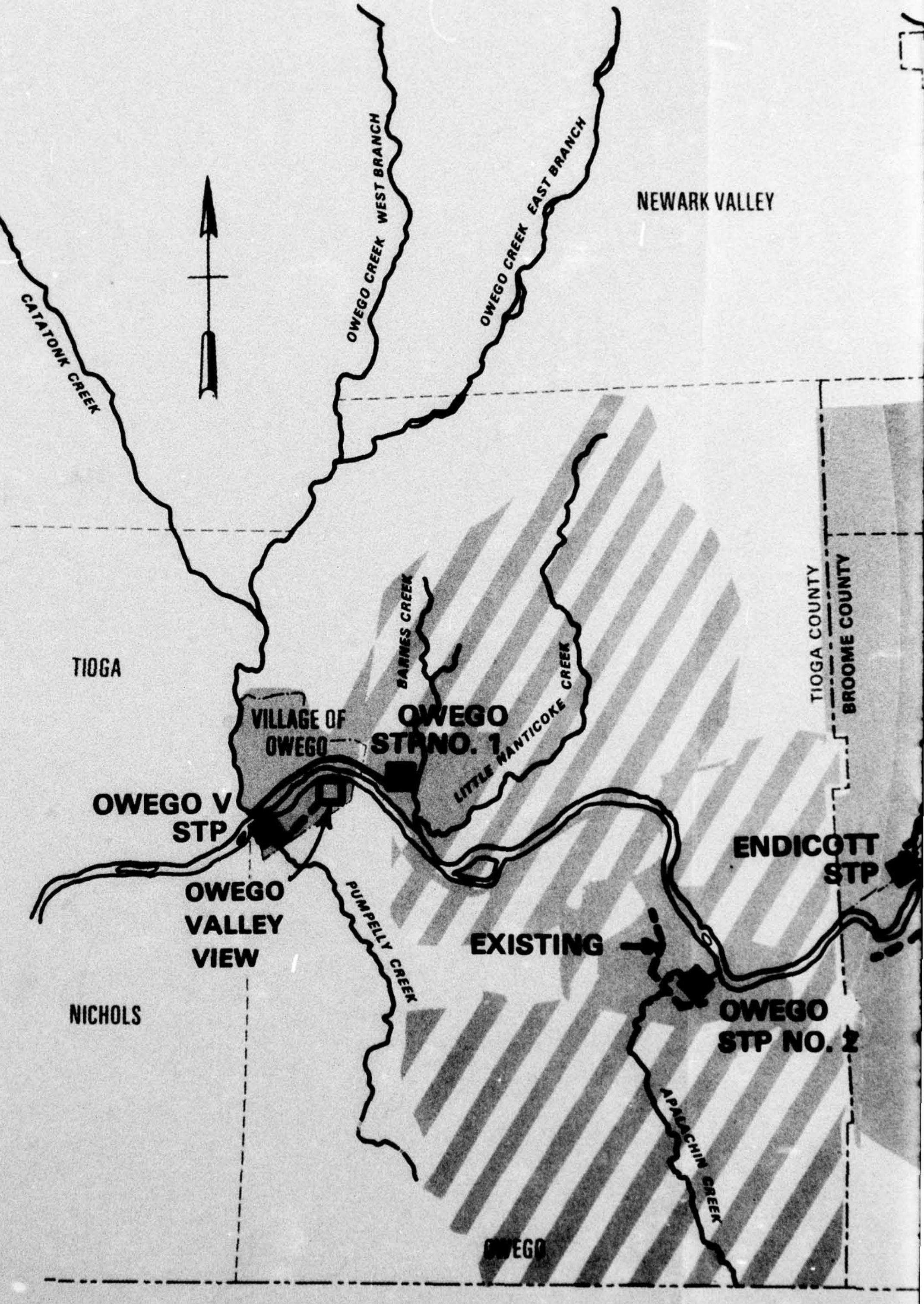
2. Upgrading of the Owego Village STP to provide secondary treatment.

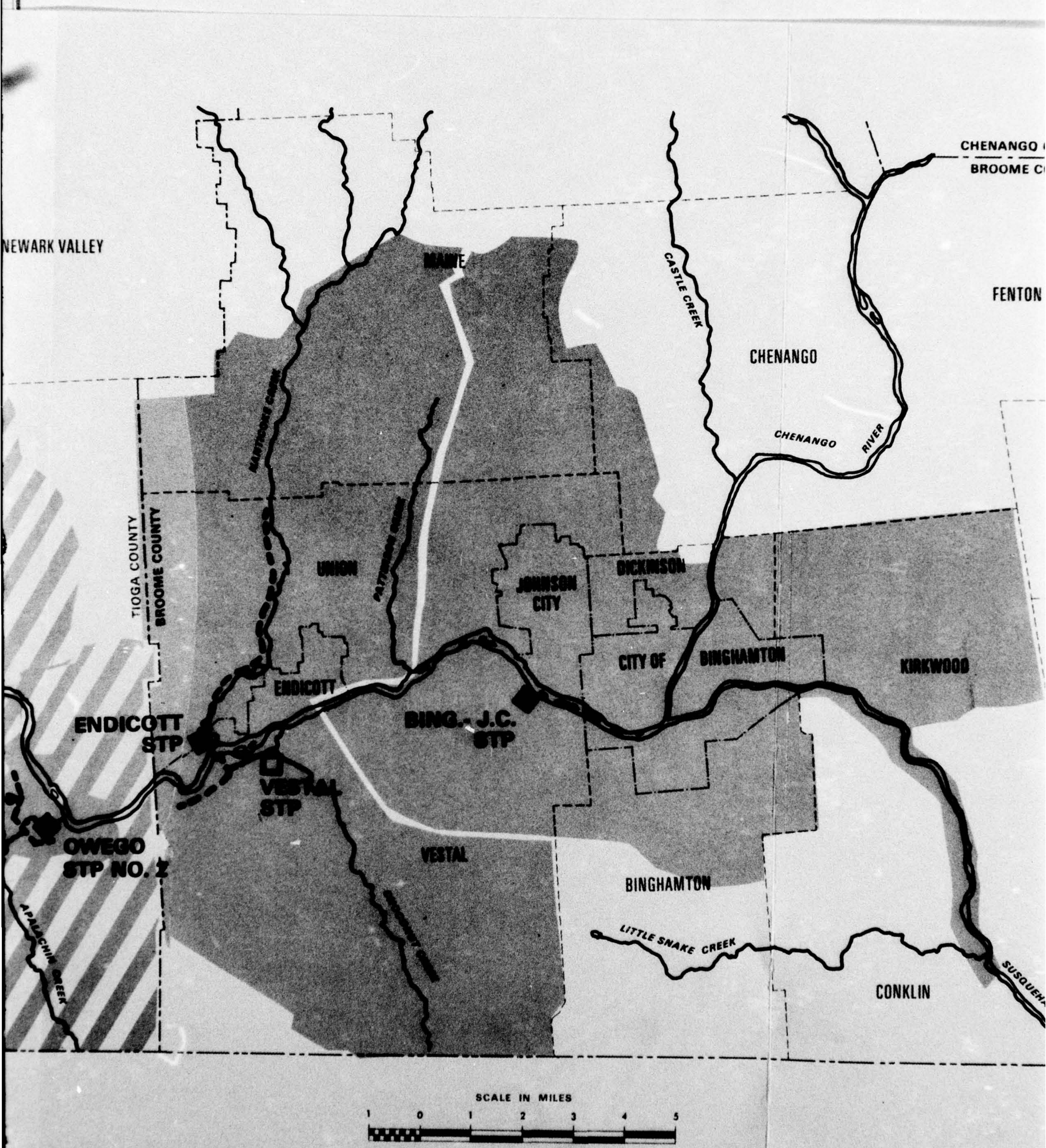
3. Abandonment of the Owego Valley View STP and diversion of it of its influent sewage to an upgraded Owego Village STP.

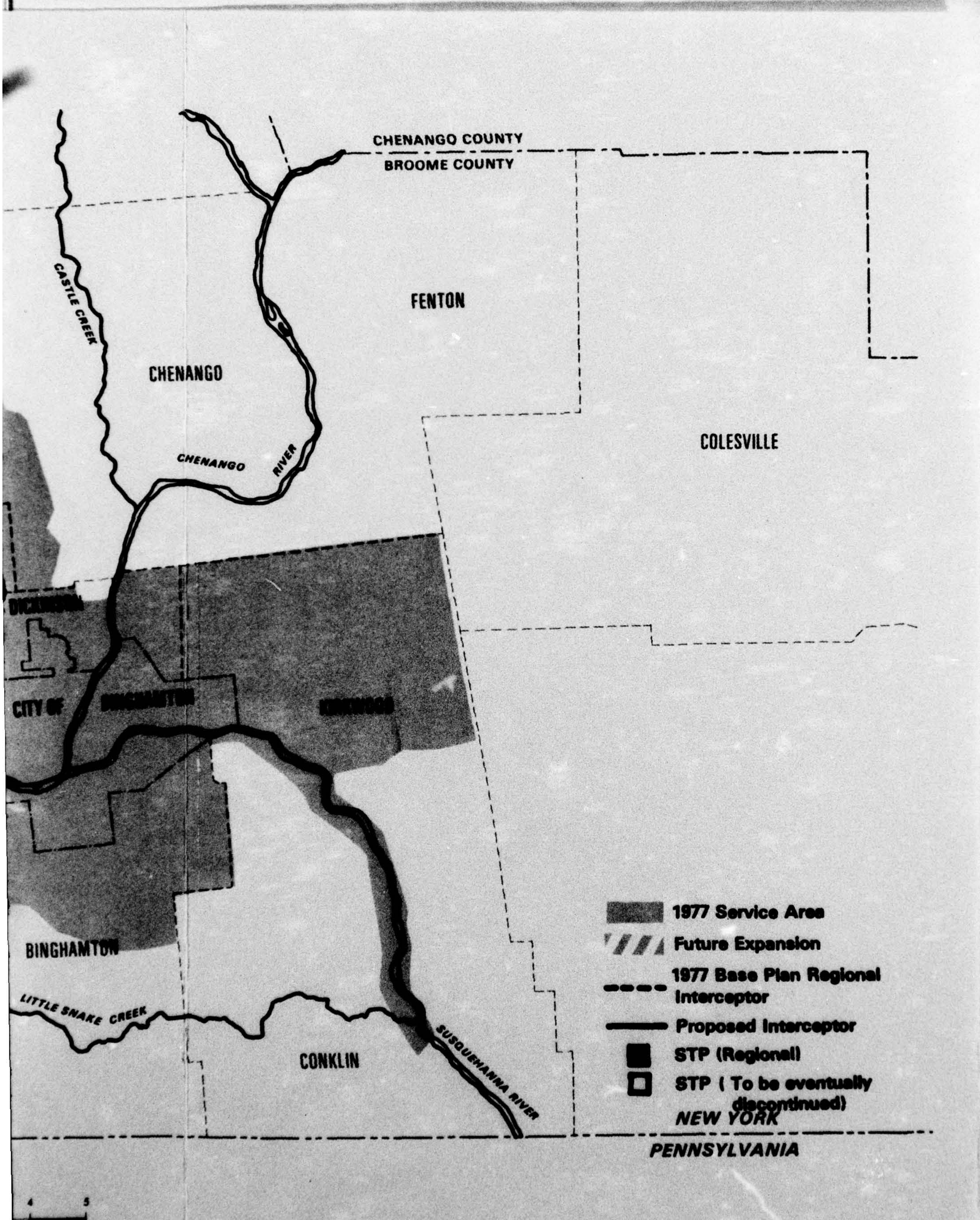
4. The remaining existing STP's, including Binghamton-Johnson City STP, Owego Town #1 STP, Owego Town #2 STP, and Endicott STP would not be expanded or upgraded.

5. The Chenango Valley area would continue on septic systems.

BASELINE PROFILE




CHENANGO C
BROOME C
NEWARK VALLEY
MAINE
CASTLE CREEK
FENTON
CHENANGO
CHENANGO
RIVER
TIOGA COUNTY
BROOME COUNTY
UNION
JOHNSON CITY
DICKINSON
CITY OF
BINGHAMTON
KIRKWOOD
ENDICOTT
ENDICOTT STP
BING.-J.C. STP
VESTAL STP
OWEGO STP NO. 2
VESTAL
BINGHAMTON
APALACHIN CREEK
LITTLE SNAKE CREEK
CONKLIN
SUSQUEHA
SCALE IN MILES
1 0 1 2 3 4 5



CHENANGO COUNTY
BROOME COUNTY
CASTLE CREEK
FENTON
CHENANGO
CHENANGO RIVER
COLESVILLE
CITY OF
BINGHAMTON
LITTLE SNAKE CREEK
CONKLIN
SUSQUEHANNA RIVER
1977 Service Area
Future Expansion
1977 Base Plan Regional Interceptor
Proposed Interceptor
STP (Regional)
STP (To be eventually discontinued)
NEW YORK
PENNSYLVANIA
4
5

FIGURE I-3

3

6. Extensions of sewage collection and treatment services would take place within the Nanticoke Creek Valley and toward Five Mile Point.

7. The sewered population to all STP's would continue to grow and sewage flows would increase.

Wastewater management service areas, stemming from existing conditions and common to all alternatives including the Baseline, were finalized in Stage II-1 of the Study. The six wastewater management service areas include Binghamton-Johnson City, Chenango Valley, Endicott, East Owego, West Owego, and Owego Village. Generally, these service areas corresponded to those areas which either were served by the existing sewage treatment plants, or were planned for such service by 1977. The exception was Chenango Valley, which presently is unsewered. Figures I-4, 5, and 6, show the boundaries of these service areas.

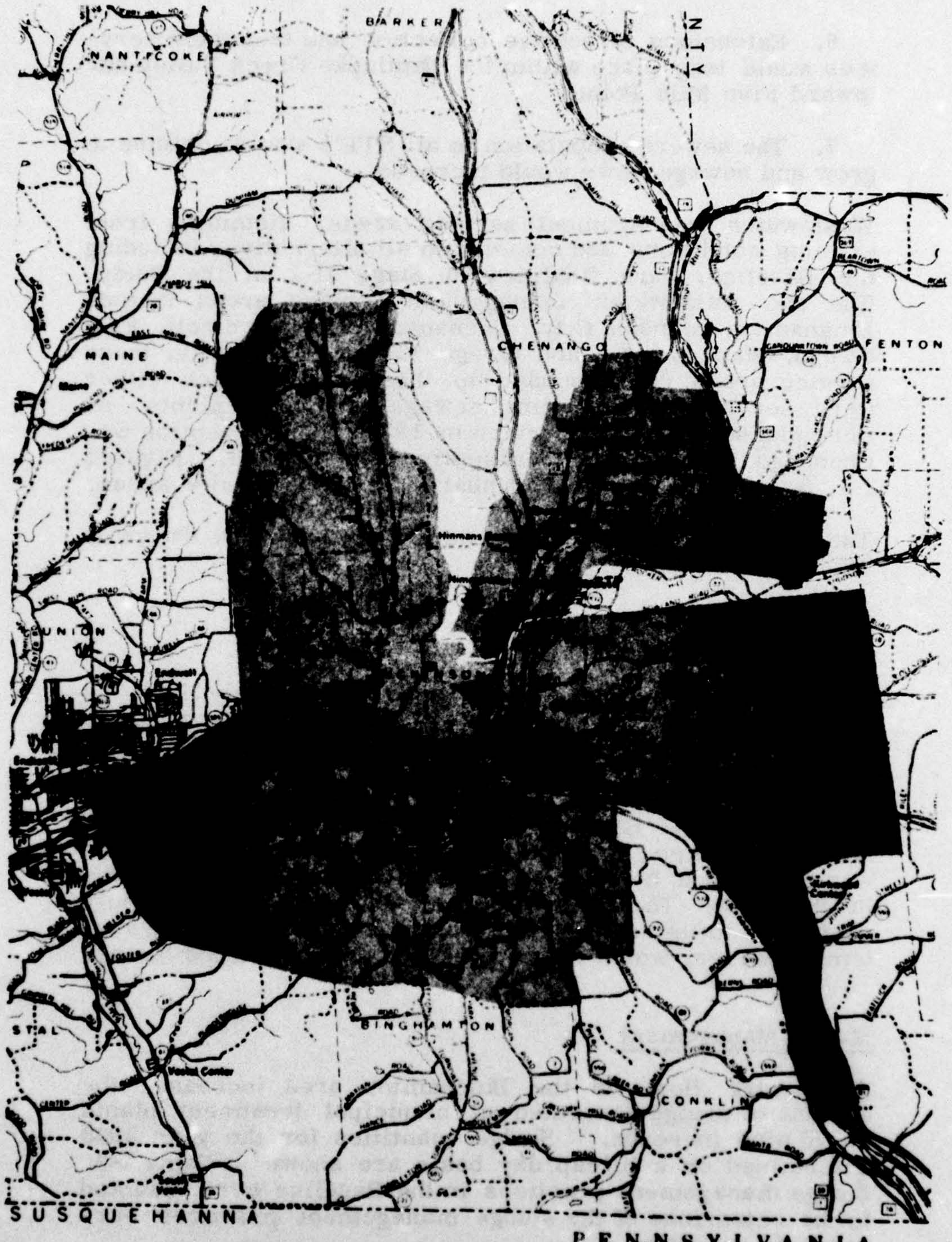
The projected sewered populations and flows are shown in Table I-1.

Infiltration and Inflow

Infiltration into the sewer lines, particularly into the Binghamton-Johnson City sewer system, would continue to be a severe problem. Additionally, problems associated with inflow into the B-JC system, such as combined sewer overflows during heavy rains, would also continue to occur in the Baseline. Because of continued efforts to improve the sewerage system, infiltration into the West Owego sewers was assumed to be corrected by 1977 and thus not a problem in the future. The infiltration and inflow which presently contribute to the total sewage flow of the Owego Village system, however, would continue to be a problem in the future.

Sludge Management

As sewage flows in the Binghamton area increase, the amount of sludge generated at municipal treatment plants would also increase. Sludge quantities for the year 2020 determined on a lb/cap/day basis are shown in Table I-2. Sludge management practices in the Baseline were assumed to be extensions of the sludge management practices currently in operation.



BINGHAMTON-JOHNSON CITY SERVICE AREA
CHENANGO VALLEY SERVICE AREAS

Figure 1-4

ENDICOTT SERVICE AREA **Figure 1-5**

OWEGO SERVICE AREAS Figure 1-6

TABLE I-1

PROJECTED SEWERED POPULATIONS* AND SEWAGE FLOWS

SERVICE AREA	1973 POPULATION ($x10^3$)	1973 SEWAGE FLOW (MGD)	1980 POPULATION ($x10^3$)	1980 SEWAGE FLOW (MGD)	2000 POPULATION ($x10^3$)	2000 SEWAGE FLOW (MGD)	2020 POPULATION ($x10^3$)	2020 SEWAGE FLOW (MGD)
Binghamton-Johnson City	102	18.3	116.1	21.6	118.7	24.5	123.8	25.4
Endicott**	52.2	5.2	67.6	7.1	73.6	8.9	75.2	9.2
East Owego	6.5	0.4	13.5	1.2	18.9	2.5	21.3	2.8
West Owego	0.6	0.2	0.8	0.2	3.4	0.5	4.4	0.7
Owego Village***	4.1	0.9	4.9	0.9	4.6	0.9	5.0	1.0
Chenango Valley	–	–	16.0	1.5	19.0	2.0	21.0	2.2
TOTALS	165.4	25.0	218.9	32.5	238.2	39.3	250.7	41.3

* Population projections are only for sewered population of Urban Study Area.
Includes Vestal. * Includes Valley View

TABLE I-2

SLUDGE QUANTITIES FOR THE YEAR 2020

SERVICE AREA	SLUDGE QUANTITY Digested (lb/day)	SLUDGE QUANTITY Undigested (lb/day)
Binghamton-Johnson City	35,400	51,300
Endicott	5,000	8,400
East Owego	2,800	4,800
West Owego	700	1,100
Owego Village	1,300	2,300
Chenango Valley	3,200	5,300
Totals	48,400	73,200

Owego Village presently landfills its dried primary sludge. After 1977, with the onset of secondary treatment at the Owego Village STP, greater quantities of sludge would be produced. Therefore, at some time during the planning period (to the year 2020) either a new landfill site would have to be chosen or a new disposal methodology would have to be selected.

East and West Owego currently deliver liquid sludge to nearby farmers who apply the sludge to their lands. This present practice of land application of liquid sludge would probably be suitable for East and West Owego throughout the planning period.

The Endicott STP presently disposes of its sludge in the nearby town sanitary landfill. However, since the life expectancy of the landfill is less than the 50 year planning period, Endicott would have to either locate a new landfill for sludge disposal or utilize a different sludge disposal methodology.

The Binghamton-Johnson City STP is currently facing a critical situation with regard to sludge disposal. A planned program of land application of sludge has not yet been commenced. If it does not succeed, the remaining alternative for sludge disposal would be to landfill at a county-owned site. Temporarily, sludge is being used as a soil conditioner in a nearby horticulture operation.

Industrial Wastewater

Treatment of industrial wastewater must comply with Federal and State regulations. Industries served by municipal systems must satisfy the pretreatment requirements. Industries discharging directly to receiving waters must comply with the pertinent Effluent Limitations Guidelines and New Sources Performance Standards. Analysis of the industrial wastewater flow in the Study Area and the impacts of industrial wastewater effluents discharged to the surface waters indicated that there would be no need to apply higher treatment levels to meet National requirements. In other words, there is no need to consider alternative industrial wastewater management systems that would require more stringent treatment for discharge to surface waters than those required by existing regulations.

There are, however, some indications that industrial discharges are a source of management problems in the Endicott and Binghamton-Johnson City systems. Discharges of heavy metals to the Endicott system have been implicated in the poor performance of the secondary treatment portion of this STP, and, in addition, have resulted in a prohibition against use of the sludge from this plant as a soil conditioner. Although the precise magnitude and source of this problem are still in doubt, it is fairly well documented that the cause of the problem is the discharge of heavy metals to the sewer system, and this is most likely due to an industrial discharge or discharges.

In the Binghamton-Johnson City system, problems with industrial discharges were less acute than at Endicott, but it was felt that the high influent levels of suspended solids were cause for some concern, particularly since the STP has had difficulties in dewatering the existing volumes of sludge. It would appear that the high influent solids levels were due to one or more industrial discharges. Additionally, stormwater may contribute heavy metals to the sewerage system making treatment difficult during periods of high flow to the plant.

There are existing mechanisms by which most of these problems can be overcome, including pretreatment guidelines for incompatible pollutants (such as heavy metals) discharged to publicly owned treatment works, and the ability of Binghamton-Johnson City to either require pretreatment for suspended solids removal, or to levy a surcharge for such a discharge to the sewer system. However, unless the existing institutions utilize their powers to overcome the few existing problems associated with industrial wastewaters, then the minor problems now apparent would become major problems later in the planning period.

ECOLOGICAL

Aquatic Ecology

Increased sewage flows to the sewage treatment plants under the Baseline would result in overloading the treatment capacity of the STP's by 2020, thus reducing the quality of sewage effluents entering the Susquehanna River. Pollutant loadings from these projected sewage effluents in the year 2020 are summarized in Table I-3 and are compared to existing loadings. Additionally, during periods of heavy rain, combined sewer overflows would discharge pollutants into the Chenango and Susquehanna Rivers. Estimates of such combined sewer overflow pollutant characteristics for

TABLE I - 3

MUNICIPAL EFFLUENT CHARACTERISTICS

Existing (Year 1973) and Baseline Condition (Year 2020)

STP		Flow (MGD)	SS (lb/day)	BOD[1] (lb/day)	NOD[2] (lb/day)	Total N (lb/day)	Total P (lb/day)
Binghamton-Johnson City							
A)	Existing	18.3	4600	3050/3650	5200/8700	2800	700
B)	Year 2020	25.4	10000	6350/11200	9400/12800	3480	870
Chenango Valley							
A)	Existing		Periodic septic system overflows and malfunctions				
B)	Year 2020		Periodic septic system overflows and malfunctions				
Endicott[3]							
A)	Existing	4.2	870	870	3060/4600	1010	313
B)	Year 2020	9.2	1500	1520	5500/9100	2260	600
Vestal							
A)	Existing	1.0	350	1200	1600/1600	350	71
B)	Year 2020		To be abandoned and flows sent to Endicott				
East Owego							
A)	Existing	0.4	50	30	100/650	175	45
B)	Year 2020	2.8	435	435	1450/3020	640	150
West Owego							
A)	Existing	0.2	130	90	215/360	78	23
B)	Year 2020	0.7	180	180	100/1680	300	80
Owego Village							
A)	Existing	0.9	180	300	450/450	97	32
B)	Year 2020	0.97	125	125	415/700	150	40
TOTAL							
A)	Existing	25.0	6180	5540/6140	10625/16360	4510	1184
B)	Year 2020	41.3	12,240	8610/13,460	16865/27300	6830	1740

[1],[2] summer loadings/winter loadings
single # – year round loadings
[3] assumes solution of present problems and achieves normal trickling filter performance i.e., 85% BOD + SS removal

a 1.25 inch storm in a 24 hour period are 9,400 pounds of BOD and 4,200 pounds of NOD.

In discussing the changes in aquatic ecology for the Baseline, two river flow conditions are employed. First, the minimum average seven consecutive day river flow which will occur once in ten years (MA-7-CD-10) was used to emphasize aquatic conditions when they may be at their worst. Second, the design storm flow is used to discuss the aquatic conditions which would most likely occur during periods of combined sewer overflows. The MA-7-CD-10 flow is not assumed to occur during periods of heavy rain; the design storm river flow is assumed to be approximately twice as great as the MA-7-CD-10 flow (see Stormwater Management Section in Design and Cost Appendix).

Physical/Chemical Characteristics.

Dissolved oxygen. Increases in the biological and nitrogenous oxygen demanding wastes entering the Susquehanna would result in a minimum in-stream dissolved oxygen (DO) concentration of 3.5 mg/l by the year 2020 during the MA-7-CD-10. During design storm periods, the dissolved oxygen in the Susquehanna would be 3-4 mg/l. Thus, for the Baseline, dissolved oxygen level would be at its worst during low river flow.

Low dissolved oxygen concentrations of 3-4 mg/l, such as would be experienced during storm conditions and during MA-7-CD-10 flow conditions in the Susquehanna River under the Baseline would, to varying degrees, adversely affect aquatic flora and fauna. For example, adult species of local sport fish such as smallmouth bass and walleye pike may avoid the areas of low dissolved oxygen concentrations. However, if such low dissolved oxygen concentrations occurred during spawning and hatching periods of the fishes' life cycle, the survival rate of eggs and fry of the species would decrease. Low dissolved oxygen concentrations would adversely affect the growth and activity of adult smallmouth bass and walleye pike.

Temperature. The seasonal temperature fluctuations in effluent sewage correspond closely to the seasonal temperature changes recorded within the Susquehanna. During the summer months when high river temperatures (26 degrees C) results in lower levels of dissolved oxygen (DO), the effects of sewage effluents upon river temperature will be minimal since the effluent temperatures are approximately the same as the river temperatures (within a few degrees C).

Consequently, changes in dissolved oxygen concentrations within the river in response to sewage effluent temperatures would be minimal.

It is important, however, to consider other sources which may create large temperature changes within the river, since a significant change of in-stream temperatures would change the level of DO saturation; that is, the higher the river temperature, the lower the concentration of DO. Under instances of high river temperatures, oxygen demanding wasteloads would create more adverse conditions in terms of degree and duration of oxygen depletion within the river.

At present, the New York State Electric and Gas Goudy Power Plant station in Johnson City, located about one mile downstream of the Binghamton-Johnson City STP, utilizes on an average daily basis approximately 80 mgd of water with a maximum of 150 mgd from the Susquehanna for cooling purposes. Under the MA-7-CD-10 flow conditions of the Susquehanna River, 150 mgd (230 cfs) represents approximately 70 percent of the river flow of 330 cfs. The heated condenser cooling waters are discharged into Little Choconut Creek slightly upstream of its confluence with the Susquehanna River. Currently, thermal discharge criteria for the effluent cooling waters are set at a maximum of 100 degrees F (37.8 degrees C) with discharge-intake temperature difference not to exceed 25 degrees F (12 degrees C), whichever is more stringent. By 1 July 1983, the effluent limits for the cooling water are a discharge temperature less than or equal to 89 degrees F (31.7 degrees C) with a discharge-intake temperature difference less than or equal to 30 degrees F (16.7 degrees C). The New York State Department of Environmental Conservation, through its regional offices, has the responsibility for enforcing these standards.

Currently, adverse temperature effects of the power station discharge on the dissolved oxygen concentrations within the Susquehanna have not been observed. However, assuming the Baseline DO parameters for the year 2020, additional reductions in the levels of DO within the river could occur if significant river temperature changes are created by the power plant thermal discharges. Should such conditions arise, operational changes to the power plant would be necessary in order to meet temperature criteria for the Susquehanna River.

pH. The pH of the Susquehanna River varies seasonally depending on the amount of algal activity in the river which is in turn influenced by nutrients inputs. Variations in pH along the river range from a low of 6.5 to a high of 8.3, both measured by the NYSDEC in 1971 and 1972 at the Route 26 Bridge between Endicott and Vestal (MP 30.8). Data recorded in 1973 along the river showed pH ranges from 6.7 to 8.1. Accordingly, it can be assumed that both the NYSDEC standards and EPA proposed criterion for pH are currently being met in the Susquehanna River.

Turbidity and Suspended Solids. The EPA suspended solids (ss) maximum limit of 30 mg/l is met within the stretch of river between the City of Binghamton and the Village of Owego despite the fact that not all existing sewage treatment facilities provide secondary treatment of the wastes and significant quantities of SS are discharged via combined storm sewers. The NYSDEC quantitative suspended solids criteria are also currently being met.

Under the Baseline, the five treatment plants would provide secondary treatment, thus reducing the suspended solids concentrations contributed to the river. Although suspended solids loadings from STP's under the Baseline would increase due to increased flows, it is unlikely that any significant changes of in-stream suspended solids concentrations would occur. Septic system overflows and overflows from combined sewers in the urban area would continue to add periodic high concentrations of suspended solids to the rivers.

The turbidity of a water is a reflection of the effects of suspended solids. Although the concentration of suspended solids does not violate water quality criteria, the small particle size of the suspended solids create high turbidity within the Susquehanna. Therefore, existing points of discharge of sewage effluent are not noticeable, since the background turbidity of the Susquehanna is already high. Thus the NYSDEC turbidity standard is not violated by any existing sewage effluents.

Nutrients. Nutrients are any chemicals which are necessary to the growth and reproduction of aquatic flora. Nitrogen and phosphorus, two macronutrients, are important factors in artificial eutrophication. Generally, phosphorus is the limiting nutrient of concern in relation to nuisance aquatic floral growths. Even if all nutrients necessary for growth were available, other environmental factors such as temperature, light, river flow, and depth may limit aquatic plant growths. Although the NYSDEC has no phosphorus standards for fresh surface waters, the EPA has a proposed limit of less than or equal to 0.1 mg/l of phosphorus (as P) in those flowing waters where phosphorus is a limiting constituent for the growth of nuisance aquatic plants. The average and range of phosphorus concentrations were measured within the Susquehanna and Chenango Rivers in 1973 and 1974 at various sampling stations. The average phosphorus concentration at every station was above the proposed limit of 0.1 mg/l for phosphorus.

A phytoplankton study conducted on the Susquehanna River from April 1967 to April 1968 in the Triple-Cities area concluded that the region had algae typical of productive bodies of water, but not typical of strong pollution. At that time, the Binghamton-Johnson City Sewage Treatment Plant, the Endicott STP, and the Vestal STP produced primary treated effluent only, and all other sewage discharges entered the river untreated. Between 1968 and 1974, although sewage flow increased, the level of treatment of sewage also increased, so that by 1974, sewage discharged to the river received at least primary treatment and the major portion of sewage effluent received secondary treatment. Since secondary treatment of sewage removes between 20 and 30 percent of phosphorus and between 20 and 25 percent of nitrogen, it is probable that despite increased sewage flows, the total amounts of nitrogen and phosphorus entering the river system is approximately the same as was the case in 1967-1968 when the phytoplankton survey was undertaken. Therefore, it is likely that at present the phytoplankton in the Susquehanna River system, near the Triple Cities area, is of the same composition as during the 1967-1968 survey. Additionally, macrophytes in the river system have not been documented as being a nuisance.

The Baseline which provides for secondary treatment at five STP's (Chenango Valley remains unsewered) would discharge approximately the same amount of phosphorus and as is currently discharged. Since existing in-stream phosphorus concentrations of between 0.05 to 1.4 mg/l (at Watson Bridge) are not resulting in any apparent problems of nuisance growths of aquatic vegetation, it is unlikely that the small increase in phosphorus loadings from municipal sewage effluents would create problems in the future.

Ammonia. The toxicity of ammonia to aquatic organisms is dependent upon the portion of un-ionized ammonia which increases with increasing pH. The NYSDEC standard for ammonia is less than or equal to 2.0 mg/l at pH 8.0, or above. Since pH levels in the river system have at times been greater than pH 8.0, ammonia toxicity may be a problem during periods of extremely low river flows.

Chlorine. NYSDEC has no standard for the concentration of chlorine and related compounds in fresh water. Chlorine and chloramines, however, have been found to be toxic to aquatic life at certain concentrations. The toxicity of chlorine can be estimated from a measure of residual chlorine. The EPA has proposed stringent chlorine residual criteria--0.003 mg/l maximum acceptable concentration for chronic exposures, with a maximum value of 0.05 mg/l acceptable for periods of 30 minutes in 24 hours. The following discussion attempts to analyze the problem of chlorine residual at the larger STP's (B-JC and Endicott).

Average chlorine residual levels in the effluent of the Binghamton-Johnson City STP are approximately 0.42 mg/l at present. At the MA-7-CD-10 flows of 330 cfs, the resultant in-stream chlorine residual would be approximately 0.03 mg/l, which although unacceptable when compared to EPA proposed criteria for chronic exposures, is below the maximum EPA proposed value of 0.05 mg/l for periods of 30 minutes in 24 hours. For the Baseline throughout the planning period, it is likely that residual chlorine levels at the B-JC STP would be approximately the same as that found currently, and, therefore, would have approximately the same effect upon the river.

No data on residual chlorine levels are available for the Endicott STP. With the long detention time (1 1/2 hours) currently found in the chlorine contact chamber, it is probable that current residual chlorine levels are less than 0.5 mg/l in the effluent from the Endicott STP. At the MA-7-CD-10 flow, resultant in-stream concentrations of residual chlorine would be approximately 0.009 mg/l. This concentration would be below the proposed EPA maximum of 0.05 mg/l for 30 minutes in 24 hours.

The existing primary treatment plant in Vestal likewise has no data available on residual chlorine levels in its effluent. However, it can be estimated that the probable concentration is between 0.5 mg/l and 1.0 mg/l. Thus, at the MA-7-CD-10 river flows, resultant in-stream concentrations of residual chlorine, attributable to the Vestal STP effluent would be approximately 0.002--0.005 mg/l, which would meet the EPA proposed criteria.

In the Baseline, the combined Endicott-Vestal STP would probably have an effluent residual chlorine concentration similar to existing conditions (less than 0.5 mg/l). Under future effluent flow conditions of 8.9 MGD, the resulting in-stream chlorine concentration, during the MA-7-CD-10 river flows, would be approximately 0.02 mg/l. This concentration of residual chlorine would achieve the proposed EPA criteria of less than 0.05 mg/l for 30 minutes in 24 hours but would not achieve the more stringent criteria of 0.003 mg/l for chronic exposures.

Aquatic organisms can tolerate short-term exposures to much higher levels of chlorine than those concentrations which result in chronic effects. Since, under the Baseline sewage treatment facilities would be overloaded, excessive chlorination of effluent to effectuate coliform kill could create conditions for chronic chlorine toxicity of aquatic organisms.

Heavy Metals. NYSDEC has in-stream standards for copper, zinc, and cadmium. Data on in-stream concentrations of these and other metals are available from a 1970 survey conducted by Dr. Bruce McDuffie of the State University of New York at Binghamton. These data indicate that in-stream metal standards are being met.

Major contributing sources of metals within the Susquehanna River are industrial wastewater discharges. Six major industrial sources to the Susquehanna River contribute to in-stream metal concentrations. These metals from industrial sources do not violate existing standards even at the MA-7-CD-10 flows where concentrations would be higher (approximately 2 times greater) than those recorded in the 1970 survey.

The Baseline assumed that industries, in the future, would be required to meet surface discharge criteria established by the EPA if wastes are discharged directly to surface water, or would be required to meet pretreatment standards if wastes are discharged to municipal sewage treatment plants. Under these conditions of the Baseline (year 2020), future industrial contributions to in-stream metal concentrations would not result in violations of NYSDEC criteria. However, the possibility exists that for short periods of time, both now and in the future, in-stream standards for metals would be violated due to overflows of combined sewers. As discussed earlier, institutional controls such as city and village ordinances would help to cut down the discharge of heavy metals if they are strictly enforced.

Flora and Fauna.

Phytoplankton were sampled at four stations along the Susquehanna River by Wager and Schumacher (1970) from April 1967 to April 1968. Stations sampled were from just upstream of Binghamton and Endicott. Shifts in algal dominance were indicated seasonally among the three major groups, diatoms, green algae, and blue-green algae. The results were noted to be indicative of productive but not heavily polluted waters.

A benthic survey conducted by the New York State Department of Health during the summer of 1973 along the Susquehanna and Chenango Rivers within Broome and Tioga counties indicated that the three most abundant benthic taxonomic groups included Chironomids, Tricopterans, and Ephemeropterans (aquatic larval form of midges, caddisflies, and mayflies, respectively). Two pollution-tolerant species were noted which were indicative of enriched conditions, the midges Dicrotendipes neomodestus and Glyptotendipes sp. These organisms were dominant at locations receiving large quantities of organic particulates.

A warm-water fishery exists within the main stems of the Susquehanna and Chenango rivers and is characterized by game species such as smallmouth bass and walleye. Other species include various roughfish such as carp, fallfish, and suckers; forage fish include several species of shiners and minnows. In spite of the fact that walleyes were last stocked in the main study area during 1968 and smallmouth bass prior to that period, the very good success of sport fishermen illustrates that self-sustaining game fish populations have successfully increased their numbers during the period from 1968 to the present. Unfortunately, an important factor which presently limits fishing activities throughout the study area is limited access to the water's edge due to stretches of posted land and a limited number of roadways leading to the river.

Based upon available data, no endangered aquatic species are presently found along the Susquehanna and Chenango Rivers within or near the Binghamton area.

A profile of future aquatic flora and fauna, as part of the Baseline, can be made by an extension of existing trends influenced by expected future wastewater effluent characteristics mentioned previously.

Shifts in benthos composition and abundance to more pollution tolerant organisms and a general increase in algal densities would be expected in the future under the Baseline Condition. Such changes would most likely be accompanied by an increase in trash fish species, such as carp, which may compete more successfully than sport fish species for benthic food resources.

Bacteriology.

The Baseline, although providing secondary waste treatment at five facilities, would most likely contribute significant quantities of coliform to the river, during MA-7-CD-10 conditions, because of overloading of treatment facilities. In addition, since combined sewer overflows would continue without any treatment, coliform concentrations during storm conditions for the Baseline would be as high as 240,000 MPN/100 ml in the Susquehanna River, and 123,000 MPN/100 ml in the Chenango River; concentrations which are well in excess of Class B swimming (monthly median of less than or equal to 2,400 MPN/100 ml) and Class C fishing (monthly mean of less than or equal to 10,000 MPN/100 ml) coliform standards.

Terrestrial Ecology

Open-land wildlife habitats within the Study Area contain such species as pheasants, meadowlarks, field sparrow, doves, cottontail rabbits, red foxes, and woodchucks. These animals find food and shelter in areas of cropland, pastures and meadows, lawns and areas overgrown with grasses and smaller shrubs. Cottontail rabbit, woodchuck, and pheasant are the major small game open-land wildlife species in the Bi-county Area.

Wildlife species found in woodlands commonly include wild turkey, ruffed grouse, woodcocks, thrushes, vireos, scarlet tanagers, gray and red squirrels, gray foxes, raccoons, varying (snowshoe) hares, and white-tailed deer. White-tailed deer and ruffed grouse are found throughout Broome and Tioga Counties in the immature forests recently released from agriculture. Wild turkeys, however, prefer more mature forest stands. The varying hare frequents wooded, preferably coniferous, areas and dense low cover. Woodcock, a popular game bird, prefers forest cover in moist lowland areas.

In wetland habitats, including ponds, marhses, swamps, and other wet places, wildlife species such as wood and black ducks, mergansers, buffle-heads, geese, rails, redwing blackbirds, minks, muskrats, and beavers can be found.

Whitney Point Lake and the larger rivers and streams are used by migratory birds as resting and nesting places. Generally speaking, there are few suitable waterfowl habitats along the Susquehanna River aside from Whitney Point Lake. Primary waterfowl species observed in the Study

Area include black ducks, mallards, wood ducks, wood cock, and scaup. The waterfowl populations are also managed by NYSDEC. Diving waterfowl include mergensers, golden eyes, and bufflehead.

The dominant game resources in the Study Area include whitetail deer, turkeys, beavers, and pheasants. These populations are presently managed by the NYSDEC. Small game species include the otter, fisher, muskrat, mink, skunk, raccoon, grouse, and fox. Otter and fisher populations are not available for hunting in the Study Area. Available data indicate no endangered wildlife species within the Binghamton Study Area.

Although the Baseline Condition would not directly create any longterm terrestrial ecology changes, the increase in human population associated with the Baseline could result in the undirected development of existing open spaces within the urban area including obsolete farmlands, lowlands, and perhaps some of the forested uplands.

Changes in the patterns of existing terrestrial ecology, associated with development, would create a shift in both the plant and animal communities toward species associated with suburban areas. Extended development within flood plains is a possibility under the Baseline Condition and will be discussed in the next section.

SOCIAL

Land Use and Development

It is assumed that projected future population growth and development in the Study Area would occur whether or not sewerage services were provided. However, growth would tend to concentrate within and near areas which provide sewerage services. Haphazard expansion of sewerage services which could occur under the Baseline may or may not result in development patterns which are desired either on the local or regional level. Sewer lines often are placed in floodplains to take advantage of gravity flow to the STP's, and development often parallels sewer lines. Some methods for development restriction, such as flood plain zoning, other local zoning ordinances, and building permit regulations could help to limit sprawl. Not all flood prone communities have flood plain regulations at the present time and if flood plain zoning is not forthcoming, continued development within flood plains would not only create adverse ecological impacts, but could also create adverse social impacts if a destructive flood occurs or if other man-made flood prevention mechanisms have to be initiated (such as, building dikes, dams, and levees).

Recreation

The Susquehanna River and its tributaries were a major focal point of the early settlements and development of the Susquehanna River Valley. In the late nineteenth century, Hiawatha Island was a major resort area of the Susquehanna River with its hotel, bowling alleys, a dance pavillion, and summer house. Two steamboats were used to transport people to the attractions of the Island.

Fishing in the rivers and streams for trout, shad and other fish in the late eighteenth and early nineteenth centuries was not so much a recreational activity as it was a necessity for supplementing food supplies.

Man-made alternations to the river system including the construction of dams along the rivers, the discharge of municipal and industrial wastewaters, and the influence of rural and urban runoff were important factors in the declining recreational use of the river system in the twentieth century.

Existing River Parks.

Approximately twenty parks of various sizes, and a variety of available facilities are found adjacent to the Susquehanna River, between Owego Village and the Town of Kirkwood and along the Chenango River, to its confluence with the Tioughnioga River. Attendance records for the river parks, except for Chenango Valley State Park, were unavailable. Statistics concerning the extent of participation in any particular activity, such as, boating, swimming, and bicycling within the river parks were also not available.

Except for such passive activities as sitting and viewing the rivers, the recreational activities of the river parks are not oriented toward direct use of the rivers as a recreational resource. Where swimming facilities are provided at river parks, swimming activities are carried on in pools or available park lakes.

Secondary Contact Recreation.

Secondary water contact recreation includes those activities where there is little probability of significant water contact or water ingestion and includes such activities as boating and fishing.

Boating, canoeing, and similar secondary contact recreation do occur on the Susquehanna and Chenango River in the Study Area. Three public boat launch sites are located on the Susquehanna--in Johnson City, in Hickories Park (Town of Owego), and in the Town of Nichols to the west of the Village of Owego. Some area homeowners with riverfront lots have private boat moorings; however, the location and number of such private sites is not documented. Warmwater sport fishing for smallmouth bass and walleye occurs within the Susquehanna and Chenango Rivers in the Study Area. Sports news articles in the local papers make reference to smallmouth bass and walleye fishing within the Susquehanna River near low dam and pipeline crossings of the River.

Primary Contact Recreation.

Primary water contact recreation includes those activities that involve significant water ingestion risks such as swimming, diving, and water skiing. Neither Broome nor Tioga Counties have any sanctioned river swimming areas at the present even through a number of public parks are adjacent to the Susquehanna and Chenango Rivers. Swimming activities within Chenango Valley State Park, adjoining the Chenango River, are limited to the lake areas within the Park.

Development Plans for River-Oriented Recreation.

The New York State Department of Transportation (DOT) is presently developing the land between Route 81 and the Chenango River, between the City of Binghamton and Nimmonsburg in the Town of Chenango, as a park facility. After the completion of the development of the Park, the operation and maintenance of the Park will be the responsibility of the Broome County Department of Parks and Recreation. The Commissioner of Parks and Recreation in Broome County has indicated that the Route 81 River Park would be primarily a passive recreation area, emphasizing such activities as picnicking, walking, and bicycling. There are no primary or secondary water oriented activities planned for the facility.

As part of the Southern Tier East Region General Plan for Broome and Tioga Counties, the Riverbanks Improvement Program emphasizes the potentials of the Susquehanna River system for recreation and open space. The Riverbanks Improvement Program identifies the Susquehanna River and the Chenango River as the most important scenic and recreational resources of the region; and, as such, a primary goal of the Program is to preserve and enhance the quality of these waterways. Through a system of small and large parks, conservation areas and strip connections between parks, the Program would maximize the recreational and aesthetic attributes of the area's waterways. The Program does not have any site-specific information as to other secondary (fishing) or primary (swimming) river-oriented recreational areas. Broome County is attempting to implement the goals of the Riverbanks Improvement Program via gradual acquisition of various riverbank sites. Present efforts of Broome County involve the acquisition of six riverbank sites located from the Broome-Tioga County Line to slightly upstream of the Route 17 crossing of the Susquehanna River near the Town of Union. Acquisition and/or development of riverbank recreation and open space areas in the future would proceed in an easterly direction, from the present acquisition sites, upstream along the Susquehanna and Chenango Rivers. As mentioned previously, operation and maintenance of the Route 81 River Park would be under the jurisdiction of Broome County. Present plans for riverbank recreational areas do not include primary river-oriented recreation.

Some local (town, city, village) efforts are underway or are planned to implement the goals of the Riverbanks Improvement Plan. However, use of the rivers for primary water contact recreation is not foreseen by any community.

Present and Future Problems of River-Oriented Recreation.

Several problems exist within Broome and Tioga Counties which limit the use of the river system for both primary and secondary contact river-oriented recreation. In conversations with the park departments, sanitarians, and sportsmen's associations, the following points were mentioned as being the major problems hindering river-oriented recreation. (The following list of problems does not indicate order of importance nor magnitude of the problem).

a. Limited access to the river--much private ownership of river-front land, obstructions such as highways and rainroads, flood prevention dikes, limited or no parking areas near rivers.

b. Pollution--river was said to be "dirty," "smelly," or "a health hazard.

c. River Flow--depending on the desired activity, the river flow was mentioned as being either too slow (hindering fishing) or too fast (hindering swimming).

d. Obstructions in the river--dams along the river and pipeline crossings of the rivers have been dangerous obstacles to boaters and canoers, although fishing is good at such dams and pipeline crossings.

e. Economics--costs involved in the construction, maintenance, and operation (life guards, sanitary analyses, etc.) of sanctioned river-oriented recreation were felt to be prohibitive.

f. Other--rocky river bottom and shoreline in some areas not conducive for swimming or shoreline "beach" activities.

Concentrations of coliform organisms are the primary factors in determining the suitability of surface waters for primary contact recreation according to NYSDEC surface water criteria. The Chenango River is currently classified as a Class B water. NYSDEC coliform standards for Class B (swimmable) waters are:

> "Monthly median coliform value for one hundred ml of sample shall not exceed two thousand four hundred from a minimum of five examinations and provided that not more than twenty percent of the samples shall exceed a coliform value of five thousand for one hundred ml of sample and the monthly geometric mean fecal coliform value for one hundred ml of sample shall not exceed two hundred (200) from a minimum of five examinations. This standard shall be met during all periods when disinfection is practiced."

The median total coliform concentration observed in August and September of 1974 was 120/100 ml in the reach of the Chenango River just upstream of its confluence with the Susquehanna River, and no value exceeded 5,000/100 ml. Thus, the coliform concentrations within the Chenango River currently conform to the standards for Class B waters.

Under the Baseline, it is assumed that no separate treatment facility would be located in the Chenango Valley area and that combined sewer overflows would continue to affect the

Chenango River during periods of heavy rain. Therefore, during MA-7-CD-10 river flow conditions, the present median coliform value of 120 MPN/100 ml would be maintained in the Chenango River and the river would be suitable (from a bacteriological standpoint) for primary contact recreation during nonstorm conditions.

Coliform samples were taken at five stations on the Susquehanna River in Broome County during the months of June to September in 1973 and 1974. The summer months were analyzed because it is during these months that the river has its greatest primary contact recreation potential. Under the Baseline, five sewage treatment plants along the Susquehanna would discharge secondary effluent to the river. In addition, during periods of heavy rain, overflows of combined sewers would affect the river. Because of the overloading of the five STP's and also because of the possibility of combined sewer overflows during storms, coliform concentrations would probably be higher than those allowable for primary contact recreation (particularly downstream of the City of Binghamton at the MA-7-CD-10 flow).

Public Health

Existing malfunctions and overflows of septic systems in the Chenango Valley area, particularly from the Broome County Community College facility, would continue to represent a public health hazard, not only to area residents, but also to users of the Route 81 River Park. Likewise, the reoccurrence of combined sewer overflows in the urban area would continue to have adverse impacts in terms of public health and rec eational potential of the Susquehanna in addition to constituting an illegal point source discharge of raw sewage.

Air Quality

Under the mandate of the Federal Clean Air Act, NYSDEC has submitted to the U. S. Environmental Protection Agency (EPA) a preliminary list of areas in New York State where National air quality standards could be violated by 1985. As such, NYSDEC has preliminarily designated the Binghamton Air Quality Maintenance Area (BAQMA) as an area where growth to the year 1985 may increase particulate emissions such that standards, now being met, would not be maintained by the year 1985. If, after a detailed analysis of the impacts of growth and development in the Binghamton area on ambient air concentrations of particulates, NYSDEC finds that standards would be violated, an implementation plan to prevent violation of standards must be submitted by the State to EPA.

Within the Binghamton area, the air quality parameter of concern is particulate matter. It appears from sampling between 1970 and 1973 that improvements in ambient air quality, at least for the particulate parameter, have been occurring in the area. The concern, however, is that development and growth in the area would result in violations of the ambient air quality standards for particulates by 1985.

In the year 2020, the BAQMA is projected to have a population of 265,400, or approximately 39,540 more people (17 percent increase) than in 1973. These population increases, in the absence of mechanisms or plans to limit particulate emissions could result in the violation of secondary ambient air quality standards for particulates from 1985 onward.

Cultural Resources

During the course of the Study, a Cultural Resources Reconnaissance was performed to identify the significant cultural resources of the Study Area. This reconnaissance consisted of a literature search plus an on-the-ground surface examination of selected portions of the Study Area to determine the general nature of the resources probably present. The Cultural Resources Reconnaisssance Report is printed in its entirety as Chapter VIII of the Specialty Appendix. The findings of the Report indicate that prehistoric man lived and thrived in the Susquehanna and Chenango River Valleys as evidenced by the many archeological resources. Furthermore, many historic sites dot both the urban and rural landscapes of both counties. Since many of these resources, both historic and prehistoric, are located in the river valleys where construction of wastewater management facilities are traditionally located, future construction of each facility could adversely impact on both the enjoyment and preservation of the cultural resources.

Aesthetics

Existing septic system overflows in the Chenango Valley area and overflows of combined sewers create adverse aesthetic perceptions of the rivers which adversely affect the recreational potentials of the rivers in general. Under the Baseline, such adverse aesthetic perceptions would continue to be manifested.

ECONOMIC

By using the data shown in Table I-4, a general idea of income level and income distribution can be obtained for each wastewater management service area. For example, even though the East and West Owego service areas have the highest mean family income, this mean family income must support the largest number of persons per family, as comared to other service areas. Also, although the percentage of poverty families in East and West Owego is relatively low (4.1 percent), the number of people in each poverty family is high even though the mean poverty family income is relatively high.

In the Village of Owego service area, a relatively low number of persons per family are supported by the lowest mean family income of all the wastewater management areas. Although the Village of Owego has a high percentage of families below the poverty level, the mean poverty family income in relation to poverty family size is high and therefore Owego Village has the lowest poverty income deficit.

Within the Binghamton-Johnson City STP service area, the lowest mean family income supports the lowest number of persons per family in comparison to other service areas. The relatively high percentage of families below the poverty level in the B-JC service area receive a moderate (in comparison to other service areas) income per family size and therefore, have the second lowest poverty income deficit in the area.

The Chenango Valley service area and the Endicott service area have moderate poverty family incomes supporting moderate persons per family (in comparison to other service areas). However, the mean poverty family incomes are the lowest among all the service areas. Yet the larger percentage of families below the poverty level and larger poverty family size in Endicott as compared to Chenango Valley result in a much larger poverty income deficit in the Endicott service area than in the Chenango Valley service area.

TABLE I - 4

ECONOMIC CHARACTERISTICS OF
WASTEWATER MANAGEMENT SERVICE AREAS

STP SERVICE AREA	MEAN FAMILY INCOME	MEAN PERSONS PER FAMILY	PERCENT BELOW POVERTY LEVEL	MEAN POVERTY FAMILY SIZE	MEAN POVERTY FAMILY INCOME	MEAN POVERTY INCOME DEFICIT
Chenango Valley	$11,537	3.22	4.5	3.0	$1,779	$1,243
BJC	$10,403	2.87	8.7	3.15	$1,840	$1,203
Endicott	$11,612	3.33	6.2	3.34	$1,768	$1,443
East Owego	$13,447	3.86	4.1	3.67	$1,953	$1,444
West Owego	$13,447	3.86	4.1	3.67	$1,953	$1,444
Owego Village	$ 9,974	3.01	9.7	3.46	$2,218	$1,109

Source: 1970 Census of Population; General Social & Economic Characteristics.

CHAPTER II

STAGE I - DELINEATION OF STRATEGIES

DECRIPTION OF STRATEGIES

As described in Chapter I, the first step in the planning process was the delineation of strategies to investigate a broad range of potential solutions for the wastewater management problems. Initially, many strategies were proposed for consideration using various combinations of degrees of regionalization, levels of treatment, and flow reduction schemes. The strategies covered a range of costs and impacts so that an initial evaluation process could screen out the most unacceptable concepts. A number of potentially overlapping strategies (say infiltration control and advanced waste treatment) were investigated separately in Stage I to determine both their feasibility and their desirability. Later in Stage II, the various independent strategies of Stage I were combined to form more complete systems and were labeled as alternatives. A more complete description of the planning process for Stage I can be found in the Plan Formulation Appendix, Chapter IV. The following sections are intended to give the reader a very general overview of the types of strategies initially considered.

REGIONALIZATION

Degree of regionalization refers to the number of distinct treatment systems included in any strategy. A high level of regionalization is characterized by treatment of a region's wastewater at one or two centralized plants necessitating the construction of long interceptors. On the other hand, lower levels of regionalization or decentralized treatment requires more treatment plants but shorter interceptors.

Nine urban wastewater management areas were identified as indicated on Figure II-1. To serve these nine areas, five

URBAN WASTEWATER MANAGEMENT AREAS

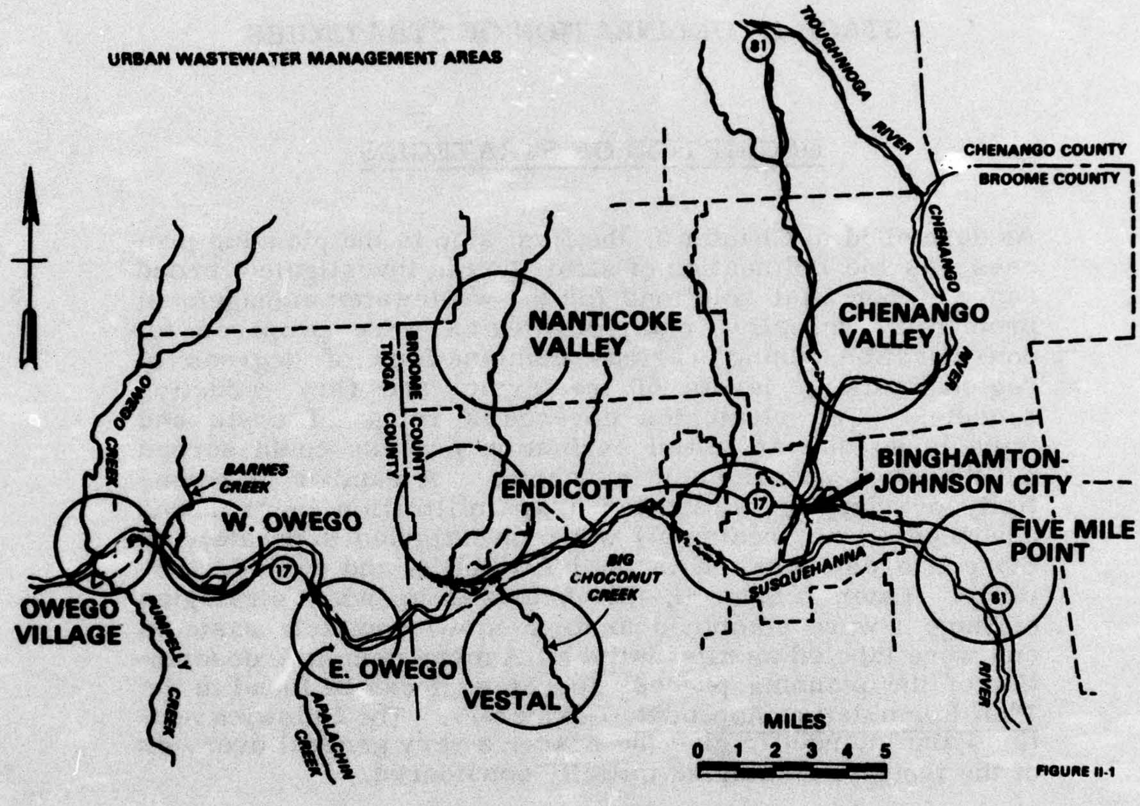


FIGURE II-1

choices for degree of regionalization were considered in Stage I (1, 3, 4, 5, and 6 wastewater treatment plants).

Six Plant Regionalization

A new plant would be constructed in Chenango Valley; Five Mile Point wastewater would flow to Binghamton-Johnson City; Nanticoke Valley and Vestal flows would go to Endicott. East Owego, West Owego, and Owego Village would each continue to be serviced by their existing treatment plants.

Five Plant Regionalization

Strategies involving five plants differed from those with six plants only in that Chenango Valley wastewater would be transported to the Binghamton-Johnson City plant.

Four Plant Regionalization

Differs from five plant schemes in that Owego Village flows would be sent to West Owego.

Three Plant Regionalization

The Binghamton-Johnson City plant would, in addition to its present service area, include flows from Five Mile Point and Chenango Valley. The Endicott service area would be expanded to include Nanticoke Valley, Vestal, and East Owego. The West Owego plant would service Owego Village.

Complete Metropolitan Regionalization

All wastewater from the nine urban wastewater management areas would be sent to an expanded Binghamton-Johnson City plant.

LEVEL OF TREATMENT

Wastewater treatment refers to any process where solids, bacteria, organic matter, and other objectional constituents are removed from the water to render it less offensive or less dangerous. The level of treatment (either primary, secondary, or advanced waste treatment) is a measure of the removal efficiency between influent and effluent of a sewage treatment plant. Generally, primary treatment is the least expensive, but it also removes the least amount of pollutants from the water. On the other hand, advanced waste treatment is the most expensive but it removes most of the pollutants.

Public Law 92-500 requires at least secondary treatment by 1977, so strategies were developed that furnished a range of treatment opportunities between secondary and advanced waste treatment. Several processes exist for achieving the various levels of treatment. The biological process, for instance, employs an induced natural oxidation of organic wastes to remove pollutants from the water. Either the trickling filter or the activated sludge method can achieve secondary treatment using the biological process. With the addition of a nitrification step to the biological process, even more BOD and nitrogenous oxygen demand (NOD) can be removed, resulting in an effluent quality between the secondary and advanced waste treatment levels. To achieve AWT with the biological process, several additional steps such as denitrification, coagulation, sedimentation, and carbon absorption are necessary, providing a polished effluent approaching the "no discharge" goal.

The physical/chemical process is an alternate method for treating wastewater, and is usually employed for achieving a high level of treatment. Instead of relying on the natural oxidation system used by the biological process, the physical/chemical process applies physical means (gravity settling and filtration) and chemical methods (flocculation and sedimentation) for attaining proper treatment. Industries frequently use physical/chemical treatment for wastewater containing concentrations of metals since the biological treatment process is severely hampered by toxic compounds.

Yet another treatment process approaching the "no discharge" goal is the application of secondary treated wastewater to the land. Soil, air, plants, and bacteria are used as the treatment media to remove pollutants from the water. Either spray irrigation, overland flow, or rapid infiltration can be used to apply the secondary effluent to the soil-plant complex where vegetation and micro-organisms remove additional pollutants.

Land application has been considered with increasing favorability during recent years because of the value of the water for irrigation and because of the value of nutrients in the water as fertilizer supplements.

FLOW REDUCTION MEASURES

In many respects, wastewater flow reduction measures are a positive approach to water pollution abatement. Rather than merely treating what comes out the end of the pipe at the sewage treatment plant, why not attempt to control what goes into the pipe? The reduction of wastewater flows to STP's cannot only lower the cost of required collection and treatment facilities, but may also reduce the overall environmental impact of wastewater treatment. Flow reduction can be achieved by either structrual or nonstructural means. Structural measures include infiltration control (sewer rehabilitation or replacement) and stormwater control facilities, particularly desirable in highly urbanized areas such as Binghamton and Johnson City. Nonstructural measures for flow reduction include: metering of sewer use, pricing on a volume basis, implementation of water conservation programs, sewer use ordinances, land use zoning, or public education programs.

FORMULATION

The myriad permutations of numerous degrees of regionalization, different levels of treatment, and various flow reduction schemes interacted to produce many combinations of strategies for consideration (see Figure II-2). Emphasis in Stage I was to provide a wide range of choice for the Bicounty Area, with the only significant limitation being the elimination of management options which were of doubtful technical feasibility or were inconsistent with Federal or State law. Data were developed to the level of detail necessary to facilitate comparison of strategies. Since the intention of Stage I was to delineate a range of choice, no preliminary designs were included nor was any attempt made at detailed optimization of wastewater treatment processes. Impacts of each strategy were categorized under broad headings such as predicted values of DO or miles of regional interceptor required.

COMPONENTS FOR DELINEATION OF STRATEGIES

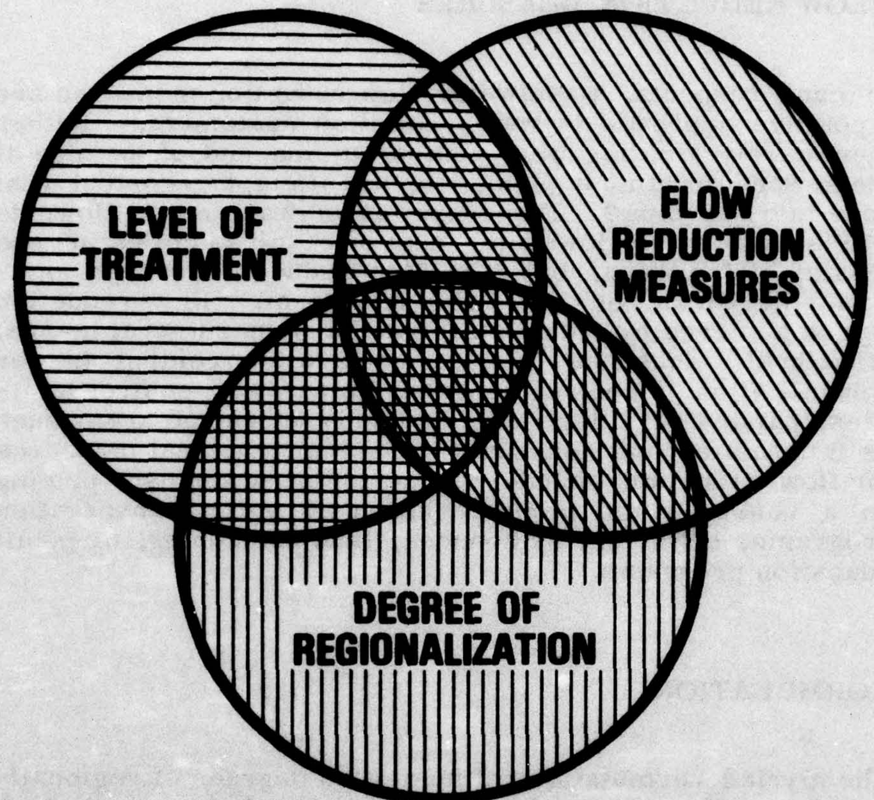


FIGURE II-2

STRATEGIES

Twenty-five strategies were arranged in three groups with the exception of Strategy I which represented the 1977 Baseline Condition against which the other strategies were compared. Numbers 2 through 14 provided for treatment of maximum wastewater flows for the year 2000, that is, flows that could be expected with maximum anticipated increases in water usage. Numbes 15-19 were designed to evaluate wastewater reduction measures through structural and nonstructural means to prevent or decrease the expected increase in per capita water consumption. Costs of the flow reduction measures were included in this stage. The third group of strategies, Numbers 20-25, represented short term schemes, meeting treatment requirements for 1980 flows only.

Strategy 1

The Baseline represented the existing conditions plus those proposed actions likely to be in effect by 1977; that is, sewerage provided for Nanticoke Valley and Five Mile Point (but not Chenango Valley), closing down the Vestal and Owego Valley View treatment plants, and upgrading the Owego Village plant to secondary. Sewer extensions to expanding population centers would occur, but no new STP's would be built nor would any existing STP's be upgraded. This scheme was also referred to as the no action strategy.

Strategy 2

Included six STP's providing secondary treatment, at the five existing facilities plus a new plant at Chenango Valley.

Strategy 3

Included six plants providing secondary treatment plus filtration as a possible means of achieving the 1983 objective of fishable-swimmable waters.

Strategy 4

Is equivalent to Strategy 3 except that Chenango Valley wastewater would be diverted to the Binghamton-Johnson City STP. The comparison attempted to indicate any relative advantages of a separate Chenango Valley STP.

Strategy 5

Utilized advanced water treatment at six plants.

Strategies 6, 7, 8, 9

Four plant regionalization schemes. Treatment levels employed were secondary (No. 6), secondary plus filtration (No. 7), secondary plus nitrification (No. 8) to provide another means of achieving the 1983 objective, and advanced waste treatment (No. 9).

Strategies 10, 11, 12

Applied secondary, secondary plus filtration, and advanced waste treatment, respectively, at three regional STP's: Binghamton-Johnson City, Endicott, and West Owego.

Strategy 13

Represented a different approach to advanced waste treatment by utilizing land application. Approximately 15 mgd (million gallons per day) of effluent from the Binghamton-Johnson City STP would be applied on 5,800 acres in the Osbourne Creek area in the Town of Fenton and 2.3 mgd from the Owego Town #1 STP effluent would be applied to 900 acres in the Hunt's Creek region of the Town of Nichols. The remaining secondary effluent from the two plants plus the secondary effluent from Endicott would continue to be discharged to the River.

Strategy 14

Complete regionalization of the urban area with the expansion of the Binghamton-Johnson City plant to handle all of the metropolitan area wastewater by applying advanced waste treatment.

Strategies 15, 16, 17, 18, 19

Applied flow reduction measures to a four plant regionalization system for comparision to Strategies 5, 6, and 7 (maximum wastewater flows). Infiltration control in Binghamton sewers was assumed to reduce the flow by 5 mgd. Nonstructural methods incorporated throughout the Study

Area were assumed to reduce flows by a total of 11 mgd. Strategies 15 and 16 employed infiltration control in Binghamton. Number 15 also provided infiltration in addition to secondary treatment. Strategies 17 and 18 included improved secondary, infiltration from No. 17 and nitrification for No. 18. Strategy 19 utilized both infiltration control and nonstructural measures in addition to secondary treatment plus filtration.

Strategies 20, 21, 22, 23, 24, 25

Short term strategies designed for 1980 wastewater flows only. Strategies 20, 21, and 25 included six plants providing secondary, secondary plus infiltration, and secondary plus nonstructural methods, respectively. Strategies 22 and 23 applied secondary treatment and nonstructural measures at four plants; Strategy 22 assumed a normally expected NOD effluent of 50 mg/l at the Binghamton-Johnson City STP while Strategy 23 used the current NOD of 10 mg/l. Strategy 24 provided secondary plus nonstructural for the five existing STP's.

A summary of the strategies, cost, and impact on the low flow dissolved oxygen of the Susquehanna River is presented in Table II-1.

IMPACT ASSESSMENT

In this first stage of the Study a large number of strategies were formulated and initially screened to determine if any of the strategies were obviously not within the objectives of the Study. This initial review took into consideration only the broad economic, social-enviromental, and institutional impacts, appropriate for this level of the Study.

ECOLOGICAL IMPACTS

As the level of regionalization increased or decreased between the different strategies the impact on the social-environmental setting differed. Generally the adverse impact on the terrestrial ecology increased with increasing levels of regionalization. This was due to the construction of new interceptors to bring wastewater to the regional plant

TABLE II-1

COSTS AND DISSOLVED OXYGEN IMPACTS FOR STRATEGIES**
(YEAR 2000 MAXIMUM LOWS UNLESS NOTED)

No.	Strategy	Number of STP's	Capital Costs Millions	O & M Millions per Year	Total Annual Costs Millions per yr	Minimum Low Flow DO mg/l
1	*Baseline Condition	5	6	0.4	0.8	2.2
2	*Secondary	6	15	0.4	1.5	2.4
3	Secondary + Filtration	6	19	0.8	2.2	3.1
4	Secondary + Filtration	5	21	0.7	2.2	2.9
5	*Advanced Waste Treatment	6	54	3.9	8.0	6.1
6	Secondary	4	17	0.4	1.6	2.2
7	Secondary + Filtration	4	21	0.7	2.2	2.9
8	*Secondary + Nitrification	4	26	0.7	2.6	5.3
9	*Advanced Waste Treatment	4	53	3.3	7.4	6.0
10	Secondary	3	20	0.5	1.9	2.1
11	Secondary + Filtration	3	23	0.8	2.5	2.8
12	*Advanced Waste Treatment	3	54	3.3	7.4	5.9
13	*Secondary + Land Treatment	3	39	1.3	4.1	4.0
14	*Advanced Waste Treatment	1	60	3.3	7.7	5.9
15	Secondary + Infiltration Control[1]	4	15	0.3	1.4	2.7
16	Secondary + Filtration + Infiltration Control[1]	4	19	0.6	2.0	3.3
17	Secondary + Filtration + Non-structural Measures[1]	4	12	0.4	1.2	3.8
18	*Secondary + Nitrification + Non-structural Measures[1]	4	16	0.4	1.5	5.5
19	*Secondary + Filtration + Infiltration Control + Non-structural Measures**[1]	4	9	0.3	0.9	5.0
20	Secondary	6	9	0.2	0.8	3.3
21	Secondary + Filtration	6	12	0.5	1.4	3.8
22	Secondary + Non-structural Measures[1, 2]	4	7	0.05	0.5	3.6
23	*Secondary + Non-structural Measures[1, 2]	4	7	0.05	0.5	4.5
24	*Secondary + Non-structural Measures[1, 2]	5	6	0.05	0.4	4.5
25	*Secondary + Non-structural Measures[1, 2]	6	6	0.8	0.4	4.5

[1] – Does not include costs of flow reduction measures.
[2] – Based on year 1980 maximum wastewater flows.
* – Strategies for further study.

** – Average Annual Costs based on 6% interest with a 50-year project life.

from communities that had their treatment plant phased out. The construction of the interceptors would require the removal of the vegetative cover and the wildlife associated with it.

The minimum river dissolved oxygen level shown in Table II-1 was a measure of the impact of the strategy on the aquatic ecology of the river. Generally, the higher the dissolved oxygen level in comparison to the no action or Baseline strategy, the larger the beneficial impact.

ECONOMIC IMPACTS

The economic impacts of the different strategies may be somewhat measured by the cost of the strategies shown in Table II-1. These costs were very rough at this level of the Study and were greatly refined in the following stages. Also, later in the Study an evaluation was made as to what these costs mean to the individual in the Study Area. For this level of detail, however, it was generally noted that the higher the level of treatment, the higher the cost.

SUMMARY AND EVALUATION

During Stage I initial strategies were developed and a very preliminary review took place. The impact assessment indicated that as degree of regionalization increased the degree of adverse impact on the terrestrial ecology increased. Also as the level of dissolved oxygen increased the beneficial impact on the aquatic ecology increased, but along with this the adverse economic impact also increased.

Therefore, the evaluation of the impacts of the strategies indicated that strategies with high degrees of regionalization, low DO levels, and high cost should be looked upon as less favorable than those that did not. The screening of strategies in Stage I to select alternatives for Stage II was done by selecting those strategies that met the State's requirement of a minimum DO of 4 mg/l (these strategies are marked with an asterisk in Table II-1). Also carried into Stage II were possible flow reduction measures, stormwater control, and sludge management, but these were considered as options to any of the alternatives. The screening in Stage I did not rule out any potential alternative that had significant beneficial social-environmental impacts.

It should be noted that the model for predicting the dissolved oxygen level for the different strategies used in Stage I underwent refinement during Stage II of the Study. This refinement showed that the DO levels presented in Table II-1 were too low. An example is Strategy 1, the Baseline Strategy, which shows a DO of 2.2 mg/l in Table II-1, but was later determined to be between 3 to 4 mg/l in Stage III.

Because the screening of strategies in Stage I was based on DO levels a reevaluation was accomplished when the DO model was modified in Stage II-2. This reevaluation showed that no strategies were dropped that should not have been deleted.

CHAPTER III

STAGE II- FORMULATION OF ALTERNATIVES

ITERATION 1

MODIFICATION AND REFINEMENTS

In Stage I uniform treatment levels were imposed on all treatment plants for each of the given strategies proposed. Alternatives in Stage II were developed in sufficient detail to determine the most efficient levels of treatment at each plant. Land application during the warmer months only allowed for a more prudent evaluation of this alternative. Also, two plant regionalization systems were also investigated to allow an examination of a full range of regionalization schemes, from one to six plants. By varying the level of treatment at each sewage treatment plant and by expanding the range of regionalization, the strategies in Stage I were refined to 40 specific alternatives. The relationship between the strategies of Stage I and the alternatives of Stage II-1 is shown in Table III-1.

DESCRIPTION OF ALTERNATIVES

Figure III-1 shows the Urban Study Area and the Outlying Communities. All alternatives in Stage II-1 dealt with the Urban Study Area except Alternative VIII which examined a single STP serving the entire Bicounty Area. More information about the Outlying Communities can be found in Chapter I of the Specialty Appendix. The alternatives in Stage II-1 are grouped under 12 basic categories. Within each category varying levels of treatment and flow reduction measures are identified for 40 separate alternatives. These 40 alternatives have been very briefly summarized in Table III-1.

TABLE III-1

RELATIONSHIP OF STRATEGIES TO ALTERNATIVES

Stage II-1 Alternative 1/	Stage I Strategies	Addition or Modification
I. Baseline	1	No change.
II. Metro Regionalization		
(a) Nit - 2		Varied treatment levels applied.
(b) AWT	14	No change.
III. Two Plant		
(a) Nit		Two plant systems evaluated.
(b) Nit 1		"
(c) Filtration, Nit @ Endicott		"
(d) AWT		"
IV. Three Plant		
(a) Nit		Varied treatment levels applied.
(b) Nit - 2		"
(c) Nit - 1		"
(d) AWT	12	No change.
V. Four Plant		
(a) Nit	8	No change.
(b) Nit - 2		Varied treatment levels applied.
(c) Nit - 1		"
(d) AWT	9	No change.
VI. Five Plant		
(a) Nit		Varied treatment levels applied.
(b) Nit - 2		"
(c) Nit - 1		"
(d) AWT		"
VII. Six Plant		
(a) Nit		Varied treatment level applied.
(b) Nit - 2		"
(c) Nit - 1	2	Nitrification added.
(d) AWT	5	No change.

TABLE III-1 (Continued)

Stage II-1 Alternatives 1/	Stage I Strategies	Addition or Modification
VIII. Bicounty Regionalization		
(a) Nit		One plant for total Bi-county area evaluated.
(b) AWT		
IX. Physical/Chemical (4 plants)		
(a) Nit		Physical/Chemical processes to replace biological.
(b) AWT		
X. Land Treatment (4 plants)		
(a) 80% Year Round		Varied level of treatment applied.
(b) 80% Seasonal	13	Four plant system.
(c) 100% Seasonal		Varied level of treatment applied.
XI. Non-Structural (4 plants)		
(a) Nit	18	No change.
(b) Nit - 2		Varied level of treatment applied.
(c) Nit - 1	23, 24, 25	Nit added, long range alternative.
(d) AWT		Varied level of treatment applied.
XII. Infiltration Control (4 plants)		
(a) 2 mgd reduction + Nit		Varied level of treatment applied.
(b) 4 mgd reduction + Nit		"
(c) 4 mgd reduction + Non-struc.	19	Filtration dropped.
(d) Nit @ Endicott + (c)		Varied level of treatment applied.
(e) Nit - 2 + (c)		"
(f) AWT		"

1/ All treatment plants have minimum of secondary treatment. Technologies are biologically based except for Category IX alternatives. Nitrification (Nit), Advanced Waste Treatment (AWT) applied to all treatment plants except as noted: Nit - 1 denotes nitrification at the Binghamton-Johnson City plant only; Nit - 2 denotes nitrification at both the Binghamton-Johnson City and Endicott plants.

BICOUNTY STUDY AREA

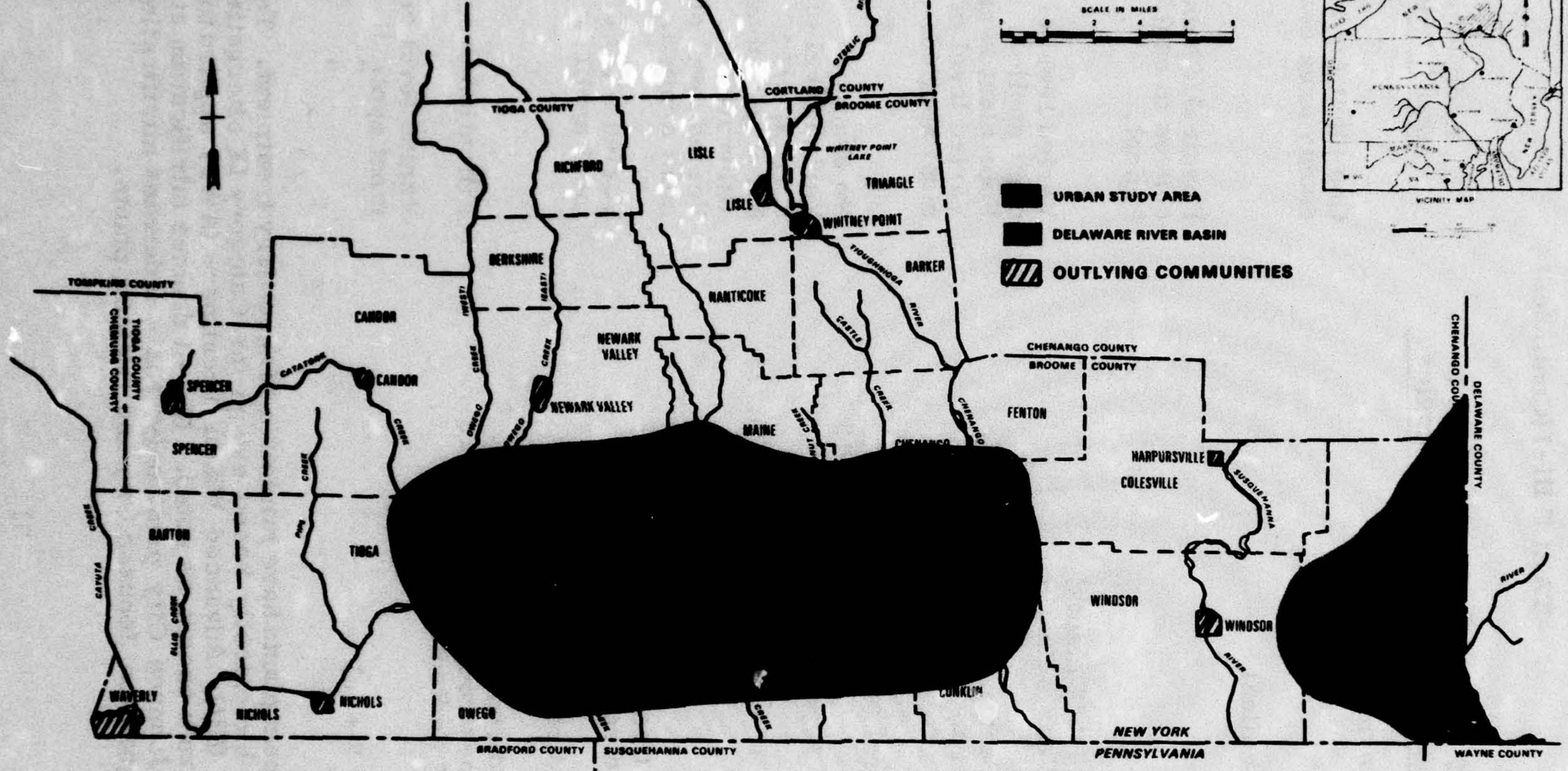


Figure III-1

I. Baseline Conditions

The Baseline Alternative was a no action or existing conditions plan. The purpose of including this alternative was to provide a baseline condition to which the features of any of the "action" alternatives could be compared. This alternative provided a prediction of conditions which would occur if the physical systems for wastewater management existing in 1977 were to remain unchanged throughout the planning period (to year 2020) while population continued to grow as projected. Systems included in the Baseline Alternative were the existing treatment plants of Binghamton-Johnson City, Endicott, an upgraded Owego Village providing secondary treatment, and Town of Owego Sewage Treatment Plants No. 1 and No. 2. Also included were proposed projects or expected projects to be completed by 1977. Such projects included: construction of an interceptor to bring Vestal sewage to the Endicott plant for which funding has been approved, and the closing of the Owego Village Valley View Plant.

Because of the uncertainty surrounding the proposed plans for wastewater management in the Chenango Valley area, the Baseline Condition for Chenango Valley was assumed as the continued use of septic tanks for sewage disposal throughout the planning period. All existing STP's would maintain their present capacity throughout the planning period. With this stable physical condition, the population was assumed to grow at the same rate as with the "action" alternatives. Population growth was not assumed to be limited by the capacity of wastewater facilities even though a treatment plant or septic system might become overloaded. It was also assumed population growth within a given treatment plant service area would be served by that plant, even where physical expansion of the collection system would be necessary to accomplish this.

The Baseline Alternative provided the future no action condition against which the impacts and costs of the action alternatives were assessed. The Baseline Alternative would result in increasing volumes of effluent, deteriorating river water quality, increasing problems with septic tanks in the Chenango Valley area, and continued combined sewer overflows problems; but this alternative would cost the citizens of Broome and Tioga Counties less than any of the action alternatives.

II. Metropolitan Regionalization

All existing operations would be discontinued except for the Binghamton-Johnson City plant which would be expanded to service all nine metropolitan wastewater management areas. Major transmission mains would be constructed throughout the urban areas.

III. Two Plant Regionalization

Wastewater from the Study Area would flow to the two largest existing plants, Binghamton-Johnson City and Endicott, with both requiring expansion (major expansion for Endicott). See Figure III-2.

IV. Three Plant Regionalization

In this category wastewaters from the two counties would be handled by separate treatment systems. Owego Town Sewage Treatment Plant #2 would be expanded to treat sewage from the entire Tioga County wastewater management areas. An alternative three-plant strategy was considered which placed the Tioga County plant at Owego Town #1 STP. However, costs were higher than the Owego Town #2 STP location. See Figure III-3.

V. Four Plant Regionalization

Category V continued the two-county theme and utilizes all the existing secondary treatment plants. As such, it required abandonment of only two primary plants. The principal consolidation of existing service areas would be the treatment of Owego Village wastewaters at an expanded Owego Town Treatment Plant #1. The Chenango Valley and Five Mile Point wastewater management areas which are presently unsewered would send wastewater to the Binghamton-Johnson City plant. See Figure III-4.

VI. Five Plant Regionalization

This regionalization scheme was identical to V, except that separate treatment would be provided for Owego Village. This category generally used the existing physical system. See Figure III-5.

VII. Six Plant Regionalization

The only completely new treatment plant proposed in any of the alternatives was provided in the six-plant regionalization alternatives. A treatment plant was proposed for the

Chenango Valley wastewater management area. Comparison with the five-plant alternatives indicated whether or not the new plant would be desirable. See Figure III-6.

VIII. Complete Regionalization

This system was included to place the wastewater problems of Outlying Communities in perspective by providing for one treatment plant at Binghamton-Johnson City for the entire two-county area. An extensive network of transmission mains and a completely centralized management system would be required for the region. The Specialty Appendix (Chapter I) discusses the wastewater management problems of the Outlying Communities in detail. See Figure III-7.

Each of the following alternatives (physical/chemical treatment, land application, nonstructural measures, and infiltration control) were investigated separately in the first iteration of Stage II. Later stages and iterations combined these particular concepts with various degrees of regionalization in formulating detailed plans for evaluation.

IX. Physical/Chemical Treatment

A four plant level of regionalization was utilized for physical/chemical treatment and in each of the remaining category groups to facilitate a standard basis for comparison. These categories all represent departures from what might be called conventional wastewater management, and it is of interest to compare such alternatives to the standard options. The four plant regionalization system was used because it achieved minimum water quality levels at slightly lower cost.

X. Land Application

The Binghamton area was found not an ideal location for land application, primarily due to soils and climate limitations. Preliminary estimates of the costs of land application indicated that the on-site costs alone (exclusive of treatment and transmission) of complete land application substantially exceeded the total costs of AWT. Hence, an attempt was made to devise more feasible land application schemes. The diversion of a portion of treated effluent and the use of land application only during the months of critical low river flows essentially put the land application in its most favorable light. Alternatives X-b and X-c (Table III-1) represented the least cost land-oriented methods for achieving minimum river DO values of 4 and 5 mg/l, respectively. Alternative

TWO PLANT REGIONALIZATION

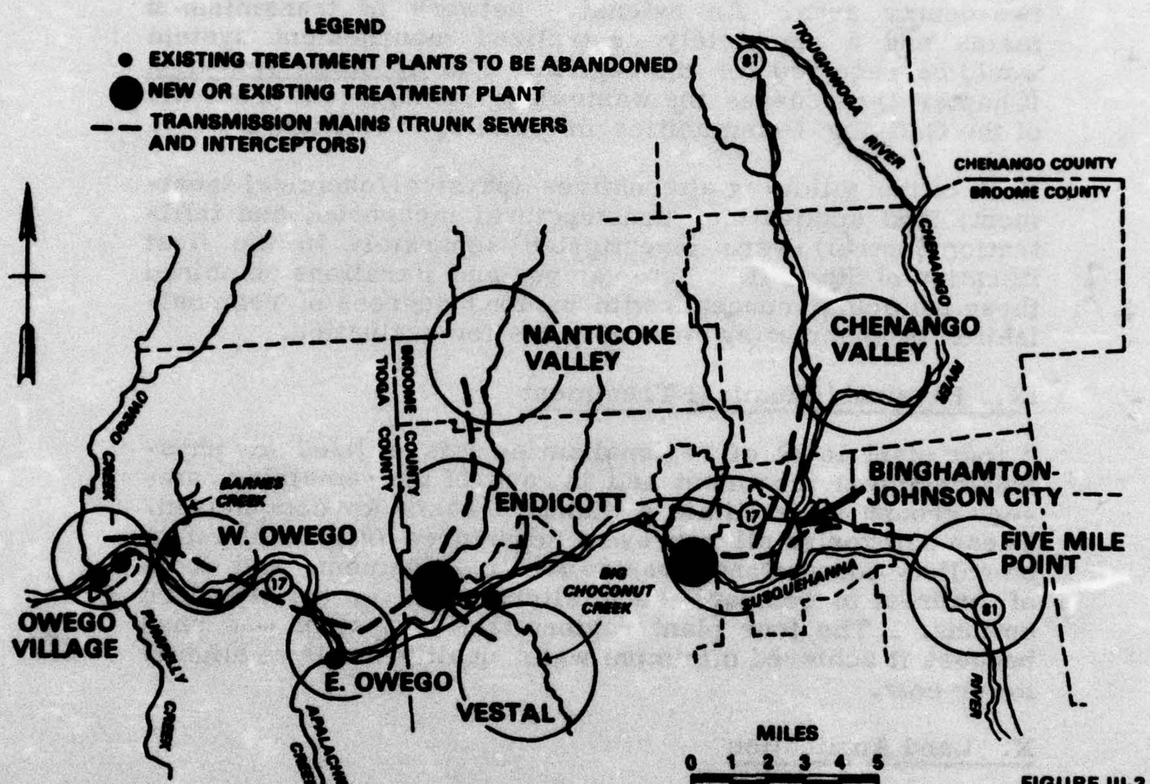


FIGURE III-2

THREE PLANT REGIONALIZATION

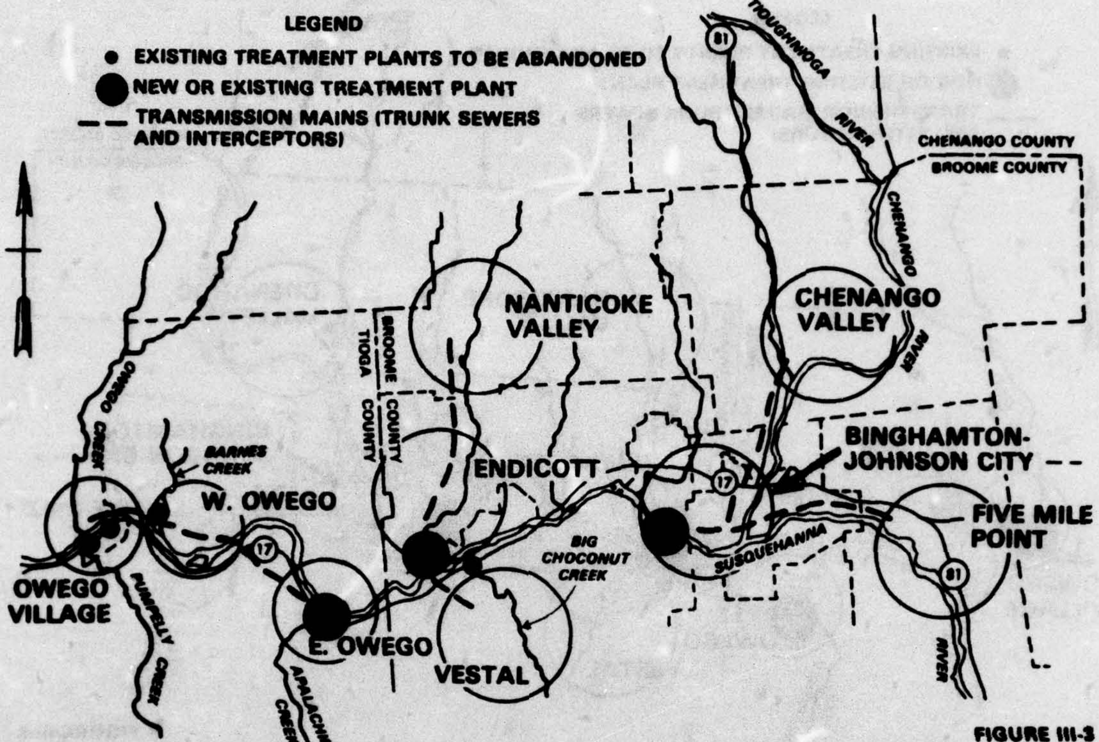


FIGURE III-3

FOUR PLANT REGIONALIZATION

FIGURE III-4

FIVE PLANT REGIONALIZATION

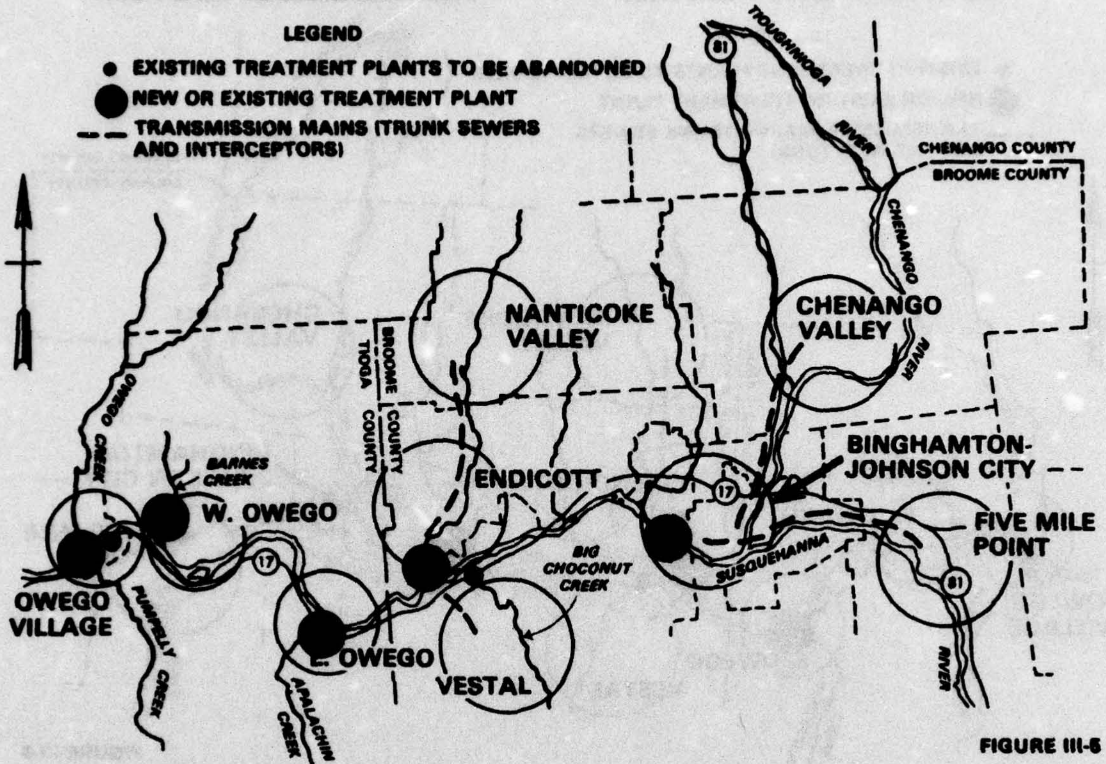


FIGURE III-5

SIX PLANT REGIONALIZATION

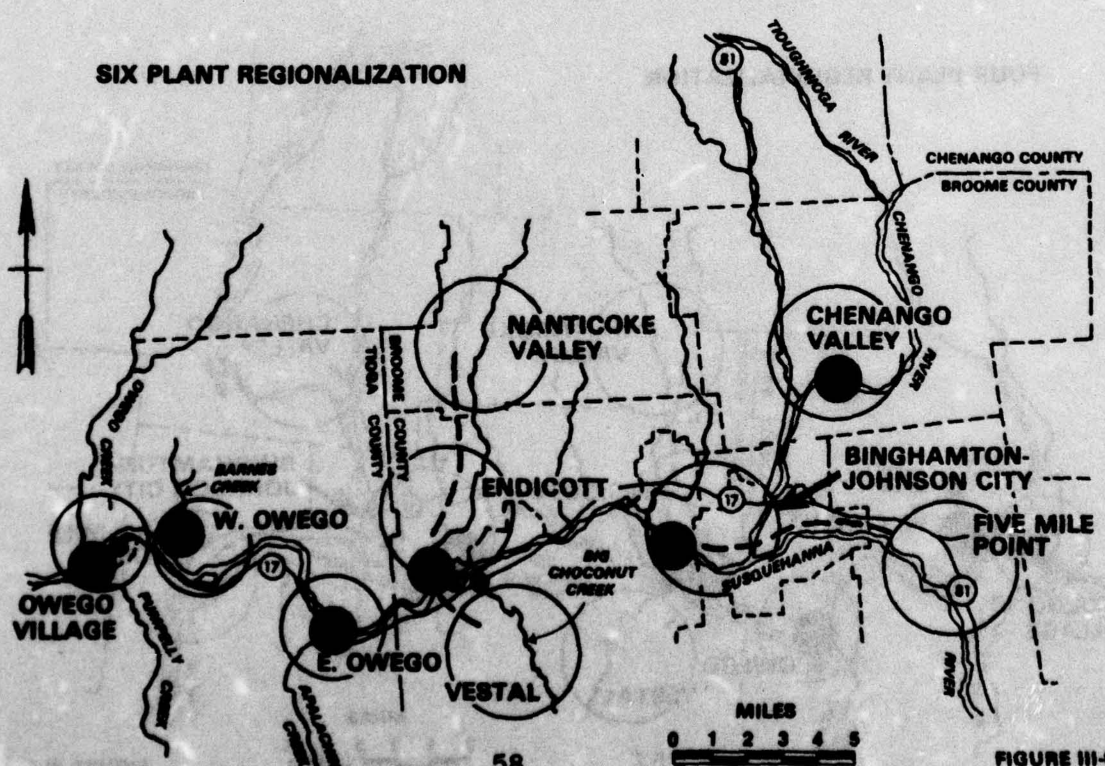


FIGURE III-6

BICOUNTY REGIONALIZATION

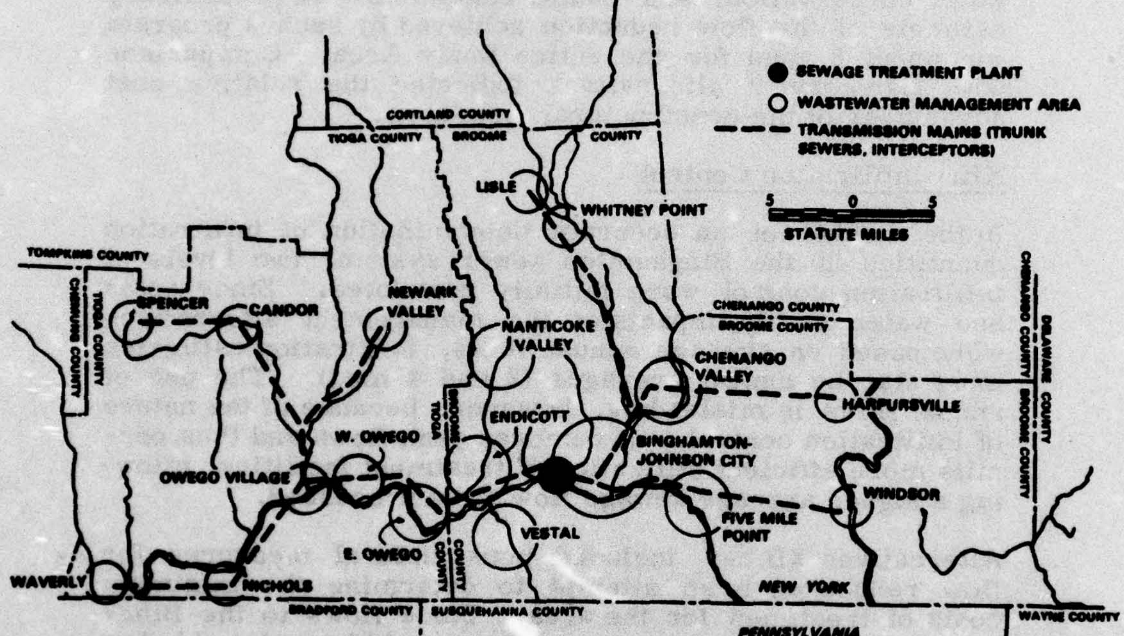


FIGURE III-7

X-a was the only alternative which diverted wastewater for land application year-round, thereby requiring large storage lagoons for the diverted wastewater during the months of November through April.

XI. Nonstructural Measures

Nonstructural measures were designed to reduce future wastewater flows. The proposed measures included service area limitation, sewer ordinances, water metering, pricing, water conservation, and public education. A preliminary estimate of the flow reduction achieved by such a program was about 8 mgd for the entire Study Area. Comparison with Category V alternatives indicated the relative cost advantages of the nonstructural measures.

XII. Infiltration Control

In the absence of an accurate determination of infiltration quantities in the Binghamton sewer system, two levels of infiltration control were initially postulated. Since costs and water quality impacts of the management alternatives were based on average annual flows, infiltration estimates must also be annual averages (2 and 4 mgd). The use of annual flows is misleading, however, because of the nature of infiltration control. It removes peak flows and thus permits more efficient utilization of treatment facilities, allowing a higher average sewage flow to be processed.

Alternatives XII c-f included nonstructural measures for flow reduction, in an attempt to determine the minimum costs of treatment for the area. Since flows to the Binghamton-Johnson City treatment plant would be reduced below current levels, the plant's existing low level of NOD in the effluent (10 mg/l) was assumed in two of the plans, XII-c and XII-d. Comparison of XII-d and XII-e which included a nitrification process at Binghamton-Johnson City would be indicative of cost savings associated with high performance at the plant. Later in the planning process, control of stormwater was also investigated as a possible means of flow reduction.

The forty wastewater management alternatives for Stage II-1 are summarized in Table III-2 along with a tabulation of costs and dissolved oxygen concentrations.

TABLE III-2

SUMMARY OF WASTEWATER MANAGEMENT ALTERNATIVES

STAGE II-1

Alternatives	Treatment Level	Capital Cost ($10⁶)	Net O&M ($10⁶)	Annual** Cost ($10⁶)	Minimum Daily Average DO (mg/l)
I. Baseline Condition	Secondary	12	0.6	1.6	2-3
II. Metropolitan Regionalization	(a) Nitrification (1)	35	0.9	3.3	5-6
	(b) AWT	59	3.0	7.3	5-6
III. Two-Plant	(a) Nitrification	27	0.8	2.7	5-6
	(b) Nitrification (1)	24	0.7	2.3	3-4
	(c) Filtration Nitrification-Endicott	25	0.9	2.7	4-5
	(d) AWT	54	3.1	7.1	5-6
IV. Three-Plant	(a) Nitrification	24	0.8	2.5	5-6
	(b) Nitrification (2)	23	0.7	2.3	5-6
	(c) Nitrification (1)	20	0.6	2.1	4-5
	(d) AWT	53	3.6	7.6	5-6
V. Four-Plant	(a) Nitrification	23	0.7	2.4	5-6
	(b) Nitrification (2)	22	0.6	2.2	5-6
	(c) Nitrification (1)	20	0.5	2.0	4-5
	(d) AWT	54	3.8	7.9	5-6
VI. Five-Plant	(a) Nitrification	24	0.7	2.5	5-6
	(b) Nitrification (2)	22	0.6	2.3	5-6
	(c) Nitrification (1)	20	0.6	2.0	4-5
	(d) AWT	55	3.9	8.1	5-6
VII. Six-Plant	(a) Nitrification	22	0.8	2.5	5-6
	(b) Nitrification (2)	20	0.8	2.2	5-6
	(c) Nitrification (1)	17	0.7	2.0	4-5
	(d) AWT	55	4.3	8.5	5-6
VIII. Complete Regionalization	(a) Nitrification	46	1.0	4.2	5-6
	(b) AWT	71	3.4	8.6	5-6
IX. Physical/Chemical (4 plants)	(a) Nitrification	30	1.1	3.4	5-6
	(b) AWT	51	3.3	7.2	5-6*
X. Land Application (4 plants)	(a) 80% Year Round	65	3.5	8.2	4-5
	(b) 80% Seasonal	40	1.6	4.4	4-5
	(c) 100% Seasonal	47	2.0	5.3	5-6*
XI. Non-Structural (4 plants)	(a) Nitrification	16	0.5	1.6	5-6
	(b) Nitrification (2)	15	0.4	1.4	5-6*
	(c) Nitrification (1)	13	0.3	1.1	4-5
	(d) AWT	42	3.1	6.2	5-6
XII. Four-Plant System with Infiltration Control[2]	(a) Nitrification-2 mgd reduction	21	0.7	2.2	5-6
	(b) Nitrification-4 mgd reduction	21	0.7	2.2	5-6*
	(c) + Nonstructural	9	0.2	0.8	4-5
	(d) (c) + Nitrification at Endicott	11	0.3	1.0	5-6*
	(e) (c) + Nitrification (2)	14	0.4	1.4	5-6
	(f) AWT	39	2.8	5.8	5-6

*Alternatives carried into Stage II-2

**6% interest and 50-year project life. Capital cost is construction cost of both STP's and transmission mains which may or may not occur in 1977, depending on need. Therefore, column one does not represent a present worth of construction expenditures.

[1] All treatment plants have minimum of secondary treatment. Treatment technologies biological based except for Strategy No. III, IX, Nitrification, and AWT applied to all treatment plants except as noted: (1) Nitrification at Binghamton-Johnson City Plant only; (2) Nitrification at Binghamton and Endicott only.

[2] Costs represent treatment and transmission works and do not include costs of infiltration control. The decreased cost of a treatment system with infiltration control are due to savings achieved by not expanding a plant to handle excess infiltration flows.

IMPACT ASSESSMENT

Ecological Impacts

Aquatic.

Implementation of any of the 40 alternatives would result in ecological impacts to the existing aquatic and terrestrial ecosystem. In the case of the aquatic environment an indication of these impacts may be derived from certain parameters of wastewater effluent. Of major interest in this Iteration in assessing these impacts in relation to the no action or baseline alternative was dissolved oxygen (DO) and nutrients, such as phosphorus and nitrogen.

During low flow conditions, DO concentrations of 2-3 mg/l could be expected in the Susquehanna River under Alternative 1, the Baseline Condition. The impacts of the other alternatives were determined after considering the river flow, the existing DO level in the river, the flow and oxygen demanding characteristics of the effluent, the number and location of effluent discharges, and temperature. The minimum daily average DO for the alternative is shown in Table III-2.

Impacts upon dissolved oxygen levels were therefore influenced by the degree of regionalization as well as the level of wastewater treatment. A comparison of the alternatives indicated that minimum DO levels within the Susquehanna vary somewhat depending on the level of treatment practiced at the various possible treatment facilities. For example, nitrification practiced at just the Binghamton-Johnson City (B-JC) Treatment Plant did not achieve DO concentrations above 5 mg/l during the MA-7-CD10 flows. Yet nitrification practiced at both the B-JC treatment plant and the Endicott treatment plant with secondary treatment at the other plants achieved DO concentrations of the same magnitude as would be experienced by installation of AWT at both or all possible treatment facilities.

The minimum dissolved oxygen concentration was not the only measurement of the effect of a wastewater management alternative on aquatic ecology. Other important effects to consider were the location and duration of oxygen depletion (or oxygen sag) caused by the discharge of wastewater effluents. In this regard the location, number, and size of sewage treatment plants were the major parameters of concern. In general, large single discharges of effluent would create a severe DO sag which would extend for several miles downstream. When expressed in terms of time, this DO sag can approach several days in duration. Smaller discharges dispersed throughout the length of a river would create small DO depressions, in length as well as time. However, the closer these effluent discharges are to one another the greater would be the severity of the DO depression and the greater would be the length and time of the DO deficit.

If a sewage treatment plant should be shut down for any reason, or if some of the influent wastewater is by-passed and sent directly to the river, then an additional large stress would be placed on the in-stream dissolved oxygen concentration. The impacts of such a shut-down or by-pass would be greater with higher degrees of regionalization.

In comparison to the no action alternative, those alternatives (see Table III-2) having minimum DO concentrations of 5 mg/l would have the greatest beneficial impact upon the aquatic fauna. Alternatives resulting in minimum DO concentrations of 4 mg/l would have a moderate beneficial impact, and those with 3 mg/l would have only a slight beneficial impact on the aquatic fauna in comparison to the Baseline Alternative.

Nutrients, in the forms of nitrogen and phosphorus compounds, are important criteria of water quality, primarily in regard to the resulting effects on aquatic ecology. Treatment levels were found to be the primary factors in determining the type and concentration of nutrients being discharged into both ground and surface water. The total nutrient loading to the river would be a function of the total wastewater flow being treated. Varying degrees of regionalization would affect the distribution of this total nutrient loading within the river.

Secondary biological treatment of wastewater in the Baseline Strategy would not remove substantial quantities of either nitrogen or phosphorus found in the wastewater. Therefore, simple secondary biological effluent would generally contain ammonia-nitrogen (NH3-N), nitrate-nitrogen (NO3-N) and phosphate phosphorus (PO4).

The addition of a filtration step would not significantly reduce the quantities of these nutrients below those found at the secondary treatment level. Secondary biological treatment with nitrification functions primarily to reduce the concentration of NH3-N. This conversion would be helpful in reducing the nitrogen oxygen demanding characteristics (NOD) of the effluent but in so doing would increase the concentration of NO_3-N being discharged. Advanced biological waste treatment, including secondary treatment, nitrification, denitrification (removal of NO_3-N) and phosphate removal was most effective in removing nutrients from the wastewater.

Secondary physical/chemical treatment would remove some phosphorus but would not substantially remove nitrogen. With the addition of a nitrification step to secondary physical/chemical treatment, some nitrogen would be removed. Again, however, as with biological based treatment, only AWT would remove substantial concentrations of either nitrogen or phosphorus.

The question remained as to how important was the removal of these nutrients, taking into account present and projected future nutrient levels with the river. Present nutrient loadings are low in the rivers upstream of the urban core (30,900 lb/day of nitrogen and 2600 lb/day of phosphorus at the confluence of the Susquehanna and Chenango Rivers). Future nutrient loadings from wastewater discharges (assuming secondary treatment) would be an additional 2700 lb/day of phosphorus and 6900 lb/day of nitrogen. Therefore, removal of nitrogen from wastewaters would not have any significant impact upon nitrogen levels within the rivers.

Advanced wastewater treatment could remove approximately 2400 lb/day of the projected 2700 lb/day of phosphorus resulting in a total phosphorus loading of approximately 2900 lb/day (2600 + 300) within the river as compared to 5300 lb/day (2600 + 2700) of phosphorus without AWT. It is unlikely that this reduction in total phosphorus would have a significant impact upon water quality. However, from an environmental standpoint, the closer the physical-chemical quality of the effluent is to the natural environmental system the less adverse the impact would be.

Alternative X, land application, had similar impacts on the aquatic ecology as the other alternatives that accomplished equivalent dissolved oxygen levels and nutrient loadings. However, land application did carry with it the possibility of pollution of groundwater. Any land application alternative would, therefore, be designated with a monitoring system to detect groundwater pollution.

Terrestrial.

The construction of a wastewater treatment facility would cause direct effects upon the terrestrial ecology. Therefore, the level of new construction, and this usually means the level of regionalization, will be a prominent factor in determining the degree of impact associated with an alternative.

Table III-3 presents the size, in acres, necessary for various treatment facilities under various regionalization schemes. There would be minor variations depending on the level of treatment. Generally, Table III-3 shows that with increasing levels of regionalization the total land required for treatment facilities decreases. However, land availability and community preferences may override the apparent desirability of large plants at only a few locations. The impact of a facility would depend on its size, whether or not it was a new site, and the surrounding land use. The existing land use is presented in Table III-3.

Temporary disturbance to the terrestrial ecology of an area would be unavoidable during construction of transmission lines. Trees and shrubs would be uprooted and the associated wildlife would be displaced or killed. The construction of interceptors and force mains through undeveloped areas would enhance the possibilities of development and, therefore, could cause a change in the natural or man-influenced existing terrestrial habitats.

The reduction of openland terrestrial habitats, such as found in active or fallow agricultural lands, by increased development would not be severe. Since such openland habitats are expected to decline in number, though, the impacts of future reductions of this habitat may be slightly more adverse. It is unlikely that transmission lines would be constructed through mature woodlands, since such habitats exist primarily in areas of steep slopes or high elevation. Thus, little impact would be expected on this type of habitat. Construction of transmission lines through wetlands or bogs, although perhaps not generating development in these unsuitable soils, may nevertheless cause severe adverse impacts to these sensitive, scarce habitats.

The extent of these secondary impacts on terrestrial ecology caused by construction of transmission lines with subsequent increases in development, would depend upon the degree of regionalization. In general, larger impacts upon the terrestrial environment would occur with greater wastewater treatment centralization. Alternatives involving the development of a treatment facility in the Chenango Valley would, however, cause additional impacts in the immediate area since no treatment or collection system presently exists.

TABLE III-3

IMPACTS OF THE PHYSICAL STRUCTURE OF A SEWAGE TREATMENT PLANT ON ADJACENT LAND USAGES

SEWAGE TREATMENT PLANT (EXISTING OR PROPOSED)	SURROUNDING LAND USAGE[a]	APPROXIMATE ACREAGE REQUIRED FOR VARIOUS REGIONALIZATION ALTERNATIVES[bc] 6 Plants	5 Plants	4 Plants	3 Plants	2 Plants	1 Plants
Chenango Valley	Fallow agriculture Brush cover with trees up to 30 feet in height Bogs & shrub wetland	10	---	---	---	---	---
Binghamton-Johnson* City	Vacant land Shopping center commercial with 1/3 residential Light manufacturing	30	32	32	32	32	45
Vestal*	Highway Light manufacturing	TO BE CONVERTED TO PUMP STATION					
Endicott*	Bogs & shrub wetlands Brush cover with trees up to 30 feet in height	20	20	20	20	24	---
Owego #2*	Brush cover with trees up to 30 feet in height	11	11	11	11	---	---
Owego #1*	Cropland Brush cover with trees up to 30 feet in height Bogs & shrub wetlands	10	10	10	---	---	---
Owego Valley View*	Brush cover with trees up to 30 feet in height Light residential Highway	TO BE CONVERTED TO PUMP STATION					
Owego Village*	Brush cover with trees up to 30 feet in height Fallow agriculture Highway	10	10	---	---	---	---
TOTAL		91	83	73	63	56	45

a) Adjacent land usage given in order of greatest to least areal coverage. Data obtained from LUNR land use overlays of USGS quadrangle maps.

b) Slight variation dependent on level of treatment.

c) Source: Black and Veatch Consulting Engineers, "Estimating Costs and Manpower Requirements for Conventional Wastewater Treatment Facilities," EPA Water Pollution Control Series 17090 Jan 10/71.

* existing STP

Land application (alternatives X a, b, and c) would present different impacts to the terrestrial ecology in the application area (see Figure III-8). The area is 17 miles northwest of the Binghamton-Johnson City STP. It is rural in character and it is unlikely that the area would experience any major population increase in the near future. The existing ground uses include northern hardwood forests, croplands (primarily hay) and fallow agricultural land. Soils in the area are predominantly of the Volusia-Mardin association, with fragipan occurring at depths of 15 to 22 inches below the surface.

The area affected by Alternative X a would be 7,840 acres; Alternative X b--3,140 acres; and Alternative X c--5,010 acres. The impacts upon these areas vary, depending upon the existing vegetation. Spray irrigation on a mixed hardwood forest could be expected to result in variable increases in tree growth depending on tree species, with oak species having only minor increases in growth while maple species would show larger growth increases (Sopper, 1972). On the other hand, the number of tree seedlings present would be expected to be substantially reduced. Areas of cropland, which in this case would consist primarily of hay fields can, under controlled agricultural practices, show increased crop yields. The advisability, however, of using such crops as cattle feed is still questionable. Fallow agriculture land consisting primarily of herbaceous vegetation may experience changes in species composition from dry to more water tolerant species.

Limited information on the effects of spray irrigation of wastewater on wildlife habitats showed no conclusive evidence as to the beneficial or adverse nature of such a system. Evidence to date indicates no significant changes to deer, rabbit or grouse populations in spray irrigated areas (Sopper, 1973).

Social

A large impact of a wastewater treatment alternative upon the social environment of an area may be a secondary impact caused principally by the extension of the public sewer service. The relocation, expansion or extension of sewage collection systems, especially into undeveloped areas, may act to stimulate growth and development in the area. Certainly, the provision of sewage collection and treatment services would not be the only impetus for development; however, if other conditions were favorable, provision of this public service may help to stimulate growth and guide development

LAND APPLICATION AREA, STAGE II-1

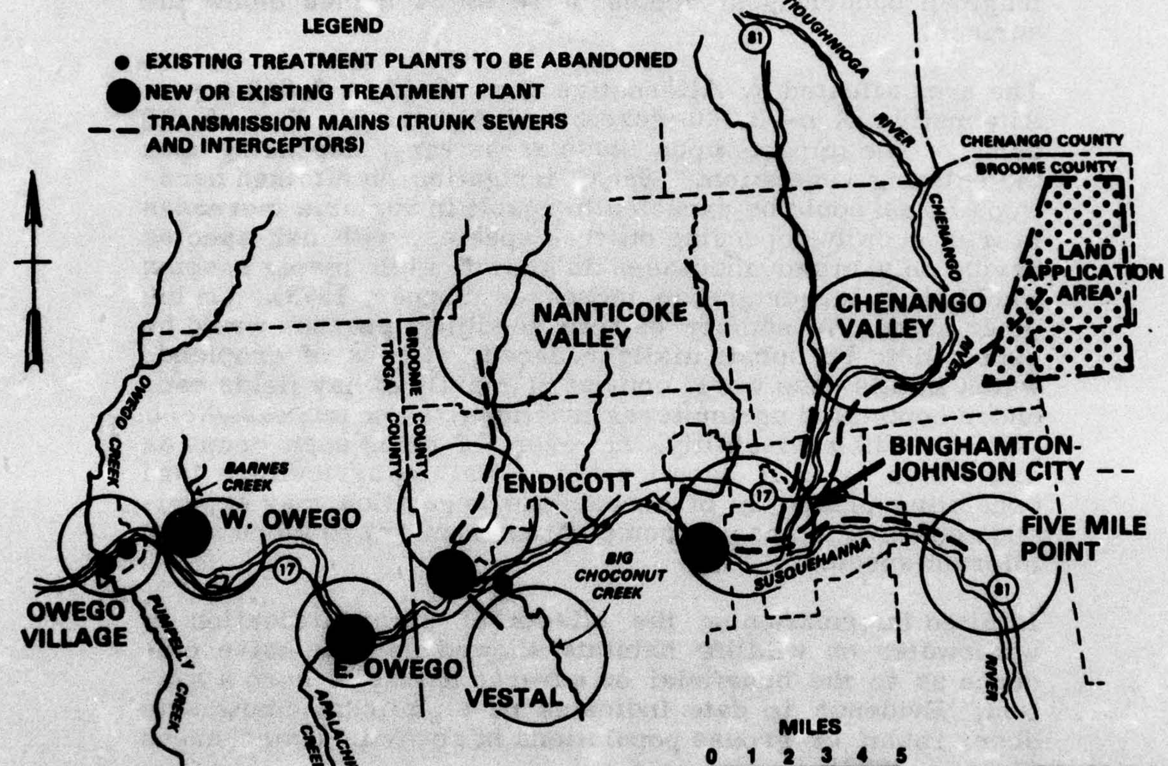


FIGURE III-8

patterns. Thus, the major factor in analyzing the impacts of a wastewater management alternative on development patterns would be the extent or degree of regionalization of the alternative, and its conformance to the area's master plans for development.

If the general development patterns, encouraged by the extension of sewage treatment facilities, were desired by the communities, then the impacts of an alternative would be beneficial. Conversely, if an undesirable type of development is caused by extension of sewage treatment facilities, impacts will be adverse.

Alternative VIII, the complete bicounty regionalization alternative, with its extensive system of transmission lines connected to a single treatment facility could create the severest adverse impacts upon regional development plans. Provision of this utility, coupled with such factors as adequate roadways, level land and an available water supply could foster strip development along sewage transmission lines which connect the Outlying Communities to the Binghamton urban core.

The metropolitan (one-plant) alternative, number II; the two-plant alternative , number III; and the three-plant alternative, number IV, would result in a linear development pattern extending along the Susquehanna River from Binghamton to Owego with development also encouraged up into the Chenango and Nanticoke Valleys. These alternatives would therefore have moderate adverse impacts upon proposed development plans since undesired development between Apalachin and the Village of Owego in the Susquehanna Valley would be encouraged.

Alternatives involving four, five or six treatment plants (numbers I, V, VI, and VII; also IX, X, XI and XII with 4 plants) would most likely encourage development patterns as proposed in the general plan for the bicounty urban areas, i.e. development would be encouraged along the Susquehanna River between Five Mile Point and the Apalachin Creek area and also up into the Chenango and Nanticoke Valleys. Therefore, these alternatives would have moderate beneficial impacts upon proposed development patterns; but this is a zero impact when compared to the Baseline Condition (Alternative I), which would have the same impact.

In addition to the impacts on land use along sewage collection routes for four plant regionalization, the Lnad Application Alternative (number X) would also have significant social impacts to those living in the application area.

Use of the land disposal system would require the commitment of existent forest, cropland, or inactive agriculture lands. Existing land usage and proposed land use practices as described in the master plan for the Bicounty Area would not be violated if such a land application system were adopted Future residential and recreational areas are sufficiently distant from the proposed site to be unaffected. Nevertheless, the installation of such a facility would require relocation of those families which are presently located in the area. This loss of land supporting residences and agriculture could result in severe social impacts on those people living in the affected area.

The aesthetic impacts of a sewage treatment system would involve the physical, or architectural, attractiveness of the treatment plant itself as well as the operation and location of the treatment plant. Public knowledge of the location of a facility and in particular, the location of its effluent discharge, would result in unfavorable reactions to the existence of the facility. In those alternatives where the proposed facilities would be situated at existing treatment plant sites, such unfavorable reactions would be minor. Those alternatives where an entirely new facility is planned, such as a decentralized six plant strategy involving a Chenango Valley treatment plant, would have a moderate adverse impact upon aesthetic perceptions of the area.

The proposed Chenango Valley plant would be upstream of a proposed river recreational area. Adverse reactions stemming from the knowledge that sewage effluent is being discharged above this park and eventually passes the park, could adversely affect the potential public use of this facility, especially with regards to swimming, boating, fishing or other shoreline activity.

The aesthetic impacts associated with spray irrigation (alternatives Xa, b and c) of secondary waste effluent are different than any other alternative. Knowledge, by the public, that sewage effluent is being sprayed near their home or vacation spot may generate complaints which are unfounded or may very likely lead to an unfavorable public response to the facility. Actual aesthetic problems which may occur would be the creation of undesirable odors, when ponding or clogging of the soil pores occurs. Therefore, those alternatives with longer periods of spray application (alternatives Xa and c) may result in larger adverse aesthetic impacts than shorter spray application periods.

In the area of public health impacts, any of the wastewater management strategies would have a beneficial impact in comparison to the Baseline Condition. This benefit would accrue as a result of the sewering of areas currently using individual septic systems for the disposal of wastewaters. Since the possible spread of waterborne disease organisms is not entirely eliminated by the sewage treatment practices presented in the alternatives, the installation of a sewage treatment and collection system would have only a moderate beneficial impact, however.

As with the aesthetic impacts, land application of sewage effluent (Alternative X) raises additional questions and concerns in the area of public health impact, such as air-borne viruses and groundwater contamination.

Alternatives XIa through XId present the nonstructural alternatives for reducing wastewater flows. The success of nonstructural measures would rely on the cooperation of the general public. Even with measures such as pricing and water metering, only the desire of the users to decrease their usage would result in an observable reduction in wastewater flow.

Economic

Various beneficial short-term economic impacts resulting from monies expended for land acquisition, raw materials, and utilization of the local labor force during construction could be expected to occur as a result of any action alternative. Those alternatives which differ markedly from the no action or Baseline Alternative would most likely create a larger short-term beneficial economic impact than those alternatives which would be similar to future conditions without any project. Additional long-term economic impacts could occur due to possible increases in employment generated by the operation and maintenance requirements of a wastewater management system.

The local economic burdens for construction and operation and maintenance would be felt by all communities but the burden would be greatest in those areas which presently are unsewered and/or are sparsely developed. Installation of local collection systems in developed but unsewered areas would result in a fairly even, although large, distribution of costs to users. In presently unsewered and sparsely developed areas, earlier users may shoulder a disproportionately high economic burden until additional development occurs.

The implementation of some wastewater reduction alternatives would place a direct economic strain on the water users of the Study Area. Increasing the cost to the user by pricing or metering to decrease the amount of wastewater flowing to the treatment plant would cause the public to have to make individual decisions as to how much water he could afford and how much he is willing to pay for water saving devices. The signficance of this adverse economic impact would depend on the final level and cost of the wastewater reduction option to be attached to the final plans.

SUMMARY AND EVALUATION

Table III-4 presents a summary of the impacts that would be expected by the forty alternatives considered in Stage II-1. The Table is broken into three general categories of ecological, social, and economic impacts for this Stage in the planning process. These categories are further broken down into the sub-categories of aquatic and terrestrial ecology; land use, aesthetics, and public health for social; and average annual cost for economics. Under each of the impact sub-categories an evaluation of the impact by alternative is made, except for economic category where the average annual cost is shown. This evaluation is general in nature and is shown to be a comparison of the impact between the alternative and the Baseline Condition. The evaluation is given in one of seven levels. They are: significantly beneficial, moderately beneficial, minor beneficial, O for very slight or no impact in comparison to the Baseline, minor adverse, moderately adverse, and significantly adverse.

As shown in Table III-4, Alternative IIIb having a DO of 3-4 mg/l (see Table III-2), has a minor beneficial impact on the aquatic environment in comparison to the Baseline Conditions. Alternatives IIIc, IVc, Vc, VIc, VIIc, Xa, Xb, XIc, and XIIc provide for a DO of 4-5 mg/l and have a moderately beneficial impact on the baseline aquatic conditions. The remainder of the Alternatives (IIa, b; IIIa, d; IVa, b, d; Va, b, d; VIa, b, d; VIIa, b, d; VIIIa, b; IXa, b; Xc; XIa, b, d; and XIIa, b, d, e, f) result in a DO of 5-6 mg/l during low flow conditions and have significantly beneficial impact over the Baseline Conditions of 2-3 mg/l of DO.

In the sub-category of terrestrial ecological impacts the degree of the impact is dependent a great deal upon the amount of regionalization. Therefore, Alternative VIII with complete regionalization would have a significant adverse impact on the baseline terrestrial ecology. Those alternatives with high degrees of regionalization, but not to the same level as in Alternative VIII, were evaluated as moderately adverse (Alternatives II, III, and IV). Land treatment, Alternative X, was also rated as moderately adverse because of the required transmission lines to the application areas. The five alternatives numbered V, VI, IX, XI, and XII were considered to have minor adverse impacts on the terrestrial ecology, because they would have approximately the same arrangement as the Baseline but would require more space for additional wastewater management facilities necessary to reach the higher level of treatment. Alternative VII was considered to have a very slight impact because of the low level of regionalization with the only terrestrial impact being the construction of the new Chenango Valley treatment plant with its associated collection system and expanded wastewater management facilities at the existing plants.

The social impact category is divided into the three sub-categories of land use, aesthetics, and public health. In the land use sub-category only Alternative VIII, six plant regionalization, would have a significantly adverse impact, and Alternatives II, III, and IV were evaluated to have a moderate adverse impact. Alternative categories V, VI, VII, IX, X, XI, and XII would have a moderately beneficial impact; but when compared to the Baseline Condition, which also has the same impact, all these alternatives were considered not to change the future conditions and, therefore, would have no net impact.

The aesthetic impacts shown in Table III-4 is the evaluation of the long term aesthetic impacts associated with the alternatives. There would be, as footnoted, short term construction impacts, which can be generally assumed to increase with increasing levels of regionalization. There would be no significant long term aesthetic impacts except for Alternative VII, six plant regionalization, and X, land application. These were evaluated to be moderately adverse. Alternative VII was rated as moderately adverse because it would require the construction of a new Chenango Valley wastewater treatment plant, and there would be permanent aesthetic impacts associated with the operation of the plant. The land application alternatives, number X, were also considered to have a moderate adverse aesthetic impact because the land in the Study Area is not well suited for land application and problems such as ponding and the associated undesirable odors could result.

All the action alternatives would have a minor beneficial impact on the public health sub-category except alternatives in groups numbered VII and X. Alternative VII would have the same impacts as the other alternatives as far as treatment levels are concerned but this would be somewhat offset by construction of the new Chenango Valley treatment plant. The new treatment plant would discharge effluent in the Chenango River where none is discharged now and this would be just upstream of the proposed Route 81 River Park.

TABLE III-4

IMPACT ASSESSMENT EVALUATION OF WASTEWATER MANAGEMENT ALTERNATIVES FOR STAGE II-1

Alternative	Impact Category					
	Ecological		Social			Economic [2]
	Aquatic	Terrestrial	Land Use	Aesthics[1]	Public Health	Avg. Annual Cost (Millions)
I. Baseline	0	0	0	0	0	1.6
II. Metropolitan Regionalization						
a) Nitrification	significantly beneficial	moderate adverse	moderate adverse	0	minor beneficial	3.3
b) AWT	significantly beneficial	moderate adverse	moderate adverse	0	minor beneficial	7.3
III. Two-Plant						
a) Nitrification	significantly beneficial	moderate adverse	moderate adverse	0	minor beneficial	2.7
b) Nitrification (1)	minor beneficial	moderate adverse	moderate adverse	0	minor beneficial	2.3
c) Filtration	moderate beneficial	moderate adverse	moderate adverse	0	minor beneficial	2.7
d) AWT	significantly beneficial	moderate adverse	moderate adverse	0	minor beneficial	7.1
IV. Three-Plant						
a) Nitrification	significantly beneficial	moderate adverse	moderate adverse	0	minor beneficial	2.5
b) Nitrification (2)	significantly beneficial	moderate adverse	moderate adverse	0	minor beneficial	2.3
c) Nitrification (1)	moderate beneficial	moderate adverse	moderate adverse	0	minor beneficial	2.1
d) AWT	significantly beneficial	moderate adverse	moderate adverse	0	minor beneficial	7.6
V. Four Plant						
a) Nitrification	significantly beneficial	minor adverse	0	0	minor beneficial	2.4
b) Nitrification (2)	significantly beneficial	minor adverse	0	0	minor beneficial	2.2
c) Nitrification (1)	moderate beneficial	minor adverse	0	0	minor beneficial	2.0
d) AWT	significantly beneficial	minor adverse	0	0	minor beneficial	7.9
VI. Five-Plant						
a) Nitrification	significantly beneficial	minor adverse	0	0	minor beneficial	2.5
b) Nitrification (2)	significantly beneficial	minor adverse	0	0	minor beneficial	2.3
c) Nitrification (1)	moderate beneficial	minor adverse	0	0	minor beneficial	2.0
d) AWT	significantly beneficial	minor adverse	0	0	minor beneficial	8.1
VII. Six-Plant						
a) Nitrification	significantly beneficial	0	0	moderate adverse	0	2.5
b) Nitrification (2)	significantly beneficial	0	0	moderate adverse	0	2.2
c) Nitrification (1)	moderate beneficial	0	0	moderate adverse	0	2.0
d) AWT	significantly beneficial	0	0	moderate adverse	0	8.5
VIII. Complete Regionalization						
a) Nitrification	significantly beneficial	significantly adverse	significantly adverse	0	minor beneficial	4.2
b) AWT	significantly beneficial	significantly adverse	significantly adverse	0	minor beneficial	8.6
IX. Physical/Chemical						
a) Nitrification	significantly beneficial	minor adverse	0	0	minor beneficial	3.4
b) AWT	significantly beneficial	minor adverse	0	0	minor beneficial	7.2
X. Land Application						
a) 80% Year Round	moderate beneficial	moderate adverse	0	moderate adverse	minor adverse	8.2
b) 80% Seasonal	moderate beneficial	moderate adverse	0	moderate adverse	minor adverse	4.4
c) 100% Seasonal	significantly beneficial	moderate adverse	0	moderate adverse	minor adverse	5.3
XI. Non-Structural						
a) Nitrification	significantly beneficial	minor adverse	0	0	minor beneficial	1.6
b) Nitrification (2)	significantly beneficial	minor adverse	0	0	minor beneficial	1.4
c) Nitrification (1)	moderate beneficial	minor adverse	0	0	minor beneficial	1.1
d) AWT	significantly beneficial	minor adverse	0	0	minor beneficial	6.2
XII. Infiltration Control						
a) Nitrification + 2 mgd reduction	significantly beneficial	minor adverse	0	0	minor beneficial	2.2
b) Nitrification + 4 mgd reduction	significantly beneficial	minor adverse	0	0	minor beneficial	2.2
c) Non-Struc. +4mgd Red.	moderate beneficial	minor adverse	0	0	minor beneficial	0.8
d) Nitrification (1) + c	significantly beneficial	minor adverse	0	0	minor beneficial	1.0
e) Nitrification (2) + c	significantly beneficial	minor adverse	0	0	minor beneficial	1.4
f) AWT	significantly beneficial	minor adverse	0	0	minor beneficial	5.8

[1] Short term construction impacts will occur with all action alternatives.

[2] 6 percent interest, 50-year project life

ITERATION 2

MODIFICATION AND REFINEMENTS

The 40 alternatives of Stage II-1 were refined and narrowed to 13 that were considered in Stage II-2. The following modifications and refinements were significant changes that were applied in this Iteration.

The first of these changes dealt with the dissolved oxygen level of 1977 Baseline Condition. A reevaluation of the DO model based on more detailed data changed the value from 2.2 mg/l to 3.5 mg/l. (A full discussion of the DO model is contained in Chapter IV of the Design and Cost Appendix). Based on the revised DO model, it was also determined that nitrification at Binghamton-Johnson City alone was sufficient to maintain the DO concentration above 5 mg/l. Therefore, nitrification at the Endicott Plant was no longer needed to maintain the DO above 5 mg/l.

It was assumed in Stage II-1 that per capita water consumption and sewage contribution would increase by 10 percent per decade through the year 2020. A reanalysis lead to the conclusion that this assumption yielded unrealistically high flow. For this reason, a 10 percent increase per decade in per capita wastewater was used only up to 1990. The increase was tapered to 5 percent between 1990 and 2000 with no increase in per capita wastewater projected thereafter.

A summary of the changes and the reasons for the changes is presented in Table III-5. Table III-5 also shows the relationship between corresponding alternatives of Stage II-1 and Stage II-2.

DESCRIPTION OF ALTERNATIVES

The 13 alternatives carried into Stage II-2 are shown in Table III-5 and briefly outlined here.

TABLE III-5

COMPARISON OF STAGE II ALTERNATIVES

STAGE II-1			STAGE II-2		
NUMBER	**OBJECTIVE**	**FEATURES**	**NUMBER**	**CHANGES**	**RATIONALE**
I	Baseline Condition	2 + 3 STP's	1	DO was changed from 2.2 mg/l to 3.5 mg/l	Correction
IVb	Meet 5 mg/l DO with 3 STP's	2 + 1 STP's Nitrification at B-JC + Endicott	2	Nitrification at B-JC only (in 1983)	Nitrification at Endicott not needed to meet DO of 5 mg/l
			3a (New Alternative)	3 + 1 STP's with nitrification at B-JC	Provide four plant alternatives with three plants in Broome Co.
Vb	Meet 5 mg/l DO with 4 STP's	2 + 2 STP's Nitrification at B-JC + Endicott	3b	Nitrification at B-JC only (in 1983)	As in No. 2
			4a (New Alternative)	3 + 2 STP's with nitrification at B-JC	Provide five plant alternatives with three plants in Broome Co.
VIb	Meet 5 mg/l DO with 5 STP's	2 + 3 STP's Nitrification at B-JC + Endicott	4b	Nitrification at B-JC only (in 1983)	As in No. 2
VIIb	Meet 6 mg/l DO with 6 STP's	3 + 3 STP's Nitrification at B-JC + Endicott	5	Nitrification at B-JC only (in 1983)	As in No. 2
Vd	Provide AWT, with Two plant regionalization in Tioga Co.	2 + 2 STP's Bio. Based AWT - No flow reduction	6	Bio. based AWT Nitrification in 1983 AWT in 1985 Chenango V. STP Infiltration control @ B-JC	Comparison to P/C AWT Avoid complicating factors of flow reduction, storm water control, sewer system capacity Cost effective
IXb	Provide AWT with Two plant regionalization in Tioga Co.	2 + 2 STP's P/C AWT No flow reduction	7	P/C based AWT Nitrification in 1983 AWT in 1985 Chenango V. STP Infiltration control @ B-JC	Comparison to Bio. AWT As in No. 6 As in No. 6
Xc	Seasonal land application Two plants regionalization in Tioga Co.	2 + 2 STP's No flow reduction Apply only B-JC effluent to land	8a	Chenango V. STP Change application site for B-JC Apply Owego effluents to land	As in No. 6 Reduce costs Reduce discharge of pollutants
			8b (New Alternative)	As 8a but with flow reduction	Reduce costs
XIb	Non-Structural Measures Meet 5 mg/l DO Two plant regionalization in Tioga Co.	2 + 2 STP's Nitrification at B-JC + Endicott	9	Chenango V. STP Nitrification at B-JC only (in 2000)	As in No. 6 As in No. 2
XIIb	Nitrificaton at all plants Two plant regionalization in Tioga Co. Infiltration control at Binghamton	2 + 2 STP's Nitrification at all	10	Chenango V. STP	As in No. 6
XIId	Max flow reduction by non-structural and infiltration control Meet 5 mg/l DO Two plant regionalization in Tioga	2 + 2 STP's Nitrification at Endicott only	11	Chenango V. STP No nitrification at Endicott	As in No. 6 Not necessary to meet 5 mg/l DO
VIc	Meet 4 mg/l with 5 plant	2 + 3 STP's Nitrification at B-JC	12a	No nitrification at B-JC	Not necessary to meet 4 mg/l DO
VIIc	Meet 4 mg/l with 6 plant	3 + 3 STP's Nitrification at B-JC	12b	No nitrification at B-JC	As in 12a
			13 (New Alternative)	3 + 2 STP's Infiltration control + nitrification at B-JC	To evaluate infiltration control at Binghamton

NOTE: 2 + 3 refers to the number of sewage treatment plants in Broome County and Tioga County, respectively.

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Alternative 1: Baseline Conditions

The Baseline Alternative was a no action or existing conditions alternative. It provided a baseline condition to which the features of an action alternative could be compared. Systems included in the Baseline Conditions were the existing treatment plants of Binghamton-Johnson City, Endicott, Owego Village, and Town of Owego Sewage Treatment Plants No. 1 and 2. Also included were the proposed projects for construction of an interceptor to bring Vestal sewage to the Endicott plant, transmission of Five Mile Point sewage to the Binghamton-Johnson City plant, and transmission of Nanticoke Valley sewage to Endicott.

Alternatives 2-5: Regionalization

Alternatives 2-5 were developed to compare different levels of regionalization. They all would provide a minimum DO of 5 mg/l in the Susquehanna River by furnishing nitrification at Binghamton-Johnson City in 1983 and secondary treatment elsewhere.

Alternative 2, the three plant regionalization alternative, would include two STP's in Broome County (Binghamton-Johnson City and Endicott) and one in Tioga County (Owego Village No. 2 STP). The interceptors included in this Alternative were numbers I, II, III, and IV shown on Figure III-9.

Alternative 3A, the four plant regionalization alternative, would include three STP's in Broome County (B-JC, Endicott, and Chenango and one STP in Tioga County at Owego Town No. 2 STP).

The interceptors included in this Alternative are I, II, and IV as located on Figure III-9 and detailed on Figure III-10.

Alternative 3B also provided for a four plant regionalization scheme, but it did so by putting two plants in Broome County (B-JC and Endicott) and two in Tioga County (Owego Town No. 1 and No. 2). The interceptors required would be numbers I, III, and IV on Figure III-9.

Alternative 4A provided for five plants with three in Broome County (B-JC, Endicott, and Chenango) and two in Tioga County (Owego Town No. 1 and No. 2). The interceptors required for Alternative 4A are numbered I and IV of Figure III-9.

Alternative 4B also included a five sewage treatment plant scheme, but the split would be two in Broome County (B-JC and Endicott) and three in Tioga County (Owego Town No. 1, No. 2, and Owego Village). The interceptors required for this Alternative would be numbers II and IV shown on Figure III-9.

Alternative 5 included three treatment plants in each of the counties; that is, Binghamton-Johnson City, Endicott, and Chenango in Broome County; and Owego Town Plant No. 1, Owego Town Plant No. 2, and Owego Village in Tioga County. The only interceptor required for Alternative 5 would be number IV on Figure III-9.

Alternatives 6-8A: Level of Treatment

Alternatives 6 through 8 provided for the comparison of the level of treatment with three plants in Broome and two in Tioga. Alternative 6 would provide nitrification by 1983 and biological AWT by 1985 for all five treatment plants. Infiltration control at Binghamton would also be included. The DO level in the Susquehanna River would be above 6 mg/l except during certain storm conditions.

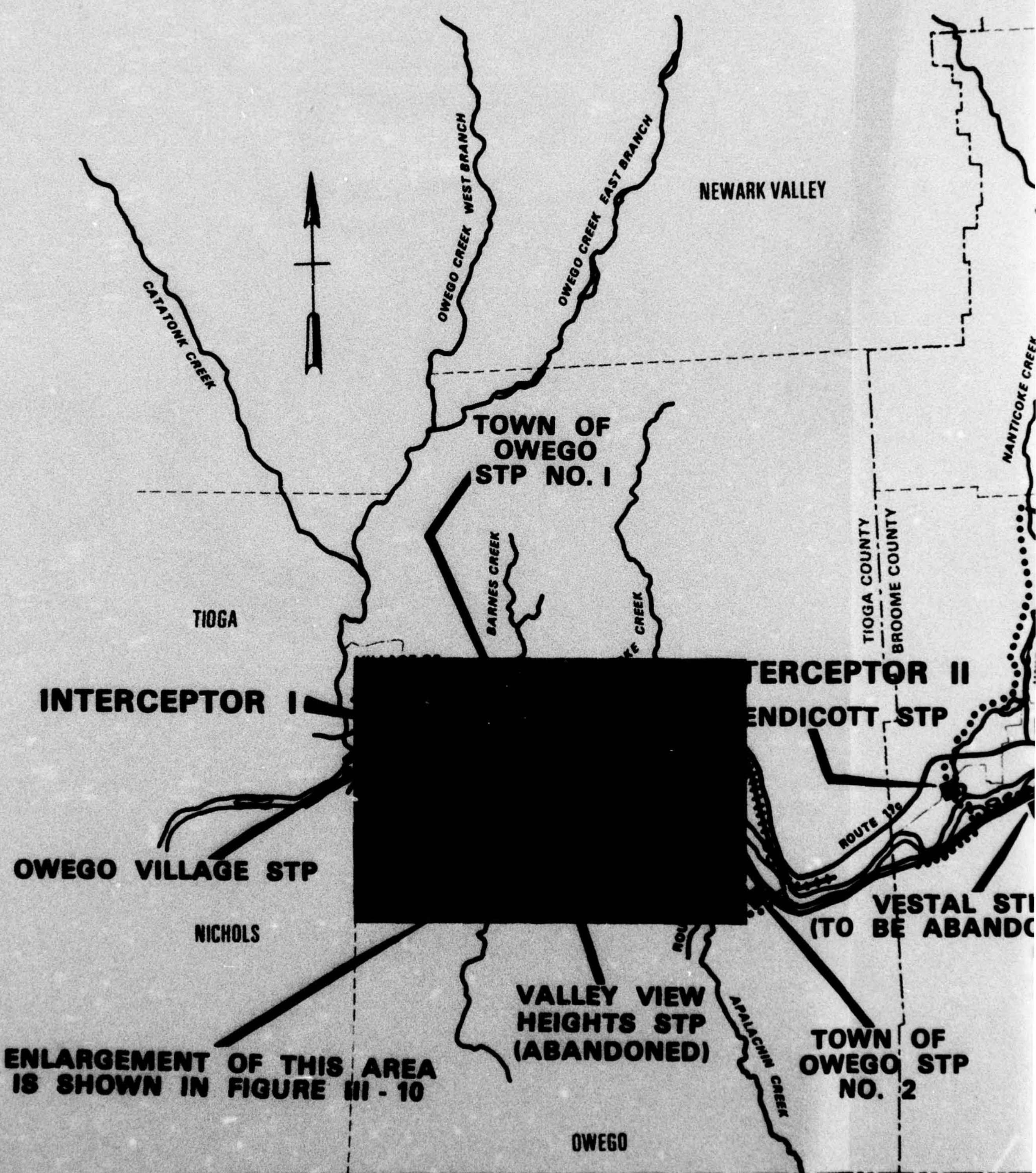
Alternative 7 proceeded directly from secondary treatment to Physical/Chemical AWT for all five treatment plants in 1985. The DO level in the Susquehanna River would be maintained above 6 mg/l except during certain storm conditions.

Alternative 8A provided for seasonal (May through October) land application of secondary effluent from Binghamton-Johnson City, Owego Town STP No. 1 and No. 2. The remaining STP's (Chenango Valley and Endicott) would discharge secondary effluent directly to the river. The DO level in the Susquehanna River would be maintained above 6 mg/l except during periods of combined sewer overflows.

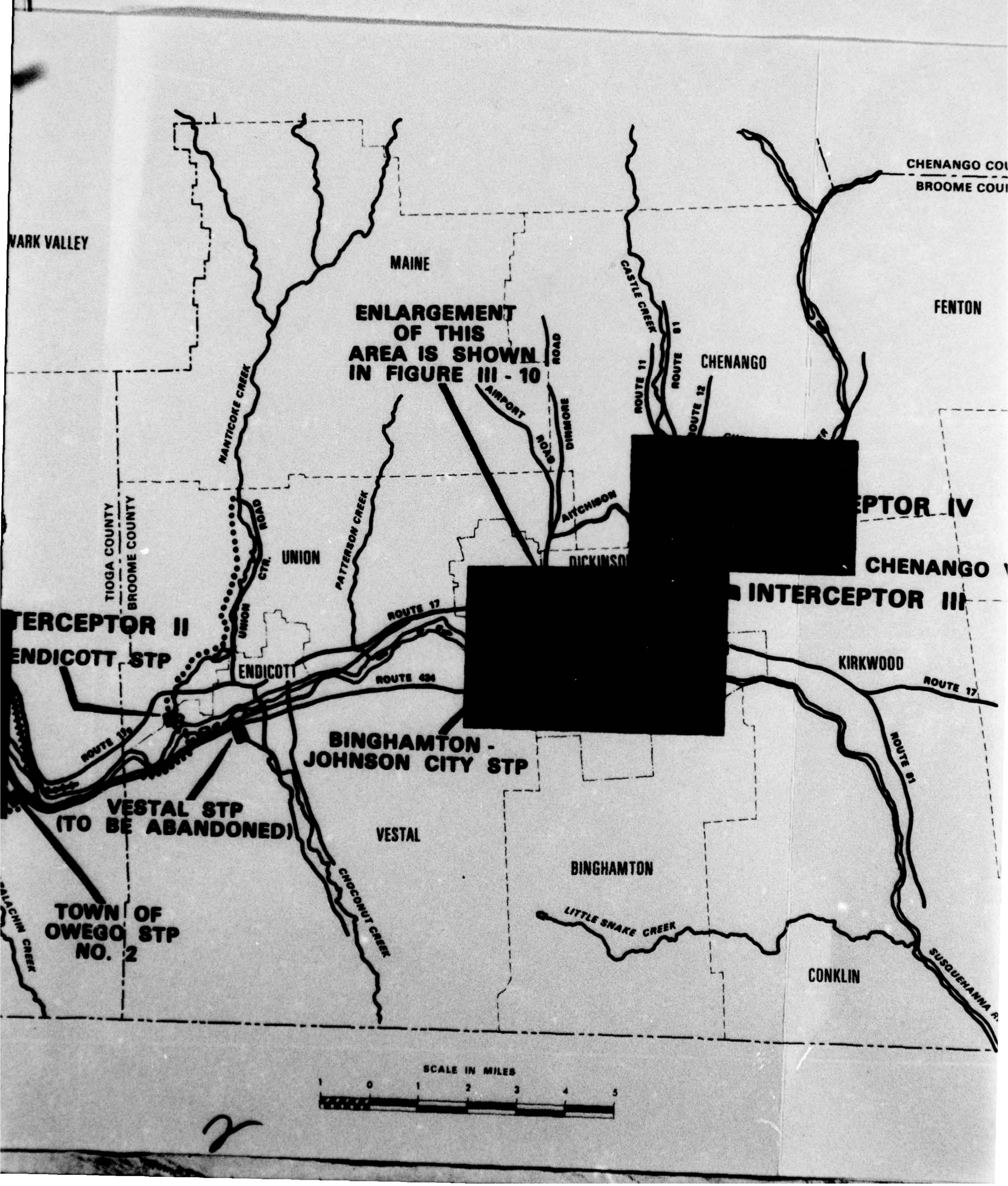
Alternatives 8B-11, 13: Flow Reduction

Alternatives 8B through 11 and Alternative 13 were established to test the effects of flow reduction. Regionalization would be 3+2 (three plants in Broome County and two in Tioga County).

Alternative 8B was identical to Alternative 8A except that nonstructural measures would be applied to all the wastewater management areas to reduce flows by 7 mgd. In



NEWARK VALLEY
OWEGO CREEK WEST BRANCH
OWEGO CREEK EAST BRANCH
CATATONK CREEK
TOWN OF OWEGO STP NO. I
BARNES CREEK
NANTICOKE CREEK
TIOGA COUNTY
BROOME COUNTY
TIOGA
INTERCEPTOR I
[redacted]
TERCEPTOR II
ENDICOTT STP
ROUTE 17c
OWEGO VILLAGE STP
VESTAL ST
(TO BE ABANDO
NICHOLS
VALLEY VIEW HEIGHTS STP (ABANDONED)
APALACHIN CREEK
TOWN OF OWEGO STP NO. 2
ENLARGEMENT OF THIS AREA IS SHOWN IN FIGURE III - 10
OWEGO



MAINE
ENLARGEMENT OF THIS AREA IS SHOWN IN FIGURE III - 10
CASTLE CREEK
ROUTE 81
ROUTE 11
ROUTE 12
CHENANGO
FENTON
AIRPORT
ROAD
DINMORE
NANTICOKE CREEK
PATTERSON CREEK
AITCHISON
[redacted]
UNION
UNION CTR. ROAD
TIOGA COUNTY
BROOME COUNTY
ENDICOTT STP
ENDICOTT
ROUTE 17
ROUTE 434
INTERCEPTOR III
KIRKWOOD
ROUTE 17
ROUTE 81
BINGHAMTON - JOHNSON CITY STP
VESTAL STP (TO BE ABANDONED)
VESTAL
TOWN OF OWEGO STP NO. 2
CHOCONUT CREEK
BINGHAMTON
LITTLE SNAKE CREEK
CONKLIN
SCALE IN MILES
1 0 1 2 3 4 5

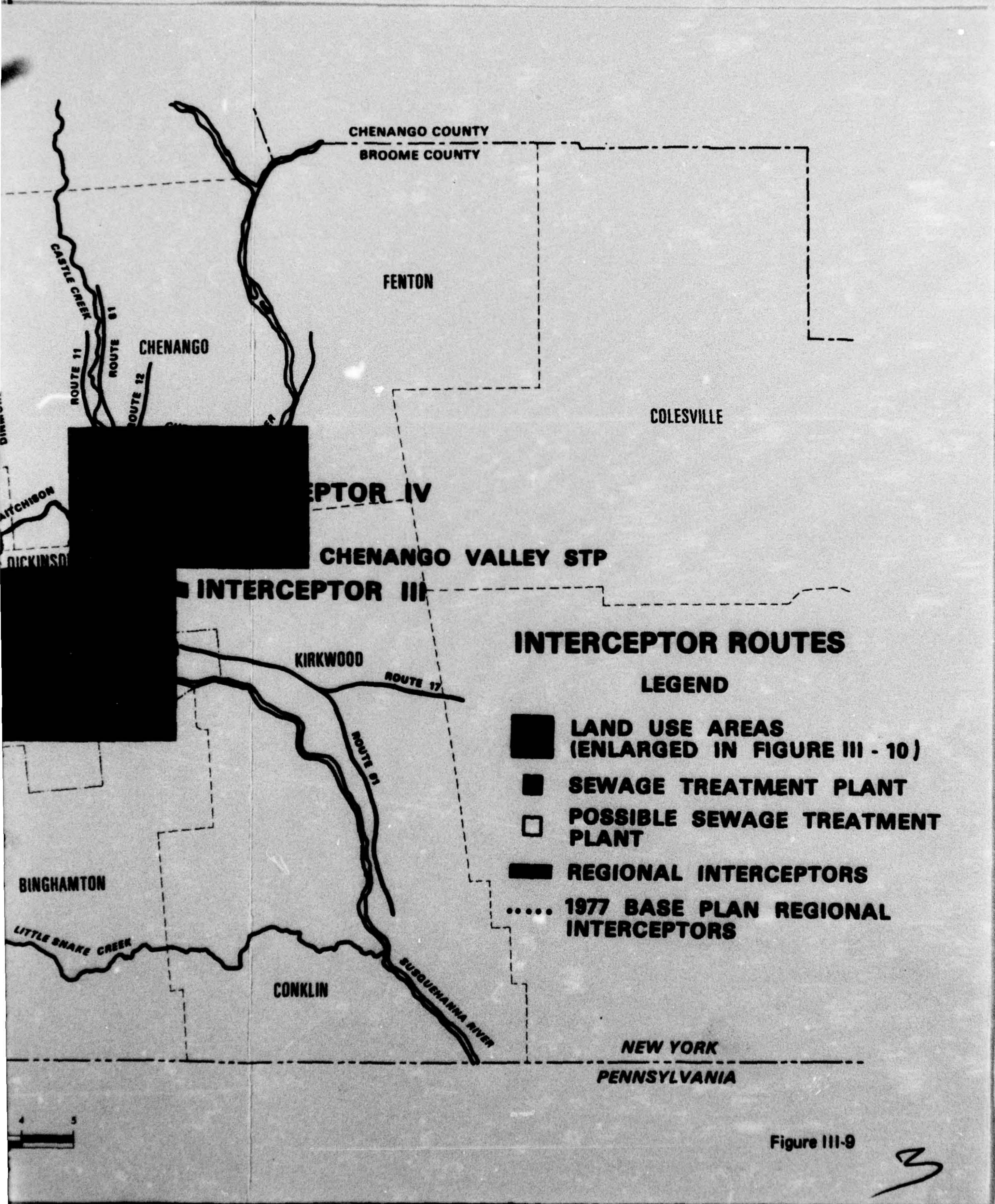
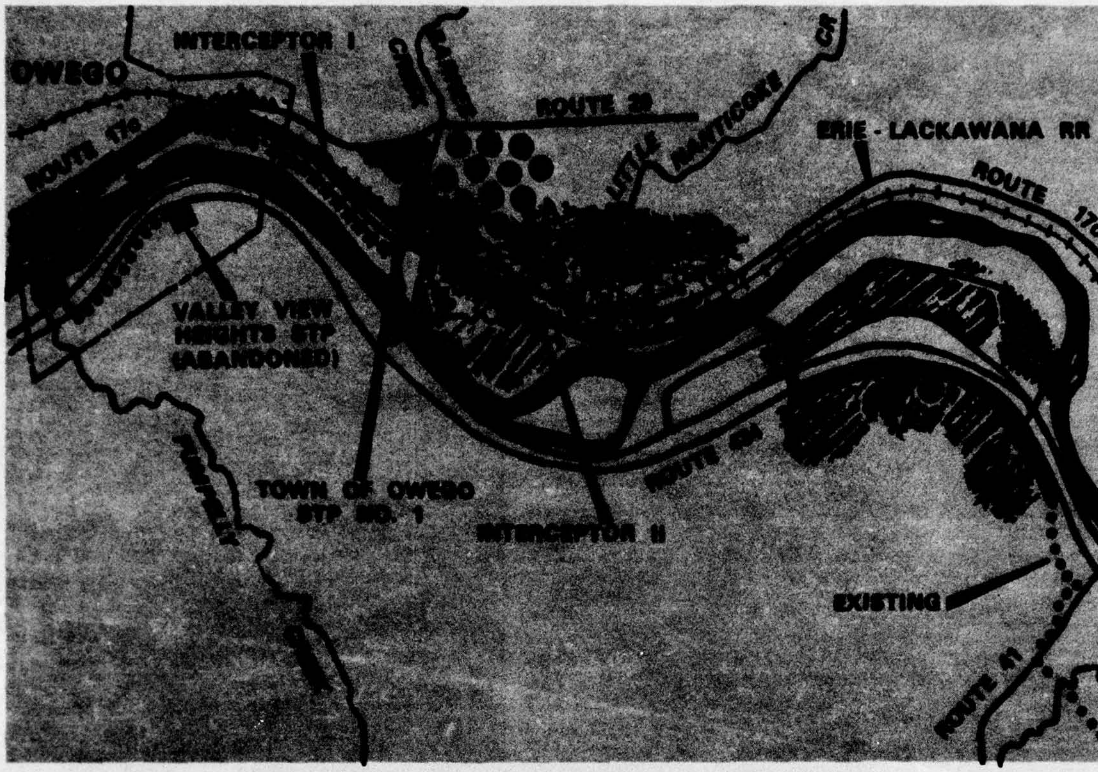
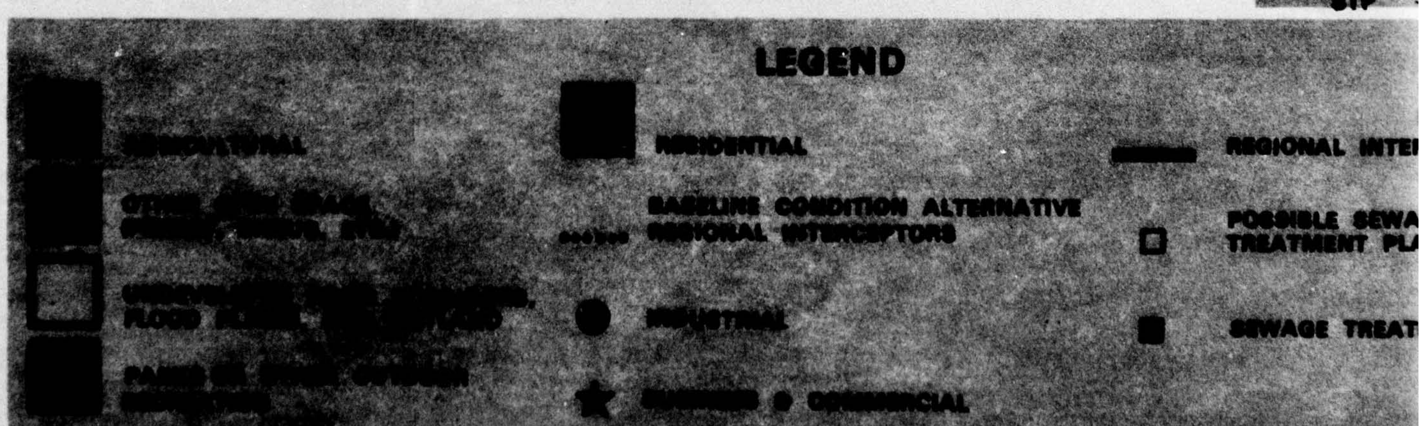
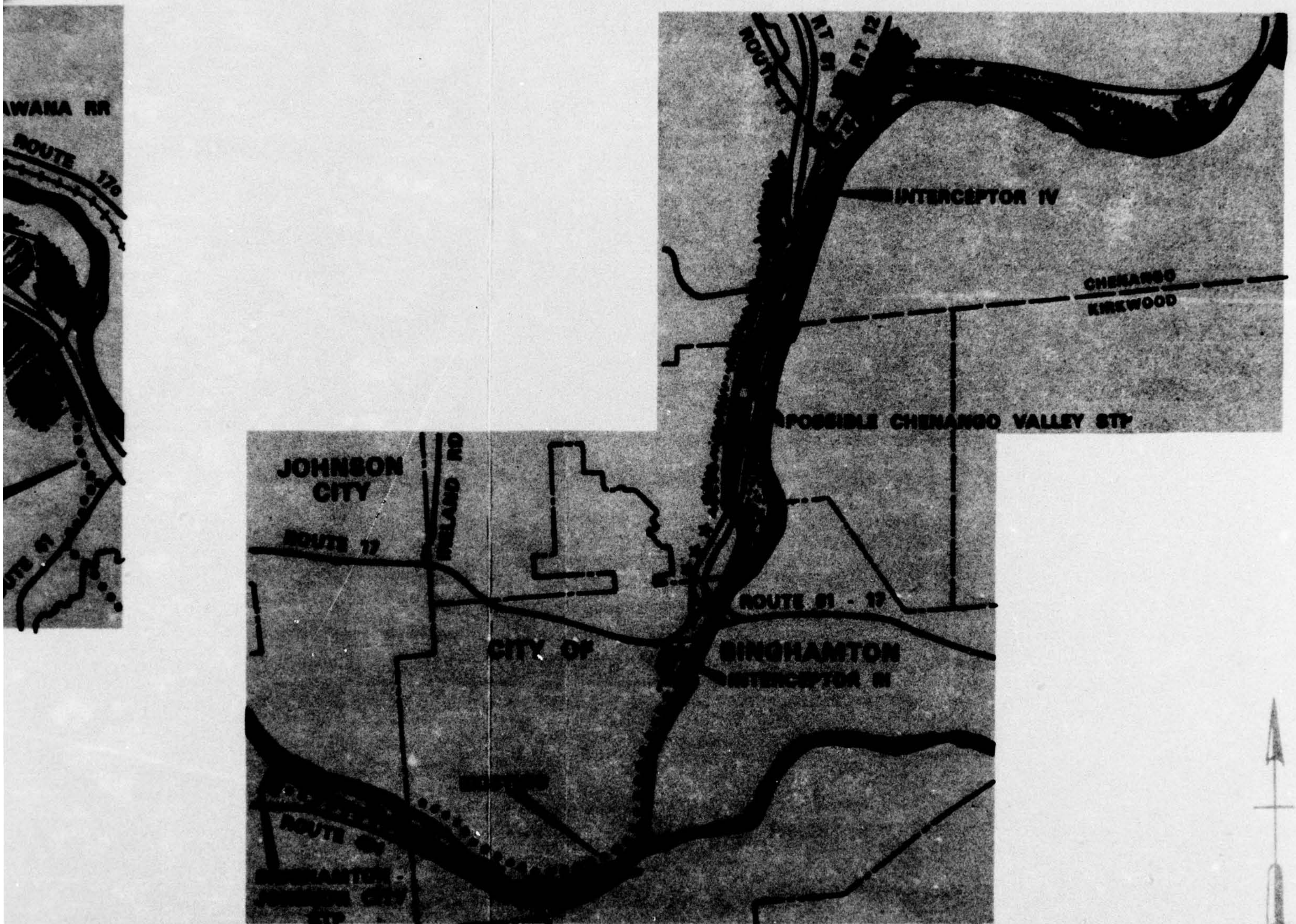

CHENANGO COUNTY
BROOME COUNTY
FENTON
CASTLE CREEK
ROUTE 11
ROUTE 81
ROUTE 12
CHENANGO
COLESVILLE
CHENANGO VALLEY STP
INTERCEPTOR III
KIRKWOOD
ROUTE 17
ROUTE 81
BINGHAMTON
LITTLE SNAKE CREEK
CONKLIN
SUSQUEHANNA RIVER
NEW YORK
PENNSYLVANIA
INTERCEPTOR ROUTES
LEGEND
LAND USE AREAS (ENLARGED IN FIGURE III - 10)
SEWAGE TREATMENT PLANT
POSSIBLE SEWAGE TREATMENT PLANT
REGIONAL INTERCEPTORS
1977 BASE PLAN REGIONAL INTERCEPTORS
4
5

Figure III-9

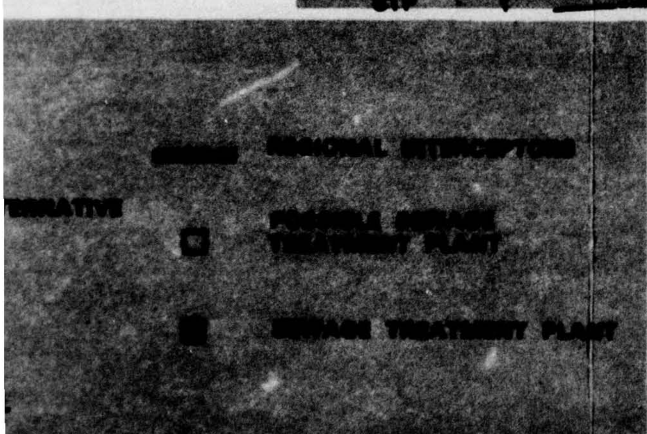


LAND USE AREAS SURROUNDING INTERCEPTORS I & II





LAND USE AREAS SURROUNDING INTERCEPTORS III & IV



LAND USE NEAR PROPOSED INTERCEPTOR ROUTES

(se Figure II-9 for location)

1 0 1

SCALE IN MILES

FIGURE III-addition, infiltration control of the Binghamton sewerage system would further reduce flows by 4 mgd.

Alternative 9 incorporated nonstructural measures throughout the Study Area to maintain the per capita wastewater flows at present levels. In order to maintain a minimum DO level in the Susquehanna River above 5 mg/l, nitrification would be applied to the Binghamton-Johnson City plant by 2000.

Alternative 10 provided for nitrification at all five plants and infiltration control in the City of Binghamton at an average daily amount of 4.5 mgd. The minimum DO level in the Susquehanna River would be 5-6 mg/l, except during certain storm conditions.

Alternative 11 includes the application of nonstructural measures for the entire Study Area in order to maintain per capita wastewater flows at the current levels. Flows would be reduced by an average of 7 mgd. Also, infiltration control for the City of Binghamton was assumed to further reduce flows by 4.5 mgd. The DO level in the Susquehanna River would be maintained above 5 mg/l except during occurrences of combined sewer overflows during certain storm conditions.

Alternatives 12A+12B: 4 mg/l DO

These alternatives provided for secondary treatment only. This would resuls in minimum DO levels in the Susquehanna River of between 4 and 5 mg/l.

Alternative 12A provided for two plants in Broome County and three in Tioga County.

Alternative 12B was the same as Alternative 12A, except it provided for a plant in Chenango Valley. Thus there would be three plants in Broome County as well as Tioga County.

IMPACT ASSESSMENT

As the number of alternatives decreased during the planning process the level of detail and investigation to determine the impacts resulting from the remaining alternatives increased.

This increase in detail was done for the general impact categories of ecology, social, and economic; but not for every specific item covered in these categories. Therefore, the increase in the level of detail was not always linear; that is, all impacts were not investigated to the same level in each iteration. However, each iteration presented additional information until detailed impacts were assessed and evaluated in the last iteration.

Because of the large number of iterations used in the Study, the impacts presented in an earlier iteration will not be continuously repeated in each of the following iterations. Rather, new and revised information will be presented with the old and new information summarized together at the end of the Impact Assessment Section.

Ecological

Interceptors.

An integral part of all the action alternatives was the pipeline system required to transport the raw or partially treated sewage. Often neglected, but nevertheless important, impacts of a wastewater management plan are those which result from the installation of these sewage transport systems including interceptors (large gravity-flow pipes) and force mains (pipes through which sewage is pumped). Such construction impacts, although usually lasting a relatively short period of time (such as a few weeks on a length of street) could produce adverse impacts to the natural ecology of the area. If the sewer line was installed through a natural unbroken area, then existing trees, shrubs and other vegetation as well as any native terrestrial fauna could be disturbed if not completely destroyed by construction activities.

Where rivers or streams have to be crossed, the pipeline could be placed in the river bed or hung above the water surface. If it is placed within the river bed it would cause temporary diversion of natural river flow and disturbance of the river bottom. Such in-stream work would promote temporary erosion and increased sedimentation within the river. These disturbances, in turn, would temporarily decrease the productivity of the river. Crossings above the water surface are usually less disruptive, but could be aesthetically unacceptable. Where pipelines can be suspended under existing bridges, most of these impacts can be avoided.

Gravity flow interceptors and pumped flow force mains have fundamental differences in the type and timing of impacts resulting from their installation. The installation of gravity flow interceptors would require the blasting and digging of deep trenches and placement of manholes to ensure that the system will transport waste entirely by the force of gravity. The operation and maintenance requirements of such a gravity system would be minimal.

Force mains would not require extensive excavation for installation since an average depth of pipe is approximately three feet and no manholes are needed. Pump stations at strategic locations along such a route, however, would be necessary to maintain flow within the system. Operation and maintenance requirements of force pumped systems would be high both in terms of power requirements and pump maintenance.

Thus, the impacts of a gravity flow system may involve extensive disturbance of the natural and human ecology over a short period of time while a force main system would have a large impact over a longer period of time in terms of energy requirements and maintenance costs.

The interceptor and force main sewage collection routes were divided into four segments for analysis. As shown on Figures III-9 and III-10, Segment I runs between the Owego Village STP and Owego Town STP #1 and would be required for all the alternatives except those with 3 plants in Tioga County (alternatives 4B, 12A, and 12B). Segment II would be between Owego Town #1 STP and Owego Town #2 STP. It would be required only for alternatives 2 and 3A that call for one plant in Tioga County. Segment III would be required if there are to be less than three plants in Broome County. It would connect the Chenango Valley area to the B-JC system. This segment would be for all the alternatives except 1, 3A, 4A, 5, 12B and 13. Segment IV would be a regional interceptor collecting sewage flows from Chenango Valley area. It could transport the sewage to a new sewage treatment plant in Chenango Valley or to the Binghamton-Johnson City system through Segment III. Segment IV would be required by all the alternatives except the Baseline.

The selection of the four segments was done in such a manner that the adverse impacts on the existing ecological, social and economic condition was minimized for each segment.

The path for Interceptor I would be from Owego Village STP north across the Susquehanna River to Williams Street, then proceeding east on Front Street to intersection of Erie Railroad and Broadway. After crossing the railroad tracks, the route proceeds in a generally westerly direction along the railroad and near Route 17C until it proceeds north into the Owego Town #1 STP (see Figure III-10).

An interceptor crossing the Susquehanna River to the Owego Village STP already exists and would be able to carry flows in either direction (either pumped or gravity). Therefore, this section of the regional interceptor was not considered in the analysis of impacts presented in Table III-6.

Approximately 4,800 feet of Interceptor I would pass through undeveloped flood plains paralleling an existing railroad right-of-way through vacant marshlands and other lands with existing high water tables. Although development within these vacant wetlands is unlikely to occur, construction of interceptors in these sensitive ecology areas could disturb natural drainage patterns and disturb or completely eliminate some native biota. Secondary impacts, in the form of induced development of present open spaces, would be minor since the majority of lands traversed by the route are not suitable for residential or industrial development.

Regional Interceptor II would extend about 4.3 miles between Owego Town #1 and #2 STP's. Beginning at Owego Town #1 STP the regional interceptor would proceed south through a wetland area to and across the Erie Railroad and then would proceed in a generally eastward direction along the southern side of the railroad right-of-way near the Route 17 interchange, across Barnes Creek, along Hickories Park and across Little Nanticoke Creek. The route would continue parallel to the Susquehanna River, cross to the southern side of the River and would then proceed across Marshland Road and along Forest Hill Road passing under Route 17 and Route 434. Continuing along the southern side of Route 434, the interceptor would proceed eastward to the intersection of Route 434 and Main Street in Apalachin, where it would connect with a presently planned interceptor for Owego Town #2 STP.

Adverse direct environmental impacts from construction of this interceptor route would result from the three stream crossings (especially that of the Susquehanna River) and passage through unbroken wetlands and other open spaces. There would also be the possibility that construction of such a regional interceptor could induce development along its corridor resulting in undesirable subdivisions within this unspoiled stretch of the Susquehanna River Valley.

Interceptor III would connect the Chenango Valley to the Binghamton-Johnson City sewage treatment system. A force main, beginning at the approximate location of a possible Chenango Valley STP near the Broome Community College, would proceed south along the eastern side of Route 81, cross Route 81 near the buildings of the Soil Conservation Service, then continue south and east toward the banks of the Chenango River through river flood plain land owned by the Department of Transportation (DOT). The route would continue along the banks of the Chenango River to the existing sewage collection lines of the City of Binghamton near the intersection of Front Street and the Erie-Lackawanna Railroad.

As a result of development of homes and highways along the banks of the Chenango River, much of this force main route will require construction directly adjacent to the River. Erosion and sedimentation would occur within the Chenango River. However, constructing a force main rather than a gravity flow interceptor could help minimize stream bank erosion and limit extensive cut and fill operations. A major portion of the route would traverse the Route 81 River Park being developed by the DOT. However, the use of a force main rather than a gravity interceptor should again minimize construction cut and fill operations and thereby minimize adverse impacts to the river park.

Interceptor IV would be a regional interceptor collecting sewage flows from Chenango Bridge, Hinmans Corner, Kattelville and other communities of the Chenango Valley area. Sewage collected by such an interceptor could either be transported to a new sewage treatment plant in the Chenango Valley area or be transported via Interceptor III to the Binghamton-Johnson City system. Thus, a wastewater management alternative which did not call for a new Chenango Valley STP would utilize both Interceptors III and IV. In those management alternatives wherein a new Chenango Valley STP was proposed, only Interceptor IV would be necessary.

Beginning at the possible Chenango STP site, Interceptor IV would proceed north along the western edge of Route 81 passing behind a mixed residential-business area on Route 11-12 in the Town of Dickinson. The Interceptor would then pass under Route 81, just south Hinman's Corners, and then parallel to the Chenango River behind several commercial establishments.

After passing through the primarily residenital sections of Hinman's Corner, the interceptor would continue to proceed in an easterly direction paralleling the Chenango through undeveloped lowland forests and other undeveloped open spaces between Route 12A and the Chenango River. Since no roadway exists in this portion of the interceptor route, care would have to be taken during possible construction of the interceptor to minimize ecological disturbances.

Continuing parallel to the Chenango River, the interceptor would pass behind some recreational lands of Chenango Bridge and then continue behind the residences along the River, again not following any existing roadways. The remainder of the Interceptor route would closely parallel the Chenango River through both developed and undeveloped river corridor lands.

Since much of Interceptor IV would not follow existing roadways and would parallel the Chenango River through both developed and undeveloped river corridor lands, care should be taken to prevent erosion along the river banks. By keeping both the construction and permanent route easements as narrow as possible and by utilizing restoration techniques and avoiding larger tree species, adverse impacts to the corridor ecology could be minimized.

It is possible that extension of sewerage services into an interceptor and new STP the Chenango Valley area may encourage development in flood prone areas. However, such encouragement would be no greater than that created by an extended interceptor to the B-JC STP. Additionally, although the Chenango Valley area currently has no flood plain development restrictions, it is expected that flood plain zoning would curb undesirable and hazardous flood development in the future.

A summary of the construction impacts associated with Interceptors I, II, III, and IV, is given in Table III-6.

Land Application.

Alternatives 8A and 8B called for seasonal land application from Binghmaton-Johnson City, Owego Town #1 and #2 STP's. There would be temporary construction impacts which would result if the force mains were installed to the respective spray application sites.

There were three potential alternative spray application sites for the Binghamton-Johnson City STP. They are labeled as areas 1, 2, and 3 on Figure III-11. A summary of the construction impacts is presented in Table III-7.

TABLE III-6

SUMMARY OF ECOLOGICAL IMPACTS
OF INTERCEPTOR CONSTRUCTION

Categories	Segment I Owego V. to Owego #1	Segment II Owego #1 to Owego #2	Segment III Possible Chenango V. STP to B-JC STP	Segment IV Chenango Valley Interceptor to possible Chenango V. STP
Length (miles)	2.3	4.3	2.3	4.0
Major Stream Crossing (#)	0	2	0	2
Undeveloped flood plains (miles)	0.9 (near railroad)	0.9	0.7	1.6 (not along roadways)
Undeveloped forest, shrub and grassland (miles)	0	0.7	0.4	0.9 along roadway 0.5 not along roadway
Recreation Land (miles)	0.1	0.4 (Hickories Park)	0.7 (Rt. 81 River Park)	0.7

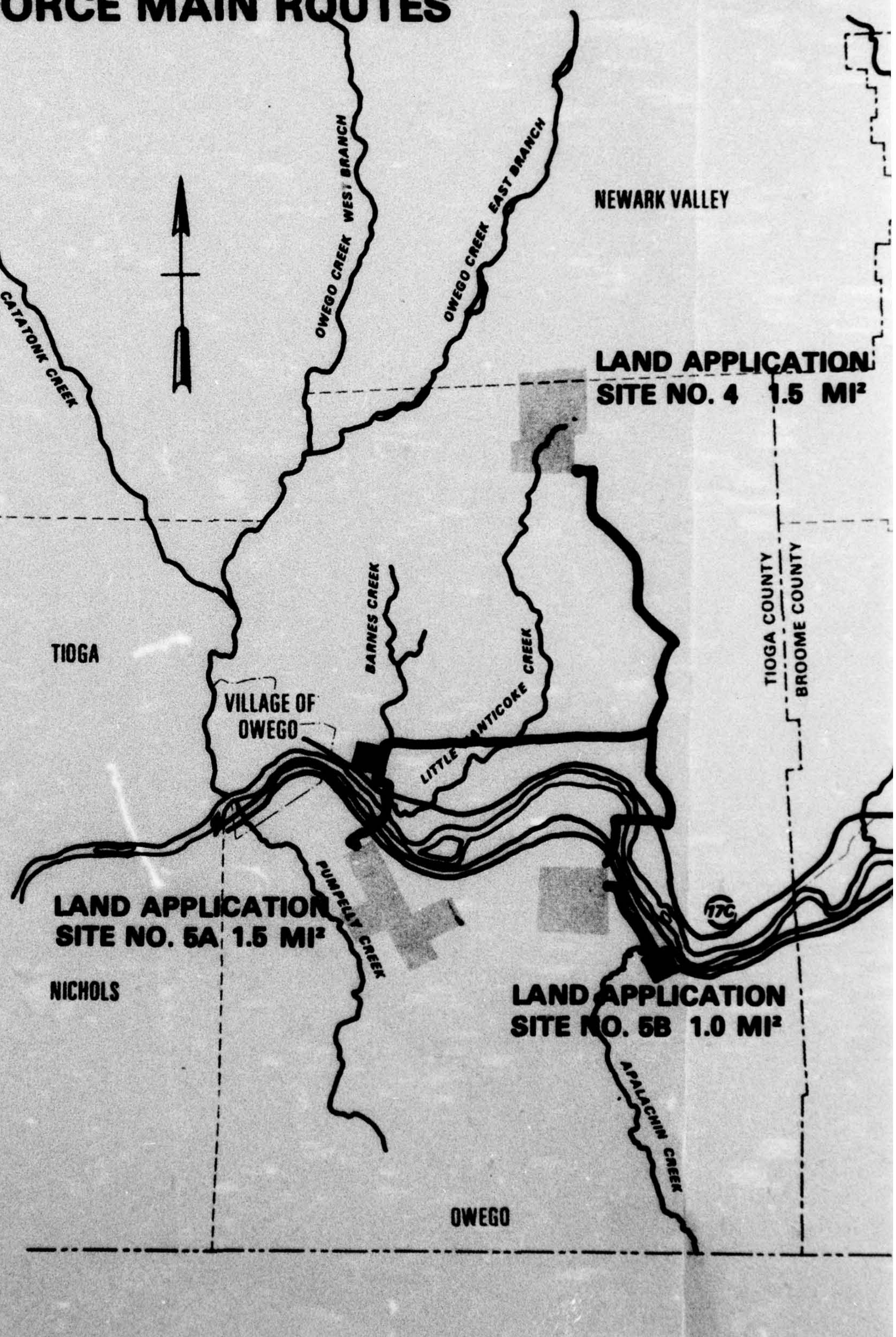
NOTE: Lengths are in miles.

A pipeline transporting effluent to a spray application site in either the Fenton area (Site 1) or the Castle Creek area (Site 3) from the Binghamton-Johnson City STP would encounter a wide variety of environmental situations from the urbanized complex of the City of Binghamton to the sparsely developed agricultural and forested areas of Fenton or Castle Creek.

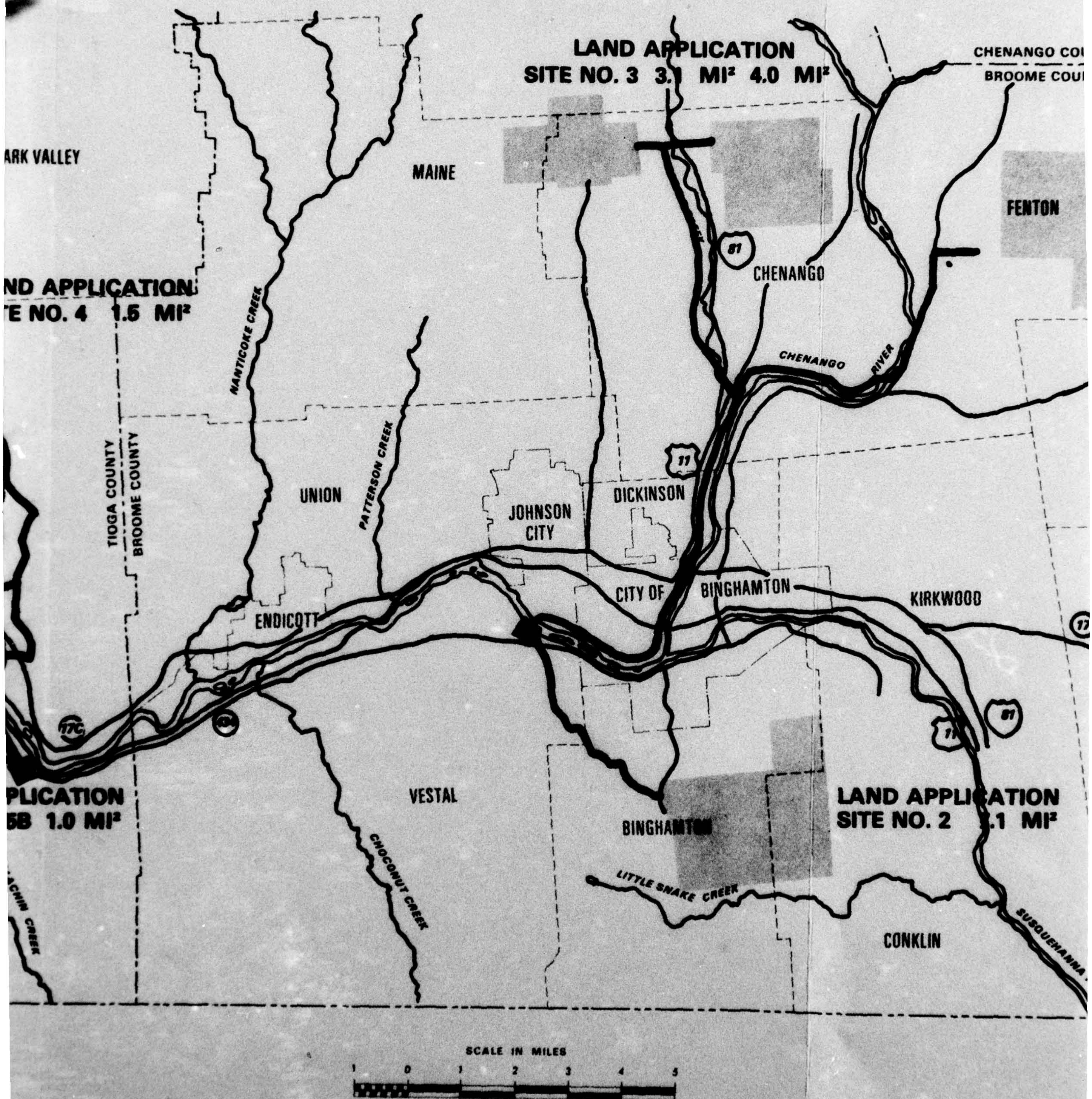
Transport to either spray application site would require the construction of a force main from the B-JC STP to Hinmans Corners, at which point the force main routes diverge to the respective areas. In order to minimize pumping requirements the routes would parallel the major river valleys as much as possible. Between the B-JC STP and Hinmans Corners the major sensitive areas which would be encountered are the extensively developed riverbanks near and within the City of Binghamton, the Route 81 River Park and two major river crossings (one of the Susquehanna River near the B-JC STP and one of Castle Creek near Hinmans Corners). Extensive urban development including homes, businesses, and highways directly adjacent to the Rivers would not only hamper the movement of construction vehicles but could also necessitate encroachment on the Rivers in some areas in order to install the force main. Erosion and sedimentation within the rivers would result from such construction activities along the riverbanks. Temporary disturbances to the water quality and biota of the Susquehanna River would be unavoidable during the river crossing near the B-JC STP. Similar disturbances would be felt on Castle Creek and the Chenango River during the crossing of Castle Creek. Temporary disruptions to both the Route 81 River Park lands and activities would likewise be unavoidable during the installation of the force main.

From Hinmans Corners to Site 1 in Fenton the force main would travel up the Chenango River Valley. The major environmental impacts which would be caused by installation of a force main would be felt by the undeveloped flood plains which would be traversed and the Chenango River itself. Within the community of Chenango Bridge the force main route would travel through the remaining sections of undeveloped flood plain, thus creating at least temporary disturbances of existing flora and fauna. Disturbances to agricultural developed flood plains, undeveloped flood plains and possible encroachment into the Chenango River would result during construction of the force main near Route 7. In addition, temporary disturbances to aquatic biota and water quality would be unavoidable during the crossings of the Chenango River, Thomas Creek and Osborne Creek.

LAND APPLICATION ALTERNATIVE SITES & FORCE MAIN ROUTES



VE SITES



LAND APPLICATION
SITE NO. 3 3.1 MI² 4.0 MI²
CHENANGO COU
BROOME COU
ARK VALLEY
MAINE
FENTON
81
CHENANGO
ND APPLICATION
TE NO. 4 1.5 MI²
NANTICOKE CREEK
CHENANGO
RIVER
TIOGA COUNTY
BROOME COUNTY
PATTERSON CREEK
11
UNION
JOHNSON CITY
DICKINSON
CITY OF BINGHAMTON
KIRKWOOD
ENDICOTT
17
17C
81
11
PLICATION
5B 1.0 MI²
VESTAL
LAND APPLICATION
SITE NO. 2 3.1 MI²
BINGHAMTON
CHOCONUT CREEK
LITTLE SNAKE CREEK
CONKLIN
SUSQUEHANNA
SCALE IN MILES
1 0 1 2 3 4 5

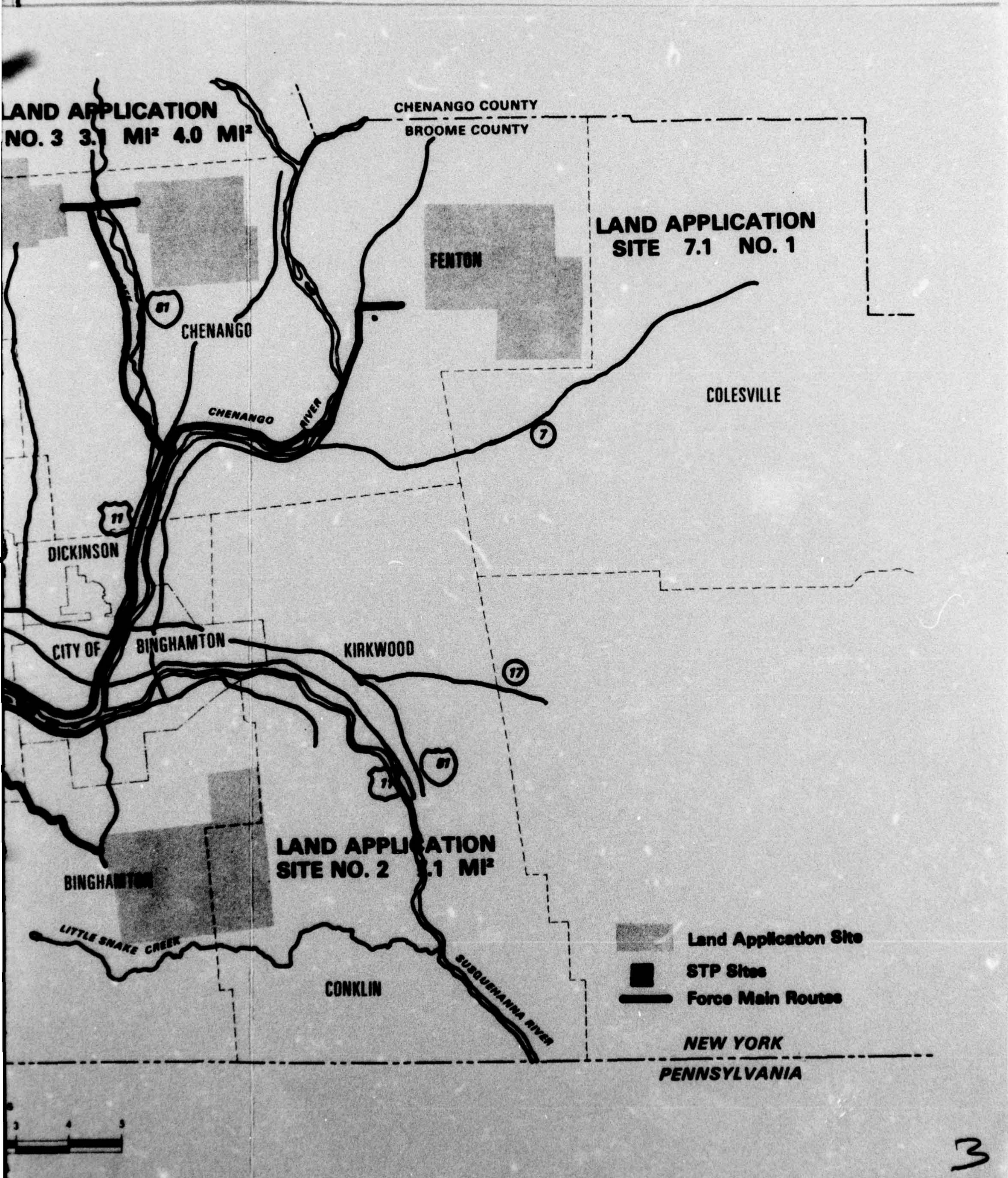


FIGURE III-11

The major portion of the force main extending from Hinmans Corners to the Castle Creek land application site (Site 3) would parallel existing roadways (Route 11, Fox Road and East Hill Road). Aside from the temporary impacts which would result during the two additional crossings of Castle Creek, the major impacts from construction of this force main route would be dust and noise.

In order to transport effluent to spray application Site 2 within the Town of Binghamton (to the southeast of the B-JC STP), a pipeline of approximately 4.4 miles in length would have to be constructed (see Figure III-11). Beginning at the Binghamton-Johnson City STP, the effluent pipe would travel along Powerhouse Road to the junction of Powerhouse Road and Hawthorne Road. The route would continue for a short distance (to the northeast) on Hawthorne Road and would then continue south along the stream bed of a small intermittent stream. After traversing some agricultural fields, the route would continue along Hogan Road to its intersection with Upper Pennsylvania Road. The pipeline would then continue to the southeast following the streambed of a second intermittent stream to Peckman Road. Finally, the route would continue to the southeast along Peckman Road and end on Park Avenue slightly to the south of the intersection of Peckman Road and Park Avenue.

In those areas where the pipeline route does not follow existing roadways, native forest or agricultural lands would be disturbed. In order to lessen the amount of destruction of either native woodlands or croplands the construction and permanent easements for the pipeline route should be kept to a minimum (15 feet to 30 feet). A summary of impacts is presented in Table III-7.

Spray application of effluent is also an alternative wastewater management plan for the two-plant regionalization scheme within Tioga County. Effluent from the two Tioga sewage treatment plants (Owego Town #1 and #2) would be transported to a central application site within Tioga County (Site 4) or would be transported to the nearest portion of Site 5 (see Figure III-11).

Spray application Site 4 is located to the north of the Susquehanna River near Lisle Road and Hollister Road in the Town of Owego. The force mains which would connect the Owego Town #1 and #2 sewage treatment plants to the spray application site are shown in Figure III-11 and a summary of their construction impacts is presented in Table III-8.

TABLE III-7

CONSTRUCTION IMPACTS OF SPRAY APPLICATION FORCE MAINS FROM BINGHAMTON-JOHNSON CITY STP

Category	Site 1	Site 2	Site 3
Length	14.3	4.4	14.1
River Crossing			
Susquehanna	1	0	1
Chenango	1	0	0
Stream Crossing	2	0	3
River Corridor, undeveloped flood plains and wetlands	2.4	0.5	0.3
Other undeveloped open space (forest, shrub, grassland)	0.7	1.3	1.3

NOTE: Lengths are in miles.

TABLE III-8

CONSTRUCTION IMPACTS OF SPRAY APPLICATION FORCE MAINS FROM TOWN OF OWEGO STP #1 AND #2

Category	Site 4	Site 5
Length	12.2	2.8
River Crossings Susquehanna	1	1
Stream Crossings	2	2
River corridors, undeveloped flood plains and wetlands	1.2	0.2
Other undeveloped open space (forest, grassland, shrub)	2.7	0.8

NOTE: Lengths are in miles.

Most of the 12.2 miles of force main to the land application site would be installed along existing roadways, thereby minimizing any environmental impacts to the natural ecology of the area. Approximately 3,400 feet of the force main, however, would be constructed through undeveloped stream flood plains and agricultural lands. Construction and permanent easement through such unbroken areas would have to be kept to a minimum in order to prevent extensive ecological disruptions. River banks should be reseeded and replanted to prevent erosion. Stream crossings, especially that of the Susquehanna, would create temporary disturbances to aquatic biota and may temporarily increase sedimentation and siltation within these water bodies.

Land application Site 5 in the Town of Owego actually consists of two parcels of land. Site 5A, of approximately 1.5 square miles, is located on the southern side of the Susquehanna River near Montrose Turnpike and would be used for the spray application of effluent from the Owego Town #1 STP. The force main route to Site 5A from the Owego Town #1 STP is shown in Figure III-11. Site 5B, approximatley 1 square mile, is also located on the southern side of the Susquehanna River in the Town of Owego near Jewett Hill Road. Site 5B would be the area of spray application of effluent from the Owego Town #2 STP. The force main route from the Owego Town #2 STP to Site 5B is shown in Figure III-11. Table III-9 summarizes the impacts of both the force main route to Site 5A and Site 5B under the general heading of Site 5.

The primary short-term adverse impacts of construction of the force mains would be imposed upon the rivers and streams which would be crossed. Temporary degradation of water quality in terms of increased sedimentation would have some adverse impacts to stream biota. These stream impacts and some destruction and disturbance to farm and woodland habitats would be the areas of major ecological concern in the construction of the force main route to Site 5A and 5B.

Social

Construction of any of the interceptors (see Figures III-9 and III-10) would also have an impact upon the social environment of the area. Traffic disruption, dust, noise, loss of business, disturbances to recreational activities, and adverse impact on regional development would be the major social impacts that could result from construction of any of the interceptors. A summary of the social impacts resulting from contribution are presented in Tables III-9 and III-10 for interceptors and force mains to land application sites, respectively.

TABLE III-9

SUMMARY OF SOCIAL IMPACTS OF INTERCEPTOR CONSTRUCTION

Categories	Segment I Owego V. to Owego #1	Segment II Owego #1 to Owego #2	Segment III Possible Chenango V STP to B-JC STP	Segment IV Chenango Valley Interceptor to possible Chenango V. STP
Total Length	2.3	4.3	2.3	4.0
Residential (# homes within 100 feet)	136	20	32	105
Commercial area	0.4	0.2	0.2	0.3
Recreation land	0.1	0.4	0	0
Agriculture land	0	1.0	0	0

NOTE: Lengths are in miles.

TABLE III-10

SOCIAL IMPACTS FROM CONSTRUCTION OF FORCE MAINS FOR LAND TREATMENT ALTERNATIVES

Category	BINGHAMTON-JOHNSON CITY STP			TOWN OF OWEGO #1 AND #2	
	Site 1	Site 2	Site 3	Site 4	Site 5
Length	14.3	4.4	14.1	12.2	2.8
Residential lands (homes within 100 feet)	275	150	430	125	105
Commercial	0.3	0.2	0.7	0.9	0.1
Recreation Land	2.5	0	2.6	0	0
Agriculture	1.5	0.3	1.2	5.3	0.6

NOTE: Lengths are in miles.

Another social concern is the quality of the air within the Study Area. The Binghamton area has been designated by the New York State Department of Environmental Conservation as an Air Quality Maintenance Area. This is because it is an area where national air quality particulate standards could be violated by 1985. The standards have been violated in the past, but in recent years there has been a marked increase in the air quality in the Maintenance Area. However, with expected population increases and in the absence of mechanisms or plans to limit particulate emissions, there could be a violation of secondary ambient air quality standards for particulates from 1985 onward. The wastewater alternatives under study could channel expected growth within certain regions of the maintenance area, but they are not expected to contribute to additional growth in the area.

The only alternative that would require any relocations of people is alternative 8A, which would require the relocation of about 80 families in the spray irrigation locations. The loss of lands used for residences and agriculture would result in severe social impact to some of those families in the area.

Economic

Table III-11 shows a summary of the costs of the different alternatives. It shows the annual maximum and minimum costs per family. These preliminary figures related to the charges that could be expected to occur to a family over the planning period. Because of the preliminary nature of these figures no evaluation of the economic impact was made at this stage. In a later iteration, the costs were more correctly determined and an assessment of their possible impacts was presented.

SUMMARY AND EVALUATION

Table III-13 at the end of this section gives a summary of the impacts of the thirteen wastewater management alternatives.

Alternative 1: Baseline Condition

Environmental conditions associated with the Baseline Condition or no action alternative formed the basis against which the other wastewater management alternative were compared. The projected conditions under this Alternative included existing waste treatment plants at Binghamton-Johnson City, Endicott, Owego Village, Owego Town #1 and Owego Town #2.

TABLE III-11

COSTS OF ALTERNATIVES
STAGE II-2

Alternative	Present worth of all expenditures ($ millions)	Present worth of local expenditures ($ millions)	Per family annual payment (Dollars per year)	
			minimum	maximum
1	33	24.0	12.44	14.95
2	48.6	29.7	14.35	16.63
3A	52	31.4	15.13	17.76
3B	46.6	29.5	14.27	16.74
4A	49	32.0	15.45	18.35
4B	46.6	30.1	14.61	17.08
5	49	31.8	15.59	17.93
6	103	60.1	15.28	42.99
7	104	63.5	12.38	50.91
8A	71	40.8	15.28	25.21
8B	55	32.3	14.96	18.90
9	41.6	27.4	13.76	15.47
10	59	35.5	15.28	21.74
11	40	27.4	12.64	15.50
12A	41.6	27.6	13.50	15.32
12B	45	29.4	14.40	16.73
13	45.4	29.3	14.95	16.00

Ecological.

The minimum instream dissolved oxygen concentration achieved by Alternative 1 would be 3.5 mg/l which represented a poor water condition against which the action alternatives were be compared.

The expected nutrient loading would be 6,830 lb/day nitrogen and 1,740 lb/day of phosphorus. The instream ammonia concentration would be 2.06 mg/l.

Social.

Existing malfunctions and overflows of septic systems in the Chenango Valley area would continue to represent a public health hazard, not only to area residents, but also to users of the Route 81 River Park. Likewise, the reoccurrence of combined sewer overflows in the urban area would continue to have adverse impacts in terms of public health and recreation potential of the Susquehanna River.

Existing development patterns would be expected to continue in the Baseline Condition Alternative and, in addition, sewerage services (such as extension of sewer lines) would keep pace with any such development. Unrestricted extension of sewers in the no action alternative may result in development patterns which are undesired by the Southern Tier East Region. Some methods for development restriction, such as flood plain zoning, other local zoning ordinances, and building permit regulations may help to limit undesirable sprawl.

Any construction of wastewater facilities associated with the Baseline Condition Plan would involve extension of sewer lines, abandonment of some existing facilities and construction of interceptors from abandoned facilities to the remaining facilities. Associated with this construction there would be short term social impacts such as disruption of traffic and adverse aesthetic impacts in terms of dust and noise.

Economic.

The present worth of all expenditures for the Baseline Condition Alternative would be 33 million dollars in the base year of 1977. Local costs for the no action alternative were estimated at 24 million dollars, which is the present worth of local expenditures.

Under the Baseline, the minimum payment which a family (3.5 persons/family) could expect per year would occur in the year 2026 when the annual per family payment would be $12.44. The maximum annual per family payment of $14.95 would occur in the year 1977.

Alternative 2

Wastewater management Alternative 2 utilized a three plant regionalization scheme with waste treatment facilities at Binghamton-Johnson City, Endicott and Owego Town #2. The three STP's would have biological secondary waste treatment and, in adition, the B-JC STP would have nitrification.

Ecological.

The minimum instream dissolved oxygen concentration achieved by Alternative 2 would be 5.4 mg/l. This DO concentration would represent a beneficial impact in comparison to the no action alternative.

Total nutririent loadings to receiving waters from wastewater effluents in Alternative 2 would be 7,540 lb/day of nitrogen and 1880 lb/day of phosphorus. These nutrient inputs are greater in Alternative 2 than in the no action alternative because Alternative 2 would include wastewater flows from the Chenango Valley area which would be treated by individual septic systems under the Baseline Alternative. The degree of possible adverse impacts, in the form of stimulation of nuisance growths of aquatic vegetation, would not be high since other environmental factors also would act to limit nuisance aquatic growths.

The instream ammonia concentration of 1.14 mg/l achieved by Alternative 2 would conform to the NYSDEC standard for ammonia of 2.0 mg/l and this would represent a beneficial impact in comparison to the Baseline Condition Alternative.

During construction of regional interceptors I, II, III, and IV, temporary adverse impacts to aquatic ecology, such as increased erosion and sedimentation within surface waters, would occur during the five major stream and river crossings.

Possible direction of development along the 7.2 miles of regional interceptors which do not follow existing roadways may adversely affect the native terrestrial ecosystems occurring in these unbroken areas. Likewise, destruction of the native vegetation and associated wildlife within the path of the regional interceptors may also occur.

Social.

Possible induced development patterns associated with the location of sewage services in Alternative 2 probably would not conform to the desired development patterns expressed by the Southern Tier East Region General Plan. Local development restrictions such as zoning ordinances and building codes may act to hinder undesired development. In the absence of such local development restrictions, however, provision of sewerage services (especially by Interceptor II) may induce undesirable development.

Dust, noise and traffic inconveniences would temporarily adversely affect the population along the 5.7 miles of regional interceptors which would be constructed along existing roadways.

Elimination of septic system overflows and malfunctions in the Chenango Valley area would, in Alternative 2, not only reduce potential health hazards but would also improve the recreational potentials of the area's rivers during non-storm periods. The occurrence of combined sewer overflows during heavy rains would, however, continue to adversely affect both public health and the recreational potentials of the river system.

During construction of the regional interceptors, five recreational areas, including Hickories Park and the Route 81 River Park, would be temporarily disturbed.

Economic.

The total cost of Alternative 2, reflected in the present worth of all expenditures, would be 48.6 million dollars. Local costs of Alternative 2, reflected in the present worth of local expenditures, would be 29.7 million dollars.

In Alternative 2 the minimum annual per family payment of $14.35 would occur in the year 2026. The maximum annual per family payment of $16.63 would occur in the year 1991.

Alternative 3A

Alternative 3A utilized a scheme of four treatment plants including a Chenango Valley STP, the Binghamton-Johnson City STP, the Endicott STP and a regionalized Owego Town #2 STP for Tioga County. Nitrification would be applied at the B-JC STP and all other facilities would utilize secondary biological treatment.

Ecological.

The minimum instream DO achieved by Alternative 3A would be 5.4 mg/l which would be a beneficial impact to aquatic ecology when compared to the Baseline DO of 3.5 mg/l.

Total nutrient loadings of nitrogen and phosphorous under Alternative 3A would be greater than those under the Baseline Condition Alternative due to the inclusion of Chenango Valley sewage flows. However, the resulting effects upon aquatic nuisance algal growths would be limited since other factors, such as penetration of light and high natural turdibity may retard aquatic growths.

The resulting maximum instream concentration of ammonia (NH_3) which would occur under Alternative 3A is 1.12 mg/l which would conform to the NYSDEC standard. When compared to the Baseline Condition Alternative, Alternative 3A would have a beneficial impact upon instream ammonia concentrations.

During the construction of regional interceptors I, II and IV temporary adverse impacts to aquatic ecology, such as increased erosion sedimentation, would result from five major river or stream crossings.

The construction of a new Chenango Valley STP would require utilization of approximately 5 acres of previous flood plain land along Route 81 and Route 11-12 near the Broome County Community College. The proposed site was once flood plain land before the Chenango River was rechannelized. Utilization of the proposed site would eliminate only a small amount of primary weedy vegetation and its associated wildlife. Nevertheless, this elimination would be an adverse impact in comparison to the Baseline which does not include a new Chenango Valley STP.

Possible direction of development into areas which are presently open spaces may occur along the 5.8 miles of regional collection interceptors which would be constructed under

Alternative 3A. New development would eliminate existing undisturbed vegetation and wildlife patterns along the 5.8 miles of interceptors. Such elimination of existing natural terrestrial ecosystems under Alternative 3A may be more adverse than that occurring under the Baseline Condition Alternative. In addition, the native terrestrial ecosystems along the path of these interceptors would be eliminated.

Social.

The construction of regional Interceptor II between the Owego Town #1 STP to the Owego Town #2 STP could direct development to that area. Development in the area of Interceptor II is not desired by the Southern Tier East Region.

Dust, noise and traffic interruption would temporarily adversely impact upon the population adjoining the 4.8 miles of interceptors to be constructed along existing roadways.

Elimination of septic system overflows and malfunctions in the Chenango Valley area under Alternative 3A would not only reduce potential health hazards but would also improve the recreational potentials of the area's rivers during non-storm periods. However, during periods of heavy rain, overflows of combined sewers in the urban area would continue to adversely affect both public health and the recreational potentials of the rivers.

During the construction of interceptors under Alternative 3A, four recreational areas, including Hickories Park, would temporarily be disturbed. Also, improper operation of a new Chenango Valley STP may adversely affect the Route 81 River Park via odor problems.

Economic.

The total cost of Alternative 3A, reflected by the present worth of all expenditures, would be 52 million dollars. Local costs, expressed by the present worth of local expenditures would be 31.4 million dollars.

The minimum annual per family payment of $15.13 in Alternative 3A would occur in the year 2026. The maximum annual per family payment of $17.76 would occur in 1983.

Alternative 3B

Alternative 3B utilized a *four plant regionalization scheme* with wastewater treatment facilities located at Binghamton-Johnson City, at Endicott, at Owego Town #1 and Owego Town #2. All treatment facilities would utilize biological secondary waste treatment and the Binghamton-Johnson City STP would also utilize a nitrification process.

Ecological.

The minimum instream dissolved oxygen concentration achieved by Alternative 3B would be 5.4 mg/l which would represent a beneficial impact in comparison to the Baseline Condition Alternative.

Total nitrogen loadings from the sewage treatment facilities in Alternative 3B would be 7,540 lb/day and total phosphorus loadings would be 1,905 lb/day. These nutrient inputs are greater than those for the Baseline because of the provision of sewerage services in the Chenango Valley area. The degree of possible impacts upon aquatic ecosystems, especially in regards to the stimulation of nuisance growths of aquatic vegetation, would be minimal since other environmental factors also act to limit nuisance aquatic growths.

The maximum instream ammonia concentration of 1.14 mg/l achieved by Alternative 3B would conform to the ammonia standard set by the NYSDEC (2.0 mg/l) and would represent a beneficial impact in comparison to the Baseline Condition Alternative.

During construction of regional interceptors I, III and IV temporary adverse impacts, such as increased erosion and sedimentation would occur during the two major stream crossings.

Possible direction of development along the 5.2 miles of regional interceptors which do not follow existing roadways may adversely affect the native terrestrial ecosystems occurring in these unbroken areas. Likewise, destruction of the native vegetation and disturbance of associated wildlife within the path of such interceptors would also occur.

Social.

Possible induced development patterns associated with the location of municipal sewage treatment facilities in

Alternative 3B would conform to the desired development patterns according to the Southern Tier East Region General Plan.

Dust, noise and traffic inconveniences would temporarily adversely affect the population along the 3.5 miles of interceptors which would be constructed along existing roadways.

Elimination of septic system overflows and malfunctions in the Chenango Valley area would, in Alternative 3B, not only reduce potential health hazards but would also improve the primary contact recreation potentials of the area's rivers during non-storm periods. The reoccurrence, however, of combined sewer overflows during heavy rains would continue to adversely affect both public health and the recreational potentials of the river system.

During construction of the regional interceptors, 4 recreational areas, including the Route 81 River Park would be temporarily disturbed.

Economic.

Total costs of Alternative 3B, as reflected by the present worth of all expenditures would be 46.6 million dollars. The present worth of local expenditures, reflecting the local costs of Alternative 3B would be 29.5 million dollars.

The minimum annual per family payment of $14.27 for Alternative 3B would occur in the year 1982, while the maximum annual per family payment of $16.74 would occur in 1983.

Alternative 4A

Wastewater management Alternative 4A utilized a five plant regionalization scheme with sewage treatment facilities at Chenango Valley, Binghamton-Johnson City, Endicott, Owego Town #1, and Owego Town #2. All facilities would utilize secondary waste treatment and the B-JC STP would also have a nitrification step.

Ecological.

The minimum instream dissolved oxygen concentration achieved by Alternative 4A would be 5.4 mg/l. This DO concentration would represent a beneficial impact to aquatic ecosystems in comparison to the Baseline Condition Alternative.

Total nutrient loadings of nitrogen and phosphorus from the wastewater treatment facilities in Alternative 4A would be 7,40 lb/day and 1,90 lb/day, respectively. These nutrient loadings would be greater than those under the Baseline due to the provision of sewerage service in the Chenango Valley area. However, the degree of possible adverse impacts to aquatic ecosystems, such as stimulation of nuisance growths of aquatic vegetation, would be low since other environmental factors also act to limit nuisance aquatic growths.

The maximum instream ammonia concentration of 1.12 mg/l achieved by Alternative 4A would conform to the NYSDEC standard for ammonia and would represent a beneficial impact in comparison to the Baseline Condition Alternative.

During construction of regional interceptors I and IV temporary adverse impacts to aquatic ecology, that is, increased erosion and sedimentation within surface waters, would occur during the two major stream crossings.

The construction of a new Chenango Valley STP would require the utilization of approximately acres of land along Route 81 and Route 11-12, near the Broome Community College. The proposed site for the new STP was formerly a floodplain area prior to the rechannelization of the Chenango River. Utilization of the proposed site would eliminate the primary (new field) vegetation and associated wildlife which presently occupy the site. Such elimination would represent an adverse impact to terrestrial ecology when compared to the Baseline Condition Alternative which does not include a new Chenango Valley STP.

Possible direction of development along the 3.8 miles of regional interceptors which do not follow existing roadways may adversely affect the native terrestrial ecosystems occurring in these unbroken areas. Likewise destruction of the native vegetation and disturbance of associated wildlife within the path of such interceptors would also occur.

Social.

Possible induced development patterns associated with the location of municipal sewage treatment and collection facilities in Alternative 4A would conform to desired development patterns according to the Southern Tier East Region General Plan.

Dust, noise and traffic inconveniences would temporarily adversely affect the population along the 2.5 miles of interceptors which would be constructed along existing roadways.

Elimination of septic system overflows and malfunctions in the Chenango Valley area would, under Alternative 4A, not only reduce potential health hazards but would also improve the recreational potentials of the areas rivers during non-storm periods. The reoccurrence, however, of combined sewer overflows during heavy rains would continue to adversely affect both public health and the recreational potential of the river system.

During construction of the regional interceptors and outfall from the Chenango Valley STP, three recreational areas, including the Route 81 River Park would be temporarily disturbed. Also, improper operation of the Chenango Valley STP may adversely affect, via odors, the Route 81 River Park.

Economic.

The total costs of Alternative 4A, as reflected by the present worth of all expenditures would be 49 million dollars. Local costs of Alternative 4A, as reflected by the present worth of local expenditures, would be 32 million dollars.

For Alternative 4A, the minimum annual per family payment of $15.45 would occur in the year 2025, while the maximum annual per family payment of $18.35 would occur in 1983.

Alternative 4B

Wastewater management Alternative 4B utilized a five plant regionalization scheme with sewage treatment facilities located in Binghamton-Johnson City; Endicott, Owego Town #1, Owego Town #2, and Owego Village. All treatment facilities would have secondary biological waste treatment and the B-JC STP would also have a nitrification process.

Ecological.

The minimum instream dissolved oxygen concentration of 5.4 mg/l achieved by Alternative 4B would represent a beneficial impact to aquatic ecology in comparison to the no action alternative.

Total nutrient loadings of nitrogen and phosphorus from the STP's in Alternative 4B to the Susquehanna River would be 7,540 lb/day and 1,905 lb/day, respectively. These nutrient inputs would be greater than those for the Baseline due to the inclusion of sewage flows from the Chenango Valley area. However, the degree of possible impacts, in the form of stimulation of nuisance growths of aquatic vegetation, would be low since other environmental factors also act to limit nuisance aquatic growths.

The maximum instream concentration of ammonia (NH_3) of 1.14 mg/l achieved in Alternative 4B would conform to the NYSDEC ammonia standard of 2.0 mg/l and would represent a beneficial impact in comparison to the Baseline Condition Alternative.

During construction of regional interceptor III and IV temporary adverse impacts to aquatic ecosystems, such as increased erosion and sedimentation in surface waters, would occur during the two major stream crossings.

Possible direction of development along the 4.2 miles of regional interceptors which do not follow existing roadways may adversely affect the native terrestrial ecosystems occurring in these unbroken areas. In addition, native terrestrial vegetation and associated wildlife within the path of the regional interceptors would be eliminated.

Social.

Possible induced development patterns associated with the location of treatment facilities and interceptors would conform to the desired development patterns expressed in the Southern Tier East Region General Plan.

Dust, noise and traffic inconveniences would temporarily adversely affect the population adjoining the 2.2 miles of regional interceptors which would be constructed along existing roadways.

Elimination of septic system overflows and malfunctions in the Chenango Valley area would, in Alternative 4B, not only reduce potential health hazards but would also improve the recreational potentials of the area's rivers during non-storm periods. The occurrence of combined sewer overflows during heavy rains would, however, continue to adversely affect both public health and the recreational potential of the rivers.

During construction of the regional interceptors, three recreational areas, including the Route 81 River Park would be temporarily disturbed.

Economic.

The present worth of all expenditures, which reflect the total costs of Alternative 4B, would be 46.6 million dollars. The local costs, reflected by the present worth of local expenditures would be 30.1 million dollars.

The minimum annual per family payment of $14.61 for Alternative 4B would occur in the year 1982. The maximum annual per family payment of $17.08 would occur in the year 1983.

Alternative 5

Alternative 5 would include six treatment plants: a Chenango Valley STP, the B-JC STP, the Endicott STP, the Owego Town #1 STP, the Owego Town #2 STP, and the Owego Village STP. All treatment plants would utilize secondary biological treatment and in addition the B-JC STP would have nitrification.

Ecological.

The minimum DO achieved in Alternative 5 would be 5.4 mg/l which would represent a beneficial impact in comparison to the Baseline Condition Alternative.

Total loadings of nitrogen would be 7,540 lb/day and total phosphorous loadings would be 1,905 lb/day. These loadings would be greater than those under the Baseline Condition Alternative. However, the degree of possible adverse impacts, that is, nuisance aquatic growths, would be uncertain since other environmental factors also act to limit nuisance aquatic growths.

The maximum instream NH3 concentration of 1.12 mg/l which would occur under Alternative 5 would conform to the NYSDEC ammonia standard and would represent a beneficial impact in comparison to the no action alternative.

During the construction of regional Interceptor IV temporary adverse impacts to aquatic ecology would occur during two major stream crossings.

The construction of a new Chenango Valley STP would require the utilization of approximately 5 acres of land along Route 81 and Route 11-12 near the Broome Community College. The proposed site was once flood plain land before the rechannelization of the Chenango River. Utilization of the proposed site would eliminate 5 acres of primary weedy vegetation and its associated wildlife. Nevertheless, this elimination is a minor adverse impact to terrestrial ecosystems when compared to the Baseline which does not include a new Chenango Valley STP.

Possible direction of development along the 2.8 miles of interceptors which do not follow existing roadways would represent an adverse impact to the native terrestrial ecosystems along this 2.8 miles. In addition, native terrestrial ecosystems within the path of such interceptors would be eliminated during construction of the interceptors.

Social.

Possible induced development patterns associated with the location of treatment facilities and interceptors would conform to the desired development patterns expressed by the Southern Tier East Region General Plan.

Dust, noise and traffic interruptions would temporarily adversely impact upon the population adjoining the 1.3 miles of interceptors which would be constructed along existing roadways.

Elimination of septic system overflows and malfunctions in the Chenango Valley area would, under Alternative 5, not only reduce potential health hazards but would also improve the recreational potentials of the area's rivers during non-storm periods. The occurrence of combined sewer overflows during heavy rains would, however, continue to adversely affect both public health and the recreational potentials of the rivers.

During construction of Interceptor IV and the outfall from the Chenango Valley STP, the Route 81 River Park would be temporarily disturbed. Also, improper operation of the Chenango Valley STP may adversely affect (via odors) the Route 81 River Park.

Economic.

Total costs of Alternative 5, reflected by the present worth of all expenditures would be 49 million dollars. Local cost as reflected in the present worth of local expenditures would be 31.8 million dollars.

The minimum annual per family payment of $15.59 for Alternative 5 would occur in the year 2026, while the maximum annual per family payment of $17.93 would occur in 1983.

Alternative 6

Alternative 6 would utilize 5 sewage treatment plants including: a Chenango Valley STP, the B-JC STP, the Endicott STP, Owego Town #1 STP, and Owego Town #2 STP. All treatment plants would have biologically based advanced waste treatment and infiltration control measures would be applied to the Binghamton-Johnson City sewerage system.

Ecological.

The minimum dissolved oxygen achieved by Alternative 6 would be 6.7 mg/l and would represent a beneficial impact to aquatic ecology when compared to the Baseline Condition Alternative.

The total nutrient loadings of nitrogen and phosphorous under Alternative 6 would be 625 lb/day and 555 lb/day, respectively. These loadings represent substantial reductions in N and P loadings to the rivers when compared to the no action alternative. The possible extent of beneficial impacts upon the river system is uncertain since other environmental factors may be the limiting constituents to nuisance growths of aquatic vegetation.

Maximum ammonia concentrations within receiving waters under Alternative 6 would be 0.18 mg/l which would meet the NYSDEC ammonia standard. In comparison to the Baseline, Alternative 6 would significantly reduce instream concentrations of ammonia.

The construction of a new Chenango Valley STP would require the utilization of approximately 5 acres of land along Route 81 and Route 11-12 near the Broome Community College.

The proposed site was once flood plain land prior to the rechannelization of the Chenango River. Utilization of the proposed site would eliminate the primary vegetation (new field weedly growths) and its associated wildlife. Although this utilization is small, it would represent an adverse impact to terrestrial ecosystems when compared to the Baseline Condition Alternative which does not include a new Chenango Valley STP.

Possible direction of development along the 3.8 miles of interceptors (along interceptors I and IV) which would not follow existing roadways would represent an adverse impact to the native terrestrial ecosystems along the 3.8 miles. In addition, the native terrestrial vegetation and wildlife within the path of such interceptors would be eliminated during construction.

Social.

Possible induced development patterns associated with the location of treatment facilities and interceptors under Alternative 6 would conform to desired development patterns.

Dust, noise and traffic interruptions would temporarily adversely impact upon the population adjoining the 2.5 miles of interceptors which would be constructed along existing roadways.

Elimination of septic system overflows and malfunctions in the Chenango Valley area would, under Alternative 6, not only reduce potential health hazards but would also improve the recreational potentials of the area's rivers during non-storm periods. The occurrence of combined sewer overflows during periods of heavy rains would, however, continue to adversely affect both public health and the recreational potentials of the rivers.

During construction of Interceptor I, IV and the outfall from the Chenango Valley STP, 3 recreational areas including the Route 81 River Park would be temporarily disturbed. Also, improper operation of the Chenango Valley STP may adversely affect, via odor problems, the Route 81 Park.

Economic.

The present worth of all expenditures of Alternative 6, which reflects the total costs, would be 103 million dollars. Local costs, reflected by the present worth of local expenditures, would be 60.1 million dollars.

In Alternative 6, the minimum annual per family payment of $15.28 would occur in 1982, while the maximum annual per family payment of $42.99 would occur in the year 1985.

Alternative 7

Alternative 7 would utilize a scheme of 5 treatment facilities including a Chenango Valley STP, the B-JC STP, the Endicott STP, Owego Town #1 STP, and Owego Town #2 STP. All treatment facilities would have advanced waste treatment utilizing complete physical-chemical waste treatment processes. In addition, infiltration control measures would be utilized in the B-JC sewerage system.

Ecological.

The minimum instream dissolved oxygen achieved by Alternative 7 would be 6.7 mg/l which would represent a beneficial impact to aquatic ecology when compared to the Baseline Condition Alternative.

The total nutrient loadings of nitrogen and phosphorous under Alternative 7 would be 625 lb/day and 125 lb/day, respectively. These loadings represent substantial reductions in N and P loadings to the rivers when compared to the Baseline. The extent of possible beneficial impacts resulting from such nutrient reductions would be uncertain since other environmental factors may be the limiting constituents to nuisance growth of aquatic vegetation.

Maximum ammonia concentrations within receiving waters under Alternative 7 would be 0.18 mg/l which would meet the NYSDEC standard of 2.0 mg/l for ammonia and would represent a significant reduction in instream NH_3 concentrations when compared to the no action alternative.

The construction of a new Chenango Valley STP would require the utilization of approximately 5 acres of land along Route 81 and Route 11-12 near the Broome Community College. The proposed site was once flood plain land prior to the rechannelization of the Chenango River. Utilization of the proposed site would eliminate the primary vegetation (new field weedy growths) and its associated wildlife. Although this utilization is small, it would represent an adverse impact to terrestrial ecosystems when compared to the Baseline which does not include a new Chenango Valley STP.

Possible direction of development along the 3.8 miles of interceptors which would not follow existing roadways would represent an adverse impact to the native terrestrial ecosystems along the 3.8 miles. In addition, the terrestrial vegetation and associated wildlife within the path of such interceptors would be eliminated during construction.

Social.

Possible induced development patterns created by the location of treatment facilities and interceptors under Alternative 6 would conform to desired development patterns.

Dust, noise and traffic interruptions would temporarily adversely impact upon the population adjoining the 2.5 miles of interceptors which would be constructed along existing roadways.

Elimination of septic system overflows and malfunctions in the Chenango Valley area would, under Alternative 7, not only reduce potential health hazards but would also improve the recreational potentials of the area's rivers during non-storm periods. The occurrence of combined sewer overflows during periods of heavy rains would, however, continue to adversely affect both public health and the recreational potentials of the rivers.

During construction of Interceptor IV, Interceptor I and the outfall from the Chenango Valley STP, three recreational areas including the Route 81 River Park would be temporarily disturbed. Also, improper operation of the Chenango Valley STP may adversely affect, via odor problems, the Route 81 River Park.

Economic.

Total costs of Alternative 7, as reflected by the present worth of all expenditures would be 104 million dollars. Local costs for Alternative 7 as reflected by the present worth of local expenditures would be 63.5 million dollars.

The minimum annual per family payment of $12.38 for Alternative 7 would occur in the year 1982. The maximum annual per family payment of $50.91 would occur in the year 1985.

<u>Alternatives 8A and 8B</u>

Wastewater management alternatives 8A and 8B would utilize a five plant scheme including a treatment facility in Chenango Valley, the Binghamton-Johnson City STP, the Endicott STP, the Owego Town #1 STP, and the Owego Town #2 STP. Each treatment facility would provide secondary waste treatment. During the summer months (May through October) 100 percent of the effluent from the B-JC STP, the

Owego Town #2 STP and the Owego Town #1 STP would be applied to the land while the effluent from the Chenango Valley STP and Endicott STP would be discharged to surface waters. During the winter months (November through April) all STP's would discharge effluents to surface waters, the Chenango and Susquehanna Rivers.

Alternative 8A would not include any wastewater flow reduction measures but would require secondary treatment expansion of the B-JC STP in 1977 and 1990. Alternative 8B would employ nonstructural measures for flow reduction in all service areas, infiltration control measures to reduce the influent wastewater flow to the B-JC STP, and would also have one expansion of the secondary treatment capacity of the B-JC STP in 1977.

A preliminary selection of the most desirable site for spray application of wastewaters was made for the sewage treatment facilities which would utilize spray application during the summer months. The sites initially investigated and their respective effluent pipeline routes to the site are shown in Figure III-11.

Selection of the most suitable land application site for the effluent from each STP was made by consideration of such factors as:

(a) distance from the STP,

(b) population density and extent of human activity within the spray application area,

(c) location and number of surface waters in the spray application area,

(d) suitable existing land usage, such as agriculture and forest and,

(e) suitable soils and slopes

Of the three areas investigated for spray application of wastewaters from the B-JC STP, Site 2 to the southeast of the B-JC STP in the Towns of Binghamton and Conklin was selected as being most suitable. Of the two possible sites investigated for spray application of wastewaters from the Owego Town #2 STP, Site 5B to the northwest of the STP in the Town of Owego was selected as most suitable. Site 5A to the south of the West Owego plant was selected as the more suitable spray application site for the wastewaters from the Owego Town #1 STP.

Although a preliminary site selection was made for spray application areas it must be keep in mind that the sites found to be most suitable nevertheless may have numerous problems associated with them. For example, within any of the generally suitable sites could be areas of slopes too great for spray application and areas of poorly suited soils. Also, the problems of human activity near or in the spray application sites may preclude labeling selected sites as completely appropriate for spray application of wastewater.

Ecological.

During critical summer low river flow conditions effluents from three of the five sewage treatment plants would be disposed of on the land, and the minimum dissolved oxygen concentrations achieved by alternatives 8A and 8B would be 6.3 mg/l. Thus, DO concentrations would meet NYSDEC standards during critical summer conditions as well as during the non-critical winter months for both alternatives. Alternatives 8A and 8B would achieve a higher minimum DO than does the no action alternative.

Again, due to diversion of effluents, the total nutrient loadings of nitrogen and phosphorus to receiving waters during the summer months in both alternatives 8A and 8B would be significantly lower than those under the Baseline Condition Alternative. Total summer N loadings would be 2,970 lb/day and total summer P loadings would be 765 lb/day in both alternatives 8A and 8B. The possible affects of such reductions in nutrient inputs upon nuisance growths of aquatic vegetation would be uncertain since other environmental factors may limit such summer nuisance growths. Total nitrogen and phosphorus loadings to receiving waters during the winter months would be 7,540 lb/day and 1,905 lb/day, respecitvely for both alternatives 8A and 8B. Although the winter nutrient inputs to the aquatic ecosystem is slightly higher for alternatives 8A and 8B than for the Baseline Condition Alternative, the effects upon aquatic vegetation would be minimal during the winter months.

The maximum instream ammonia concentrations achieved under alternatives 8A and 8B would be 0.87 mg/l and would meet the NYSDEC ammonia standard. Additionally, the lower NH_3 concentrations achieved by alternatives 8A and 8B would represent a beneficial impact in comparison to the Baseline Condition Alternative.

During construction of regional interceptors I and IV and during construction of effluent pipelines to the spray application sites, in both alternatives 8A and 8B, temporary adverse impacts to stream ecology, in the form of increased erosion and sedimentation, would occur during the five major river and stream crossings.

In both alternatives 8A and 8B, the construction of a new Chenango Valley STP would require the utilization of approximately 5 acres of land along Route 81 and Route 11-12 near the Broome Community College. The proposed site for the new STP was formerly a floodplain area prior to the rechannelization of the Chenango River. Utilization of the proposed site would eliminate the primary (new field) vegetation and associated wildlife which occurs at the site. Such an elimination would represent a minor adverse impact to terrestrial ecosystems when compared to the Baseline Condition Alternative which does not include a new Chenango Valley STP.

Possible direction of development along the 3.8 miles of regional interceptors which do not follow existing roadways in alternatives 8A and 8B may adversely affect the native terrestrial ecosystems occurring in these unbroken areas. In addition, destruction of native vegetation within both the 3.8 miles of interceptor pathways and 1.5 miles of effluent pipeline pathways would occur in alternatives 8A and 8B.

During the operation of the spray irrigation site both beneficial and adverse impacts to terrestrial biota would occur. A gross measure of the magnitude and extent of either beneficial or adverse impacts would be a measure of the total land area requirements for the spray application site. Estimates of the total land requirements for spray application of wastewaters from the B-JC STP, the Owego Town #1 STP and the Owego Town #2 STP for alternatives 8A and 8B are presented in Table III-12. Utilization of flow reduction measures would significantly reduce the total acreage requirements for spray application sites.

TABLE III-12

ACREAGE REQUIREMENTS FOR LAND APPLICATION OF WASTEWATER EFFLUENTS (YEAR 2020)

	ALTERNATIVE 8A		ALTERNATIVE 8B	
SEWAGE TREATMENT PLANT	FLOW (MGD)	ACRES REQUIRED*	FLOW (MGD)	ACRES REQUIRED*
Binghamton-Johnson City	25.3	4560	17.0	3060
Owego Town #1	2.4	432	1.95	351
Owego Town #2	2.8	504	2.3	414

*Required acres/MGD assumed to be 180 acres/MGD including 20 percent buffer zone.

Beneficial impacts upon terrestrial ecology could include: (1) phosphorus and nitrogen from the wastewater effluent may enrich nutrient deficient soils resulting in higher crop yields; (2) coliforms, a problem in receiving waters, would die-off in the soil matrix; and (3) suspended solids, BOD and NOD would add to the organic matter of the soil. On the other hand, adverse impacts of spray irrigation of wastewater effluent could include: (1) a build-up of heavy metal ions in the soil or within crops; (2) clogging of soil spaces creating odors and health problems; (3) surface runoff to local streams thereby contributing to erosion of land surfaces and pollution of surface waters; and (4) changes in vegetative cover and removal of some wildlife habitats.

Social.

The large total land requirements, in areas of suitable soils and slopes, for spray application of wastewaters in Alternative 8A could require the displacement of approximately 80 families, particularly in Site 2 in the Towns of Binghamton and Conklin, and this would represent a significant adverse social impact. The reduced total land requirements for spray application areas in Alternative 8B would probably not necessitate the relocation of any families.

Commitments of large areas of land in both alternatives 8A and 8B within the Towns of Binghamton and Conklin to wastewater management by spray irrigation may not conform to local land use and development patterns. On a larger scale, the general physical wastewater management schemes involved in alternatives 8A and 8B do conform to desired development patterns as expressed in the Southern Tier East Region General Plan.

Dust, noise and traffic inconveniences would temporarily adversely affect the population adjoining the 2.5 miles of regional interceptors and 5.8 miles of effluent pipelines, in both alternatives 8A and 8B, which would be constructed along existing roadways.

During construction of the regional interceptors, the outfall from the Chenango Valley STP, and the effluent pipelines to the spray irrigation areas, four recreational areas would be temporarily disturbed in both alternatives.

In both alternatives 8A and 8B the elimination of septic system overflows and malfunctions in the Chenango Valley area would not only reduce potential health hazards but would also improve the recreational potentials of the areas rivers during non-storm periods. The occurrence of combined sewer overflows during heavy rains would, however, continue to adversely affect both public health and the recreational potentials of the area's waterways.

A possible adverse affect to public health from spray application of wastewater is the dispersal of viruses via aerosols. Therefore, to minimize any such adverse affects, spray irrigated areas in alternatives 8A and 8B should be at a minimum distance of 500 feet from any areas of human activity, such as, homes, roads, businesses, and schools. Another possible adverse impact to public health may be created if ponding and stagnation of soil surfaces occurring during spray irrigation. Application rates of sewage effluent should be based on soil and crop characteristics to prevent such ponding. Finally, surface runoff of spray irrigated waters may pollute streams, impoundments or underground waters.

Economic.

The present worth of all expenditures, which reflect the total costs of alternatives 8A and 8B would be 71 million dollars and 55 million dollars, respectively. Local costs for alternatives 8A and 8B, as reflected by the present worth of local expenditures, would be 40.8 million dollars and 32.3 million dollars, respectively.

The minimum annual per family payment for Alternative 8A, of $15.28, would occur in 1982 and the minimum annual per family payment for Alternative 8B, of $14.96 would occur in the year 1984. The maximum annual per family payment for Alternative 8A of $25.21 would occur in 1985 and the minimum annual payment for Alternative 8B of $18.90 would also occur in 1985.

Alternative 9

Alternative 9 would utilize a treatment scheme of five sewage treatment plants including a Chenango Valley STP, the B-JC STP, the Endicott STP, the Owego Town #1 STP and the Owego Town #2 STP. All sewage treatment plants would have secondary waste treatment and the B-JC STP would also utilize nitrification. In addition all sewerage systems would utilize nonstructural measures for flow reductions.

Ecological.

The minimum instream dissolved oxygen concentrated achieved by Alternative 9 would be 5.5 mg/l which would represent a beneficial impact to aquatic ecology when compared to the Baseline Condition Alternative.

The total nutrient inputs of nitrogen and phosphorous from STP's in Alternative 9 would be 7,540 lb/day and 1,905 lb/day, respectively. These loadings would be greater than those achieved by the Baseline due to the addition of Chenango Valley sewage flows. However, the resulting effects upon nuisance aquatic algal growths would probably be minimal since other environmental factors could act as the limiting factors to growths of aquatic vegetation.

The resulting maximum ammonia concentration of 1.08 mg/l which would occur under Alternative 9 would meet NYSDEC standards for NH_3 concentrations and would represent a beneficial impact in comparison to the no action alternative.

the 3.8 miles. In addition, native terrestrial wildlife and vegetation along the path of such interceptors would be eliminated during construction.

Social.

Possible induced development patterns associated with the location of treatment facilities and interceptors would conform to desired development patterns.

Dust, noise and traffic interruptions would temporarily adversely affect the population adjoining the 2.5 miles of interceptors which would be constructed along the existing roadways.

Elimination of septic system overflows and malfunctions in the Chenango Valley area would, under Alternative 9, not only reduce potential health hazards but would also improve the recreational potentials of the area's rivers during non-storm periods. The occurrence of combined sewer overflows during heavy rains would continue to adversely affect both public health and the recreational potentials of the rivers.

During construction of interceptor I, IV and the outfall from the Chenango Valley STP, three recreational areas, including the Route 81 River Park would be temporarily disturbed. Also, improper operation of the Chenango Valley STP may adversely affect (via odors) the Route 81 River Park.

Economic.

The total costs of Alternative 9, as reflected by the present worth of all expenditures would be 41.6 million dollars. Local costs, as reflected by the present worth of local expenditures, would be 27.4 million dollars.

The minimum annual per family payment for Alternative 9 of $13.76 would occur in the year 2026, while the maximum annual per family payment of $15.47 would occur in 1977.

Alternative 10

Wastewater management Alternative 10 utilized five sewage treatment plants including a Chenango Valley STP, the Binghamton Johnson City STP, the Endicott STP, the Owego Town

#1 STP and the Owego Town #2 STP. All sewage treatment facilities would have nitrification, and infiltration control measures would be applied to the Binghamton-Johnson City sewerage system.

Ecological.

The minimum instream DO achieved in Alternative 10 would be 6.1 mg/l which would represent a beneficial impact to aquatic ecology in comparison to the Baseline.

Total nitrogen loadings from STP's under Alternative 10 would be 7,540 lb/day and total phosphorus loadings would be 1,905 lb/day. These nutrient loadings to receiving waters would be greater than those under the Baseline Condition Alternative due to Chenango Valley flows, however, the degree of possible adverse impacts, in the form of nuisance aquatic vegetation, would be low since other environmental factors also act to limit nuisance aquatic vegetation.

The instream concentration of ammonia (NH_3) of 0.41 mg/l achieved under Alternative 10 would conform to the NYSDEC standard of 2.0 mg/l for NH_3 and would represent a beneficial impact in comparison to the Baseline Condition Alternative.

During construction of regional interceptors I and IV temporary adverse impacts, such as increased erosion and sedimentation in surface waters would occur during the two major stream crossings.

The construction of a new Chenango Valley STP would require the utilization of approximately 5 acres of land along Route 81 and Route 11-12 near the Broome Community College. The proposed site for the new STP was formerly a part of the flood plain of the Chenango River prior to the rechannelization of the River. Utilization of the proposed site would eliminate the primary (new field) vegetation and associated wildlife which occurs at the site. Such an elimination would represent an adverse impact to terrestrial ecology when compared to the Baseline which does not include a new Chenango Valley STP.

Possible directon of development along the 3.8 miles of regional interceptors which do not follow existing roadways may adversely affect the native terrestrial ecosystems occurring in these unbroken areas. In addition, native terrestrial vegetation within the interceptor pathways would be eliminated.

Social.

Possible induced development patterns associated with the location of treatment facilities and interceptors would conform to the desired development patterns according to the Southern Tier East Region General Plan.

Dust, noise and traffic inconveniences would temporarily adversely affect the population adjoining the 2.5 miles of interceptors which would be constructed along existing roadways.

Elimination of septic system overflows and malfunctions in the Chenango Valley area would, under Alternative 10, not only reduce potential health hazards but would also improve the recreational potentials of the area's rivers during non-storm periods. The occurrence of combined sewer overflows during heavy rains would, however, continue to adversely affect both public health and the recreational potential of the rivers.

During construction of the regional interceptors and outfall of the Chenango Valley STP, three recreational areas, including the Route 81 River Park would be temporarily disturbed. Also, improper operation of the Chenango Valley STP may adversely affect, via odors, the Route 81 River Park.

Economic.

The total costs of Alternative 10, as reflected by the present worth of all expenditures would be 59 million dollars. The local costs, as reflected by the present worth of local expenditures would be 35.5 million dollars.

The minimum annual per family payment of $15.28 for Alternative 10 would occur in 1982, while the maximum annual per family payment of $21.74 would occur in 1983.

<u>Alternative 11</u>

Alternative 11 would include five sewage treatment facilities: a Chenango Valley STP, the Binghamton-Johnson City STP, the Endicott STP, the Owego Town #1 STP and the Owego Town #2 STP. Nonstructural measures to reduce wastewater flows would be utilized in all service areas and infiltration control measures would be applied to the Binghamton-Johnson City sewerage system.

Ecological.

The minimum instream dissolved oxygen achieved under Alternative 11 would be 5.1 mg/l which would represent a beneficial impact to aquatic ecology in comparison to the no action alternative.

Total nitrogen loadings from the STP's in Alternative 11 would be 7,540 lb/day and total phosphorus loadings would be 1,905 lb/day. These nutrient loadings to receiving waters would be greater than those under the Baseline due to the addition of a chenango Valley STP. However, the degree of possible adverse impacts, in the form of nuisance growths of aquatic vegetation, would be small since other environmental factors also act to limit nuisance aquatic growths.

The instream ammonia concentration of 1.67 mg/l achieved under Alternative 11 would conform to the NYSDEC standard for NH_3 and would represent a beneficial impact in comparison to the Baseline Condition Alternative.

During construction of regional interceptors (I and IV) temporary adverse impacts, such as increased erosion and sedimentation within surface waters, would occur during the two major stream crossings.

The construction of a new Chenango Valley STP would require the utilization of approximately 5 acres of land along Route 81 and Route 11-12 near the Broome Community College. The proposed site for the new STP was formerly a floodplain area prior to the rechannelization of the Chenango River. Utilization of the proposed site would eliminate the primary (new field) vegetation and associated wildlife which presently occupy the site. Such an elimination would represent an adverse impact to terrestrial ecosystems when compared to the Baseline Condition Alternative which does not include a new Chenango Valley STP.

Possible direction of development along the 3.8 miles of regional interceptors which do not follow existing roadways may adversely affect the native terrestrial ecosystems occurring in these unbroken areas. Likewise, destruction of the native vegetation within the path of such interceptors would also occur.

Social.

Possible induced development patterns associated with the location of municipal sewage treatment facilities in

Alternative 11 would conform to desired development patterns according to the Southern Tier East Region General Plan.

Dust, noise and traffic inconvenience would temporarily adversely affect the population along the 2.5 miles of interceptors which would be constructed along existing roadways.

Elimination of septic system overflows and malfunctions in the Chenango Valley area would, under Alternative 11, not only reduce potential health hazards but would also improve the recreational potentials of the area's rivers during non-storm periods. The occurrence of combined sewer overflows during heavy rains would, however, continue to adversely affect both public health and the recreational potentials of the river system.

During construction of the regional interceptors and outfall from the Chenango Valley facility, three recreational areas, including the Route 81 River Park would be temporarily disturbed. Also, improper operation of the Chenango Valley STP may adversely affect, via odors, the Route 81 River Park.

Economic.

The present worth of total expenditures, which reflect the total costs of Alternative 11, would be 40 million dollars. Local costs, reflected by the presnet worth of local expenditures would be 27.4 million dollars.

The minimum annual per family payment of $12.64 for Alternative 11 would occur in the year 2026. The maximum annual per family payment of $15.50 would occur in 1977.

<u>Alternative 12A</u>

Wastewater management Alternative 12A utilized a five plant regionalization scheme including the Binghamton-Johnson City STP, the Endicott STP, the Owego Town #1 STP, the Owego Town #2 STP and the Owego Village STP. All sewage treatment facilities would utilize secondary biological waste treatment processes.

Ecology.

The minimum instream dissolved oxygen concentration achieved by Alternative 12A would be 4.4 mg/l, and this would represent a moderate beneficial impact over the no action alternative DO of 3.5 mg/l.

Total nitrogen loadings and phosphorus loadings from the five sewage treatment facilities to the Susquehanna River would be 7,540 lb/day and 1,905 lb/day, respectively. These nutrient inputs to receiving waters would be greater than those for the Baseline Condition Alternative due to the inclusion of the wastewater flows from the Chenango Valley area. The degree of possible impacts from such nutrient inputs, in the form of stimulation of nuisance growths of aquatic vegetation, would probably be low since other enviornmental factors also act to limit nuisance aquatic growths.

The maximum instream ammonia concentration of 2.02 mg/l achieved by Alternative 12A would be about the same as the Baseline Alternative and the NYSDEC standard and would represent no significant impact (although violation of the 2.0 mg/l standard may occur during extreme conditions).

During construction of regional interceptors III and IV, temporary adverse impacts to aquatic ecosystems, such as increased erosion and sedimentation, would occur during the two major stream crossings.

Possible direction of development along the 4.2 miles of regional interceptors which do not follow existing roadways may adversely affect the native terrestrial ecosystems occurring in these unbroken areas. In addition, native terrestrial vegetation and associated wildlife within the interceptor pathways would be eliminated.

Social.

Possible induced development patterns associated with the location of treatment facilities and regional interceptors would, in Alternative 12A, conform to the desired development patterns expressed in the Southern Tier East Region General Plan.

Dust, noise and traffic inconveniences would temporarily adversely affect the population adjoining the 2.2 miles of interceptors which would be constructed along existing roadways.

Elimination of septic system overflows and malfunctions in the Chenango Valley area would not only reduce potential health hazards but would also improve the recreational potentials of the area's rivers during non-storm periods. The occurrence, however, of combined sewer overflows during heavy rains would continue to adversely affect both public health and the recreational potential of the rivers.

During construction of regional interceptors III and IV, three recreational areas including the Route 81 River Park would be temporarily disturbed.

Economic.

Total costs of Alternative 12A, as reflected in the present worth of total expenditures, would be 41.6 million dollars. Local costs, as reflected by the present worth of local expenditures, would be 27.6 million dollars.

The minimum annual per family payment of $13.50 for Alternative 12A would occur in the year 2026. The maximum annual per family payment of $15.32 would occur in the year 1983.

Alternative 12B

Wastewater management Alternative 12B utilized six sewage treatment facilities including a Chenango Valley STP, the Binghamton-Johnson City STP, the Endicott STP, the Owego Town #1 STP, the Owego Town #2 STP and the Owego Village STP. All six treatment facilities would have biological secondary waste treatment.

Ecological.

A minimum instream dissolved oxygen concentration of 4.7 mg/l would be achieved by Alternative 12B. This would represent a moderate beneficial impact over the Baseline DO of 3.5 mg/l.

Total nutrient loadings of nitrogen and phosphorus from the six treatment facilities in Alternative 12B would be 7,540 lb/day and 1,905 lb/day, respectively. These nutrient loadings would be greater than those found under the Baseline Condition Alternative due to the addition of a new Chenango Valley STP. However, the degree of possible impacts, such as resultant growths of nuisance aquatic vegetation, would be uncertain since other environmental factors also may act to limit nuisance growths.

The instream concentration of ammonia of 1.67 mg/l achieved under Alternative 12B would meet the NYSDEC ammonia standard and would represent a beneficial impact in comparison to the Baseline Condition Alternative.

During construction of regional Interceptor IV, temporary adverse impacts to stream ecology, such as increased erosion and sedimentation, would occur during the two major stream crossings.

The construction of a new Chenango Valley STP would require the utilization of approximately 5 acres of land along Route 81 and Route 11-12 near the Broome Community College. The proposed site for the new STP was formerly a floodplain area prior to the rechannelization of the Chenango River. Utilization of the proposed site would eliminate the primary (new field) vegetation and associated wildlife which occurs at the site. Such an elimination would represent a minor adverse impact to terrestrial ecosystems when compared to the Baseline Condition Alternative which does not include a new Chenango Valley STP.

Possible direction of development along the 2.8 miles of regional interceptors which do not follow existing roadways may adversely affect the native terrestrial ecosystems occurring in these unbroken areas. In addition, destruction of native vegetation and associated wildlife within the interceptor pathways would also occur.

Social.

Possible induced development patterns associated with the location of municipal sewage treatment services in Alternative 12B would conform to desired development patterns as expressed in the Southern Tier Region General Plan.

Dust, noise and traffic inconveniences would temporarily adversely affect the population along the 1.3 miles of interceptors which would be constructed along existing roadways.

Elimination of septic system overflows and malfunctions in the Chenango Valley area would, in Alternative 12B, not only reduce potential health hazards but would also improve the recreational potentials of the area's rivers during non-storm periods. The occurrence of combined sewer overflows during heavy rains would, however, continue to adversely affect both public health and the recreational potentials of the river system.

During construction of the regional Interceptor IV and the outfall from the Chenango Valley STP, two recreational facilities including the Route 81 River Park would be temporarily disturbed. Also, improper operation of the Chenango Valley STP may adversely affect, via odors, the Route 81 River Park.

Economic.

Total costs of Alternative 12B, as reflected by the present worth of all expenditures would be 45 million dollars. Local costs, as reflected by the present worth of local expenditures, would be 29.4 million dollars.

The minimum annual per family payment of $14.40 would occur in the year 2026. The maximum annual per family payment of $16.73 would occur in the year 1992.

Alternative 13

Alternative 13 utilized a scheme of five sewage treatment facilities including a Chenango Valley STP, the Binghamton-Johnson City STP, the Endicott STP, the Owego Town #1 STP and the Owego Town #2 STP. All treatment plants would have secondary biological waste treatment, and in addition, the B-JC STP would have nitrification. Infiltration control measures would be applied to the B-JC sewerage system.

Ecological.

The minimum instream dissolved oxygen concentration of 5.6 mg/l achieved by Alternative 13 would constitute a beneficial impact in comparison to the Baseline Condition Alternative.

The total amount of nitrogen and phosphorus being discharged to surface waters would be 7,540 lb/day and 1,905 lb/day, respectively. These nutrient loadings would be greater than those found in the Baseline due to the addition of a new Chenango Valley treatment facility. However, the degree of possible impacts, such as resultant nuisance growths of aquatic vegetation, would be low since other environmental factors also may act to limit nuisance growths.

The instream concentration of ammonia of 1.08 mg/l achieved by Alternative 13 would meet the NYSDEC ammonia standard and would represent a beneficial impact when compared to the Baseline.

During construction of regional interceptors I and IV temporary adverse impacts to stream ecology, such as increased erosion and sedimentation, would occur during the two major stream crossings.

The construction of a new Chenango Valley treatment facility would require utilizing approximately 5 acres of land along Route 81 and Route 11-12 near the Broome Community College. The propsoed site for the new STP was once a floodplain area prior to the rechannelization of the Chenango River. Utilization of the propsoed site would eliminate the primary (new field) vegetation and associated wildlife which presently occupies the site. Such an elimination would represent a minor adverse impact to terrestrial ecosystems when compared to the Baseline Condition Alternative which does not include a new Chenango Valley STP.

Possible direction of development along the 3.8 miles of regional interceptors which does not follow existing roadways may adversely affect the native terrestrial ecosystems occurring in these unbroken areas. In addition, destruction of native vegetation within the interceptor pathways would also occur.

Social.

Possible induced development patterns associated with the location of municipal sewage treatment services in Alternative 13 would conform to desired development patterns as expressed in the Southern Tier East Region General Plan.

Dust, noise and traffic inconveniences would temporarily adversely affect the population along the 1.3 miles of interceptors which would be constructed along existing roadways.

Elimination of septic system overflows and malfunctions in the Chenango Valley area would not only reduce potential health hazards but would also improve the recreational potentials of the area's rivers during non-storm periods. The occurrences of combined sewer overflows during heavy rains would, however, continue to adversely affect both public health and the recreational potentials of the river system.

During construction of the regional interceptors (I and IV) and the outfall from the Chenango Valley STP, three recreational areas, including the Route 81 River Park, would be temporarily disturbed. Also, improper operation of the Chenango Valley STP may adversely affect, via odors, the Route 81 River Park.

Economic.

Total costs, as reflected by the present worth of all expenditures in Alternative 13, would be 45.4 million dollars. Local costs as reflected by the present worth of local expenditures, would be 29.3 million dollars.

The minimum annual per family payment of $14.94 for Alternative 13 would occur in the year 2026. The maximum annual per family payment of $16.00 would occur in the year 1983.

General

Table III-13 summarizes the impact assessment for the wastewater management alternatives considered in Stage II-2. Each of the three major impact categories of ecological, social, and economic is further broken down into subcategories for each alternative.

TA

IMPACT ASSESSME
STAGE II-

Impact Indicators	1 1977 Baseline Condition	2 3 STP's Nitrification at B-JC	3A 4 STP's (3+1) Nitrification at B-JC	3B 4 STP's (2+2) Nitrification at B-JC	4A 5 STP's (3+2) Nitrification at B-JC	4B 5 STP's (2+3) Nitrification at B-JC	5 6 STP's Nitrification at B-JC	6 5 STP's BIOL. AWT I-Control at B-JC
Ecological								
1. DO mg/l	3.5	5.4	5.4	5.4	5.4	5.4	5.4	6.7
2. Total N (lb/day)	6830	7540	7540	7540	7540	7540	7540	625
3. Total P (lb/day)	1740	1880	1880	1905	1905	1905	1905	555
4. Ammonia mg/l	2.06	1.14	1.12	1.14	1.12	1.14	1.12	0.18
5. No. major stream crossings	1	5	5	2	2	2	2	2
6. Acreage for new STP	0	0	5	0	5	0	5	5
7. Miles of new regional interceptor not along existing roadways	4.0	11.2	9.8	9.2	7.8	8.2	6.8	7.8
8. Other acreage used for waste-water treatment (spray irrigation)	0	0	0	0	0	0	0	0
9. Other miles of pipeline (to spray irrigation sites) not along existing roadways	0	0	0	0	0	0	0	0
Social								
1. No. families displaced	0	0	0	0	0	0	0	0
2. Result in desired development patterns	May or May not	No	No	Yes	Yes	Yes	Yes	Yes
3. Miles of new regional interceptors along existing roadways	4.5	10.2	9.3	8.0	7.0	6.7	5.8	7.0
4. Miles of other pipelines along existing roadways	0	0	0	0	0	0	0	0
5. No. recreational places disturbed	0	5	4	4	3	3	2	3
6. Improve recreational potential of Rivers during non-storm periods	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes Yes
7. Reduce potential health hazard	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
8. No. historic sites distrubed	0	0	0	0	0	0	0	0
Economic								
1. Present worth of all expenditures ($ Millions)	33	48.6	52	46.6	49	46.6	49	103
2. Present worth of local expenditures ($ Millions)	24.0	29.7	31.4	29.5	32.0	30.1	31.8	60.1
3. Minimum per family annual payment ($)-Year	12.44-2026	14.35-2026	15.13-2026	14.27-1982	15.45-2025	14.61-1982	15.59-2026	15.28-1982
4. Maximum per family annual payment ($)-Year	14.95-1977	16.63-1991	17.76-1983	16.74-1983	18.35-1983	17.08-1983	17.93-1983	42.99-1985

(s) - summer, (w) - winter

*7540 (W) – Alternative 8A, 7540 (W) – Alternative 8B
**1905 (W) – Alternative 8A, 1905 (W) – Alternative 8B

TABLE III-13

IMPACT ASSESSMENT SUMMARY, YEAR 2020
STAGE II-2 ALTERNATIVES

s tion C	6 5 STP's BIOL. AWT I-Control at B-JC	7 5 STP's P/C AWT I-Control at B-JC	8A 5 STP's Applied to Land	8B 5 STP's Applied to Land, Flow Reduced	9 5 STP's Non- Structural & Nitrification at B-JC Measures	10 5 STP's Nitrification at all STP's	11 5 STP's Non- Structural + I-Control	12A 5 STP's (2+3) All Secondary	12B 6 STP's All Secondary	13 5 STP's Nitrification + I-Control at B-JC
	6.7	6.7	6.3	6.3	5.5	6.1	5.1	4.4	4.7	5.6
	625	625	2970(S)*	2970(S)*	7540	7540	7540	7540	7540	7540
	555	125	765(S)**	765(S)**	1905	1905	1905	1905	1905	1905
	0.18	0.18	0.87	0.87	1.08	0.41	1.67	2.02	1.67	1.08
	2	2	5	5	2	2	2	2	2	2
	5	5	5	5	5	5	5	0	5	5
	7.8	7.8	7.8	7.8	7.8	7.8	7.8	8.2	6.8	7.8
	0	0	5496	3825	0	0	0	0	0	0
	0	0	1.5	1.5	0	0	0	0	0	0
	0	0	80	0	0	0	0	0	0	0
	Yes	Yes	May or May not	May or May not	Yes	Yes	Yes	Yes	Yes	Yes
	7.0	7.0	7.0	7.0	7.0	7.0	7.0	6.7	5.8	7.0
	0	0	5.8	5.8	0	0	0	0	0	0
	3	3	4	4	3	3	3	3	2	3
	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes	Yes	Yes
	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	0	0	0	0	0	0	0	0	0	0
	103	104	71	55	41.6	59	40	41.6	45	45.4
	60.1	63.5	40.8	32.3	27.4	35.5	27.4	27.6	29.4	29.3
	15.28-1982	12.38-1982	15.28-1982	14.96-1984	13.76-2026	15.28-1982	12.64-2026	13.50-2026	14.40-2026	14.94-2026
	42.99-1985	50.91-1985	25.21-1985	18.90-1985	15.47-1977	21.74-1983	15.50-1977	15.32-1983	16.73-1992	16.00-1983

SLUDGE MANAGEMENT

SLUDGE QUANTITIES

In general, sludge quantities for the year 2020 were determined on a lb/cap/day basis. This figure was obtained from either existing conditions or on typical literature design values.

The amount of sludge produced would also be a function of the degree of treatment. The amounts are shown by major treatment process and by treatment plant in Table III-14. Sludge quantities generated by the nitrification process or the land application processes were assumed to be approximated by the tabulated quanity for sludge generated by secondary treatment.

ALTERNATIVES

Alternatives for sludge management were formulated separately in Stage II and applied to each alternative plan in Stage III to form complete plans.

The alternatives considered for analysis in Stage II were incineration, land application of liquid sludge, and landfill. Figure III-12 depicts the three processes that were considered as alternatives for sludge handling and disposal.

Incineration

Alternative A, incineration, would involve thickening of the sludge by a gravity thickener, dewatering by vacuum filtration, incineration in a multiple hearth incinerator, and hauling the ash by truck to a landfill for disposal.

Because the incineration process and the related costs, depend to a high degree on the percent moisture content of the sludge, it was necessary to include both thickening and dewatering in the flow diagram. The combination of these two processes would reduce the moisture content of the sludge from approximately 99 percent to about 75 percent.

Since an inert residue or ash would be produced in the incineration process, it must be disposed of in a landfill. Because incineration involves evaporation of the water in the

TABLE III-14

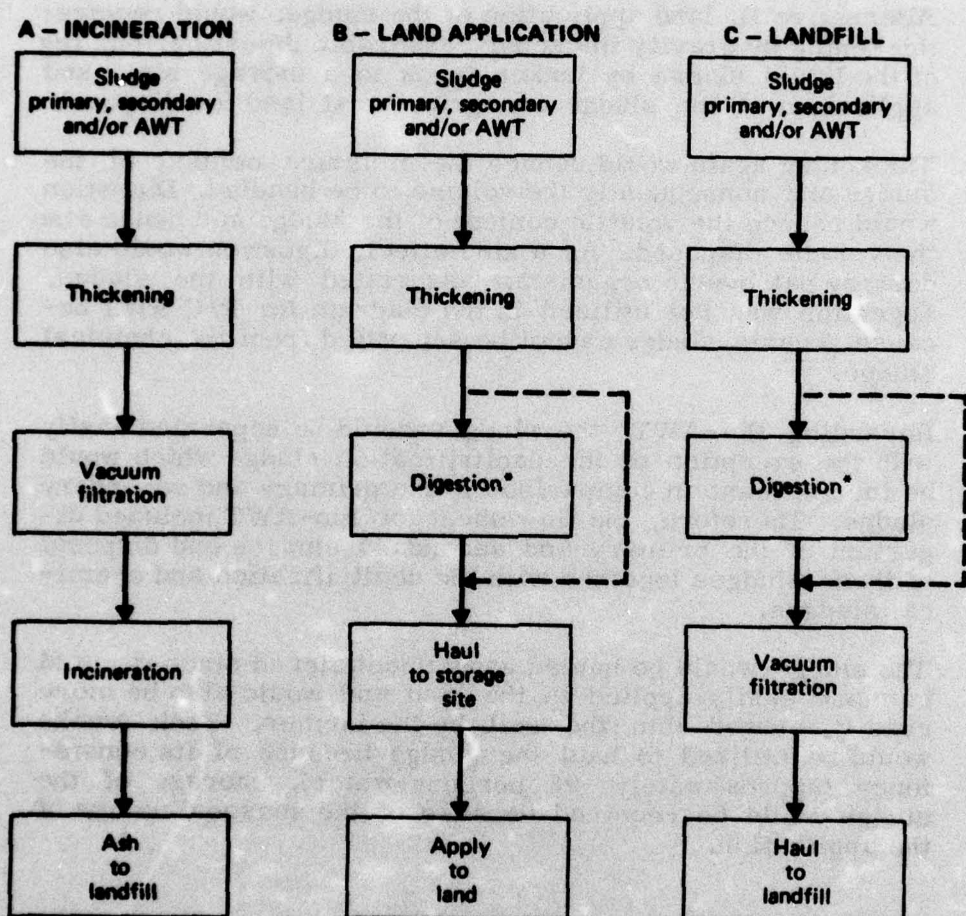
SLUDGE QUANTITIES FOR YEAR 2020

TREATMENT PLANT	TYPE OF TREATMENT SECONDARY*	BIO-AWT	P/C-AWT**
Bing. – J.C.			
digested (#/d)	35,400	50,100	–
undigested (#/d)	51,300	68,600	75,600
Endicott			
digested (#/d)	5,000	11,800	–
undigested (#/d)	8,400	16,000	14,900
E. Owego			
digested (#/d)	2,800	4,900	–
undigested (#/d)	4,800	7,100	5,800
W. Owego & O.V.			
digested (#/d)	2,000	3,400	–
undigested (#/d)	3,400	5,000	4,100
Chenango Valley			
digested (#/d)	3,200	5,400	–
undigested (#/d)	5,300	7,900	6,400
Total			
digested (#/d)	48,400	75,600	–
undigested (#/d)	73,200	104,600	106,800

*Sludge quantities for secondary plus nitrification and land treatment processes assumed to be approximated by sludge quantities listed for secondary treatment.

**Digestion process is not used for physical/chemical sludges.

SLUDGE MANAGEMENT ALTERNATIVES



**Not used for denitrified or physical-chemical sludges*

FIGURE III-12

sludge, the residue would contain no moisture and hence the volume to be disposed of would be relatively minor in comparison to the non-incinerated sludge.

Land Application

Alternative B, land application of the sludge, would require: thickening by gravity thickener, anaerobic digestion, hauling of the liquid sludge by tanker truck to a storage site, and application of the sludge on agricultural land for disposal.

Thickening again would reduce the moisture content of the sludge and consequently the volume to be handled. Digestion would reduce the volatile content of the sludge and hence also the volume disposed. As a side effect, digestion would also destroy pathogenic organisms associated with the sludge. Digestion was not utilized in the diagram for P/C AWT because organic sludge cannot be separated from the chemical sludge.

Regarding Bio-AWT, the sludges could be separated easily with the exception of the denitrification sludge which would be insignificant in comparison to the primary and secondary sludge. Therefore, the flow sheet for Bio-AWT included digestion of the primary and secondary sludges and disposal of these sludges together with the denitrification and chemical sludges.

The sludge would be hauled away undewatered since it would be more easily applied to the land and would also be more readily plowed into the soil by the farmer. Tank trucks would be utilized to haul the sludge because of its consistency (approximately 95 percent water). Storage of the sludge would be required because of the seasonal nature of the application.

Landfill

Alternative C, landfill, included: thickening by gravity thickener, anaerobic digestion, dewatering by vacuum filtration and hauling of the sludge by dump truck to a landfill site.

The same methods would be utilized as in land application regarding the inclusion of thickening and digestion. Vacuum filtration would then be used as an additional step to reduce the moisture content to 75 percent, thus reducing the volume to be handled. The dewatered sludge would then be hauled by dump truck to a landfill site.

IMPACT ASSESSMENT AND EVALUATION

Tables III-15 through III-17 present the quantifiable impacts associated with each of the sludge management alternatives broken down by treatment alternative. The cost of the alternatives by treatment process are shown in Table III-18.

Incineration would have moderate adverse impacts to air quality and resource commitments and highest cost with no offsetting beneficial impact other than disposing of the sludge. Land application would be the least costly alternative and would have a moderate adverse impact due to the increased truck traffic. However, it would have an offsetting beneficial impact in the resource production field. This would be due to the fact that nutrients would be returned to the land in a useable manner. Landfill falls between the other two alternatives as far as costs go and would have a moderate adverse impact on land use, because of the acreage committed for the landfill site. It would have no offsetting beneficial impact, except to manage the sludge in an acceptable manner.

On an impact evaluation basis, land application appeared promising for a sludge handling and disposal method regardless of degree of treatment. A few treatment plants are presently using land disposal. Land application would also be the chosen method derived from a cost-effective analysis (see Table III-18). The farm land for sludge disposal is readily available (170,000 acres of agricultural land in Broome and Tioga Counties) and land application would in turn benefit the farmer (nutrients and organic content present in the sludge). However, the above observations were made with certain reservations.

There would exist the potential for heavy metal build-up in the soils and/or toxicity effects of the metals in plants. However, there are city and village ordinances which when enforced could eliminate the majority of heavy metals from the wastewater. Also possible would be nitrate pollution of groundwater as a result of nitrification and subsequent leaching. These possibilities could be mitigated by selecting an appropriate application rate and strict monitoring at the site. Strict monitoring of the soil and crops for heavy metal buildup would determine what both short term and long term effects areoccurring, if any, within the soil and crops.

A potential odor problem would exist at the storage site, especially regarding the P/C AWT treatment alternative (undigested). This impact could be mitigated, in part, by

TABLE III-15

SECONDARY TREATMENT SLUDGE MANAGEMENT IMPACTS (Year 2020)

IMPACT	INCINERATION	LAND APPLICATION	LANDFILL
1) Use of land, acres (50 yr period)	14 (minor adverse)	7 (minor adverse)	226 (moderate adverse)
2) Air impacts:			
Particulate Emissions (1 lbs/yr)	17,425 (moderate adverse)	230 (minor adverse)	190 (minor adverse)
Hg (lbs/yr)	.13 (minor adverse)	–	–
3) Resource Consumption:			
Fuel (gallon/yr)	24,000 (minor adverse)	14,700 (minor adverse)	12,100 (minor adverse)
Power (Kwh/yr)	1.9 × 10^6 (moderate adverse)	–	1.12 × 10^6 (minor adverse)
Dewatering Chemicals			
Lime (tons/yr)	1,067 (minor adverse)		830 (minor adverse)
$FeCl_3$ (tons/yr)	266 (minor adverse)		276 (minor adverse)
Lime for fertilizer & pH control (tons/yr)		1,100 (minor adverse)	
Nutrients (tons/year)			
Nitrogen	–	185 (moderate beneficial)	–
Phosphorus	–	90 (moderate beneficial)	–
Potassium	–	18 (minor beneficial)	–
4) Resource Production			
Ash (tons/yr)	4,700 (minor adverse)	–	–
Digester gas (Cf/yr)	–	9.45 × 10^7 (none)	9.45 × 10^7 (none)
5) Noise			
# truck trips/yr	467 (minor adverse)	7,300 (moderate adverse)	3,536 (minor adverse)
6) Return of scrubb water on STP (MGD)	1.2 (minor adverse)		

TABLE III-16

BIO-AWT SLUDGE MANAGEMENT IMPACTS (Year 2020)

IMPACTS	INCINERATION	LAND APPLICATION	LANDFILL
1) Use of land (acres) (50 yr. period)	27 (minor adverse)	16 (minor adverse)	360 (moderate adverse)
2) Air Impacts			
Particulate Emissions (lbs/yr)	24,850 (moderate adverse)	480 (minor adverse)	275 (minor adverse)
Hg (lbs/yr)	.19 (minor adverse)	–	–
3) Resource Consumption			
Fuel (gal/yr)	330,000 (moderate adverse)	184,000 (moderate adverse)	18,000 (minor adverse)
Power (Kwh/yr)	3.0×10^6 (minor adverse)	–	1.63×10^6 (minor adverse)
Dewatering chemicals			
Lime (tons/yr)	1,527 (minor adverse)	–	1.241 (minor adverse)
$FeCl_3$ (tons/yr)	381 (minor adverse)		414 (minor adverse)
Lime for fertilizer and pH control		1730 (minor adverse)	
4) Resource Production			
Ash (tons/yr)	8,960 (minor adverse)	–	–
Digester gas	–	9.45×10^7 (none)	9.45×10^7 (none)
Nutrients (tons/yr)			
Nitrogen		240 (moderate beneficial)	–
Phosphorus		180 (moderate beneficial)	
Potassium		22 (moderate beneficial	
5) Noise			
# truck trips/yr	895 (minor adverse)	15,300 (moderate adverse)	5,688 (minor adverse)
6) Return of Scrubber Water on STP (MGD)	1.7 (minor adverse)	–	–

TABLE III-17

P/C-AWT SLUDGE MANAGEMENT IMPACTS (Year 2020)

IMPACT	INCINERATION	LAND APPLICATION	LAND FILL
1) Use of land (acres) (50 yr. period)	30 (minor adverse)	16 (minor adverse)	425 (moderate adverse)
2) Air Impacts			
particulate emission (lb/yr)	25,350 (moderate adverse)	485 (minor adverse)	295 (minor adverse)
Hg (lbs/yr)	.19 (minor adverse)	–	–
3) Resource Consumption			
Fuel (gal/yr)	670,000 (moderate adverse)	31,000 (minor adverse)	18,600 (minor adverse)
Power (Kwh/yr)	3.1×10^6 (minor adverse)	–	2.15×10^6 (minor adverse)
Dewatering Chemicals			
Lime (tons/yr)	1,558 (minor adverse)	–	1,558 (minor adverse)
$FeCl_3$ (tons/yr)	388 (minor adverse)		388 (minor adverse)
Lime for fertilizer and pH control		1,765 (minor adverse)	
4) Resource Production			
Ash (tons/yr)	10,000 (minor adverse)	–	–
Nutrients (tons/yr)			
Nitrogen	–	240 (moderate beneficial)	–
Phosphorus	–	180 (moderate beneficial)	–
Potassium	–	22 (minor beneficial)	–
5) Noise			
# truck trips/yr	1,003 (minor adverse)	15,500 (moderate adverse)	5,652 (minor adverse)
6) Return of scrubber water On STP (MGD)	1.8 MGD (minor adverse)		

TABLE III-18

SLUDGE QUANTITIES AND AVERAGE ANNUAL COSTS*
SLUDGE MANAGEMENT ALTERNATIVES

Treatment Process	Undigested Sludge Tons/Day (Year 2020)	ALTERNATIVE A Incineration $/year	B Land Application $/year	C Landfill $/year
Secondary	36.6	1,250,000	450,000	800,000
Biological AWT	52.3	1,620,000	600,000	1,200,000
Physical/ Chemical AWT	53.4	1,750,000	710,000	1,480,000

* 50 year at 6 1/8% interest, includes replacement at 25 years.

site location. The noise associated with the trucks utilized to transport the sludge could be alleviated by choosing routes that avoid residential areas or congested traffic sites.

In summation, potential impacts do, in fact, exist for land application. However, these impacts could probably be avoided or alleviated, and if problems do arise which cannot be solved, another method of sludge handling could be utilized. The exception to the above statements was the Endicott STP which was known to exhibit a heavy metals problem. Since work was being conducted on controlling this problem at the treatment plant and within the sewer system, it was assumed that the problem would be controlled in the future.

Therefore, because of the lower cost involved and the beneficial impacts associated with this method of sludge handling, it was recommended that land application be utilized as the sludge handling and disposal method for Broome and Tioga Counties.

STORMWATER MANAGEMENT

INTRODUCTION

Stormwater runoff is the water draining from the surface of an area during and immediately after a period of rain. Storm runoff is handled by either of two types of sewage systems-separate or combined. In a separate sewer system, storm runoff is conveyed by a system of pipes designed only for that purpose. Discharge is generally to a stream or river with little or no treatment of the wastes which the water has picked up from streets and roofs. Sanitary wastes are carried in a separate system of pipes to a sewage treatment plant.

In a combined system, the sewer handles municipal, industrial, and storm runoff flows in the same pipe which leads to a STP. When a combined sewer system is overloaded by stormwater and/or infiltration, the STP is bypassed and raw wastewater from domestic and industrial sources as well as stormwater runoff are discharged at numerous overflow points. The combined sewer overflows are discharged directly to receiving waters such as the Susquehanna River without the benefit of any treatment. These combined sewer overflows can result in serious water pollution and health hazard problems.

In many instances, wastewater management plans that are based only on dry weather conditions will be ineffective in achieving water quality levels compatible with the intended uses of the river. Thus, stormwater management plans complement dry weather flow wastewater management plans in achieving water quality goals.

In the City of Binghamton, major storm overflows are persistent problems throughout the year. Combined storm and sanitary sewers discharge raw-diluted sewage into surface waters during heavy rains, and this creates severe adverse water quality conditions and represents a public health problem. Impacts associated with stormwater overflows are critical during low river flows, yet even during normal river flows, such pollutional loads added to area surface waters can result in adverse impacts to the aquatic ecology.

ALTERNATIVES

Chapter VII of the Design and Cost Appendix discusses in detail the range of stormwater control options which were initially considered. These initial options ranged all the way from complete sewer separation with separate treatment for stormwater to optimum operation of the existing systems for maximum conveyance. Many alternatives were eliminated after preliminary investigations found significantly adverse economic impacts in relation to other alternatives that would perform just as well at a much lower cost.

From this initial array of options, four alternative control measures for the City of Binghamton's serious combined sewer overflow problems were formulated and evaluated in detail. The control structures were designed to handle the overflow volume and the amount of increased flow occurring at the treatment plant as a result of the design storm. The design storm was a 1.25 inch storm in a 24 hour period occurring at a Susquehanna River flow of 600 cfs at the Vestal gage. Selection of the design storm and design river flow is also discussed in Chapter VII of the Design and Cost Appendix. The four stormwater management alternatives were:

A. Storage of storm overflows at the overflow sites with subsequent discharge to existing sewer system and treatment at Binghamton-Johnson City Sewage Treatment Plant during non-peak periods.

B. Treatment of stormwater overflows at overflow sites using micro-strainers, plus chlorination.

C. Treatment of stormwater overflows at overflow sites using dissolved air flotation, plus chlorination.

D. Centralized treatment of stormwater overflows using a modified biological process, plus chlorination.

Alternative A - Storage and Subsequent Treatment at B-JC STP

A storage basin would be built near each of the five locations where major combined sewer overflows are discharged to the rivers (see Figure III-13 and Figure III-14). Each storage basin is designed to contain the stormwater runoff from a storm of 1.25 inches in a 24 hour period. During these high sewer flow conditions, overflows would be diverted to the

CITY OF BINGHAMTON

LOCATION OF PLANNED OVERFLOW CONTROL FACILITIES

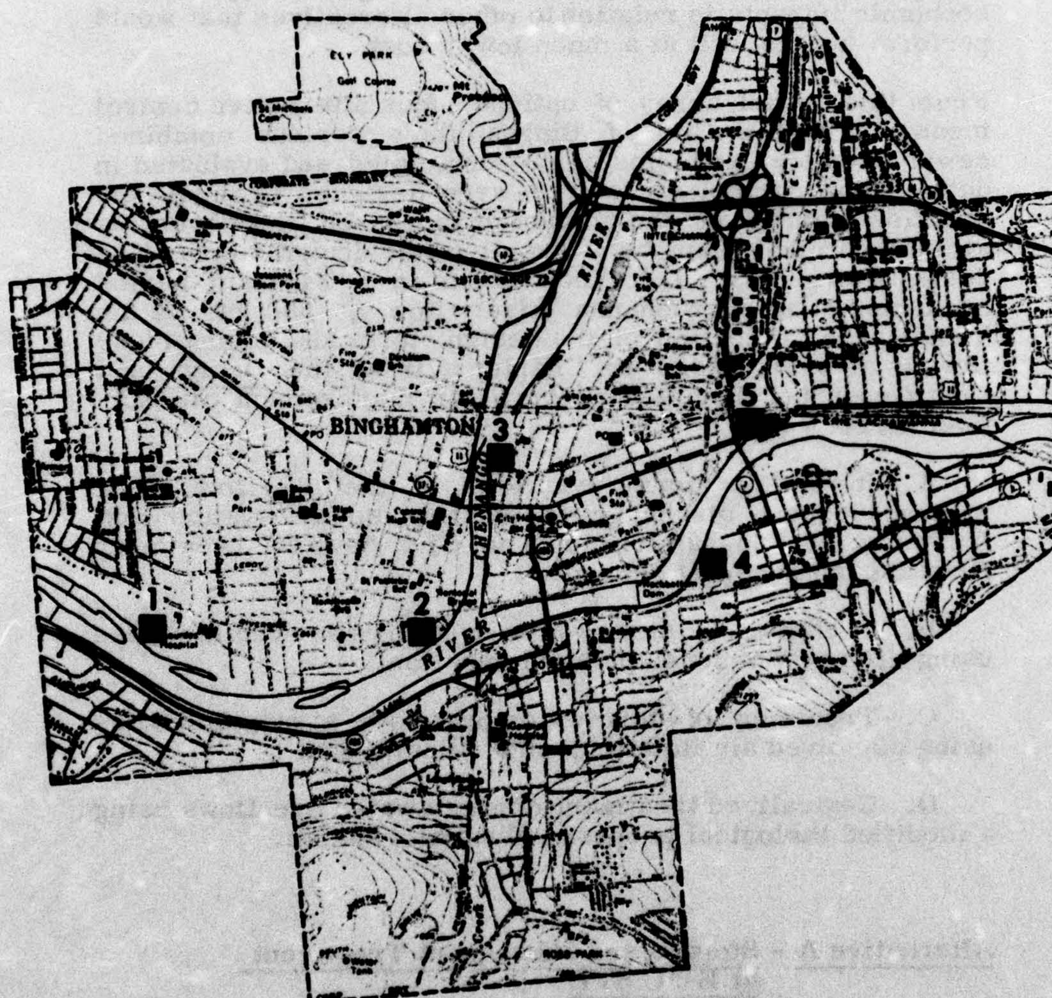


FIGURE III-13

OVERFLOW TREATMENT STORAGE BASIN SYSTEM

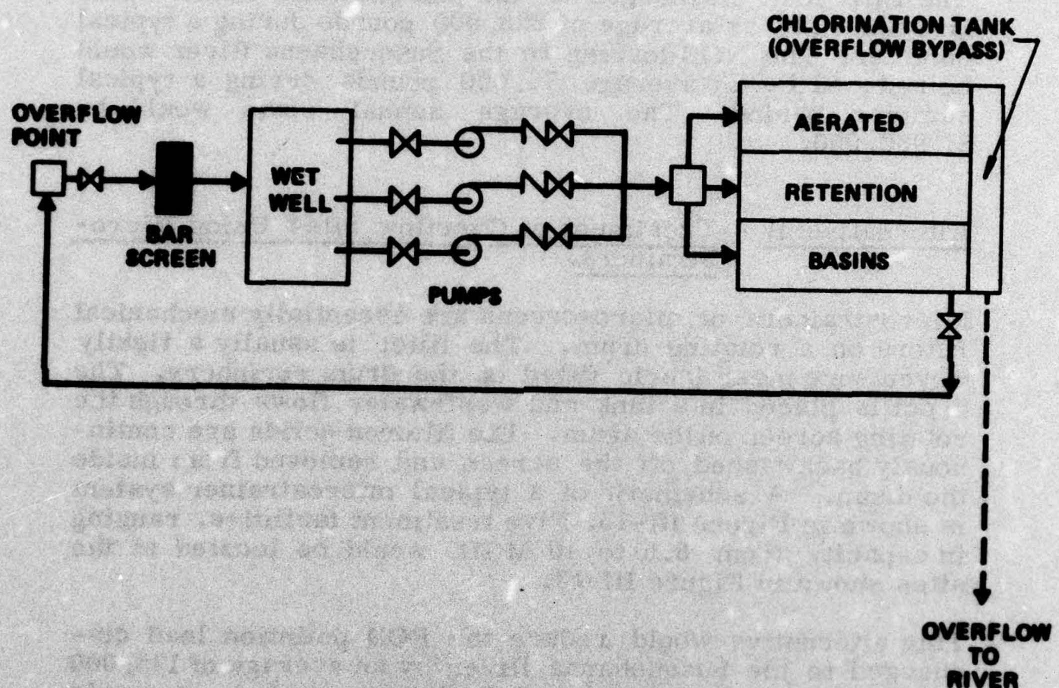


FIGURE III-14

basins. After the storm subsides, the stored wastewater would be released to the existing Binghamton-Johnson City sewage treatment plant. This would reduce the peak flows at the plant, it may delay expansion of facilities due to projected wastewater flow increases, and it may improve the efficiency of the wastewater treatment processes because of equalizing flow. It would be advantageous to have the storage basins as close as possible to the main interceptors in order to save the transmission costs to and from these basins.

The BOD load discharged to the Susquehanna River would be reduced by an average of 225,000 pounds during a typical summer. The NOD loading to the Susquehanna River would be reduced by an average 75,000 pounds during a typical summer period. The average annual costs would be $1,930,000.

Alternative B - Treatment at Overflow Sites Using Micro-Strainers.

Microstrainers or microscreens are essentially mechanical filters on a rotating drum. The filter is usually a tightly woven wire mesh fabric fitted on the drum periphery. The drum is placed in a tank and wastewater flows through the rotating screen on the drum. The filtered solids are continuously backwashed off the screen and removed from inside the drum. A schematic of a typical microstrainer system is shown in Figure III-15. Five treatment facilities, ranging in capacity from 6.5 to 10 MGD, would be located at the sites shown in Figure III-13.

This alternative would reduce the BOD pollution load discharged to the Susquehanna River by an average of 125,000 pounds during a typical April-September period. It would also reduce the NOD load discharged to the Susquehanna River by an average of 125,000 pounds during a typical April-September summer period. The average annual cost would be $311,000.

Alternative C - Treatement at Overflow Sites Using Dissolved Air Flotation

This alternative provided combined overflow treatment using dissolved air flotation. In this process, fine air bubbles are forced into the overflow holding tanks. As the bubbles attach to solid particles or liquid droplets, the bouyant force of the combined particle and air bubble causes it to rise.

OVERFLOW TREATMENT MICROSTRAINER SYSTEM

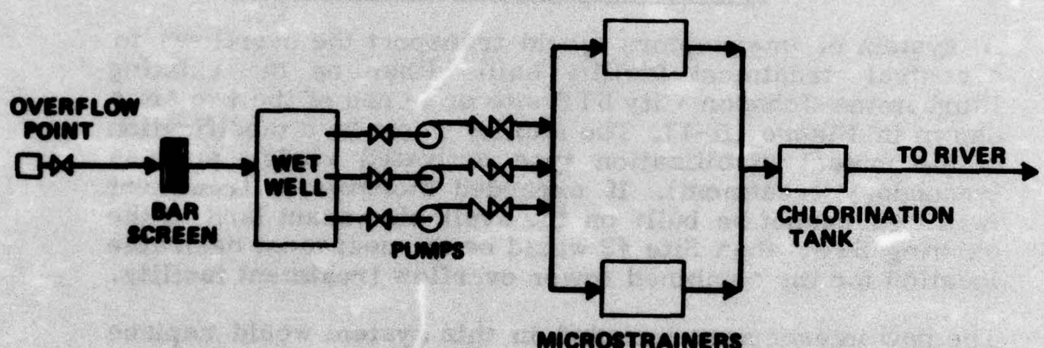


FIGURE III-15

Particles floating to the surface are then removed by skimming. Five treatment facilities, ranging in capacity from 6.5 to 10 mgd, would be located at the sites shown in Figure III-13. A flow diagram of the Dissolved Air Flotation System is shown in Figure III-16.

Alternative C would reduce the BOD pollution load discharged to the Susquehanna River by an average of 150,000 pounds during a typical summer period. It would also reduce the NOD load discharged to the Susquehanna River by an average of 125,000 lbs. during a typical summer period. The average annual cost would be $386,000.

Alternative D - Centralized Treatment of Combined Overflows Using Modified Biological Treatment

A system of interceptors would transport the overflows to a central treatment facility built either on the existing Binghamton-Johnson City STP site or in one of the two sites shown in Figure III-17. The facility would be a modification of the contact stabilization type activated sludge process (secondary treatment). If expanded stormwater treatment facilities cannot be built on the available vacant land at the existing STP, then Site #2 would be the next most desirable location for the combined sewer overflow treatment facility.

The new interceptors included in this system would replace some of the existing trunk and interceptor lines that are old and subject to high infiltration rates. This could prove effective in controlling significant amounts of infiltration. These interceptors would also provide enough capacity to handle wastewater flows from the communities surrounding the City of Binghamton, thus enabling the existing Binghamton-Johnson City STP to serve these communities. The centralized storm overflow treatment facility may also be used during dry weather flow for treating the projected increase in wastewater flows.

This alternative would reduce the BOD pollution load discharged to the Susquehanna River by an average of 207,000 pounds during a typical summer period. The average annual costs would be $1,888,000.

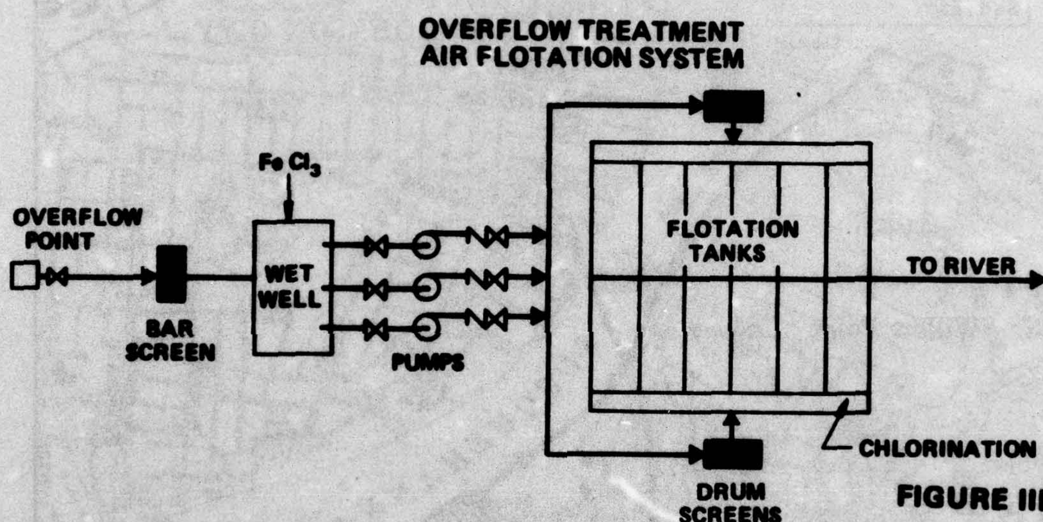


FIGURE III-16

BINGHAMTON–JOHNSON CITY STP EXPANSIONS AND CORRESPONDING SEWAGE TRANSPORT SYSTEMS

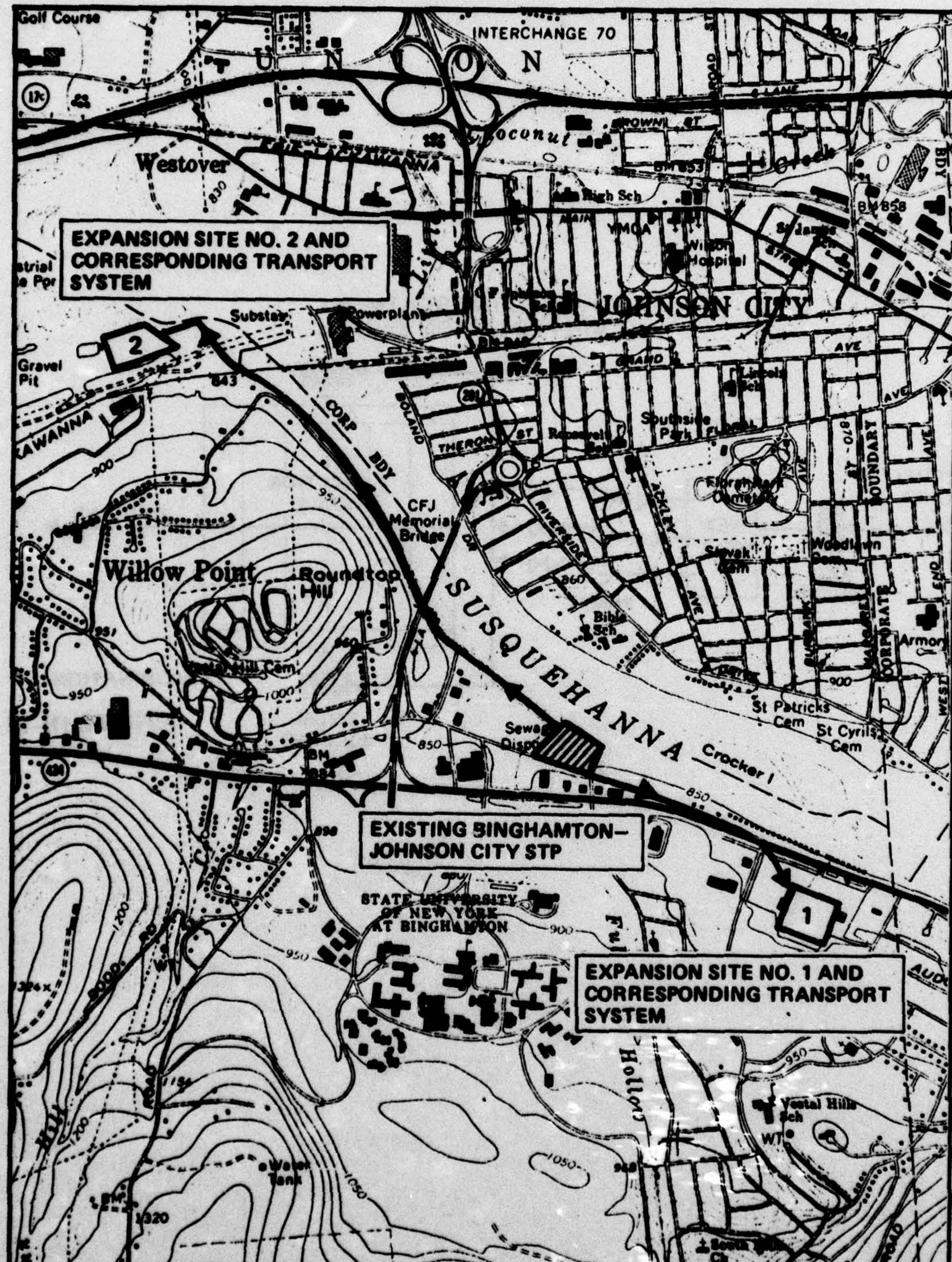


FIGURE III-17

IMPACT ASSESSMENT

Ecological

Since all alternatives involved some degree of treatment of combined overflows, they all would beneficially impact upon water quality in comparison to the Baseline.

Centralized treatment of the overflows either at the Binghamton-Johnson City STP or at a new facility (Alternatives A and D) would remove a substantial portion of the biological oxygen demanding characteristics of the overflows before they are discharged into the river, resulting in a dissolved oxygen concentration above 5 mg/l. In maintaining adequate concentrations of dissolved oxygen within the river, Alternatives A and D which treat the stormwaters at a central facility, would also beneficially impact upon aquatic fauna.

Treatment at satellite facilities (Alternatives B and C) near overflow points would remove some of the oxygen demanding characteristics of the overflows. Minimum DO concentrations would be between 4-5 mg/l.

Microstraining (Alternative B) and dissolved air flotation (Alternative C) treatment of storm overflows would probably not result in significant removals of heavy metals and would therefore not have any significant beneficial impacts in relation to uncontrolled overflows. Modified biological treatment of storm overflows would somewhat reduce the concentration of heavy metals entering the River and could, therefore, result in a beneficial impact to the aquatic biota. Storage and subsequent treatment (Alternative A) would result in the greatest reductions of heavy metals and would therefore have the most beneficial impacts upon aquatic biota. Strict enforcement of city and village samitary ordinances would be most effective in reducing the heavy metals content in the sewage system that is subject to overflow.

All the stormwater management alternatives would require construction of some sort of facility, be it a storage basin, satellite treatment plant, new overflow interceptors, or a centralized treatment facility designed to specifically handle storm overflows. This construction may have an adverse impact upon terrestrial ecology. If a new facility were constructed to work in conjunction with the existing Binghamton-Johnson City Sewage Treatment Plant, additional lands of approximately five acres would be needed. However, vacant land is at a premium in the vicinity of the existing Binghamton-Johnson City STP and the expansion could be at some distance from the STP. Construction of overflow treatment facilities at either of the two sites indicated on Figure III-17 will have little adverse impact on the terrestrial ecology of the area.

Social

Assuming a future condition in which secondary treatment of domestic wastes is required, then the largest remaining source of coliform bacteria found within the urban waterways would be attributable to combined overflows, with those overflows from the City of Binghamton constituting the greatest portion. All overflow management strategies reduce dangers to public health by eliminating the discharge of raw sewage into area waterways.

The impacts of the alternatives in comparison to the no action alternative are shown in Table III-19. As shown in this Table, there would be significant improvements in water quality due to any of the action stormwater management alternatives. All the alternatives showed a reduction in MPN/100 ml coliform counts from 240,000 to about 1,000 based on a 1.25 inch storm in 24 hours. Reduction of BOD would range from 50 to 90 percent while reduction of NOD would range from 17 to 50 percent, depending on the stormwater management alternative.

Construction of stormwater treatment facilities would create some adverse dust, noise and traffic impacts to local business and commercial establishments and general urban traffic patterns. Although these impacts are adverse, they would be minor in magnitude and temporary in nature.

Economic

The average annual costs of the four stormwater alternatives A, B, C and D would be $1,930,000; $311,000; $386,000; and $1,888,000, respectively. Storage and subsequent treatment at Binghamton-Johnson City Sewage Treatment Plant (Alternative A) and centralized treatment using a modified biological process would be the most costly; while treatment at overflow sites using microstrainers (Alternative B) and treatment at overflow sites using dissolved air flotation (Alternative C) would be the least expensive.

TABLE III-19

EFFECTIVENESS OF STORMWATER

MANAGEMENT ALTERNATIVES
(1.25 inch storm in 24 hours)

	ALTERNATIVE			
	A	B	C	D
Effect	No Action	Storage	Microstrainers	Dissolved Air Flotation	Centralized Treatment

Effect	No Action	Storage	Microstrainers	Dissolved Air Flotation	Centralized Treatment
Cost (average annual)*	0	$1,930,000	$311,000	$386,000	$1,888,000
BOD(lb)	9400	940	4700	3800	1600
% Reduced	0	90	50	60	83
NOD (lb)	4200	2100	3500	3500	2100
% Reduced	0	50	17	17	50
Minimum DO (mg/l)	3-4	5-6	4-5	4-5	5-6
Coliform in Susquehanna R.	240,000	1000	1000	1000	1000

* 6 1/8 percent interest at 50 years

SUMMARY AND EVALUATION

Table III-19 shows average annual cost per wastewater management alternative and the impact each alternative would have on the water quality of the Susquehanna River. It can be seen from this Table that all the action alternatives would meet the State standards for DO above 4.0 mg/l at anytime. Alternatives A and D have the most beneficial impact by increasing the DO from 3-4 mg/l, under the no action plan, to 5-6 mg/l; but at the same time, they would have the most adverse economic impact. Alternatives B and C would meet the State standards for DO and show a beneficial impact in comparison to the no action alternative by increasing minimum River DO from 3-4 mg/l to 4-5 mg/l. Although alternatives B and C would not have as much a beneficial impact on the water quality of the Susquehanna River, their respective average annual costs would be significantly less than alternatives A and D, while still meeting the NYSDEC minimum standard for water quality at any time (greater than 4.0 mg/l of DO).

Should the design storm of 1.25 inches/day be exceeded, overflows to the rivers would occur with some adverse impact on the aquatic ecology and a potential adverse impact in relation to public health. However, provisions for chlorinating such overflows were included in each alternative. Furthermore, most pollutants would have been treated during the early part of the storm because of the "first flush" action. Additionally, the intense storm of more than 1.25 inches/day would tend to dilute the combined overflows such that the impact would be significantly less than if no overflow control facilities had been provided.

One other concern regarding stormwater management alternatives was the dosage of chlorine and the potential for residual chlorine remaining in the combined overflows after treatment. Proper equipment adjustment, regular inspection, and strict monitoring should insure that the stormwater control facilities operate correctly. Adverse impacts may occur to the aquatic ecology, however, if large amounts of chlorine reach the waterway. Should such an impact occur consistently after treatment of overflows, process changes to convert from chlorine to ozone as the disinfectant may be warranted.

CHAPTER IV

STAGE III -- REFINEMENT OF PLANS

ITERATION 1

MODIFICATION AND REFINEMENTS

The thirteen alternatives of Stage II-2 were reduced to eight plans in Stage III-1. There were certain modifications made to the alternatives of Stage II-2 in formulating the plans of Stage III-1. A summary of the plans and respective alternatives with modifications is presented in Table IV-1.

Infiltration control had been considered a separate alternative or strategy. For Stage III-1, it was added on to all the plans, but in different degrees. The level of infiltration control for a plan was dependent upon the cost of treatment as opposed to the cost of providing the infiltration control. That is, did it cost less to continue to allow the infiltration and pay for treatment or was it more cost effective to implement infiltration control measures?

Similarly, cost effectiveness was used to determine the level of nonstructural flow reduction for all the plans except Plan 2 and Plan 3. These two plans received no nonstructural reduction so that levels of regionalization could be compared. Plan 7 had the objective of maximum flow reduction so the cost effectiveness test was slightly exceeded to more fully evaluate the potential of flow reduction from nonstructural measures.

Also, cost effectiveness was used to determine the degree of regionalization in both counties for each level of treatment. That is, for a given goal of water quality or level of treatment, what arrangement of STP's costs the least?

DESCRIPTION OF PLANS

A summary of the description of the eight plans is provided in Table III-7.

TABLE IV-1

RELATIONSHIP BETWEEN STAGE II-2 ALTERNATIVES AND STAGE III-1 PLANS

Stage II-2			Stage III-1		
Alternative No.	Objective	Features	Plan No.	Changes	Rationale
1	provide baseline for assessment		1	no change	
3b	provide basis for regionalization assessment (w/Alt.5)	2+2 STP's 5 mg/1 D.O. 0% non-structural no infiltration control	2	3 MGD Infiltration Control	Cost effective
5	provide basis for regionalization assessment	3+3 STP's 5 mg/1 D.O. 0% non-structural no infiltration control	3	3 MGD Infiltration Control	Cost effective
6	Bio AWT	3+2 STP's 0% non-structural 5 MGD infiltration control	4	2+2 STP's 100% non-structural 3 MGD infiltration control	Cost effective Cost effective Cost effective
7	Physical/ Chemical AWT	3+2 STP's 0% non-structural 5 MGD Infilt.	5	2+2 STP's 100% non-structural	Cost effective Cost effective
8b	Land Application	3+2 STP's Chenango Valley + Endicott: no land appl. 5 MGD Infilt. Control 100% non-structural	6	2+2 STP's Apply all sewage to land (seasonal)	Cost effective provide better basis for assessment & evaluation
11	Maximum flow reduction, meet 5 mg/1 D. O.	3+2 STP's 5 MGD infilt.control 100% non-structural	7	2+3 STP's 3 MGD infilt. control	Cost effective close to cost: effective
12a	Minimum cost to meet 4 mg/1 D.O.	2+3 STP's secondary treatment only no flow reduction	8	1 MGD infilt. control	Cost effective

Plan 1

The Baseline Condition Plan was the no action plan that provided the base against which the other plans were compared and evaluated. It was assumed in this Plan that no construction of wastewater treatment plants or new interceptors would be built beyond what has already been approved. Interceptors within service areas were expected to be extended, but only for projected increases in population.

The no action or Baseline Condition Plan included the following elements: (1) abandonment of the Vestal STP and diversion of its sewage to the Endicott STP; (2) upgrading of the Owego Village STP to provide secondary treatment; (3) abandonment of the Owego Valley View STP and diversion of its sewage to Owego Village STP (4) remaining STP's (B-JC, Owego Town #1, Owego Town #2, and Endicott) would not be expanded or upgraded; (5) the Chenango Valley area would continue on septic systems; (6) extensions of sewage collection and treatment services would take place within the Nanticoke Creek Valley and toward Five Mile Point; and (7) the sewaged population of all STP's would continue to grow and sewage flow would increase.

The present worth of total costs to the year 2020 would be $32.6 million, of which $24 million represented the local share (based on current cost sharing arrangements).

Plan 2

The objective of this Plan was to define a minimum cost wastewater management system that would maintain a minimum DO of 5 mg/l during low flow periods and during storm overflow conditions. It included two STP's in Broome County and two STP's in Tioga County. The Broome County plants would be the Binghamton-Johnson City STP with nitrification and the Endicott STP with secondary treatment. The Tioga County plants would have secondary treatment and they would be Owego Town No. 1 and No. 2 STP's.

Infiltration control associated with this Plan called for a reduction of 3 mgd in the City of Binghamton. Microscreening devices followed by chlorination facilities would be provided at the major overflow sites. Land application of sludge was recommended. The present worth of total costs of Plan 2 was $44.3 million of which $30.7 million represents local share.

Plan 3

The objective of Plan 3 was to define a minimum cost wastewater management system that would maintain a minimum DO of 5 mg/l during low flow periods and storm overflows conditions. Nonstructural measures for flow reduction would not to be included in this Plan. Plan 3 included three STP's in both Broome and Tioga Counties. B-JC would receive nitrification while Endicott, Chenango Valley, Owego Town #1, Owego Town #2 and Village of Owego STP's would have secondary treatment.

Three mgd of infiltration control would be provided in the B-JC Service Area. Microscreening devices followed by chlorinating facilities would be provided at major storm overflow sites. Land application of sludge would be recommended. The present worth of the total costs of Plan 3 was $45.8 million, of which $28.6 million represented the local share.

Plan 4

Plan 4 provided biologically based AWT. The minimum DO level in the Susquehanna River during dry weather conditions would be 6-7 mg/l. This Plan called for two treatment plants in both Broome and Tioga Counties. The Broome County plants would be B-JC and Endicott STP's and the Tioga County plants would be Owego Town #1 and #2 STP's. Treatment at the four plants would call for nitrification, denitrification, phosphorus removal, filtration and carbon absorption.

Infiltration control would be 3 mgd. Nonstructural measures would include implementation of a water pricing system and a public education program. Microscreening devices followed by chlorinating facilities would be provided at the major overflow sites. Land application of sludge would be recommended. The present worth of total cost would be $81.9 million, of which $47.8 million would be the local share.

Plan 5

Plan 5 provided physical/chemical based AWT. A minimum DO level of 6-7 mg/l would be maintained in the Susquehanna River during dry weather conditions. The Plan called for two

STP's in Broome County as well as Tioga County. The Broome County plants would be at B-JC and Endicott plants. The Tioga County STP's would be at Owego Town #1 and #2 STP's. AWT would be provided at all four plants and would include alum addition to the primary clarifier, breakpoint chlorination, filtration, and activated carbon absorption.

Infiltration flow reduction would be 5 mgd. Nonstructural measures would include a water pricing system and a public education program. For storm overflows, microscreening devices followed by chlorination facilities would be provided at the major overflow sites. Land application was recommended for sludge management. The present worth of total costs would be $84.3 million of which $48.4 million represented the local share.

Plan 6

This Plan provided for seasonal land treatment of wastewater effluents from all the municipal wastewater plants. Spray irrigation systems would be operated May through October, while the secondary effluent would be discharged directly to the Susquehanna River for the remainder of the year. A minimum DO level of 6-7 mg/l would be maintained in the Susquehanna River. Plan 6 included two STP's in Broome County and the same number in Tioga County. The plants would be Binghamton-Johnson City, Endicott, Owego Town #1, and Owego Town #2.

To minimize the required land for treatment, the optimum reduction of infiltration flow would be 5 mgd. Nonstructural measures for flow reduction were also recommended to maintain the current per capita wastewater flow. Microscreening devices followed by chlorination facilities would be provided at the major overflow sites. It was also recommended that land application of sludge be utilized. The present worth of total costs is $69.4 million, of which $36.4 million represented the local share.

Plan 7

The objective of Plan 7 was to define a minimum cost wastewater management system that would maintain a DO level above 5 mg/l in the Susquehanna River during low flow periods, and during storm overflow conditions, by application of flow reduction measures. Flow reduction would be achieved by applying the cost effective level of infiltration control, and by acvhieving 100 percent of the nonstructural measures. The Plan included two STP's in both Broome and Tioga Counties. Nitrification would be applied to B-JC STP with secondary treatment sufficing at the other three STP's.

Microscreening devices followed by chlorination facilities would be provided at major overflow sites, and land application was recommended for sludge management. The present worth of total costs would be $38.9 million, of which $25.1 million represented the local share.

Plan 8

The objective of this Plan was to define a minimum cost wastewater management system that would maintain a minimum DO of 4 mg/l during both low flow periods and storm overflow conditions. Nonstructural measures for flow reduction were not to be included.

This Plan would include two STP's in Broome County at B-JC and Endicott and three STP's in Tioga County at Owego Town #1, #2, and Village of Owego. Secondary treatment would be applied to all STP's with 1 mgd of infiltration control in the City of Binghamton. Microscreening devices followed by chlorination facilities would be provided at major overflow sites. Land application for sludge management was recommended. The present worth of total cost is $40.2 million, of which $25.5 million represented the local share.

IMPACT ASSESSMENT

Ecological

Nutrients are any chemical necessary to the growth and reproduction of aquatic flora. Nitrogren and phosphorus, two macronutrients, are important factors in artificial eutrophication. Generally, phosphorus is the limiting nutrient of concern in relation to nuisance aquatic floral growths. Even if all nutrients necessary for growth are available, other environmental factors such as temperature, light, river flow and depth may limit aquatic plant growths. Although the NYSDEC has no phosphorus standards for fresh surface waters, the EPA has a proposed limit of less than or equal to 0.1 mg/l of phosphorus (as P) in those flowing waters where phosphorus is a limiting constituent for the growth of nuisance aquatic plants.

A phytoplankton study conducted on the Susquehanna River from April 1967 to April 1968 in the Triple-Cities area concluded that the region had algae typical of productive bodies of water but not typical of strong pollution. At that time the Binghamton-Johnson City Sewage Treatment Plant, the Endicott STP, and the Vestal STP produced primary treated effluent only and all other sewage discharges entered the river untreated. Between 1968 to 1974, although sewage flow increased, the level of treatment of sewage also increased, so that by 1974 sewage discharged to the river received at least primary treatment and the major portion of sewage effluent received secondary treatment. Since secondary treatment of sewage removes between 20-30 percent of phosphorus and 20-25 percent of nitrogen, it is probable that despite increased sewage flows, the total amounts of nitrogen and phosphorus entering the river system is approximately the same as was the case in 1967-1968 when the phytoplankton survey was undertaken. Therefore, it is likely that at present the phytoplankton in the Susquehanna River system, near the Triple Cities area, is of the same composition as during the 1967-1968 survey. Additionally, macrophytes in the river system have not been documented as being a nuisance.

The Baseline Condition Plan, which provided for secondary treatment at five STP's (Chenango Valley remained unsewered) would discharge approximately the same amount of phosphorus and nitrogen as is currently discharged. Therefore, no significant changes in aquatic flora would be expected under the Baseline. Plans 2, 3, 7 and 8, all of which provide for some treatment of sewage flows from Chenango Valley, would result in slightly increased nitrogen loadings of 7,540 lbs/day and slightly increased phosphorus loadings of 1,905 lbs/day. These nitrogen loadings would be 10 percent greater than the Baseline nitrogen loadings and phosphorus loadings would be 9 percent greater than the Baseline phosphorus loadings. The slightly higher nutrient loadings would not significantly increase the growth of aquatic flora since it appears that, even under existing conditions, neither phosphorus nor nitrogen are limiting nutrients.

Plans 4 and 5 which would provide advanced waste treatment (including denitrification, carbon absorption, and phosphorus removal) would result in significantly lower nitrogen and phosphorus loadings than the Baseline Condition Plan. However, it is uncertain to what extent growth of aquatic flora would be limited.

Plan 6, which provided for seasonal land application of sewage effluent at all treatment plants, would result in zero discharge of nutrients from the STP's to the river system from May to October. During the winter months of November to April, however, nitrogen and phosphorus discharges to the river would be the same as previously discussed for plans 2, 3, 7 and 8. Again, however, it is uncertain as to what extent growth of aquatic flora would be limited.

All wastewater management plans would contribute to the instream concentrations of total and fecal coliform. The major factor influencing total coliform contributions is the overflow of combined sewers. The second major contributor to total coliform concentrations is the Binghamton-Johnson City STP.

The Baseline Condition Plan, although providing secondary wastewater treatment at five facilities, would most likely contribute significant quantities of coliform to the river during MA-7-CD-10 conditions because of overloading of treatment facilities. In addition, since combined sewer overflows would continue without any treatment, coliform concentrations during storm conditions for the Baseline would be as high as 240,000 MPN/100 ml in the Susquehanna River and 123,000 MPN/100 ml in the Chenango River, which would be well in excess of swimming standards (monthly median less than 2,400/100 ml and 20 percent of samples not to exceed 5,000/ml).

For those action plans which provided for treatment of sewage flows from Chenango Valley at the Binghamton-Johnson City STP, the maximum coliform concentration, during the MA-7-CD-10 flow conditions in the Chenango River would be approximately 120 MPN/100 ml. The maximum concentration of total coliform in the Susquehanna River, under the same circumstances is approximately 360 MPN/100 ml. Both of these concentrations would conform to the NYSDEC standards for total coliform in water suitable for primary contact recreation. Under design storm conditions, wherein combined sewer overflows would be treated, the maximum total coliform concentration in the Chenango River would be approximately 1,125 MPN/100 ml and 1,040 MPN/100 ml in the Susquehanna River. Under design storm conditions, total coliform concentrations would still allow for primary contact recreation in the area's rivers provided that combined sewer overflows are treated.

In those plans which provide for separate treatment of sewage from the Chenango Valley area, total coliform concentrations in both the Chenango and Susquehanna River at MA-7-CD-10 flow conditions would conform to the NYSDEC standards for primary contact recreation. At MA-7-CD-10 conditions, maximum total coliform in the Chenango would be approximately 180 MPN/100 ml and maximum total coliform in the Susquehanna River would be approximately 340 MPN/100 ml. At design storm conditions, assuming treatment of combined sewer overflows, maximum total coliform in the Chenango and Susquehanna Rivers would be 1,150 MPN/100 ml and 1,025 MPN/100 ml, respectively. It is apparent that any action plan which incorporates treatment of combined sewer overflows would have a significant beneficial impact upon total coliform concentrations in the area's waterways.

Seasonal spray application of secondary wastewater effluent would require the use of a total of approximately 5,700 acres of land in Broome County (in the Towns of Binghamton and Conklin) and 700 acres of land in Tioga County (in the Town of Owego).

Approximately 75 percent of the land to be used for spray irrigation in Broome County is in shrub and forest cover, while approximately 50 percent of the spray irrigation land in Tioga County is in shrub and forest cover. Active and inactive agricultural lands accounted for approximately 25 percent of the lands to be used for spray irrigation in Broome County and approximately 50 percent of the irrigation sites in Tioga County.

Resource Committments

Resources committed to wastewater management alternatives may be classified as either consumptive (irretrievable) or non-consumptive (retrievable). Committments of land acreage to a wastewater management scheme are made for at least the life of the wastewater management project, but may be converted to other uses after the abandonment of the wastewater project. Land committments are therefore non-consumptive uses of local resources. On the other hand, resources such as chemicals, electricity and fuel are consumed during wastewater treatment and disposal and therefore represent irretrievable committments of resources.

Land.

The major land committments associated with wastewater management are those acres devoted to physical facilities (such as sewage treatment plants), acres devoted to spray irrigation of sewage effluent, and acres devoted to land application of sewage sludge.

In comparison to the no action plan, only those alternatives which provided for separate treatment of wastewater in the Chenango Valley area would require an additional committment of approximately 5 acres of flood plain land for a new STP.

Spray application of treated sewage effluent would require the temporary committment, for at least the life of project, of approximately 6,400 acres, most of which is in shrub and forest cover. Reconversion of this large amount of land to its prespray application land uses and accompanying terrestrial ecosystems could take several years.

Land application of sewage sludge would require the commitment, for at least the life of the project, of active agricultural land, of variable acres depending on the treatment methodology used. Since lands required for application of sewage sludge are already used for agricultural activities, no unalterable committments of land for sludge application would be made.

Electricity.

The electrical consumption of the all wastewater management plans is presented in Impact Summary Table IV-7. Table IV-2 presents the percentage of wastewater treatment electrical consumption in terms of the present yearly electrical consumption in the Binghamton area. Also shown in Table IV-2 is the percentage of wastewater treatment electrical consumption in terms of peak summer electrical demand.

Physical/chemical advanced waste treatment would require less electricity than under the Baseline Condition Plan, and, therefore, would have a beneficial impact upon electrical consumption in the Binghamton area. Plans emphasizing secondary waste treatment only or secondary treatment enhanced by nonstructural flow reduction measures utilized approximately the same amount of electricity as the Baseline and, therefore, would not affect electrical consumption.

TABLE IV-2

ELECTRICAL CONSUMPTION

Plan	Consumption (10 KWHr/YR)	% of Present Binghamton Area Consumption/1	% of Present Binghamton Peak Summer Demand/2
1) Baseline Condition Plan	11.2	0.7	0.5
2) 2 + 2, Nitrification at B-JC	16.0	1.0	0.6
3) 3 + 3, Nitrification at B-JC	16.0	1.0	0.6
4) Bio. AWT	20.0	1.2	0.8
5) P/C AWT	10.0	0.6	0.4
6) Land Application	30.5	1.9	3.7
7) Nonstructural	11.5	0.7	0.5
8) Secondary	11.5	0.7	0.5

/1 Present Consumption = 1,500 x 10 KWHr/YR.

/2 Present Peak Summer Demand = 281 MW

Plans which provide for secondary treatment plus nitrification utilize 52 percent more electricity on an annual basis than does the Baseline Condition Plan. In area wide terms, the electrical consumption would increase about 0.3 percent and would create a slightly adverse impact.

Biological advanced waste treatment plans would utilize 79 percent more electricity than the no action plan. Again in areawide terms, the increased electrical consumption would be about 0.5 percent and may create a slightly adverse impact.

The spray application plan's electrical consumption, which represented an increase of 1.2 percent in the yearly electrical consumption on a areawide basis, utilized about 170 percent more electricity than the Baseline Condition Plan. On a yearly basis, the additional consumption of electricity by the spray application would represent an adverse impact on areawide electrical consumption. However, of perhaps major significance, is the proportion of the peak summer demand for which the electrical consumption of spray application would account. This proportion, 3.7 percent of the peak summer electrical demand, could produce a significant adverse impact upon electrical resources when they are needed most.

Chlorine.

Consumptive use of chlorine would take place in all wastewater plans including the Baseline Plan. Chlorine would be used for disinfection of STP effluents and stormwater overflows in all plans. The amount of chlorine used for stormwater disinfection in any action plan would be about 3.7 tons/year and is reflected in the total chlorine consumption figures presented in the Table IV-7.

The amount of total chlorine used for disinfection of STP effluents would depend on the level of prior treatment. Generally, a higher level of treatment prior to effluent disposal will require less chlorine for disinfection. In those plans emphasizing secondary treatment or secondary treatment with nitrification, the amount of chlorine utilized would not be significantly different than the amount of chlorine used under the Baseline Condition Plan. Therefore, no significant impacts upon chlorine resources would be expected.

The plan which emphasizes biological advanced waste treatment would utilize one-half of the chlorine required by the

Baseline Condition Plan. Since chlorine shortages have appeared at sewage treatment plants around the country in the past year, this reduction in chlorine requirements may represent a beneficial impact upon nationwide chlorine resources.

Lime.

Wastewater treatment and disposal processes which consume lime include the vacuum filtration of sludge and the land application of sludge. Lime is used in the process of land application of sludge primarily as a mitigating measure against heavy metal toxicity. Lime, however, can be assumed to be in general use by farmers as a general agricultural supplement for soil enrichment. None of the plans would use significantly more lime than that used for the Baseline Condition Plan. In addition, the amount of lime required when applying sludge to agricultural land is probably not significantly different than the amount of lime already used by farmers in their general agricultural practices.

Activated Carbon.

Activated carbon is used for the reduction of BOD and organic carbon in the biological and physical/chemical advanced waste treatment plans. The Baseline Condition Plan and most action plans would utilize no activated carbon. Biological advanced waste treatment, however, would consume 121 tons/year and therefore may have some adverse impact upon activated carbon resources. Physical/chemical AWT, which would consume 830 tons/year of activated carbon, could have significant adverse impacts depending upon the availability of activated carbon in the area.

Methanol.

Methanol, or wood alcohol, is used for denitrification only in the biological advanced waste treatment plans. The amount, 3,570 tons/year, of methanol required by the biological AWT system may represent an adverse impact depending upon the availability and cost of methanol in the Binghamton area and in the nation as a whole.

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Coagulants.

Coagulants in the form of alum and/or polymers would be required for phosphorus removal in the advanced waste treatment plans numbered 6 and 7. The amount of polymers required, 65 tons/year, would most likely be insignificant in terms of its availability, although the cost of polymers is generally high.

The consumptive uses of alum, 10,400 tons/year, for both biological and physical-chemical AWT would represent a significant increase in the utilization of this chemical in comparison to the Baseline Condition Plan and may adversely impact upon available resources particularly in the Binghamton area.

Fuel.

Fuel would be utilized primarily in the regeneration of activated carbon in the biological and physical/chemical advanced waste treatment systems and for the transportation of sewage sludge to some land application (or landfill) site. The major source of fuel consumption, approximately 13,900 gal/year in the Baseline Condition Plan, is the transportation of sewage sludge. The consumption of fuel in the no action plan is less than .01 percent of the fuel consumed by all motor vehicles (passenger, commercial, and motorcycle) registered in Broome and Tioga Counties.

The consumption of fuel in those action plans emphasizing secondary treatment plus nitrification is not significantly different than the fuel consumption under the Baseline Condition Plan and, therefore, those plans would not have any signficant impacts upon fuel consumption in the Binghamton area.

The fuel consumption of the biological and physical-chemical advanced waste treatment plans would be significantly higher than that for the Baseline Condition Plan. For the biological advanced waste treatment system, the fuel consumption would be approximately 158,700 gal/year and for the P/C AWT system the fuel consumption would be approximately 951,000 gal/year. In terms of areawide consumption, the fuel used for the biological AWT system would represent 0.11 percent of areawide fuel consumption and the physical/chemical AWT system would represent 0.64 percent of areawide fuel consumption. The increases in areawide fuel consumption under these two AWT systems could represent adverse impacts to fuel resources in the Binghamton area if fuel on the national scale becomes a critical commodity again as it did during the 1973-1974 winter and spring seasons.

Social

Dust and noise produced during operation of sewage treatment plants is usually minimal, although odors may become a problem particularly if a plant is overloaded or if it is not operated properly. Odors, therefore, could be particularly offensive under the Baseline Plan since by the year 2020 all sewage treatment plants would be overloaded. Assuming proper maintenance and the installation of mitigating measures such as covers for activated sludge tanks, sewage treatment plants in other management plan should create no offensive odor problems. Spray application of treated sewage effluent would be a prominent feature of the landscape particularly within the Town of Binghamton. Knowledge by the public that sewage effluent is being sprayed near their homes, schools and businesses could create adverse aesthetic perceptions of the area and could stimulate public opposition to a possible project.

Regionalization.

It was assumed that projected future population growth and development in the wastewater management Study Area would occur whether or not sewerage services were provided. However, growth will tend to concentrate within and near areas which provide sewerage services.

Haphazard expansion of sewerage services which could occur under the Baseline may or may not result in development patterns which are desired either on the local or regional level.

On a regional basis, all wastewater management plans conformed to desired development patterns as expressed in the General Plan for Broome and Tioga Counties. Regionalization of waste treatment facilities and land application of wastewater effluent would have the greatest potentials to affect future local development patterns.

Provisions of sewage collection and treatment in the Chenango Valley area, upstream of the City of Binghamton, could be provided by either of the two following wastewater management schemes:

i. Provision of sewage collection systems in the Towns of Fenton, Chenango, and Dickinson with treatment at a sewage treatment facility located in the Town of Dickinson, near the Broome Community College.

ii. Provision of sewage collection systems in the Towns of Fenton, Chenango and Dickinson connected to the existing Binghamton-Johnson City sewage treatment plant.

Existing development patterns in the Chenango Valley generally parallel existing major thoroughfares such as Route 11, Route 12, Route 12A and Route 7. In the Town of Chenango, areas of more intensive development include the hamlets of Nimmonsburg, Hinman's Corners, Chenango Bridge and Kattelville. In the Town of Fenton, development is clustered in the Hillcrest and Port Crane sections of the Town. In the Town of Dickinson, major population is clustered along Route 11, near the Broome Community College.

The Southern Tier East Regional Plan for Broome and Tioga Counties reflects anticipated growth and predicts that future development will occur along the Chenango Valley from the City of Binghamton toward Chenango Bridge and Port Crane. Additionally, the plan provides a policy for determining regionally desired land use patterns.

Since the Towns of Chenango, Fenton, and Dickinson do not have any master plans or future land use plans, an examination of their zoning maps and ordinances in relation to population projections for the areas were made to determine possible future locally desired land use patterns.

Population projections for the Town of Dickinson, derived in Stage II-1, indicated little population growth in the Town even to the year 2020. In fact, population was expected to slightly decline. As such, it is likely that any new development in Dickinson would be of a business-commercial nature and this development, if any, would concentrate along Route 11, sections of which are zoned for business activities.

The Town of Chenango is expected to experience a population inc ease of 7 percent by 1980 and an increase of 22 percent by the year 2020. Although this increase in the resident population of Chenango may possibly occur throughout the Town, it is probable that additional residential growth would concentrate near existing developed areas as mentioned previously. That is, residential growth will probably occur near the hamlets of Nimmonsburg, Hinman's Corners, Chenango Bridge, Chenango Forks, and Kattelville, all of which are primarily zoned for residential use.

Population within the Town of Fenton is expected to inc ease 5 percent by 1980 and 52 percent by the year 2020. Again, it is possible the population growth within Fenton would be evenly distributed throughout the entire Town. However, it is more likely that additional residential growth would occur near the Hillcrest and Port Crane areas of the town and along Route 7 and Ballyhack Road which are zoned for various residential densities.

A comparison of the STERPB general development plan and the zoning maps and ordinances of the Chenango Valley communities indicated general agreement as to the location of future population growth areas.

Those wastewater management plans utilizing a separate treatment facility located in the Town of Dickinson would also utilize an interceptor which basically parallels the Chenango River from the proposed treatment site to the bend of the Chenango River near River Road. Concentration of future growth near this interceptor would result in increased development in Chenango Bridge, Hinman's Corners, Nimmonsburg and possibly Kattelville and along Route 11 in the Town of Dickinson, most of which would be expected to experience future growth even in the absence of sewage services.

Therefore, it is unlikely that those plans providing separate sewage treatment for the Chenango Valley area would, of themselves, create undesireable land use patterns as Laid out by the Southern Tier East Region Bicounty development plan and the zoning maps and ordinances of the affected towns.

Those wastewater management plans which regionalize the treatment requirement for the Chenango Valley area at the existing Binghamton-Johnson STP would utilize an interceptor extending from the bend of the Chenango River near River Road to the point of connection with the Binghamton-Johnson City sewer system near the boundary of the City of Binghamton.

The northern portion (about 3/5) of the required regional interceptor would be equivalent to the interceptor described for those plans utilizing separate waste treatment for Chenango Valley in the Town of Dickinson. The land use implications for this interceptor segment, as stated earlier, would concentrate future development in areas which would probably experience increased development in the absence of sewerage services.

The remaining 2/5 of the regional interceptor from Broome Community College to the boundary of the City of Binghamton, basically parallels the Chenango River near Route 11 (Front Street). The major portions of this interceptor route either traverse the Route 81 River Park or parallel existing Route 11.

As stated previously, there is little population growth forecasted within the Town of Dickinson. The placement of a regional interceptor through the Route 81 River Park would not likely encourage redevelopment of the Park land for purposes other than recreation. Some commercial establishments may be encouraged to develop along Route 11; if so, this is foreseen both by the local zoning ordinances and bi-county land use plan. Therefore, no undesireable inducement of development would be likely to occur with the placement of a regional interceptor between Broome Community College and the boundary of the City of Binghamton.

The regionalization plans for Tioga County included:

i. Regionalization at the existing site of the Owego Town STP #1 with abandonment of the Owego Village STP.

ii. Regionalization at the existing site of the Village of Owego STP with abandonment of the Owego Town #1 STP.

The eastern portion of the Village of Owego, north of the Susquehanna River, is developed for medium and high density residential uses primarily along Front Street, East Main Street and Route 17C. Undeveloped lands lie between Route 17C and Front Street. All existing developed areas within this eastern portion of the Village are presently serviced by the Village of Owego Sewage Treatment Plant.

Residential development in the western portion of the Town of Owego, north of the Susquehanna River, is particularly concentrated along Davis Road, Lisle Road, Sunnyside Drive and the Bodle Hill Road area. Some commercial development parallels Route 17C and the major industrial complex (IBM) is located between Route 17C and Bodle Hill Road. The remaining portions of this area which are included in sewer districts #1 and #5 of the Town of Owego, are basically undeveloped (including Hickories Park). Although a stretch of undeveloped land lies to the north and south of Taylor Road, there are existing sewer lines in the area which could service future development.

The Southern Tier East Regional development plan for the Bicounty Area envisions that future development will continue to concentrate around the Village of Owego extending as far east as Hiawatha Island in the Town of Owego.

In the community development plan for the Town of Owego, lands lying between the Erie Railroad to the south, Taylor Road to the north, the IBM complex to the east and the boundary of the Village of Owego to the West, are intended for industrial development. Limited development is envisioned for those lands lying between the Erie Railroad and the Susquehanna River. Medium and high density residential development is intended for lands to the north of the Bodle Hill Road and Taylor Road and along Day Hollow Road.

In general, local development plans concur with the location and intensity of desired future growth patterns as expressed in the Southern Tier East Regional development plan for the Bicounty Area.

It was assumed that projected population increases in the Town of Owego (118 percent increase by the year 2020) will be experienced by the Town regardless of the provision of sewerage facilities. Again, it was also assumed that provision of sewage collection and treatment facilities would concentrate expected increases in growth within and near sewage service areas.

Regionalization of sewage treatment facilities at either the site of the Owego Village STP or the site of the Town of Owego STP #1 would require the construction of an interceptor between the two existing facilities. The route of the connecting interceptor is the same whether the chosen regional site is in the Village of Owego or at the Owego Town STP #1. This connecting interceptor would proceed mainly along Route 17C and the Erie Railroad in the Town of Owego and along Front Street and Williams Street in the Village of Owego.

The areas through which this regional interceptor would proceed already have sewer facilities or are within existing service areas and have access to sewer services. Assuming that no regional interceptor were to be constructed, the area between the two existing sewage treatment plants (and their immediate vicinities) are already prime growth areas and could be expected to experience development in the future. Such growth in the areas surrounding the Owego Village STP and the Owego Town #1 STP is considered to be desirable by both the local and Bicounty development plans.

In the event that a regional interceptor constructed to connect the Owego Village STP and the Owego Town #1 STP would be an impetus for increased development of the area between the two treatment facilities, such increased development would only be that which is already desired by local and Bicounty development plans.

Land Application.

Spray application of treated wastewater effluent on approximately 5,700 acres in the Towns of Binghamton and Conklin and on approximately 700 acres in the Town of Owego could severely impact upon local growth and development and proposed future land use patterns, particularly in the Town of Binghamton.

Approximately two-thirds of 700 acres of land devoted to spray application in the Town of Owego are located on lands zoned for agriculture uses and approximately one-third is located on lands zoned for industrial uses. Spray application would constitute a non-conforming land use on the lands zoned for industrial land use. However, no significant adverse land use or development impacts would be created as a result of spray irrigation in the Town of Owego.

Although the total acreage required for spray irrigation (including buffer zones) in the Towns of Binghamton and Conklin consisted of approximately 5,700 acres (8.9 square miles), close to 12 square miles of land would be needed in order to prevent the displacement of families, businesses, schools, roadways and other areas of suburban activity and to prevent possible contamination of well water supplies. Thus, approximately 12 square miles (9.5 square miles in the Town of Binghamton and 2.5 square miles in the Town of Conklin) would either be directly affected by spray application of effluent or would be in relatively close proximity to spray application sites.

Utilization of 2.5 square miles of land in the Town of Conklin would not result in significant adverse impacts to the Town since most of the area designated for spray application is in use for agricultural land or is in forest.

Utilization of the major section of 9.5 square miles for spray application of wastewater effluent would represent a significant committment on the part of the Town of Binghamton, since the size of the entire Town is approximately 25 square miles. Therefore, 38 percent of the Town of Binghamton would be affected by spray application of the wastewater effluent. Although most of the population of the Town of Bighamton would lie to the north of the spray application site, future land use plans of the Town include increased development along Pennsylvania Avenue and Park Avenue, both of which would be in or near the spray application areas. Also, since the spray application area would lies in the middle of the Town of Binghamton, the southern rural portion of the Town would be isolated from the urbanized northern sections of the Town. Population projections for the Town of Binghamton indicated a growth in population from 4,844 in 1970 to a population of 7,000 by the year 2020. If spray application were practiced in the Town of Binghamton the major portion of the population increase would have to be accommodated in either the northern or very southern portions of the Town. Obviously, committment of such a large part to Town of spray irrigation of effluent could have severe adverse impacts to desired land use, population growth, community cohesion and economy of the community.

Air Quality.

The Binghamton area, including the Town of Owego, City of Binghamton, and the Towns of Binghamton, Conklin, Kirkwood, Fenton, Chenango, Dickinson, Union and Maine has received a preliminary designation as an Air Quality Maintenance Area (AQMA). The air quality parameter of concern in the area is suspended particulates, especially in relation to nonpoint sources (small sources such as homes and small businesses). Therefore, the Binghamton AQMA is presently being studied, by the NYSDEC, in terms of population and land use projections to see whether the Binghamton area should receive a final designation as an Air Quality Maintenance Area. If analysis of the Binghamton AQMA indicates that population growth and land use trends to 1985 would result in violation of primary and/or secondary particulate standards, an implementation plan to prevent violation of these standards will be submitted by the NYSDEC. Analysis to date by the NYSDEC of the Binghamton AQMA indicates that the Binghamton area will probably remain undesignated, because population growth and land use trends do not indicate violation of standards in 1985, and, therefore, no maintenance plan will be promulgated for the area. Furthermore, extension of sewerage services in the Binghamton AQMA would probably proceed after development of an area rather than encourage development in new areas. Therefore, it is probable that no wastewater management plan, including the

Baseline Condition Plan, would significantly affect air quality in the Binghamton AQMA in terms of encouraging additional non-point sources of particulate emissions.

Economic

In order to properly assess the financial impacts of a wastewater management plan, a general economic profile of the affected public must first be constructed. Businesses, commercial establishments, industries and area residents would all pay a share of the costs. For the purposes of this Iteration, however, only the local costs and local financial impacts to area residents will be analyzed. Although most of this information has been discussed in Chapter I, it will be presented again in this Chapter so that the reader may assess and evaluate the wastewater management plans of Stage III-1.

By using the data shown in Table IV-3, an idea of income level and income distribution can be obtained for each wastewater management service area. For example, even though the East and West Owego service areas have the highest mean family income, this mean family income must support the largest number of persons per houshold, as compared to other service areas. Also, although the percentage of poverty families in East and West Owego is relatively low (4.1 percent), the number of people in each poverty family is high; therefore, the poverty income deficit is high even though the mean poverty family income is relatively high.

In the Village of Owego service area a relatively low number of persons per household are supported by the lowest mean family income of all the wastewater management areas. Although the Village of Owego has a high percentage of families below the poverty level, the mean poverty family income in relation to poverty family size is high and therefore Owego Village has the lowest poverty income deficit.

Within the Binghamton-Johnson City STP service area, the lowest mean family income supports the lowest number of persons per household in comparison to other service areas. The relatively high percentage of families below the poverty level in the B-JC service area receive a moderate (in comparison to other service areas) income per family size and, therefore, have the second lowest poverty income deficit in the area. The Chenango Valley service area and the Endicott service area have moderate poverty family incomes

TABLE IV-3

ECONOMIC CHARACTERISTICS OF
WASTEWATER MANAGEMENT SERVICE AREAS

STP Service Area	Mean Family Income	Mean Persons Per Family	Percent Below Poverty Level	Mean Poverty Family Size	Mean Poverty Family Income	Mean Poverty Income Deficit
Chenango Valley	$11,537	3.22	4.5%	3.0	$1,779	$1,243
B-JC	$10,403	2.87	8.7%	3.15	$1,840	$1,203
Endicott	$11,612	3.33	6.2%	3.34	$1,768	$1,443
East Owego	$13,447	3.86	4.1%	3.67	$1,953	$1,444
West Owego	$13,447	3.86	4.1%	3.67	$1,953	$1,444
Owego Village	$ 9,974	3.01	9.7%	3.46	$2,218	$,109

SOURCE: 1970 Census of Population; General Social and Economic Characteristics.

supporting moderate persons per household (in comparison to other service areas). However, the mean poverty family incomes are the lowest among all the service areas. Yet, the larger percentage of families below the poverty level, and larger poverty family size in Endicott as compared to Chenango Valley, result in a much larger poverty income deficit in the Endicott service area than in the Chenango Valley service area.

Total costs of wastewater management in any plan are attributable to the capital, operation and maintenance costs, and replacement costs, of various components including sewage treatment and disposal, pipelines, sludge disposal, infiltration control, stormwater management, and nonstructural measures of flow reduction.

The annual local residential costs per capita within each service area, are presented in Table IV-7 at the end of Stage III-1. However, the costs presented in Table IV-7 for Stage III-1 include only the costs directly attributable to collection, treatment, and disposal of sewage and sludge. In Stage III-2, comprehensive wastewater management plans will be developed to include costs for other items such as stormwater control, infiltration control, and nonstructural measures.

For all plans, except biological advanced waste treatment, physical/chemical advanced waste treatment and land application, the annual per capita cost (in 1974 dollars) to a residential user was computed as a uniform series of annual payments equal in present worth to the total present worth of the actual projected residential payments. For these plans, the actual project annual costs to residential users are fairly uniform. However, the three AWT plans, particularly biological and physical/chemical AWT have much larger payments after 1985 than before. For these plans, the impact on the residential user is better expressed as a "typical" payment after 1985. The year 2000 has been chosen as the typical year for expressing the residential per capita payment for the biological, physical/chemical and land application advanced waste treatment alternatives.

Table IV-4 shows, in 1969 dollars, the cost per family by service area of each of the plans. The Table also shows what percentage of the mean income these costs represent.

Per capita annual costs for any plan varied depending on the service area and level of treatment achieved. In the Chenango Valley area, the least annual per capita costs (of an action plan) would occur under Plan 8 which provided just secondary treatment.

TABLE IV-4

ECONOMIC IMPACTS OF WASTEWATER MANAGEMENT: RELATIONSHIP OF COSTS TO MEAN FAMILY INCOME (1969 Dollars)

	PLANS															
	1		2		3		4		5		6		7		8	
SERVICE AREA	PER FAMILY COSTS	% COSTS OF MEAN INCOME	PER FAMILY COSTS	% COSTS OF MEAN INCOME	PER FAMILY COSTS	% COSTS OF MEAN INCOME	PER FAMILY COSTS	% COSTS OF MEAN INCOME	PER FAMILY COSTS	% COSTS OF MEAN INCOME	PER FAMILY COSTS	% COSTS OF MEAN INCOME	PER FAMILY COSTS	% COSTS OF MEAN INCOME	PER FAMILY COSTS	% COSTS OF MEAN INCOME
Chenango Valley	-	-	$ 7.73	0.07%	$11.11	0.10%	$15.78	0.14%	$18.00	0.16%	$10.72	0.09%	$ 6.86	0.06%	$ 6.67	0.06%
B-JC	$ 6.40	0.06%	$ 6.89	0.07%	$ 7.23	0.07%	$14.06	0.14%	$16.04	0.15%	$10.49	0.10%	$ 6.11	0.06%	$ 5.94	0.06%
Endicott	$ 8.62	0.07%	$ 9.62	0.08%	$ 9.62	0.08%	$18.75	0.16%	$22.28	0.19%	$11.65	0.10%	$ 8.49	0.07%	$ 9.62	0.08%
East Owego	$13.63	0.10%	$15.36	0.11%	$15.36	0.11%	$31.73	0.24%	$29.03	0.22%	$15.25	0.11%	$15.36	0.11%	$15.36	0.11%
West Owego	$ 7.68	0.06%	$11.97	0.09%	$10.11	0.08%	$36.01	0.27%	$34.39	0.26%	$15.05	0.11%	$10.11	0.08%	$10.11	0.08%
Owego Village	$13.57	0.14%	$ 9.33	0.09%	$12.37	0.12%	$28.08	0.28%	$26.82	0.27%	$11.74	0.12%	$12.37	0.12%	$12.37	0.12%

The least cost plan for the B-JC service area would also be Plan 8. However, the costs for Plan 7 (Nonstructural) would not be significantly different than the costs associated with Plan 8.

The least cost plan on a per capita basis for the Endicott service area is Plan 7, which emphasizes nonstructural methods for waste flow reduction. However, Plan 1 (Baseline Condition Plan) would not be significantly greater in cost than Plan 7.

In the East Owego service area, the least annual per capita costs would be associated with Plan 1 (Baseline Condition Plan). Likewise, in the West Owego service area, the least cost plan would be the Baseline Condition Plan.

For the Owego Village service area, the least annual per capita costs would be associated with Plan 2 which provided for a regionalized secondary treatment facility for a combined Owego Village--West Owego Service area.

It is important to remember that the costs presented here and in Table IV-7 are for comparative purposes only. Also, the institutional arrangements selected for a given wastewater management plan could affect the costs and the economic impacts for any particular service area.

Costs dependent on the degree of regionalization in conjunction with treatment levels are also reflected in service area per capita charges. In the Chenango Valley area, regionalization would generally be cheaper per capita than subregionalization. Likewise, for the B-JC service area resident, regionalization would be cheaper. In the West Owego and Owego Village service area, sub-regionalization for West Owego and Owego Village would be cheaper.

Physical/chemical advanced waste treatment would be the most costly plan for the Chenango Valley, B-JC and Endicott service areas, whereas biological advanced waste treatment would be slightly more costly than P/C AWT for the East Owego, West Owego and Owego Village service areas on an annual per capita basis.

Since families or households, rather than individuals, pay for wastewater treatment services, annual per family wastewater costs have been calculated within each service area for all plans. Annual per capita charges were multiplied by the average number of persons per family within each service area to obtain the annual per family costs. Table IV-4 presents the annual per family costs of each plan and what percentage of the mean family income (in 1969 dollars) would be attributable to wastewater treatment. A measure of the adverse or beneficial impacts to the economic characteristics of a family within any service area is the percent of the total family income which would be devoted to wastewater treatment. An increase in the percentage of the total family income used to pay for wastewater management (in comparison to the Baseline Condition Plan) would adversely alter the spending and savings pattern of the family. Conversely, a decrease in the percentage of the total family income (in comparison to the Baseline Condition Plan) would be beneficial to the spending and savings pattern of the family.

For the Binghamton-Johnson City service area, the percent of wastewater costs, in relation to family income, of Plans 7 and 8 would be the same as for the Baseline; therefore, no significant changes in economic conditions of a B-JC service area families would be expected. For Plans 2 and 3, wastewater costs account for 0.07 percent of a family's income which would only be 0.01 percent higher than under the Baseline Condition Plan; therefore, no significant adverse impacts to the economic condition of a B-JC service area family would be expected for plans 2 and 3. In Plan 6 the percentage of wastewater costs per family income would be 0.10 percent, which is 0.04 percent greater than under the Baseline; therefore, some adverse impacts to the economic patterns of a B-JC service area family would occur. Plans 4 and 5 would have the greatest adverse impacts upon the economic conditions of a B-JC family. Wastewater costs in Plan 4 represented 0.14 percent of the mean family income (0.08 percent higher than Baseline) and wastewater costs in Plan 5 represent 0.15 percent of the mean family income (0.09 percent higher than Baseline).

For the Endicott service area family, no adverse economic impacts would be expected from Plan 7 in comparison to the Baseline Condition Plan (in both wastewater treatment plans, costs account for 0.07 percent of the mean family income). Plans 2, 3, and 8 may have slight adverse economic impacts to the Endicott service area family, since in all three plans wastewater costs account for 0.08 percent of the mean family income which would be 0.01 percent higher than under the no action plan. Plan 6 will have moderate adverse economic impacts upon the Endicott service area family since in this plan wastewater treatment costs account for 0.10 percent of the mean family income which would be 0.03 percent higher than for the Basleine Plan. Plans 4 and 5 would have a greater adverse impact to the economic characteristics of the Endicott service area family. Wastewater treatment costs in Plan 4 accounted for 0.16 percent of the mean family income (0.09 percent higher than Baseline) and wastewater treatment costs in Plan 5 accounted for 0.19 percent of the mean family income (0.12 percent higher than Baseline).

In the East Owego service area all action plans had the potential to adversely affect the economic conditions of the average family. Wastewater costs of plans 2, 3, 6, 7 and 8 represented 0.11 percent of the mean family income, which would be 0.01 percent higher than under the Baseline Condition Plan, and may thus slightly adversely affect the economic conditions of the East Owego service area family. Plans 4 and 5 would have greater adverse affects on the economic conditions of the average family since wastewater costs in these plans account for 0.24 percent and 0.22 percent, respectively, of the mean family income as compared to 0.10 percent under the Baseline Condition Plan.

In the West Owego service area all action plans would adversely affect the economic conditions of the average family. In Plan 2, wastewater costs accounted for 0.09 percent of the mean family income, as compared to 0.06 percent under the Baseline, and, therefore, may slightly adversely affect the average family in terms of its economic condition. Plans 3, 7, and 8 have wastewater costs which accounted for 0.08 percent of the mean family income and would, therefore, also have slight adverse impacts to the socio-economic characteristics of the average family. Plan 6 costs would account for 0.11 percent of the mean family income and this plan would have moderate adverse economic impacts. Plans 4 and 5, in which wastewater costs would account for 0.27 percent and 0.26 percent, respectively, of the mean family income, would have significantly greater adverse impacts to the average West Owego service area family.

In the Owego Village service area, wastewater costs under the Baseline Condition Plan would account for 0.14 percent of the mean family income because of the treatment plant expansions and upgrading which would be required by 1977. Plan 2 would represent a beneficial impact to the average income family since the associated wastewater costs account for only 0.09 percent of the average family income. Likewise, Plans 3, 6, 7 and 8 would produce a beneficial economic impact since the wastewater treatment costs accounted for only 0.12 percent of the mean family income.

Plans 4 and 5 would have an adverse economic impact upon the average family since the associated wastewater treatment costs account for 0.28 percent and 0.27 percent, respectively, of the mean family income.

Although Table IV-4 indicates no wastewater treatment costs for the Chenango Valley area under the Baseline Condition Plan, the average family does pay some portion of its income for the construction, operation and maintenance of private septic systems. Since it is likely that the cost associated with septic systems is small, only a minor portion of the family income is attributable to wastewater treatment under the Baseline. Therefore, all action plans have the potential to adversely affect the economic characteristics of the average Chenango Valley service area resident. Plans 2, 7, and 8, in which wastewater treatment costs would account for 0.07 percent, 0.06 percent, and 0.06 percent, respectively, would have the least adverse economic impacts. Plans 3 and 6, in which wastewater treatment costs would account for 0.10 and 0.09 percent, respectively, would have moderate adverse economic impacts. Plans 4 and 5, in which wastewater treatment costs account for 0.14 percent and 0.16 percent, respectively, of the mean family income, would have the greatest adverse economic impacts.

The economic impacts associated with the costs of wastewater treatment may be particularly adverse to the lower income or poverty families of a wastewater service area. Table IV-5 presents the annual wastewater treatment cost to a poverty family, the percentage of wastewater treatment costs in relation to the mean poverty family income, and the possible percent increase in the poverty income deficit resulting from increased wastewater treatment costs within each service area.

The greatest adverse impacts to poverty families would occur in the Owego Village service area. Poverty families in all service areas would be most adversely impacted under the biological and physical/chemical advanced waste treatment plans.

As stated in the early paragraphs of the section, additional costs which are not shown in Table IV-7 at the end of Stage III-1 will also be attributable to infiltration control measures, stormwater management and nonstructural flow reduction measures. Nonstructural flow reduction measures have been included in all plans and particularly emphasized in Plan 7. Infiltration control measures and stormwater overflow management measures have been assumed to be required in at least the City of Binghamton for all action plans in Stage III-2.

TABLE IV-5

ECONOMIC IMPACTS OF WASTEWATER MANAGEMENT PLANS TO POVERTY LEVEL FAMILIES

SERVICE AREA	Plan 1 PER FAMILY COSTS	Plan 1 % COSTS OF MEAN INCOME DEFICIT	Plan 1 % INCREASE OF INCOME DEFICIT	Plan 2 PER FAMILY COSTS	Plan 2 % COSTS OF MEAN INCOME	Plan 2 % INCREASE OF INCOME DEFICIT	Plan 3 PER FAMILY COSTS	Plan 3 % COST OF MEAN INCOME	Plan 3 % INCREASE OF INCOME DEFICIT	Plan 4 PER FAMILY COSTS	Plan 4 % COSTS OF MEAN INCOME	Plan 4 % INCREASE OF INCOME DEFICIT
Chenango Valley	-	-	-	$ 7.20	$0.40%	0.58%	$10.35	0.58%	0.83%	$14.70	0.83%	1.18%
B-JC	$ 7.02	0.38%	0.58%	$ 7.56	0.41%	0.63%	$ 7.94	0.43%	0.66%	$15.44	0.84%	1.28%
Endicott	$ 8.65	0.49%	0.60%	$ 9.65	0.55%	0.67%	$ 9.65	0.55%	0.67%	$18.80	1.06%	1.30%
East Owego	$12.96	0.66%	0.90%	$14.61	0.75%	1.01%	$14.61	0.75%	1.01%	$30.17	1.54%	2.09%
West Owego	$ 7.30	0.37%	0.51%	$11.38	0.58%	0.79%	$ 9.62	0.50%	0.67%	$34.24	1.75%	2.37%
Owego Village	$15.81	0.71%	1.43%	$10.72	0.48%	0.97%	$14.22	0.64%	1.28%	$32.28	1.46%	2.91%

SERVICE AREA	Plan 5 PER FAMILY COSTS	Plan 5 % COSTS OF MEAN INCOME DEFICIT	Plan 5 % INCREASE OF INCOME DEFICIT	Plan 6 PER FAMILY COSTS	Plan 6 % COSTS OF MEAN INCOME	Plan 6 % INCREASE OF INCOME DEFICIT	Plan 7 PER FAMILY COSTS	Plan 7 % COST OF MEAN INCOME	Plan 7 % INCREASE OF INCOME DEFICIT	Plan 8 PER FAMILY COSTS	Plan 8 % COSTS OF MEAN INCOME	Plan 8 % INCREASE OF INCOME DEFICIT
Chenango Valley	$16.77	0.94%	1.34%	$ 9.99	0.56%	0.80%	$ 6.39	0.36%	0.51%	$ 6.21	0.35%	0.50%
B-JC	$17.61	0.96%	1.46%	$10.49	0.57%	0.87%	$ 6.71	0.36%	0.56%	$ 6.52	0.35%	0.54%
Endicott	$22.34	1.26%	1.55%	$11.69	0.66%	0.81%	$ 8.52	0.48%	0.59%	$ 9.65	0.55%	0.67%
East Owego	$27.60	1.41%	1.91%	$14.50	0.74%	1.00%	$14.61	0.75%	1.01%	$14.61	0.75%	1.01%
West Owego	$32.70	1.67%	2.26%	$14.31	0.73%	0.99%	$ 9.62	0.50%	0.67%	$ 9.62	0.50%	0.67%
Owego Village	$30.83	1.39%	2.78%	$13.49	0.61%	0.12%	$14.22	0.64%	1.28%	$14.22	0.64%	1.28%

SUMMARY AND EVALUATION

Table IV-7 gives a summary of the impacts of the eight wastewater management plans considered during Stage III-1

Plan 1: Baseline Condition or No Action Plan

Environmental conditions associated with the Baseline Condition Plan formed the basis against which the other wastewater management plans were compared. The projected conditions under this Plan included existing waste treatment plants at Binghamton-Johnson City, Endicott, Owego Village, Owego Town #1 and Owego Town #2.

Ecological.

The minimum instream dissolved oxygen concentration achieved by Plan 1 would be 3.5 mg/l which represented a relatively poor water quality condition against which the action plans were compared.

The expected nutrient loading would be 6,830 lb/day nitrogen and 1,740 lb/day of phosphorus. The instream ammonia concentration would be 2.06 mg/l (the State standard is 2.0 mg/l).

Resources Commitments.

Resources commitments for the Baseline Plan included 11.2x10/6 KWHr/yr (11.2 times 10 to the 6 power Kilowatt hour per year) of electricity, 271 tons/yr. chlorine, 798 to 1,198 tons/yr. of lime, and 13,900 gal/yr. of fuel. No additional land would be required nor would there be any need for activated carbon, mehanol, or coagulants.

Social.

Existing malfunctions and overflows of septic systems in the Chenango Valley area would continue to represent a public health hazard, not only to area residents, but also to users of the Route 81 River Park engaged in primary contact recreation. Likewise, the reoccurrence of combined sewer overflows in the urban area would continue to have adverse impacts in terms of public health and recreation potential of the Susquehanna.

Existing development patterns would be expected to continue in the Baseline Condition Plan, and, in addition, sewerage services (such as extension of sewer lines) would attempt to keep pace with any such development. Unrestricted extension of sewers in the no action plan may result in development patterns which are undesired by the Southern Tier East Region. Some methods for development restriction, such as flood plain zoning, other local zoning ordinances, and building permit regulations, could help to limit undesirable sprawl.

Any construction of wastewater facilities associated with the Baseline would involve extension of sewer lines, abandonment of some existing facilities and construction of interceptors from abandoned facilities to remaining facilities. Associated with this construction would be short term social impacts such as disruption of traffic and adverse aesthetic impacts in terms of dust and noise.

Economic.

Annual per capita costs by service area for the Baseline Condition were: $0 for Chenango Valley, $3.65 for B-JC Service Area, $4.24 for the Endicott Service Area, $5.77 for the E. Owego Service Area, $3.25 for the W. Owego Service Area, and $7.48 for the Owego Village Service Area.

Plan 2

Plan 2 utilized a four plant regionalization scheme with wastewater treatment facilities located at Binghamton-Johnson City, at Endicott, at Owego Town #1 and Owego Town #2. All treatment facilities would utilize biological secondary waste treatment and the Binghamton-Johnson City STP would also add a nitrification process. It would also include 3 mgd of infiltration control.

Ecological.

The minimum instream dissolved oxygen concentration achieved by Plan 2 would be 5-6 mg/l which would represent a beneficial impact comparison to the Baseline Condition Plan.

Total nitrogen loadings from the sewage treatment facilities in Plan 2 would be 7,540 lb/day and total phosphorus loadings would be 1,905 lb/day. These nutrient inputs are greater than those for the Baseline because of the provision of sewerage services in the Chenango Valley area. The degree of impacts upon aquatic ecosystems, especially in regard to the stimulation of nuisance growths of aquatic vegetation, would be minimal since other environmental factors also act to limit nuisance aquatic growths.

The maximum instream ammonia concentration of 1.14 mg/l achieved by Plan 2 would conform to the ammonia standard set by the NYSDEC and would represent a beneficial impact in comparison to the Baseline Condition Plan.

During construction of regional interceptors I, III and IV temporary adverse impacts, such as increased erosion and sedimentation within surface waters would occur during the two major stream crossings.

Possible direction of development along the 5.2 miles of regional interceptors which would not follow existing roadways could adversely affect the native terrestrial ecosystems occurring in these unbroken areas. Likewise, destruction of the native vegetation and disturbance of associated wildlife within the path of such interceptors would also occur.

Resources Commitments.

The resources commitments for Plan 2 included 1,777 acres for sludge disposal, 16x10/6 KWHr/yr electricity, 267 tons of chlorine per year, and 840 to 1,261 tons/yr of lime. All these resources uses represented larger quantities than the Baseline Condition Plan except for chlorine usage which would be slightly lower in Plan 2.

Social.

Possible induced development patterns associated with the location of municipal sewage treatment facilities in Plan 2 would conform to the desired development patterns according to the Southern Tier East Region General Plan.

Dust, noise and traffic inconveniences would temporarily adversely affect the population along the interceptors which would be constructed along 3.2 miles of existing roadways.

Elimination of septic system overflows and malfunctions in the Chenango Valley area would, in Plan 2, not only reduce potential health hazards but would also improve the primary contact recreation potentials of the area's rivers during non-storm periods.

During construction of the regional interceptors, four recreational areas, including the Route 81 River Park would be temporarily disturbed.

Economic.

Annual costs per capita by service area for Plan 2 would be $3.92 for Chenango Valley and B-JC, $4.73 for the Endicott Service Area, $6.51 for East Owego Service Area, and $5.07 for both West Owego and Owego Village Service areas.

Plan 3

Plan 3 would include six treatment plants: a Chenango Valley STP, the B-JC STP, the Endicott STP, the Owego Town #1 STP, the Owego Town #2 STP, and the Owego Village STP. All treatment plants would utilize secondary biological treatment and, in addition, the B-JC STP would have nitrification. Also 3 mgd of infiltration control would be used at B-J.C. STP.

Ecological.

The minimum DO achieved in Plan 3 would be 5-6 mg/l which would represent a beneficial impact in comparison to the Baseline Condition Plan.

Total loadings of nitrogen would be 7,540 lb/day and total phosphorous loadings would be 1,905 lb/day. These loadings would be greater than those under the Baseline Condition Plan. However, the degree of possible adverse impacts, such as nuisance aquatic growths, would be low since other environmental factors also act to limit nuisance aquatic growths.

The maximum instream NH3 concentration of 1.12 mg/l which would occur under Plan 3 would conform to the NYSDEC ammonia standard and would represent a beneficial impact in comparison to the Baseline.

During the construction of regional Interceptor IV, temporary adverse impacts to aquatic ecology would occur during two major stream crossings.

The construction of a new Chenango Valley STP would require the utilization of approximately 5 acres of land along Route 81 and Route 11-12 near the Broome Community College. The proposed site was once flood plain land before the rechannelization of the Chenango River. Utilization of the proposed site would eliminate a small area of primary weedy vegetation and its associated wildlife. Nevertheless, this elimination would be a minor adverse impact to terrestrial ecosystems when compared to the Baseline Condition Plan which did not include a new Chenango Valley STP.

Possible direction of development along the 2.8 miles of interceptors which do not follow existing roadways would represent an adverse impact to native terrestrial ecosystems. In addition, native terrestrial ecosystems within the path of such interceptors would be eliminated during construction of the interceptors.

Resources Commitments.

Land commitments needed for Plan 3 includes 1,777 acres for sludge disposal and 5 acres for the new Chenango Valley STP. Electricity required would be 16x10/6 KWHr/yr. Lime needed would be 840 to 1,261 tons per year while fuel estimates would be about 14,700 gallons per year. All these requirements would be greater than the Baseline Condition Plan except chlorine which would be slightly less.

Social.

Possible induced development patterns associated with the location of treatment facilities and interceptors would conform to the desired development patterns expressed by the Southern Tier East Region General Plan.

Dust, noise and traffic interruptions would temporarily adversely impact upon the population adjoining the interceptors which would be constructed along 1.4 miles of existing roadways.

Elimination of septic system overflows and malfunctions in the Chenango Valley area would, under Plan 3, not only reduce potential health hazards but would also improve the recreational potentials of the area's rivers during non-storm periods.

During construction of Interceptor IV and the outfall from the Chenango Vally STP, the Route 81 River Park would be temporarily disturbed. Also, improper operation of the Chenango Valley STP could adversely affect (via odors) the Route 81 River Park.

Economic.

Annual costs per capita by service area for Plan 3 would be higher than the Baseline. In the Chenango Valley Service area the cost would be $5.64; in the B-JC Service Area it would be $4.13; in the Endicott Service area it would be $4.73; in the East Owego Service Area it would be $6.51; in the West Owego Service Area it would be $4.29; and in the Owego Village Service Area it would be $6.73.

Plan 4

Plan 4 would utilize 4 sewage treatment plants including: the B-JC STP, the Endicott STP, Owego Town #1 STP, and Owego Town #2 STP. All treatment plants would have biologically based advanced wastewater treatment, and infiltration control measures would be applied to the Binghamton-Johnson City sewerage system. Nonstructural measures would also be used in all service areas.

Ecological.

The minimum dissolved oxygen achieved by Plan 4 would be 6-7 mg/l and would represent a beneficial impact to aquatic ecology when compared to the Baseline Condition Plan.

The total nutrient loadings of nitrogen and phosphorous under Plan 4 would be 625 lb/day and 155 lb/day, respectively. These loadings would represent substantial reductions in N and P loadings to the rivers when compared to the Baseline. The extent of beneficial impacts upon the river system would be low since other environmental factors may be the limiting constituents to nuisance growths of aquatic vegetation.

Maximum ammonia concentrations within receiving waters under Plan 4 would be 0.18 mg/l which would meet the NYSDEC NH3 ammonia standard of 2.0 mg/l. In comparison to the Baseline Condition Plan, Plan 4 significantly reduced instream concentrations of ammonia.

Possible direction of development along the 5.2 miles of interceptors (along interceptors I and IV) which would not follow existing roadways would represent an adverse impact to the native terrestrial ecosystems. In addition, the native terrestrial vegetation and wildlife within the path of such interceptors would be eliminated during construction.

Resources Commitments.

Resource commitments required for Plan 4 included 2,781 acres of land for sludge handling, 20x10/6 KWHr/yr. of electricity, 147 tons of chlorine per eyar, 1,383-2,074 tons per year of lime, 121 tons per year of activated carbon, 3,570 tons of methanol per year, 10,465 tons per year of coagulants, and 158,700 gallons per year of fuel. All these requirements would be significantly higher than the Baseline Condition Plan except the requirement for chlorine which would be somewhat lower.

Social.

Possible induced development patterns associated with the location of treatment facilities and interceptors under Plan 4 would conform to desired development patterns.

Dust, noise and traffic interruptions would temporarily adversely impact upon the population adjoining the interceptors which would be constructed along 3.2 miles of existing roadways.

Elimination of septic system overflows and malfunctions in the Chenango Valley area would, under Plan 4, not only reduce potential health hazards but would also improve the recreational potentials of the area's rivers during non-storm periods.

Economic.

Annual costs per capita by service area would be significantly higher under Plan 4 in comparison to the Baseline Condition Plan (see Table IV-7). Annual Cost to the B-J.C. and Chenango Valley uses would be $8.01; annual costs to the Owego Village and Owego No. 1 users would be $15.27; annual costs to the Endicott users would be $9.21; and annual costs to the East Owego Town STP No. 2 users would be $13.45.

Plan 5

Plan 5 would utilize a scheme of 4 treatment facilities including the B-JC STP, the Endicott STP, Owego Town #1 STP, and Owego Town #2 STP. All treatment facilities would have advanced wastewater treatment utilizing complete physical/chemical waste treatment processes. In addition, infiltration control measures would be utilized in the B-JC sewerage system, and nonstructural measures would be used in all service areas.

Ecological.

The minimum instream dissolved oxygen achieved by Plan 5 would be 6-7 mg/l which would represent a beneficial impact to aquatic ecology when compared to the Baseline Condition Plan.

The total nutrient loadings of nitrogen and phosphorous under Plan 5 would be 625 lb/day and 155 lb/day, respectively.

These loadings would represent substantial reductions in N and P loadings to the rivers when compared to the Baseline. However, the extent of possible beneficial impacts resulting from such nutrient reductions would be uncertain since other environmental factors presently limit nuisance growth of aquatic vegetation.

Maximum ammonia concentrations within receiving waters under Plan 5 would be 0.18 mg/l which would meet the NYSDEC standard for ammonia and would represent a significant reduction of instream NH_3 concentrations when compared to the Baseline Condition Plan.

Possible direction of development along the 5.2 miles of interceptors which would not follow existing roadways would represent an adverse impact to the native terrestrial ecosystems In addition, the terrestrial vegetation and associated wildlife within the path of such interceptors would be eliminated during construction.

Resource Commitments.

Resource commitments required for Plan 5 included 2,841 acres of land for sludge handling, 10x10/6 KWHr per year of electricity, 14,700 tons of chlorine per year, 1,413-2,119 tons of lime per year, 830 tons per year of activated carbon, 10,465 tons per year of coagulants, and 951,000 gallons per year of fuel. All these requirements would be significantly higher than the Baseline Condition Plan except chlorine and electricity which would be lower.

Social.

Possible induced development patterns created by the location of treatment facilities and interceptors under Plan 5 would conform to desired development patterns.

Dust, noise and traffic interruptions would temporarily adversely impact upon the population adjoining the interceptors which would be constructed along 3.2 miles existing roadways.

Elimination of septic system overflows and malfunctions in the Chenango Valley area would, under Plan 5, not only reduce potential health hazards but would also improve the recreational potentials of the area's rivers during non-storm periods.

During construction of interceptors I, III, and IV two recreational areas including the Route 81 River Park would be temporarily disturbed.

Economic.

Annual costs per capita by service area are shown in Table IV-7, the costs are significantly higher for Plan 5 in comparison to the Baseline Condition Plan. Annual costs for

B-J.C. and Chenango Valley would be $9.15; annual costs for Owego Valley and West Owego 1 would be $14.58; annual costs to Endicott would be $10.94; and annual cost to East Owego would be $12.31.

Plan 6

Wastewater management Plan 6 would utilize a four plant scheme including a treatment facility at the Binghamton-Johnson City STP, the Endicott STP, the Owego Town #1 STP, and the Owego Town #2 STP. Each treatment facility would provide secondary wastewater treatment. During the summer months (May through October) 100 percent of the effluent would be applied to the land. During the winter months (November through April) all STP's would discharge effluents to surface waters. Infiltration control measures for B-J.C. and nonstructural measures for all service areas would be used.

Ecological.

During critical summer low river flow conditions, effluent from the sewage treatment plans would be disposed on the land, thus the minimum dissolved oxygen concentrations achieved by Plan 6 would be 6-7 mg/l. Thus, DO concentrations would meet NYSDEC standards during critical summer conditions as well as during the non-critical winter months.

Again, due to diversion of effluents, the total nutrient loadings of nitrogen and phosphorus to receiving waters during the summer months in Plan 6 would be significantly lower than those under the Baseline Condition Plan. Total summer N loadings and P loadings would be zero. The possible affects of such reductions in nutrient inputs upon nuisance growths of aquatic vegetation would be uncertain, however, since other environmental factors presently limit summer nuisance growths. Total nitrogen and phosphorus loadings to receiving waters during the winter months would be 7,540 lb/day and 1,905 lb/day, respectively, for Plan 6. Although the winter nutrient inputs to the aquatic ecosystem would be slightly higher for Plan 6 than for the Baseline, the effects upon aquatic vegetation would be to be minimal.

There would be no instream ammonia concentrations under Plan 6 during the summer. During the winter it would be

0.87 mg/l and this 0.87 mg/l would represent a beneficial impact in comparison to the Baseline Condition Plan. During construction of regional interceptors I, III, and IV and during construction of effluent pipelines to the spray application sites, temporary adverse impacts to stream ecology, in the form of increased erosion and sedimentation would occur during the seven major river and stream crossings.

Possible direction of development along the 5.2 miles of regional interceptors which would not follow existing roadways in Plan 6 would adversely affect the native terrestrial ecosystems occurring in these unbroken areas. In addition, destruction of native vegetation within both the 5.2 miles of interceptor pathways and 2.0 miles of effluent pipeline pathways would occur in Plan 6.

During the operation of the spray application site both beneficial and adverse impacts to terrestrial biota would occur. A gross measure of the magnitude and extent of either beneficial or adverse impacts would be a measure of the total land area requirements for the spray application site. Estimates of the total land requirements for spray application of wastewaters for Plan 6 would be 6,400 acres.

Beneficial impacts upon terrestrial ecology may include: 1) phosphorus and nitrogen contributions from the wastewater effluent could enrich nutrient deficient soils and result in higher crop yields; 2) coliforms, a problem in receiving waters would die-off in the soil matrix; 3) suspended solids, BOD and NOD would add to the organic matter of the soil. On the other hand adverse impacts of spray irrigation of wastewater effluent could include; 1) a build-up of heavy metal ions in the soil or within crops; 2) clogging of soil spaces creating odors and health problems; 3) surface runoff to local stream causing erosion of land surfaces and pollution of surface waters; and 4) changes in vegetative cover and removal of some wildlife habitats could also occur.

Resources Commitments.

The major difference in the commitments of resources between the Baseline Condition Plan and Plan 6 would be the large commitment of land (about 8200 acrea) and electricity required for Plan 6.

Social.

The large total land requirements, in areas of suitable soils and slopes, for spray application of wastewaters in Plan 6 were carefully blocked out in Stage III-1 to avoid the potential displacement of families. Nevertheless, large tracts of land would still be required that would not be available for future residential use.

Commitments of large areas of land in Plan 6 within the Towns of Binghamton and Conklin, to wastewater management by spray application may not conform to local land use and development patterns. On a larger scale, the general physical wastewater management schemes involved in Plan 6 would conform to the desired regional development patterns as expressed in the Southern Tier East Region General Plan.

Dust, noise, and traffic inconveniences would temporarily adversely affect the population adjoining the 3.2 miles of regional interceptors and 12.1 miles of effluent pipelines which would be constructed along existing roadways.

During construction of the regional interceptors and the effluent pipelines to the spray irrigation areas, 4 recreational areas would be temporarily disturbed by Plan 6.

In Plan 6 the elimination of septic system overflows and malfunctions in the Chenango Valley area would not only reduce potential health hazards but would also improve the recreational potentials of the areas rivers during non storm periods. A possible adverse effect to public health would be that spray application of wastewater could result in the possible dispersal of viruses via aerosols. Therefore, to minimize any such adverse affects, spray application areas in Plan 6 would be at a minimum distance of 500 feet from any areas of human activity, such as homes, roads, businesses, and schools. Another possible adverse impact to public health may be created if ponding and stagnation of soil surfaces occurred during spray application. Application rates of sewage effluent should be based on soil and crop characteristics to help prevent such ponding (see Cahpter V of Specialty Appendix). Finally, surface runoff of spray application waters could pollute streams, impoundments or underground waters.

Economic.

Annual costs per capita by wastewater management service area for Plan 6 would be greater than the Baseline Condition Plan. The cost per area would be: Chenango Valley and B-JC--$5.45, Endicott--$5.70, East Owego--$6.49, and West Owego and Owego Village--$6.33.

Plan 7

Plan 7 would include five sewage treatment facilities: the Binghamton-Johnson City STP, the Endicott STP, the Owego Town #1 STP, the Owego Town #2 STP, and Owego Village STP. Nonstructural measures to reduce wastewater flows would be utilized in all service areas and infiltration control measures would be applied to the Binghamton-Johnson City sewerage system.

Ecological.

The minimum instream dissolved oxygen achieved under Plan 7 would be 5-6 mg/l which would represent a beneficial impact to aquatic ecology in comparison to the Baseline.

Total nitrogen loadings from the STP's in Plan 7 would be 7,540 lb/day and total phosphorus loadings would be 1,905 lb/day. These nutrient loadings to receiving waters would be greater than those under the Baseline Condition, due to the addition of waste from Chenango Valley. However, the degree of possible adverse impacts, in the form of nuisance growths of aquatic vegetation, would be small since other environmental factors also act to limit nuisance aquatic growths.

The instream ammonia concentration of 1.67 mg/l achieved under Plan 7 would conform to the NYSDEC standard for NH_3 of 2.0 mg/l and would represent a beneficial impact in comparison to the Baseline Condition Plan.

During construction of the regional interceptors temporary adverse impacts, such as increased erosion and sedimentation in surface waters, would occur during the two major stream crossings.

Possible direction of development along the 4.3 miles of regional interceptors which would not follow existing roadways would adversely affect the native terrestrial ecosystems occurring in these unbroken areas. Likewise, destruction of the native vegetation and associated wildlife within the path of such interceptors would also occur.

Resource Commitments.

Resource commitments for Plan 7 would be very similar to those of the Baseline Plan. The one exception would be the 1777 acres of agricultural land used for sludge application in Plan 7.

Social.

Possible induced development patterns associated with the location of municipal sewage treatment facilities in Plan 7 would conform to desired development patterns according to the Southern Tier East Region General Plan.

Dust, noise and traffic inconvenience would temporarily adversely affect the population along the 2.3 miles of interceptors which would be constructed along existing roadways.

Elimination of septic system overflows and malfunctions in the Chenango Valley area would not only reduce potential health hazards but would also improve the recreational potentials of the area's rivers during non-storm periods.

During construction of the regional interceptors, two recreational areas, including the Route 81 River Park would be temporarily disturbed.

Economic.

Under Plan 7 annual costs per capita would go up in three of the service areas and down in three in comparison to the Baseline Condition Plan. The three that would go up would be Chenango Valley, East Owego, and West Owego. The service areas that would have a decrease in annual costs per capita were B-JC, Endicott, and Owego Village.

Plan 8

Wastewater management Plan 8 utilized a five plant regionalization scheme including the Binghamton-Johnson City STP, the Endicott STP, the Owego Town #1 STP, the Owego Town #2 STP and the Owego Village STP. All sewage treatment facilities would utilize secondary biological waste treatment processes, and there would be 1 mgd of infiltration control at B-J.C.

Ecological.

The minimum instream dissolved oxygen concentration achieved by Plan 8 would be 4-5 mg/l, and this would represent a moderate beneficial impact over the Baseline DO of 3-4 mg/l.

Total nitrogen loadings and phosphorus loadings from the five sewage treatment facilities to the Susquehanna River would be 7,540 lb/day and 1,905 lb/day, respectively. These nutrient inputs to receiving waters would be greater than those for the Baseline Condition Plan due to the inclusion of the wastewater flows from the Chenango Valley area. The degree of possible impacts from such nutrient inputs, in the form of stimulation of nuisance growths of aquatic vegetation, would probably be low since other environmental factors also act to limit nuisance aquatic growths.

The maximum instream ammonia concentration of 2.02 mg/l achieved by Plan 8 is about the same as the Baseline Condition Plan and the NYSDEC standard, and represents no significant impact in comparison to the Baseline.

During construction of regional interceptors III and IV, temporary adverse impacts to aquatic ecosystems, such as increased erosion and sedimentation would occur during the two major stream crossings.

Possible direction of development along the 4.3 miles of regional interceptors which do not follow existing roadways would adversely affect the native terrestrial ecosystems occurring in these unbroken areas. In addition, native terrestrial vegetation and associated wildlife within the interceptor pathways would be eliminated.

Resource Commitments.

Resource commitments for Plan 8 included 1,777 acres of land for sludge management, 11.5x10/6 KWHr per year of electricity, 282 tons of chlorine per year, 840 to 1,261 tons per year of lime and 14,700 gallons per year of fuel. These are approximately the same resource commitments that would be required by the Baseline Condition Plan.

Social.

Possible induced development patterns associated with the location of treatment facilities and regional interceptors would conform to the desired development patterns expresed in the Southern Tier East Region General Plan.

Dust, noise and traffic inconveniences would temporarily adversely affect the population adjoining the 2.3 miles of interceptors which would be constructed along existing roadways.

Elimination of septic system overflows and malfunctions in the Chenango Valley area would not only reduce potential health hazards but would also improve the recreational potentials of the area's rivers during non-storm periods.

During construction of regional interceptors III and IV, two recreational areas including the Route 81 River Park would be temporarily disturbed.

Economic.

Annual per capita costs for Plan 8 would be reduced in two service areas and raised in four in comparison to the Baseline Condition Plan. The two service areas where there would be a reduction were B-JC and Owego Village. The remaining service areas would experience an increase over the Baseline Condition Plan.

SUMMARY AND EVALUATION

Degree of Regionalization

The impacts associated with the degree of regionalization in Broome and Tioga Counties were compared by evaluating the similarities and differences of plans 2 and 3 which provided for secondary treatment facilities at all STP's except the B-JC STP which would have secondary treatment plus nitrification. In Plan 2, Chenango Valley and Binghamton-Johnson City would be joined at regional plant and Owego Village and West Owego would be joined at a regional plant. In Plan 3, each of these service areas would have a separate STP.

As presented in Table IV-7, the impacts which were particularly associated with the level of regionalization in Broome County included: the number of major stream crossings, the in-stream dissolved oxygen during the MA-7-CD-10, the maximum total coliform concentrations, the land acres required for a new STP, the miles of regional interceptors not along existing roadways, the number of miles of regional interceptors along existing roadways, the number of recreational places disturbed, and the economic impacts to the Chenango Valley and B-JC service area residents.

The only impacts which arose that were particularly associated with the level of regionalization in the Owego Village - West Owego areas were the economic impacts to the West Owego and Owego Village service areas. Impacts associated with the degree of regionalization in Tioga County were not observed in the other impact categories.

Ecological.

In Broome County the aquatic ecology impacts associated with two STP's were not significantly different than the aquatic ecology impacts associated with there STP's. The number of major stream crossings (that is, the amount of temporary adverse impacts to aquatic ecology) in both regionalization schemes would be two.

The dissolved oxygen concentration during the MA-7-CD-10 and the total maximum coliform concentration during both the MA-7-CD-10 (that is, the long term aquatic ecology impacts) and storm conditions were slightly, but not significantly, more beneficial in the three plant scheme for Broome County.

The adverse terrestrial ecology impacts associated with a new STP in Broome county was counterbalanced by the additional miles of terrestrial ecosystems which would be disturbed under the two plant scheme, which would require additional connecting interceptors. Therefore, neither regionalization scheme in Broome County would be significantly more beneficial than the other in terms of terrestrial ecology impacts.

Social.

In Broome County, under the social impact category, the number and location of recreational facilities (such as the ball park in the Town of Chenango and the Route 81 River Park) disturbed during construction would be the same, although the three plant scheme could disturb the Route 81 River Park on a long-term basis via odors and other unfavorable aesthetic implications of the Chenango Valley STP. Therefore, on a cumulative basis, the additional short-term social impacts associated with two plants could be offset by the possible additional long-term social impacts of three plants.

Economic.

The most significant differences, in terms of impacts, between two and three plants in Broome County would be noted in the economic factors. For the two plant scheme, economic impacts to both the Chenango Valley service area and Binghamton-Johnson City service area would be less than under the three plant scheme. Although the economic benefits for the B-JC service area to regionalize with Chenango Valley were not too striking, the economic benefits for Chenango Valley to regionalize would be obvious.

Possible adverse economic impacts to the West Owego service area would be less under a three plant scheme in Tioga County than under a two plant scheme. Although Table IV-7 indicates that two plants would have fewer adverse economic impacts for the Owego Village service area than three plants, the cost-effective analysis indicated that subregionalization for Owego Village would be the best scheme. Additionally, institutional arrangements would most likely be implemented in the Owego Village-West Owego area, to minimize the adverse economic impacts for the Owego Village area under the three plant scheme with secondary treatment.

However, at higher degrees of treatment, the economics of scale definitely favor a single plant for Owego Village and West Owego.

Treatment Level

Treatment levels associated with the seven action wastewater management plans included: secondary biological treatment at all treatment plants, secondary biological treatment at all plants except the B-JC STP (which would have secondary treatment plus nitrification), seasonal spray application of effluent, and some form of advanced waste treatment at all sewage treatment plants. In the following comparison of treatment levels, the optimum regionalization scheme for Broome and Tioga County have been assumed, that is, regionalization of Owego Village and West Owego at higher levels of treatment and separate plants for Owego Village and West Owego when secondary treatment is applied in the Owego area.

Table IV-6 presents a comparison and evaluation of the four general treatment levels. Each treatment level is ranked from 1 to 4 based on its beneficial and/or adverse impacts within each of five impact categories including aquatic ecology, terrestrial ecology, resource commitments, social factors, and economic factors. (It should be noted that these rankings cannot be summed, nor can an average be obtained by simple numerical calculation. This is because a simple comparison of the beneficial impacts on aquatic ecology cannot be numerically compared to the adverse impact on the terrestrial ecology.)

Secondary treatment at all treatment facilities would generally be the least costly for all service areas, had few adverse terrestrial ecology impacts and required few resource commitments. However, secondary treatment at all STP's had the fewest benefits to aquatic ecology and only slight benefits to water-oriented recreation in comparison to other treatment levels.

Under secondary treatment at all STP's plus nitrification at Binghamton-Johnson City, there would be few adverse terrestrial ecology impacts, few resource commitments and moderate beneficial impacts to aquatic ecology. The temporary adverse aesthetic impacts associated with construction at this treatment level were offset by the beneficial impacts to water oriented recreation. In addition, the costs associated with this treatment level were relatively low in comparison to the benefits achieved.

TABLE IV-6

RANKING OF TREATMENT LEVELS*

	Secondary At STP's	Secondary + Nitrification At Binghamton	Seasonal Land Application	Advanced Waste Treatment
Aquatic Ecology	4	3	2	1
Terrestrial Ecology	1	2	3	4
Resource Commitments	1	2	4	3
Social Factors	3	2	4	1
Economic Factors	1	2	3	4

*Rankings from 1 (best) to 4 (worst).

The two advanced waste treatment plans (biological based and physical/chemical based) were assumed to be similar on a comparative basis to other treatment levels. Major benefits of advanced waste treatment to aquatic ecology and to water oriented recreation were counterbalanced to a great extent by large commitments of resources and possibe severe economic impacts. A comparison of biological and physical/chemical advanced waste treatment on the basis of impact indicators is presented in Table IV-7. The two impact categories which emphasized differences between the two AWT plans were resource commitments and economic factors. In all other impact categories, the impacts associated the two AWT alternatives were not significantly different. The resource commitments associated with biological advanced waste treatment are generally less than those for physical/chemical advanced waste treatment especially for such critical resources chlorine and fuel consumption. The economic impacts associated with biological AWT were slightly less adverse than for physical/chemical AWT for the service areas in Broome County. However, the economic impacts of biological AWT are slightly more adverse than the economic impacts of physical/chemical AWT for the Tioga County service areas.

The seasonal land application alternative did not compare favorably with the other three basic treatment levels compared in Table IV-6. The possible severe adverse social impacts and resource commitments associated with the large electrical and land (particularly in Broome County) requirements of the seasonal land application plan outweighed any benefits to aquatic ecology and terrestrial ecology since the same benefits may be obtained in other plans in a more environmentally acceptable manner. In addition, the costs associated with land application, which are not high in comparison to the other AWT plans, would be moderately high in comparison to other treatment plans in terms of the possible benefits gained.

TABLE IV-7

IMPACT ASSESSMENT SUMMARY STAGE III-1

(YEAR 2020)

IMPACT INDICATORS	1 BASELINE PLAN	2 FOUR PLANTS 2 BROOME	2 FOUR PLANTS SUM	2 FOUR PLANTS 2 TIOGA	3 SIX PLANTS 3BROOME	3 SIX PLANTS SUM	3 SIX PLANTS 3TIOGA	4 BIOLOGICAL AWT	5 PHYSICAL/CHEMICAL AWT	6 SEASONAL LAND APPLICATION	7 NON-STRUCTURAL + I-CONTROL	8 SECONDARY TREATMENT
ECOLOGICAL												
1. # Major Stream Crossings	1	2			2			2	2	7	2	2
2. DO (mg/1) a) MA-7-CD_{10}	3.5		5.4			5.5		6.7	6.7	6.9	5.1	4.4
b) Design Storm	3-4		5-6			5-6		5-6	5-6	5-6	5-6	4-5
3. Total N lb/day	6830		7540			7540		625	625	0	7540	7540
4. Total P lb/day	1740		1905			1905		155	155	0	1905	1905
5. NH_3 (mg/1)	2.06		1.14			1.12		0.18	0.18	0	1.67	2.02
6. Benefit to Fisheries Resources	None		Moderate			Moderate		Large	Large	Large	Moderate	Slight
7. Maximum Total Coliform (MPN/100 ml) a) MA-7-CD_{10}	<1000		360		340			360	360	0	360	360
b) Design Storm	240,000		1040		1025			1040	1040	<1000	1040	1040
8. Acreage for new STP	0	0			5			0	0	0	0	0
9. Acreage for Spray Irrigation of effluent	0		0			0		0	0	6400	0	0
10. Acreage for Land Application of sludge	-	1770 (7.0 for storage)				1770 (7.0 for storage)		2765 (16.0 for storage)	2825 (16.0 for storage)	1770 (7.0 for storage)	1770 (7.0 for storage)	1770 (7.0 for storage)
11. Miles of Regional Interceptors not Along Existing Roadways	4.0	4.3		.9	2.8			5.2	5.2	5.2	4.3	4.3
12. Miles of Other Pipeline not Along Existing Roadways	0		0			0		0	0	2.0	0	0
RESOURCE COMMITMENTS												
1. Total Lane Requirements (acres)	-		1777		5	1777		2781	2841	8177	1777	1777
2. Electricity (KWHr/Yr)	$11.2x10^6$		$16x10^6$			$16x10^6$		$20x10^6$	$10x10^6$	$30.5x10^6$	$11.5x10^6$	$11.5x10^6$
3. Chlorine (tons/Yr)	271		267			267		147	14,000	282	282	282
4. Lime (tons/year)	798-1198		840-1261			840-1261		1383-2074	1413-2119	840-1261	840-1261	840-1261
5. Activated Carbon (tons/Yr)	-		-			-		121	830	-	-	-
6. Methanol (tons/yr)	-		-			-		3570	-	-	-	-
7. Coagulants a) Alum (tons/yr)	-		-			-		10,400	10,400	-	-	-
b) Polymers (tons/yr)	-		-			-		65	65	-	-	-
8. Fuel (gal/yr)	13,900		14,700			14,700		158,700	951,000	14,700	14,700	14,700
SOCIAL												
1. Miles of regional interceptors along existing roadways	4.5	2.3		0.9	1.4			3.2	3.2	3.2	2.3	2.3
2. Miles of other pipelines along existing roadways	0		0			0		0	0	12.1	0	0
3. # historic sites disturbed	0		0			0		0	0	0	0	0
4. # recreational places disturbed	0	2			2			2	2	4	2	2
5. Improvement to Secondary Water Contact Recreation Potentials	None		Moderate			Moderate		Large	Large	Large	Moderate	Slight
6. Improvement to Primary Water Contact Recreation Potentials	None		Large			Large		Large	Large	Large	Large	Large
7. # Families Displaced	0		0			0		0	0	0	0	0
8. Result in locally desired development patterns	May or May not		Yes			Yes		Yes	Yes	No	Yes	Yes
9. Result in regionally desired development patterns	May or May not		Yes			Yes		Yes	Yes	Yes	Yes	Yes
10. Contravene air quality standards	No		No			No		No	No	No	No	No
ECONOMIC												
Annual per capita costs ($)												
1. Chenango Valley - Service Area	-	3.92			5.64			8.01	9.15	5.45	3.49	3.39
2. BJC Service Area	3.65	3.92			4.13			8.01	9.15	5.45	3.49	3.39
3. Endicott Service Area	4.24		4.73			4.73		9.21	10.94	5.70	4.18	4.73
4. E. Owego Service Area	5.77		6.51			6.51		13.45	12.31	6.49	6.51	6.51
5. W. Owego Service Area	3.25			5.07			4.29	15.27	14.58	6.33	4.29	4.29
6. Owego Village Service Area	7.48			5.07			6.73	15.27	14.58	6.33	6.73	6.73

ITERATION 2

MODIFICATION AND REFINEMENTS

As described in Chapter VI of the Plan Formulation Appendix, the eight plans of Stage III-1 were reduced in number by dropping the spray application plan and physical-chemical based advanced waste treatment. It was also decided that in Stage III-2 three different methods for sewering of the Chenango Valley area should be reviewed. These included: (a) a separate Chenango Valley STP, (b) connection of Chenango Valley to the Binghamton-Johnson City Sewage Treatment Plant and (c) a first phase plant servicing a limited area in the Chenango Valley to be expanded to a full scale sewage treatment plant depending on the demonstrated need for servicing. Three sewage treatment plants in Tioga County were recommended at the end of Stage III-1 except for the AWT Plan where it was more cost effective with two plants.

DESCRIPTION OF PLANS

Table IV-8 shows the relationship between the plans of Stage III-1 and Stage III-2. Table IV-9 summarizes the four plans of Stage III-2 and the different options of plans 2 and 3 which took into account the question of degree of regionalization in Broome County.

Plan 1: Baseline Condition Plan

The Baseline Condition Plan was the no action plan that provides the basis for the impact assessment of the other three wastewater management plans. Plan 1 assumed that the Urban Study Area's wastewater management system remained unchanged from those presently planned for the year 1977.

It was assumed that no wastewater treatment plants would be added other than those that have already been approved by NYSDEC for construction by 1977. Expansion of existing STP's service area were ssumed to continue to follow the existing trends. The additional interceptors approved by NYSDEC for funding by 1977 were assumed to be included in the baseline conditions. However, the Chenango Valley interceptor was not included in these conditions, since

TABLE IV-8

RELATIONSHIP BETWEEN STAGE III-1 AND STAGE III-2 PLANS

Stage III-1 Plans	Features	Stage III-2 Plans	Changes	Rationale
1	Baseline	1	None	Basis for Assessment
8	Secondary; 2+3 STP's, 1 mgd infiltration control storm overflow control	2	STP's: 2+3 (Plan 2A), 3+3 (Plan 2B), 3+3 (First Phase Plan 2C)	Determine optimum degree of regionalization to achieve 4 mg/l DO
2,3	Secondary; nitrification @ Binghamton-Johnson City STP's: 2+2 (Plan 2), 3+3 (Plan 3); 3 mgd infiltration control storm overflow control	3	STP's: 2+3 (Plan 3A), 3+3 (Plan 3B), 3+3 (First Phase Plan 3C)	Determine optimum degree of regionalization to achieve 5 mg/l DO
4	Advanced waste treatment; 2+2 STP's; 3 mgd infiltration control; non-structural measures; storm overflow control	4	None	Approach zero discharge by 1985

NOTE: (2+3) STP's refers to the number of Sewage Treatment Plants in Broome County and Tioga County, respectively.

TABLE IV-9

STAGE III-2 WASTEWATER MANAGEMENT PLANS

PLAN	OBJECTIVE	NUMBER OF STPS BROOME	NUMBER OF STPS TIOGA	CHENANGO FIRST PHASE	BINGHAMTON INFILTRATION REDUCTION (MGD)	PER CENT ACHIEVEMENT OF NON-STRUCTURAL MEASURES
1	Baseline	2	3	No	0	0
2A	4 mg/1	2	3	No	1	0
2B	4 mg/1	3	3	No	1	0
2C	4 mg/1	3	3	Yes	1	0
3A	5 mg/1	2	3	No	3	0
3B	5 mg/1	3	3	No	3	0
3C	5 mg/1	3	3	Yes	3	0
4	AWT	2	2	No	3	100

Broome County was studying other alternatives. The interceptors providing service for growth areas that were included in the Broome County Sewage Feasibility Study were also included in the Baseline Condition Plan.

The wastewater management plans for the Baseline Condition Plan included abandonment of the Vestal STP and diversion of its influent sewage via a new interceptor to the Endicott STP. Also included was the upgrading of the Owego Village STP to provide secondary treatment, and abandonment of the Owego Valley View STP and diversion of its influent sewage to an upgraded Owego Village STP. The remaining STP's, including Binghamton-Johnson City STP, Owego Town #1 STP, Owego Town #2 STP, and Endicott STP would not be expanded or upgraded. The Chenango Valley area would continue on septic systems under Plan 1, and extensions of sewage collection and treatment services would take place within the Nanticoke Creek Valley and toward Five Mile Point. The Baseline Plan also assumed that the sewered population to all STP's would continue to grow and sewage flows would increase.

The present worth value of Plan 1, the Baseline Condition Plan, would be $31.9 million.

<u>Plan 2A</u>

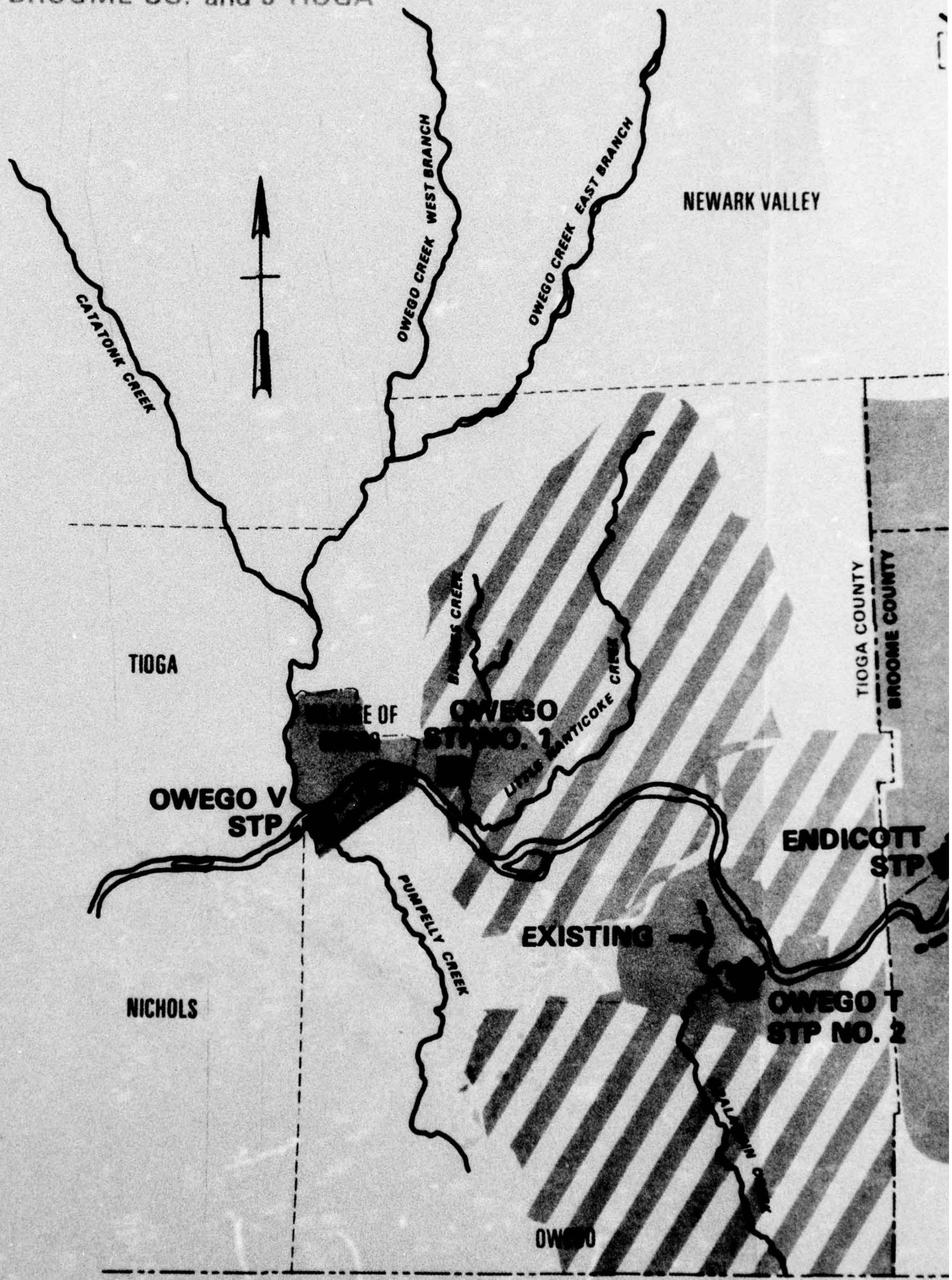
The intent of this Plan was to achieve a minimum DO of 4 mg/l in the Susquehanna River during both low flow and storm overflow conditions. This alternative included two sewage treatment plants in Broome County and three STP's in Tioga County. Comparing this plan to plans 2B and 2C would enable the selection of a cost-effective plan to maintain a minimum DO of 4 mg/l during low flow conditions. The present worth of the costs for Plan 2A was $47.2 million.

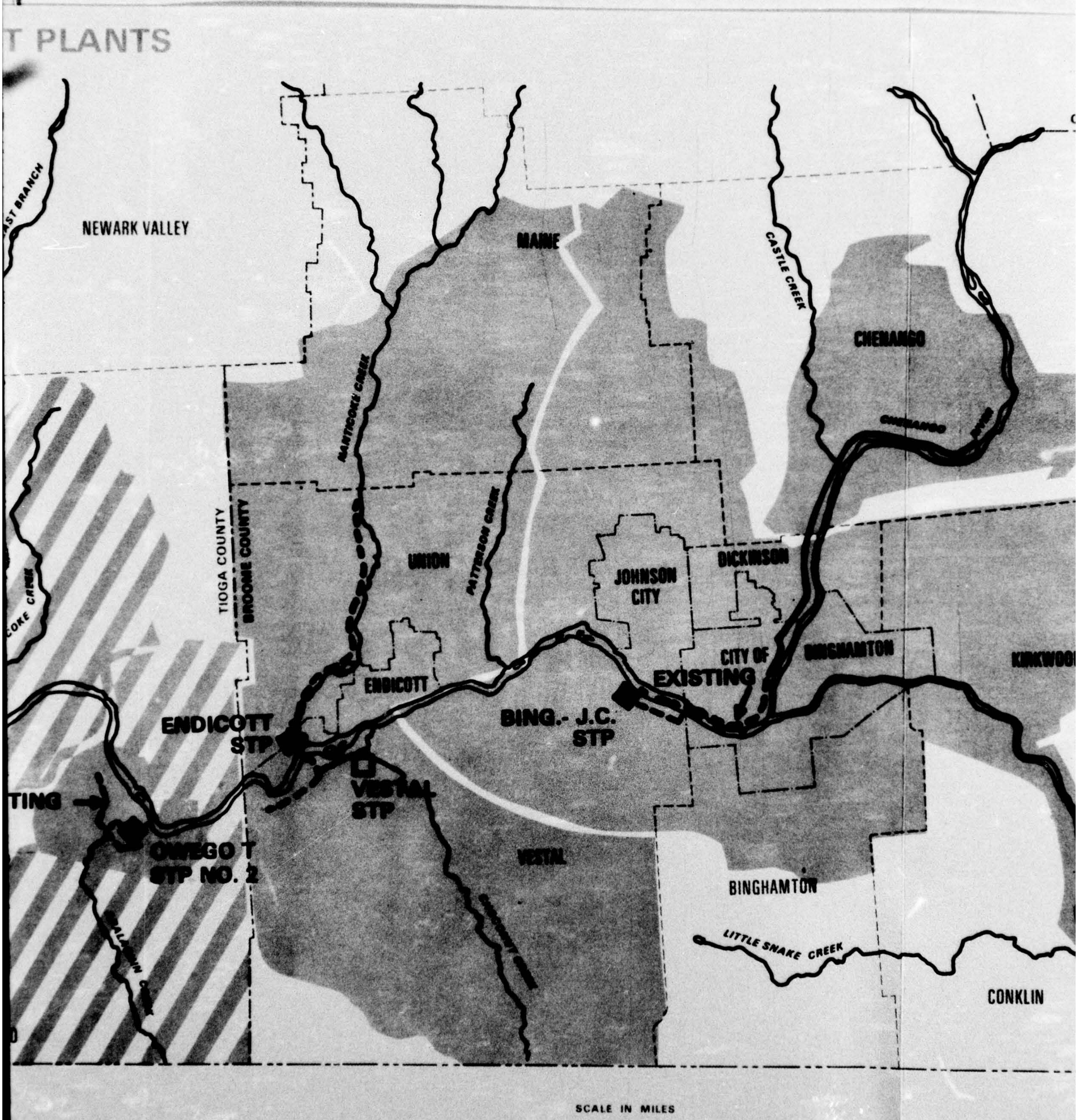
This Plan included two STP's at Broome County and three STP's at Tioga County as shown in Figure IV-1. The Broome County plants would be at the existing Binghamton-Johnson City and Endicott STP's. The wastewater generated at the Chenango service area would be treated at the B-JC STP. Tioga County plants would be at the Owego Town #1 STP, the Owego Town #2 STP and the Village of Owego STP.

The interceptors included in this plan are shown in Figure IV-2 and IV-3. The only regional interceptors for Plan 2A in addition to those already included in the Baseline Condition Plan, would be the interceptor from the Chenango Valley

FIVE REGIONAL TREATMENT PLANTS

2 BROOME CO. and 3 TIOGA





T PLANTS
NEWARK VALLEY
MAINE
CASTLE CREEK
CHENANGO
NANTICOKE CREEK
PATTERSON CREEK
UNION
TIOGA COUNTY
BROOME COUNTY
JOHNSON CITY
DICKINSON
CITY OF BINGHAMTON
EXISTING
ENDICOTT
ENDICOTT STP
BING.- J.C. STP
VESTAL STP
VESTAL
OWEGO T STP NO. 2
TING
BINGHAMTON
LITTLE SNAKE CREEK
CONKLIN
SCALE IN MILES
1 0 1 2 3 4 5

2

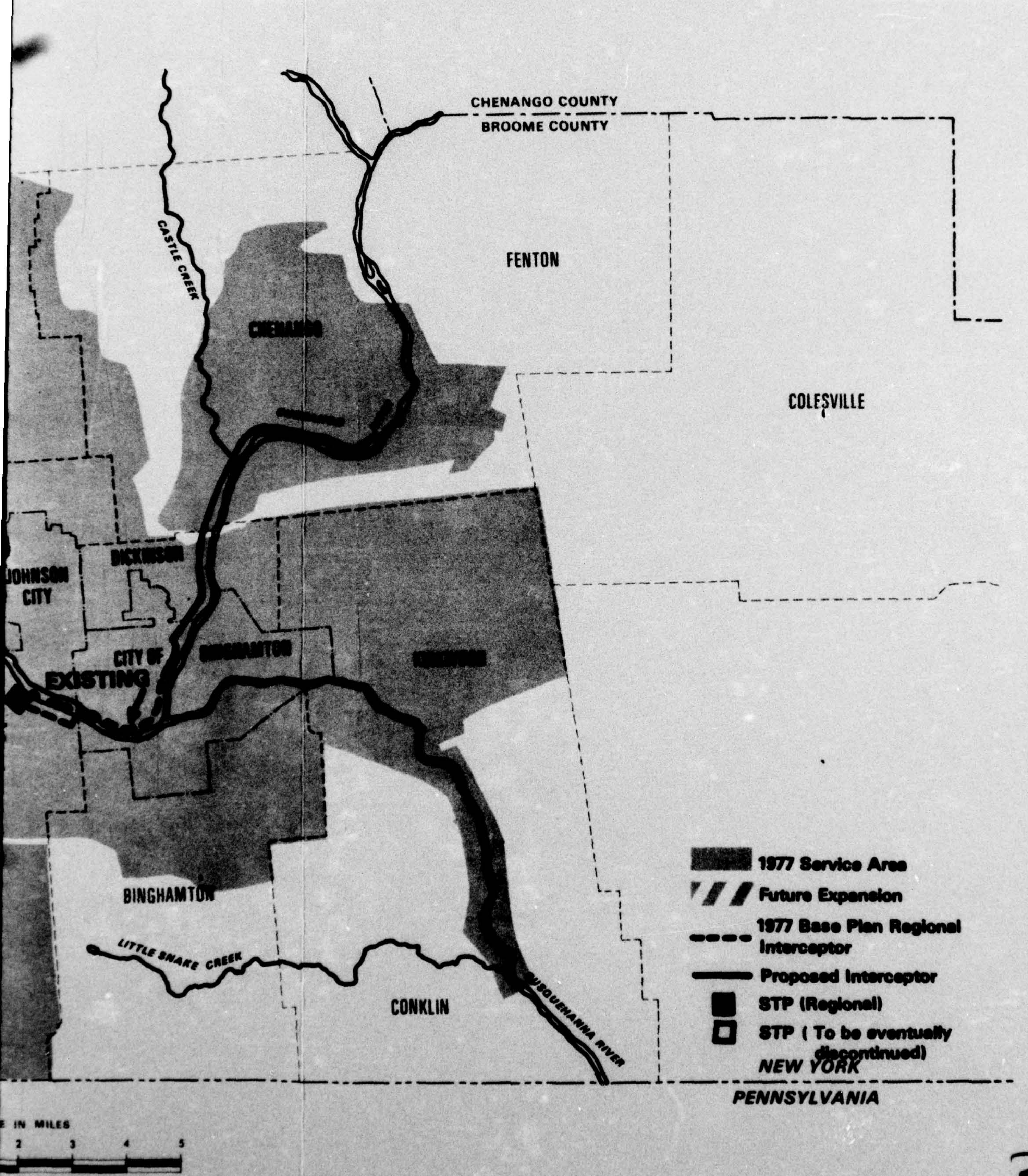
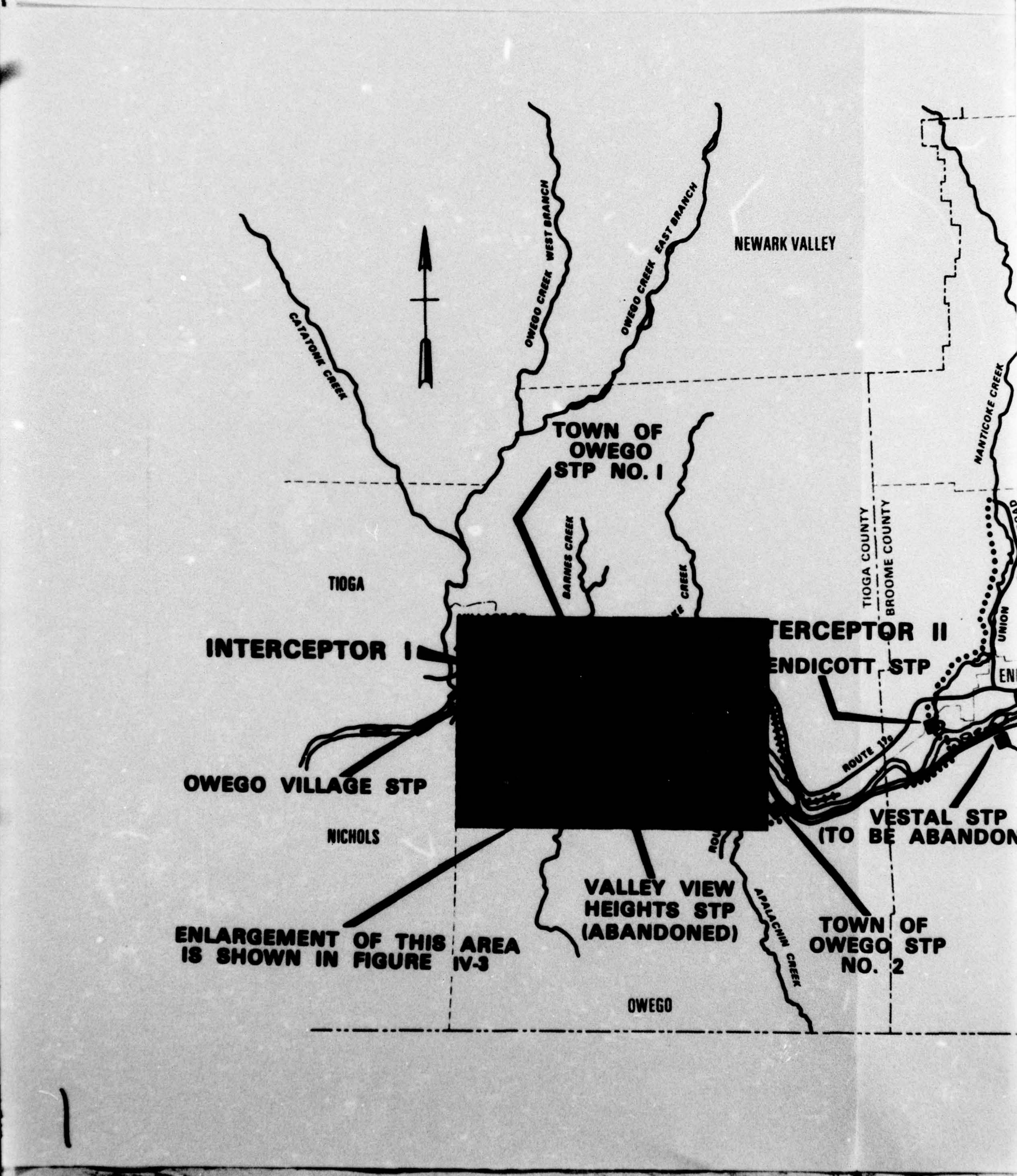
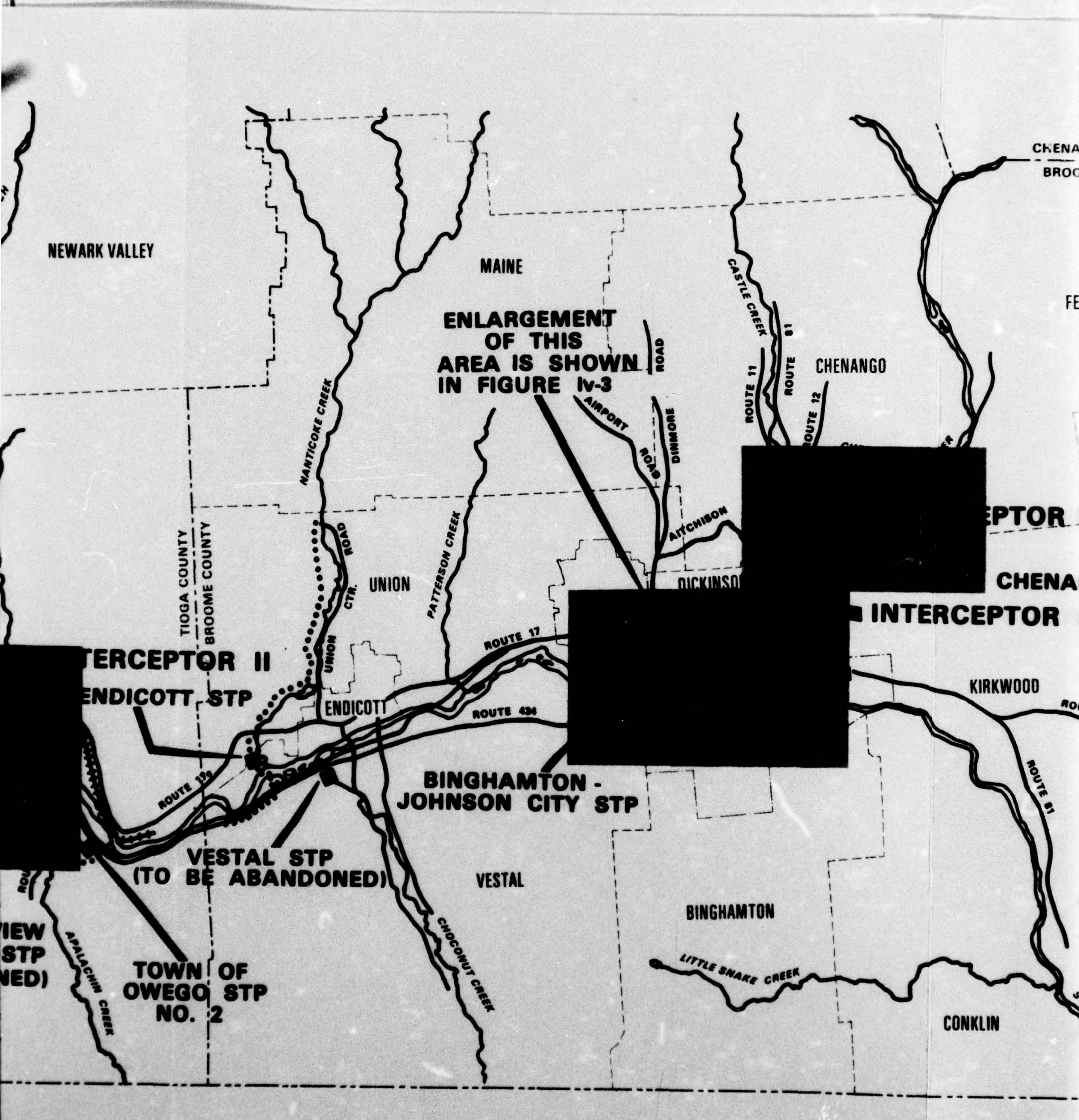

CHENANGO COUNTY
BROOME COUNTY
CASTLE CREEK
FENTON
CHENANGO
COLESVILLE
DICKINSON
JOHNSON CITY
CITY OF BINGHAMTON
EXISTING
BINGHAMTON
LITTLE SNAKE CREEK
CONKLIN
SUSQUEHANNA RIVER
NEW YORK
PENNSYLVANIA
1977 Service Area
Future Expansion
1977 Base Plan Regional Interceptor
Proposed Interceptor
STP (Regional)
STP (To be eventually discontinued)
2 3 4 5

FIGURE IV-1


NEWARK VALLEY
CATATONK CREEK
OWEGO CREEK WEST BRANCH
OWEGO CREEK EAST BRANCH
NANTICOKE CREEK
TOWN OF OWEGO STP NO. 1
BARNES CREEK
TIOGA
TIOGA COUNTY
BROOME COUNTY
UNION
INTERCEPTOR I
[redacted]
TERCEPTOR II
ENDICOTT STP
ROUTE 17
OWEGO VILLAGE STP
NICHOLS
VESTAL STP
(TO BE ABANDON
VALLEY VIEW HEIGHTS STP (ABANDONED)
APALACHIN CREEK
TOWN OF OWEGO STP NO. 2
ENLARGEMENT OF THIS AREA IS SHOWN IN FIGURE IV-3
OWEGO


NEWARK VALLEY
MAINE
ENLARGEMENT OF THIS AREA IS SHOWN IN FIGURE Iv-3
CHENANGO
CASTLE CREEK
ROUTE 11
ROUTE 81
ROUTE 12
AIRPORT ROAD
DINMORE ROAD
NANTICOKE CREEK
PATTERSON CREEK
AITCHISON
TIOGA COUNTY
BROOME COUNTY
UNION CTR. ROAD
UNION
[redacted]
INTERCEPTOR
KIRKWOOD
ROUTE 17
ROUTE 434
ROUTE 17c
ROUTE 81
ENDICOTT
ENDICOTT STP
BINGHAMTON - JOHNSON CITY STP
VESTAL STP (TO BE ABANDONED)
VESTAL
TOWN OF OWEGO STP NO. 2
APALACHIN CREEK
CHOCONUT CREEK
BINGHAMTON
LITTLE SNAKE CREEK
CONKLIN
SCALE IN MILES
1 0 1 2 3 4 5

2

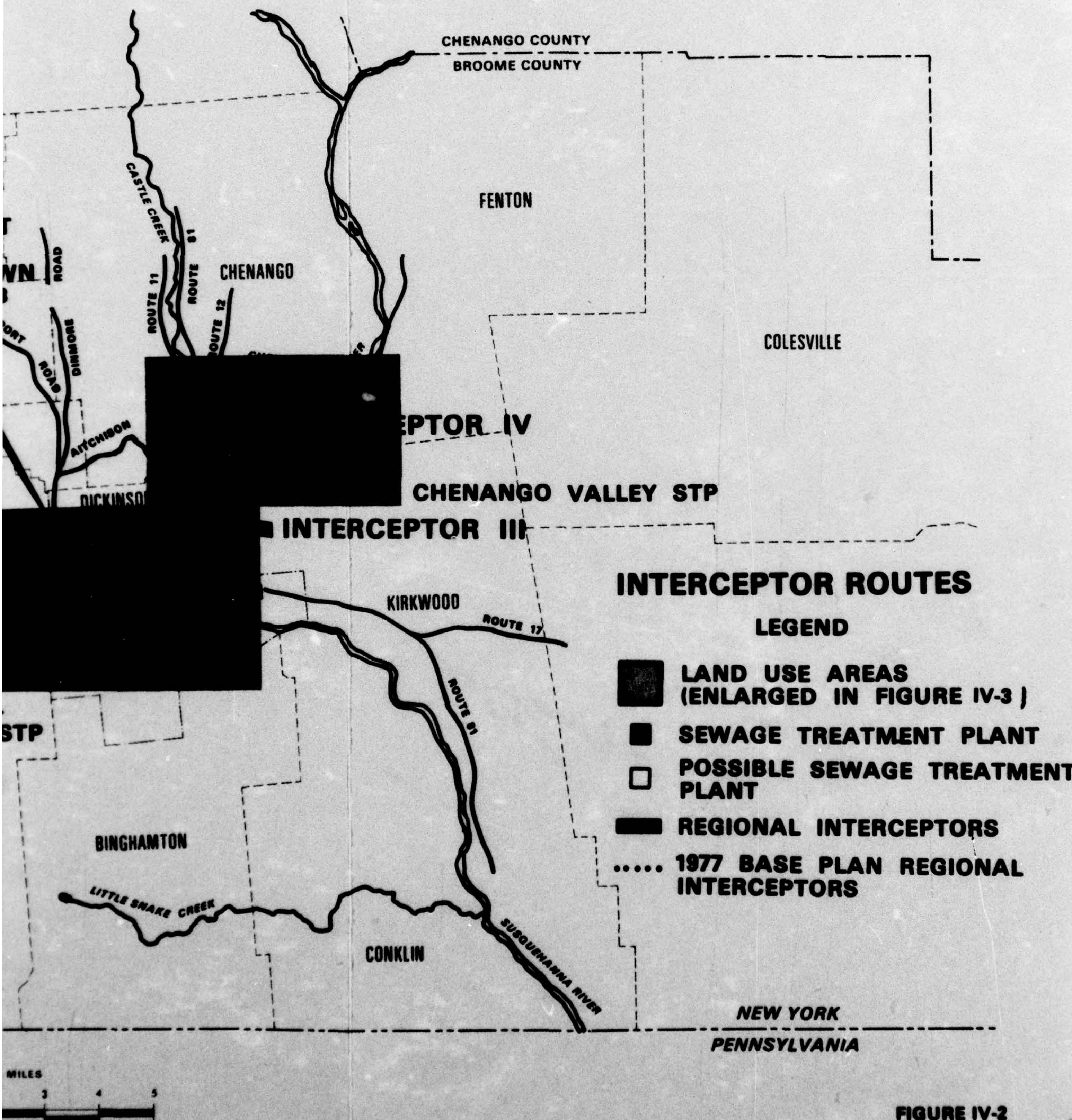
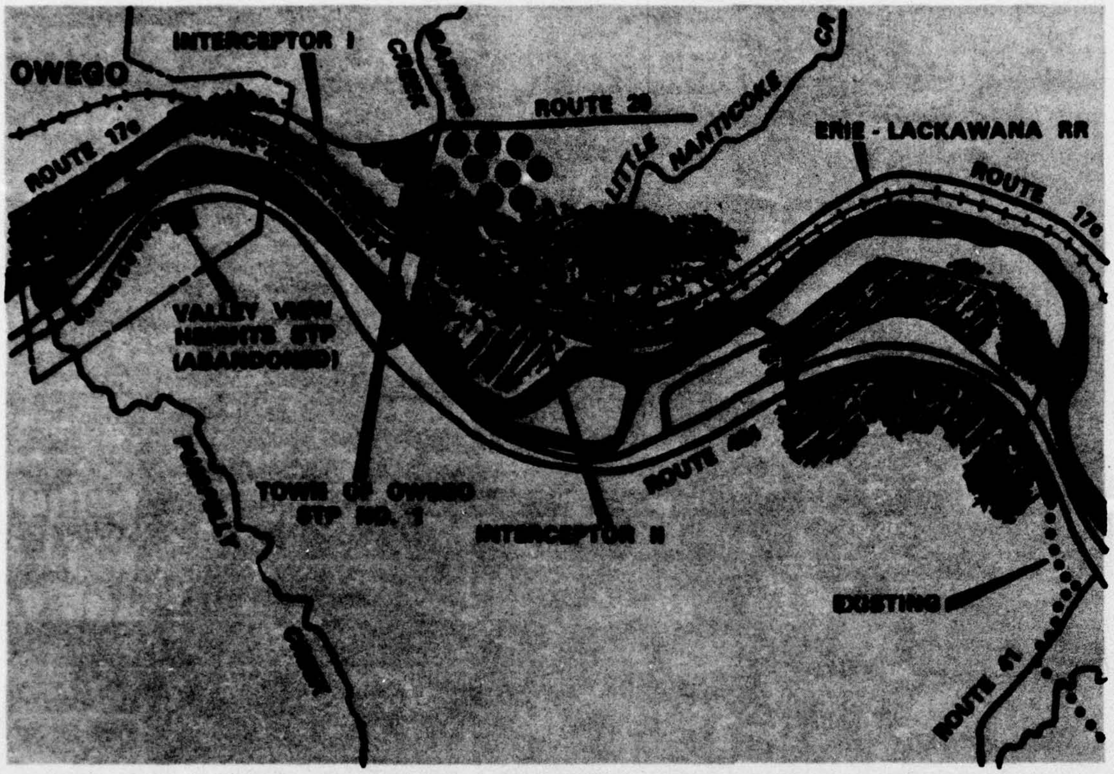
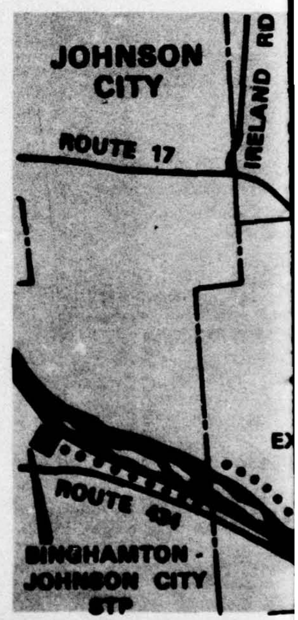
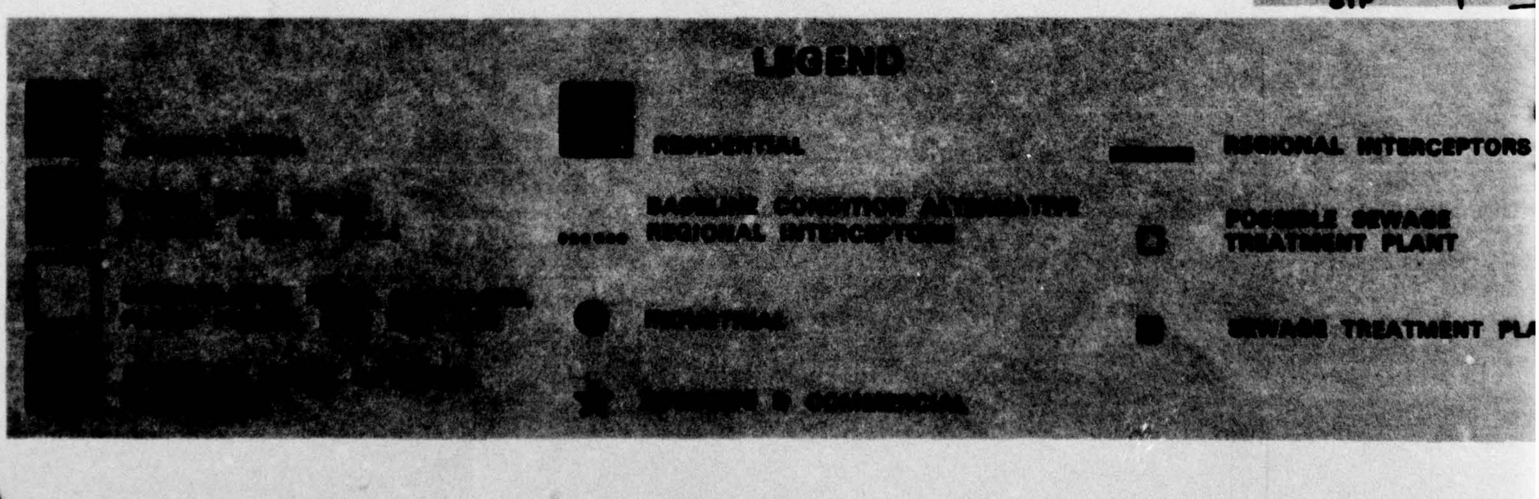

CHENANGO COUNTY
BROOME COUNTY
FENTON
CHENANGO
COLESVILLE
CASTLE CREEK
ROUTE 81
ROUTE 11
ROUTE 12
ROAD
DIMMORE
AITCHISON
PTOR IV
CHENANGO VALLEY STP
INTERCEPTOR III
KIRKWOOD
ROUTE 17
ROUTE 81
STP
BINGHAMTON
LITTLE SNAKE CREEK
CONKLIN
SUSQUEHANNA RIVER
NEW YORK
PENNSYLVANIA
MILES
3
4
5
INTERCEPTOR ROUTES
LEGEND
LAND USE AREAS (ENLARGED IN FIGURE IV-3)
SEWAGE TREATMENT PLANT
POSSIBLE SEWAGE TREATMENT PLANT
REGIONAL INTERCEPTORS
1977 BASE PLAN REGIONAL INTERCEPTORS

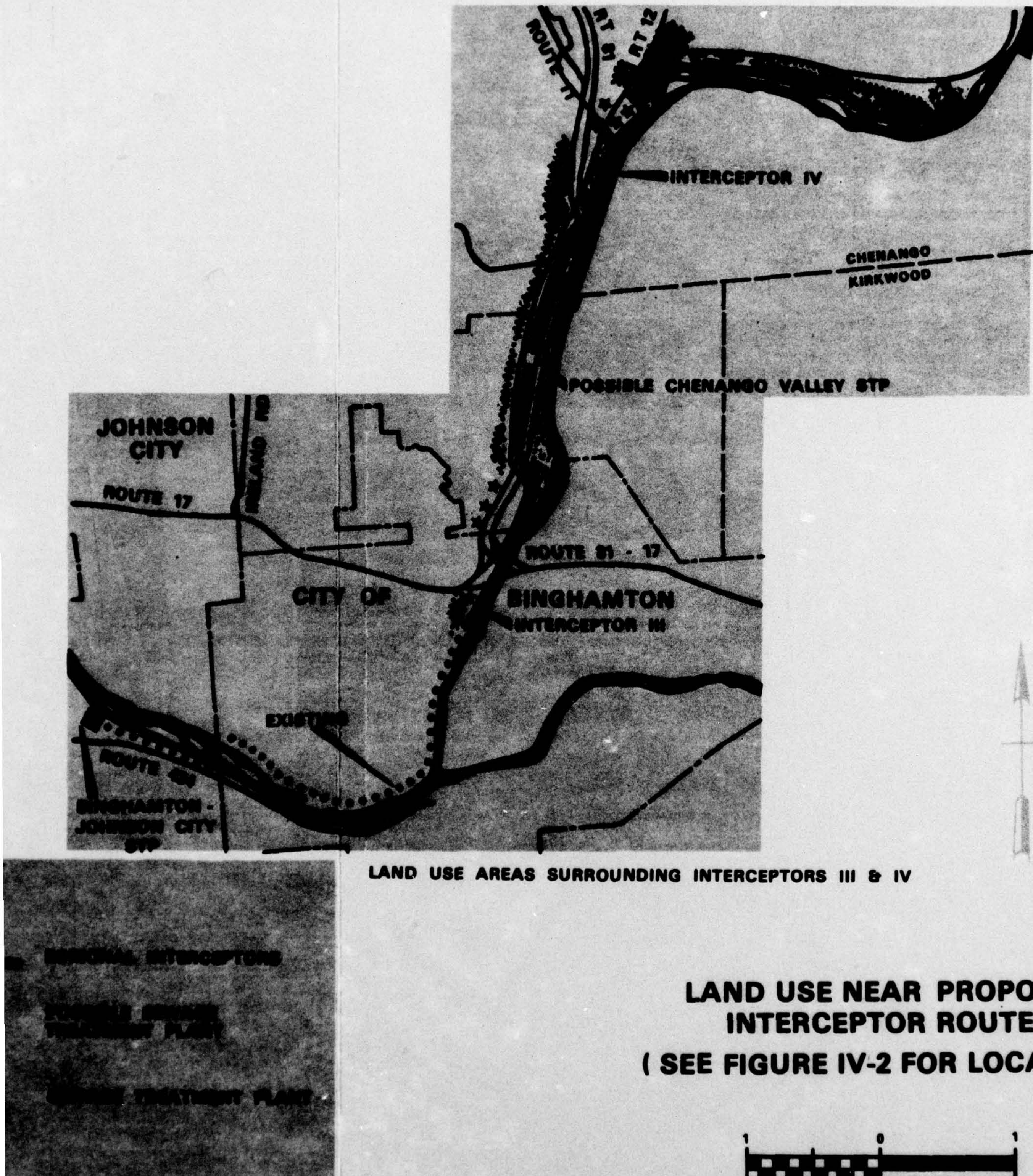
FIGURE IV-2



LAND USE AREAS SURROUNDING INTERCEPTORS I & II







LAND USE NEAR PROPOSED INTERCEPTOR ROUTES

(SEE FIGURE IV-2 FOR LOCATION)

1 0 1

SCALE IN MILES

FIGURE IV-3

to the City of Binghamton wastewater collection system and Interceptor IV collecting sewage within the Chenango Valley.

Secondary treatment would be applied at all STP's. The existing activated sludge processes would be used at the Binghamton-Johnson City STP and at the Owego Town #2 STP. The existing trickling filter processes would be used at the Endicott STP and the Owego Town #1 STP. The Village of Owego STP would be upgraded to provide secondary treatment using a trickling filter process.

The cost-effectiveness of alternative infiltration control levels in the City of Binghamton wastewater collection system were evaluated. For the level of treatment (secondary) and the regionalization scheme assumed in this Plan 2A, an infiltration flow reduction of one mgd was found to be economically justifiable.

In this Plan, it was assumed that the Village of Endicott and the Town of Owego would institute metered user rates. Given that the fees would be leveed via a metered rate, the increase in the price the consumer is paying for water associated with this Plan above the current price should result in a decrease from current water consumption.

Five microscreening devices followed by chlorination facilities would be provided near the major overflow sites (see Figure IV-4). This storm overflow treatment system would maintain a minimum DO of 4 mg/l during storm conditions.

The sludge management techniques for Plan 2A would be land application of liquid sludge with the land fill alternative considered as a backup.

Plan 2B

The intent of this Plan was to achieve a minimum DO of 4 mg/l in the Susquehanna River during both low flow and storm overflow conditions. This Plan included three sewage treatment plants in Broome County and three STP's in Tioga County. Comparing this Plan to plans 2A and 2C, would enable the selection of a cost-effective plan to maintain a minimum DO of 4 mg/l during low flow conditions. The present worth of the costs for Plan 2B would be $47.7 million.

This Plan included three STP's in Broome County and three STP's in Tioga County as shown on Figure IV-5. The Broome County plants would be at the existing Binghamton-Johnson

CITY OF BINGHAMTON
LOCATION OF PLANNED OVERFLOW CONTROL FACILITIES

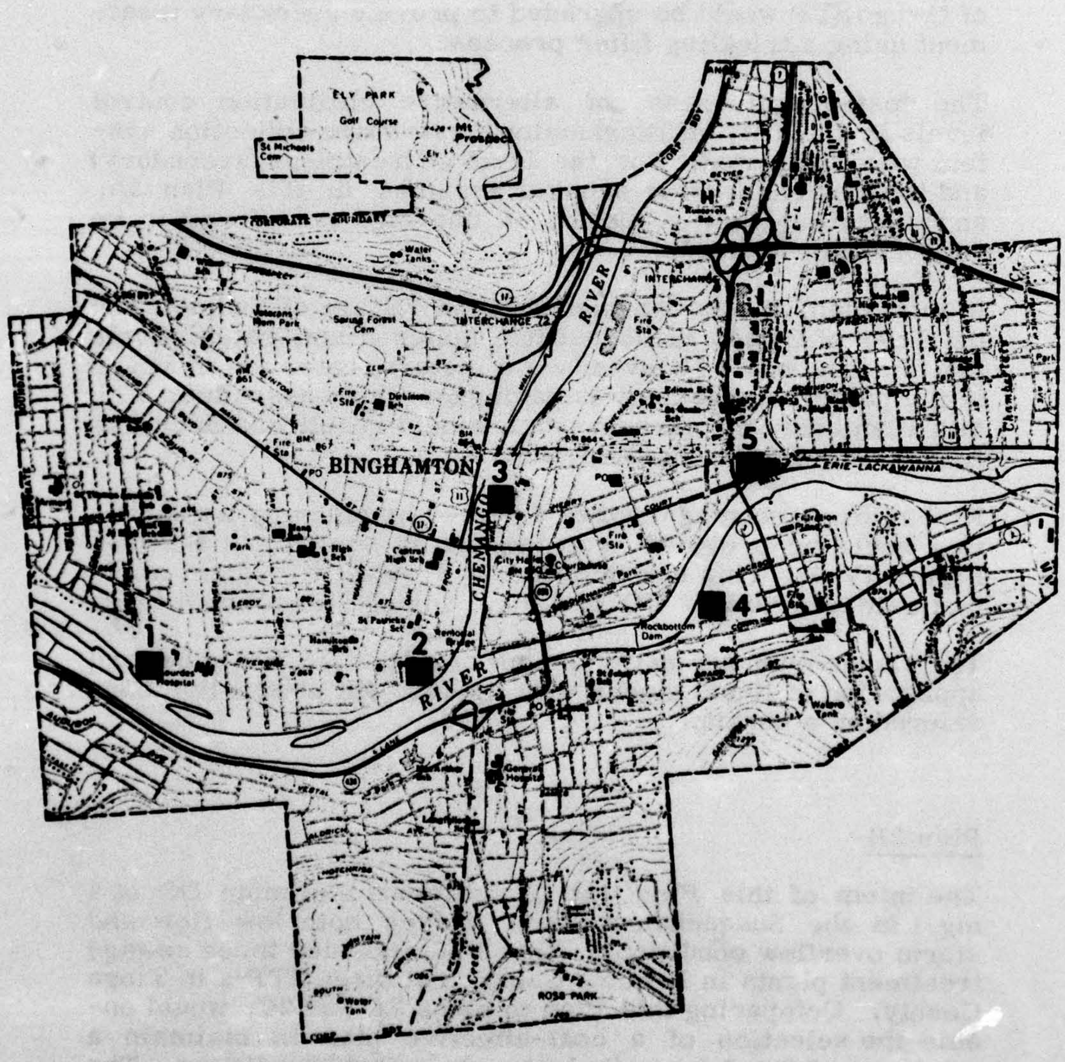
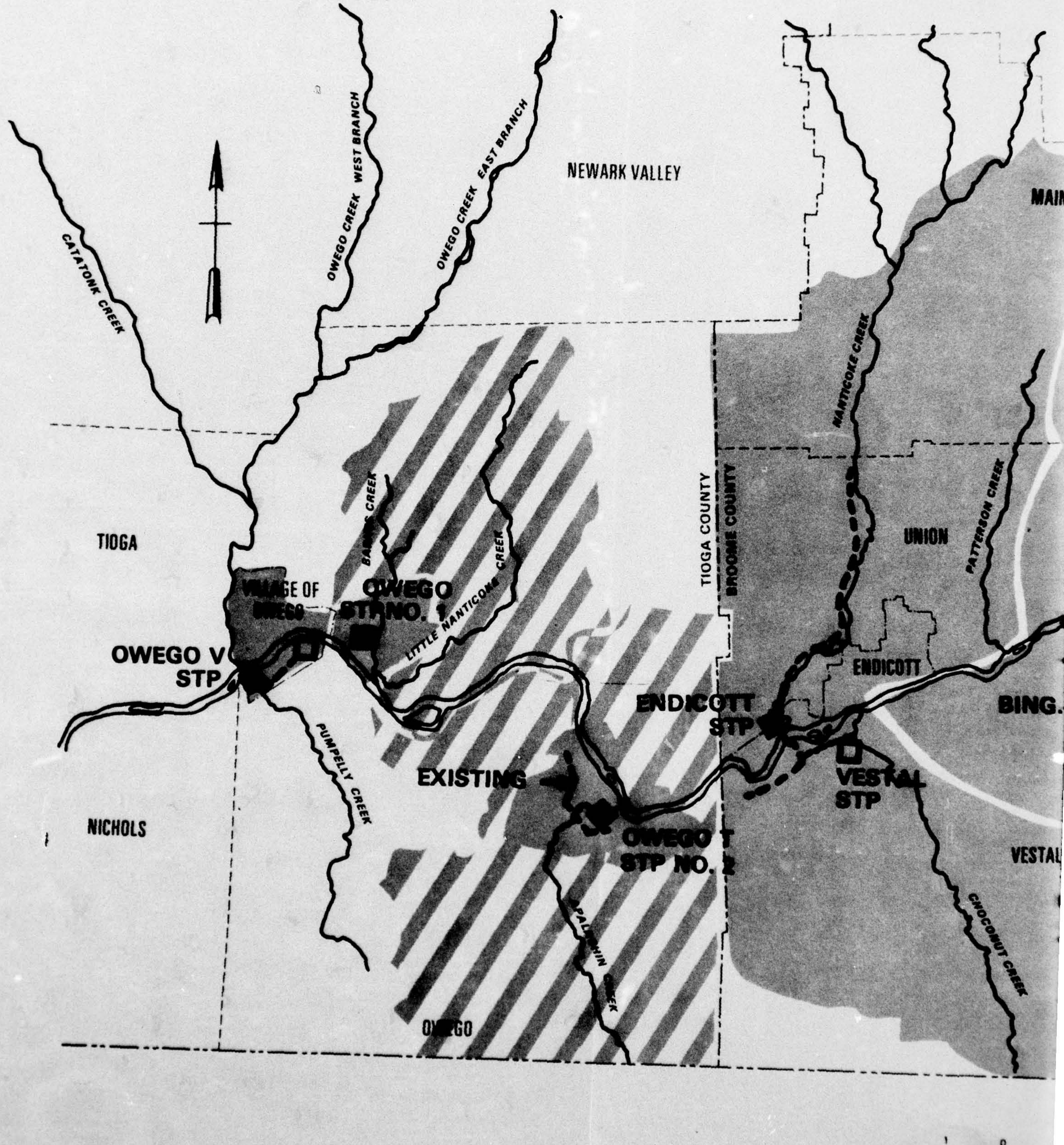
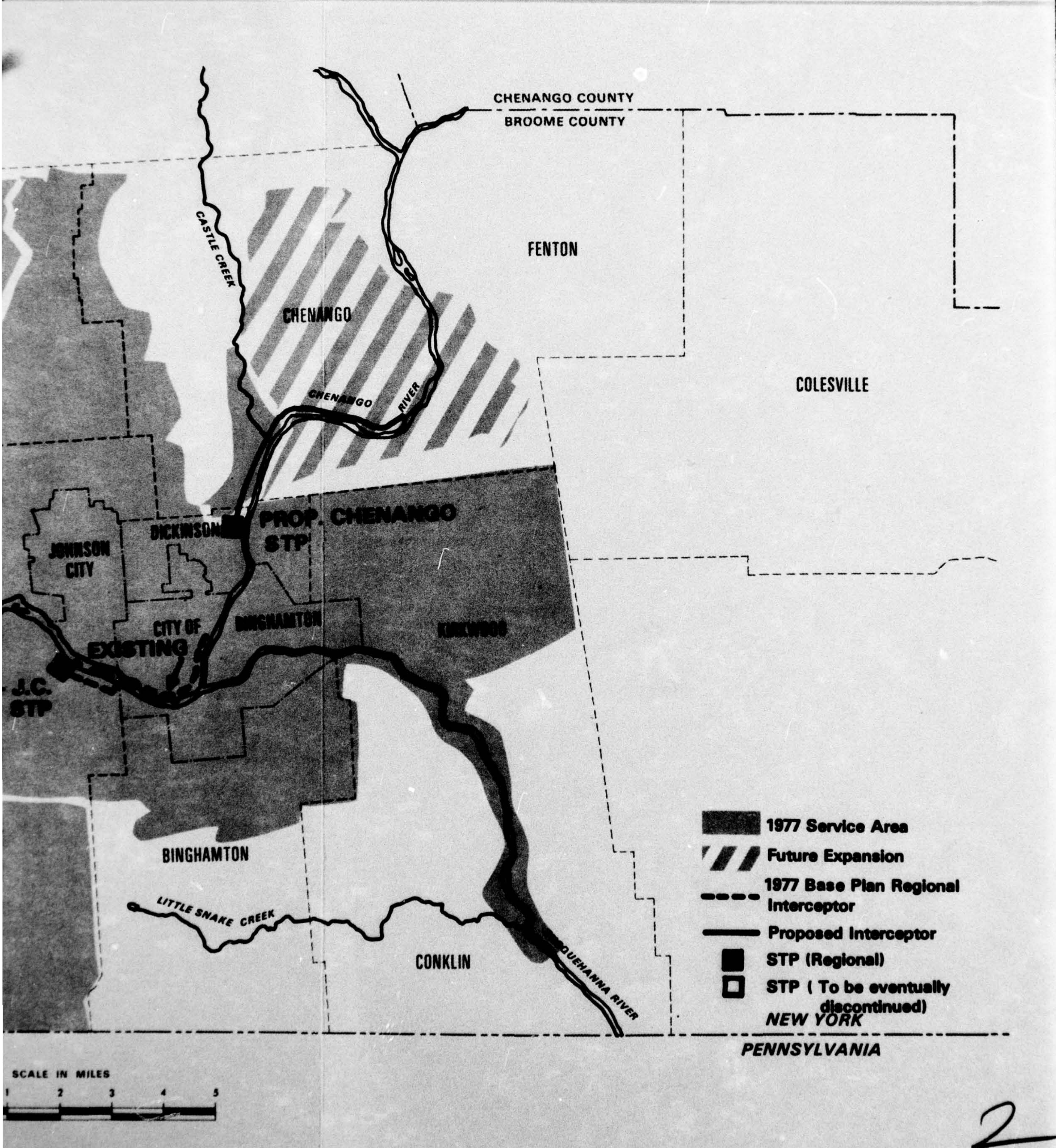


FIGURE IV-4

SIX REGIONAL TREATMENT PLANTS
3 BROOME CO. and 3 TIOGA CO.





CHENANGO COUNTY
BROOME COUNTY
CASTLE CREEK
FENTON
CHENANGO
COLESVILLE
CHENANGO RIVER
DICKINSON
PROP. CHENANGO STP
JOHNSON CITY
CITY OF BINGHAMTON
KIRKWOOD
EXISTING J.C. STP
BINGHAMTON
LITTLE SNAKE CREEK
CONKLIN
SUSQUEHANNA RIVER
1977 Service Area
Future Expansion
1977 Base Plan Regional Interceptor
Proposed Interceptor
STP (Regional)
STP (To be eventually discontinued)
NEW YORK
PENNSYLVANIA
SCALE IN MILES
1 2 3 4 5
2

FIGURE IV-5

City and Endicott STP's and a new STP for the Chenango Service area. Tioga County plants would be at the Owego Town #1 STP, the Owego Town #2 STP and the Village of Owego STP (all existing).

The interceptors included in this alternative are shown in Figure IV-5 and detailed in Figure IV-2 and IV-3. These are the same interceptors included in the Baseline Condition Plan except for the addition of the Chenango Valley collection interceptor along the river.

Secondary treatment would be applied at all STP's. The existing activated sludge processes would be used at the Binghamton-Johnson City STP and at the Owego Town #2 STP. A new activated sludge treatment plant would be built in Chenango Valley. The existing trickling filter processes would be used at the Endicott STP and the Owego Town STP #1. The Village of Owego STP would be upgraded to provide secondary treatment using a trickling filter process.

The cost-effectiveness of alternative infiltration control levels in the City of Binghamton wastewater collection system were evaluated. For the level of treatment (secondary) and the regionalization scheme assumed in this Plan, an infiltration flow reduction of one mgd was found to be economically justifiable.

In Plan 2, it was assumd that the Village of Endicott and the Town of Owego would institute metered user rates. Given that the fees would be leveled via a metered rate, the increase in the price the consumer is paying for water associated with this Plan above the current price should result in a decrease from current water consumption.

In Plan 2B, five microscreening devices followed by chlorination facilities would be provided near the major overflow sites. This storm overflow treatment system would maintain a minimum DO of 4 mg/l during storm conditions.

Sludge management techniques for Plan 2B would be the land application of liquid sludge, with the land fill alternative as a backup.

Plan 2C

The intent of this Plan was to achieve a minimum DO of 4 mg/l in the Susquehanna River during both low flow and storm overflow conditions. This Plan included three sewage treatment plants in Broome County and three STP's in Tioga County. Comparing this Plan to plans 2A and 2B enabled the selection of a cost-effective plan to maintain a minimum DO of 4 mg/l during low flow conditions. This plan provided a first phase treatment plant to serve the Chenango Valley wastewater management area. The present worth of the costs for Plan 2C is $47.7 million.

Plan 2C was identical to 2B, with the exception of the Chenango Valley STP. In this Plan, the initial service area for Chenango Valley would be smaller than in Plan 2B enabling the construction of a smaller initial capacity STP to serve the immediate sewer needs.

The Chenango Valley activated sludge "first phase" treatment plant would be built to conform with the Federal requirements for secondary treatment. The plant would have an initial capacity of 1.0 mgd and eventually be expanded to a capacity of 2.2 mgd as the "second phase" service area is connected to the STP. All other STP's would be expanded as described in Plan 2B.

Plan 3A

The intent of this Plan was to achieve a minimum DO of 5 mg/l in the Susquehanna River during low flow conditions and of 4 mg/l during storm conditions. Plan 3A included two sewage treatment plants in Broome County and three STP's in Tioga County. Comparing this Plan to Plan 3B and would enable 3C the selection of a cost-effective plan to maintain a minimum DO of at least 5 mg/l during low flow conditions. The present worth of the costs for this Plan would be $50.5 million.

This Plan included two STP's in Broome County and three STP's in Tioga County as shown previously in Figure IV-1 and detailed in Figure IV-2 and IV-3. The Broome County plants would be at the existing Binghamton-Johnson City and Endicott STP's. Tioga County plants would be at the Owego Town #1 STP, the Owego Town #2 STP and the Village of Owego STP.

The only interceptor included in this Plan in addition to the Baseline interceptors is shown in Figure IV-6 as the Chenango Valley to B-JC system connection and the Chenango Valley collection interceptor.

In order to maintain a 5 mg/l DO level in the Susquehanna River during low flow conditions, addition of nitrification facilities to the existing activated sludge secondary treatment process at the Binghamton-Johnson City STP would be required by the year 1994. Secondary treatment level would be sufficient at the other four STP's. The Owego Village treatment plant would be upgraded to provide secondary treatment using a trickling filter process. The activated sludge process at the Owego Town #2 STP and the trickling filter processes at the Village of Endicott and the Owego Town #1 STP would be continued in use while their capacities would be expanded as the wastewater flows increase.

The cost-effectiveness of alternative infiltration control levels in the City of Binghamton wastewater collection system were evaluated. For the level of treatment (secondary plus nitrification of B-JC STP) and the regionalization scheme assumed in this Plan, an infiltration flow reduction of 3 mgd was found to be economically justifiable.

In this Plan, it was assumed that the Village of Endicott and the Town of Owego would institute metered user rates. Given that the fees would be leveed via a metered rate, the increase in the price the consumer is paying for water associated with this alternative above the current price should result in a decrease from current water consumption.

In Plan 3A, five microscreening devices followed by chlorination facilities would be provided near the major overflow sites shown previously in Figure IV-4. This storm overflow treatment system would enable maintain a minimum DO of 4 mg/l during storm conditions.

The sludge management techniques for Plan 3A would be the land application of liquid sludge with landfill alternative as a backup.

Plan 3B

The intent of this Plan was to achieve a minimum DO of 5 mg/l in the Susquehanna River during low flow conditions and 4 mg/l during storm conditions. Plan 3B included three sewage treatment plants in Broome County and three STP's in Tioga County. Comparing this Plan to plans 3A and 3C would enable the selection of a cost-effective plan to maintain a minimum DO of at least 5 mg/l during low flow conditions. This Plan was identical to 2B, except for the expansion and upgrading required at the B-JC STP. The present worth of Plan 3B was $51.1 million.

The Broome County plants would be at the existing Binghamton Johnson City and Endicott STP's and a new STP for the Chenango Valley Service area. Tioga County plants would be at the Owego Town #1 and #2 STP's, and the Village of Owego STP.

The interceptors included in this Plan are shown in Figure IV-5 and detailed on Figure IV-2 and IV-3. These are the same interceptors included in the Baseline Plan with the exception of a collection interceptor for the Chenango Valley.

In order to maintain a 5 mg/l DO level in the Susquehanna River during low flow conditions, addition of nitrification facilities to the existing activated sludge secondary treatment process at the Binghamton-Johnson City STP would be required by the year 1994. Secondary treatment level would be sufficient at the other five STP's. The new Chenango Valley STP would use an activated sludge process. The Owego Village treatment plant would be upgraded to provide secondary treatment using a trickling filter process. The activated sludge process at the Owego Town #2 STP and the trickling filter processes at the Village of Endicott and the Owego Town #1 STP would be continued in use while their capacities were upgraded as the wastewater flows increase.

The cost-effectiveness of alternative infiltration control levels in the City of Binghamton wastewater collection system were evaluated. For the level of treatment (secondary and nitrification) and the regionalization scheme assumed in Plan 3B, an infiltration flow reduction of 3 mgd was found to be economically justifiable.

In this Plan, it is assumed that the Village of Endicott and the Town of Owego would institute metered user rates. Given that the fees would be leveed via a metered rate, the increase in the price the consumer is paying for water associated with Plan 3B above the current price should result in a decrease from current water consumption.

In this Plan, five microscreening devices followed by chlorination facilities would be provided near the major overflow sites (Figure IV-4). This storm overflow treatment system would maintain a minimum DO of 4 mg/l during storm conditions.

The sludge management techniques for Plan 3B would be land application of liquid sludge with the land fill alternative used as a backup.

Plan 3C

The intent of Plan 3C was to achieve a minimum DO of 5 mg/l in the Susquehanna River during low flow conditions and 4 mg/l during storm conditions. This Plan included three sewage treatment plants in Broome County and three STP's in Tioga County. Comparing this Plan to Plans 3A and 3B would enable the selection of a cost-effective plan to maintain a minimum DO of at least 5 mg/l during low flow conditions. Plan 3C provided a first phase treatment plant to serve the Chenango Valley area. The present worth of Plan 3C was $51.1 million.

This Plan was identical to 3B, with the exception of the Chenango Valley STP. In Plan 3C, the initial service area for Chenango Valley would be smaller than in Plan 3B, enabling the construction of a smaller initial capacity STP to serve the immediate sewer needs.

The Chenango Valley activated sludge "first phase" treatment plant would be built to conform with the Federal requirements for secondary treatment. The plant would have an initial capacity of 1.0 mgd and eventually be expanded to a capacity of 2.2 mgd as the "second phase" service area is connected to the STP. All other STP's would be expanded as described in Plan 3B.

Plan 4

Plan 4 provided for the application of nitrification by the year 1983 and Advanced Waste Treatment (AWT) by the year 1985 at all municipal wastewater treatment plants to achieve the zero discharge goal of Public Law 92-500. The AWT processes used in this Plan were biologically based. The present worth of Plan 4 would be $90.2 million.

Storm overflow management facilities would be provided to maintain a 5.0 mg/l minimum DO in the Susquehanna River during storm conditions. The minimum cost regionalization schemes for Broome and Tioga Counties were selected in this Plan. Flow reduction techniques, including both infiltration control and nonstructural measures, were included.

Plan 4 included two STP's in Broome County and two STP's in Tioga County, as shown in Figure IV-6. The Broome County plants would be at the existing Binghamton-Johnson City and Endicott sites. Tioga County STP's would be at the Owego Town #1 and #2 STP's.

The selection of these regionalization schemes was based on the economics of the AWT system. The economics showed the over-riding economic advantage of providing treatment of Chenango Valley waste at Binghamton-Johnson City and treatment of Owego Village waste at Owego Town #1 STP.

The regional interceptors included in this plan are shown in Figure IV-2 and IV-3 as interceptors I, III, and IV. A regional interceptor would transmit the Chenango Valley wastewater to the Binghamton-Johnson City STP for treatment. Another regional interceptor would carry the wastewater from the Village of Owego for treatment at the Town of Owego #1 STP.

The same treatment levels would be applied at all the STP's. Nitrification of the secondary effluent would be provided by 1983 while AWT would provide for denitrification, phosphorus removal, filtration, and carbon absorption by 1985.

The cost-effectiveness of alternative infiltration control levels in the City of Binghamton wastewater collection system were evaluated. For the advanced waste treatment level and the regionalization scheme assumed in Plan 4, an infiltration flow reduction of three mgd was found to be economically justifiable.

In this Plan, it was assumed that the Village of Endicott and the Town of Owego would institute metered user rates. Given that the fees would be leveed via a metered rate, the increase in the price the consumer is paying for water associated with this plan above the current price should result in no increase from current water consumption.

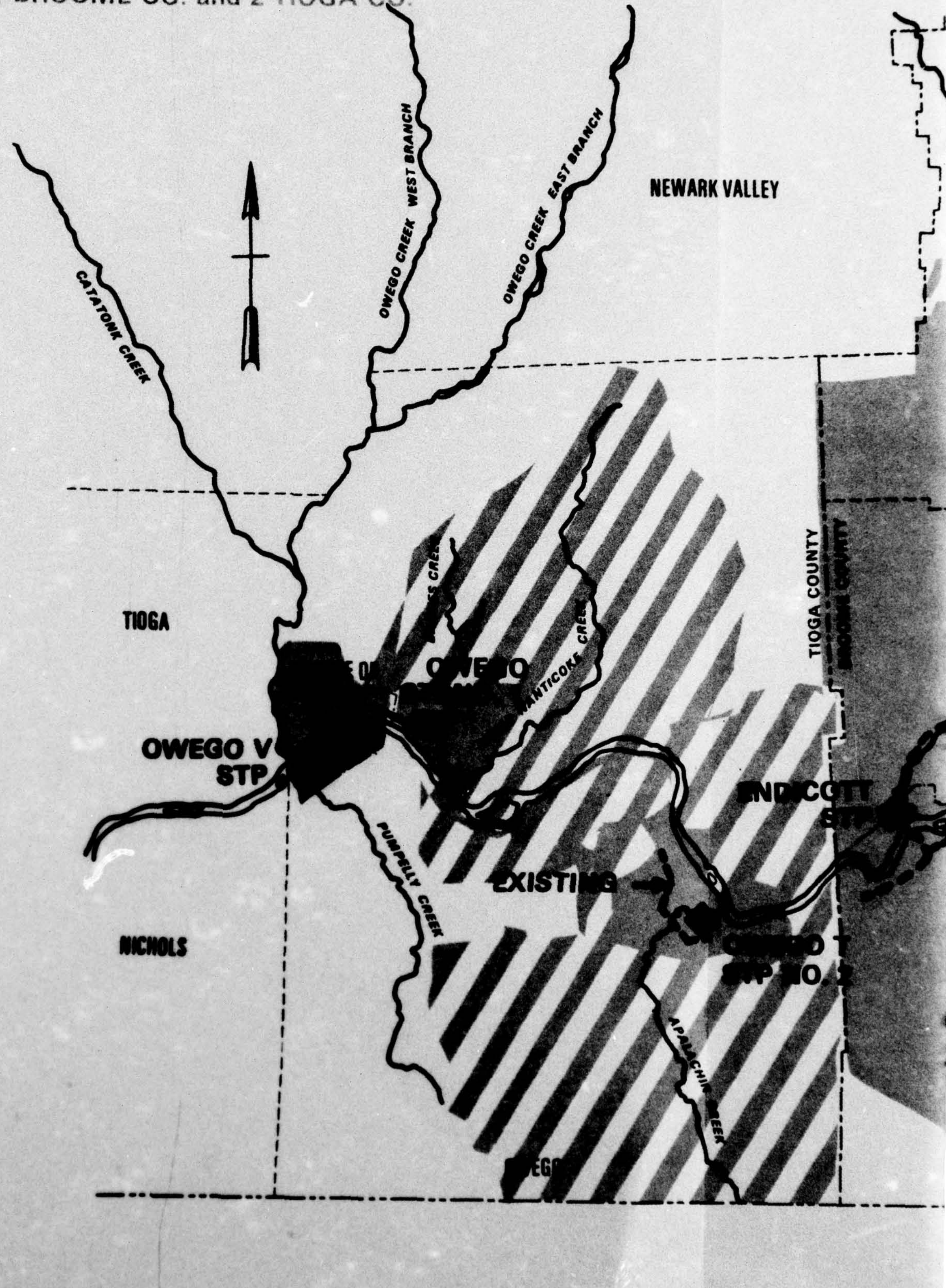
An educational program to encourage the use of water saving devices could result in the achievement of the nonstructural flow reduction. Formal educational activities are included in this Plan.

In Plan 4, microscreening devices followed by chlorination facilities would be provided near the major overflow sites. shown on Figure IV-4. This storm overflow treatment system would maintain a minimum DO of 5 mg/l during storm conditions.

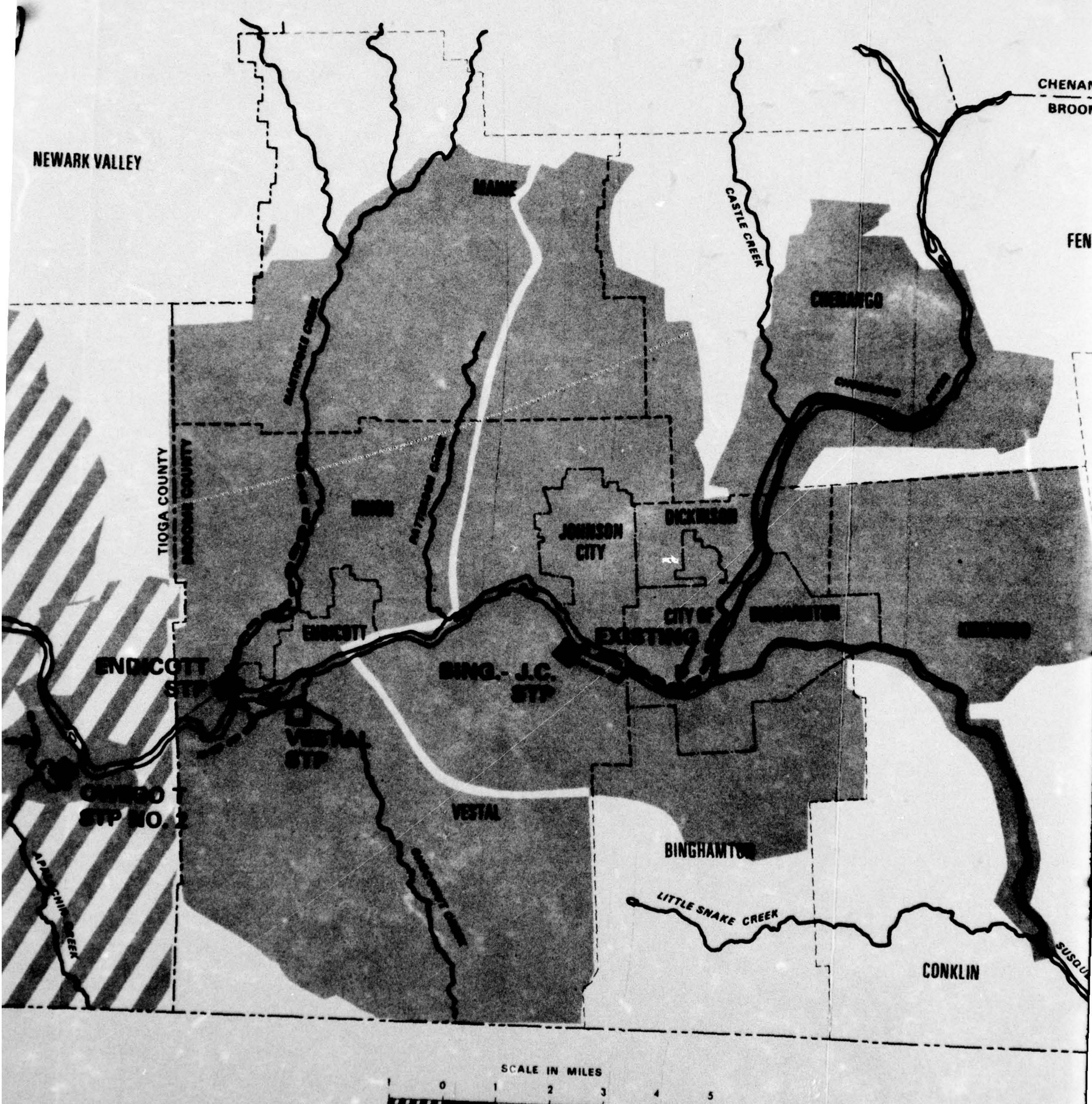
Several sludge management techniques have been analyzed in this Study, as summarized in Chapter 3. For the wastewater management Plan 4, it was assumed that the land application of liquid sludge be used with landfill used as a backup.

FOUR REGIONAL TREATMENT PLANTS

2 BROOME CO. and 2 TIOGA CO.



PLANTS



CHENANGO
BROOME
NEWARK VALLEY
MAINE
CASTLE CREEK
FENT
CHENANGO
TIOGA COUNTY
BROOME COUNTY
UNION
JOHNSON CITY
DICKINSON
ENDICOTT
CITY OF
BINGHAMTON
EXISTING
ENDICOTT STP
BING.- J.C. STP
VESTAL STP
OWEGO STP NO. 2
VESTAL
BINGHAMTON
LITTLE SNAKE CREEK
CONKLIN
SCALE IN MILES
1 0 1 2 3 4 5

2

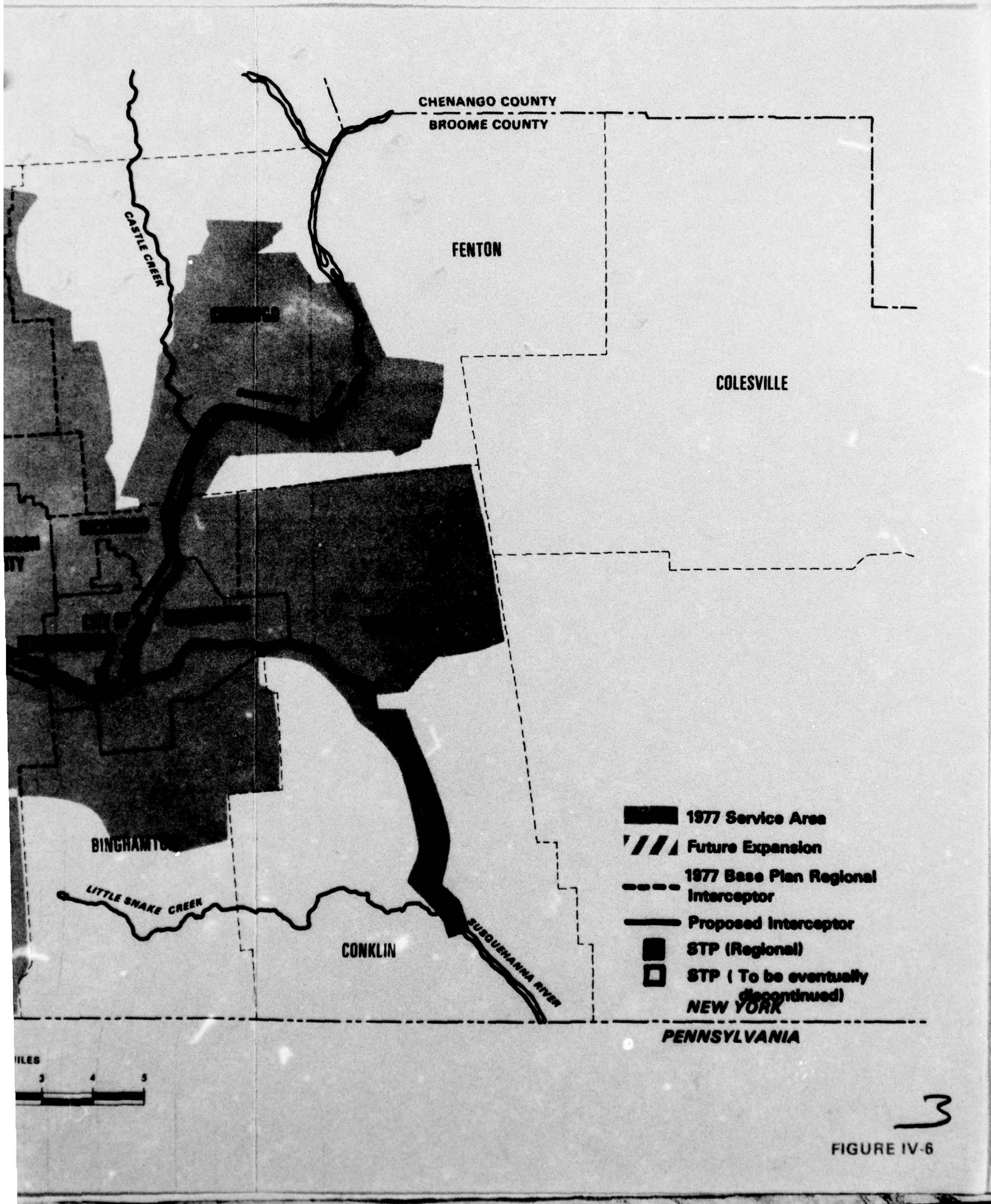

CHENANGO COUNTY
BROOME COUNTY
CASTLE CREEK
FENTON
COLESVILLE
BINGHAMTON
LITTLE SNAKE CREEK
CONKLIN
SUSQUEHANNA RIVER
1977 Service Area
Future Expansion
1977 Base Plan Regional Interceptor
Proposed Interceptor
STP (Regional)
STP (To be eventually discontinued)
NEW YORK
PENNSYLVANIA
MILES
3
4
5
3

FIGURE IV-6

IMPACT ASSESSMENT

Table IV-15 at the end of Stage III-2 presents a summary of the impact assessment for Stage III-2 as discussed in the following pages.

Ecological

Aquatic.

Construction. Temporary impacts to aquatic ecosystems would result during construction of interceptors and force mains across rivers and streams. Such river crossings would tempporarily increase erosion and sedimentation within surface waters and may thus create locally stressful conditions to aquatic flora and fauna. A measure of the extent of such temporary adverse impacts to aquatic ecosystems would be the number of major stream crossings which would be involved in a particular wastewater management plan; that is, the greater the number of stream crossings, the greater the extent of temporary adverse impacts to aquatic ecosystems. All of the wastewater management plans in Stage III-2 would have approximately equal short-term impacts to aquatic ecology (2 stream crossings) despite the degree of regionalization.

Water Quality. Major aquatic ecology impacts associated with the operation of wastewater management facilities would be dependent primarily on the level of sewage treatment being achieved. Only minor differences in impact were associated with the degree of regionalization of treatment facilities.

The NYSDEC standard for dissolved oxygen in both the Susquehanna and Chenango Rivers is a daily average of greater than or equal to 5.0 mg/l and not less than 4.0 mg/l at any time. The minimum in-stream dissolved oxygen concentrations achieved in the Susquehanna River during MA-7-CD-10 flow conditions and during design storm conditions are enumerated in Table IV-15 at the end of this Chapter.

An important fact to keep in mind is that this minimum DO level occurs only in a small segment of the Susquehanna River for only a few days during the MA-7-CD-10 flow conditions (minimum average seven consecutive day flow which will occur on an average of once in ten years). The minimum average daily DO level cited for each plan may occur approximately once in ten years, in the Susquehanna River, between the Endicott STP and the East Owego STP. Before and after this location in the river the DO level would be higher than the stated minimum average daily. During most of the year and during other years of higher river flows, the minimum instream DO achieved by any plan would be higher than that indicated in Table IV-15. A review of the minimum monthly average dissolved oxygen which would have been achieved by a 4 mg/l-secondary treatment plan (Plans 2A, B and C) from August 1963 to September 1973 showed that only during the very low flow years of 1964 and 1965 would the minimum average DO have dropped below 5.0 mg/l. The weekly average dissolved oxygen concentrations which would have been achieved by a 4 mg/l secondary treatment plan was calculated for the low flow months of August and September 1975 and shown in Table IV-10. The minimum instantaneous DO during this low flow period would never have dropped below 4.0 mg/l.

TABLE IV-10

WEEKLY DISSOLVED OXYGEN FOR AUGUST TO SEPTEMBER 1975 FOR PLAN 2

Week	Minimum Average (mg/l)	Minimum Instantaneous (mg/l)
1	4.9	4.4
2	4.6	4.1
3	4.5	4.0
4	5.2	4.7
5	5.0	4.5
6	4.7	4.2
7	4.9	4.4
8	5.5	5.0

The options to plans 2 and 3 (labelled A, B, and C) which provided for different approaches to the treatment of sewage in the Chenango Valley, would have little effect on the daily DO level of 7 mg/l found in the Chenango River.

Similarly, separate treatment of sewage from the Chenango Valley service area would result in little DO change in the Susquehanna River when compared to the dissolved oxgyen concentration achieved in the Susquehanna River by connection of Chenango Valley the Binghamton-Johnson City STP.

The Baseline Plan would achieve a minimum average daily DO concentration of 3.5 mg/l within the Susquehanna River during MA-7-CD-10 flows between the Endicott STP and the Owego Town #2 STP. The 4 mg/l plans would achieve a minimum average daily DO of 4.5 mg/l. The 5 mg/l plans would achieve a minimum average daily DO of 5.5 mg/l. Finally, the Biological AWT Plan would achieve a minimum average daily DO of 6.7 mg/l.

The question remained as to the impacts of these wastewater management plans, in terms of their dissolved oxygen concentrations, upon aquatic ecosystems. Within the Susquehanna and Chenango Rivers the fish fauna included both game fish species and forage species. The major game fish are:

Walleye	<u>Stizostedion vitreum</u>
Chain pickerel	<u>Esox niger</u>
Smallmouth bass	<u>Micropterus dolomieui</u>
White sucker	<u>Catostomus commersoni</u>
Carp	<u>Cyprinus carpio</u>
Yellow perch	<u>Perca flavescens</u>

These fish species are spring/early summer spawners; by late July spawning is completed except on infrequent, sporadic occasions. None of these fish are considered rare or endangered species.

In evaluating oxygen levels necessary for the protection of fish, it was necessary to determine the level of protection which was desired. Protection may range from maintaining populations at the lowest levels for the existence of the species, maintaining production and reproduction of the fish with moderate impairment, or providing complete protection to allow maximum production of the species. Fishes, unlike man, are highly sensitive to concentration of oxygen, and they are also highly mobile. In view of their sensitivity to oxygen and their mobility, the avoidance reaction which is displayed when fishes approach water of low DO is easily explained.

Therefore, in dealing with mobile species, the DO concentration and duration of exposure to this concentration determines survival or the amount of stress which is placed on the species. For example, coho salmon can survive 2 ppm of DO but eat sluggishly and lose weight (Davisoin et al., 1959). Thus, depending on frequency of occurrence and duration, a DO level can have no effect, moderate effect or lethal effect on a fish population. If the lowered DO level involves only a portion of the aquatic system, and if other areas of that system are capable of supporting resident fish populations, most fishes will simply avoid the unfavorable conditions and will repopulate the area when conditions again become favorable.

Considering the DO level, extent of the DO sag, and temperature, no wastewater management plan would impact upon fish spawning. However, there would be periods of reduction of swimming and feeding activity of fish. This reduction in feeding and swimming activity would be particularly noticeable in the five mile stretch of minimum DO between the Endicott STP and the Owego Town #2 STP. Again, the lower the minimum DO achieved by a particular plan the greater would be the adverse impacts upon fish activity.

None of the action wastewater management plans would create any significant fish mortalities due to oxygen depletion. On the other hand, none of the wastewater management plans would have any significant beneficial impacts upon the fishery resources of the Binghamton area, as a whole. However, those plans resulting in high minimum DO levels would benefit the fishery resources in the Susquehanna River especially in the area between the Endicott STP and the Owego Town #2 STP. A complete report on the effect of the various wastewater management plans on the river environment was prepared by the U. S. Department of Interior, Fish and Wildlife Service. The report is included as an attachment to this Appendix.

A nutrient is any chemical which is necessary to the growth and reproduction of aquatic flora. Nitrogen and phosphorus, two macronutrients, are important factors in artificial eutrophication. Generally, phosphorus is the limiting nutrient of concern in relation to nuisance aquatic floral growths. Even if all nutrients necessary for growth are available, other environmental factors such as temperature, light, river flow and water depth may limit aquatic plant growths. Although the NYSDEC has no phosphorus standards for fresh surface waters, the EPA has a proposed limit of less than or equal to 0.1 mg/l of phosphorus (as P) in those flowing waters where phosphorus is a limiting constituent for the growth of nuisance aquatic plants.

A phytoplankton survey of the Susquehanna River taken in 1967-1968 indicated that the phytoplankton in the Triple Cities Area was indicative of enriched but not grossly polluted conditions. It is likely that the 1975 phytoplankton are similar in composition to those of the 1967-1968 survey, because of the increase in level of wastewater treatment in the area. Additionally, macrophytes in the river system have not been documented as being a nuisance.

Since the Baseline Condition Plan, which provided for secondary treatment at 5 STP's (Chenango Valley service area remains unsewered), would discharge approximately the same amount of phosphorus as is currently discharged, no significant changes in the aquatic flora are expected under Plan 1. All action plans except Plan 3A and 4 would result in a total average daily nitrogen loading of 7,540 lbs/day irregardless of the level of regionalization. These nitrogen loadings of the action plans would be 10 percent greater than the Baseline nitrogen loadings and phosphorus loadings would be 8 percent greater than the Baseline phosphorus loadings because the action plans, unlike the Baseline, would sewer the Chenango Valley area. However, it is unlikely that these slightly higher nutrient loadings would significantly effect the growth of aquatic flora since it appeared that even under existing conditions neither phosphorus nor nitrogen are limiting nutrients.

Plan 3A and 4 waste would result in significantly lower nitrogen and phosphorus loadings than the Baseline Condition Plan. It is doubtful, however, if the future growth of aquatic flora would be limited because neither phosphorus nor nitrogen appeared to be limiting factors.

The toxicity of ammonia to aquatic organisms is dependent upon the amount of un-ionized ammonia which increases with increasing pH. The NYSDEC standard for ammonia is less than or equal to 2.0 mg/l at pH 8.0 or above. Since pH levels in the river system have at times been greater than pH 8.0, ammonia toxicity could be a problem during periods of extremely low river flows.

However, as seen in Table IV-15, all wastewater management plans would produce an ammonia concentration below 2.0 mg/l at the critical point in the river between Endicott and Owego Town #2 STP. Therefore, no ammonia toxicity problems would be expected under any plan, including the Baseline Condition, as long as all sewage treatment plants were in proper operation.

The Baseline Condition Plan, although providing secondary waste treatment at five STP's, would most likely contribute significant quantities of coliform to the river, during MA-7-CD-10 conditions, because of overloading of the sewage treatment plants. In addition, since combined sewer overflows would continue without any treatment, coliform concentrations during storm conditions for the Baseline would be as high as 240,000 MPN/100 ml in the Susquehanna River and 123,000 MPN/100 ml in the Chenango River, which would be well in excess of Class B (swimming, 2400 MPN/100 ml coliforms) and Class C (secondary contact only, 10,000 MPN/100 ml coliforms).

For those options labelled A and Plan 4 which provided for treatment of sewage flows from Chenango Valley at the Binghamton-Johnson City STP, the maximum coliform concentration during the MA-7-CD-10 flow conditions in the Chenango River would be approximately 120 MPN/100 ml. The maximum concentration of total coliform in the Susquehanna River, under the same circumstances would be approximately 360 MPN/100 ml. Both of these concentrations would conform to the NYSDEC standards for total coliform in water suitable for primary contact recreation (2400 MPN/100ml). Under design storm conditions, wherein combined sewer overflows would be treated, the maximum total coliform concentration in the Chenango River would be approximately 1,125 MPN/100 ml and approximately 1,040 MPN/100 ml in the Susquehanna River. Under design storm conditions, total coliform concentrations would still allow for primary contact recreation in the area's rivers in all plans providing treatment of combined sewer overflows.

In those options labelled B and C which provided for separate treatment of sewage from the Chenango Valley area, total coliform concentrations in both the Chenango and Susquehanna River at MA-7-CD-10 flow conditions conform to the NYSDEC standards for primary contact recreation. At MA-7-CD-10 conditions, maximum total coliform in the Chenango would be approximately 180 MPN/100 ml and maximum total coliform in the Susquehanna River would be approximately 340 MPN/100 ml. At design storm conditions, assuming treatment of combined sewer overflows, maximum total coliform in the Chenango and Susquehanna Rivers would be 1,150 MPN/100ml and 1,025 MPN/ 100 ml, respectively.

It is apparent that any action plan (in contrast to the Baseline Condition Plan) which provided for treatment of combined sewer overflows would have a significant beneficial impact upon total coliform concentrations in the area's waterways.

As presently formulated, all plans would utilize some form of chlorine to achieve disinfection of wastewater effluents. Free chlorine and chlorine compounds (such as, chloramines) can be toxic to aquatic organisms. Aquatic biota can tolerate on a short-term basis much higher levels of chlorine than those concentrations which result in adverse chronic effects.

Chlorine dosages should, therefore, be minimized in any plan such that the advantages of bacterial disinfection are not overshadowed by possible adverse impacts to aquatic biota. Assuming that this would be done, then no adverse impacts to aquatic organisms would be expected. Proper equipment adjustment, regular inspection, and strict monitoring should insure that chlorine equipment functions properly. If chlorine residuals are persistent problems, then process changes to convert from chlorine to ozone treatment may be warranted.

Terrestrial.

Construction. Construction impacts upon terrestrial ecology would be apparent during the construction of new sewage treatment facilities such as treatment plants, interceptors, effluent outfalls and sludge storage lagoons. Direct adverse impacts would occur to terrestrial vegetation and its associated wildlife habitats. Trees and shrubs would be uprooted and wildlife would either be killed or displaced.

Options labelled B and C which utilize a separate Chenango Valley treatment plant would need approximately five acres of a presently vacant weedy area adjacent to Route 11 near the Broome Community College. The vegetation and wildlife associated with this five acres is similar to recently abandoned farmland. Its utilization for a treatment plant site would not have major adverse impacts to the terrestrial ecology of the area.

Construction of interceptors and effluent pipelines would also have an immediate direct effect upon terrestrial ecosystems when such pipelines are constructed through unbroken land. A measure of the extent of such direct adverse terrestrial impacts is the number of miles of pipeline to be constructed which do not follow existing roadways, see Table IV-15. Installation of pipelines would disturb, if not completely destroy, native vegetation and wildlife within the permanent and temporary easements along a pipeline route. The action wastewater management plans would impact differently upon areas depending upon the degree of regionalization and level of wastewater treatment. The AWT Plan, for instance, would require greater sludge storage acreage than other plans.

In options labelled B and C which provided for separate treatment of Chenango Valley's waste at a new STP, a regional interceptor carrying sewage to the new STP would be constructed. Direct adverse impacts to terrestrial ecosystems would occur along the 2.8 miles of this regional interceptor (see figures IV-2 and IV-3, Interceptor III), in areas where the interceptor would not follow existing roadways. In addition, direct adverse impacts to terrestrial ecosystems would occur during the construction of the 400 feet of effluent outfall. Much of the terrestrial environments which would be disturbed in options labelled B and C are presently within the flood plain of the Chenango River.

For those options labelled A and Plan 4, which connect Chenango Valley with Binghamton-Johnson City, one interceptor and one force main would be needed in Broome County. The interceptor would collect sewage flows in the Chenango Valley area, and the force main would transport the sewage to the B-JC sewage system (see Interceptor III, Figure IV-2 and IV-3). Direct adverse terrestrial ecology impacts would, therefore, be created along a total of 4.3 miles in options labelled A and Plan 4 in a reas where the interceptors or force mains would not follow existing roadways. Again, much of the area impacted during construction of these pipelines lies within the flood plain of the Chenango River and, therefore, erosion may become a problem during the construction of these pipelines.

Finally, in Plan 4, not only is Chenango Valley connected to the B-JC STP, but Owego Village would also be connected to the Owego Town #1 STP. During the construction of the interceptor between the Owego Village STP and the Owego Town #1 STP, (see Interceptor I, Figure IV-2 and IV-3), direct adverse impacts to terrestrial impacts would be created along 0.9 mile of this interceptor in those areas where it would not be constructed along existing roadways. Thus in Plan 4, direct adverse terrestrial ecology impacts would be created along 5.2 miles of interceptors which would be constructed in primarily undisturbed areas.

Those lands utilized in each wastewater management plan for the storage of liquid sludge, prior to its application to farmlands, would have an adverse impact during the construction of the storage lagoons. All vegetation and wildlife within the storage acreage would be removed. Therefore, the larger the storage basin required, the greater would be the direct adverse impacts to terrestrial ecosystems. All plans except Plan 4, the AWT Plan, would require about 7.0 acres for sludge storage. Plan 4 would require 16 acres for sludge storage.

Should landfilling of sludge be required to replace land application of sludge, then direct adverse impacts to terrestrial ecosystems could occur if new landfill sites must be found. Therefore, it is possible that direct adverse terrestrial impacts may occur to 226 acres of land required for sludge landfill for all plans except the AWT Plan. In Plan 4, 360 acres would be subject to adverse terrestrial ecology impacts if landfilling of sludge is required.

Operational. During the operation of a wastewater management system, impacts to terrestrial ecology are related to such components as interceptors and storage and land application of sewage sludge.

Construction of interceptors could be an inducement for development in areas which are not presently served by existing wastewater treatment facilities. Development in presently rural areas would reduce the quantity of various terrestrial habitats.

It was expected, though, that little or no development would occur in any wastewater management plans because of the extension of sewerage services in comparison to the Baseline. Therefore, although development in presently rural areas would occur, the long-term impact of any wastewater management plan on terrestrial ecosystems would not be substantially different than what may be expected under the Baseline Condition Plan.

Application of liquid sludge to agricultural lands in all action plans would require land for both the application and storage of the sludge. The land requirements vary depending on the wastewater treatment methodology used. Plans provide secondary treatment (Baseline) or secondary treatment with nitrification would require 1,770 acres of cropland for the application of liquid sludge and would also require 7.0 acres of land for lagoons for storing the sludge during winter months. The biological advanced waste treatment plan produces more sludge and therefore would require more land for the application and storage of the liquid sludge. The AWT Plan would require 2,765 acres for sludge application and 16 acres for sludge storage.

Resources recycled to the land (such as nitrogen, phosphorus, potassium, and organic matter) by land application of liquid sludge would represent a beneficial impact to agricultural production in the area, since many soils are nutrient deficient and may also be low in organic matter.

Possible adverse impacts to the terrestrial ecosystems of the agricultural lands to which liquid sludge is applied could result from of the occurrence of heavy metals in the sludge. Heavy metals which accumulate in the soil may be biologically concentrated in the crops or in wildlife which is associated with agricultural lands, or may be leached to ground waters. The problems of heavy metal toxicity may be mitigated by adjusting the application rate of the liquid sludge, by selecting crops which are less sensitive to heavy metals or which do not tend to biologically concentrate heavy metals, and by adding lime to the soil thereby raising the pH of the soil to levels at which heavy metals are less toxic.

The terrestrial ecosystems of the acres required for the sludge storage lagoon would be eliminated for at least the life of the project. Even if the lagoons are abandoned in the future, it would take many years for natural vegetation to again occupy these areas.

Should landfilling of the sludge be warranted in future years to replace the land application of sludge, all plans except the AWT Plan would require 226 acres of land for sludge landfill. The biological AWT plan would require 360 acres for landfilling of liquid sludge. If new landfills in Broome and Tioga Counties would be needed in any of the wastewater plans in the future, the terrestrial habitats of new landfill acres would be eliminated.

Resources Commitments

Resources committed to wastewater management plans may be classified as either consumptive (irretrievable) or nonconsumptive (retrievable). Commitments, for example, of land for the application of sludge may be considered to be a retrievable resource commitment since the practice of land application of sludge may be terminated at any time and no destruction or consumption of the land would occur when the sludge is applied to the land. On the other hand, resources such as chemicals, electricity and fuel would be consumed during wastewater treatment and disposal and, therefore, would represent irretrievable commitments of resources.

Land.

The major land commitments associated with wastewater management would be those acres devoted to physical facilities (such as sewage treatment plants), acres devoted to land application of sewage sludge, acres required for sludge storage lagoons near the site(s) for the land application of sludge, and acreage required for sludge landfill site if land application of sludge is discontinued for any reason.

In comparison to the Baseline Condition Plan, only those plans which provide for separate treatment of wastewater in the Chenango Valley area would require an additional commitment of approximately 5 acres of flood plain land for a new STP.

Land application of liquid sludge would require the commitment, for at least the life of the project, of active agricultural land to receive liquid sludge. For all plans except the biological AWT plan, 1,770 acres of agricultural land would be required for liquid sludge application. The biological AWT plan would require 2,765 acres of land for liquid sludge application. These commitments of agricultural land for liquid sludge application are easily retrievable; and, in fact, would be used for crop production throughout the life of the project.

The commitments of land for sludge storag e lagoons and possibly a sludge landfill site would not be as easily retrievable. After a sludge storage lagoon site or landfill site is abandoned it would be very difficult to restore the area to its original terrestrial ecosystems, although the land could be reused for other purposes. In all plans, except the AWT plan, sludge storage requires approximately seven acres and a sludge landfill site requires 226 acres. For the biological AWT plan 16 acres would be required for sludge storage lagoons and 360 acres would be required for a sludge landfill site.

Electricity.

The electrical consumption of all the wastewater management plans is presented in Table IV-15 at the end of this chapter. Table IV-11 presents the percentage of wastewater treatment electrical consumption in terms of the present yearly electrical consumption in the Binghamton area. Also shown in Table V-11 is the percentage of wastewater electrical consumption in terms of peak summer electrical demand.

TABLE IV-11

ELECTRICAL CONSUMPTION

PLAN		CONSUMPTION (10^6 KWHr/YR)	% OF PRESENT BINGHAMTON AREA CONSUMPTION	% OF PRESENT BINGHAMTON AREA PEAK SUMMER DEMAND
1)	Baseline Profile	11.2	0.72	0.46
2A)	4 MG/L, 5 STP	11.5	0.72	0.46
2B)	4 MG/L, 6 STP	11.5	0.72	0.46
2C)	4 MG/L, 6 STP with First Phase Plant	11.5	0.72	0.46
3A)	5 MG/L, 5 STP	16	1.0	0.64
3B)	5 MG/L, 6 STP	16	1.0	0.64
3C)	5 MG/L, 6 STP with First Phase Plant	16	1.0	0.64
4)	Biological AWT	20	1.25	0.81

In comparison to the Baseline Condition Plan, the secondary treatment plans (2A, 2B and 2C) would not have any significant increases in electrical consumption. Regionalization at Binghamton-Johnson City would not affect the amount of electrical consumption.

Level of treatment, however, would affect electrical consumption. The biological AWT plan, which would utilize approximately 1.25 percent of the present Binghamton area electrical consumption, had the highest electrical consumption of 20 x 10/6 KWHr/year (read as 20 times 10 to the 6 power kilowatts-hours per year) which is 74 percent more than the Baseline).

Chlorine.

Consumptive use of chlorine would take place in all wastewater alternatives including the Baseline Condition Plan. Chlorine would be used for disinfection of STP effluents in all plans including Baseline and would be used for stormwater disinfection in all action plans. The amount of chlorine used for stormwater disinfection in any action alternative would be 3.7 tons/ year and was reflected in the total chlorine consumption figures presented is Table IV-15, at the end of this Chapter.

The amount of total chlorine used for disinfection of STP effluents would depend on the level of treatment. Generally, a higher level of treatment prior to effluent disposal would require less chlorine for disinfection. In those plans emphasizing secondary treatment or secondary treatment with nitrification (Plans 2A, 2B, 2C, 3A, 3B and 3C), the amount of chlorine utilized would not be significantly different than the amount of chlorine used under the Baseline Condition Plan. Therefore, no significant impacts upon chlorine resources would be expected.

The plan which emphasized biological advanced waste treatment would utilize one-half of the chlorine required by the Baseline. Since chlorine shortages have appeared at sewage treatment plants around the country in recent years, this reduction in chlorine consumption could represent a beneficial impact upon nationwide chlorine resources.

Lime.

Wastewater treatment and disposal processes which would consume lime included the vacuum filtration of sludge and the land application of sludge. Lime would be used in the process of land application of sludge primarily as a mitigating measure against heavy metal toxicity. Lime, however, can be assumed to be in general use by farmers as a general agricultural practice for soil enrichment. No plan would use significantly more lime than that used for the Baseline. In addition, the amount of lime required when applying sludge to agricultural land would probably not be significantly different than the amount of lime already used by farmers in their general agricultural practices.

Activated Carbon.

Activated carbon would be used for the reduction of BOD and organic carbon in the biological advanced waste treatment plan (Plan 4). None of the other wastewater management plans utilized activated carbon. Biological advanced waste treatment would utilize 121 tons/year and, therefore, could have more adverse impact upon activated carbon resources than the other plans.

Methanol.

Methanol, or wood alcohol, would be used for denitrification only in the biological advanced waste treatment plan. The amount, 3,570 tons/year, of methanol that would be required by the biological AWT system could represent an adverse impact depending upon the availability and cost of methanol in the Binghamton area and in the nation as a whole.

Coagulants.

Coagulants in the form of alum and/or polymers would be required for phosphorus removal only in the biological advanced waste treatment plan. The amount of polymers required, 65 tons/year, would be most likely insignificant in terms of its availability, although the cost of polymers is generally high.

The consumptive uses of alum, 10,400 tons/year, for the biological AWT plan would be represent a significant increase in the utilization of this chemical in comparison to the Baseline Condition Plan and could adversely impact upon available resources particularly in the Binghamton area.

Fuel.

Fuel would be utilized primarily in the regeneration of activated carbon in the biological advanced waste treatment system and for the transportation of sewage sludge to some land application (or landfill) site. The major source of fuel consumption, of approximately 13,900 gal/year, in the Baseline Condition Plan, would be in the transportation of sewage sludge.

The consumption of fuel, in those plans emphasizing secondary treatment alone or secondary treatment with nitrification, would not be significantly different than the fuel consumption under the Baseline and therefore plans 2A, 2B, 2C, 3A, 3B and 3C would not have any significant impacts upon fuel consumption in the Binghamton area.

The fuel consumption of the biological advanced waste treatment plan would be significantly higher than that for the Baseline Condition Plan. For the biological advanced waste treatment system, the fuel consumption would be approximately 158,700 gal/year. In terms of area-wide fuel consumption which would occur under the AWT system, this could represent adverse impacts to fuel resources in the Binghamton area, particularly if fuel on a national scale becomes c itical commodity as it did during the 1973-1974 winter and spring seasons.

Social.

Construction.

Aesthetic. The creation of dust, noise and traffic detours and delays, would be created at or near various sites of construction.

Construction of a new sewage treatment plant in the Chenango Valley area would temporarily adversely impact upon the local residents, the Broome Community College, the users of Route 11 and Interstate Route 81, and the users of the new

Route 81 River Park (through which the effluent outfall of the new STP would be constructed). These adverse aesthetic impacts would occur during either the construction of a new "first phase" facility or a full-scale STP. In the case of a first phase facility, adverse aesthetic impacts would occur again within a few years as the plant is expanded to a complete facility.

A measure of the amount of construction impacts (such as, dust, noise, and traffic delays), associated with the construction of interceptors, would be the number of miles of such pipelines which would be constructed along existing roadways. Plans providing separate treatment at Chenango Valley, on both a first phase and complete basis, would result in temporary construction disturbances along 1.4 miles of regional interceptors to the new STP. Plans 2A and 3A which connect Chenango Valley to the B-JC system would create construction disturbances along 2.3 miles. Plan 4, which regionalizes Owego Village STP and Owego Town #1 STP would create temporary adverse construction impacts along an additional 0.9 miles of Interceptor I (see Figure IV-2 and IV-3) for a total Bicounty figure of 3.2 miles.

The construction of stormwater treatment facilities would have the same impacts regardless of the chosen wastewater management plan. Temporary adverse dust, noise and traffic impacts to local residents, businesses and commercial establishments and general urban traffic patterns would be created during the construction of the five stormwater treatment facilities (see Figure IV-4).

Recreational. Parks and other recreational places could be temporarily disturbed during construction of various wastewater management facilities. Construction of either a first phase or complete STP and its effluent outfall in the Chenango Valley area would temporarily disturb recreational activities within the Route 81 River Park.

Likewise, construction of an interceptor (Interceptor IV, Figure IV-2 and IV-3) in the Chenango Valley area, either now or in the future, would temporarily disturb a playfield in the Town of Chenango near the Chenango River and would also slightly disturb the Route 81 River Park. Construction of the interceptor (Interceptor III) to regionalize the Chenango Valley area with the B-JC STP service area would require cut and fill operations through the Route 81 River Park. To minimize adverse impacts to the River Park and to limit erosion along the Chenango River during construction, it would be advisable to install a force main rather than a gravity flow pipeline along the Chenango River.

Construction of stormwater overflow management facility #3 would take place near Stow Park in the City of Binghamton and may, therefore, temporarily adversely affect recreational facilities within the Park.

Prompt and adequate restoration procedures after any construction through park facilities would be required in order to minimize adverse impacts.

Cultural Resources. No known national historic sites would be impacted during either construction or operation of any wastewater management facility. Locally important historic and cultural sites in the Village of Owego, particularly along Front Street would be temporarily impacted, via dust and noise during the construction of an interceptor between the Owego Village STP and the Owego Town #1 STP, required in Plan 4 (Advanced Waste Treatment).

Construction of wastewater management facilities including sewage treatment plants, interceptors, transmission pipelines and stormwater treatment facilities would involve digging within the Susquehanna and Chenango River valleys and could thus disturb archeological sites within the river valleys. A cultural resources reconnaissance was performed during the Study and is presented as Chapter VIII in the Speciality Appendix. This reconnaissance assessed the general nature of the resources probably present and the probable impact of a plan; and of the possible need for more intensive, on-the-ground surveying and testing to determine the need for preserving, recovering or mitigating adverse effects on cultural resources during construction.

Employment. Construction of wastewater collection, treatment and disposal facilities, including pipelines, treatment plants, and stormwater management facilities would provide employment opportunities for various construction related individuals, particularly during those years of initial construction and later expansion. All action wastewater management plans would provide for greater construction employment opportunities than the Baseline Condition Plan. However, each plan would provide approximately the same construction employment opportunities as any other plan, except for Plan 4 which would provide slightly more construction related job opportunities.

Operation.

Aesthetic. Wastewater management facilities including sewage treatment plants and storm overflow management facilities could produce noise and odors during the operation of the facilities and/or would be visually unaesthetic.

Dust and noise produced during operation of sewage treatment plants is usually minimal, although odors could become a problem particularly if a plant is overloaded or if it is not operated properly. Odors, therefore, may be particularly offensive under the Baseline by the year 2020. Stormwater overflow management facilities would create only negligible dust, noise and odor problems.

The visual appearance of a wastewater treatment facility could also be aesthetically unpleasing depending on its architecture, landscaping and surrounding land uses. For example, the existing landscape (new field vegetation) and surrounding land users (Broome Community College, Routes 81 and 11, and the Route 81 River Park) near the site of the proposed Chenango Valley STP could make the sewage treatment plant a prominent and perhaps aesthetically unpleasing feature of the area. Additionally, although discharge of effluent from the Chenango Valley STP to a point above the Route 81 River Park would not adversely affect public health or water based recreation (no increases in instream coliform concentrations beyond those allowable for primary water contact recreation), public reaction to such a new wastewater discharge above the Park could be adverse. Since the other proposed sewage treatment plants are already in existence and accepted in the communities, no additional adverse aesthetic impacts would be created by their continued operation.

Stormwater overflow management facilities could be constructed below ground and/or could be complimentary to existing land uses by incorporating imaginative architecture and landscaping.

Land application of liquid sludge in all wastewater management plans would have operational adverse aesthetic impacts associated with the movement of tank trucks to the land application areas and with the six winter months storage requirements of the liquid sludge. Should landfilling of sludge be required, care should be taken so that offensive odors do not develop at the landfill site. Dust and noise impacts due to the trucking of the liquid sludge would be more adverse for the AWT Plan, Plan 4, than for the other plans, since more sludge and truck trips would be produced in the AWT Plan. Odors eminating from the sludge storage basin could be particularly offensive to any nearby residents during the six months of winter storage.

Public Health. Elimination of septic system failures and overflows into area waterways is an eventual beneficial impact that would be achieved by all action wastewater management plans in comparison to the Baseline Condition Plan. Furthermore, the treatment of combined sewer overflows by all action plans represented an additional beneficial impact to public health in comparison to the Baseline Condition Plan.

The degree of regionalization and the timing of treatment plant construction (with corresponding phasing of sewer service) within the Chenango Valley area would influence the public health impacts of options labelled A, B or C of plans 2 and 3. Options labelled A or B would provide immediate full service to the Chenango Valley area experiencing septic system problems. Options labelled C, however, would initially provide only limited service to a part of the Chenango Valley. Therefore, areas of the Valley (such as Nimmonsburg), which are experiencing scattered septic system problems would not have sewerage services until about five years after construction of the first phase STP. After years, the first phase STP could be expanded to provide full sewerage services to the Chenango Valley area or the sewage from the whole service area could be piped to B-JC STP for treatment. The economics of the latter would not favorable. Provision of a short outfall from the Chenango Valley STP to the Chenango River (similar to the long outfall considered during Stage II-2 and Stage III-1) to a point above the Route 81 River Park would have no significant adverse or beneficial impacts upon the bacteriological characteristics of the Chenango River primarily because of two factors: the effluent flow is less than 1/30 of the MA-7-CD-10 river flow, and the effluent would be disinfected prior to discharge.

Recreation. Some improvements, in comparison to Baseline, to the potentials for secondary water contact recreation (particularly fishing) in the critical river area between the Endicott STP and Owego Town #2 STP would result from those plans which produce high dissolved oxygen in combination with low ammonia, low chlorine and low nutrient concentrations within the area's waterways. No plan would significantly benefit fishery potentials along the Chenango River and Susquehanna River lengths upstream of the Binghamton-Johnson City STP.

Significant reductions in total and fecal coliform, particularly as a result of treatment of combined sewer overflows, would improve the potentials for primary water contact recreation in all action plans as compared to the Baseline Condition Plan. It should be kept in mind, however, that although a wastewater management plant may improve the potentials for either secondary or primary water contact recreation, no plan would result in significant increases in the participation rates of water related activities unless other restrictive problems such as water access are also alleviated (see Chapter IV of the Specialty Appendix).

Adverse public perception of the water quality of the Chenango River due to an effluent discharge upstream of the Route 81 Route Park could adversely affect the recreational potential of the Park. Such adverse aesthetic impacts would, however, have no bearing in terms of actual bacteriological quality.

Regional Development. It was assumed that projected future growth and development in the Urban Study Area would occur whether or not sewerage services was provided. This growth, would, however, tend to concentrate within and near areas which provide sewerage services. Therefore, the impacts of a wastewater management plan would depend on the changes to expected growth and development, if any, caused by the plan and also on whether these changes would be desired at local or regional levels of planning and government.

Haphazard expansion of sewerage services which could occur under the Baseline Condition Plan may or may not result in development patterns which are desired either on the local or regional level.

On a regional basis, all action wastewater management plans conform to desired development patterns as expressed in the General Plan for the Southern Tier East Region.

In the Chenango Valley area neither the two plant scheme (options labelled A) with connection to the B-JC STP via a connecting force main, nor the three plant scheme (options labelled B or C), providing a separate sewage treatment plant, would impact either adversely or beneficially upon growth and development since sewer service would be provided in all of the options.

In the Owego Village STP - Owego Town #1 STP area, two regionalization schemes were possible depending on the wastewater management plan. For the AWT Plan (#4), the cost-effective solution was regionalization of the two service areas to an expanded, upgraded STP at the site of the Owego Town #1 STP. In all other wastewater plans, the cost-effective solution was two separate treatment facilities; one at the existing Owego Village STP and one at the existing Owego Town #1 S TP. No beneficial or adverse impacts to desired growth and development in the Owego Village - West Owego area were expected in either regionalization scheme.

Finally, land application of liquid sludge in all plans would have no adverse impacts associated with conflicting land uses or development, since the liquid sludge would be applied only in areas designated for agricultural activities. Likewise, should landfilling of sludge be required, it was expected that lands already designated for such purposes would be used. Of course, should sufficient lands for a sludge landfill not be in existence at the required time, then problems could arise in finding a suitablr parcel or parcels of land for the landfill.

Air Quality. The Binghamton area (including the City of Binghamton; and the Towns of Binghamton, Conklin, Kirkwood, Fenton, Chenango, Dickinson, Union, Maine, and Owego) has received a preliminary designation as an Air Quality Maintenance Area. The air quality parameter of concern in the Binghamton Air Quality Management Area (BAQMA) is suspended particulates, especially in relation non-point sources (such as small sources as homes, and small businesses). Therefore, the BAQMA is presently being studied by the NYSDEC, in terms of population and land use projections, to see whether the Binghamton area should receive a final designation as an Air Quality Maintenance Area. If analysis of the BAQMA indicates that population growth and land use trends to 198 would result in violation of primary and/or secondary particulate standards, an implementation plan to prevent violation of these standards will be submitted by the NYSDEC. Analysis to date by the NYSDEC of the BAQMA indicates that the Binghamton area will probably remain undesignated, because population growth and land use trends do not indicate violation of standards by 1985. Therefore, no maintenance plan would be promulgated for the area. Furthermore, extension of sewerage services in the BAQMA would probably proceed after development of an area rather than encourage development in new areas. Therefore, it would be probable that no wastewater management plan, including the Baseline would significantly affect air quality in the BAQMA in terms of encouraging additional nonpoint sources of particulate emissions.

Employment. Operation of the various wastewater management facilities in any plan would require workers of various skills and technical backgrounds. Since some technical worker pool does exist in the Binghamton area, each wastewater management plan would provide some employment opportunities for area workes.

Table IV-12 summarizes the ultimate manpower requirements for operating each of the four plans by service areas in the year 2020. The manpower requirements are further broken down by various work categories (superintendent, operator, maintenance mechanic, electrician, laboratory technician, clerk typist, and laborer) in Chapter VI of the Institutional Analysis Appendix. Plans 2 and 3 would both have about equal impact on operating employment potential in the Bicounty Area. Within Plans 2 and 3, Option A would provide a small increase in employment while Option B and C would provide a slightly higher amount of employment. Most additional workers required in either Plan 2 or 3 would probably come from the local or regional work force. Plan 4 (AWT), on the other hand, would more than double the operating employment projected for the Baseline Plan. Because of the high degree of technical skills and experience required for operating an AWT plant, workers may or may not come from either the local or regional labor force.

TABLE IV-12
ULTIMATE OPERATING MANPOWER REQUIREMENTS
(Year 2020)

Plan	1	2A	2B	2C	3A	3B	3C	4
Service Area								
Binghamton-Johnson City	31	31	31	31	31	29	29	62
Endicott	11	15	15	15	15	15	15	27
Chenango Valley	--	--	7	7	--	7	7	---
East Owego	7	10	10	10	10	10	10	17
West Owego	5	5	5	5	5	5	5	15
Owego Village	5	5	5	5	5	5	5	---
TOTAL	59	66	73	73	66	71	71	121

Economic

The annual per capita costs (in 1975 dollars) of each wastewater management plan including the Baseline are presented in Table IV-15 at the end of this chapter. The costs of each wastewater management plan included the costs of wastewater collection, treatment and disposal; sludge treatment and disposal, infiltration control (if any), stormwater overflow treatment and disposal, and the costs of implementing any additional nonstructural flow reduction measures. In calculating these costs, Federal and state construction grants were assumed to equal 87.5 percent of total construction costs, and State operation and maintenance grants were assumed to equal 33 1/3 percent of all operating costs. A zero percent inflation rise and a zero percent income rise assumed for the planning period resulted in no change in real incomes during the planning period. The interest rate in Stage III-2 was assumed to be 6 1/8 percent for a period of 50 years.

Per capita annual costs for any plan varied depending on the service area, level of treatment and degree of regionalization. The Baseline, which provided for no additional improvements to sewage treatment facilities after 1977, had the least annual per capita payment within each service area, of all the wastewater management plans. Those plans providing secondary waste treatment were the next least costly for the Chenango Valley and B-JC service areas. Secondary treatment plans and 5 mg/l plans were of equal cost to the Endicott, East Owego, West Owego and Owego Village service areas because the costs of nitrification in the 5 mg/l plans accrued only to the B-JC STP. Biological advanced waste treatment plans were the most costly for each service area.

The costs presented in Table IV-13 and summarized in Table IV-15 indicate that connection of the Chenango Valley service area into the B-JC area would be cheaper for the Chenango Valley resident than construction of a separate Chenango Valley STP. For the B-JC service area, there would be no significant cost difference between regionalization and sub-regionalization. Regionalization at B-JC, however, would not be less costly than sub-regionalization if the present billing formula of the Binghamton-Johnson City Joint Sewerage Board remained unchanged. With the present billing formula, a separate STP would be cheaper for the Chenango Valley resident.

Since families, rather than individuals, pay for wastewater treatment services, annual per family wastewater costs

TABLE IV-13

ECONOMIC IMPACTS OF WASTEWATER MANAGEMENT: RELATIONSHIP OF COSTS TO MEAN FAMILY INCOME (1969 Dollars)

SERVICE AREA	1		2A		2B		2C		3A		3B		3C		4	
	PER FAMILY COSTS	% COSTS OF MEAN INCOME	PER FAMILY COSTS	% COSTS OF MEAN INCOME	PER FAMILY COSTS	% COSTS OF MEAN INCOME	PER FAMILY COSTS	% COSTS OF MEAN INCOME	PER FAMILY COSTS	% COSTS OF MEAN INCOME	PER FAMILY COSTS	% COSTS OF MEAN INCOME	PER FAMILY COSTS	% COSTS OF MEAN INCOME	PER FAMILY COSTS	% COSTS OF MEAN INCOME
Chenango Valley	-	-	$ 7.79	0.07%	$11.17	0.10%	$11.17	0.10%	$ 8.28	0.07%	$11.17	0.10%	$11.17	0.10%	$17.71	0.15%
B-JC	6.14	0.06%	6.95	0.07%	7.18	0.07%	7.18	0.07%	7.38	0.07%	7.63	0.07%	7.63	0.07%	15.79	0.15%
Endicott	7.89	0.07%	8.82	0.08%	8.82	0.08%	8.82	0.08%	8.82	0.08%	8.82	0.08	8.82	0.08	17.62	0.15%
East Owego	13.34	0.10%	15.05	0.11%	15.05	0.11%	15.05	0.11%	15.05	0.11%	15.05	0.11%	15.05	0.11%	29.53	0.22%
West Owego	17.18	0.13%	18.22	0.14%	18.22	0.14%	18.22	0.14%	18.22	0.14%	18.22	0.14%	18.22	0.14%	53.38	0.40%
Owego Village	22.54	0.23%	25.89	0.26%	25.89	0.26%	25.89	0.26%	25.89	0.26%	25.89	0.26%	25.89	0.26%	41.63	0.42%

NOTE: Costs include treatment costs and not the costs of the collection system (such as lateral sewers). These costs are common to all plans and they may be a significant cost in a given service area.

have been calculated within each service area for all plans. Annual per capita charges were multiplied by the average number of persons per family within each service area to obtain the annual per family costs. Table IV-13 presents the annual per family costs of each wastewater management plan and what percentage of the mean family income (in 1969 dollars) would be attributable to wastewater treatment. A measure of the adverse or beneficial impacts to the economic characteristics of a family within any service area would be the percent of the total family income which would be devoted to wastewater treatment. An increase in the percentage of the total family income (in comparison to the Baseline) may adversely alter the spending and savings pattern of the family. Conversely, a decrease in the percentage of the total family income (in comparison to the Baseline) may be beneficial to the spending and savings pattern of the family.

For the Binghamton-Johnson City service area, the percent of family income devoted to wastewater costs for the 4 mg/l plans (2A, 2B and 2C) and in the 5 mg/l plans (3A, 3B and 3C) would be similar to the percent of family income devoted to wastewater treatment in the Baseline Condition Plan. In the 4 mg/l and 5 mg/l plans, the percent of family income in the B-JC service area devoted to wastewater treatment would be 0.07 percent and for the Baseline wastewater treatment costs would account for 0.06 percent of the mean family income. Advanced waste treatment costs would account for 0.15 percent (more than double the Baseline) of the mean family income.

Similar relationships of wastewater costs to mean family income were also observed for the Endicott, East Owego and West Owego service areas. In these three service areas the percent of mean family income devoted to wastewater treatment would be 0.01 percent higher for the 4 mg/l and 5 mg/l plans than for the Baseline Condition Plan. Advanced waste treatment in these three service areas would significantly increase the percent of the mean family income devoted to wastewater treatment, particularly within the West Owego service area.

In the Owego Village service area wastewater treatment in Plan 1, the Baseline Condition Plan, would account for 0.23 percent of the mean family income. The 4 mg/l and 5 mg/l plans raised this percentage to 0.26 percent. The AWT plan may to have significant impacts upon the mean family income of Owego Village since it would raise the percentage devoted to waste treatment from 0.23 percent to 0.42 percent.

Although Table IV-13 indicates no wastewater treatment costs for the Chenango Valley area under the Baseline, the average family does pay some portion of its income to the construction, operation and maintenance of its private septic system. Since it is likely that the costs associated with septic systems is small, only a minor portion of the family income is attributable to wastewater treatment under the Baseline. Therefore, all other plans have the potential to adversely affect the economic characteristics of the average Chenango Valley service area resident. In Plans 2A (4 mg/l objective with Chenango Valley regionalized to B-JC) and 3A (5 mg/l objective with Chenango Valley regionalized to B-JC) the wastewater treatment costs would account for 0.07 percent of the mean Chenango Valley family income. Plans 2B, 2C, 3B and 3C which would construct a separate Chenango Valley STP would result in wastewater treatment costs amounting to 0.10 percent of the mean family income. Biological advanced waste treatment would result in 0.15 percent of the mean Chenango Valley family income being utilized for waste treatment.

The economic impacts associated with the costs of wastewater treatment may be particularly adverse to the lower income (that is, poverty families) of all wastewater service areas. Table IV-14 presents the annual wastewater treatment cost per poverty family, the percentage of wastewater treatment costs in relation to the mean poverty family income, and the possible percent increase in the poverty income deficit resulting from increased wastewater treatment costs within each service area.

Generally, no significant differences, in terms of possible economic impact to poverty families, were seen between the 4 mg/l objective plans (2A, 2B and 2C) and the 5 mg/l objective plans (3A, 3B and 3C).

The greatest potentials for adverse impacts to poverty families existed under the biological advanced waste treatment plan and may be particularly severe for the poverty family within the Owego Village service area.

SUMMARY AND EVALUATION

The four plans of Stage III-2 proposed different solutions to the wastewater management problems in the Urban Study Area. There were four main questions needing answers before a recommendation could be formalized. These questions

TABLE IV-14

ANNUAL ECONOMIC IMPACTS OF WASTEWATER MANAGEMENT TO POVERTY LEVEL FAMILIES (1969 Dollars)

SERVICE AREA	1			2A			2B			2C		
	PER FAMILY COSTS	% COSTS OF MEAN INCOME	% INCREASE OF INCOME DEFICIT	PER FAMILY COSTS	% COSTS OF MEAN INCOME	% INCREASE OF INCOME DEFICIT	PER FAMILY COSTS	% COSTS OF MEAN INCOME	% INCREASE OF INCOME DEFICIT	PER FAMILY COSTS	% COSTS OF MEAN INCOME	% INCREASE OF INCOME DEFICIT
Chenango Valley	-	-	-	$ 7.26	0.41%	0.58%	$10.41	0.59%	0.84%	$10.41	0.59%	0.84%
B-JC	$ 6.74	0.37%	0.56%	7.62	0.41	0.63	7.88	0.43	0.65	7.88	0.43	0.65
Endicott	7.92	0.45	0.55	8.85	0.50	0.61	8.85	0.50	0.61	8.85	0.50	0.61
East Owego	12.73	0.65	0.88	14.31	0.73	0.99	14.31	0.73	0.99	14.31	0.73	0.99
West Owego	16.33	0.84	1.13	17.32	0.89	1.20	17.32	0.89	1.20	17.32	0.89	1.20
Owego Village	25.92	1.17	2.34	29.76	1.34	2.68	29.76	1.34	2.68	29.76	1.34	2.68

	3A			3B			3C			4		
	PER FAMILY COSTS	% COSTS OF MEAN INCOME	% INCREASE OF INCOME DEFICIT	PER FAMILY COSTS	% COSTS OF MEAN INCOME	% INCREASE OF INCOME DEFICIT	PER FAMILY COSTS	% COSTS OF MEAN INCOME	% INCREASE OF INCOME DEFICIT	PER FAMILY COSTS	% COSTS OF MEAN INCOME	% INCREASE OF INCOME DEFICIT
Chenango Valley	$ 7.71	0.43%	0.62%	$10.41	0.59%	0.84%	$10.41	0.59%	0.84%	$16.50	0.93%	1.33%
B-JC	8.10	0.44	0.67	8.38	0.46	0.70	8.38	0.46	0.70	17.33	0.94	1.44
Endicott	8.85	0.50	0.61	8.85	0.50	0.61	8.85	0.50	0.61	17.67	1.00	1.22
East Owego	14.24	0.73	0.99	14.24	0.73	0.99	14.24	0.73	0.99	28.08	1.44	1.94
West Owego	17.32	0.89	1.20	17.32	0.89	1.20	17.32	0.89	1.20	50.76	2.60	3.52
Owego Village	29.76	1.34	2.68	29.76	1.34	2.68	29.76	1.34	2.68	47.85	2.16	4.31

pertained to the desirability of a "first phase" waste treatment plant in the Chenango Valley, the appropriate level of regionalization in Broome County, the desired level of treatment, and achievement of the planning objectives. In each of these decisions there were certain trade offs to be made before coming to a final recommendation. This section deals with the trade offs associated with environmental-social impacts of the different plans.

First Phase Chenango Valley STP

The major trade off between the immediate full scale sewering options (labelled A or B) and limited sewering options (labelled C) were the short-term public health and socio-economic impacts.

The full scale sewering options would have a greater immediate beneficial public health impact since, unlike the first phase plans, they could initially service all areas having septic system problems including Chenango Bridge. In Chenango Bridge, the need for sewers has been reported to be quite high because poorly operating individual disposal systems have deteriorated the water quality of the Chenango River and pose a threat to water supply wells which are located nearby.

The first phase options also would not serve Fenton where the dense development may warrant sewerage construction, although septic tank malfunctions have been rather isolated there.

Other short-term impact differences would be associated with the costs to those who initially connect to a regional collection system. The initially reduced scope of sewering would require a treatment plant with a reduced economy of scale and would thereby result in higher treatment charges for those who initially connect to the system.

There are no overriding social-environmental impacts or trade-offs associated with a first phase plant for the Chenango Valley. If a decision were to be made on a strictly environmental standpoint, then a full scale Chenango Valley plant would be built to immediately correct the septic system problems. However, if the decision were to be made strictly on a social-economic consideration, then the first phase plant would be built. But again, neither of these are overriding concerns from an impact assessment and evaluation standpoint and could be justifiably overruled by significant concerns expressed in the other appendixes.

Broome County Regionalization

Regionalization at B-JC would result in higher treatment costs than subregionalization for the Chenango Valley area resident if the present billing policy of the Binghamton-Johnson City Joint Sewage Board were maintained. On the other hand, by maintaining the current billing formula, the Binghamton-Johnson City service area resident would benefit from reduced per capita treatment costs if Chenango Valley were connected to Binghamton-Johnson City. The environmental impacts and resource commitments associated with either two or three plants in Broome County would not be significantly different.

In both regionalization and subregionalization options, the Route 81 River Park along the Chenango River would be adversely impacted during construction activities. Construction impacts would be more adverse if the force main, required for connecting Chenango Valley to Binghamton-Johnson City, were constructed through the Park.

The effluent outfall of a separate Chenango Valley STP, upstream of the main activity centers of the Route 81 River Park, could adversely affect the recreational use of the Park and the Chenango River by adversely effecting people's perception of the river water quality, even though no significant water quality degradation would be expected from such a discharge to the Chenango River.

Again, there were no social-environmental concerns, either beneficial or adverse, that were considered important enough to tip the scale of decision one way or the other. Thus, the decision concerning the degree of regionalization for Broome County can be made without overriding concern that the decision would have significant adverse social-environmental impacts.

Treatment Level

There were four basic treatment levels considered in Stage III-2 including: no improvement in treatment operations after 1977 (Baseline Condition Plan or no action plan), secondary treatment only at all sewage treatment plants (Plan 2), secondary treatment at all STP's plus nitrification at B-JC STP (Plan 3), and biological advanced waste treatment (Plan 4).

As expected, increasing levels of treatment would improve the water quality characteristics of the Susquehanna River.

The Baseline Condition Plan showed an adverse impact to fisheries resources and public health due to the low level of treatment and the impact of septic system problems in Chenango Valley in comparison to any of the action plans. Although it was the least expensive of the plans, the trade offs from an environmental-social standpoint indicated that an action plan would be more acceptable.

The differences in the physical-chemical water quality characteristics of the 4 mg/l and 5 mg/l plans was not as significant as the differences between these two plans and the Baseline Plan.

The physical and biological significance of the differences between the 4 mg/l and 5 mg/l plans depended to a certain extent on assumptions which were made in developing the dissolved oxygen model of the Susquehanna River for the NYSDEC. This model did not predict either the minimum daily average DO (5.0 mg/l standard) or the minimum instantaneous DO (4.0 mg/l standard). Rather, the model predicted a hypothetical minimum DO which would exist if there were no DO fluctuations due to plant life. (Fluctuations in DO due to plant life are very difficult to predict because of the many variables - types of plants, time of year, presence of nutrients, temperature, etc.)

However, for the sake of analysis it was concluded that the model predicted a value close to the minimum daily average DO and the minimum instantaneous value would be about 0.5 mg/l lower than the average.

Having established this relationship, the following points describe the significance of the dissolved oxygen resulting from the 6 STP 4 mg/l plan with the waste loadings that would occur in the year 2020. The minimum instantaneous DO would never be less than 4.0 mg/l, if the river flow is at or higher than the one in 10 year minimum seven consecutive day flow (MA-7-CD-10). The minimum average DO under MA-7-CD-10 conditions would be no lower than 4.5 mg/l, at a single point in the river. The average DO, at MA-7-CD-10 conditions would be less than 5.0 mg/l for a 5.5 mile reach of the river. For the flows recorded in the eleven years from 1963 to 1973, the minimum average DO, for the critical month in each year, would have been less than 5.0 mg/l in only 2 years during the drought period 1964-1965. In some years the minimum average would have been 6.0 mg/l or greater. In 1965, the year in which the MA-7-CD-10 flow actually occurred, the minimum average DO would have been less than 5.0 mg/l during six out of the eight weeks in August and September but would never have been less than 4.5 mg/l. Any time that the minimum daily average DO is below 5.0 mg/l this condition would prevail for a maximum of 5.5 miles below Endicott.

Biologically, it was concluded that the 4 mg/l plan would furnish an aquatic environment satisfactory for the propagation and maintenance of the native fish species. This finding was partly due to the fact that the low DO conditions never occur in the spawning season, when fish are most sensitive to DO reductions. Furthermore, most fish have a response mechanism which leads them away from areas of adverse DO conditions. Finally, fish response to DO reveals that within the medium to high DO range (4.0 to 6.0 mg/l), there is only a slight discernible effect on fish activity between the limits of the range. Further examination found that the species of fish in the Susquehanna River could maintain normal life activities at 4.0 mg/l especially for the periods required in Plan 2. Therefore, concern for water quality should weigh this slight reduction of normal activity (in the 4.0 mg/l plan) for a 5.5 mile reach of the river for roughly two months out of ten years, against the added cost of the B-JC nitrification facilities required by the 5.0 mg/l plan (Plan 3). In other areas of possible impact including terrestrial ecology, resource commitments and social factors, the 4.0 mg/l plan and the 5.0 mg/l plan would not be significantly different.

The biological advanced waste treatment plan would result in a 50 percent increase in minimum DO, during the MA-7-CD-10, in comparison to the secondary treatment 4.0 mg/l plans. The AWT plan would also result in a 20 percent increase in minimum DO in comparison to the 5.0 mg/l plan, which provides for secondary treatment and nitrification. Additionally, nitrates, phosphorus, suspended solids and dissolved organic material would be greatly reduced in the effluent discharges in the AWT plan. No substantial change, however, in recreational use of the Susquehanna River was projected with implementation of any of the wastewater plans including the AWT Plan, although the bacteriological quality of the river would certainly be improved relative to the Baseline Condition Plan. The trade offs against the improved water quality of the AWT plan were the large economic impacts associated with its cost, increased resource commitments and larger adverse terrestrial impacts particularly during construction of interceptors and force mains. Electrical consumption for the AWT plan would be double that for secondary treatment and could represent an approximate increase of 1 percent in the region's electrical consumption, which in turn may create other environmental stresses.

Achievement of Planning Objectives

Each of the four Plans for Choice was also evaluated on the basis of achieving the program requirements of Public Law 92-500 and the water quality standards and stream classficatiions designated by the New York State Department of Environmental Conservation.

For P.L. 92-500, program requirements and goals have been designated for three benchmark years 1977, 1983, and 1985. By 1977 and thereafter, all publicity owned STP's must achieve secondary treatment. The U.S. EPA has defined secondary treatment as 85 percent removal of biological oxygen demand (BOD) and 85 percent removal of suspended solids (SS). By 1983, P.L. 92-500 states that an interim goal of water quality be achieved providing for the protection and propagation of fish, shellfish, and wildlife and providing for recreation in and on the water. Specific criteria for these "fishable-swimmable" waters have not yet been established by EPA, but most likely will include secondary treatment as a minimum with higher levels of treatment investigated on a case-by-case basis for specific areas. Futhermore, P.L. 92-500 states: "It is the national goal that the *discharge of pollutants into navigable waters* be eliminated by 1985."

In addition to the Federal requirements, the NYSDEC has certain stream classifications and water quality standards which must be achieved. Each stream has a certain classification which, in turn, carries with it certain standards for water quality. Most waters of the Susquehanna and Chenango Rivers within the Bicounty Area are classified as either Class A, B, or C waters. Class A water are drinking waters; Class B waters are suited for primary contact recreation (swimming); and Class C waters are suited for secondary contact recreation (fishing and boating). Aside from Class A drinking water, the major difference in the classes of water are the allowable limits for the bacteriological indication of coliform. Class A waters allow 5000 MPN/100 ml of total coliform; Class B water allow 2400 MPN/ 100 ml of total coliform; and Class C waters allow 10,000 MPN/100 ml of total coliform. Dissolved oxygen (DO) concentration is also an important standard of the NYSDEC's water quality program. For the main stem of the Susquehanna River downstream of Rockbottom Dam and for the Chenango River, 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." This standard applies to the MA-7-CD-10 flow and all higher flows.

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For the purposes of the Binghamton Wastewater Management Study, the Federal program requirements and goals of P.L. 92-500 and the NYSDEC water quality classifications and standards were applied in the following manner. For the 1977 requirement, all STP's should achieve secondary treatment with no bacteriological violations of the stream classifications and no violations of the 4.0 mg/l instantaneous minimum DO standard. For the 1983 goal of fishable-swimmable waters, a minimum daily average DO concentration of 5.0 mg/l should be maintained in the river at all times with no bacteriological violations. And finally, advanced waste treatment would approach the Corps of Engineers' definition of the "no discharge" goal established for 1985.

Using these requirements, water quality standards, and assumptions as objectives, each of the four Plans for Choice was evaluated as outlined in the following paragraphs.

Plan 1.

The Baseline Plan would not avhieve the secondary treatment requirements for 1977 and thereafter. All STP's in the Bicounty Area would gradually become overloaded as sewage flows continue to increase without corresponding increases in STP capacities or efficiencies. The resulting BOD and SS loadings to the river would be high, and adverse impacts would occur to the aquatic ecology of the Susquehanna River.

The minimum daily average DO level in the Susquehanna River would drop to 3.5 mg/l at the MA-7-CD-10 flow, and could be below the minimum instantaneous standard of 4.0 mg/l even at higher flows. Design storm conditions would similarly degrade the bacteriological conditions of the Susquehanna and Chenango Rivers (total coliform as high as 240,000 MPN/100 ml) due to uncontrolled and untreated combined sewer overflows. The Chenango Valley area would remain unsewered, resulting in possible groundwater and surface water pollution.

Consequently, the Baseline Plan would meet none of the NYSDEC or Federal requirements for water quality.

Plan 2.

The all secondary treatment plan would meet the 1977 secondary treatment requirements. All STP's in the Urban Study

Area, including the Owego Village STP, would be expanded at appropriate times to provide a minimum of secondary treatment throughout the planning period (2020). The resulting BOD and SS loadings to the Susquehanna River would be lower than in the Baseline Plan, although phosphorous and nitrogrn loadings would be slightly higher because of the sewering of Chenango Valley.

Plan 2 would meet the Study's criteria for fishable-swimmable waters at the MA-7-CD-10 flow, at least until the mid-1990's. After 1995, the minimum daily average DO concentration in the Susquehanna River could occasionally drop below 5.0 mg/l, but never below 4.0 mg.l. At the 2020 sewage loading rates and the MA-7-CD-10 flow, the critical DO sag in the Susquehanna River would occur for a five mile stretch of the river between Endicott and Apalachin. The minimum daily average DO concentration would be about 4.5 mg/l at the low point. Design storm conditions would never depress the DO level below the minimum instantaneous standard. Bacteriological violations, either during the MA-7-CD-10 flow or the design storm conditions, would not occur.

Therefore, Plan 2 was evaluated as fully satisfying the 1977 requirements. Additionally, Plan 2 would meet the fishable-swimmable objective at least to the mid-1990's. Potential violations of the fishable-swimmable objective could occur after 1995; these violations, though, would be isolated in time, short in duration, and limited in distance. Consequently, Plan 2 was judged to satisfy the broad intent of the 1983 goal by providing fishable-swimmable waters during all but extreme conditions. Plan 2, however, would not achieve the 1985 "no discharge" requirements.

Plan 3.

Plan 3 would provide secondary treatment at all STP's except Binghamton-Johnson City, which would have an additional nitrification process. All STP's would be expanded as required to maintain secondary treatment efficiencies, and the B-JC STP would be upgraded to provide nitrification by the mid-1990's. The resulting BOD and SS loadings to the Susquehanna River would be slightly lower than in either the Baseling Plan or Plan 2 with phosphorous and nitrogen loadings to the river about the same as Plan 2.

Plan 3 would meet the Study's criteria for fishable-swimmable waters above 5.0 mg/l of DO at the MA-7-CD-10 flow throughout the planning period. Design storm conditions would never depress the DO level below the minimum instantaneous standard. Bacteriological violations, either during the MA-7-CD-10 flow or the design storm conditions, would not occur.

Therefore, Plan 3 was evaluated as fully satisfying the 1983 goal for fishable-swimmable waters throughout the entire planning period. However, Plan 3 would not meet the 1985 goal of "no discharge".

Plan 4.

Plan 4 would provide nitrification in 1983 and advanced waste treatment in 1985 for strict compliance with the Corps of Engineers' definition of the 1985 "no discharge" goal of P.L. 92-500. Plants would be expanded as required after 1985 to accomodate increasing flows and maintain the strict limits for effluent discharge. Resulting BOD, SS, phosphorphorous, and nitrogen loadings to the river would be minimal. Bacteriological violations of water quality classifications would not occur. Dissolved oxygen concentrations would not drop below 5.0 mg/l, either during design storm conditions or normal operation at MA-7-CD-10 flows.

Consequently, Plan 4 was evaluated as satisfying the intent of the 1985 "no discharge" goal of P.L. 92-500.

General

Table IV-15 presents the impact assessment summary of the Plans for Choice investigated in Stage III-2.

TABLE IV - 15

IMPACT ASSESSMENT SUMMARY STAGE III-2

(YEAR 2020)

IMPACT INDICATORS ECOLOGICAL	1 BASELINE PROFILE	2A 4mg/l 5 STP PLAN	2B 4mg/l 6 STP PLAN	2C 4mg/l, 6 STP FIRST PHASE STP PLAN	3A 5mg/l 5 STP PLAN	3B 5mg/l 6 STP PLAN	3C 5 mg/l, 6 STP FIRST PHASE STP PLAN	4 BIOLOGICAL AWT 4 STP PLAN
1. # Major Stream Crossings	1	2	2	2	2	2	2	2
2. DO (mg/l)								
a) Minimal daily average: Year 2020, MA-7-CD-10	3.5	4.4	4.5	4.5	5.4	5.5	5.5	6.7
b) Minimum instantaneous Year 2020, Design Storm	3-4	4-5	4-5	4-5	4-5	4-5	4-5	5-6
3. Total N lb/day (Stream)	6830	7540	7540	7540	6830	7540	7540	585
4. Total P lb/day (Stream)	1740	1905	1905	1905	1740	1905	1905	145
5. NH_3 (mg/l) at minimum DO (Stream)	1.74	1.69	1.69	1.69	0.94	0.94	0.94	0.15
6. Benefit to Fishery Potentials of Limited Area	None	Slight	Slight	Slight	Moderate	Moderate	Moderate	Moderate
7. Maximum Total Coliform (MPN/100 ml) (Stream)								
a) MA-7-CD_{10}	<1000	360	340	340	360	340	340	360
b) Design Storm (Stream)	240,000	1040	1025	1025	1025	1025	1025	1040
8. Acreage for new STP	0	0	5	5	0	5	5	0
9. Acreage for Land Application of Sludge & Storage	-	1777	1777	1777	1777	1777	1777	2781
10. Acreage for Possible Landfill	150-200	226	226	226	226	226	226	360
11. Miles of Regional Interceptors not Along Existing Roadways	4.0	8.3	6.8	6.8	8.3	6.8	6.8	9.2
RESOURCES COMMITTMENTS								
1. Total Land Requirements (acres)	-	1777	1782	1782	1777	1782	1782	2781
2. Electricity (KWHr/Yr)	11.2×10^6	11.5×10^6	11.5×10^6	11.5×10^6	16×10^6	16×10^6	16×10^6	20×10^6
3. Chlorine (tons/yr)	271	282	282	282	267	267	267	147
4. Lime (tons/yr)	798-1198	840-1261	840-1261	840-1261	840-1261	840-1261	840-1261	1383-2074
5. Activated Carbon (tons/yr)	-	-	-	-	-	-	-	121
6. Methanol (tons/yr)	-	-	-	-	-	-	-	3570
7. Coagulants								
a) Alum (tons/yr)	-	-	-	-	-	-	-	10400
b) Polymers (tons/yr)	-	-	-	-	-	-	-	65
8. Fuel (gal/yr)	13,900	14,700	14,700	14,700	14,700	14,700	14,700	158,700

TABLE IV - 15

IMPACT ASSESSMENT SUMMARY STAGE III-2

(YEAR 2020)

IMPACT INDICATORS	1 BASELINE PROFILE	2A 4mg/1 5 STP PLAN	2B 4mg/1 6 STP PLAN	2C 4mg/1, 6 STP FIRST PHASE STP PLAN	3A 5mg/1 5 STP PLAN	3B 5mg/1 6 STP PLAN	3C 5 mg/1, 6 STP FIRST PHASE STP PLAN	4 BIOLOGICAL AWT 4 STP PLAN
ECOLOGICAL								
SOCIAL								
1. Miles of regional interceptors along existing roadways	4.5	6.8	5.9	5.9	6.8	5.9	5.9	7.7
2. # historic sites disturbed	0	0	0	0	0	0	0	0
3. # recreational places disturbed	0	2	2	2	2	2	2	2
4. Improvement to Secondary Water Contact Recreation Potentials	None	Slight	Slight	Slight	Moderate	Moderate	Moderate	Moderate
5. Improvement to Primary Water Contact Recreation Potentials	None	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
6. # Families Displaced	0	0	0	0	0	0	0	0
7. Result in locally desired development patterns	May or May not	Yes	Yes	Yes	Yes	Yes	Yes	Yes
8. Result in regionally desired development patterns	May or May not	Yes	Yes	Yes	Yes	Yes	Yes	Yes
9. Contravene air quality standards	No	No	No	No	No	No	No	No
10. Manpower Requirements	59	66	73	73	66	71	71	121
ECONOMIC								
Annual per capita costs (1975$)								
1. Chenango Valley Service Area	-	4.17	5.98	5.98	4.43	5.98	5.98	9.47
2. B-JC Service Area	3.69	4.17	4.30	4.30	4.43	4.59	4.59	9.47
3. Endicott Service Area	4.09	4.57	4.57	4.57	4.57	4.57	4.57	9.11
4. E. Owego Service Area	5.97	6.71	6.71	6.71	6.68	6.68	6.68	13.18
5. W. Owego Service Area	7.66	8.13	8.13	8.13	8.13	8.13	8.13	23.82
6. Owego Village Service Area	12.91	14.81	14.81	14.81	14.81	14.81	14.81	23.82
TOTAL COSTS*								
Present Worth ($106)	31.9	47.2	47.7	47.7	50.5	51.1	51.1	90.2
Average Annual ($106)	2.1	3.0	3.1	3.1	3.3	3.3	3.3	5.8

*6-1/8% interest and 50-year project life.

ATTACHMENT A

U.S. FISH AND WILDLIFE SERVICE REPORT

INTRODUCTION

As part of its Urban Studies Program and its survey scope planning, the Corps of Engineers is required to coordinate its work with the U.S. Department of Interior, Fish and Wildlife Service. The purpose of such coorindation is to insure that all necessary measures for preserving and enhancing the Nation's fish and wildlife resources are considered in the early stages of project formulation, and to obtain comments on the entire planning effort for any particular project.

For the purpose of the Binghamton Wastewater Management Study, the U.S. Fish and Wildlife (F&WL) Service was requested to prepare an inventory of existing fish and wildlife resources in Broome and Tioga Counties. Having developed this information, the F&WL Service then evaluated the four Plans for Choice to determine the impacts of the proposed wastewater management plans on the study area's fish and wildlife resources of future years.

The report prepared by the F&WL Service for the Binghamton Wastewater Management Study is printed in its entirity on the following pages.

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Post Office and Courthouse Building
BOSTON MASSACHUSETTS 02109

FEB 17 1976

District Engineer
Baltimore District, Corps of Engineers
Post Office Box 1715
Baltimore, Maryland 21203

Dear Sir:

The enclosed is our revised report on the Binghamton Wastewater Management Study, Broome and Tioga Counties, New York. This will replace the report sent to you on February 3, 1976.

Our report has been revised to include the comments of the New York State Department of Conservation.

Sincerely yours,

Howard N. Larsen

Regional Director

Enclosure

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Post Office and Courthouse Building
BOSTON MASSACHUSETTS 02109

BINGHAMTON WASTEWATER MANAGEMENT STUDY

NEW YORK

Report of the U. S. Fish and Wildlife Service on Plans Developed by the U. S. Army Corps of Engineers for Short- and Long-Range Wastewater Management to Insure High Quality Water for Future Generations in Broome and Tioga Counties.

February 13, 1976

PREFACE

The study was initiated in January 1974, and is being performed under three authorities: the June 1970 Corps of Engineers' Comprehensive Study Report for the Susquehanna River Basin; Section 235 of the Flood Control Act of 1970 (Public Law 91-611); and the Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500).

The study is a joint effort by the Corps of Engineers, Baltimore District, the U. S. Environmental Protection Agency (EPA), Region II, the Susquehanna River Basin Commission, the New York State Department of Environmental Conservation (NYSDEC), and the Southern Tier East Regional Planning Board. Study activities are structured to comply with the Corps of Engineers' guidelines for its Urban Studies Program and with EPA guidelines for area-wide waste treatment management planning. There are three stages in the plan formulation process for the study. The first two stages have been completed. The third stage, which is being processed at this time, consists of a narrowing down of thirteen alternatives to four plans. The alternatives were selected from a broad range of about 40 strategies and have been identified in the previous stages. The four plans are being reviewed by the participating agencies for a final recommendation.

The Corps of Engineers, however, has no authority for preparation of plans and specifications of the recommended alternative, nor do they have authority for construction of wastewater treatment systems.

This report has been prepared in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), in cooperation with the New York State Department of Environmental Conservation. Study plans upon which our report is based were provided by the Chief Planning Division of the Baltimore Corps District in letters dated May 9, 1975, and September 24, 1975.

PROJECT DESCRIPTION

The Susquehanna River, draining about 27,500 square miles over a 360-linear-mile distance, originates at Otsego Lake, New York, flows southerly through Pennsylvania, and empties into Chesapeake Bay at Perryville, Maryland.

The portion of the watershed in New York, accounting for approximately 23 percent of the total, is irregularly shaped. The New York watershed varies from 110 to 170 miles in length (east-west) and from 15 to 60 miles in width (north-south). Topography is mainly hilly with broad valleys. Elevations range from a high of 2,738 feet at Mt. Jefferson, Schoharie County, to a low of 750 feet at Waverly, Tioga County. In the past, most of the area has been denuded of forests and utilized for agricultural purposes. The underlying rocks consist largely of shales, readily subject to erosive action. Runoff is rapid, causing frequent flood damage.

Serving as the outlet to Otsego Lake, the Susquehanna River flows south and southwesterly from Cooperstown (elevation 1,200 feet above sea level) to the Pennsylvania state line (elevation 900 feet over a distance of 70 miles). Four miles south of the state line at the town of Susquehanna, the river turns west and then northwest back into New York over a distance of about ten miles. The river continues flowing northwest another nine miles to the city of Binghamton, where it again turns westerly and eventually southwesterly 38 miles to the Pennsylvania state line (elevation 755 feet), east of the town of Waverly.

The Corps of Engineers' Wastewater Management Study for Broome and Tioga Counties, New York, concentrates on the urbanized portions of both counties from the city of Binghamton downstream to the village of Owego. Background information was collected, and existing and potential problems were identified. About forty strategies to solve the problems emerged from this material. Thirteen were selected for refinement of technical, economic, environmental, political, and institutional aspects. These alternatives were eventually reduced to the following four plans which are currently under consideration by the participating agencies for a final recommendation:

1. Base Line profile;

2. Maintain a minimum in-stream dissolved oxygen concentration of 4 mg/l (milligrams per liter). The MA7CD/10 river flow (minimum average seven-consecutive-day river flow which will occur once in ten years; used to emphasize aquatic conditions when they may be at their worst).

3. Maintain a minimum in-stream dissolved oxygen concentration of 5 mg/l during the MA7CD/10 river flow.

4. Advanced wastewater treatment.

The alternatives are designed to the year 2020.

The Base Line Profile forms the basis against which all alternative wastewater management plans are compared and it is an alternative in itself. In the Base Line Profile, the Corps of Engineers has assumed that no wastewater treatment plants or interceptors will be added other than those that have already been approved by NYSDEC for construction in the years 1975 and 1976. Expansion of existing plants' service areas will be assumed to continue following existing trends.

The main characteristics of the Base Line Profile include:

Five sewage treatment plants (STP) at Binghamton-Johnson City (located in the town of Vestal, Broome County, south side of Susquehanna River); Endicott (town of Union, Broome County, junction of Nanticoke Creek and Susquehanna River); Owego Village (town of Owego, Tioga County, junction of Pumpelly Creek and Susquehanna River); West Owego (town of Owego, Tioga County, junction of Barnes Creek and Susquehanna River); and East Owego (town of Owego, Tioga County, junction of Appalachin Creek and Susquehanna River).

All sewage treatment plants will provide secondary waste treatment, but will eventually be overloaded because of the increased wastewater flows.

No infiltration control practiced in city of Binghamton.

No storm water management.

No nonstructural measures.

No relief of individual septic system problems, especially in the Chenango Valley area.

Three plans are being considered under the category of maintaining a minimum in-stream dissolved oxygen concentration of 4 mg/l during the MA7CD/10 river flow. The major differences in the three plans are the location and construction timing of sewage treatment plants. Each plan provides for micro-screening and chlorination of storm-water overflows and the application of infiltration control measures within the city of Binghamton, which will reduce wastewater flows by one million gallons per day. Wastewater sludge in each plan will be applied to the land; however, land filling is included as a backup sludge management scheme if land application should prove infeasible. In addition, not one of the three plans provides for the application of nonstructural flow reduction measures.

Plan 2A provides for two sewage treatment plants in Broome County (Binghamton-Johnson City, Endicott) and three in Tioga County. Chenango Valley wastewaters would be sent via force main to the Binghamton-Johnson City Plant.

Plan 2B provides for three sewage treatment plants in Broome County (Binghamton-Johnson City, Endicott and Chenango Valley) and three in Tioga County. The Chenango Valley Plant would discharge its effluent directly east to the Chenango River via a 400-foot pipeline.

Plan 2C is similar to Plan 2B; however, the scope of sewerage service is limited to a smaller area for five years after the plan is implemented. After 1982, the entire Chenango Valley Service area is included for sewerage services. Both the interim and completed Chenango Valley Plant would be provided with the same effluent outfall described for Plan 2A.

There are three plans under consideration for maintaining a minimum in-stream dissolved oxygen concentration of 5 mg/l during the MA7CD/10 river flow. Each plan would implement infiltration control measures within the city of Binghamton so that influent wastewater flows to the Binghamton-Johnson City Plant would be reduced by 3 MGD. Nonstructural measures for flow reduction are assumed not to achieve any reduction in wastewater flows. Storm-water overflows in the urban areas are to be treated by micro-screening, followed by disinfection. Sludge would be applied to farm lands; however, landfilling is carried through as a backup system if land application is found to be undesirable. The differences in the three plans are the number, location, and timing of plant construction.

Plan 3A regionalizes the Chenango Valley area into the Binghamton-Johnson City sewerage system via force main and pump station. Complete service would be provided for the towns of Dickinson, Chenango, and Fenton by 1985.

Plan B would provide for a separate Chenango Valley Plant, in addition to the Binghamton-Johnson City and Endicott Plants in Broome County. The Chenango Valley plant would discharge effluent directly to the Chenango River via a short outfall pipeline. There would be three sewage treatment plants in Tioga County.

Plan 3C would eventually have three treatment plants in Broome County, as does Plan 3B. Sewerage service would be provided in limited areas (town of Dickinson, and Nimmonsburg in the town of Chenango) up to 1982. After 1982, other areas such as Chenango Bridge and the town of Fenton would also be serviced. The short outfall of the interim Chenango Valley Plant would be used for the completed Chenango Valley Plant.

The Advanced Wastewater Treatment Plan would provide denitrification, phosphorus removal, filtration, and carbon adsorption at four sewage treatment plants in the Binghamton urban area by 1985. The plants would be located at the existing sites of the Binghamton-Johnson City, Endicott, East Owego, and West Owego plants. Infiltration control measures within the city of Binghamton would be utilized to reduce the influent wastewater flows to the Binghamton-Johnson City plant by three million gallons per day. Nonstructural measures of flow reduction are assumed to be 100% effective. Storm-water overflows would be treated by micro-screening, followed by disinfection (chlorination), at five main overflow locations within the city of Binghamton. Wastewater sludge would be applied to farm lands. Land filling of sludge would be maintained as a backup management alternative if land application should prove infeasible.

The area of study focuses on the urbanized portions of the Susquehanna River from the city of Binghamton, Broome County, to the village of Owego, Tioga County, and includes the lower portion of the Chenango River in Broome County. The U. S. Fish and Wildlife Service report concentrates on this area, but includes information on the 47-mile section from Riverside, Broome County (where the river enters New York) to Waverly, Tioga County.

Environmental Setting Without the Project

The Susquehanna River Valley in the project area is broad and open. The river itself is generally broad (varying from 100 to 800 feet wide) and shallow, with a few deeper spots above dams and in natural pools.

The elevation of the river at the hamlet of Riverside, town of Kirkwood, Broome County (where the Susquehanna enters New York) is about 845 feet above sea level. Over the next 9.1 miles, to the eastern city limits of Binghamton, the river drops about ten feet. From this point downstream for a distance of about seven miles (through the urbanized portions of Binghamton and Johnson City), the gradient increases and drops about 25 feet. Entering Endwell and Endicott and for a considerable distance downstream to the vicinity of Owego, the river slows and drops about ten feet every nine miles. Passing into the Narrows, downstream of Owego, the river again picks up speed and drops steadily about ten feet every four to five miles, passing out of the State east of Waverly at about elevation 755 feet. In this 47-mile stretch, the Susquehanna receives over 65 tributary streams, including the Chenango River, Owego, Nanticoke, and Choconut Creeks.

Most of the tributary streams are generally broad and shallow, with the majority running dry during the summer months. The area in New York which has been drained by these streams and the Susquehanna totals about 4,500 square miles. Fifty years ago, the predominate use of the land was for agriculture, but this activity has waned during the intervening years to the present when less than a quarter of the land is utilized for this purpose. Woodlands have conversely increased to the present stage, accounting for over 50% of the land usage. Urban and residential use has increased dramatically, with concentrations taking place along the Susquehanna and Chenango Rivers.

The total annual precipitation, averaging about 37 inches per year, is distributed throughout the 12-month period. However, the greatest monthly average occurs during the growing season of April through September. Annual snowfall averages about 50 inches around Binghamton, and 85 inches or more in the higher elevations. Sudden thaws, warm rains, intense thunder storms and hurricanes, coupled with easily erodable soils, result in considerable damages and floods. Not only does agricultural and privately developed property sustain damage, but streams lose their bank cover and are widened, making them more shallow, and good pools are destroyed.

Surface records by the U. S. Geological Survey indicate that the Susquehanna River at Conklin, 3.5 miles downsteam from the Pennsylvania-New York state line in Broome County, has an average discharge over a 61-year period of record of 3,558 cubic feet per second (cfs). The maximum discharge of 61,600 cfs occurred on March 18, 1936, and the minimum discharge of 85 cfs occurred on October 14, 1964. Maximum discharges on a yearly basis occur in December and April; minimum discharges occur in October.

Similar data for the Susquehanna At Waverly (one mile downstream fron the New York - Pennsylvania state line) show that an average discharge for the 37-year period of record is 7,400 cfs. The maximum discharge of 121,000 cfs occurred on June 23, 1972, and the minimum discharge of 237 cfs occurred on September 22 and 23, 1964. Maximum discharges on a yearly basis occur in December and April; minimum discharges occur in October.

The Chenango River, draining about 1,500 square miles, is one of the largest tributaries; in character, however, it resembles most of the others in the area. It is broad and flat, with relatively few good pools in the lower sections. U. S. Geological Survey records indicate that the average discharge over the 61-year period of record is 2,394 near Chenango Forks, Broome County. The maximum discharge of 96,000 cfs occurred on July 8, 1935, and the minimum discharge of 84 cfs occurred on September 19 and 25, 1939. Maximum discharges on a yearly basis occur in December and April; minimum discharges occur in October.

<u>FISHERY RESOURCES</u> - <u>Under Existing Conditions</u>

The native fish fauna of the Susquehanna is made up of many elements. Based on the total number of species, the geographic area to the south has contributed most. Many of the same species found in the Potomac River and in other Atlantic coastal streams are common to the Susquehanna.

Other elements in the population include components from the Atlantic Ocean and from river systems west of the Alleghanies. How the latter group got into the Susquehanna system is unknown, but species from the Atlantic reached the upper Susquehanna because of their remarkable migratory abilities. Construction of flood control structures in Maryland and Pennsylvania has since eliminated this source.

A small group of native species, such as the brook trout, became widespread during the period when the region was in rather close proximity to the glacial ice front. Subsequent changes in conditions (especially the increasing warmer climate) have probably restricted the range of this group to a fraction of its former extent. Most of these are cold-water fishes, but some are tolerant of warm waters. Trout cannot exist in the main branch of the Susquehanna, but they are found in some of the smaller tributaries.

A large number of native fishes in the upper Susquehanna system have been augmented by introductions. Such species as the brown and rainbow trout and carp are not native to New York. Smallmouth bass and black crappie are native to some parts of the State, but are not indigenous to the Susquehanna.

The overall fish fauna of the river system has been continuously modified by the construction of dams, by the introduction of alien species, and by the changes in land use and development of the resources of the valley. Shad, which formerly reached Binghamton during their annual migrations, are no longer found in the New York waters. The run of eels has greatly diminished, although the young are still able to pass the obstructions and attain headwaters. Until the late 1950's, pickerel were very abundant; by mid-1960, however, they had practically disappeared. Rock bass have dropped in importance since 1968. Smallmouth bass went through a sharp decline between 1969 and 1970, and have very gradually increased until the present time, although they still have not reached past numbers and sizes.

The New York portion of the Susquehanna watershed was biologically surveyed in 1935 by the State of New York Conservation Department ("A Biological Survey of the Delaware and Susquehanna Watersheds," 1936 No. X, Biological Survey, Supplemental to 25th Annual Report, 1935, Albany). At that time, most of the land was under agricultural usage, which led the investigators to note that deforestation, lumbering operations, and clearing of lands for crops and pasturage had had a widespread influence on the fish life of the region. Pollution, depending on the nature and amount of the substances causing the pollution, was also cited as being of considerable importance for its influence in conditioning the distribution of fish life. It was concluded that the general trend of effects had been toward a decrease in the low water flow of streams, an increase in runoff after periods of precipitation, an increase in the erosion processes, a decrease in deep stream pools, and raising of stream temperatures.

Table 1 lists the fish species collected in the Susquehanna River by abundance in August 1935. Collections were obtained from 14 different locations along the Susquehanna (See Table 1). Twenty-seven species were identified, with smallmouth bass being the most prevalent.

Table 2 lists the fish species collected in the Chenango River from the mouth to Chenango Bridge, about four miles upstream from the mouth. All collections were again made in August 1935. Four sample sites, delineated in Table 2, were utilized.

The New York State Conservation Department, subsequently renamed the New York State Department of Environmental Conservation, has continued to monitor the fisheries situation in the Susquehanna. Since 1967, fish tagging programs have been carried out on walleye and smallmouth bass. A creel census was carried out on the river and its major tributaries in 1965 and 1966. Since 1970, walleye, smallmouth bass, yellow perch, brown bullhead, and white sucker specimens have been collected for pesticide analysis. The following is a summation of the results of these monitoring programs:

<u>Walleye</u> - In 1935, it was noted that this species was an introduction which was common locally in the larger streams. It was one of the principal game speci[illegible], with good fishing reported in limited areas. Specimens attained a good size. Recent studies indicate that there

are three main concentration areas for this species: just below the Whitney Point Dam on the Otselic River; at the Goudey Power Station Dam (New York State Electric and Gas); hamlet of Westover, town of Union; and below Rock Bottom Dam, city of Binghamton. All of these are impassable barriers. The fish are migratory, moving upstream throughout the river system in the spring, but are gone from most areas by May 15. There are strong indications that spawning is taking place. They are not present in the fall around the Binghamton area, but can be found around Owego in a four and one-half mile stretch in the vicinity of Hiawatha Island. This area is large enough and deep enough to hold a sub-population which would account for the showing in the fall.

The walleye is a popular sport fish; in the spring (April and May) the best fishing area is located at Goudey Dam. The second best area is located at Rock Bottom Dam (in the spring especially) and at Sandy Beach, city of Binghamton. The latter spot is unpredictable, being either a "boom or bust" situation.

Walleye fry were stocked in the lower Chenango River for several years (from 1925 to about 1969). In 1967, from the mouth of the Chenango River to Mile 46, the recommended stocking policy was 77,580 per mile. Thirty-five specimens, collected and tagged at the Goudey Station Dam in April 1967, averaged 14.2 inches in length. Sixteen walleye, averaging 12.2 inches, were collected and tagged the following month at the same location.

Specimens have been collected for DDT pesticide and mercury analyses since 1970. All samples from the Susquehanna and Chenango have been within the acceptable concentration limits established by the U. S. Food and Drug Administration for DDT and mercury. Mercury, however, was found in the Chenango. In 1975, specimens were collected for poly-chlorinated biphenyls (PCB) analysis. Concentrations were within the acceptable limits established by the U. S. Food and Drug Administration for PCB's.

<u>Smallmouth Bass</u> - In 1935, this species was very common and constituted one of the principal game fishes. Specimens attained good size in the stretch between Owego and Waverly, providing excellent sport fishing at all times. This species was probably not native to the Susquehanna system, but had been introduced. Stocking was carried out from about 1925 to about 1969.

Since 1970, surveys for DDT and mercury in the Susquehanna reveal that concentrations in the fish sampled were within acceptable limits established by the U. S. Food and Drug Administration for DDT and mercury. Samples taken in 1975 for PCB contamination were all within the acceptable limits.

A tagging program has been carried out since about 1967. Indications are that the Susquehanna population went through a sharp decline between 1969 and 1970 (reasons unknown). Since that time to the present, their numbers and sizes have very gradually increased. However, numbers and sizes have not reached past levels. Fish lengths run to about nine or ten inches; few are larger. Bass, which prefer a habitat similar to that of the walleye, are also known to spawn in the Susquehanna.

Chain Pickerel - This species was also very common in the 1935 survey and constituted one of the most important game fishes, especially in the main branches of the Susquehanna and Chenango Rivers. They were very abundant in the late 1950's and shared the same fishing status as the smallmouth bass. By the mid-1960's, they had just about disappeared (reasons unknown).

Largemouth bass - Moderately common as an introduced species in 1935, the status of this fish has remained relatively unchanged. Presently, the major area of concentration is around Hiawatha Island in the vicinity of Owego.

Rock bass - A very common pan fish in 1935, this species has dropped in importance since 1968.

Yellow perch - Although abundant in larger streams and some lakes in 1935, this pan fish was taken only occasionally in the Susquehanna and lower Chenango. Its present status is relatively unchanged. With the exception of specific places (such as Rock Bottom Dam), it is generally uncommon. Specimens have been obtained from the Susquehanna and Chenango for DDT pesticide and mercury analyses since 1970. Results have shown concentrations within acceptable limits established by the U. S. Food and Drug Administration for DDT and mercury.

Brown bullhead - Widely distributed in the more sluggish parts of streams throughout the watershed in 1935, the species has maintained its status. It is currently a popular pan fish and provides good fishing in the Susquehanna. Specimens have been obtained from the Susquehanna and Chenango for DDT pesticide and mercury analyses since 1970. Results have shown concentrations within acceptable limits established by the U. S. Food and Drug Administration for DDT and mercury.

White sucker - At the top of the list in abundance throughout the watershed in 1935, this species has maintained its ability to get along under almost all conditions. Although edible, it has never been popular with fishermen but it does serve as an important resource of food for game fish. Specimens have been obtained from the Susquehanna and Chenango for DDT pesticide and mercury analyses since 1970. Results have shown concentrations within acceptable limits established by the U. S. Food and Drug Administration for DDT and mercury.

The incidental species reported in 1935 (shiners, darters, minnows, etc.) have remained relatively unchanged. Black crappie (Pomoxis nigromaculatus), a popular pan fish termed "rare" in the Susquehanna system in 1935, was not found in the main stem of the Susquehanna. Within the past decade, however, the species has started to show up fairly regularly in the waters of the Susquehanna that will support them. Muskellunge (Esox masquinongy) was not reported in the Susquehanna watershed in 1935. Since about 1966, individuals of this species have been routinely recovered from the

Susquehanna during NYSDEC's sampling program. Murphy's Island, below Goudey Dam, is a common recovery spot. These fish probably originated through the stocking program of the Commonwealth of Pennsylvania. NYSDEC also stocked some muskellunge in Whitney Point Reservoir about 1966.

Northern Pike (Esox lucius) were accidently introduced into the upper reaches of the Chenango River in 1964. These fish have moved rapidly downstream and evidently have been successful in reproducing naturally. The Northern pike is a popular game fish, and it is third in importance in the Chenango River at the present time.

Channel Catfish (Ictalurus punctatus) were introduced into the Whitney Point Reservoir by NYSDEC in 1964 or 1965. Some were caught in the Chenango River and in the Susquehanna River by Binghamton, but the introduction appears to have failed.

Other fish species collected in the main Susquehanna in recent years by NYSDEC, but not obtained in 1935, include the American eel (Anguilla rostrata); carp (Cyprinus carpio); golden shiner (Notemigonus crysoleucas); river carpsucker (Carpiodes carpio); quill back (Carpiodes cyprinus); river redhorse (Moxostoma carinatum); bluegill (Lepomis macrochirus); and slimy sculpin (Cottus cognatus).

Fishery Resources Under Conditions Anticipated Without the Project

Seven sewage treatment plants are operating at the present time in the project area. Data available from 1973 indicate that four of these plants were providing secondary treatment service for a population of 153,800, and three plants were providing primary treatment service for 11,600 people. With no project, the wastewater management plan involves: abandoning two of the primary treatment plants and diverting their sewage to plants providing secondary treatment; upgrading a third plant to provide secondary treatment and extensions of sewage collection and treatment services into some new areas.

At least 23 industries are situated along the Susquehanna and on tributaries immediately adjacent to the river. Of the total 93.72 to 94.05 million gallons of water which are removed and discharged back to the river each day, over 86% of this is used for cooling by the New York State Electric and Gas Company's Goudey Station at Johnson City. Most industries either discharge treated wastewater directly to streams or discharge untreated wastewater to municipal sewage treatment plants.

Projected wastewater flows for 2020 show a 66% total overall increase over present conditions. Projected effects include gradually deteriorating water quality conditions in the Susquehanna River. Dissolved oxygen deficiencies would result during periods of low flow or floods. Low dissolved oxygen concentrations adversely affect the growth and activity of numerous fish species, especially walleye and smallmouth bass.

Existing land use patterns indicate that the predominate land uses in Broome and Tioga Counties are woodlands (58%) and agriculture (22%). Residential, industrial, and urbanized uses are less than ten percent, but projections indicate a continued increase while active agricultural lands will decrease. The major urban concentration is expected to remain essentially where it is now.

Land use patterns have a direct effect on soil erosion losses which affect lakes and streams. The Soil Conservation Service has developed a method for inventorying sheet erosion and sediment deposition in New York State, and has compiled figures showing annual soil loss in tons per acre for each land use, as well as the sediment delivery to selected points. Sheet erosion or the removal of thin layers of soil over extensive areas, especially on bare or unprotected soils such as cultivated fields, accounts for most of the sediment reaching the State's waters. About 58% of the bicounty area is in woodlands and, except for Man's disturbance during timber harvest, sheet erosion is relatively low.

Sheet erosion also occurs on the bare, exposed soil surfaces created on construction sites, but at a considerably accelerated rate. Stream bank erosion is another significant source of sediment. In the bicounty area the combination of erosion factors results in an annual soil loss of 2,091,064 tons. A good portion of this is carried into the Susquehanna, resulting in increased turbidity and decreased light penetration, covering of fish eggs and benthic plant and animal organisms, loss of habitat by reducing overhangs, filling in of pools, and widening of stream banks.

The projected decrease in agricultural practices will result in a reduced rate of erosion. However, an increase in urbanized areas will result in an increased rate of soil erosion, although damages in this case will be generally short-term during the periods of construction. Stream bank and road bank erosion will probably continue at the present rates of about 50 tons per stream bank mile and 98 tons per road bank mile, respectively.

Besides the physical impact of soil particles in the water systems, fertilizers, pesticides, and herbicides which are used on the land surface are often washed into streams along with the soil. Fertilizers provide nutrients such as nitrogen and phosphorus which may result in increased eutrophication rates and, therefore, reduced dissolved oxygen. Pesticides and herbicides, especially those containing resistant hydrocarbons such as DDT, are picked up by tiny organisms and transferred up the food chain to the fish. Excessive amounts can cause damage and death to individuals who imbibe such compounds. Also, a danger exists to Man if he consumes such infected organisms.

Sampling done by the NYSDEC since 1970 indicates that although some chemical compounds such as DDT and mercury and PCB's are in the Susquehanna system, fish specimens collected have all contained amounts below the acceptable limits. Recent legislation banning the usage of dangerous chemical compounds, as well as the projected reduction in agricultural practices, indicates that during the project life, use of dangerous chemical compounds will decrease.

The New York State Electric and Gas Company's Goudey Station near Johnson City utilizes about 80 million gallons of river water per day for generator cooling. Thermal discharge, which flows into Little Choconut Creek slightly upstream of its confluence with the Susquehanna River, can have a maximum temperature of ten degrees F, with the discharge to intake temperature difference not to exceed 25 degrees F. By July 1, 1983, the discharge temperature must not exceed 89 degrees F, with a discharge to intake temperature not to exceed 30 degrees F. The New York State Electric and Gas Company has recently initiated a program of biological assessment of the effects of the thermal plume on aquatic organisms in the Susquehanna. Significant river temperature changes may result, causing reductions of dissolved oxygen.

Chlorine is used at the Goudey Station and the sewage treatment plants as a procedure for anti-fouling of the water intake structures and cooling systems. Chlorine and related compounds have been found to be toxic to aquatic life at certain concentrations. The toxicity, however, depends more on the concentration of residual chlorine and relative amounts of free chlorine and chloramines remaining than on the amount of chlorine added. Toxicity also depends on the amount of ammonia originally present in the water and the amount of chlorine added, the pH value, the temperature, and the length of time over which the reaction has taken place.

The welfare of the fishery resources in the Susquehanna for the projected project life is, therefore, dependent on many factors. Changes in dissolved oxygen, temperature, pH, turbidity and suspended solids, nutrients, ammonia, chlorine and heavy metals in the Susquehanna, brought about by effects of the current wastewater management plan, cannot be analyzed by themselves, since the effects on aquatic life are cumulative. Natural soil erosion, land use changes, effects of power plants, and other industrial discharges must be studied concurrently.

A creel census carried out by the NYSDEC in 1965 and 1966, along the 47-mile stretch of the Susquehanna from Waverly to Riverside, interviewed 275 fishermen who had spent a total of 361½ hours fishing. The total amount of fish caught was 385, or an average of 1.07 fish caught per hour. Table 3 provides a summary of this census.

In 1975, six commercial fishing licenses were sold in the bicounty area (two in Broome and four in Tioga), indicating a commercial fishing value in the Susquehanna. Set lines are used to catch bullheads, suckers, carp, and eel. Although not significant, the commercial fishery probably serves as a supplement to other forms of income.

While fishing has long provided many people with recreational enjoyment, it also generates money to the economy in terms of fishing tackle, bait, license, gasoline, food and lodging expenditures, etc. Many species of fish, as they function within the ecosystem, render services that go largely undetected. Fish also provide other values such as social, aesthetic, and scientific.

Placing an overall value on the role fishes play in the social and economic life of a region is extremely difficult. Figures have been developed by the Southern Division of the American Fisheries Society on the cost of raising various species of fish in a hatchery. Estimating the abundance of each species in the river and multiplying the replacement cost by the population would arrive at one figure of fish value.

A common method of estimating a value for recreational fishing is to multiply the total man days spent fishing times the average amount of money spent per man day. It is also possible to take the number of fishing licenses sold in the region and add this total to an estimate of the number of unlicensed fishermen to get a total number of fishermen. To obtain man days spent fishing, multiply the total number of fishermen by the average number of days spent fishing per year. This, in turn, can be multiplied by an average dollar amount spent per day to get the total amount spent. Monetary benefits accrued from the commercial fishery can also be derived.

Other values of fisheries, such as biological, social, aesthetic, and scientific, are more difficult to assign monetary figures. Due to the severe time constraints involved in preparing this report, monetary values for present and anticipated fishermen usage were not worked up. Even with the best data available, it is extremely difficult to arrive at a hard dollar figure for the value of the fishery of the river. The figure will change from year to year and will never remain constant. Nevertheless, even an approximate figure would place the value in perspective when compared with other values, such as industry, commerce, and other types of recreation, so that judgements can be made in the context of economics, politics, and expanding human pressures.

<u>WILDLIFE RESOURCES</u> - <u>Under Existing Conditions</u>

The bicounty region is made up of a mixture of land use types (58% woodland, 22% agricultural, less than 10% industrialized-urban-suburban). These are not contiguous blocks, but form a mosaic of wood lots in all stages of successional growth--hedgerows, abandoned and cultivated fields, waterways, roadways, and urban-suburban areas. Even the urban areas, concentrated along the Susquehanna River (at its confluence with the Chenango) and around Owego, provide some habitat for wildlife. The bulk of the bicounty region provides from poor to excellent habitat for various terrestrial and avian wildlife species.

Woodland areas, which comprise the largest percentage of the bicounty region, are greatly affected by temperature, humidity, and soil conditions. Stream valleys and topography are oriented in a northeast to southwest orientation. Depending on altitude, by receiving the sun's warmth, the north side of streams or gorges (facing south) has trees of southern affinities--such as various oaks and hickories; being in the shade and considerably cooler, the opposite south bank (facing north) has northern types--such as hemlock, yellow birch, striped and mountain maples, and American mountain ash. These same conditions affect the types of terrestrial and avian wildlife that reside in these woodlands.

The character and juxtaposition of the other land use types likewise affect the makeup of wildlife species present.

Table 4 presents a breakdown of the preferred habitats of mammalian wildlife in the bicounty region. White-tailed deer utilize a large number of habitat types and find conditions suitable for maintaining good-sized populations. Deer comprise the major big-game resource in the region.

Mammalian small game include varying hare, cottontail rabbits, and gray squirrels, the latter two which provide good hunting opportunities to the sportsman. Cottontails are common in and around agricultural areas and abandoned fields, while gray squirrels are confined mainly to deciduous forests. Varying hares are forest creatures which are more common to the east of the bicounty region. Broome County does have a hunting season; Tioga County does not.

The furbearers (including weasels, mink, beaver, muskrat, raccoon, and fox) are particularly important to the trappers in the region. Most of these animals are dependent upon waterways (streams, swamps, marshes) for their existence. The Susquehanna River contains a sizable population of muskrats that use the banks for burrows. Other species also nest in and along the banks of the river and its tributaries. Raccoon, mink, opossum, skunk, and fox use the river banks and exposed flats to search for food.

Several species of mice, shrew, moles, and bats are also found within the region. Many are nocturnal or secretive and go largely unnoticed. However, they play an important role in the ecosystem by eating insects detrimental to Man, aerating the soil with their burrows, and providing food for larger, more economically important species. Some species, such as the house mouse and Norway rat, can be a nuisance as well as a health problem because of their habits and close association with Man.

The Indiana bat (Myotis sodalis), listed by the Department of the Interior as being endangered, has a range which includes all of New York State, but whose distribution is restricted to the area adjacent to caves. It is doubtful that this species is in the study area; however, adequate research to verify this fact has not been conducted.

The avian wildlife associated with the region falls into two categories: game birds and non-game birds. Game birds include wild turkey, ruffed grouse, ring-necked pheasant, woodcock, waterfowl, and shore birds. Turkeys, found in more mature hardwood forests, have come into the bicounty region naturally from Pennsylvania. NYSDEC has trapped many of these birds and has introduced them into the northern parts of the bicounty region with excellent results. Both counties offer a spring and fall hunting season on these birds.

Ruffed grouse maintain viable populations subject to natural fluctuations wherever conditions are suitable. A mixture of mature conifers, hardwoods, and brushy areas appear to be best. Grouse are probably the second major game species in the region, based on hunter popularity.

Woodcock, feeding principally on earthworms, can be found along meandering streams, spring-fed seeps, rich bottom land, alder thickets, or scrubby edges of damp second-growth woods. Some woodcock nest in the region; however, most birds seen are migrants moving through from more northern climates. The Susquehanna River Valley is a major flyway.

In the late 1800's, ring-necked pheasants were introduced into New York and they successfully established themselves. Pheasants occurred in much higher numbers in the bicounty region when agricultural practices were more prevalent. A bird of farm country and hedgerows, the pheasant's range has slowly decreased to the river valleys. The last stronghold of the pheasant in Broome County is along the Susquehanna. The native bird population is augmented by a "put and take" stocking program by NYSDEC. Both male and female birds may be taken. The situation is worse in Tioga County where farms no longer extend down to the river. The native population is low, and only male birds are huntable.

Wetland habitat in the bicounty region is generally poor. The Susquehanna River Valley serves as an important flyway during migration. During restricted times of each year, waterfowl and shore birds use the main channels for resting and feeding areas. Wood duck, mallard, black ducks, and mergansers in small numbers utilize the marshes, swamps, and waterways in the region for nesting. NYSDEC has put up some wood duck boxes on Corps of Engineers' land around Whitney Point lake. They are also planning small dikes and water level control structures on the same land for managing waterfowl and pheasants.

During migration, large numbers of waterfowl and shore birds pass over the region. Occasionally, a flock of Canada geese will spend a few days on the Whitney Point Lake. The major species of waterfowl, in order of abundance, include wood ducks, mallard, black ducks, and mergansers.

These are joined by green and blue-winged teal, American widgeon, gadwall, bufflehead, rails, coots, and gallinules. Occasionally, pintail and scaup, sandpipers, plovers, and other shore birds can be observed. The diving species, such as bufflehead and scaup, are confined to the deeper stretches of rivers and Whitney Point Lake. The other waterfowl, which are primarily dabblers and surface feeders, utilize shallow water edges, marshes, and flooded pastures. The shore birds, however, are restricted to mud flats and shallow flooded areas. Hunting is restricted because of limited access.

A list of game birds has not been compiled because of lack of time. Bull (1974) has listed 410 bird species in New York by range and status. At least 300 or more of these birds spend all or part of their lives in the bicounty area. Besides the economically important insect eaters (warblers, orioles, meadowlarks, vireos, shrikes, flycatchers, swallows, wrens, nuthatches, and thrushes) and seed eaters (sparrows, grosbeaks, juncos, and blackbirds), the birds of prey play an important role in the ecosystem by checking the rodent population.

Other less well-known wildlife members of the bicounty region include snakes, lizards, amphibians, turtles, toads, and frogs. Table 5 lists the known reptile and amphibian species with their preferred habitat. A good many of these species are nocturnal, spending the day under rocks, logs, and leaves. The greatest contribution, on an economic basis, is in the role of insect eaters. The bog turtle has a range extending over much of New York, but its distribution is restricted to fresh-water marshes, wet meadows, and bogs. The species is listed as being endangered by the Department of the Interior. It is doubtful that this species is present in the study area, but adequate research to verify this fact has not been conducted.

Wildlife Resources Under Conditions Anticipated Without-The-Project For The Stated Project Life

The projected decline in agricultural lands and increase in urban areas will affect the makeup and distribution of wildlife species. Cottontail rabbit and ring-necked pheasant populations, which are more dependent on farm lands than other species, will probably decline. Urbanization along stream systems will have insidious and fatal effects on many species of furbearers, as well as small mammals, reptiles, and amphibians. Changes in land use also influence songbird distribution. White-tailed deer, wild turkey, ruffed grouse and those species associated with forests and woodlands will prosper.

The projected wastewater management treatment plan will affect water quality in the Susquehanna and Chenango Rivers. During low flows and flood conditions, water quality will decrease and terrestrial species directly dependent upon the main river courses will be affected. The habitat for amphibians, reptiles, and insects may be destroyed. These effects will be mirrored up the food chain to furbearers, waterfowl, and shore birds which are dependent on the smaller species for food.

Time constraints have precluded an in-depth analysis of the effects on population projections, values in dollars, man days, etc.

Other Resources Ancillary To Fish And Wildlife Resources

Within the ecosystem of the Susquehanna watershed there are many associated factors which are inter-dependent. Fish and wildlife resources are dependent upon the type, quality, and quantity of the various habitats and their relationship to each other. Making up these habitats are climatic, physiographic, geologic, and floristic factors interacting with each other.

No attempt has been made to analyze the flora of the region or to determine the presence of rare or endangered species, unique natural areas, etc. Projected land-use trends will affect the flora by destroying or altering species composition and distribution. Aquatic vegetation will be altered or destroyed with decreased water quality.

ENVIRONMENTAL IMPACTS WITH-THE-PROJECT

Fishery Resources

Under all alternative plans other than the Base Line, two river crossings for interceptor lines will be required. Such river crossings will involve temporary disruption of aquatic habitat at the construction site, possible stream diversion, and increased turbidity. Depending upon the time of year of construction and stream conditions, significant alteration and damage to the aquatic ecosystem will result. Turbidity and siltation will occur far downstream from the construction sites, causing decreased light penetration, siltation of spawning sites, and covering of fish eggs.

Selection of crossing sites should be made in close cooperation with the NYSDEC. Construction dates should be planned for low flow periods after major fish spawning has occurred (after June 1). Stream protection measures should be implemented and closely monitored throughout the duration of the construction period. Bottom habitat in the vicinity of the crossing site should be left resembling, as closely as possible, the original habitat.

All of the alternative plans, regardless of the number of treatment plants or level of treatment, have approximately equal short-term impacts to the aquatic environment.

The major impacts on the aquatic system of the various alternative plans are associated with the level of sewage treatment achieved. One of the critical factors in the survival and well-being of fish and other aquatic organisms is the amount of dissolved oxygen (D.O) available in the water. The duration of exposure to D.O. concentration determines survival or the amount of stress placed on the species. Various species of fish have different D.O. tolerance levels. Most species can tolerate low concentrations for long periods of time.

Temperature has a marked effect on the D.O. concentration; i.e., an increase in temperature results in a D.O. decrease.

Availability of food also influences the effect of D.O. concentration on organisms. An important factor to take into consideration is the synergistic effects of decreased D.O. on ammonia toxicity. The only time that this may become a problem, however, is during low water levels. In all wastewater management plans, no ammonia toxicity problems are expected during normal operations, since the ammonia concentrations for all plans are below the NYSDEC standard.

Fishes are highly mobile and also highly sensitive to concentrations of oxygen. Given the proper conditions, fish will avoid areas of low D.O. However, if they are confined by dams, low water, thermal plumes, or other chemical or physical barriers, mortality can result. Immobile organisms, such as clams, must survive under stressful conditions or perish.

According to Corps of Engineers' data, none of the wastewater plans will create any significant fish mortalities due to oxygen depletion; neither will any one of them have any beneficial impacts upon the fishery resources of the Binghamton area as a whole. Nevertheless, during periods of minimum D.O. concentrations it is expected that fish feeding and movement patterns will be altered. What significance this will have on the various fish species is not known since normal movement and feeding patterns are poorly understood.

The NYSDEC standard for dissolved oxygen in the main branches of the Susquehanna and Chenango Rivers is a daily average of about 5.0 mg/l and not less than 4.0 mg/l at any time. The minimum D.O. level is projected to occur for only a few days during the MA7CD/10 flow conditions and then only in a segment of the Susquehanna between Endicott and the East Owego sewage treatment plant. Plan 2 alternatives would achieve a minimum average daily dissolved oxygen concentration of 4.4 mg/l or 4.5 mg/l, depending upon the degree of regionalization. Plan 3 alternatives would achieve a minimum average daily D.O. of 5.4 mg/l or 5.5 mg/l, depending upon the degree of regionalization. Plan 4 would achieve a minimum average daily D.O. of 6.7 mg/l. The lower the minimum D.O. achieved by a particular plan, the greater will be the adverse impacts on fish and aquatic organisms.

Projected nutrient loadings for Plans 2 and 3 indicate a slightly higher rate than current conditions. Nitrogen and phosphorus are important factors in artificial eutrophication; however, neither appears to be a limiting nutrient. Recent surveys in the Susquehanna showed that the

Binghamton area situation indicated enriched but not gross pollution. The increased nutrient loadings are not expected to significantly increase the growth of aquatic flora. However, additional nutrients in an aquatic environment may significantly change macro-invertebrate populations and resultant fish populations far downstream.

Chlorine, as previously discussed under Section III, can be toxic to aquatic organisms. Sub-lethal effects can also result in changes in abundance and distribution of fishes, macro-invertebrates, and flora within a stream. Since all alternative plans will utilize some form of chlorine for effluent disinfection, there may be problems downstream where the Goudey Power Station and other industries, which also use chlorine in their effluents, discharge their wastes. Chlorine dosages should therefore be minimized in any plans.

Wildlife Resources

Impacts on terrestrial wildlife for alternatives under Plans 2, 3, and 4 include those from construction, displacement, and sludge disposal. Plans labeled B and C, utilizing a separate Chenango Valley treatment plant, will require about five acres of land adjacent to Route 11, near the Broome County Community College. In character, the site resembles abandoned farm land in early successional stages. Wildlife habitat supporting small mammals (mice, moles, shrews, and perhaps some cottontails or furbearers) and songbirds will be destroyed. Construction of interceptors and effluent pipelines will also cause destruction and alteration of habitat. Approximately 2.8 miles of interceptor and 400 feet of effluent fall, which do not follow existing roadways, will destroy wildlife habitat and alter wildlife populations on an area covering about 30 acres.

The plan labeled A and Plan 4, which regionalize the Chenango Valley with Binghamton-Johnson City, will cause destruction and alteration along the 4.2 miles of interceptor and force main rights-of-way, affecting about 40 acres. In Plan 4, an interceptor will be constructed between the Owego Village and West Owego sewage treatment plants. About ten acres of wildlife habitat will be destroyed or altered.

Moat animals in the project areas are mobile and adaptable enough to move out of the construction areas and reestablish themselves elsewhere. Some individuals will be destroyed, but populations as a whole will not be significantly affected. Habitat alteration becomes critical when it is limited. Location of interceptor pipelines and the Chenango Valley STP for all alternatives are in the Chenango River Flood Plan, which is the last natural redoubt in Broome County for pheasants. Specific right-of-way alignments will have to be identified before impacts on specific wildlife species can be determined. Generally, however, major adverse impacts are not anticipated.

A vast acreage of the homogeneous habitat is not as productive of wildlife as areas broken up into different types. Thus, clearing of interceptor rights-of way, if constructed properly and seeded to vegetation favorable to wildlife, can be beneficial. Construction of interceptors may be an inducement for development in areas which are not presently serviceable by existing wastewater treatment facilities. This may lead to a general deterioration of wildlife habitat in the vicinity of the development. Losses could be significant.

No direct adverse impacts on terrestrial wildlife species are anticipated in any wastewater management plan as a result of liquid sludge application on crop lands. Storage of liquid sludge prior to its application to farm lands, however, requires construction of in-ground lagoons. Plans 2 and 3 will require 7.2 acres for sludge storage while Plan 4 will require 16 acres, resulting in destruction and displacement of wildlife habitat. Depending upon the location of these sites, significant adverse impacts on wildlife populations are not anticipated. Selection of sites, however, should be coordinated closely with NYSDEC to minimize effects.

Sludge land filling, if selected as the alternative for sludge land application, will have adverse impacts to terrestrial wildlife on 226 acres of land in Plans 2 and 3, and 360 acres in Plan 4. Areas of this size lost to land filling will have significant impacts on wildlife, particularly if the habitat lost is prime pheasant cover. If storage lagoons are built, provisions for seeding and planting of plant species beneficial to wildlife on the storage sites should be implemented upon abandonment of the sites.

Other Resources Ancillary to Fish and Wildlife Resources

Time constraints have prevented a detailed analysis of the flora in the bicounty region, especially woody and vegetative species, and those plant and plant associations in the proposed interceptor line, outfall, storage lagoon, sewage treatment plant, and land fill sites. NYSDEC has published a list of vulnerable plants in New York (Section 9-1503, Environmental Conservation Law, Section 193.3, Protected Native Plants). The list includes plants that are endangered, threatened, rare, scarce, and vulnerable. Close cooperation with NYSDEC in selection of construction sites will help to minimize destruction of any vulnerable plant species or unique natural areas.

Habitat destruction is the most critical aspect in the welfare of wildlife species. The coal skink, which prefers a moist, wooded habitat generally on the ground under stones and logs, is found only in a relatively restricted area in New York. The red hellbender, long-tailed salamander, and map turtle likewise have restricted ranges which lie in the bicounty region in New York. Loss of suitable habitat will cause further reduction of their range.

Discussion

The portions of the Susquehanna and Chenango Rivers in the Binghamton-Owego vicinity contain viable populations of game and forage fish. Conditions at present support an important sport fishery and a limited commercial fishery. Time constraints have precluded the opportunity to work up economic values for the fishery. The overall fish fauna has been continuously modified by the construction of barriers, by the introduction of alien species, and by the changes in land use and development of the resources of the valley. Unfortunately, direct cause and effect relationships in the river are poorly understood. However, chemical and physical requirements for most fish species are known and it is relatively easy to predict general beneficial and adverse conditions.

Construction of interceptors and force mains across rivers and streams will cause temporary disruption of aquatic habitat, possible stream diversion, and increased turbidity.

Plans 2, 3, and 4 would achieve minimum dissolved oxygen concentrations above the NYSDEC standard in the Susquehanna and Chenango Rivers except during extreme flow conditions. Projected wastewater flows for 2020 show a 66% total overall increase over present conditions. Without modification of the present wastewater treatment system, dissolved oxygen deficiencies adversely affecting fish species and other aquatic life will result during periods of low flow and floods.

The lower the minimum D.O. achieved by a particular plan, the greater will be the impacts on fish and aquatic organisms. With or without project plans, increased nutrient loadings of nitrogen and phosphorus are expected.

Use of chlorine is an integral part of all alternative plans. Fish and aquatic organism destruction may result from a combination of natural and artificial conditions. Use of chlorine should be minimized.

Overall terrestrial wildlife impacts are expected to be minimal. However, depending upon selection of alternatives, significant damage could occur to individual species and populations of fauna and flora.

Insufficient data are available at present to determine the status of rare and/or endangered plant and animal species in the project site.

Any plan selected should include all steps necessary to minimize adverse environmental effects. The U. S. Fish and Wildlife Service would appreciate receiving advanced planning data on the project as soon as they are available. This office will then conduct the necessary detailed studies to determine how loss prevention measures or wildlife enhancement features can be most effectively incorporated into the work plan. Supplemental comments and/or reports will be provided as necessary.

Recommendations

Plan 1, Base Line Profile, will satisfy most environmental conditions at present and during normal operation for some years to come. Low river flows and high water conditions, however, will cause immediate deleterious effects on the aquatic environment. Projections of long-term adverse effects, based on increased population demands, will gradually accelerate, causing significant damage to the aquatic resource. Plans 2, 3, or 4 will sustain and improve water quality in the Susquehanna and Chenango Rivers.

From an aquatic aspect, Plan 4 will have the least adverse effect. Selection of river crossing sites should be made in close cooperation with the NYSDEC. Construction dates should be planned for low flow periods after major fish spawning has occurred (after June 1). Stream protection measures should be implemented and closely monitored throughout the duration of the construction period. Bottom habitat in the vicinity of the crossing site should be left resembling, as closely as possible, the original habitat.

Chlorine applications should be minimized.

In terms of total habitat destroyed or altered by construction of sites, sludge land application, or land filling, Plans 2 or 3, B or C, will have lesser adverse effects upon terrestrial wildlife than Plan 4. Specific right-of-way alignments, land fill, and lagoon sites will have to be identified and closely coordinated with NYSDEC to minimize adverse impacts. Unique natural areas and critical habitat must be identified. Reseeding of rights-of-way with plant species beneficial to wildlife should be built into the project. Unavoidable loss of critical wildlife habitat should be mitigated by replacement of suitable land for those species affected.

Table 1

Fish Collected in the Susquehanna River (August 1935)

listed in order of abundance

**Species	***Location													
	Tioga County								Broome County					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Smallmouth bass (Micropterus dolomieui)	A+	C	A	C+	C	C+	C	C	C	C	C	A	C	A
2. Fallfish (Semotilus corporalis)		x	C+	C+	A	A	A-	C+	A	C-		C+	C	C+
3. Common shiner (Notropis cornutus)	A	C-			A	A	A	C	A	C-	A	C+	C+	
4. Spottail shiner (Notropis hudsonius)	C·	A		C			A	C+	C	C-	A-	C	C-	C
5. Johnny darter (Etheostoma nigrum)				C	CT	C	x	C+	C	C-	C	C	A	A
6. Rock bass (Ambloplites rupestris)	C	x		C+			C		C	C	C-	C	A	C
7. Comely shiner (Notropis amoenus)		A	A		A		A	A	A+	A		A		
8. River chub (Nocomis micropogon)		C-	C-		C-		R		x	C-		R		
9. White sucker (Catostomus commersoni)								C+	C+	C-	A-		C+	
10. Spotfin shiner (Notropis spilopterus)			C-	C	C+	C-	C	x						
11. Northern hog sucker (Hypentelium nigricans)		x		C				C-	C	C		C		
12. Shield darter (Percina peltata)		C-			C-		C-			C		C-	C-	
13. Pumpkinseed (Lepomis gibbosus)	C			C-						C-	C		C	
14. Largemouth bass (Micropterus salmoides)		C-		C		C-			C-		C-			
15. Bluntnose minnow (Pimephales notatus)	R	R						C	C					
16. Cutlips minnow (Exoglossum maxillingua)		C-						C-	C-	C				
17. Chain pickerel (Esox niger)	C+											C		

Table 1 continued

6. Tioga County, 3 1/2 miles east of Owego village, downstream end of Hiawatha Island.

7. Tioga County, 1/2 mile downstream hamlet of Campville.

8. Tioga County, 1 1/2 miles upstream from hamlet of Apalachin.

9. Broome County, at Hooper (Endwell) in small cove 1/2 mile below island.

10. Broome County, upstream end of island just below railroad bridge at Lestershire (Johnson City).

11. Broome County, 1 1/2 miles downstream of Chenango River mouth, Binghamton.

12. Broome County, North end of Collier Lake opposite Kirkwood Center.

13. Broome County, North end of Berkalew Island opposite hamlet of Kirkwood.

14. Broome County, 1 1/2 miles southeast hamlet of Corbettsville.

Status:

A - Abundant
C - Common
R - Rare
x - present, but in small numbers

Table 1 continued

**Species	***Location													
	Tioga County								Broome County					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
18. Longnose dace (Rhinichthys cataractae)			C		C-					C				
19. Margined madtom (Noturus insignis)					C-					C		C-		
20. Brown bullhead (Ictalurus nebulosus)				C-								C		R
21. Satinfin shiner (Notropis analostanus)		C-						C+						
22. Walleye (Stizostedion vitreum vitreum)	C-													C
23. Yellow perch (Perca flavescens)										C-	C-			
24. Blacknose dace (Rhinichthys atratulus)							C							
25. Stoneroller (Campostoma anomalum)								C-						
26. Bridle shiner (Notropis bifrenatus)														C-
27. Shorthead redhorse (Moxostoma macrolepidotum)								x						

*"A biological survey of the Delaware and Susquehanna watersheds". 1936 State of New York Conservation Department, suppl. to 25th Annual Rpt. Albany

** Nomenclature is based on "A List of Common and Scientific Names of Fishes from the United States and Canada". 1970 Third ed. American Fisheries Soc. Spec. Pub. No. 6

*** Locations are as follows:

1. Tioga County, 2 miles upstream of state line, vicinity hamlet of Osborn.
2. Tioga County, 1 mile upstream hamlet of Barton.
3. Tioga County, tributary 8 to trib. 14 vicinity hamlet of Nichols.
4. Tioga County, 1 mile upstream hamlet of Tioga Center.
5. Tioga County, head of Squaw Island, 1 mile downstream of Owego Village bridge.

Table 2

Fish Collected in the Chenango River (August 1935) listed in order of abundance

Species	*Location 1	2	3	4
1. Fallfish (*Semotilus corporalis*)	C+	C+	C-	+
2. Johnny darter (*Etheostoma nigrum*)	C+	C+	C+	
3. Northern hog sucker (*Hypentelium nigricans*)	C-	R	C	
4. Smallmouth bass (*Micropterus dolomieui*)	C		C	+
5. White sucker (*Catostomus commersoni*)	A	C		
6. Common shiner (*Notropis cornutus*)	C+		C+	
7. Rock bass (*Ambloplites rupestris*)	C		C	
8. Longnose dace (*Rhinichthys cataractae*)	C+		C-	
9. Shield darter (*Percina peltata*)			C+	+
10. Largemouth bass (*Micropterus salmoides*)	C-	C-		
11. Cutlips minnow (*Exoglossum maxillingua*)	C-		C-	
12. Margined madtom (*Noturus insignis*)		C		R
13. Comely shiner (*Notropis amoenus*)			A	
14. Bridle shiner (*Notropis bifrenatus*)		A-		
15. River chub (*Nocomis micropogon*)			C	
16. Chain pickerel (*Esox niger*)		C		
17. Yellow perch (*Perca flavescens*)		C		

Table 2 Continued

Fish collected in the Chenango River (August 1935)

listed in order of abundance

Species	* Location 1	2	3	4
18. Spottail shiner (<u>Notropis</u> <u>hudsonius</u>)	C-			
19. Satinfin shiner (<u>Notropis</u> <u>analostanus</u>)	C-			
20. Stoneroller (<u>Campostoma</u> <u>anomalum</u>)	C-			

* Locations are as follows:

1. Just above mouth at first bridge in Binghamton
2. Two miles upstream of railroad bridge at Binghamton.
3. At head of island 1/2 mile downstream of Port Dickinson.
4. Four miles north of Binghamton.

A-Abundant

C-Common

R-Rare

T-collected, but abundance unspecified.

Table 3

*Creel Census Summary

1965-66

	Waverly to Endicott	Endicott to Riverside	Total
Total No. of fisherman interviewed	44	231	275
**Total completed Fishing hours	2 1/2	5 1/2	8
***Total Incompleted fishing hours	45 1/4	308	353 1/4
Total combined hours	47 3/4	313 1/2	361 1/4
Fish caught by Species			
Smallmouth bass	20	76	96
Rock bass	21	74	95
Pickerel	8	1	9
Walleye	1	95	96
Sunfish	4	49	53
Perch	1	11	12
Bullhead		3	3
Chubs		3	3
Carp	2	14	16
Suckers		1	1
Shiner		1	1
Total fish caught	57	328	385
Fish caught per hour	1.19	1.04	1.07

*Source NYSDEC ***Fishermen contacted continued to fish, amount indicates how much time had been spent fishing previous to contact.

**Fishermen contacted had completed their fishing that day.

TABLE 4

A list of mammals and their habitats in bicounty region

SPECIES	HABITATS					
	WOODLAND	BRUSH LAND	ABAND. FIELDS	CULTIV. FIELDS	MEADOW	WET LAND
1. White-tailed deer (*Odocoileus virginianus*)	X	X	X	X	X	X
2. Gray squirrel (*Sciurus carolinensis*)	X					X
3. Red squirrel (*Tamiasciurus hudsonicus*)	X					
4. Flying squirrel (*Glaucomys volans*)	X					
5. Chipmunk (*Tamias striatus*)	X	X	X			
6. Woodchuck (*Marmota monax*)	X		X		X	
7. Eastern gray fox (*Urocyon cinereoargenteus*)	X					
8. Red fox (*Vulpes fulva*)			X		X	X
9. Beaver (*Castor canadensis*)						X
10. Muskrat (*Ondatra zibethica*)						X
11. Opossum (*Didelphis virginiana*)	X		X			X
12. Raccoon (*Procyon lotor*)	X					X
13. Eastern cottontail (*Sylvilagus floridanus*)		X	X	X	X	
14. Varying hare (*Lepus americanus*)	X	X				
15. River otter (*Lutra canadensis*)						X
16. Eastern skunk (*Mephitis mephitis*)				X	X	
17. Short-tailed weasel (*Mustela erminea*)	X	X				
18. New York weasel (*Mustela frenata*)			X		X	
19. Common mink (*Mustela vison*)	X					X
20. Porcupine (*Erethizon dorsatum*)	X					
21. Hairy-tailed mole (*Parascalops breweri*)	X		X			

TABLE 4 continued

SPECIES	HABITATS: WOOD LAND	BRUSH LAND	ABAND. FIELDS	CULTIV. FIELDS	MEADOW	WET LANDS	URBAN
22.Star-nosed mole (Condylura cristata)	X				X	X	
23.Common shrew (Sorex cinereus)	X	X	X	X	X	X	
24.Smokey shrew (Sorex fumeus)	X						
25.Pigmy shrew (Microsorex hoyi)	X						
26. Least shrew (Cryptotis parva)			X			X	
27.Short-tailed shrew (Blarina brevicauda)	X	X	X		X		
28.Canadian deer mouse (Peromyscus maniculatus)	X	X	X				
29.White-footed mouse (Peromyscus leucopus)	X						
30.Bog lemming (Synaptomys cooperi)	X						
31.Red-backed mouse (Clethrionomys gapperi)	X						
32.Meadow vole (Microtus pennsylvanicus)	X				X	X	
33.Pine mouse (Pitymys pinetorum)					X		
34.House mouse (Mus musculus)			X		X	X	X
35Norway rat (Rattus norvegicus)				X			X
36.Meadow jumping mouse (Zapus hudsonius)					X		
37.Woodland jumping mouse (Napaeozapus insignis)	X						
38.Little brown bat (Myotis lucifugus)	X	X	X	X	X	X	
39.Say's bat (Myotis keenii septentrionalis)	X	X	X	X	X	X	
40.Silver-haired bat (Lasionycteris noctivagans)						X	
41.Pygmy bat (Pipistrellus subflavus)	X	X	X	X	X	X	X
42.Big brown bat (Eptesicus fuscus)	X	X	X	X	X	X	X
43.Red bat (Lasiurus borealis)	X	X	X	X	X	X	X
44.Hoary bat (Lasiurus cinereus)	X	X	X	X	X	X	X

TABLE 5

A list of Reptiles and Amiphibians in the Bicounty Region

SPECIES	HABITAT				
Snakes	woodland	aquatic	upland	agricult.	suburban
1. Water snake (*Natrix sipedon*)		X			
2. Brown snake (*Storeria dekayi*)			X		X
3. Red-bellied snake (*Storeria occipitomaculata*)			X		
4. Ribbon snake (*Thamnophis sauritus*)		X			
5. Garter snake (*Thamnophis sirtalis*)	X		X	X	X
6. Hognose snake (*Heterodon platyrhinos*)	X				
7. Ringneck snake (*Diadophis punctatus*)	X				
8. Black racer (*Coluber constrictor*)	X		X	X	
9. Smooth green snake (*Opheodrys vernalis*)	X		X		
10. Black rat snake (*Elaphe obsoleta*)			X		
11. Milk snake (*Lampropeltis doliata*)				X	
LIZARDS					
1. Coal skink (*Eumeces anthracinus*)		X			
Turtles					
1. Common snapping turtle (*Chelydra serpentina*)		X			
2. Spotted turtle (*Clemmys guttata*)		X			
3. Bog turtle (*Clemmys muhlenbergi*)		X			
4. Wood turtle (*Clemmys insculpta*)	X				
5. Box turtle (*Terrapene carolina*)	X		X		
6. Map turtle (*Graptemys geographica*)		X			

TABLE 5 continued

SPECIES	HABITAT				
AMPHIBIANS	WOODLAND	AQUATIC	UPLAND	AGRICULT.	SUBURBAN
1. Spadefoot (Scaphiopus holbrooki)			X		
2. American toad (Bufo americanus)	X		X	X	X
3. Fowler's toad (Bufo woodhousei)	X	X			
4. Spring peeper (Hyla crucifer)		X			
5. Gray treefrog (Hyla versicolor)	X				
6. Bullfrog (Rana catesbeiana)		X			
7. Green grog (Rana clamitans)		X			
8. Wood frog (Rana sylvatica)	X				
9. Leopard frog (Rana pipiens)		X			
10. Pickerel frog (Rana palustris)		X			
11. Hellbender (Cryptobranchus alleganiensis)		X			
12. Red eft newt (Diemictylus viridescens)	X	X			
13. Four-toed salamander (Hemidactylium scutatum)		X			
14. Red-backed salamander (Plethodon cinereus)	X				
15. Slimy salamander (Plethodon glutinosus)	X				
16. Spring salamander(Gyrinophilus porphyriticus)		X			
17. Red salamander (Pseudotriton ruber)	X	X			
18. Two-lined salamander (Eurycea bislineata)		X			
19. Mountain salamander (Desmognathus ochrophaeus)		X			
20. Long-tailed salamander (Eurycea longicauda)		X			
21. Dusky salamander (Desmognathus fuscus	X	X			
22. Spotted salamder (Ambystoma maculatum)	X	X			

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